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Surgical-site infections (SSIs) are one of the most common healthcare-associated infections, accounting for 31% of all healthcare-associated infections worldwide. It is estimated that 2–5% of patients undergoing surgery develop SSIs, with a higher percentage estimated in resource-limited healthcare settings. The impact of SSIs on healthcare delivery systems is very severe, resulting in prolonged hospitalisation, complex medical treatments, increased readmissions and outpatient visits as well as increased direct and indirect medical costs. Previous research indicates that approximately 60–80% of SSIs are preventable through the implementation of evidence-based practices such as surgical antimicrobial prophylaxis (SAP) guidelines.

The key to preventing SSIs lies in the understanding and careful implementation of SAP guidelines. Choosing the right antibiotic for each case is of particular importance, as the right antibiotic will produce adequate serum and tissue drug levels and exceed the minimal inhibitory concentration for any organisms that are likely to be encountered during the operation. Optimal timing of the antibiotic prophylaxis administration is considered to be 30–60 minutes before the first incision is made, except for certain antibiotics (e.g. vancomycin and ciprofloxacin) which are administered 120 minutes beforehand. Bratzler et al. have confirmed that a single dose of an antimicrobial agent is sufficient for most surgical operations. Although the principles of antimicrobial prophylaxis in surgery are clearly established and several guidelines have been published, the implementation of these guidelines remains problematic and controversial among surgeons. The over-prescription and inappropriate timing and duration of antimicrobials remains a significant issue in the practice of surgical prophylaxis. In addition, the incidence of SSIs has increased and new antimicrobial-resistant bacteria have emerged due to poor adherence to SAP guidelines.

The aforementioned challenges have been widely addressed in many developed countries, although very little attention has been given to this issue in developing countries and the Middle Eastern region. In the November 2015 issue of SQUMJ, Telfah et al. published a report on the impact of a multidisciplinary quality improvement project on the adherence to SAP guidelines in the treatment of surgical oncology patients. A clinical pharmacist was noted to play a key role in updating the SAP guidelines and providing the surgeons with required prophylaxis education. Telfah et al. concluded that there was significant improvement in the adherence to SAP guidelines following the implementation of the multidisciplinary quality improvement project. This approach demonstrates the important role of both clinical pharmacists and surgeons in engaging with and improving adherence to SAP guidelines.

A review of studies evaluating guideline implementation strategies found only modest-to-moderate effects and noted that healthcare organisations’ resources for guideline implementation were usually insufficient to allow much more than the dissemination of educational materials or lunchtime educational meetings, interventions whose effects were usually only short-lived. Barlow et al. found that education and audit-based interventions used before the implementation of guidelines resulted in a significant increase in appropriate antibiotic prescriptions after the introduction of a multifaceted education programme. Audit feedback systems to improve the quality of care have also been shown to be feasible and effective in hospital settings in low-income countries. Consequently, successful guideline implementation...
programmes need to understand local barriers, incorporate multiple-component interventions and proceed within a framework of continuous quality improvement.12

Although SAP plays an important role in reducing the rate of SSIs, other factors must be taken into consideration. These include attention to basic infection control strategies; the experiences and techniques of the surgeon; the duration of a procedure; hospital and operating room environments; instrument-sterilisation procedures; preoperative preparation techniques (e.g. surgical scrubs, skin antisepsis and appropriate hair removal); perioperative management of patient temperature and glycaemic control; and the underlying medical condition of the patient.6

In conclusion, drafting SAP guidelines without addressing the implementation process will not necessarily decrease SSI rates. To achieve optimal adherence, antibiotic policy-makers should develop evidence-based guidelines in collaboration with surgeons, guarantee an effective distribution of those guidelines, perform periodic audits on adherence to the guidelines and provide feedback from these audits to surgeons and the appropriate authorities. Hospitals also need to establish a SSI surveillance system, formulate a multidisciplinary implementation team and monitor antimicrobial consumption related to surgical procedures. Moreover, education and training on SSI prevention and management, including SAP guidelines, should be integrated in all undergraduate and postgraduate surgical training programmes.

References

Cutaneous Scar Prevention and Management
Overview of current therapies

*Sultan Al-Shaqsi and Taimoor Al-Bulushi

ABSTRACT: Cutaneous scarring is common after trauma, surgery and infection and occurs when normal skin tissue is replaced by fibroblastic tissue during the healing process. The pathophysiology of scar formation is not yet fully understood, although the degree of tension across the wound edges and the speed of cell growth are believed to play central roles. Prevention of scars is essential and can be achieved by attention to surgical techniques and the use of measures to reduce cell growth. Grading and classifying scars is important to determine available treatment strategies. This article presents an overview of the current therapies available for the prevention and treatment of scars. It is intended to be a practical guide for surgeons and other health professionals involved with and interested in scar management.

Keywords: Scarring; Hypertrophy; Keloids; Silicone; Steroids; Surgery.

E very physical injury to the human skin leaves a footprint in the form of a scar which can range in appearance from hardly visible to extensively disfiguring. Cutaneous scars commonly form after surgical operations, trauma, burns and infections. It is estimated that approximately 100 million people develop scars after trauma and elective surgery in middle-income countries every year. Furthermore, 15% of this population will require surgical intervention for their scars due to aesthetic considerations or functional impairment.

Scars can have disturbing physical, aesthetic, functional, psychological and social connotations. Physical symptoms frequently reported by sufferers of excessive scarring include uncontrollable pruritus, stiffness, scar contracture and pain while the psychological consequences include diminished self-esteem and confidence and increased stigmatisation and mental suffering (e.g. anxiety and depression). Several societies use unique scars as a permanent marker for low social status. For example, in ancient Arab cultures, scars around the tip of the nose of a man indicated that he had been defeated in war. Studies have shown that the physical appearance of a surgical scar following elective surgery is strongly associated with patient satisfaction; one study found that 95% of patients who underwent elective surgery described their overall healthcare experience based on the physical appearance of their surgical scar. Therefore, a good understanding of scar prevention and management is relevant to many areas of medical practice. This review provides a practical flowchart for scar prevention and discusses management guidelines based on recent international recommendations published by the International Advisory Panel of Scar Management (IAPSM). Along with recommendations for scar prevention and management, this article highlights emerging and future strategies in the treatment of scars.
Scar Formation

A scar is the fibroblastic replacement of normal skin tissue that has healed by resolution rather than regeneration. The degree of scarring is determined by the extent of the initial wound and the time interval between the injury and complete healing. Several factors contribute to the formation of scars, including infections, retention of foreign bodies and prolonged healing beyond 2–3 weeks.1–4 Normal skin has a matrix of collagen sheets, while scars have organised unidirectional collagen bundles. This leads to prominent or raised tissue in comparison to normal skin.

TYPES OF SCARS

Clinically significant scars are divided into two categories: hypertrophic or keloid [Figure 1]. Hypertrophic scars are defined as excessive tissue production at the site of a physical injury to the skin which remains within the boundaries of the initial lesion.1 These can be subdivided into linear or widespread hypertrophic scars. Linear scars usually result from surgery or localised trauma while widespread hypertrophic scars can be a consequence of extensive burns or soft tissue infections.1 Unlike hypertrophic scars, keloids involve excessive scarring that extends beyond the boundaries of the initial lesion. They have a low chance of regression and a high chance of recurrence after treatment.1 Keloids are described as minor if the scar extends less than 0.5 cm beyond the border of the initial lesion or major if the scar extends more than 0.5 cm beyond the border.1 There are several histological differences between hypertrophic and keloid scars on a cellular level. For instance, hypertrophic scars contain well organised type III collagen fibres while keloids contain a disarray of type I and III collagen bundles.5

Scar Prevention

Prevention of scars is critical as it is much easier to prevent formation than to rely on management once

Figure 1 A–F: Photographs of a (A) mature scar, (B) immature scar, (C) linear hypertrophic scar, (D) widespread hypertrophic scar, (E) minor keloid and (F) major keloid.

Figures reproduced with permission from the Department of Plastic & Reconstructive Surgery, Khoulia Hospital, Muscat, Oman.

Figure 2: Flowchart depicting the recommended strategy for prevention of scarring.
the scars have formed [Figure 2]. The first step in scar prevention is meticulous attention to presurgical details, operative procedures and postoperative wound care. Certain surgical techniques—such as making incisions along tension-free lines, approximating skin edges with minimal tension and maintaining haemostasis—are examples of factors to be considered when aiming to lower the risk of wound scarring.\(^2\) Furthermore, identifying patients at high risk of developing scars is essential. These include patients with a previous history of scarring and those undergoing surgeries in high-risk scarring regions of the body, such as the neck and thorax.\(^2,4\)

Several measures have been shown to prevent scar formation.\(^1\) Silicone-based products (i.e. gels, sheets and tapes) are the preferred preventative measure.\(^8-10\) Such products should be applied after epithelisation is established and used for at least a month to maximise results. Silicone sheets are commonly available and should be applied for at least 12 hours per day. Silicone gels, creams and ointments are acceptable alternatives for face and neck scars as well as for patients in hot or humid climates.\(^6-8\) Intralesional corticosteroid injections are considered second-line approaches in scar prevention.\(^12,13\) However, silicone and intralesional steroid injections should be used synergistically in high-risk patients. Exposure to sunlight during wound healing has been associated with scar pigmentation; therefore, it is recommended that patients minimise sun exposure during wound healing.\(^6-8\)

**Scar Management**

The management of scarring is both complex and challenging due to several factors. The exact pathophysiology of scar formation has yet to be completely elucidated, although several factors are believed to play a role, including the degree of tension across the edges of the wound and the speed of cell growth.\(^9,10\) Variable systems exist to quantify changes in scar appearance and there is also a lack of theoretical models available to evaluate current therapies. This has led to a limited amount of useful data derived from prospective randomised studies. Nevertheless, there are several measures which can be utilised for the prevention and treatment of scars.

**GRADING AND CLASSIFICATION**

In order to tackle the issue of scar management, a grading system must be used as a common framework as this is critical in determining treatment for affected patients. Cutaneous scars can be graded based on pigmentation, vascularity, pliability, thickness, height and depression, as well as patient factors such as comfort and acceptability.\(^4\) Several scales have been reported in the literature such as the Vancouver Scar Scale and the Patient and Observer Scar Assessment Scale.\(^14,15\) These tools have good consistency and acceptability but are heavily subjective and have limited sensitivity with regards to detecting changes in the appearance of a scar.\(^4,6\) There is currently no gold-standard system to classify or grade scars. Nevertheless, regardless of the scale initially chosen by the clinician, the same scale should be used throughout the course of treatment for that particular patient. The IAPSM classification of scars can be found in Table 1.\(^2,7\)

**RECOMMENDATIONS**

Measures used to treat scars are largely determined by the type of scar and symptomology. Below is a

<table>
<thead>
<tr>
<th>Scar type</th>
<th>Appearance</th>
<th>Characteristics</th>
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<tbody>
<tr>
<td>Mature</td>
<td>Light-coloured, Flat</td>
<td></td>
</tr>
<tr>
<td>Immature</td>
<td>Red</td>
<td>Slightly pruritic and painful</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Can develop into a linear hypertrophic scar</td>
</tr>
<tr>
<td>Linear hypertrophic</td>
<td>Rope-like appearance, Red</td>
<td>Develops weeks after initial insult</td>
</tr>
<tr>
<td></td>
<td></td>
<td>May slowly grow</td>
</tr>
<tr>
<td>Widespread hypertrophic</td>
<td>Widespread, Red, Raised</td>
<td>Burns are the main cause</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Confined to the border of the original injury</td>
</tr>
<tr>
<td>Minor keloid</td>
<td>Raised, Extends &lt;0.5 cm</td>
<td>Develops months to years after the event</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Does not regress</td>
</tr>
<tr>
<td></td>
<td></td>
<td>High recurrence rate</td>
</tr>
<tr>
<td>Major keloid</td>
<td>Large, Raised, Extends &gt;0.5 cm</td>
<td>Slightly pruritic and painful</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Continues to grow</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Does not regress</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Very high recurrence rate</td>
</tr>
</tbody>
</table>
detailed description of current recommendations on scar management based on scar type. It is essential to address symptoms using adequate analgesics, systemic antihistamines, moisturisers, topical corticosteroids, antidepressants, massage or hydrotherapy.

**Immature Scars**
Immature scars are scars which are still in the process of maturing and remodelling. These types of scars can potentially develop into linear hypertrophic scars and are considered as such if symptoms persist beyond one month. Therefore, a preventative strategy is recommended. Monthly pulsed dye laser therapy sessions for 2–3 months have been shown to provide some benefit for immature scars. If the scar shows minimal improvement to pulsed dye laser therapy, then fractional laser therapy may be attempted.

**Linear Hypertrophic Scars**

Based on randomised controlled trials, silicone sheets and gels are the recommended first-line treatment strategy for linear hypertrophic scars. Success rates are improved if the sheets or gels are applied for at least 12 hours every day for a minimum of two months. If the patient has severe scarring, then augmentation of therapy using intralesional corticosteroid injections or 5-fluorouracil (5-FU) is indicated. It is important to note that hyperpigmentation and skin irritation at the injection site are well-known side-effects of 5-FU therapy.

Second-line strategies for linear hypertrophic scars should be instituted if first-line measures fail. Pulsed dye or fractional laser therapies have been shown to help scar regression in persistent linear hypertrophic scars if used in combination with silicone products and/or intralesional injections. Studies have shown that surgical intervention is required if 12 months of augmented treatment fails to treat a scar. In such cases, tension of the wound edges is almost always evident. Surgeons should aim to reduce this tension during the procedure. Immediate first-line measures should be instituted post-surgery.

Several surgical techniques have been reported to reduce scar tension in linear hypertrophic scars, including Z- and W-plasty. Both of these well-known techniques have similar recurrence rates. New research shows that small-wave or S-plasty is equivalent in effectiveness to the Z-plasty approach. Skin grafts and local flaps are reserved as a last resort if all other strategies fail to treat linear hypertrophic scars. Adjunctive biological therapy such as dermal scaffolds, matrices and epithelial cell suspensions have been reported to enhance wound healing, but evidence in favour of the routine use of these therapies is currently lacking. Post-surgical use of silicone products and intralesional combined corticosteroid and 5-FU injections are essential in reducing the rate of scar recurrence.

**Widespread Hypertrophic Scars**

Burns are the main cause of widespread hypertrophic scarring; as such, patients with widespread hypertrophic scars should ideally be treated in a specialised burn unit. Clinical evidence supports the early use of silicone sheets, gels and pressure therapy as first-line strategies for treating widespread hypertrophic scars. If these fail to improve regression of the scar, then fractional ablative laser therapy should be added as a second-line adjunct. Such scars are usually complex and require a combination of therapies, including silicone products, pressure therapy and surgical procedures such as skin grafts, contracture release and flaps. Furthermore, burn scars can cause significant pruritus and pain; therefore, neoadjuvant therapies such as analgesics and systemic antihistamines are essential before embarking on significant surgical reconstructive procedures.

**Minor Keloids**

For minor keloids, silicone sheets or gels in combination with monthly intralesional corticosteroid injections is considered the first line of therapy. Several studies have also shown potential benefits from contact or intralesional cryotherapy in arresting the expansion of minor keloid scars. Cryotherapy generally provokes intense pain when applied; as a result, it is critical to provide adequate oral analgesia and pre-therapy local anaesthesia. If the above treatment does not result in scar improvement after 8–12 weeks, then intralesional 5-FU, laser therapy or surgical resection is warranted. It is important to counsel patients with keloids and inform them that the post-surgery recurrence rate is very high in order to ensure that their expectations are realistic. Partial surgical excision is the therapy of choice if a full excision would damage underlying important structures. Local and free flaps are surgical options in some refractory keloid cases.

In order to reduce the recurrence rate of keloids after surgery, adjunct therapies such as silicone sheets and intralesional corticosteroid injections should be applied promptly. Post-surgery radiotherapy at the keloid site has shown benefits. Available evidence supports the use of 5-FU following a keloid resection. The use of other chemotherapeutic agents, such as bleomycin, mitomycin C and 5% imiquimod cream, have been shown to slow cell growth, thereby reducing the recurrence rate of keloids post-surgical
Major Keloids

Major keloids are a surgical challenge, particularly as the post-treatment recurrence rate is very high.\(^1\) Current evidence recommends the use of monthly corticosteroid injections and cryotherapy as a first-line therapy.\(^2 \text{-} 4\) Unfortunately, most major keloids are refractory to this therapy and intralesional 5-FU and surgical intervention is usually required. It is important to transfer patients with major keloids to a specialised plastic surgery unit to ensure improved functional outcomes. Post-surgical prophylactic therapy is even more important in keloids than in other scars.\(^2 \text{-} 4\)

Emerging Therapies

Understanding the physiology of wound healing is critical in emerging future therapies for abnormal scar formation. Several experimental therapies reported in the literature may soon become standard practice. Gassner et al. found that injections of botulinum toxin A (BTA) enhanced wound healing and reduced the rate of scar formation in comparison to a placebo.\(^31\) Although the biological basis of this scar treatment is plausible—BTA paralyses the local muscles around the edges of a wound, thereby reducing tension—conclusive evidence is still lacking. Most of the published literature are case reports or retrospective studies.\(^32 \text{-} 34\) As such, there is a lack of randomised controlled trials to assess BTA therapy in scar prevention and treatment.

Other therapies used to prevent or treat scars include calcineurin inhibitors, retinoic acid, tamoxifen, verapamil and interferon alfa-2b.\(^3,30\) However, such therapies have not yet been supported by randomised controlled trials and there is currently no evidence to support their routine use in clinical practice.

Conclusion

Scars continue to represent a significant medical burden. Wound healing processes and the pathophysiology of scar formation are evolving areas of research and treatment modalities will continue to change accordingly. Current prevention methods strongly supported by the literature include meticulous surgical techniques and the utilisation of silicone products. Scar classification and grading systems are essential in determining the appropriate choice of therapy. Silicone products are the first-line strategy in most cases. Adjunct therapies such as intralesional corticosteroids, chemotherapy, cryo-therapy, radiotherapy and pressure therapy are useful synergistic modalities if first-line therapy fails. Surgical interventions are usually required for extensive major keloids.

References


The Use of Laparoscopy in the Management of Trauma Patients
Brief review

Yehia B. A. El-Bendary, Juhaina Al-Adawi, Hani Al-Qadhi

Abstract: Laparoscopy is one of the most effective intervention modalities, resulting in improved outcomes for major surgeries. In the past decade, the laparoscopic approach in trauma patients has shown better diagnostic outcomes than traditional laparotomies. Furthermore, this approach is cost-effective, significantly reduces the length of hospital stay and contributes to reduced complication rates. However, the use of laparoscopies in trauma cases is generally restricted to patients with normal haemodynamic parameters and is contraindicated for individuals with head injuries. With advances in knowledge and improved training, laparoscopies can also be used in the treatment of other conditions, such as diaphragmatic injuries and organ lacerations. This article briefly reviews the extent of laparoscopy use and its significance in the management of trauma patients.

Keywords: Laparoscopy; Laparotomy; Trauma; Abdominal Injuries; Diaphragm; Penetrating Wounds; Acute Abdomen.

In the management of trauma patients, laparoscopies have proven to be safer and more cost-effective than laparotomies in terms of hospital stay and the prevention of subsequent unnecessary laparotomies. Although the use of laparoscopies in trauma patients is generally restricted to patients with normal haemodynamic parameters and is contraindicated for individuals with head injuries, With advances in knowledge and improved training, laparoscopies can also be used in the treatment of other conditions, such as diaphragmatic injuries and organ lacerations. This article briefly reviews the extent of laparoscopy use and its significance in the management of trauma patients.

Keywords: Laparoscopy; Laparotomy; Trauma; Abdominal Injuries; Diaphragm; Penetrating Wounds; Acute Abdomen.

History

The first laparoscopic intervention was performed by Stone et al. in 1942 to diagnose internal bleeding in a patient with traumatic injuries. In 1970,
Heselson advocated the use of the laparoscopy to detect penetrating injuries and injuries to internal abdominal organs. Since then, there has been a major improvement in laparoscopic technology and instruments with a corresponding improvement in outcomes. Ahmed et al. revealed that the laparoscopic technique was both safe and accurate in the management of penetrating abdominal injuries. The use of laparoscopy has since spread rapidly throughout trauma centres worldwide and is slowly replacing the need for exploratory laparotomies.

**Indications for Laparoscopy**

The role of the laparoscopy in screening, diagnosis and therapy has been studied extensively throughout the past few decades. Many studies have confirmed that laparoscopies can be safely performed for patients with a normal haemodynamic status and equivocal abdominal/pelvic computed tomography (CT) or ultrasonography (US). The European Association of Endoscopic Surgeons has published evidence-based guidelines for the use of laparoscopies in patients with blunt or penetrating abdominal trauma. This minimally invasive procedure may potentially prevent non-therapeutic laparotomies; in a study of 819 patients with small bowel injuries, Sitnikov et al. found that video-assisted laparoscopies were associated with postoperative complication and mortality rates of 11.8% and 2.3%, respectively.

**Diagnostic Use**

Among patients with abdominal trauma, the main concern is a possible injury to the liver or spleen which is not identified during the initial assessment, especially for patients with normal haemodynamic parameters. The use of a laparoscopy in such cases would help to rule out any associated organ injuries or haemorrhage, particularly of the bowel, that were not visible on imaging. While intra-abdominal fluid can usually be seen on CT or US scans, this may either be associated with abdominal trauma or be secondary to resuscitative measures. It is difficult to identify the type of fluid based on diagnostic imaging alone; therefore, a laparoscopy can be utilised in these circumstances to identify the fluid and obtain samples for analysis.

Nonetheless, the diagnostic utility of a laparoscopy depends primarily on the skills of the operating surgeon. In a recent study from Taiwan, two groups of trauma patients underwent either a laparotomy or a laparoscopy carried out by surgeons who had previously performed at least 10 acute care laparoscopies per month. Laparoscopies were found to have a 100% sensitivity in detecting injuries; this suggests that better patient outcomes are associated with increased laparoscopic experience in acute care settings. In the USA, 4,755 out of 2.5 million trauma patients in 467 trauma centres underwent diagnostic laparoscopies between 2007–2010; among these, there was a 0.5% rate of missed injuries requiring a delayed laparotomy and therapeutic intervention. This could potentially be due to a reduced level of expertise in the use of minimal invasive surgery in trauma patients. Nevertheless, results from both studies indicated better outcomes for laparoscopic patients in terms of reduced hospital stay and fewer complications.

**Penetrating Injuries**

Penetrating abdominal trauma, including stabbing- and gunshot-related wounds, is one of the most common causes of mortality in trauma patients. This form of trauma does not have to penetrate the peritoneal cavity itself—some injuries can be tangential without violating the peritoneum. In one study, it was estimated that 45% of patients with normal haemodynamic parameters who sustained a penetrating abdominal wound had a tangential path of injury. Therefore, there is a need to develop an accurate and sensitive diagnostic modality to identify patients with true penetration of the peritoneum. Laparoscopies have shown superior specificity and sensitivity in identifying peritoneal penetration when compared to CT and focused assessment with sonography for trauma (FAST). In a study conducted to analyse 10 years of laparoscopy experience in a level-one trauma centre, 83% of the 131 patients who underwent laparoscopic interventions had a penetrating abdominal injury. The indications for a laparoscopy in these patients included a gunshot wound involving the flanks, an anterior abdominal stab wound with fascia penetration, evidence of peritonitis on FAST scans and uncertainty regarding the tangential path of injury. Had any of these patients experienced a decline in vital signs, a laparotomy would have been the modality of choice.

**Diaphragmatic Injuries**

One of the most common injuries associated with penetrating trauma is a diaphragmatic tear or rupture. Thoracoabdominal trauma is any injury within the region bounded by the posterior nipple line superiorly to the costal margin inferiorly. Diaphragmatic injuries should always be suspected in such conditions, as they can be easily missed during the initial diagnosis. Powell et al. found that 20% of patients who sustained penetration to the thoracoabdominal area developed a diaphragmatic injury. A study estimating mortality...
and morbidity due to complicated diaphragmatic injuries reported rates of 20% and 30%, respectively. The most common complication of a diaphragmatic injury is the herniation of abdominal content into the thorax which, if untreated, can cause complications that can lead to death. Accordingly, ruling out violations or breaches of the diaphragm is crucial. Unfortunately, non-invasive imaging modalities (CT and US) have been associated with high false-negative rates in the diagnosis of diaphragmatic injuries. In addition, Mihos et al. reported that 74% of traumatic diaphragmatic injuries in their study were diagnosed intra-operatively after being missed initially on non-invasive imaging. A laparoscopy enables visual examination of the left lobe of the diaphragm and, to a lesser extent, the right lobe, which would otherwise be obscured by the liver on imaging. Direct laparoscopic visualisation of the diaphragm has been shown to be the best diagnostic modality to identify diaphragmatic tears and ruptures. However, CT scans remain the standard imaging modality in patients involved in trauma.

**BLUNT ABDOMINAL TRAUMA**

Non-invasive radiological imaging has shown good sensitivity and specificity in detecting intra-abdominal injuries following blunt abdominal trauma (97% and 98%, respectively). However, there is still a degree of ambiguity involved with certain splenic lacerations and pancreatic or gastrointestinal tract injuries. The indications for the use of a laparoscopy in blunt trauma cases include evidence of a hollow viscous injury on CT scans or peritonitis on physical examination. Additionally, physical examinations may be unreliable due to a patient’s altered mental status. However, as mentioned previously, haemodynamic stability is mandatory in the choice of a laparoscopic intervention over a traditional laparotomy. Diaphragmatic injuries have also been associated with blunt trauma, manifesting as larger ruptures and tears in comparison to penetrating trauma. These injuries account for 2.1% of patients with blunt trauma injuries. Laparoscopic examinations can confirm the presence of blunt trauma injuries but a laparotomy is still essential in cases of large tears.

**THERAPEUTIC USE**

The use of a laparoscopy is not limited to screening and diagnostics. Multiple centres worldwide have implemented therapeutic laparoscopies for the management of specific injuries. Patients with normal haemodynamic parameters and no associated head or chest injuries are ideal candidates for a therapeutic laparoscopic intervention. In a recent systematic review on the use of laparoscopies in trauma, 20 research papers on therapeutic laparoscopies were identified. Of the 1,263 patients involved in these studies, 143 therapeutic laparoscopy procedures were performed. The most common injuries repaired were diaphragmatic injuries (54%), followed by liver and mesenteric injuries (13% each). In liver injuries, laparoscopies have been utilised to provide haemostasis by the application of fibrin glue to minimally bleeding lacerations. Laparoscopies have also been used to wash accumulated blood from the peritoneal cavity as a sequel to intra-abdominal bleeding. This ensures a reduction in associated complications, including peritonitis, ileus and inflammation. Carrillo et al. reported the use of laparoscopies in suction drainage to evacuate residual fluids and prevent further fluid accumulation.

**Contraindications for Laparoscopy**

**ABNORMAL HAEMODYNAMICS**

Patients with abnormal haemodynamic parameters are not considered appropriate candidates for laparoscopic interventions. Suspected major bleeding or an injury which might cause the patient’s condition to deteriorate usually calls for urgent surgery. Rapid identification of the bleeding source or critical injury is important in trauma patients; this cannot be carried out efficiently via a laparoscopy.

**MULTIPLE ORGAN INVOLVEMENT**

No advantage has been found in the use of a laparoscopy over a laparotomy among patients with injuries involving multiple organs. In fact, the time required to perform a laparoscopy increases in cases of complicated multiple injuries. Thus, a laparotomy is preferred in such situations as it allows full exploration of the intraperitoneal and retroperitoneal structures and provides more efficient damage control and repair of injuries.

**HEAD INJURIES**

Few studies in the literature cover the effect of pneumoperitoneum on intracranial pressure. One report relayed a rise in intracranial pressure among trauma patients managed laparoscopically. This is thought to be due to an increase in the partial pressure of carbon dioxide, as it is used to provide the pneumoperitoneum required for a laparoscopy. Therefore, it is advisable to proceed directly with a traditional laparotomy for patients with suspected head injuries.
Benefits of Laparoscopy

One of the greatest advantages of laparoscopies in trauma cases is the reduction in the rate of negative or non-therapeutic laparotomies performed; this in turn reduces hospitalisation, laparotomy-associated morbidity and overall costs and improves outcomes. The low prevalence of majority of which focused on the laparoscopic repair research papers had therapeutic applications, the interventions in trauma cases, only 24.6% of the solid organ injuries. However, it has been found to detecting diaphragmatic tears or ruptures and other been shown to be more accurate than CT and US in detecting hollow viscous injuries. Laparoscopy use was thought to be due to a lack of expertise in using laparoscopy in a trauma setting. Laparoscopy-associated complications and morbidity are significantly lower than in cases of traditional laparotomy. Recent research on the complications associated with diagnostic laparoscopy versus negative laparotomy showed reduced complication rates (3% versus 22%) and decreased hospital stay (1.4 versus 5.1 days). Other studies have found that laparoscopies can significantly reduce hospitalisation- and complication-related costs when compared to the traditional laparotomy, with an estimated total reduction of 1.78–2 times.

Kaban et al. reported that the laparoscopy had sensitivity and specificity rates of 92% and 100%, respectively, in detecting injuries. Another study confirmed the superiority of laparoscopy over diagnostic peritoneal lavage with regards to sensitivity and specificity; additionally, no significant bleeding or trauma was observed during a subsequent laparotomy for 8% of those in the laparoscopy group compared to 27% of those in the peritoneal lavage group. Direct visualisation using laparoscopy has been shown to be more accurate than CT and US in detecting diaphragmatic tears or ruptures and other solid organ injuries. However, it has been found to have a low sensitivity (20%) in the identification of hollow viscous injuries.

In a recent systematic review on laparoscopic interventions in trauma cases, only 24.6% of the research papers had therapeutic applications, the majority of which focused on the laparoscopic repair of diaphragmatic injuries. The low prevalence of laparoscopy use was thought to be due to a lack of expertise in using laparoscopy in a trauma setting. Nevertheless, the rate of therapeutic laparoscopy is expected to rise with continuous advancements in the development of new techniques and training programmes. In a randomised control trial, 20 haemodynamically stable patients with no signs of peritonitis underwent an exploratory laparotomy and 23 underwent a diagnostic laparoscopy; there were no statistically significant differences between the two groups, apart from length of hospital stay, which was lower among those who underwent diagnostic laparoscopies. In the same study, patients with equivocal peritoneal violations underwent either a diagnostic laparoscopy (n = 28) or expectant nonoperative management (n = 31). Diagnostic laparoscopies were performed more often for minor organ injuries; however, there were no statistical differences in therapeutic operation rates, morbidity or hospital costs.

Complications of Laparoscopy

As with any other invasive procedure, the laparoscopy carries a risk of complications; however, it has been estimated that only 1–11% of patients undergoing a diagnostic laparoscopy will develop complications related to the procedure.

**MISSED INJURIES**

Previously, high rates (up to 77%) for missed bowel injuries have been reported while using laparoscopies as a screening or diagnostic modality. However, Kawahara et al. reported that a systemic approach for laparoscopic abdominal examinations resulted in the complete absence of missed bowel injuries and high avoidance of unnecessary laparotomies (73.33%). Nevertheless, patients with suspected retroperitoneal involvement and those with deteriorating haemodynamic parameters should undergo an open laparotomy to prevent complications secondary to a missed injury.

**TENSION PNEUMOTHORAX**

Pneumothorax occurs with the insufflation of air during the laparoscopic procedure when an underlying diaphragmatic injury allows communication between the abdominal and thoracic cavities. If undetected or left untreated, this serious condition can lead to death. Tension pneumothorax is one of the most common laparoscopy-associated complications in trauma patients. It is mandatory to insert a thoracotomy tube in such a situation to prevent further deterioration of the patient’s condition.

**Conclusion**

Laparoscopic interventions in trauma patients with normal haemodynamic parameters are an excellent modality to identify diaphragmatic injuries and peritoneal penetration. In comparison with
traditional laparotomies, laparoscopies are more efficient and cost-effective and associated with fewer complications. However, clear guidelines to support and indicate the use of laparoscopy in trauma patients are still lacking. Additionally, there is a need for prospective randomised controlled trials to provide stronger evidence for the use of the laparoscopic approach in the management of trauma patients.

References


Disaster Preparedness
Need for inclusion in undergraduate nursing education

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ABSTRACT: With the increasing global frequency of disasters, the call for disaster preparedness training needs to be reinforced. Nurses form the largest group of the healthcare workforce and are often on the frontline in disaster management. Therefore, nurses should be adequately equipped with the knowledge and skills to respond to disasters, starting from their pre-service training to their in-service professional training. However, the inclusion of disaster preparedness education in undergraduate nursing curricula is minimal in most countries. The purpose of this article is to highlight the current state of nursing education and training in disaster management, both generally and in Oman. The significance of disaster preparedness training and recommendations for its inclusion in nursing practice and education are also discussed.

Keywords: Disasters; Disaster Planning; Nursing Education; Students; Health Personnel; Oman.

The United Nations Office for Disaster Risk Reduction defines a disaster as a “serious disruption of the functioning of a community or society involving widespread human, material, economic or environmental losses and impacts which exceeds the ability of the affected community and society to cope using its own resources.” Disasters can be natural or man-made and range from localised events to large-scale public health emergencies. The occurrence of a disaster is unpredictable and may result in chaos, mass casualties and destruction of property with devastating long-term social, physical, psychological, environmental and economic consequences that affect the health of a population and strain the capacity of the healthcare system. Globally, there has been a steady increase in the magnitude and frequency of disasters and public health emergencies in recent years. In the last decade, there has been an estimated 60% increase in disasters worldwide in which an estimated two million people lost their lives, 4.2 million were injured, 33 million were left homeless and three billion were otherwise affected. Climate change is thought to play a role in the larger number and greater impact of natural disasters; as a result, countries worldwide are encouraged to prepare accordingly. Disasters have increasingly become a global concern as an event in one region can have a great impact on another; as such, no nation, region or community is immune. For instance, the recent Ebola outbreak in West Africa put major cities across the globe on alert.
strengthening disaster preparedness at all levels as a priority for effective disaster management. Disaster preparedness involves planning and preparation to effectively respond to any disaster situation. This includes implementing capacity development, coordinating the participation of responsible organisations, individuals and volunteers and ensuring that all personnel are equipped for response.

Role of the Nurse in Disasters

When disasters occur, members of the healthcare professions are often among the first individuals to respond to the situation. As such, the disaster preparedness training of all healthcare professionals is essential to maintaining an efficient healthcare system in the midst of a disaster, particularly in view of the potentially widespread nature and complex environment of this type of incident. However, disaster preparedness training in most countries is based in specialised hospitals, public health schools or medical schools. Surveys of recent global disasters have noted persistent gaps in the education, training and abilities of healthcare professionals in emergency situations. In response to these deficiencies, several organisations and groups based mainly in developed countries have begun to develop competency-based education and training for members of the healthcare workforce and other responders.

Due to the recent global increase in disasters, the World Health Organization (WHO) recommends that all countries, no matter how frequently they experience disasters, consider training their healthcare professionals to respond to disasters as a national and local priority. As nurses make up the majority of healthcare providers, they represent an indispensable workforce during disasters. The fundamental attributes of the nursing practice are to provide care to the injured or ill, assist individuals and families to deal with physical and emotional issues and work to improve health and well-being within the community. These attributes require competent nurses who are ready to respond in all situations, including in the event of a disaster. Nurses must be able to adapt their skills from focusing on individuals to large numbers of patients, both in their delivery of lifesaving and emergency care and in the maintenance of public health. Therefore, disaster training for nurses is vital. Nurses must be involved in all phases of disaster planning in order to increase their understanding of their role and expected contributions in response to a disaster.

Disasters and Disaster Management in Oman

Oman has a history of frequent tropical storms which can have devastating effects on lives and infrastructure, the most recent of which was Cyclone Gonu in 2007. In addition, Oman is at risk of emerging public health emergencies such as the influenza A virus subtype haemagglutinin-1 neuraminidase-1 (swine flu) and coronavirus (Middle East respiratory syndrome), among others. The National Disaster Management Committee coordinated by the Oman National Committee for Civil Defence has standards for health emergency plans which involve prevention, mitigation, preparedness and response measures to both natural and man-made disasters.

Nevertheless, emergency management in Oman is still lacking and large gaps in disaster management have been reported following major disasters; according to interviews with health personnel, they were often confused, disoriented or left to work without prior guidelines during Cyclone Gonu. In addition, infrequent training and unclear staff training modalities were found to exist in healthcare disaster plans designed and implemented by the Ministry of Health (MOH) in Oman.

Role of Nursing Undergraduate Curricula in Disaster Preparedness

Higher education institutions are capable of making great contributions to all phases of disaster management. First, these institutions can inculcate a culture of disaster preparedness and mitigation by developing training curricula, promoting educational opportunities and raising awareness of institutional disaster management plans. Second, academic institutions can conduct relevant research and develop capacity-building programmes for healthcare workers and those involved in humanitarian work. These measures would create a wealth of resources that could be utilised in national preparedness and response systems through academic-public health partnerships.

Disaster preparedness is a critical component of undergraduate education for health professionals. Students must be adequately educated to successfully carry out their roles in disasters as a professional requirement. As such, core competencies must be established and function effectively. In 2009, the WHO and the ICN developed the Framework of Disaster Nursing Competencies; all nurses...
worldwide are expected to be able to demonstrate the outlined competencies, thus providing an avenue to adequately prepare nurses for their future roles in disaster management. However, many health academic institutions around the world lack disaster preparedness curricula and have no developed competencies for students in health professions.

Global Trends in Disaster Preparedness Education

In the USA, education on preparing for disasters was introduced within nursing curricula in the early 1970s but was then gradually removed. It wasn’t until the late 1990s that the increasing involvement of nurses in disaster response situations strengthened the need to once again include disaster nursing education in the curriculum. In 2003, the National Student Nurses’ Association in the USA passed resolutions to include disaster preparedness content in the nursing curricula of all nursing schools. A few other nursing programmes worldwide have adopted the American curriculum. In the UK, as one of the requirements for nursing education pre-registration, nurses joining adult health specialties are mandated to recognise their role in disaster management, major incidents and public health emergencies and to respond appropriately according to their level of competence.

Disaster nursing education for undergraduate students was recently introduced in 44 nursing schools in China. In contrast, less than half of the nursing education programmes in Japan included disaster nursing courses in 2009. Universities in Hong Kong and Australia did not include disaster content in their undergraduate nursing curricula in 2013. There is little information available on disaster training in nursing curricula among universities in Africa or the Middle Eastern region, apart from certain universities in Iran, Turkey and Jordan.

Disaster Preparedness Education in Oman

Currently, there is no information on the availability of disaster nursing content in the undergraduate curriculum for nursing students in Oman. Diploma-level training of nurses in Oman began in the early 1970s and the first baccalaureate nursing programme commenced in 2002. Currently, two universities in Oman provide degree programmes and the MOH plans to encourage nursing institutions offering diploma programmes to upgrade their curricula to the baccalaureate level. However, there is no documented evidence that disaster preparedness is or will be included within the core competencies of either diploma or undergraduate nurses in Oman. It can therefore be assumed that disaster training for nursing students in Oman is suboptimal; critically, this may translate into a generation of future nurses who are ill-equipped to handle disasters.

Barriers to Implementing Disaster Preparedness Education

Several barriers exist to the implementation of disaster training for student nurses. For a long time, disaster preparedness training was reserved only for nurses practicing in emergency departments or was offered only as a specialised post-basic course. Additionally, existing nursing curricula in many countries are already at maximum capacity without the addition of further modules on disaster preparedness. To cope with this, there is a need to review nursing curricula to identify areas where disaster concepts can be integrated into current courses within nursing programmes. Furthermore, teaching faculty may lack the knowledge and confidence to teach disaster content. In the USA, the National League for Nurses reported that 75% of faculty teaching 348 nursing programmes were poorly prepared to teach disaster preparedness content.

Significance of Disaster Preparedness Training for Undergraduate Students

In general, the number of undergraduate programmes preparing student nurses for disaster management is still limited in many countries, resulting in professional nurses with limited competencies to participate effectively during a disaster. Various international regulatory bodies have called for the inclusion of disaster content in nursing education at all levels. Introducing disaster nursing content at the undergraduate level will not only increase the capacity of the health workforce to respond but will provide graduates entering the workforce with a foundation which can be developed further through in-service training and continuing professional development (CPD) programmes, thus saving resources. Effective prior training also ensures the safety and health of healthcare workers and responders during a disaster. Additionally, it may also improve the willingness of students to help during a disaster; undergraduate nursing students may be called upon during large-scale disasters to boost the capacity of practicing nurses.
and these students must therefore possess the basic knowledge and skills of disaster nursing. Student nurses trained in disaster management could also assist in community education programmes as part of a community disaster preparedness health initiative.

**Recommendations for Improving Disaster Preparedness Education**

In preparation for disasters, nurses must be able to assess their own limitations, knowledge and skills. Integrating disaster management courses into nursing curricula and offering CPD courses in disaster management would prepare nurses for emergency situations. The development of the teaching faculty through partnerships with agents involved in training personnel for disaster management is a step in the right direction to ensure proficiency in the undergraduate teaching of disaster preparedness. The WHO and ICN Framework of Disaster Nursing Competencies could be adopted by universities to underpin undergraduate nursing curriculum content.

Currently, there is no evidence in the literature of a national action to prepare nurses for disasters in Oman. Academic institutions and the MOH should work together to develop a national framework for disaster training in Oman. This will provide a more consistent approach and standardisation of nursing education programmes in order to ensure that subsequent generations of nurses have been reliably and consistently trained in disaster management. The regulatory authority of professional nurses in Oman needs to ensure that all nursing graduates meet the WHO/ICN disaster competencies by including disaster nursing as a mandatory component in nursing curricula. The Oman Medical Specialty Board, as a body responsible for CPD in Oman, should include evidence-based disaster preparedness in the undergraduate teaching of disaster preparedness.

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**References**


Application to Patient Care

- The results of this study may be utilised by healthcare policy-makers in Oman to help raise awareness among Afzal users about the potential dangers of this smokeless tobacco product.

Advances in Knowledge

- This study analysed the composition of a random sample of the common Omani smokeless tobacco product Afzal. It revealed high levels of certain tobacco-specific nitrosamines, including 4-(N-nitrosomethylamino)-1-(3-pyridyl)-1-butanone and N-nitrosoanabasine.

Abstract: Objectives: There is a lack of awareness regarding the carcinogenicity of Afzal, an illegal smokeless tobacco product (STP) widely used among the Omani youth. Previous research has shown that certain types of tobacco-specific nitrosamines (TSNAs) are associated with oral and lung cancers. This study therefore aimed to assess levels of four common TSNAs in a randomly selected sample of Afzal.

Methods: This study was carried out at Sultan Qaboos University in Muscat, Oman, between April and September 2013. A random sample of Afzal was analysed for four types of TSNAs using high-performance liquid chromatography-tandem mass spectrometry. The four types of TSNAs analysed were 4-(N-nitrosomethylamino)-1-(3-pyridyl)-1-butanone (NNK), N-nitrosonornicotine (NNN), N-nitrosoanatabine (NAT) and N-nitrosoanabasine (NAB). As a reference product, a sample of laboratory-manufactured American moist snuff (Centers for Disease Control and Prevention, Atlanta, Georgia, USA) was also used to confirm the accuracy and precision of the analysis.

Results: The analysis revealed total TSN concentration levels in the Afzal sample. Mean levels of NNN, NNK, NAT and NAB were 1.205, 1.015, 0.809 and 0.545 μg/g, respectively.

Conclusion: Levels of the two most abundant TSNAs (NNN and NNK) found in the Afzal sample exceeded international regulatory limits. Afzal users therefore need to be educated regarding the potential health risks associated with their STP use. Stricter implementation of current legislation is recommended to reduce the availability and usage of Afzal in Oman.

Keywords: Smokeless Tobaccos; Carcinogenesis; Nitrosamines; Tandem Mass Spectrometry; Liquid Chromatography; Oman.

Smokeless tobacco products (STPs) represent a significant health risk and have been associated with oral and pancreatic cancers, oral lesions, coronary artery and peripheral vascular disease and adverse pregnancy outcomes. Approximately 28 carcinogens have been identified in STPs so far. Tobacco-specific nitrosamines (TSNAs) are considered a potent class of carcinogens in STPs. TSNAs are found to have high concentrations of heavy metals and cancer-enhancing anions in their components and are therefore not equal in their delivery of carcinogenic TSNAs into the human body. The World Health Organization (WHO) reports that Swedish snus has the lowest level of nitrosamine—the most dangerous carcinogen—among STPs available on the global market. In contrast, the highest levels of TSNAs have been detected in Sudanese toombak. In the USA, the three most popular brands of snuff were found to have high concentrations of TSNAs. Afzal is a STP widely used by youth and teenagers in Oman. This study was carried out at the Sultan Qaboos University (SQU) in Muscat, Oman, between April and September 2013. A single package of 4.00 kg of Afzal was purchased by the researchers from one source in order to maintain uniformity throughout the study. The Afzal sample was labelled, pH and moisture levels were tested and the sample was refrigerated as previously described. The analysis was undertaken within six months of manufacture of the product. In order to enhance the quality of the data and to confirm the accuracy and precision of the analysis, a sample of American moist snuff was utilised as a reference. The certified reference product-2 (CRP-2) is purposely manufactured for laboratory analysis by the Tobacco and Volatiles Branch of the Division of Laboratory Sciences at the Centers for Disease Control and Prevention (Atlanta, Georgia, USA) and is not commercially available. This manufactured product is useful for comparing reference values obtained from different international analytical laboratories. Samples of CRP-2 were thus prepared and analysed using the same methods as the Afzal samples [Figure 1]. Simultaneously, the CRP-2 samples were dealt with in the analysis as a different STP sample matrix in order to prove the validity of the method used for other STPs.

Methods

This study was carried out at the Sultan Qaboos University (SQU) in Muscat, Oman, between April and September 2013. A single package of 4.00 kg of Afzal was purchased by the researchers from one source in order to maintain uniformity throughout the study. The Afzal sample was labelled, pH and moisture levels were tested and the sample was refrigerated as previously described. The analysis was undertaken within six months of manufacture of the product. In order to enhance the quality of the data and to confirm the accuracy and precision of the analysis, a sample of American moist snuff was utilised as a reference. The certified reference product-2 (CRP-2) is purposely manufactured for laboratory analysis by the Tobacco and Volatiles Branch of the Division of Laboratory Sciences at the Centers for Disease Control and Prevention (Atlanta, Georgia, USA) and is not commercially available. This manufactured product is useful for comparing reference values obtained from different international analytical laboratories. Samples of CRP-2 were thus prepared and analysed using the same methods as the Afzal samples [Figure 1]. Simultaneously, the CRP-2 samples were dealt with in the analysis as a different STP sample matrix in order to prove the validity of the method used for other STPs.

 Afzal and CRP-2 samples were dried separately in accordance with standard protocols from the CDC to determine moisture content in STPs. Approximately 15.00 g each of Afzal and CRP-2 were weighed separately in pre-weighed moisture dishes and placed uncovered in an oven at 99 ± 1 °C for three hours. The samples were then removed from the oven, covered and cooled in a desiccator at room temperature for

![Figure 1: Photograph of the reference product](image-url)
Analysis of Tobacco-Specific Nitrosamines in the Common Smokeless Tobacco Afzal in Oman

Table 1: Accuracy, precision, reliability and linearity values for each type of tobacco-specific nitrosamine analysed in the Afzal samples

<table>
<thead>
<tr>
<th>Sample</th>
<th>NAB</th>
<th>NAT</th>
<th>NNK</th>
<th>NNN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average</td>
<td>10.480</td>
<td>83.400</td>
<td>23.270</td>
<td>89.690</td>
</tr>
<tr>
<td>SD</td>
<td>1.110</td>
<td>0.650</td>
<td>0.280</td>
<td>0.970</td>
</tr>
<tr>
<td>RSD in %</td>
<td>10.550</td>
<td>0.780</td>
<td>1.220</td>
<td>1.080</td>
</tr>
<tr>
<td>Accuracy in %</td>
<td>104.840</td>
<td>92.670</td>
<td>93.090</td>
<td>99.660</td>
</tr>
<tr>
<td>R-value</td>
<td>0.986</td>
<td>0.986</td>
<td>0.971</td>
<td>0.994</td>
</tr>
<tr>
<td>LOD in ppb</td>
<td>3.320</td>
<td>1.960</td>
<td>0.850</td>
<td>2.910</td>
</tr>
<tr>
<td>LOQ in ppb</td>
<td>11.060</td>
<td>6.530</td>
<td>2.850</td>
<td>9.710</td>
</tr>
</tbody>
</table>

NAB = N-nitrosoanabasine; NAT = N-nitrosoanatabine; NNK = 4-(N-nitrosomethylamino)-1-(3-pyridyl)-1-butanone; NNN = N-nitrosonornicotine; SD = standard deviation; RSD = relative standard deviation; LOD = limit of detection; ppb = parts per billion; LOQ = limit of quantification.

Table 2: Concentrations of tobacco-specific nitrosamine levels in three Afzal samples and one reference product sample as determined by high-performance liquid chromatography-tandem mass spectrometry

<table>
<thead>
<tr>
<th>Sample</th>
<th>NNK</th>
<th>NNN</th>
<th>NAB</th>
<th>NAT</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Afzal 1</td>
<td>1.018</td>
<td>1.178</td>
<td>0.624</td>
<td>0.807</td>
<td>3.627</td>
</tr>
<tr>
<td>Afzal 2</td>
<td>1.017</td>
<td>1.221</td>
<td>0.524</td>
<td>0.818</td>
<td>3.580</td>
</tr>
<tr>
<td>Afzal 3</td>
<td>1.009</td>
<td>1.216</td>
<td>0.486</td>
<td>0.802</td>
<td>3.513</td>
</tr>
<tr>
<td>Mean</td>
<td>1.015</td>
<td>1.205</td>
<td>0.545</td>
<td>0.809</td>
<td>3.573</td>
</tr>
<tr>
<td>SD</td>
<td>± 0.004</td>
<td>± 0.019</td>
<td>± 0.058</td>
<td>± 0.007</td>
<td>± 0.047</td>
</tr>
<tr>
<td>Mean</td>
<td>0.465</td>
<td>1.793</td>
<td>0.209</td>
<td>1.668</td>
<td>4.135</td>
</tr>
<tr>
<td>SD</td>
<td>± 0.280</td>
<td>± 0.970</td>
<td>± 1.110</td>
<td>± 0.650</td>
<td>± 0.752</td>
</tr>
</tbody>
</table>

TSNA = tobacco-specific nitrosamine; NNK = 4-(N-nitrosomethylamino)-1-(3-pyridyl)-1-butanone; NNN = N-nitrosonornicotine; NAB = N-nitrosoanabasine; NAT = N-nitrosoanatabine; SD = standard deviation; CRP-2 = certified reference product-2.

42 filtration paper, Sigma-Aldrich Corp., St. Louis, Missouri, USA (Whatman® GD/X syringe filter) followed by a 0.22 µm pore-sized nylon syringe filter (Whatman® GD/X syringe filter, Sigma-Aldrich Corp.). Analytical standards of NNN, NNK, NAT and NAB were purchased (Sigma-Aldrich Corp.). Methanol dilution was used to prepare five different concentrations of each analyte (10, 30, 50, 70 and 100 parts per billion [ppb]). Standard calibration curves were plotted for each of the TSNA. For accuracy and precision, the relative standard deviation (RSD), limit of detection (LOD), limit of quantification (LOQ) and r-value of 10 replicate injections of 10 ppb each of the standards were calculated.

Analytical separation of the Afzal and the CRP-2 samples was performed using a high-performance liquid chromatography (HPLC) system (1290 Infinity LC System, Agilent Technologies, Santa Clara, California, USA) with a Zorbax SB C18 1.8 µm, 2.1 x 50 mm stationary phase column (Agilent Technologies). Eluent A (aqueous phase) was a 5 mM ammonium acetate solution, whereas eluent B (organic phase) was comprised of acetonitrile and water at a ratio of 70:30, along with 5 mM of ammonium acetate. The column temperature was kept at 40 ºC and the flow rate was constant at 0.4 mL/minute. The eluents were run in a gradient manner with a running time of five minutes. The detector used was a 6460 Triple Quadrupole LC/MS (Agilent Technologies). All chromatographic data were processed using MassHunter Workstation software B.06.00 (Agilent Technologies). All chemicals used in the analysis were from Sigma-Aldrich Corp. and were of analytical grade. Deionised water from a Milli-Q® Integral Water Purification System (EMD Millipore Corp., Bedford, Massachusetts, USA) was used throughout the analysis. Machine detection limits were calculated for each of the analysed TSNA.
Statistical analysis was performed using Excel spreadsheet software, Version 2010 (Microsoft Corp., Redmond, Washington, USA). As this study was a chemical analysis of two forms of STPs, it did not require ethical approval.

**Results**

The method used for the analysis of the Afzal samples showed high sensitivity and reliable validity, as indicated by the LOD, LOQ, RSD and other accuracy and linearity values of the calibration curves for all four TSNA types [Table 1]. Concentrations of all four TSNAs were detected in both the Afzal and the CRP-2 samples [Table 2]. TSNA levels for each of the three Afzal samples were very similar, reflecting the precision of the analysis. In the Afzal samples, mean analyte levels of NNN, NNK, NAT and NAB were 1.205 ± 0.019 µg/g, 1.015 ± 0.004 µg/g, 0.809 ± 0.007 µg/g and 0.545 ± 0.047 µg/g, respectively. For the CRP-2
sample, mean levels of the same TSNAs were 1.793 ± 0.970 μg/g, 0.465 ± 0.280 μg/g, 1.668 ± 0.650 μg/g and 0.209 ± 1.110 μg/g, respectively. Levels of NNN were highest while NAB levels were lowest for both the Afzal and the CRP-2 samples. Overall, the CRP-2 sample contained higher mean total TSNAs levels (4.135 μg/g) than the Afzal sample (3.573 μg/g).

The observed TSNAs values for the CRP-2 sample were in line with certified reference values provided by the CDC, validating the results of the analysis [Table 3]. Chromatograms of the analysed TSNAs in all three Afzal samples were very similar, confirming the presence of the same analytes in each sample [Figure 2]. Chromatograms of TSNAs in the CRP-2 sample were comparable to those of Afzal samples, although there were slight differences between each analyte [Figure 3]. These chromatograms of TSNAs in CRP-2 showed comparable results, reflecting the effectiveness of the method used for the new STP sample matrix.

Discussion

Nitrosamines have been strongly associated with several human and animal cancers.4 While nitrosamines are present in many foods and items which come into contact with food in amounts ranging from 1–10 ng/g, the highest exposure to humans comes from tobacco use.17 These chemical compounds have been detected in the saliva of tobacco chewers and are believed to form in the digestive system.17 All STPs demonstrate a wide diversity in their chemical compositions which result from variations in geographical location, additives used and manufacturing methods.4 In order to avoid potentially diverse chemical compositions, one random sample of Afzal was chosen to conduct several chemical and toxicological tests. The presence of TSNAs in the Afzal samples was confirmed using a modified version of Lawler et al.’s method.4

Levels of nitrosamines in green tobacco leaves are negligible; however, several factors may foster the formation of TSNAs in STPs, including the dapping, curing and fermentation processes, storage temperatures, high nitrate/nitrite content, alkaline pH and high moisture levels.18,19 Most of these factors are present in Afzal. As reported previously, samples of Afzal were observed to have an alkaline pH (10.460), high moisture levels (52%) and a high nitrate concentration (8,792.200 μg/g).17 In general, Afzal is stored illicitly in local STP shops or retail outlets where there is likely to be poor hygiene, a lack of air circulation and high temperatures which dramatically increase in the summer. Shi et al. confirmed that STP storage temperatures of above 30 °C increased TSNAs formation significantly, as did high levels of nitrate.20 A study by the WHO revealed that storage at room temperature increases TSNA concentrations in STPs due to microbial action.7 Different manufacturing processes also play a role in TSNA level variations. High TSNA levels in American moist snuff and low TSNA levels in Swedish snus have been reported to be due to the fermentation process in the former and heat treatment or a pasteurisation-like process in the latter.8 Heat treatment gives rise to more sterile products by killing the bacteria implicated in the formation of nitrosamines, while fermentation leads to a high concentration of nitrites.21 Afzal is manufactured using a fermentation process; this may therefore facilitate the formation of TSNAs. The high TSNA content in toombak has been attributed to its high nitrate content, alkaline pH and its manufacture via fermentation.10

In the current study, high levels of two specific forms of TSNAs—NNN and NNK—were noted. Measurements of NNK and NNN show significant variation from one country to another. Levels of NNN and NNK levels in Afzal noted in the current study were lower than those found in traditional American STPs (135.000 μg/g and 17.800 μg/g, respectively) or dry weight toombak (3.085 μg/g and 7.870 μg/g, respectively);4 however, these levels may nevertheless increase in Afzal blends due to the effect of the aforementioned factors that contribute to TSNA formation. Stepanov et al. reported that NNN and NNK levels in Indian khaini and zarda range between 1.740–76.900 μg/g and 0.080–28.400 μg/g, respectively, while lower ranges are reported for gutkha (0.090–1.090 μg/g and 0.040–0.430 μg/g, respectively).22 In the current study, levels of NNK in Afzal were much higher than those observed in gutkha, but were lower than those found in khaini and zarda. In terms of NNK levels, the results of the current study were within the same range as those found in khaini and zarda, but were higher than that of gutkha.21 The NNK and NNN levels in toombak (516.000 μg/g and 368.000 μg/g, respectively) were markedly higher than dry weight levels of Bangladeshi zarda (3.840 μg/g and 28.600 μg/g, respectively).21 Low levels of NNN were also noted in Indian tobacco products (18.600 μg/g).21

Concentrations of NNN and NNK in American moist snuff have been reported to be 42.600 μg/g and 9.950 μg/g, respectively.23 Hearn et al. found that Alaskan Iq’nik had NNN and NNK dry weight levels of 2.700 μg/g and 0.340 μg/g, respectively.24 Handmade Pakistani gutkha has a lower total TSNA content compared with handmade gutkha.25 New STPs in the USA have decreased mean total dry weight TSNA levels (2.610 μg/g) in comparison to traditional STPs.
(7.420 µg/g), the same is true for specific NNN and NNK levels (2.050 versus 4.410 µg/g and 0.231 versus 1.200 µg/g, respectively). Nevertheless, these NNN and NNK levels are still 100–1,000 times higher than nitrosamine levels reported in food and beer.26

Both NNN and NNK are thought to be potent carcinogens.3 The use of toombak, which has high NNN and NNK levels as mentioned above, has been associated with cancers of the oral cavity.31,32 Many factors may influence the uptake or absorption of TSNAs in the oral cavity. TSNAs are highly water-soluble; therefore, as the moisture content of a STP increases, the levels of soluble TSNAs may also rise, resulting in enhanced absorption by the oral mucosa.33 The authors of the current study strongly believe that TSNAs are not safe at any level. As a result, it is strongly recommended that existing legislation in Oman regarding the illegal sale of Afzal be more strictly enforced. Furthermore, there is a need for national public health awareness programmes regarding the potential carcinogenic effects of Afzal.

For Swedish snus, maximum permissible levels of carcinogenic substances are laid out by the GOTHIATEK® standard (Swedish Match, Stockholm, Sweden).34 According to this, the maximum permissible combined NNN and NNK level is 1.000 µg/g.34 Between 1983 and 2004, manufacturers of Swedish snus gradually decreased total TSNAs levels to approximately 2.000 µg/g.33 A recent study revealed that the total TSNA level in an unused 1.000 g pouch of snus was approximately 0.830 µg/g, with quantifiable levels of NAT, NNN and NAB (0.268 µg/g, 0.191 µg/g, 0.344 µg/g and 0.025 µg/g, respectively).33 Therefore, total TSNA levels in the Afzal sample analysed in the current study were five-fold higher than the recommended GOTHIATEK® limits. Specific TSNA levels in Afzal were six-fold, 2.4-fold, 5.2-fold and 8.4-fold higher than the NAT, NNK, NNN and NAB levels, respectively, in snus. As such, TSNA levels in Afzal can be considered alarmingly high. The WHO recommends regulatory limits on the concentrations of selected carcinogens in tobacco products, including TSNAs.9 Their recommendations permit <2.00 µg/g of combined NNN and NNK levels on a dry weight basis.9 Combined levels of these two TSNAs in the studied Afzal sample (2.22 µg/g) exceeded this limit. This may have a negative effect on the health of Afzal users with frequent unmonitored use. Moreover, Afzal users may be exposed to higher levels of TSNAs as a result of varying self-determined pinch sizes; pinch sizes of Afzal are usually greater than the portions provided in packets of the more monitored and controlled Swedish snus.12,13,33,34

It is important to bear in mind that the results obtained by the current study and previous research on Afzal were derived from a single package of Afzal blend.25,33 The findings of future studies may therefore differ due to variations in the additives and manufacturing processes used.

Conclusion

This study revealed the presence of carcinogenic TSNAs in a single random sample of Afzal. Despite being present at relatively low levels in Afzal as compared to other STPs, two of the most potent carcinogenic TSNAs—NNN and NNK—still exceeded the regulatory limits proposed by the WHO. Total TSNA levels were five-fold higher than the limits recommended by the GOTHIATEK® standard. These findings indicate that Afzal consumption may pose serious health risks for users. Consequently, existing legislation on the sale and availability of this STP should be enforced more rigorously. Increased public health education regarding the potential carcinogenic effects of Afzal is recommended.

Acknowledgements

The authors are grateful to Mr. Stephen B. Stanfill from CDC, USA, for his assistance in obtaining the CRP-2 sample for analysis. The authors would also like to acknowledge the help of Mr. Singaravadivel and Mrs. Muna Al-Hosni from the Central Analytical & Applied Research Unit in the College of Science at SQU for their technical support and cooperation in one HPLC tandem mass spectrometry analysis.

Conflict of Interest

The authors declare no conflicts of interest.

References


Analysis of Tobacco-Specific Nitrosamines in the Common Smokeless Tobacco Afzal in Oman


Outcomes of Cardiopulmonary Resuscitation and Estimation of Healthcare Costs in Potential ‘Do Not Resuscitate’ Cases

*Akhwand S. Ahmad, Sayed Mudasser, Muhammad N. Khan, Hafiz N. H. Abdoun

ABSTRACT: Objectives: Cardiopulmonary resuscitation (CPR) is a life-saving procedure which may fail if applied unselectively. ‘Do not resuscitate’ (DNR) policies can help avoid futile life-saving attempts among terminally-ill patients. This study aimed to assess CPR outcomes and estimate healthcare costs in potential DNR cases. Methods: This retrospective study was carried out between March and June 2014 and included 50 adult cardiac arrest patients who had undergone CPR at Sultan Qaboos Hospital in Salalah, Oman. Medical records were reviewed and treating teams were consulted to determine DNR eligibility. The outcomes, clinical risk categories and associated healthcare costs of the DNR candidates were assessed. Results: Two-thirds of the potential DNR candidates were >60 years old. Eight patients (16%) were in a vegetative state, 39 (78%) had an irreversible terminal illness and 43 (86%) had a low likelihood of successful CPR. Most patients (72%) met multiple criteria for DNR eligibility. According to the results, 72% of the patients who had undergone CPR at Sultan Qaboos Hospital were ≥60 years old, and 78% had irreversible terminal illnesses. Conclusion: ‘Do not resuscitate’ cases may be identified and futile CPR efforts avoided. Institutional DNR policies may help to reduce healthcare costs and improve services.

Keywords: Cardiopulmonary Resuscitation; Medical Futility; Do Not Resuscitate Orders; Persistent Vegetative State; Terminally Ill; Healthcare Costs; Oman.

فِي المحاضر: الهدف: الكشف عن النتائج القلبي الرئوي في الحالات المحتملة التي قد تُفشل إذا تم تدخلها، إذ يُثبط بشكل غير متوقع، مدى العملية الفعّالة. هذة الدراسة تهدف إلى تقييم نتائج الإنعاش القلبي الرئوي في الحالات المحتملة، وذلك من خلال تقييم كلفة الرعاية الصحية على مدى عدة أشهر. هذه الدراسة بُنيت بناءً على هيئة مصري شرب وموسي 2014 م، وقد استندت إلى 30 حالة توقف قلب وعفرين من الأفراد الذين أجريت لهم عملية إنعاش قلبي رئوي في مستشفى السلطان قابوس بالداخلة. هناك، تم تقييم حالات الطوارئ المرضية للمريض المحتمل بتحديد النسبة الكلية للفشل في تقييم النتائج للكلفة الصحية المحتملة. هذه العمليات القلبي الرئوي يمكن تقييمها أيضًا في حالات المحتملة، حيث يمكن تقييم النتائج الميدانية للمريض المحتمل بتحديد انخفاض تكلفة الرعاية الصحية وتحسين الخدمات في ذلك الوقت.

مفتاح الكلمات: الإنعاش القلبي الرئوي؛ عدم الجدوي الطبية؛ التوصية بعدم الإنعاش؛ غيبوبة دماغية مستمرة؛ مرضى عزلة.

Advances in Knowledge

While cardiopulmonary resuscitation (CPR) techniques have advanced over time, these life-saving measures may still be futile for certain patients. This study indicates very poor CPR outcomes and high associated healthcare costs among potential do not resuscitate (DNR) candidates at a secondary care hospital in Oman.
Cardiopulmonary resuscitation (CPR) is an emergency medical procedure whereby external measures, including chest compression, artificial respiration or defibrillation, are carried out in an attempt to restore breathing and spontaneous circulation in a patient whose heart and/or breathing have stopped. Important milestones in the history of CPR include the implementation of mouth-to-mouth resuscitation by William Tossach in 1732, the first successful closed-chest cardiac massage by Friedrich Maass in 1892, and the first successful open-chest human defibrillation by Claude Beck and his team in 1947 and the first successful closed-chest human defibrillation by Paul Zoll and colleagues in 1955. Chest compressions were established as part of CPR procedures by William Kouwenhoven in 1958. The American Heart Association (AHA) formally endorsed CPR in 1963 and produced standardised CPR guidelines in 1966. Prompt CPR is life-saving in select cases. However, the chances of a patient surviving following CPR measures vary depending on the cause and circumstances of the cardiac arrest. With in-hospital CPR, the chances of survival-to-discharge are 15–20%, while out-of-hospital CPR carries an even lower rate of survival-to-discharge (5–10%). Survival rates decrease even further for the elderly, nursing home residents or those with multiple medical problems. For advanced cancer patients, survival-to-discharge following in-hospital CPR is approximately 6%. Furthermore, the process of CPR itself is not without risk. Rib fractures, damage to internal organs, hypoxic brain damage and increased risk of physical disability are potential CPR-associated complications.

Following CPR, a patient will normally require support in an intensive care unit (ICU); fatal anoxic encephalopathy or respiratory complications may arise from long-term ventilator dependence. Unsuccessful CPR may also lead to an undignified and/or traumatic death, as well as creating an unnecessary financial burden on the medical services system.

By 1976, as the limitations of CPR became known, the potential benefits of ‘do not resuscitate’ (DNR) orders for terminally-ill patients began to be discussed. Carrying out a DNR order means that no resuscitative measures are undertaken if the patient undergoes a cardiopulmonary arrest. Cardiac or respiratory arrest is an inevitable part of dying; thus, theoretically, CPR measures can be used indefinitely on every individual. It is therefore essential to identify patients for whom cardiopulmonary arrest represents the terminal event in their illness, as CPR is inappropriate for these patients. In circumstances where the decision is made not to perform CPR, an order for DNR—sometimes termed ‘do not attempt resuscitation’ or ‘allow natural death’—is inserted into the patient’s records. Such orders are intended to prevent inappropriate, futile or undesired CPR attempts.

The General Medical Council of the UK recommends not attempting CPR if resuscitation is likely to be unsuccessful (i.e. if cardiac or respiratory arrest is an expected part of the dying process) or if successful CPR is not clinically appropriate (i.e. due to likely clinical outcomes). In Wisconsin, USA, legislation exists which permits physicians to dispense DNR orders for the following types of adult patients: those with terminal illnesses; those with medical conditions that indicate CPR would be unsuccessful in restoring cardiac or respiratory function; those who would shortly undergo repeated cardiac or pulmonary failure before death despite CPR measures; or those who would suffer significant pain or harm as a result of the CPR measures, eclipsing the possibility that CPR measures might successfully and indefinitely restore cardiac or respiratory function. In essence, DNR orders are implemented if the clinical team believes that CPR is medically futile or if CPR will, at the most, prolong the process of dying. Additionally, CPR may not be appropriate if it is unlikely to lead to a meaningful recovery or is carried out on a vegetative patient.

In Oman, as with many other countries, no legislation regarding DNR orders currently exists. Previous research conducted in the country has focused on DNR orders in relation to terminally-ill cancer patients and in the neonatal ICU of a tertiary care centre. This study aimed to assess the outcomes and estimate the associated healthcare costs of CPR among potential DNR patients admitted to the Sultan Qaboos Hospital (SQH), a secondary care centre in Salalah, Oman.

**Methods**

This retrospective study was carried out from March to June 2014 at SQH and included all admitted adult...
medical patients >18 years old who had experienced cardiac arrest, received at least one attempt at CPR (referred to as index CPR) and were potential DNR candidates. Patients whose medical history was unknown, who presented with cardiac arrest or those with an uncertain DNR eligibility status were excluded from the study. Similarly, patients who were resuscitated in hospital areas other than the general medical ward or medical critical care area (e.g. emergency, surgical or gynaecological departments) were not included. A total of 81 patients at SQH were initially determined to have suffered a cardiac arrest and undergone CPR. Of those, 50 met the inclusion criteria and were included in the study. Another 19 patients were subsequently identified, but were excluded from the study due to a lack of information on the part of the consulting physician regarding the status of the patient prior to CPR.

Three criteria were determined to indicate DNR eligibility: (1) the clinical condition of the patient indicated that resuscitation would be medically futile as it would either not restore cardiac and respiratory function or would do so only briefly with a subsequent need for further CPR attempts; (2) the patient was in a persistent vegetative state with no reasonable possibility of regaining cognitive function; or (3) the patient had been diagnosed with an irreversible terminal illness whereby cardiopulmonary arrest was considered a natural consequence of the disease process. The demographic and clinical data of the DNR candidates were collected from medical records and via consultations with the treating teams. In some cases, the researchers had been directly involved in the care of a particular patient and were able to categorise DNR eligibility without further consultation. The potential DNR cases, once identified, were assessed for immediate and long-term CPR outcomes. Additionally, the following pre-existing conditions (i.e. present at admission) were deemed clinical risk categories predictive of a poor prognosis and were used to further classify the patients: terminal incurable malignancy, recent massive stroke, end-stage organ failure and being bed-bound.

Healthcare costs (including expenses related to medications, laboratory investigations, imaging studies, procedures such as tracheostomies or chest tube placements and hospital stay) were approximated using information collected from a comprehensive healthcare information management system (e-Government Al Shifa System, Ministry of Health, Muscat, Oman). Unfortunately, data on certain items were not available via this system (e.g. screening cultures, nutritional supplements and disposable products such as catheters, central lines, endotracheal and feeding tubes, urinary catheters and drainage bags) and thus the costs of these items were not included in the estimation. Data were analysed with simple statistical calculations performed manually using Microsoft Excel 2010 (Microsoft, Inc., Redmond, Washington, USA).

This study was approved by the Ethical Committee of the Directorate General of Health, Ministry of Health, Salalah.

Table 1: Characteristics of potential ‘do not resuscitate’ patients undergoing at least one attempt at cardiopulmonary resuscitation at Sultan Qaboos Hospital, Salalah, Oman (N = 50)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Total (n = 50)</th>
<th>Index CPR survivors (n = 20)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>29 (58)</td>
<td>13 (65)</td>
</tr>
<tr>
<td>Female</td>
<td>21 (42)</td>
<td>7 (35)</td>
</tr>
<tr>
<td>Mean age in years (range)</td>
<td>64 (26–98)</td>
<td>61 (26–79)</td>
</tr>
<tr>
<td>Nationality</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Omani</td>
<td>44 (88)</td>
<td>19 (95)</td>
</tr>
<tr>
<td>Other</td>
<td>6 (12)</td>
<td>1 (5)</td>
</tr>
<tr>
<td>Mean hospital stay in days prior to index CPR (range)</td>
<td>33 (0–320)</td>
<td>34 (0–236)</td>
</tr>
<tr>
<td>DNR eligibility category</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vegetative state [95% CI]</td>
<td>8 (16) [5.9–26.1]</td>
<td>3 (15) [0–30.6]</td>
</tr>
<tr>
<td>Terminal illness [95% CI]</td>
<td>39 (78) [66.6–79.4]</td>
<td>12 (60) [38.5–81.5]</td>
</tr>
<tr>
<td>Low likelihood of CPR success [95% CI]</td>
<td>43 (86) [76.9–95.6]</td>
<td>16 (80) [62.5–97.5]</td>
</tr>
<tr>
<td>Ventilation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Before index CPR</td>
<td>22 (44)</td>
<td>6 (30)</td>
</tr>
<tr>
<td>After index CPR</td>
<td>20 (40)</td>
<td>20 (100)</td>
</tr>
<tr>
<td>Clinical risk category</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bed-bound [95% CI]</td>
<td>25 (50) [36.1–63.9]</td>
<td>11 (55) [33.2–76.8]</td>
</tr>
<tr>
<td>Malignancy [95% CI]</td>
<td>15 (30) [17.3–42.7]</td>
<td>5 (25) [6.0–44.0]</td>
</tr>
<tr>
<td>Stroke [95% CI]</td>
<td>8 (16) [5.9–26.1]</td>
<td>3 (15) [0–30.6]</td>
</tr>
<tr>
<td>Organ failure [95% CI]</td>
<td>15 (30) [17.3–42.7]</td>
<td>4 (20) [2.5–37.5]</td>
</tr>
</tbody>
</table>

CPR = cardiopulmonary resuscitation; DNR = ‘do not resuscitate’; CI = confidence interval.
Of the 50 potential DNR cases included in the study, 29 (58%) were male and 21 (42%) were female. The patients ranged in age between 26–98 years old; 33 patients (66%) were ≥60 years old and four patients (8%) were <50 years old. The average hospital stay duration before the index CPR was 33 days (range: three hours–320 days) [Table 1]. A total of 22 patients (44%) had already been ventilated for an average of 10 days when index CPR was required (range: 10 minutes–35 days; aggregate: 218 days). Three other patients also received non-invasive ventilation, on average for two days prior to index CPR. Nine patients (18%) were in the general medical ward when they experienced cardiac arrest, while all other patients (82%) were already in the critical care area. Approximately one-third of the patients (n = 17; 34%) were septic on admission and 15 patients (30%) became septic later.

In terms of DNR eligibility criteria, eight patients (16%) were in a vegetative state, 39 (78%) had an irreversible terminal illness and 43 (86%) met the criteria of low clinical likelihood of CPR success [Figure 1]. However, the majority of the patients (n = 36; 72%) met multiple criteria for DNR eligibility. Less than one-third of the patients (n = 14; 28%) met only a single DNR criterion: one patient (2%) was vegetative, three (6%) had been diagnosed with terminal illnesses and 10 (20%) had a low likelihood of CPR success. None of the patients had provided DNR directives in advance.

<table>
<thead>
<tr>
<th>Category</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malignancy</td>
<td>15 (30)</td>
</tr>
<tr>
<td>Lung</td>
<td>3 (20)</td>
</tr>
<tr>
<td>Prostate</td>
<td>2 (13)</td>
</tr>
<tr>
<td>Stomach</td>
<td>2 (13)</td>
</tr>
<tr>
<td>Hepatocellular carcinoma</td>
<td>2 (13)</td>
</tr>
<tr>
<td>Rectum</td>
<td>1 (7)</td>
</tr>
<tr>
<td>Colon</td>
<td>1 (7)</td>
</tr>
<tr>
<td>Glioblastoma multiforme</td>
<td>1 (7)</td>
</tr>
<tr>
<td>Chronic lymphocytic leukaemia</td>
<td>1 (7)</td>
</tr>
<tr>
<td>Liver mass*</td>
<td>1 (7)</td>
</tr>
<tr>
<td>Mediastinal mass*</td>
<td>1 (7)</td>
</tr>
<tr>
<td>Organ failure</td>
<td>15 (30)</td>
</tr>
<tr>
<td>Cardiac</td>
<td>6 (40)</td>
</tr>
<tr>
<td>Pulmonary</td>
<td>5 (33)</td>
</tr>
<tr>
<td>Liver</td>
<td>4 (27)</td>
</tr>
<tr>
<td>Bed-bound</td>
<td>25 (50)</td>
</tr>
<tr>
<td>Multifactorial</td>
<td>12 (48)</td>
</tr>
<tr>
<td>Previous stroke-induced</td>
<td>8 (32)</td>
</tr>
<tr>
<td>Dementia-induced</td>
<td>5 (20)</td>
</tr>
<tr>
<td>Fracture-induced</td>
<td>3 (12)</td>
</tr>
<tr>
<td>Acute or recent stroke</td>
<td>8 (16)</td>
</tr>
<tr>
<td>Massive middle cerebral artery territory infarct</td>
<td>4 (50)</td>
</tr>
<tr>
<td>Intracerebral haemorrhage</td>
<td>2 (25)</td>
</tr>
<tr>
<td>Brain stem/cerebral infarct</td>
<td>2 (25)</td>
</tr>
</tbody>
</table>

*These masses were considered malignant although the patients did not give consent for confirmatory biopsies. These patients had overlapping causes for their bed-bound status.
Table 3: Estimated healthcare costs of potential ‘do not resuscitate’ patients who survived at least one attempt at cardiopulmonary resuscitation at Sultan Qaboos Hospital, Salalah, Oman (N = 20)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Total cost in OMR (USD)</th>
<th>25th percentile</th>
<th>75th percentile</th>
<th>IQR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medications</td>
<td>4,698.0 ($12,215.0)</td>
<td>-</td>
<td>117.5 ($305.5)</td>
<td>117.5 ($305.5)</td>
</tr>
<tr>
<td>Laboratory investigations</td>
<td>4,120.0 ($10,712.0)</td>
<td>-</td>
<td>285.5 ($742.3)</td>
<td>285.5 ($742.3)</td>
</tr>
<tr>
<td>Imaging studies</td>
<td>710.0 ($1,846.0)</td>
<td>-</td>
<td>56.5 ($146.9)</td>
<td>56.5 ($146.9)</td>
</tr>
<tr>
<td>Minor procedures</td>
<td>450.0 ($1,170.0)</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Hospital stay in an ICU/HDU</td>
<td>5,090.0 ($13,234.0)</td>
<td>40.0 ($104.0)</td>
<td>300.0 ($780.0)</td>
<td>260.0 ($780.0)</td>
</tr>
<tr>
<td>Aggregate cost</td>
<td>15,068.0 ($39,178.0)</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Average cost per patient</td>
<td>753.4 ($1,958.9)</td>
<td>40.0 ($104.0)</td>
<td>848.0 ($2,204.8)</td>
<td>808.0 ($2,100.8)</td>
</tr>
</tbody>
</table>

OMR = Omani riyals; IQR = interquartile range; ICU = intensive care unit; HDU = high dependency unit.

status was a stand-alone risk for the remaining 15 bed-bound patients (60%). Among all of the bed-bound patients, the overlapping causes of immobility included previous strokes, (n = 8; 32%), advanced dementia (n = 5; 20%), fractures of the femur or pelvis (n = 3; 12%) or a multifactorial cause (n = 12; 48%) including senility, severe osteoarthritis, degenerative spine disease and diabetes with neurovascular complications [Table 2].

The majority of patients could not be revived during index CPR (n = 30; 60%). The remaining 20 patients (40%) were resuscitated successfully with index CPR but subsequently died; 14 patients (70%) died within 24 hours and only six (30%) survived more than 24 hours (range: 1–31 days). All of these patients required post-CPR ventilator support and intensive care; they remained on ventilators for an average of 5.6 days (aggregate: 112 days) before dying. Four patients (20%) survived >15 days but remained ventilator-dependent. Only one of the patients was taken off the ventilator before death; she was a 54-year-old woman who had been vegetative for eight months and had been weaned onto a T-piece after 16 days of ventilation, despite still being on vasopressors. She arrested again four days later and underwent three further CPR attempts in the following 20 hours before dying. All of these patients underwent yet another CPR attempt prior to death; three patients (15%) underwent resuscitation three times following the index CPR. Six of the index CPR survivors (30%) had been on a ventilator prior to cardiac arrest for a mean duration of 10 days (range: 4–15 days).

Table 3 shows the estimated post-resuscitation healthcare costs for the index CPR survivors. The total cost was approximately Omani riyals (OMR) 15,068.0 (USD $39,178.0), with an average cost of OMR 753.0 (USD $1,958.9) per patient. Patients with prolonged hospital stays with ventilator support were responsible for most of the costs; one-third of costs were attributed solely to stays in high-care units alone.

Discussion

According to Lipsky, four possible indications exist for dispensing a DNR order: futility of treatment, poor quality of life, patient wishes and cost. In the current study, three criteria were used to categorise patients as potential DNR cases. While two of these criteria are relatively straightforward to assess (vegetative state or terminal illness), determining whether CPR is likely to be successful depends on the clinical judgment of the treating physician. Usually, the decision is not difficult, especially as the patient approaches a terminal state. However, some cases may be more complicated. In the current study, the majority of patients met more than one criterion for DNR eligibility; most of these patients were considered eligible for DNR due to both a terminal illness and a low chance of CPR success. However, no comparative data from other studies could be found. According to Wenger et al., DNR orders are more frequently issued to older patients, those with dementia and women. While very few of the patients in the current study were below the age of 50 years old, not many of the patients suffered from dementia and there were more male cases than female.

In the current study, patients were assessed according to four clinical risk categories deemed predictive of a poor prognosis. Half of the cohort were bed-bound, although many of these patients also fell into other risk factors. The term bed-bound is clinically vague; nevertheless, it appears useful for its additive risk due to the predisposition of bed-bound patients to develop severe infections, including aspiration pneumonia, urinary tract infections, infected pressure sores and hospital-acquired infections. Bed-bound patients are also prone to other conditions such as venous thromboembolisms, poor nutrition and bleeding due to antithrombotic administration. Sepsis was also a major factor among the subjects in the current study. As it is usually treatable, it was not included as a risk category; however, with an underlying critical illness, it can be fatal. While each patient is different, certain negative prognostic features...
such as the ones used in the current study may serve to translate into a simplified DNR score. Further research is recommended in this area.

It is important to note that none of the potential DNR patients in the current study survived even if they were successfully resuscitated during index CPR. In a study of ICU patients who underwent CPR after cardiopulmonary arrest, Tian et al. calculated an overall survival-to-discharge rate of 15.9%.22 However, patients on vasopressors were half as likely to survive and mechanical ventilation and older age (≥65 years old) were associated with even lower rates of survival. More than half of the survivors were discharged to rehabilitation centres and only 3.9% were discharged home.21 In comparison, the findings of the current study may seem disappointing; nevertheless, it is important to note that the patients in Tian et al.’s study were not categorised as eligible for a DNR order. Appropriate case selection is therefore a significant factor in guiding CPR prognosis.

In the present study, survivors of the index CPR all required prolonged ventilatory support, with several patients remaining on a ventilator for over 24 hours. Prolonged ICU care and mechanical ventilation is potentially a source of suffering for both the patient and their family; this type of care is also labour-intensive on the part of healthcare staff. Additionally, these patients require beds in ICUs or other high-care areas, which are often in finite supply. Almost half of the cohort in the current study had already been on ventilatory support prior to index CPR for a significant duration of time (aggregate: 218 days) and were already in a critical care area before the initiation of index CPR. Assuming these patients had had DNR orders to begin with, a ceiling-of-care, short of ventilation, could have been established, potentially increasing available resources for other patients. Overall, the estimated cost of post-resuscitation care in the current study was very high; however, it is important to note that the actual total costs involved with futile or inappropriate care of terminally-ill patients is likely much higher.

Patients with a DNR order deserve the same standard of care as any other patient, short of CPR; in addition, DNR orders should be revoked if clinical conditions change. Unfortunately, there is evidence that DNR orders are often broadly applied to other therapies. Beach et al. found that patients with a DNR order were less likely to be transferred to an ICU or to be intubated and that their treating physicians were less willing to draw blood cultures, place central lines or prescribe blood transfusions.25 Brizzi et al. reported that negative prognostic factors such as advanced age, low consciousness levels, history of a previous stroke, midline shift or intraventricular haemorrhage led to a DNR order among patients with intracerebral haemorrhage; moreover, DNR orders were independently associated with a 3.5-fold increase in one-month mortality.23 In this case, early DNR orders may have been used as a justification for an overall decrease in the aggressiveness of care, leading to higher mortality. Similarly, Scarborough et al. reported that preoperatively-issued DNR orders were a risk factor for mortality after emergency general surgery; this is likely because such patients do not undergo aggressive treatment for major postoperative complications.24

Policies and attitudes towards DNR orders vary according to country. In the UK, DNR orders remain clinical decisions; however such decisions should be individualised with an avoidance of blanket policies and attempts should be made to involve patients in the decision-making process.25 In the USA, the situation is different as there is a presumption in favour of resuscitation if a DNR order is not already in place; if made, the orders are established in consultation with the patient or their legal representative.26 The AHA recommends resuscitation for all patients in cardiac arrest unless there is a valid DNR order or if resuscitation is physiologically futile (e.g. if a patient shows signs of irreversible death).27 In 1976, the Natural Death Act was enacted in California, USA, to protect a patient’s right to opt for a natural death without CPR.28 Several years later, the Patient Self-Determination Act was implemented to ensure that healthcare institutions in the USA would recognise and conform to advance DNR directives.29 In Taiwan, most terminal patients were taken home to die in accordance with local customs until 2000, when the Hospice Care Law which includes legislation regarding natural death was enacted.30 Subsequently, DNR orders were found to be on the rise among Taiwanese patients who had been ill for a long period of time or who had solid tumours.30 In Japan, physicians can institute DNR orders without consulting the patient’s family if they feel that CPR is unjustified and futile.31 There are no national guidelines regarding DNR orders in Denmark; however, patients must generally give informed consent before DNR orders are implemented.32 In Saudi Arabia, a DNR order can only be applied in consultation with the patient’s family.33 Overall, CPR seems to be the only medical intervention whereby consent is automatically assumed—based on implied consent for emergency treatment—and a medical order required in order to withhold its administration.

The authors of the current study favour the approach towards DNR implemented in the UK. While CPR is not indicated in every case of cardiac arrest and natural death should be allowed in certain circumstances, the patients and their families should
be involved in the discussion. It has been suggested that changing the wording of DNR orders to ‘allow natural death’ may make the order more descriptive and less threatening. 34 Nevertheless, while communication with patients and their families can facilitate care planning, the extent that the message is understood may be affected by cultural and racial factors; according to Mack et al., end-of-life discussions (terminal illness awareness, treatment preferences and DNR orders) benefited Caucasian patients but not African American patients. 35

One of the major limitations of this study was the retrospective classification of DNR eligibility status based on data collected from medical records and consultations with each patient’s treating team. This process of case selection raises concerns of potential bias in case selection. Additionally, as this was a single-centre study, the results cannot be generalised to other institutions. However, despite these limitations, the findings of this study imply that CPR is ineffective in selected cases which can be identified with a set of predetermined criteria.

Conclusion

Although often life-saving, CPR is not beneficial in many cases. Allowing death to occur naturally can save undue suffering on the part of a terminally-ill patient and their family and reduce the burden on the healthcare system as a whole. Within institutions, the adoption of a DNR policy may reduce healthcare costs both directly and indirectly, as it establishes grounds for the concept of ceiling-of-care and appropriate case-specific treatment options.

CONFLICT OF INTEREST

The authors declare no conflicts of interest.

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33. The Saudi Commission for Health Specialties, Department of Medical Education & Postgraduate Studies. Code of ethics for health care practitioners. From: www.scfhs.org.sa/Reglations/CR/uments/%D8%A3%D8%AE%D9%84%D8%A7%D9%82%D9%8A%D8%A7%D8%AA%20%D8%A7%D8%85%D9%85%D8%A7%D8%B1%D8%B3%20%D8%A7%D9%84%D8%B5%D8%AD%D9%8A.pdf Accessed: Oct 2015.


**Abstract:** Objectives: This study aimed to identify the prevalence of antenatal depression and the risk factors associated with its development among Omani women. No previous studies on antenatal depression have been conducted in Oman. Methods: This descriptive cross-sectional study was carried out between January and November 2014 in Muscat, Oman. Pregnant Omani women ≥32 gestational weeks who were attending one of 12 local primary care health centres in Muscat for routine antenatal care were invited to participate in the study (n = 986). An Arabic version of the validated self-administered Edinburgh Postnatal Depression Scale questionnaire was used to measure antenatal depression. A cut-off score of ≥13 was considered to indicate probable depression. Results: A total of 959 women participated in the study (response rate: 97.3%). Of these, 233 were found to have antenatal depression (24.3%). A bivariate analysis showed that antenatal depression was associated with unplanned pregnancies (P = 0.010), marital conflict (P = 0.001) and a family history of depression (P = 0.019). The adjusted odds ratio (OR) after logistic multivariate regression analysis showed that antenatal depression was significantly associated with unplanned pregnancies (OR: 1.37; CI: 1.02–1.86) and marital conflict (OR: 13.83; 95% CI: 2.99–63.93). Conclusion: The prevalence of antenatal depression among the studied Omani women was high, particularly in comparison to findings from other Arab countries. Thus, antenatal screening for depression should be considered in routine primary antenatal care. Couples should also be encouraged to seek psychological support should marital conflicts develop during pregnancy.

**Keywords:** Pregnancy; Depression; Prevalence; Risk Factors; Women; Primary Health Care; Oman.

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**Prevalence and Risk Factors of Antenatal Depression among Omani Women in a Primary Care Setting**

Cross-sectional study

Mohammed Al-Azri, Iman Al-Lawati, Raya Al-Kamyani, Maisa Al-Kiyumi, Aisha Al-Rawahi, Robin Davidson, Abdullah Al-Maniri

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The prevalence of antenatal depression among the studied Omani women was 24.3%. A bivariate analysis showed that antenatal depression was associated with unplanned pregnancies (P = 0.010), marital conflict (P = 0.001) and a family history of depression (P = 0.019). The adjusted odds ratio (OR) after logistic multivariate regression analysis showed that antenatal depression was significantly associated with unplanned pregnancies (OR: 1.37; CI: 1.02–1.86) and marital conflict (OR: 13.83; 95% CI: 2.99–63.93).

Conclusion: The prevalence of antenatal depression among the studied Omani women was high, particularly in comparison to findings from other Arab countries. Thus, antenatal screening for depression should be considered in routine primary antenatal care. Couples should also be encouraged to seek psychological support should marital conflicts develop during pregnancy.
Depression is a common although often misdiagnosed disorder that can affect women during the antenatal period. While the prevalence of antenatal depression varies between countries, it is generally more common than postnatal depression. Antenatal depression is often associated with considerable medical and psychological morbidities which affect both the mother and baby. Research has shown that antenatal depression increases the risk of pre-eclampsia, operative deliveries (e.g. Caesarean sections or instrumental vaginal deliveries), use of epidural analgesics during delivery, spontaneous preterm births, postnatal depression and suicidal ideation. For the baby, antenatal depression is known to increase the risk of slower fetal activity, low birth weight, subsequent admission to the neonatal care unit and sudden death. In addition, the infants of women with antenatal depression may receive suboptimal physical and psychological care after birth and older children and/or spouses can also suffer from the secondary effects of maternal depression. Consequently, increased awareness and early identification of antenatal depression with appropriate psychotherapeutic interventions could reduce the risk of adverse effects for the mother, child and family.

Several sociodemographic, psychiatric and medical factors have been associated with an increased risk of developing antenatal depression. Low socioeconomic and educational status, low levels of social support, unplanned pregnancies and spousal violence have been associated with the condition. Psychological and psychiatric factors include the existence of psychosocial problems such as depression, stress, anxiety, low self-esteem, poor partner relationships, forced sexual relations and a history of traumatic abuse; these factors may either affect the woman herself or other family members. Finally, excessive consumption of alcohol and iron deficiency anaemia have been linked to the development of antenatal depression.

Oman is a developing country located on the southeastern tip of the Arabian Peninsula. In 2010, the national census recorded a total population of 2.7 million, of which 1.9 million were Omani. Approximately 35% of Omani were aged below 15 years and only 3.5% were aged above 65 years (median age: 22 years). In 2010, approximately 21% of the total population resided in the capital city, Muscat, which is the most populated city in Oman. Primary healthcare is considered the first port of entry to all levels of healthcare in Oman. By means of the Ministry of Health (MOH), the Omani government funds and provides free healthcare services to all Omanis, as well as non-Omanis working in the government sector. In Muscat, standard antenatal services are available in the antenatal clinics of 27 local primary care health centres, each of which provides care to the population in their specific catchment area. In general, a total of six visits are required during a normal low-risk pregnancy while higher-risk pregnancies are referred to antenatal clinics in secondary or tertiary hospitals depending on the severity of the condition. However, no screening measures currently exist within MOH antenatal care protocols to identify women with antenatal depression. To the best of the authors’ knowledge, no studies have yet been conducted in Oman to identify the prevalence of antenatal depression and its potential sociodemographic correlates. The aim of this study, therefore, was to assess the prevalence of antenatal depression among Omani women and explore associated clinical and demographic risk factors.

Methods

This descriptive cross-sectional study was carried out between January and November 2014 in Muscat, Oman. The required sample size for the current study was estimated to be approximately 1,600, based on an assumed 20% prevalence of antenatal depression, a 95% confidence interval (CI) and a 10% error in estimating the prevalence of depression. Of the 27 local primary care health centres in Muscat, 12 centres were randomly selected for inclusion in the study. A
total of 986 pregnant Omani women ≥32 gestational weeks attending one of these 12 centres for routine antenatal care during the study period were invited to participate in the study. Women who were non-Omani, currently receiving treatment for depression, or diagnosed with gestational diabetes, hypertension or pregnancy-induced hypertension were excluded.

The Arabic version of the self-administered Edinburgh Postnatal Depression Scale (EPDS) questionnaire was used to measure antenatal depression. Mohammad et al. first translated into Arabic, validated and successfully used the EPDS questionnaire in a study conducted in Jordan, an Arab country with similar cultural and sociodemographic characteristics to Oman.3 The EPDS is a widely validated questionnaire used to identify and measure depression in the antenatal and postnatal periods.3,5,17

The first part of the questionnaire included 12 items designed to determine the sociodemographic and medical characteristics of the participants, including age, occupation, education level, monthly income, gravidity, gestational age, anaemia status (haemoglobin levels <11.0 gm/dL), history of miscarriage, history of depression, family history of depression, whether the pregnancy was planned or spontaneous and marital conflict. The second part constituted 10 questions to determine the presence of antenatal depression. Each question was scored from 0–3 with a total score ranging from 0–30. A cut-off score of ≥13 was considered to indicate probable antenatal depression.3,5 Three nurses in each of the primary care health centres included in the study were trained to distribute and collect the questionnaires from the study subjects, although the questionnaires were completed solely by the participants. The reliability of the items was tested on a sample of 30 women, which indicated a Cronbach’s alpha value of 0.75. These women were subsequently included in the study.

Data were analysed using the Statistical Package for the Social Sciences (SPSS), Version 20 (IBM Corp., Chicago, Illinois, USA). All variables were subjected to univariate analysis using Pearson’s Chi-squared test to determine associations between antenatal depression and sociodemographic characteristics. A P value of ≤0.050 was considered statistically significant. To adjust for possible confounding factors, a second analysis

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age in years</td>
<td>957 (100.0)</td>
</tr>
<tr>
<td>&lt;24</td>
<td>261 (27.3)</td>
</tr>
<tr>
<td>25–30</td>
<td>451 (47.1)</td>
</tr>
<tr>
<td>&gt;30</td>
<td>245 (25.6)</td>
</tr>
<tr>
<td>Occupation</td>
<td>959 (100.0)</td>
</tr>
<tr>
<td>Housewife</td>
<td>609 (63.5)</td>
</tr>
<tr>
<td>Employed</td>
<td>350 (36.5)</td>
</tr>
<tr>
<td>Education level</td>
<td>957 (100.0)</td>
</tr>
<tr>
<td>Primary and secondary</td>
<td>519 (54.2)</td>
</tr>
<tr>
<td>University</td>
<td>438 (45.8)</td>
</tr>
<tr>
<td>Monthly income in Omani riyals</td>
<td>957 (100.0)</td>
</tr>
<tr>
<td>&lt;500</td>
<td>298 (31.1)</td>
</tr>
<tr>
<td>500–1,000</td>
<td>488 (51.0)</td>
</tr>
<tr>
<td>&gt;1,000</td>
<td>171 (17.9)</td>
</tr>
<tr>
<td>Gravidity</td>
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<tr>
<td>Primigravida</td>
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<td>465 (48.5)</td>
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<td>Grand multigravida</td>
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<td>Gestational age in weeks</td>
<td>959 (100.0)</td>
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<tr>
<td>32–34</td>
<td>399 (41.6)</td>
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<td>35–37</td>
<td>376 (39.2)</td>
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<tr>
<td>&gt;37</td>
<td>184 (19.2)</td>
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<td>Anaemia status†</td>
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<tr>
<td>Mild anaemia</td>
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<td>Moderate-to-severe anaemia</td>
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<td>History of miscarriage</td>
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</tr>
<tr>
<td>Yes</td>
<td>170 (17.7)</td>
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<tr>
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<tr>
<td>History of depression</td>
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</tr>
<tr>
<td>No</td>
<td>949 (99.0)</td>
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<tr>
<td>Family history of depression</td>
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<td>Yes</td>
<td>19 (2.0)</td>
</tr>
<tr>
<td>No</td>
<td>940 (98.0)</td>
</tr>
<tr>
<td>Planned pregnancy</td>
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</tr>
<tr>
<td>Yes</td>
<td>560 (58.5)</td>
</tr>
<tr>
<td>No</td>
<td>398 (41.5)</td>
</tr>
</tbody>
</table>

*The total of each characteristic corresponds to the number of respondents for each question. †Haemoglobin levels of <11.0 gm/dL.
Prevalence and Risk Factors of Antenatal Depression among Omani Women in a Primary Care Setting

Cross-sectional study

was conducted using multivariate logistic regression for variables that showed significant associations with antenatal depression at the $P \leq 0.050$ level.

This study was approved by the Medical Research & Ethics Committee of the College of Medicine & Health Sciences at Sultan Qaboos University (MREC #572). Written consent was obtained from each of the subjects before their participation in the study.

Results

A total of 959 pregnant Omani women participated in the study (response rate: 97.3%). The mean age of the participants was 27 ± 4.8 years (range: 17–43 years old). The majority of participants were housewives (63.5%). More than half of the participants (54.2%) had only completed primary and secondary education while 45.8% had a university qualification. In terms of gravidity, 48.5% were multigravida, 12.6% were grand multigravida and 38.9% were primigravida.

A total of 233 pregnant Omani women reported depressive symptoms, while 726 did not. The prevalence of antenatal depression was 24.3%.

Table 2: Associations between antenatal depression* and sociodemographic variables among pregnant Omani women receiving antenatal care in local primary care health centres (N = 959).

<table>
<thead>
<tr>
<th>Variable†</th>
<th>n (%)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age in years (n = 957)</td>
<td></td>
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</tr>
<tr>
<td>&lt;24</td>
<td>66 (25.3)</td>
<td>195 (74.7)</td>
</tr>
<tr>
<td>25–30</td>
<td>108 (23.9)</td>
<td>343 (76.1)</td>
</tr>
<tr>
<td>&gt;30</td>
<td>59 (24.1)</td>
<td>186 (75.9)</td>
</tr>
<tr>
<td>Occupation (n = 959)</td>
<td></td>
<td>0.399</td>
</tr>
<tr>
<td>Housewife</td>
<td>154 (25.3)</td>
<td>455 (74.7)</td>
</tr>
<tr>
<td>Employed</td>
<td>80 (22.9)</td>
<td>270 (77.1)</td>
</tr>
<tr>
<td>Education level (n = 957)</td>
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<td>0.127</td>
</tr>
<tr>
<td>Primary and secondary</td>
<td>137 (26.4)</td>
<td>382 (73.6)</td>
</tr>
<tr>
<td>University</td>
<td>97 (22.1)</td>
<td>341 (77.9)</td>
</tr>
<tr>
<td>Monthly income in Omani riyals (n = 957)</td>
<td></td>
<td>0.078</td>
</tr>
<tr>
<td>&lt;500</td>
<td>86 (28.9)</td>
<td>212 (71.1)</td>
</tr>
<tr>
<td>500–1,000</td>
<td>106 (21.7)</td>
<td>382 (78.3)</td>
</tr>
<tr>
<td>&gt;1,000</td>
<td>42 (24.6)</td>
<td>129 (75.4)</td>
</tr>
<tr>
<td>Gravidity (n = 959)</td>
<td></td>
<td>0.923</td>
</tr>
<tr>
<td>Primigravida</td>
<td>89 (23.9)</td>
<td>284 (76.1)</td>
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<tr>
<td>Multigravida</td>
<td>114 (24.5)</td>
<td>351 (75.5)</td>
</tr>
<tr>
<td>Grand multigravida</td>
<td>31 (25.6)</td>
<td>90 (74.4)</td>
</tr>
<tr>
<td>Gestational age in weeks (n = 959)</td>
<td></td>
<td>0.338</td>
</tr>
<tr>
<td>32–34</td>
<td>107 (26.8)</td>
<td>292 (73.2)</td>
</tr>
<tr>
<td>35–37</td>
<td>85 (22.6)</td>
<td>291 (77.4)</td>
</tr>
<tr>
<td>&gt;38</td>
<td>42 (22.8)</td>
<td>142 (77.2)</td>
</tr>
<tr>
<td>Anaemia status‡ (n = 958)</td>
<td></td>
<td>0.941</td>
</tr>
<tr>
<td>Normal</td>
<td>64 (25.1)</td>
<td>191 (74.9)</td>
</tr>
<tr>
<td>Mild anaemia</td>
<td>117 (24.0)</td>
<td>371 (76.0)</td>
</tr>
<tr>
<td>Moderate-to-severe anaemia</td>
<td>53 (24.7)</td>
<td>162 (75.3)</td>
</tr>
</tbody>
</table>

Table 3: Logistic regression analysis of risk factors for antenatal depression* among pregnant Omani women receiving antenatal care in local primary care health centres (N = 959).

<table>
<thead>
<tr>
<th>Variable†</th>
<th>Adjusted OR</th>
<th>95% CI</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Family history of depression (n = 959)</td>
<td>0.019§</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>9 (47.4)</td>
<td>10 (52.6)</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>225 (23.9)</td>
<td>715 (76.1)</td>
<td></td>
</tr>
<tr>
<td>Planned pregnancy (n = 958)</td>
<td>0.010§</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>120 (21.4)</td>
<td>440 (78.6)</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>114 (28.6)</td>
<td>284 (71.4)</td>
<td></td>
</tr>
<tr>
<td>Marital conflict (n = 958)</td>
<td>0.001§</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>11 (84.6)</td>
<td>2 (15.4)</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>223 (23.6)</td>
<td>722 (76.4)</td>
<td></td>
</tr>
</tbody>
</table>

*Antenatal depression was self-assessed by respondents using the Arabic version of the 22-item Edinburgh Postnatal Depression Scale questionnaire.† The total of each variable corresponds to the number of respondents for each question ‡Haemoglobin levels of <11.0 gm/dL. §Statistically significant at $P \leq 0.050$. OR = odds ratio, CI = confidence interval.
41.6% of the women were between 32–34 gestational weeks while 58.4% were ≥35 gestational weeks. A history of miscarriage was reported by 17.7% of the participants. More than half the women (58.5%) stated that their pregnancies were planned. A previous history or family history of depression was reported by 1.0% and 2.0% of the participants, respectively. The majority of the participants (98.6%) reported no marital conflict. Mean haemoglobin levels were 10.9 gm/dL. The majority of the participants were anaemic (73.3%) [Table 1].

The EPDS scores ranged from 0–23 (mean: 9 ± 4.8). A total of 233 women had antenatal depression (24.3%). A bivariate analysis showed that antenatal depression was significantly associated with unplanned pregnancies (P = 0.010), marital conflict (P = 0.001) and a family history of depression (P = 0.019) [Table 2]. Logistic multivariate regression analysis revealed that antenatal depression was significantly associated with unplanned pregnancies (OR: 1.37; 95% CI: 1.02–1.86) and marital conflict (OR: 13.83; 95% CI: 2.99–63.93) [Table 3]. The model fit 77.0% of cases correctly.

Discussion

The prevalence of antenatal depression in the studied group of Omani pregnant women was similar to that of a cohort in Brazil (24.3%), but higher than findings from other countries with similar cultural and sociodemographic characteristics, such as Jordan (19.0%) and Morocco (19.2%). Additionally, the prevalence was higher than results reported from Bangladesh, Turkey, Australia and the UK, but lower than the rate observed in South Africa (39.0%).

The high antenatal depression rate in South Africa has been attributed to a lack of partner support, high rates of intimate partner violence, low household incomes and the younger age of women during their pregnancies. Screening for antenatal depression has been recommended for developed countries by the American College of Obstetricians and Gynecologists. Considering the relatively high rate of antenatal depression observed in the current study, the MOH in Oman should consider implementing routine screening for the presence of antenatal depression as part of regular antenatal care services. Identifying women with antenatal depression would enable healthcare professionals to provide psychological support to those affected and hence potentially reduce the rate of antenatal depression and its related complications in Oman.

Rich-Edwards et al. found that young maternal age was the strongest predictor of antenatal depression, as it was associated with financial hardship, unwanted pregnancies and a lack of partner support. In Oman, most women marry at a younger age, some as young as 16 years old, which may explain the higher prevalence of antenatal depression noted in the current study. Also, Oman, like many other developing countries, has a high fertility rate. Previous research shows that the more children in a family, the greater the prevalence of depression, as a result of increased psychosocial and financial demands. Nevertheless, neither maternal age nor gravidity were identified as factors significantly associated with antenatal depression in the current study.

Unplanned pregnancy was a significant risk factor for antenatal depression in the present cohort of Omani women. A planned pregnancy ensures that the woman is more prepared for the realities of pregnancy and childbearing whereas unplanned or unintended pregnancies may increase the risk of antenatal depression because of difficulties in balancing maternal needs and other responsibilities at home or work. Women experiencing unplanned pregnancies are more likely to have an unstable psychosocial environment or feel a lack of security and attachment with their spouse. A previous study also indicated that couples with unplanned pregnancies experienced higher levels of marital conflict following delivery than couples with planned pregnancies.

Women experiencing unplanned pregnancies are often unaware of their condition; as a result they do not initiate early prenatal care and may be more likely to engage in risky behaviours, such as drinking, smoking or illicit drug use. Kuroki et al. found that women with unplanned pregnancies had a lower vitamin intake during early pregnancy, which increased the risk of premature birth, low birth weight babies, infant abuse and neonatal death. Furthermore, one unplanned pregnancy was identified as a risk factor for subsequent unplanned pregnancies, particularly among young women with low education levels. Increased education about appropriate methods of contraception and approaches towards pregnancy planning are recommended in Oman.

The other significant risk factor for antenatal depression observed in the current study was marital conflict. The physiological and psychological changes that occur during pregnancy often influence women to seek out intimate partner support; consequently, the lack of such support may increase the likelihood of antenatal depression. Indeed, difficult or strained marital relationships marked by violence and disharmony have been shown to increase rates of antenatal depression. Likewise, greater marital distress has been reported by couples where the wife is depressed; these couples also resort to less constructive tactics to resolve their conflicts. Further exploration is needed...
regarding the nature of such conflicts and their role in the development of antenatal depression. In addition, future research is recommended to identify anxiety and depression among Omani women in the antenatal or postnatal periods, perhaps through the use of structured clinical interviews to validate the reliability of the EPDS questionnaire as a screening tool.

Although a previous history of depression was initially found to represent a risk factor for antenatal depression in the current study, this association was not significant after multivariate analysis. This may perhaps be due to the low reported rates of past or family history of depression; as is the case in several other Arab countries, many women in Oman believe that psychiatric illness is a social stigma. They may feel ashamed to be known to have a psychiatric illness and may hide their condition and refuse to seek medical help. Some women prefer to rely on their faith or turn to religious leaders for help. Al-Adawi et al. noted that Omanis tend to express their psychological problems in terms of physical symptoms in order to avoid the stigma attached to a psychiatric diagnosis.

The current study is subject to certain limitations. First, as data were gathered from responses to a self-reported questionnaire, the true prevalence of antenatal depression may have been over- or underestimated. Additionally, the choice of cut-off value for EPDS scores was based on Jordanian research; although Oman has a similar culture, there may have been other differences between cohorts which could have affected the results. Indeed, it is not clear if the EPDS questionnaire has yet been established to have cross-cultural construct and criterion validity. Second, this study was descriptive and did not use objective criteria to diagnose antenatal depression; while the EPDS screens for antenatal depression, it is not intended as a diagnostic tool. Third, the cross-sectional design of this study may have resulted in the inclusion of patients with pre-existing undiagnosed depression unrelated to pregnancy, although those with a known history of depression were excluded as far as possible. Conclusions about causative factors for depressive symptoms cannot be formulated based on the findings of this cross-sectional study; carefully designed prospective studies are recommended to identify possible causal relationships. Fourth, although the sample was large, the study was not designed to be truly epidemiological and the results reflect only women who presented to primary care centres. Fifth, women with previous diagnoses of depression, diabetes and hypertension were excluded; however, the presence of a pre-existing condition does not diminish the possibility that such women may develop antenatal depression. Finally, the required sample size calculated to estimate the prevalence of antenatal depression was not achieved due to a number of constraints.

Conclusion

This study was the first to assess the prevalence of antenatal depression and associated risk factors among a group of pregnant women in Oman. Findings indicated that antenatal depression was higher in Oman compared to other countries in the Middle Eastern region. Screening for the presence of antenatal depression should be included as a routine part of antenatal care. This will ensure that sufficient support can be provided to those affected. Antenatal depression was also significantly associated with unplanned pregnancies and marital conflict. As such, Omani women should be educated regarding appropriate methods of contraception and psychological support is recommended for couples experiencing marital conflict. Further large-scale research is required to determine the true rate of antenatal depression among Omani women.

ACKNOWLEDGEMENTS

The authors are grateful to Dr. Khitam I. Mohammad, Professor Jenny Gamble and Professor Debra K. Creedy for permission to use the Arabic version of the EPDS in this research.

CONFLICT OF INTEREST

The authors declare no conflicts of interest.

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Decisions to Perform Emergency Caesarean Sections at a University Hospital

Do obstetricians agree?

Silja A. Pillai, Gowri Vaidyanathan, Maryam Al-Shukri, Tamima R. Al-Dughaisi, Shahila Tazneem, Durunda Khan, Saniya El-Tayeb, *Mariam Mathew

Objectives: This study was undertaken to assess the degree of agreement amongst obstetricians regarding decisions to perform emergency Caesarean section (CS) procedures at a university hospital.

Methods: This retrospective clinical audit was carried out on 50 consecutive emergency CS procedures performed between November 2012 and March 2013 on women with singleton pregnancies at the Sultan Qaboos University Hospital in Muscat, Oman. Data on each procedure were collected from electronic patient records and independently reviewed by six senior obstetricians to determine agreement with the decision.

Results: Of the 50 women who underwent CS procedures, the mean age was 28.9 ± 5.1 years and 48% were primigravidae. Five and four obstetricians agreed on 80% and 95% of the procedures, respectively. The range of disagreement was 4–20%. Disagreement occurred primarily with category II and III procedures compared to category I. Additionally, disagreement occurred in cases where the fetal heart trace pattern was interpreted as an indication for a category II CS.

Conclusion: The majority of obstetricians agreed on the decisions to perform 94% of the emergency CS procedures. Obstetric decision-making could be improved with the implementation of fetal scalp pH testing facilities, fetal heart trace interpretation training and cardiotocography review meetings.

Keywords: Caesarean Section; Emergency; Decision Making; Consensus; Clinical Audit; Cardiotocography; Fetal Monitoring; Oman.

Advances in Knowledge

- This study is the first formal audit to assess peer agreement on the indications for performing emergency Caesarean section (CS) procedures at a university hospital in Oman.
- A high degree of agreement amongst peer obstetricians was noted for the majority of emergency CS decisions carried out during the study period.
- The findings of this study may serve to educate peers, junior colleagues and medical students on evidence-based indications for performing CS procedures.
Over the past two decades, there has been an increase in the Caesarean section (CS) rate in the USA. This increase was noted among all women regardless of age, race, risk of complications, history of prior CS deliveries and among both preterm and full-term pregnancies. In 2010, the CS rate levelled off at 32.8% after steeply increasing for more than a decade. Currently, approximately one in three mothers gives birth by CS delivery. An increase in CS rates is not necessarily beneficial to either the mother or fetus; in fact, the surgery may have harmful effects. According to Althabe et al., CS rates of over 15% may increase maternal and neonatal morbidity. The findings of a report by a national non-profit organisation in the USA overwhelmingly support vaginal birth, particularly spontaneous vaginal birth, in the absence of compelling reasons to utilise other delivery methods. Nevertheless, CS procedures have become more widely accepted due to advances in anaesthesia, newborn care and blood transfusions as well as in order to avoid litigation. The most common indications for a CS procedure include a non-reassuring fetal heart trace, labour dystocia, previous uterine scarring and fetal malpresentation.

In Oman, the CS rate gradually increased from 9.7% in 2000 to 15.7% in 2009. At the Sultan Qaboos University Hospital (SQUH), a tertiary care university hospital in Muscat, Oman, the annual delivery rate was approximately 3,800 in 2013, with a CS rate of 18%. The CS rate is a key performance indicator for the Department of Obstetrics & Gynaecology at SQUH; the aim is to keep the rate at 15%, if possible. This study aimed to assess the degree of agreement among six senior peer obstetricians regarding emergency CS decisions at SQUH.

Methods

This retrospective clinical audit was conducted in SQUH between November 2012 and March 2013. A total of 50 consecutive emergency CS procedures performed in SQUH during the study period for women with singleton pregnancies were reviewed by six senior obstetricians to determine agreement with the decision to perform the procedure. Women with multiple pregnancies and those who underwent elective CS procedures or emergency CS procedures due to malpresentation were excluded from the study. Informed consent for the CS procedure was obtained from all patients prior to the surgery.

All of the patients included in the study were monitored using continuous cardiotocography (CTG) at a speed of 1 cm/minute during the active phase of labour. Fetal heart rate traces were categorised as normal, suspicious or pathological by the delivery ward team according to the Royal College of Obstetricians and Gynaecologists (RCOG) guidelines on intrapartum fetal monitoring. The CS procedures were categorised by urgency as per RCOG guidelines as follows: category I (immediately life-threatening to mother or fetus), category II (no immediate threat to mother or fetus) or category III (requiring early delivery). The decision to perform a category I CS was made with a pathological trace, while a decision for a category II CS was made by the senior registrar/consultant on call following suspicious traces which did not respond to conservative measures. Category III procedures were performed when early delivery was indicated, as per the availability of resources. Nonprogress of labour was defined as a failure to achieve progressive cervical dilatation and descent despite four hours of adequate uterine activity or six hours of oxytocin administration with inadequate uterine activity.

Electronic patient records were reviewed by four consultants and two senior registrars from the Department of Obstetrics & Gynaecology at SQUH. Each individual assessor collected and analysed information from each case, including maternal age, parity, body mass index (BMI), umbilical artery pH and past obstetric history as well as the CTG tracings, gestational age at delivery and Apgar scores of the fetus. Maternal and fetal outcomes and data on the CS indications and category were also reviewed. Following their analysis, each of the six peer obstetricians were asked to answer either “yes” or “no” to the following question: “Do you agree with the decision for performing the CS?” The range of agreement was calculated by a simple count of how many agreed or disagreed on the indications for each CS procedure. The obstetricians were not blinded and had full access to the hospital records. Analysis of the data was performed using descriptive statistics.

This study was approved by the Medical Research & Ethics Committee of the College of Medicine & Health Sciences at Sultan Qaboos University (MREC #991).
Decisions to Perform Emergency Caesarean Sections at a University Hospital
Do obstetricians agree?

Results

Of the 50 women included in the study, 48% were primigravidae and the rest were multiparae. The majority (66%) of the women were 21–30 years old (mean age: 28.9 ± 5.1 years). Only one of the women was over 40 years old. Most of the women (92%) delivered at full-term, while 8% had preterm deliveries. Labour occurred spontaneously in 62% of the women; the remaining women either underwent induced labour (24%) or did not go into labour at all (14%).

The birth weight of the neonates ranged from 1,500–4,200 g (mean: 2,990 ± 700 g). One of the neonates had an umbilical artery pH of <7 and required a short period of observation after birth, although they recovered without any sequelae. The majority of the women (90%) had an uneventful postoperative period and were discharged on the third postoperative day. The most common morbidity was postpartum haemorrhage (10%). A blood transfusion was required for three women who were operated on for placenta praevia. There were two cases of postoperative pyrexia and one case each of pneumonic consolidation and wound infection.

The categorisation of CS procedures based on urgency is shown in Figure 1. The most common indications for emergency CS procedures were fetal distress as evidenced by a non-reassuring fetal heart trace (40%) and dystocia (32%). Other indications included antepartum haemorrhage (8%), severe pre-eclampsia (6%) and fetal macrosomia (2%). Of the 20 cases of fetal distress, 60% had pathological traces and 40% had suspicious traces. For cases of labour dystocia, 63% were operated on during the active phase of the first stage of labour while the remaining women underwent the CS procedure at full dilation. Out of the 16 cases of labour dystocia, 15 women received oxytocin prior to the CS procedure. The mean time interval between the decision to perform the CS procedure and the delivery was 40.7 minutes for cases with non-reassuring fetal heart traces and 47.4 minutes for those with dystocia.

Complete agreement with the decision to perform CS procedures was reported by all six obstetricians for 62% of cases. Five obstetricians agreed with 80% and four agreed with 95% of the decisions. There was a higher degree of agreement for category I CS procedures compared to categories II and III. The majority of the disagreements amongst peer obstetricians occurred when the indication for the CS procedure was a non-reassuring fetal heart trace (one obstetrician disagreed in three cases, two in three cases and three in one case), dystocia (one obstetrician disagreed in three cases and two in three cases) or fetal macrosomia (three obstetricians disagreed in one case). Figure 2 shows the number of peer obstetricians who disagreed with the decision to perform a CS procedure according to selected CS indications. The frequency of disagreement with indications to perform CS procedures for each peer obstetrician is shown in Figure 3.

Discussion

Several studies have shown an inverse association between CS rates and maternal and perinatal mortality at the population level in low-income countries where...
which utilise the procedure excessively.18 The current obstetric care. 3,4,16,17 The World Health Organization (WHO) estimated the average cost of a CS procedure to be approximately USD $373 in countries with an excessive CS rate and USD $135 in countries with an optimal CS rate.18 As a result, CS procedures are approximately 2.8 times more expensive in countries with an optimal CS rate at SQUH, consequently reducing the morbidity and costs associated with this procedure.18 The current CS rate at SQUH exceeds the recommended CS rate advocated by the WHO.19 This may be a result of the referral of high-risk patients to SQUH from primary and secondary care hospitals in Oman. The current study was therefore undertaken as a measure of quality and to assess the scope for reducing the CS rate at SQUH, consequently reducing the morbidity and costs associated with this procedure.

In the current study, CS procedures were classified into three categories according to the degree of urgency.14 The majority of the disagreements amongst peer obstetricians regarding decisions to perform emergency CS procedures occurred when the indication for the CS was a non-reassuring fetal heart trace or dystocia. This often occurred in cases where the fetal heart trace pattern was interpreted as an indication for a category II CS. Unnecessary CS procedures performed due to suspicious fetal heart traces generally occur because of limited knowledge regarding the CTG patterns that predict neonatal outcomes or due to the fear of medicolegal liability.20 Review meetings designed to correctly interpret CTG traces may help to reduce the CS rate. In cases with non-reassuring fetal heart traces, resuscitative measures like maternal positioning, oxygen supplementation, correction of maternal hypotension and uterine hyperstimulation should be tried before the decision to perform a CS procedure is made. Fetal heart rate acceleration in response to scalp stimulation is a recommended procedure to confirm that the fetus does not have acidosis.13,14 Some evidence exists to indicate that fetal scalp sampling reduces the CS rate when the fetal heart trace is suspicious.21 However, fetal scalp pH testing is not favoured in certain institutions.15,20 Additionally, scalp pH test kits are not easily available and many hospitals do not have the facilities to perform scalp pH estimations. Although scalp pH estimation was previously performed at SQUH, it was stopped due to difficulties in obtaining the test kits.

The American Congress of Obstetricians and Gynecologists recommends that CS procedures performed due to active-phase labour arrest during the first stage of labour should be reserved for women with ruptured membranes who are at least 6 cm dilated and "who fail to progress despite 4 hours of adequate uterine activity, or at least 6 hours of oxytocin administration with inadequate uterine activity and no cervical change."15 In the current study, 94% of the labour dystocia cases received a trial of oxytocin before the CS procedure was performed. According to delivery ward protocol at SQUH, partograms are maintained for all women in labour. Four hours’ delay from the alert line of the partogram with good uterine contractions is considered to indicate arrest of labour in the active phase. However, this policy may not have been followed for all cases in the current study, as fetal heart tracing was perceived to be non-reassuring for some cases with dystocia.

Some of the other indications for CS observed in the current study included placenta praevia, severe pre-eclampsia and fetal macrosomia. Fetal macrosomia was the third most common indication for a CS and was the most common indication for a CS decision where the assessors had disagreement. The difficulties in estimating fetal weight clinically or by ultrasound are well-known. Ultrasonography performed late in pregnancy to estimate fetal weight is associated with an increase in CS deliveries with no evidence of neonatal benefit.22 At SQUH, CS deliveries based on late-pregnancy ultrasonography are mostly performed to avoid medicolegal issues like shoulder dystocia and Erb's palsy in cases of suspected macrosomia. Although a CS is indicated in cases where the estimated birth weight is ≥5,000 g or 4,500 g for babies born to non-diabetic and diabetic women, respectively, an accurate estimation of fetal weight is difficult, particularly in late gestation.22 Patients should be made aware that shoulder dystocia can also occur with much smaller babies—especially among diabetic women—and that this may subsequently affect the decision to perform a CS for women with pregestational or gestational diabetes.22 As the number of cases in this audit was small, it was not possible to reach a clinically significant result. Further studies with larger samples are recommended.
Conclusion
This audit was carried out to analyse emergency CS procedures performed at a university hospital in Oman and to assess the degree of agreement among peer obstetricians with the decisions to perform these procedures. Notably, disagreement mostly occurred with decisions to perform category II CS procedures due to non-reassuring fetal heart traces. Accordingly, fetal scalp pH testing facilities, cardiotocography review meetings and staff education and training sessions on the correct interpretation of fetal heart rate traces in labour are recommended to reduce CS rates.

CONFLICT OF INTEREST
The authors declare no conflicts of interest.

References
Effectiveness of a Combined Dance and Relaxation Intervention on Reducing Anxiety and Depression and Improving Quality of Life among the Cognitively Impaired Elderly

Dina Adam, Ayiesah Ramli, Suzana Shahar

ABSTRACT: Objectives: Cognitive impairment is a common problem among the elderly and is believed to be a precursor to dementia. This study aimed to explore the effectiveness of a combined dance and relaxation intervention as compared to relaxation alone in reducing anxiety and depression levels and improving quality of life (QOL) and cognitive function among the cognitively impaired elderly. Methods: This quasi-experimental study was conducted between May and December 2013 in Peninsular Malaysia. Subjects from four government residential homes for older adults aged ≥60 years with mild to moderate cognitive function as assessed by the Mini-Mental State Examination were included in the study. Subjects were divided into an intervention group and a control group; the former participated in a combined pco-poco dance and relaxation intervention whilst the latter participated in relaxation exercises only. Both groups participated in two sessions per week for six weeks. Anxiety and depression were self-assessed using the Hospital Anxiety and Depression Scale and QOL was self-assessed using the Quality of Life in Alzheimer’s Disease questionnaire. Results: A total of 84 elderly subjects were included in the study; 44 were in the intervention group and 40 were in the control group. When compared to control subjects, those in the intervention group showed significantly decreased anxiety (P <0.001) and depression (P <0.001) levels as well as improved QOL (P <0.001) and cognitive impairment (P <0.001). Conclusion: Dance as a form of participation-based physical exercise was found to reduce anxiety and depression levels and improve QOL and cognitive function among the studied sample of cognitively impaired elderly subjects in Malaysia.

Keywords: Mild Cognitive Impairment; Dance Therapy; Quality of Life; Anxiety; Depression; Malaysia

Advances in Knowledge
- The results of the current study indicate that a combination of dance and relaxation exercises improves quality of life (QOL) and cognitive impairment and reduces anxiety and depression among cognitively impaired elderly residents of government institutions as compared to relaxation alone.

Application to Patient Care
- Combined dance and relaxation interventions are recommended for elderly individuals as a form of enjoyable physical activity which can improve cognitive function and QOL and reduce anxiety and depression.

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 Filipino: فعالية الجمع بين الرقص والاسترخاء في الحد من القلق والاكتئاب وتحسين نوعية الحياة بين مرضى ضعف الإدراك في المسنين

دينا أم، أيمة رملي، سوزانا شاهر

المخلص: الهندسة: ضعف الإدراك مستقلة مشتقة بين كبار السن، ويعتقد أن يكون من قمدي خطر هدف هذه الدراسة إلى استكشاف فعالية إدراج الرقص والاسترخاء مقترنة مع الاسترخاء وحدها في الحد من القلق والاكتئاب وتحسين نوعية الحياة ووظيفة الإدراك بمرضى ضعف الإدراك في كبار السن. الطريقة: أجريت هذه الدراسة في ماليزيا في فترات بين مايو وسبتمبر 2013. مجموعتي المشاركين مثل المجموعة الدوجال على أخصائي إداريون تم اختيارهم في مجموعتي المشاركين في الدراسة. بناءً على نتائج الاستدراك، تم تقييم المشاركون إلى مجموعة استدراك مع مجموعة الاسترخاء لمجموعة في رقش روكو وتم تقييم تحسين استراتيجيات القلق والاكتئاب في مجموعة الاسترخاء فقط ورقة الدنجان المجموعتين في أطول نمط تدريجي للدنجان والملاحظات الدنجانية للدنجان، والدنجان والدنجان المستقلين. الاستدراك والدنجان وتحسين نوعية الحياة ووظيفة الإدراك في العينة المدروسة الذين لديهم ضعف الإدراك في ماليزيا

Mild cognitive impairment occurs on a spectrum between normal ageing processes and the development of dementia. The deterioration of cognitive function is more predominant in anxious or depressed individuals. According to Nikmat et al., delays in the early detection of cognitive impairment can lead to depression, functional dependence and poor quality of life (QOL). Decreased physical activity can contribute significantly to increased levels of depression. Physically active individuals have demonstrated less cognitive decline than sedentary subjects, as well as improved cardiovascular fitness, muscle strength, range of motion, posture, balance and mental health. More than one in six residents of homes for older adults have anxiety and depression problems. This is likely due to the lack of a supportive environment, societal stigma, depersonalisation, sleep disturbances, communication problems and illnesses that affect their QOL and functional abilities.

Dance interventions, multi-modal training and progressive muscle relaxation therapy have been identified as measures that can significantly reduce anxiety and depression levels and improve QOL in older adults. Dance as a form of physical activity can be performed in a range of environments. It is safe and more likely to be adopted by older adults as part of their lifestyle compared to other more structured and/or expensive exercises. Dance interventions engage the elderly in everyday life by encouraging enjoyment of the activity and improving their psychosocial QOL. The therapeutic benefits therefore motivate individuals at all levels of fitness to adhere to the interventions.

Besides dance therapy, relaxation exercises using the imagination method are useful in treating stress and anxiety, especially among older adults. These exercises are believed to be beneficial in releasing physical and mental stress, decreasing depressive symptoms and enhancing QOL. Many types of relaxation exercises—including breathing techniques, meditation, progressive muscle relaxation and autogenic training—have a positive impact on anxiety. However, very few studies have investigated the beneficial effects of a combination of dance and relaxation exercises in improving the psychological status of older adults. Therefore, this study aimed to determine the effectiveness of a combined dance and relaxation intervention in reducing anxiety and depression and improving cognitive impairment and QOL among elderly individuals with cognitive impairment residing in publicly-funded institutions.

**Methods**

This quasi-experimental study was carried out between May and December 2013 in four government residential homes for older adults in Peninsular Malaysia (Rumah Seri Kenangan Seremban, Negeri Sembilan; Rumah Seri Kenangan Cheras, Klang Valley; Rumah Seri Kenangan Cheng, Melaka; and Rumah Seri Kenangan Taiping, Perak). These institutions represent major publicly-funded institutions in the southern, central and northern areas of Peninsular Malaysia. Subjects between 60–80 years old who could walk independently and had mild (18/30) to moderate (28/30) cognitive impairment as categorised by the Mini-Mental State Examination (MMSE) were included. Exclusion criteria included uncontrolled hypertension or terminal illness; severe cognitive and musculoskeletal impairments; cardiovascular disease; mental illness; stroke; administration of antipsychotic or anticholinergic drugs; hearing or vision deterioration; speech disturbances; difficulties in performing daily routines; and severe pain.

Subjects were divided into an intervention group and a control group; the intervention group undertook a combination of poco-poco dance and relaxation exercises whilst the control group participated only in the relaxation exercises. Both groups had sessions twice per week for six weeks resulting in a total of 12 sessions. Dance sessions were facilitated by an experienced physical therapist, with each 60-minute session beginning with 10 minutes of warm-up and stretching activities followed by a 20-minute poco-poco dance session. The dance routine included two sidewalk steps to the right, left and back to the mid-point position repeated twice, followed by three backward steps from the mid-point forwards and then backwards repeated twice before a forward-backward weight transfer in walking stance repeated twice. The whole cycle was then repeated several times. At baseline and during the first two weeks, lower limb movements were incorporated with slow simple reciprocal arm-swinging. From the third week onwards, the intensity of the limb movements increased to include extension of the arms straight upward and forward-backward arm-swinging three times to both sides. In the fifth and sixth weeks, circular arm motions were added three times to both sides. All dance sessions concluded with a 10-minute cool-down period.

Participants in the intervention group undertook a 30-minute relaxation session following their dance session. In the control group, subjects took part in a 40-minute relaxation session without any physical intervention. In the relaxation sessions, subjects were requested to sit comfortably on a chair in a quiet area and loosen any tight clothing before closing their eyes.
and focusing on slow deep breathing, emphasising their exhalations. Relaxing music was played on a compact disc player and subjects were asked to visualise a peaceful and calming environment. Using the progressive muscle relaxation technique, participants were encouraged to tense and hold certain muscles for five seconds and then relax the muscles for 30 seconds, starting with their foot, calf and thigh, hand and arm, buttocks and stomach muscles and progressing up to their neck and head muscles. Subjects were then asked to lift their shoulders up to the ears for five seconds before lowering them. For facial muscles, the subjects had to yawn and pout, frown and wrinkle their nose and raise and lower their eyebrows. Finally, subjects had to wriggle their fingers and toes before opening their eyes. This process was carried out three times with deep breathing exercises interspersed throughout each session.

Among the subjects, anxiety, depression and QOL were evaluated at baseline and during the third and sixth week of the intervention. Anxiety and depression were evaluated using the Hospital Anxiety and Depression Scale (HADS), a brief self-administered questionnaire designed to assess the presence of general anxiety and depression disorders. A score of <7 was considered normal, 8–10 borderline abnormal and ≥11 abnormal out of a total score of 21. QOL was assessed using the Quality of Life in Alzheimer’s Disease (QOL-AD) questionnaire. The QOL-AD questionnaire is considered a valid, reliable and appropriate instrument for assessing QOL in individuals with cognitive impairment, particularly as the completion time is relatively short and the completion rate is high. Scores are rated on a 4-point scale, with 1 indicating poor and 4 indicating excellent QOL. Total scores range from 13–52 with higher scores indicating a better QOL. Cognitive impairment was measured at baseline and during the third and sixth weeks using the MMSE.

Statistical analysis was performed using the Statistical Package for the Social Sciences (SPSS), Version 20 (IBM Corp., Chicago, Illinois, USA). Results were expressed as means ± standard deviations. A repeated-measures analysis of variance (ANOVA) model was used to compare the effects of the interaction (time×group) with anxiety and depression levels and QOL-AD scores at three intervals (at baseline and during the third and sixth week). If the sphericity assumption was not violated (P <0.05 using Mauchly’s test of sphericity), the Huynh-Feldt correction was used to estimate P values. Cognitive impairment, anxiety and depression levels and QOL were compared between the two groups at each interval using a repeated-measures ANOVA model with the Bonferroni correction for multiple outcomes. A partial eta-squared statistic (η²) was used to measure the effect size as either small (0.01 ≤η² <0.06), medium (0.06 ≤η² <0.14) or large (η² ≥0.14). The level of statistical significance was set at P <0.050.

This study was approved by the Researchers Ethics Committee at Universiti Kebangsaan Malaysia, Bangi, Malaysia (#UKM1.5.3.5/244/NN-086-2013). Informed consent was obtained from all of the subjects prior to their participation in the intervention.

### Table 1: Demographic variables of elderly Malaysian subjects undergoing a combined dance and relaxation intervention as compared to controls undergoing relaxation exercises alone (N = 84)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Control group (n = 40)</th>
<th>Intervention group (n = 44)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cognitive impairment*</td>
<td></td>
<td></td>
<td>0.185</td>
</tr>
<tr>
<td>Mild</td>
<td>30 (75.0)</td>
<td>38 (86.4)</td>
<td></td>
</tr>
<tr>
<td>Moderate</td>
<td>10 (25.0)</td>
<td>6 (13.6)</td>
<td></td>
</tr>
<tr>
<td>Age in years</td>
<td></td>
<td></td>
<td>0.287</td>
</tr>
<tr>
<td>&gt;60</td>
<td>21 (52.5)</td>
<td>18 (40.9)</td>
<td></td>
</tr>
<tr>
<td>&gt;70</td>
<td>19 (47.5)</td>
<td>26 (59.1)</td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td>0.662</td>
</tr>
<tr>
<td>Male</td>
<td>21 (52.5)</td>
<td>21 (47.7)</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>19 (47.5)</td>
<td>23 (52.3)</td>
<td></td>
</tr>
<tr>
<td>Education level</td>
<td></td>
<td></td>
<td>0.693</td>
</tr>
<tr>
<td>None</td>
<td>11 (27.5)</td>
<td>9 (20.5)</td>
<td></td>
</tr>
<tr>
<td>Primary</td>
<td>22 (55.0)</td>
<td>25 (56.8)</td>
<td></td>
</tr>
<tr>
<td>Secondary/tertiary</td>
<td>7 (17.5)</td>
<td>10 (22.7)</td>
<td></td>
</tr>
<tr>
<td>Anxiety†</td>
<td></td>
<td></td>
<td>0.433</td>
</tr>
<tr>
<td>Borderline abnormal</td>
<td>33 (82.5)</td>
<td>32 (72.7)</td>
<td></td>
</tr>
<tr>
<td>Abnormal</td>
<td>7 (17.5)</td>
<td>12 (27.3)</td>
<td></td>
</tr>
<tr>
<td>Depression†</td>
<td></td>
<td></td>
<td>0.073</td>
</tr>
<tr>
<td>Borderline abnormal</td>
<td>32 (80.0)</td>
<td>36 (81.8)</td>
<td></td>
</tr>
<tr>
<td>Abnormal</td>
<td>8 (20.0)</td>
<td>8 (18.2)</td>
<td></td>
</tr>
<tr>
<td>QOL‡</td>
<td></td>
<td></td>
<td>0.915</td>
</tr>
<tr>
<td>Low</td>
<td>25 (62.5)</td>
<td>27 (61.4)</td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>15 (37.5)</td>
<td>17 (38.6)</td>
<td></td>
</tr>
</tbody>
</table>

QOL = quality of life.

*Cognitive impairment was assessed using the Mini-Mental State Examination with scores of 21–28 and 10–20 out of 30 indicating mild and moderate cognitive impairment, respectively. Anxiety and depression were self-assessed using the Hospital Anxiety and Depression Scale with scores of <7, 8–10 and ≥11 out of 21 considered normal, borderline abnormal and abnormal, respectively. QOL was self-assessed using the Quality of Life in Alzheimer’s Disease questionnaire with scores of <33 and >34 out of 52 indicating low and high QOL, respectively.

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Table 2: Comparison of variables among elderly Malaysian subjects undergoing a combined dance and relaxation intervention (n = 44) as compared to controls (n = 40) undergoing relaxation exercises alone (N = 84)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean ± SD</th>
<th>P value</th>
<th>Partial η²*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Baseline</td>
<td>Week 3</td>
<td>Week 6</td>
</tr>
<tr>
<td>Cognitive Impairment†</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IG</td>
<td>23.7 ± 3.4</td>
<td>25.0 ± 3.3</td>
<td>26.6 ± 3.0</td>
</tr>
<tr>
<td>CG</td>
<td>22.6 ± 3.2</td>
<td>22.5 ± 3.2</td>
<td>21.2 ± 3.7</td>
</tr>
<tr>
<td>Anxiety‡</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IG</td>
<td>7.5 ± 3.5</td>
<td>6.1 ± 3.6</td>
<td>4.4 ± 2.7</td>
</tr>
<tr>
<td>CG</td>
<td>6.2 ± 3.7</td>
<td>7.1 ± 3.3</td>
<td>7.6 ± 3.1</td>
</tr>
<tr>
<td>Depression‡</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IG</td>
<td>7.6 ± 3.1</td>
<td>5.3 ± 3.0</td>
<td>3.7 ± 2.7</td>
</tr>
<tr>
<td>CG</td>
<td>7.1 ± 3.1</td>
<td>8.1 ± 3.3</td>
<td>8.4 ± 3.4</td>
</tr>
<tr>
<td>QOL§</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IG</td>
<td>32.0 ± 7.0</td>
<td>34.1 ± 5.1</td>
<td>36.4 ± 4.1</td>
</tr>
<tr>
<td>CG</td>
<td>31.6 ± 4.8</td>
<td>30.2 ± 4.6</td>
<td>28.8 ± 4.4</td>
</tr>
</tbody>
</table>

Results

A total of 84 subjects were included in the study and were divided into an intervention group (n = 44) and control group (n = 40). The mean age of the subjects was 70.87 ± 8.19 years. At baseline, there were no significant differences in cognitive impairment, age, gender or education level between the groups (P >0.050). However, a lower percentage of subjects in the intervention group had moderate cognitive impairment as compared to the control group (13.6% versus 25.0%; P >0.050) [Table 1].

There was a significant interaction between time interval and group for cognitive impairment (P <0.001), anxiety (P <0.001), depression (P <0.001) and QOL (P <0.001), with subjects in the intervention group showing improved cognitive impairment, reduced anxiety and depression levels and improved QOL. This represented a large effect (partial η² = 0.42, 0.26, 0.35 and 0.29, respectively) [Table 2]. Furthermore, a significant difference was noted between the third and sixth week of the intervention for all of the subjects, regardless of group, for cognitive impairment (P <0.001), anxiety (P <0.001), depression (P <0.001) and QOL (P <0.001) [Table 3].

At baseline, there were equal rates of borderline abnormal anxiety (22.7%; n = 10) and abnormal anxiety (22.7%; n = 10) in the intervention group. At the same time interval, rates of borderline abnormal depression and abnormal depression in the intervention group were 34.1% (n = 7) and 18.2% (n = 8), respectively. A drastic improvement was observed following six weeks of the intervention, with the majority of subjects in the intervention group reporting normal anxiety levels (90.9%; n = 40) and only 6.8% (n = 3) reporting borderline abnormal anxiety. A similar trend was observed for depression, with 95.5% (n = 42) of subjects in the intervention group reporting normal depression levels after six weeks of the intervention; in contrast, only 57.5% (n = 23) and 37.5% (n = 15) of those in the control group reported normal anxiety and normal depression levels by the sixth week [Figure 1].

Table 3: Comparison of cognitive impairment, anxiety, depression and quality of life according to time interval among elderly Malaysian subjects (N = 84)

<table>
<thead>
<tr>
<th>Interval</th>
<th>Cognitive Impairment*</th>
<th>Anxiety‡</th>
<th>Depression‡</th>
<th>QOL§</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean (95% CI)</td>
<td>P value</td>
<td>Mean (95% CI)</td>
<td>P value</td>
</tr>
<tr>
<td>Baseline</td>
<td>23.5 (22.8–24.1)</td>
<td>&lt;0.001</td>
<td>6.7 (6.0–7.4)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Week 3</td>
<td>23.8 (23.1–24.5)</td>
<td>&lt;0.001</td>
<td>6.3 (5.7–6.9)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Week 6</td>
<td>23.5 (22.8–24.2)</td>
<td>&lt;0.001</td>
<td>6.4 (5.8–7.0)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

QOL = quality of life; CI = confidence interval.

* Cognitive impairment was assessed using the Mini-Mental State Examination with scores of 21–28 and 10–20 out of 30 indicating mild and moderate cognitive impairment, respectively. 14 Anxiety and depression were self-assessed using the Hospital Anxiety and Depression Scale with scores of <7, 8–10 and ≥11 out of 21 considered normal, borderline abnormal and abnormal, respectively. 17,18 QOL was self-assessed using the Quality of Life in Alzheimer’s Disease questionnaire with scores of <33 and >34 out of 52 indicating low and high QOL, respectively. 19,20 P values were adjusted for multiple comparisons using the Bonferroni correction procedure.
Slightly fewer subjects in the intervention group reported low baseline QOL scores compared to those in the control group (61.4% versus 62.5%; n = 27 versus 25). However, during the sixth week, 81.8% (n = 36) of those in the intervention group reported high QOL scores. In comparison, 87.5% (n = 35) of those in the control group reported low QOL scores during the sixth week with only 12.5% (n = 5) reporting high QOL scores [Figure 2].

**Discussion**

In the current study, the combined dance and relaxation intervention was found to significantly improve cognition and QOL and decrease anxiety and depression symptoms among elderly Malaysian subjects. Additionally, the large effect size supported the magnitude of the findings. This was consistent with a pilot study which demonstrated that music therapy and physical relaxation were beneficial in improving physical and mental function. The duration of the six-week intervention period was chosen to minimise
Effectiveness of a Combined Dance and Relaxation Intervention on Reducing Anxiety and Depression and Improving Quality of Life among the Cognitively Impaired Elderly

As a result of the six-week intervention, participants in the intervention group in the current study experienced improvements in cognitive impairment, anxiety, depression and QOL as measured by MMSE, HADS and QOL-AD scores, respectively. The intensity of the dance activities increased progressively in order to encourage balance, focus and engagement with the activities, with simple reciprocal arm swings progressing to forward and backward arm movements which were then later augmented with circular motions. Gradually increasing the intensity and biomechanical movements within dance sessions may further improve aspects of cognitive function, balance and QOL.23 Listening to music and dancing stimulates the parietal lobe and provides somatosensory input; these may increase the neurotrophic factor that improves cognitive and visuospatial function.26 Poco-poco is a commonly enjoyed dance among the local population of Malaysia.27 Subjects taking part in poco-poco dance sessions may favour this type of dance because it is non-competitive.

Anxiety and depression levels among control subjects in the current study were slightly lower during the third week compared to the sixth week. The leading factor contributing to depression is a perceived lack of control in life; other possible contributors include a lack of harmony with the surrounding environment, limited physical ability and various family, social and economic issues.8,28 Gottlieb et al. found that females had higher rates of borderline abnormal anxiety levels and depression compared to males; however, they also demonstrated greater improvement than their male counterparts.24 This may have been because they were more naturally inclined to enjoy dance-like activities.24 In the current study, anxiety and depression levels were reduced among the intervention group and higher among the control group; these findings were consistent with previous studies.23,29

Relaxation therapy alone without the physical movements encouraged by the dance intervention was not as effective in decreasing anxiety or depression among studied participants with a low quality of life. On the other hand, those undergoing a combined dance and relaxation intervention had reduced levels of anxiety and depression regardless of quality of life. Relaxation therapy alone may more effectively reduce anxiety and depression symptoms if sessions are conducted more frequently (i.e. if the participants engage in at least 50 sessions).17 The effect of relaxation therapy is generally minimal among elderly residents receiving standard care in institutions.30 In Malaysia, government policies ensure that elderly residents receive continuous support and care to prevent loss of functionality.25 Older adults in institutions therefore have ample and equal opportunities to take part in institutional activities.26

The significant improvement in cognitive function observed among subjects in the intervention group in the current study was consistent with the findings of Middleton et al.30 Improvements in QOL following physical interventions such as dance are potentially related to increased cognitive and physical function as well as an enhanced sense of wellbeing.8 These factors may also be linked with enhanced coping strategies when facing difficult situations within the residence and an increased sense of independence.25

This study has several limitations. As the subjects were neither randomised nor blinded, it is possible that those who agreed to participate may have been more motivated to engage in the intervention. Additionally, the study was limited by the small sample size, the absence of a no-treatment control group and the heterogeneity of the groups. Further studies to evaluate the effects of exercise intensity, frequency and duration on cognitive function are needed to verify the improvements observed in the present study. Despite these limitations, the findings of this study provide evidence of the positive effects of dance exercise on cognitive status among elderly people. Dance interventions should therefore be encouraged as an enjoyable and beneficial leisure activity in institutions for elderly residents. Such interventions should be conducted on a larger scale for longer periods of time.

Conclusion

Participation in a six-week combined dance and relaxation intervention was found to significantly reduce anxiety and depression levels and improve cognitive function and QOL among studied elderly Malaysian subjects. Furthermore, significant improvement in QOL were reported by the participants during the third week of the intervention, after only six dance and relaxation sessions. Dance interventions are therefore recommended for elderly residents among government institutions as a method of improving mental health and QOL.

CONFLICT OF INTEREST

The authors declare no conflicts of interest.
References


Physical Activity and Quality of Life among Adults with Paraplegia in Odisha, India

Shankar Ganesh and Chittaranjan Mishra

Abstract: Objectives: The complete rehabilitation of patients with spinal cord injuries (SCI) comprises both physical and psychosocial factors. This study therefore aimed to assess physical activity and quality of life (QOL) among paraplegic patients with SCI in Odisha, India. Methods: This cross-sectional prospective study was conducted between March 2010 and December 2013. All paraplegic patients treated at the Swami Vivekanand National Institute of Rehabilitation Training & Research in Odisha, India, during the study period who met the inclusion criteria were invited to participate in the study (n = 364). Structured face-to-face interviews were held with participants and QOL and physical activity were assessed using the abbreviated World Health Organization QOL instrument and the Physical Activity Scale for Individuals with Physical Disabilities, respectively. Results: A total of 84 people participated in the study (response rate: 23.1%). The mean age was 32.54 ± 10.75 years and 90.5% of the participants were male. Participants had a low mean metabolic equivalent score (18.18 ± 10.68 hours/day). Additionally, low mean scores were noted for the physical health, psychological well-being, social relationships and environment QOL domains (49.76 ± 18.74, 48.57 ± 17.04, 57.88 ± 17.04 and 49.85 ± 17.77, respectively). There was a strong positive association between levels of physical activity and all QOL domains (P <0.001). Physical activity and employment status were significant predictors of all QOL domains (P <0.001). Conclusion: Low physical activity levels and QOL were noted among the paraplegic subjects. Interventions promoting physical activity and employment may help to improve QOL among this patient group.

Keywords: Paraplegia; Spinal Cord Injuries; Quality of Life; Physical Activity; Rehabilitation; India.

Advances in Knowledge
- Low physical activity levels and quality of life (QOL) were noted among the studied individuals with spinal cord injuries (SCI) in Odisha, India.
- The study found a strong positive association between physical activity and all domains of QOL. Furthermore, physical activity and employment status were significant predictors of all QOL domains.

Application to Patient Care
- The identification of variables affecting QOL is necessary to inform rehabilitation protocols for patients with SCI. Rehabilitation measures should address emotional, social and cognitive factors as well as physical rehabilitation in order to achieve better QOL for these patients.
- As the QOL of patients with SCI in the current study was found to be influenced by physical activity and employment status, initiatives to promote physically active lifestyles and re-employment among the SCI population should be encouraged.
Advances in the medical management of spinal cord injuries (SCI) have reduced the severity of this disability and increased patient longevity.1 Following the completion of inpatient rehabilitation, most patients with SCI are discharged and are expected to resume their lives and find ways of coping with their disability.2 However, health and well-being are best understood in terms of a combination of biological, psychological and social factors. As certain disabilities are permanent, including those associated with SCI, there is a need to identify factors affecting well-being which can be influenced by the rehabilitation team. Traditional health indicators provide a measure of the impact of disease but do not assess quality of life (QOL) in the context of an individual's culture, value systems, goals, expectations, standards and concerns.3 Wilson et al. stated that QOL should be routinely assessed among individuals with SCI along with neurological and functional outcomes.4 Subjective QOL is considered by some researchers to be the only relevant measure of QOL among individuals with SCI as it reflects their own perception of their well-being.5 The inclusion of QOL assessments in healthcare will promote a holistic treatment approach and encourage healthcare professionals to account for the personal perceptions and values of their patients. Hence, the evaluation of QOL is a crucial issue for future national health planning.

Very few studies have evaluated the QOL of SCI patients in India, where the estimated SCI prevalence is 236 per million.6 Gupta et al. found that patients with neurological illnesses, including SCI, reported impaired QOL in all domains of life; moreover, the social relationships domain of QOL was noted to adversely affect functional abilities.7 Singh et al. reported that gender, employment, mobility, autonomy, partner relations and social adjustment were associated with fair-to-good QOL scores among individuals with SCI in northern India.8 Tasimski et al. compared life satisfaction and life values among SCI-affected individuals living in India, Vietnam and Sri Lanka; no significant relationships were observed between these variables.9 In an international cross-sectional study, Geyh et al. examined the QOL of SCI patients across six countries using five satisfaction items from the World Health Organization QOL (WHOQOL) assessment.10 The results indicated inter-country QOL differences that could not be explained by differences in demographic or lesion-related characteristics; future research in this area was hence recommended.10 As little is known about the subjective differences in QOL among SCI patients with different backgrounds, this study aimed to determine physical activity levels and QOL among SCI patients in Odisha, India, and identify relationships between demographic/clinical data, physical activity levels and QOL.

Methods

This cross-sectional study was conducted between March 2010 and December 2013 at the Swami Vivekanand National Institute of Rehabilitation Training & Research in Odisha. During this period, a total of 364 paraplegic in- or outpatients with SCI of at least one year’s duration were invited to participate in the study. As physical function, independence and physical well-being is known to affect the QOL of quadriplegic patients to a greater extent than paraplegic patients, the study was limited to patients with paraplegia.11 Patients with thoracic and lumbar injuries and without mental health problems or medication usage that might affect their decision-making skills were included. The exclusion criteria included patients with traumatic brain injury-associated SCI, brachial plexus injuries and/or fractures of the extremities and systemic medical diseases that would restrict physical activity. Individuals who met these criteria were invited to participate in the study. Data were collected using surveys in combination with interviews to ensure uniformity in the research process.

Each subject participated in a structured face-to-face interview which lasted an average of 45 minutes. The interviews were conducted in Oriya, the regional dialect spoken in Odisha. All questions were translated from English to Oriya by two translators using back-translation methods. Interviews were conducted by one researcher while another monitored the proceedings. Demographic data and information on QOL and physical activity was collected during the interviews using questionnaires. The questionnaires were filled out by the researcher who conducted the interviews due to the lack of reading literacy amongst some of the participants. At the end of each interview, the interviewee was given the opportunity to clarify any doubts or ask questions.

A custom-made Oriya-language survey with close-ended questions was used to collect demographic data from participants, including age, gender, time since injury, marital status, level of education and employment status. For the purpose of the study, participants were categorised into age groups of five-year intervals. Education level was recorded on a scale from 1–4 (1 = no education, 2 = primary education, 3 = secondary education and 4 = university-level education). The employment and marital statuses of the participants before and after their injury were also noted. For statistical analysis, only post-injury
values were considered. Paraplegia was classified as either complete (categories A and B) or incomplete (categories C and D) according to the American Spinal Injury Association Impairment Scale.\textsuperscript{12} Physical activity levels were measured using the Physical Activity Scale for Individuals with Physical Disabilities (PASIPD), which assesses the long-term effects of SCI on the health, functional ability and independence of persons with SCI.\textsuperscript{13} This scale has been found to have good test-retest reliability and criterion validity.\textsuperscript{14} Participants’ QOL was assessed using the abbreviated version of the WHOQOL assessment (WHOQOL-BREF).\textsuperscript{3} This international cross-culturally comparable instrument measures QOL across four domains: physical health (pain/discomfort, energy/fatigue and sleep/rest), psychological well-being (body image/appearance, negative feelings, positive feelings, self-esteem and thinking/learning/memory/concentration), social relationships (personal relationships, social support and sexual activity) and environment (financial resources, freedom/physical safety/security, accessibility/quality of health/social care, home environment, opportunities for acquiring new information/skills, participation in opportunities for recreation/leisure activities, physical environment e.g. pollution/noise/traffic/climate and transport).\textsuperscript{15} The WHOQOL-BREF assessment is currently the most accepted and established instrument to assess QOL among individuals with SCI.\textsuperscript{15} The instrument has shown good differentiation, content validity and test-retest reliability.\textsuperscript{3} Based on an individual’s responses to the questionnaire, QOL is scored between zero (poor QOL) and 100 (high QOL). In addition, domain scores correlate at approximately 0.9 with those of the full version of the WHOQOL instrument.\textsuperscript{3}

Data were analysed using the Statistical Package for the Social Sciences (SPSS), Version 16 (IBM Corp., Chicago, Illinois, USA). A Pearson product-moment correlation coefficient analysis was used to identify relationships between QOL and physical activity, time since injury, age, gender, marital status, employment status, paraplegia severity and educational level. A multiple linear regression analysis with backward elimination was used to determine the significance of eight predictors (age, gender, education level, paraplegia severity, time since injury, employment status, physical activity and marital status) of QOL. For all analyses, a $P$ value of $<0.050$ was considered significant.

Ethical approval for this study was granted from the Ethics Committee of the Swami Vivekanand National Institute of Rehabilitation Training & Research. Participation in the study was voluntary and informed consent was obtained from each participant. Due to the sensitive nature of the study, all participants were provided with the telephone number of the institute’s clinical psychologist for counselling services.

Table 1: Demographic characteristics of individuals with spinal cord injuries in Odisha, India (N = 84)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>76 (90.5)</td>
</tr>
<tr>
<td>Female</td>
<td>8 (9.5)</td>
</tr>
<tr>
<td>Mean age in years (range)</td>
<td>32.54 ± 10.75 (15–60)</td>
</tr>
<tr>
<td>Marital status</td>
<td></td>
</tr>
<tr>
<td>Unmarried</td>
<td>40 (47.6)</td>
</tr>
<tr>
<td>Married</td>
<td>44 (52.4)</td>
</tr>
<tr>
<td>Education level</td>
<td></td>
</tr>
<tr>
<td>No education</td>
<td>12 (14.3)</td>
</tr>
<tr>
<td>Primary</td>
<td>10 (11.9)</td>
</tr>
<tr>
<td>Secondary</td>
<td>28 (33.3)</td>
</tr>
<tr>
<td>University-level</td>
<td>34 (40.5)</td>
</tr>
<tr>
<td>Employment status</td>
<td></td>
</tr>
<tr>
<td>Employed</td>
<td>6 (7.1)</td>
</tr>
<tr>
<td>Unemployed</td>
<td>78 (92.9)</td>
</tr>
<tr>
<td>Paraplegia severity*</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>40 (47.6)</td>
</tr>
<tr>
<td>B</td>
<td>16 (19.0)</td>
</tr>
<tr>
<td>C</td>
<td>16 (19.0)</td>
</tr>
<tr>
<td>D</td>
<td>12 (14.3)</td>
</tr>
<tr>
<td>Mean time since injury in months (range)</td>
<td>26.73 ± 2.39 (12–84)</td>
</tr>
</tbody>
</table>

Ethical approval for this study was granted from the Ethics Committee of the Swami Vivekanand National Institute of Rehabilitation Training & Research. Participation in the study was voluntary and informed consent was obtained from each participant. Due to the sensitive nature of the study, all participants were provided with the telephone number of the institute’s clinical psychologist for counselling services.

Results

A total of 84 individuals with SCI participated in the study (response rate: 23.1%). Of these, there were 76 men (90.5%) and eight women (9.5%). The mean age was 32.54 ± 10.75 years (range: 15–60 years old). All of the participants used mechanical wheelchairs daily, were independent and needed no nursing. The post-injury employment rate of the participants was 7.1% and the average time since the onset of their injuries was 26.73 ± 23.94 months. The descriptive characteristics of the participants are reported in Table 1.

Participants reported a mean metabolic equivalent score of 18.18 ± 10.68 hours/day out of a possible
199.5 hours/day, suggesting that patients were physically active for a few hours during the day and a few days during the week. In the physical health, psychological well-being, social relationships and environment QOL domains, participants had mean scores of 49.76 ± 18.74, 48.57 ± 17.04, 57.88 ± 17.04 and 49.85 ± 17.77, respectively.

There was a strong association between levels of physical activity and the physical health (r = 0.819; P <0.050), psychological well-being (r = 0.776; P <0.050), social relationships (r = 0.706; P <0.050) and environment (r = 0.627; P <0.050) domains of QOL [Figure 1]. A weak correlation was found between employment status and the physical health (r = 0.262; P <0.050), psychological well-being (r = 0.277; P <0.050) and environment (r = 0.332; P <0.050) domains of QOL. No correlation was found between employment status and the social relationship domain (r = 0.144; P >0.050). There were moderate and weak associations between the time since injury and the physical health (r = 0.456; P <0.050) and psychological well-being (r = 0.277; P <0.050) domains of QOL, respectively. However, there was no significant relationship between the time since injury and the social relationships and environment domains. Paraplegia severity according to AIS scores was significantly related to all domains of QOL (r = 0.300; P <0.050). No association was found between QOL and age, gender, marital status or educational level [Table 2].

According to the multiple regression analysis, none of the predictors of QOL exceeded Bonferroni-adjusted critical values [Table 3]. Time since injury

---

**Table 2: Correlations between quality of life* and demographic characteristics and physical activity† among individuals with spinal cord injuries in Odisha, India (N = 84)**

<table>
<thead>
<tr>
<th>QOL domain</th>
<th>Age</th>
<th>Gender</th>
<th>Time since injury</th>
<th>Paraplegia severity‡</th>
<th>Employment status</th>
<th>Marital status</th>
<th>Education level</th>
<th>Physical activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical health</td>
<td>0.109</td>
<td>-0.157</td>
<td>0.456§</td>
<td>0.561§</td>
<td>0.267</td>
<td>0.164</td>
<td>0.033</td>
<td>0.819§</td>
</tr>
<tr>
<td>Psychological well-being</td>
<td>0.142</td>
<td>-0.019</td>
<td>0.277¶</td>
<td>0.358§</td>
<td>0.277</td>
<td>0.156</td>
<td>0.019</td>
<td>0.776§</td>
</tr>
<tr>
<td>Social relationships</td>
<td>0.032</td>
<td>-0.500</td>
<td>0.195</td>
<td>0.466§</td>
<td>0.144</td>
<td>0.007</td>
<td>0.138</td>
<td>0.706§</td>
</tr>
<tr>
<td>Environment</td>
<td>0.073</td>
<td>-0.048</td>
<td>0.198</td>
<td>0.330§</td>
<td>0.332</td>
<td>0.022</td>
<td>0.098</td>
<td>0.627§</td>
</tr>
</tbody>
</table>

QOL = quality of life.

*QOL was assessed using the abbreviated version of the World Health Organization QOL measure.†Physical activity was assessed using the Physical Activity Scale for Individuals with Physical Disabilities.‡Paraplegia was classified as either complete (categories A and B) or incomplete (categories C and D) according to the American Spinal Injury Association Impairment Scale.¶P <0.001. §P <0.050.
Table 3: Multiple regression analysis of variables predicting quality of life domains* among individuals with spinal cord injuries in Odisha, India (N = 84)

<table>
<thead>
<tr>
<th>Variable</th>
<th>B</th>
<th>SE B</th>
<th>B</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Physical health</strong></td>
<td></td>
<td></td>
<td></td>
<td>&gt;0.050</td>
</tr>
<tr>
<td>Constant</td>
<td>11.833</td>
<td>10.747</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>-0.214</td>
<td>0.882</td>
<td>-0.024</td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td>-2.954</td>
<td>4.839</td>
<td>-0.042</td>
<td></td>
</tr>
<tr>
<td>Paraplegia severity</td>
<td>2.640</td>
<td>3.081</td>
<td>0.071</td>
<td></td>
</tr>
<tr>
<td>Time since injury</td>
<td>0.139</td>
<td>0.053</td>
<td>0.182</td>
<td></td>
</tr>
<tr>
<td>Marital status</td>
<td>0.183</td>
<td>4.086</td>
<td>0.005</td>
<td></td>
</tr>
<tr>
<td>Employment status</td>
<td>11.399</td>
<td>5.283</td>
<td>0.161</td>
<td></td>
</tr>
<tr>
<td>Physical activity†</td>
<td>1.242</td>
<td>0.162</td>
<td>0.679</td>
<td></td>
</tr>
<tr>
<td>Education level</td>
<td>-0.739</td>
<td>1.242</td>
<td>-0.042</td>
<td></td>
</tr>
<tr>
<td><strong>Psychological well-being</strong></td>
<td></td>
<td></td>
<td></td>
<td>&gt;0.050</td>
</tr>
<tr>
<td>Constant</td>
<td>-17.585</td>
<td>11.844</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>-0.261</td>
<td>0.972</td>
<td>-0.029</td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td>6.552</td>
<td>5.333</td>
<td>0.094</td>
<td></td>
</tr>
<tr>
<td>Paraplegia severity</td>
<td>8.780</td>
<td>3.395</td>
<td>0.239</td>
<td></td>
</tr>
<tr>
<td>Time since injury</td>
<td>-0.040</td>
<td>0.059</td>
<td>-0.053</td>
<td></td>
</tr>
<tr>
<td>Marital status</td>
<td>1.347</td>
<td>4.503</td>
<td>0.037</td>
<td></td>
</tr>
<tr>
<td>Employment status</td>
<td>14.770</td>
<td>5.822</td>
<td>0.211</td>
<td></td>
</tr>
<tr>
<td>Physical activity†</td>
<td>1.107</td>
<td>0.179</td>
<td>0.611</td>
<td></td>
</tr>
<tr>
<td>Education level</td>
<td>0.269</td>
<td>1.368</td>
<td>0.015</td>
<td></td>
</tr>
<tr>
<td><strong>Social relationships</strong></td>
<td></td>
<td></td>
<td></td>
<td>&gt;0.050</td>
</tr>
<tr>
<td>Constant</td>
<td>28.532</td>
<td>12.371</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>-0.143</td>
<td>1.015</td>
<td>-0.018</td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td>-1.698</td>
<td>5.570</td>
<td>-0.027</td>
<td></td>
</tr>
<tr>
<td>Paraplegia severity</td>
<td>4.873</td>
<td>3.546</td>
<td>0.148</td>
<td></td>
</tr>
<tr>
<td>Time since injury</td>
<td>-0.032</td>
<td>0.061</td>
<td>-0.048</td>
<td></td>
</tr>
<tr>
<td>Marital status</td>
<td>-3.421</td>
<td>4.703</td>
<td>-0.104</td>
<td></td>
</tr>
<tr>
<td>Employment status</td>
<td>6.387</td>
<td>6.081</td>
<td>0.102</td>
<td></td>
</tr>
<tr>
<td>Physical activity†</td>
<td>0.899</td>
<td>0.187</td>
<td>0.554</td>
<td></td>
</tr>
<tr>
<td>Education level</td>
<td>-2.798</td>
<td>1.429</td>
<td>-0.179</td>
<td></td>
</tr>
</tbody>
</table>

**Environment**<0.050

<table>
<thead>
<tr>
<th>Variable</th>
<th>B</th>
<th>SE B</th>
<th>B</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>-9.140</td>
<td>12.371</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>-0.487</td>
<td>1.075</td>
<td>-0.057</td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td>-4.849</td>
<td>5.898</td>
<td>-0.072</td>
<td></td>
</tr>
<tr>
<td>Paraplegia severity</td>
<td>2.079</td>
<td>3.755</td>
<td>0.059</td>
<td></td>
</tr>
<tr>
<td>Time since injury</td>
<td>-0.031</td>
<td>0.065</td>
<td>-0.043</td>
<td></td>
</tr>
<tr>
<td>Marital status</td>
<td>2.956</td>
<td>4.981</td>
<td>0.085</td>
<td></td>
</tr>
<tr>
<td>Employment status</td>
<td>9.582</td>
<td>6.440</td>
<td>0.143</td>
<td></td>
</tr>
<tr>
<td>Physical activity†</td>
<td>0.759</td>
<td>0.198</td>
<td>0.438</td>
<td></td>
</tr>
<tr>
<td>Education level</td>
<td>1.527</td>
<td>1.514</td>
<td>0.092</td>
<td></td>
</tr>
</tbody>
</table>

SE = standard error.
*Quality of life (QOL) was assessed using the abbreviated version of the World Health Organization QOL measure. †Physical activity was assessed using the Physical Activity Scale for Individuals with Physical Disabilities.

(t = 3.274; P <0.001), employment status (t = 2.383; P <0.001) and physical activity (t = 12.550; P <0.001) were strong predictors for the physical health domain components of QOL. Paraplegia severity (t = 2.215; P <0.050), employment status (t = 3.458; P <0.001) and physical activity (t = 7.778; P <0.001) were strong predictors of the psychological well-being domain components of QOL. Marital status (t = -2.482; P <0.001), employment status (t = 1.927; P <0.001) and physical activity (t = 9.340; P <0.001) significantly predicted the social relationships domain of QOL. Employment status (t = 3.480; P <0.001) and physical activity (t = 7.563; P <0.001) were the two predictors found to influence the environment domain of QOL.

Discussion

Among the studied individuals with SCI, very low mean QOL scores were reported in comparison to normal mean scores for the physical health (49.76 ± 18.74 versus 73.50 ± 18.10), psychological well-being (48.57 ± 17.04 versus 70.60 ± 14.00), social relationships (57.88 ± 17.04 versus 71.50 ± 18.20) and environment (49.85 ± 17.77 versus 75.10 ± 13.00) domains. The results of the current study are therefore consistent with previous research reporting poor QOL in patients with SCI. de França et al. evaluated QOL among 47 SCI patients (mean age: 42.95 years) using the WHOQOL-BREF and obtained mean scores of 58.59, 63.82, 68.79 and 55.20 for the physical health, psychological well-being, social relationships and environment domains, respectively.

A statistically significant and strong positive association between physical activity and all domains...
of QOL was observed among the studied sample of SCI patients. The mean metabolic equivalent score of the participants was suggestive of a low level of physical activity among SCI patients in Odisha, indicating that patients were physically active for fewer hours per day and fewer days per week than highly-active individuals with physical disabilities (36.34 ± 15.28). Other studies have shown that higher PASIPD scores (22.5 ± 14.8) were reported by individuals with physical disabilities who rated their level of physical activity as active/extremely active. Stevens et al. also demonstrated reduced physical activity among individuals with SCI. Low physical activity has been found to correlate strongly with QOL in patients with SCI. Previous studies have found that people with disabilities are less likely to engage in physically active lifestyles than those without disabilities. Reasons for the low levels of physical activity among participants in the current study were beyond the scope of this study. However, architectural barriers (i.e. a lack of transportation facilities or wheelchair-accessible environments), societal attitudes, climate, logistical issues (i.e. problems with wheelchairs), loss of motor function and a lack of knowledge about how to engage in physical activity may play decisive roles, along with psychological factors.

Employment status was found to be a strong predictor of all domains of QOL in the current study. Critically, participants had a very low post-injury employment rate. Unemployment and low income may result in financial difficulties, which is an important factor affecting the QOL of those with SCI. Financial hardships may also be associated with emotional problems. Harrison et al. found that only 8% of 222 SCI patients were employed following their injuries. Another study showed a considerable drop in employment rates after SCI. These studies indicated that unemployment rates were 10-fold higher among SCI patients compared with the general population. Access to place of work, employer attitudes and patients’ beliefs in their own abilities may influence the decision to resume employment following SCI. Singh et al. found that employment status was associated with a higher QOL among those with SCI living in India. Chapin et al. reported that SCI patients who had been successfully rehabilitated and were employed had a significantly higher QOL in all four domains.

In the current study, physical activity and employment status were found to strongly predict scores in the physical health domain of QOL. Reduced physical activity among individuals with SCI may be related to changes in metabolism. Among paraplegic individuals, 25% have a maximum oxygen consumption of 15 mL/kg/minute; the normal range is 34–61 mL/kg/minute for males and 30–42 mL/kg/minute for females. This reduced maximum oxygen consumption is inadequate to meet the requirements of independent living. Furthermore, the total caloric intake per day for individuals with SCI is lower than that of the general population. These factors may result in increased fatigue during work-related or daily living activities.

Several studies have shown no relationship between the time since injury and QOL among individuals with SCI. In contrast, the current study identified a strong predictive relationship between the time since injury and the physical health domain of QOL. This could be attributed to a gradual reduction in pain and improvement in function over time. In a cross-sectional study, Saadat et al. compared the health-related QOL of veterans and non-veterans with SCI in Iran and noted that better health-related QOL was associated with a longer period of time since the injury.

Hu et al. found a significant difference between patients with complete and incomplete paraplegia with regards to the environment domain of QOL. However, the results of the current study indicated that the severity of paraplegia significantly predicted and was associated with the psychological well-being domain of QOL. The researchers hypothesise that this finding is a result of low self-esteem and negative feelings related to a lack of control over the environment due to the severity of the disability. Self-efficacy and self-esteem have been found to correlate highly with participation and contribute to a better understanding of functioning, disability and health in those with SCI. Access to the environment has been shown to be related to neurological status, with the environment more accessible to individuals with mild impairment than those with severe impairment.

In the current study, marital status was a significant predictor of the social relationships domain of QOL. Married subjects may have been less satisfied with their lives, more anxious about their sex lives and felt pressured by their inability to function normally in the household. Reasons for not wanting or not having the courage to be sexually intimate may be related to physical problems, low sexual desire, low self-esteem and feelings of being unattractive.

The findings of this study indicate that rehabilitation should aim to improve QOL among individuals with SCI. This may be done by facilitating shared clinical decision-making to help individuals with SCI to achieve their preferences, adjust to their disability, improve their interpersonal relationships and re-integrate within the community. The development of interventions and programmes to increase levels of
physical activity may also be effective in improving QOL among this population. Marital counselling, vocational rehabilitation training and creating job opportunities for those affected by SCI are important components of comprehensive rehabilitation programmes.

There are several potential limitations to this study. The percentage of female participants was low, which may have adversely influenced the effect of gender on QOL. In addition, the study was restricted to participants who had undergone rehabilitation after SCI of at least one year’s duration. This may have affected the results; a longitudinal multicentre study found that individuals with SCI reported changes in the physical health domain of QOL during the first two years post-injury.\(^{37}\) In the current study, secondary complications of SCI (including pain, urinary tract infections, chronic illness and changes in bowel and bladder function) were not considered. Furthermore, the QOL instrument considers the level of function at only the time of assessment. Despite these limitations, the present study fulfilled its objectives in identifying key predictors of QOL among paraplegic individuals in a developing country.

**Conclusion**

Rehabilitation for individuals with SCI should focus on aspects of all QOL domains, including physical health, psychological well-being, social relationships and environment. A strong positive correlation between physical activity and employment status with all domains of QOL was found among the studied group of individuals with SCI from Odisha. In light of these findings, programmes to increase physical activity and employment status among SCI patients are recommended.

**ACKNOWLEDGEMENTS**

A poster presentation of this study was displayed at the 53\(^{rd}\) International Spinal Cord Society Scientific Meeting in Maastricht, the Netherlands, in September 2014. An abstract of the poster was published in the Abstracts booklet for this meeting.

**CONFLICT OF INTEREST**

The authors declare no conflicts of interest.

**References**


Measuring Empathy Levels among Kurdish Medical Students in Erbil City, Iraq
Cross-sectional study

A. Awring M. Raof1 and Bervian A. Yassin2

Abstract: Objectives: Empathy is a crucial attribute within the physician-patient relationship. This study aimed to evaluate the empathy levels of students in the College of Medicine at Hawler Medical University (HMU) in Erbil city, Iraq. Methods: This cross-sectional study took place between January and May 2015 and included all medical undergraduates enrolled at HMU (n = 989). The validated self-administered English language version of the Jefferson Scale of Physician Empathy-Student Version (JSPE-SV) was used to measure empathy levels. Results: A total of 927 students completed the questionnaire (response rate: 93.7%). Female students had significantly higher empathy (P = 0.023) and more frequently chose people-oriented specialties (P = 0.001) than males. First-year students reported the highest mean score (112.9 ± 20.1) while fourth-year students had the lowest (92.7 ± 16.0). There was a significant decline in mean scores between first- and second-year male students (P = 0.050) and first- and fourth-year male students (P = 0.050). Students who chose people-oriented specialties had significantly higher scores than those who chose technology-oriented specialties (P = 0.002). Conclusion: The studied cohort of HMU students demonstrated low empathy levels. As such, the inclusion of empathy instruction in medical school curricula is recommended to promote professionalism and patient welfare.

Keywords: Empathy; Attitudes; Medical Students; Physician-Patient Relations; Medical Education; Iraq.

Advances in Knowledge
- Low empathy levels were reported among a group of medical undergraduate students in Erbil city, Iraq.
- Female students had significantly higher empathy levels than male students among the studied group and a significant decline in empathy scores was observed among male students according to academic year.
- The results of this study suggest that students with higher empathy levels may select people-oriented over technology-oriented specialties.

Application to Patient Care
- While the results of this study cannot be generalised to all medical students in Iraq, the low levels of empathy reported among the studied medical students have alarming implications for future patient care. The inclusion of empathy education in medical school curricula is therefore of vital importance due to the significant impact of this attribute on patient-physician relationships.

References

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In order to be effective, physicians need to form sympathetic and beneficial relationships with their patients. One of the most important skills needed to form and maintain a relationship is empathy. Although there are several different definitions of empathy, it is generally defined as the capacity to "see the world as others see it, be nonjudgmental, understand another's feelings, and communicate the understanding." Communications between patients and caregivers rely upon the empathetic nature of the medical doctor. Hojat et al. verified that physician compassion is strongly related to enhanced patient outcomes, compliance and contentment and a decline in medicolegal problems.

Previous studies have determined various factors that affect levels of empathy, including gender, academic performance and an individual's relationship with their mother. A study from the USA observed significant differences in empathy levels between genders and between physicians in people-oriented versus technology-oriented specialties, suggesting that certain aspects of empathy may be related to gender and choice of medical specialty.

The Hawler Medical University (HMU) is a public university in Erbil city, Iraq. The recently revised six-year undergraduate medical curriculum in the HMU College of Medicine includes a series of courses on medical ethics and communication skills with the aim of strengthening future patient-physician relationships. This training is intended to guarantee that medical graduates will have the necessary clinical skills to competently and empathetically consider patients' feelings and experiences, thus improving care by reducing patient suffering and helping them to feel more relaxed. This study therefore sought to measure empathy levels among a sample of medical students at HMU. Specifically, differences in empathy levels were assessed according to gender, academic year and choice of specialty. To the best of the authors' knowledge, no such study has yet been conducted among Kurdish medical students and this is the first time that the Jefferson Scale of Physician Empathy-Student Version (JSPE-SV) has been used in Erbil city.

**Methods**

This cross-sectional study was carried out between January and May 2015 and included all undergraduate students enrolled in the 2014–2015 academic year at the College of Medicine at HMU (n = 989; male-to-female ratio: 0.74:1). Empathy levels were determined using the JSPE-SV. This self-administered English language 20-item questionnaire was originally developed in 2001 to measure medical students' attitudes towards physician empathy in a patient-care situation. It has been validated in the USA, Mexico and Japan.

The measurement of internal consistency (Cronbach's alpha) is 0.76. The English language version of the JSPE-SV questionnaire was distributed to all students at the end of each class. The questionnaire was completed anonymously in approximately 30 minutes and returned to the researchers. Respondents reported their degree of agreement with each item on a 7-point Likert scale; however, 10 of the items were negative statements and were marked in reverse order. The final score ranged between 20–140 and a participant's level of empathy was considered directly relative to their score. A non-responder was defined as a student who failed to return the survey. Surveys with less than 16 completed items were excluded from the results.

Demographic information such as age, gender and choice of specialty was also collected. Missing gender values for respondents who did not provide their gender was determined using a discriminate function test. Males and females were categorised using forms in which the gender was identified as the endpoint. This procedure was then applied to data from those in the unknown gender group. Choice of specialty was categorised as either technology- or people-oriented. Technology-oriented specialties included surgery and related subspecialties; oncology; preventative and social medicine; pathology; radiology; and anaesthesiology. People-oriented specialties included family medicine; neurology; paediatrics; psychiatry; emergency medicine; obstetrics and gynaecology; ophthalmology; dermatology; and internal and rehabilitation medicine. Students were asked to determine their choice of specialty by rating their future likelihood of entering each specialty mentioned above on a 4-point Likert scale ranging from 1 (very unlikely) to 4 (very likely). Each student was then classified as choosing either technology- or people-oriented specialties after comparing their overall scores for each group.

Data were analysed using the Statistical Package for the Social Sciences (SPSS), Version 21 (IBM Corp., Chicago, Illinois, USA). Measures of central tendencies and distributions were determined. The one-way analysis of variance (ANOVA), Bonferroni post hoc test and Student's t-test were used to assess statistical significance. Pearson's Chi-squared test was used for group frequency comparisons. Statistical significance was set at \( P \leq 0.050 \).

This study was granted ethical approval by the Research Ethics Committee at the College of Medicine of HMU (meeting #1 paper #5). All students were informed that participation in the study was voluntary and anonymity was guaranteed. All forms were coded to avoid respondent identification.
Measuring Empathy Levels among Kurdish Medical Students in Erbil City, Iraq

Cross-sectional study

Results

Of the 989 students included in the study, a total of 927 completed the survey (response rate: 93.7%) [Table 1]. There were 391 male respondents (42.2%) and 536 female respondents (57.8%) with a male-to-female ratio of 0.72:1. The mean age of the respondents was 21.3 ± 1.4 years (range: 17–25 years old). Overall, the mean empathy score of the students was 101.9 ± 19.2. Table 2 displays the mean empathy scores of male and female students, respectively (98.6 ± 16.2 versus 102.5 ± 19.9). This difference was statistically significant (P = 0.023).

Mean empathy scores decreased as academic years increased; first-year medical students reported the highest mean empathy score (112.9 ± 20.1) while the lowest mean score was observed among the fourth-year medical students (92.7 ± 16.0) [Table 3]. When adjusted for age, gender and choice of future specialty, the difference in empathy scores between first- and fourth-year students was 16.1. A significant decline in mean empathy scores was noted between male students in their first versus second academic year (Bonferroni test = 8.7; P = 0.020) and between male students in their first versus fourth academic year (Bonferroni test = 10.1; P = 0.005) [Table 4].

There was a statistically significant difference between genders with regards to choice of specialty. Females more frequently chose people-oriented specialties in comparison to males (62.3% versus 25.8%; P = 0.001) [Table 5]. Furthermore, students who chose people-oriented specialties had higher mean empathy scores, whereas those who selected technology-oriented specialties had lower scores (109.9 ± 20.2 versus 99.8 ± 16.1; P = 0.002) [Table 6].

**Table 1:** Questionnaire distribution by academic year among students at Hawler Medical University in Erbil city, Iraq (N = 989)

<table>
<thead>
<tr>
<th>Academic year</th>
<th>1st year</th>
<th>2nd year</th>
<th>3rd year</th>
<th>4th year</th>
<th>5th year</th>
<th>6th year</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students per class</td>
<td>172</td>
<td>161</td>
<td>170</td>
<td>153</td>
<td>161</td>
<td>172</td>
<td>989</td>
</tr>
<tr>
<td>Questionnaires distributed</td>
<td>172</td>
<td>160</td>
<td>169</td>
<td>152</td>
<td>159</td>
<td>170</td>
<td>982</td>
</tr>
<tr>
<td>Respondents per questionnaires (response rate, %)</td>
<td>165 (95.9)</td>
<td>159 (99.4)</td>
<td>167 (98.8)</td>
<td>150 (98.7)</td>
<td>155 (97.5)</td>
<td>131 (77.1)</td>
<td>927 (94.4)</td>
</tr>
<tr>
<td>Response rate of class, %</td>
<td>95.9</td>
<td>98.8</td>
<td>98.2</td>
<td>98.0</td>
<td>96.3</td>
<td>76.2</td>
<td>93.7</td>
</tr>
</tbody>
</table>

**Table 2:** Distribution by mean empathy score* and gender of the studied sample of students at Hawler Medical University in Erbil city, Iraq (N = 927)

<table>
<thead>
<tr>
<th>Gender</th>
<th>n (%)</th>
<th>Mean empathy score ± SD</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>391 (42.2)</td>
<td>98.6 ± 16.2</td>
<td>0.023</td>
</tr>
<tr>
<td>Female</td>
<td>536 (57.8)</td>
<td>102.5 ± 19.9</td>
<td>-</td>
</tr>
<tr>
<td>Total</td>
<td>927 (100.0)</td>
<td>101.9 ± 19.2</td>
<td>-</td>
</tr>
</tbody>
</table>

SD = standard deviation.

*Empathy was self-assessed by respondents using the English version of the 20-item Jefferson Scale of Physician Empathy-Student Version.8

**Table 3:** Distribution by academic year and mean empathy score* of the studied sample of students at Hawler Medical University in Erbil city, Iraq (N = 927)

<table>
<thead>
<tr>
<th>Academic year</th>
<th>n (%)</th>
<th>Mean ± SD</th>
<th>95% CI</th>
<th>Lowest score</th>
<th>Highest score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st year</td>
<td>165 (17.8)</td>
<td>112.9 ± 20.1</td>
<td>112.4–121.3</td>
<td>35.0</td>
<td>139.0</td>
</tr>
<tr>
<td>2nd year</td>
<td>159 (17.2)</td>
<td>110.5 ± 20.0</td>
<td>94.3–114.7</td>
<td>44.0</td>
<td>134.0</td>
</tr>
<tr>
<td>3rd year</td>
<td>167 (18.0)</td>
<td>101.8 ± 20.0</td>
<td>97.1–106.5</td>
<td>33.0</td>
<td>137.0</td>
</tr>
<tr>
<td>4th year</td>
<td>150 (16.2)</td>
<td>92.7 ± 16.0</td>
<td>91.1–101.4</td>
<td>53.0</td>
<td>130.0</td>
</tr>
<tr>
<td>5th year</td>
<td>155 (16.7)</td>
<td>94.7 ± 17.0</td>
<td>90.8–106.5</td>
<td>56.0</td>
<td>134.0</td>
</tr>
<tr>
<td>6th year</td>
<td>131 (14.1)</td>
<td>93.7 ± 17.0</td>
<td>91.8–106.5</td>
<td>45.0</td>
<td>131.0</td>
</tr>
<tr>
<td>Total</td>
<td>927 (100.0)</td>
<td>101.9 ± 19.2</td>
<td>99.2–104.6</td>
<td>33.0</td>
<td>139.0</td>
</tr>
</tbody>
</table>

SD = standard deviation; CI = confidence interval.

*Empathy was self-assessed by respondents using the English version of the 20-item Jefferson Scale of Physician Empathy-Student Version.8
Table 4: Mean difference* in empathy scores† between male students according to academic year‡ among the studied sample at Hawler Medical University in Erbil city, Iraq (N = 927)

<table>
<thead>
<tr>
<th>Academic year</th>
<th>Mean difference</th>
<th>P value</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st year 2nd year</td>
<td>8.7</td>
<td>0.020</td>
<td>0.9–18.5</td>
</tr>
<tr>
<td>1st year 4th year</td>
<td>10.1</td>
<td>0.005</td>
<td>2.2–20.0</td>
</tr>
<tr>
<td>2nd year 1st year</td>
<td>-8.7</td>
<td>0.020</td>
<td>-18.5–0.9</td>
</tr>
<tr>
<td>4th year 1st year</td>
<td>-10.1</td>
<td>0.005</td>
<td>-20.0–2.2</td>
</tr>
</tbody>
</table>

Table 6: Mean empathy scores* by academic year and choice of specialty† among the studied sample of students at Hawler Medical University in Erbil city, Iraq (N = 927)

<table>
<thead>
<tr>
<th>Academic year</th>
<th>People-oriented specialty</th>
<th>Technology-oriented specialty</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st year</td>
<td>120.1 ± 21.2</td>
<td>106.8 ± 17.2</td>
</tr>
<tr>
<td>2nd year</td>
<td>111.4 ± 21.2</td>
<td>99.0 ± 16.1</td>
</tr>
<tr>
<td>3rd year</td>
<td>110.8 ± 20.2</td>
<td>99.1 ± 16.1</td>
</tr>
<tr>
<td>4th year</td>
<td>110.8 ± 20.2</td>
<td>96.3 ± 15.1</td>
</tr>
<tr>
<td>5th year</td>
<td>104.2 ± 20.1</td>
<td>98.7 ± 16.2</td>
</tr>
<tr>
<td>6th year</td>
<td>102.2 ± 20.0</td>
<td>98.7 ± 16.1</td>
</tr>
<tr>
<td>Total</td>
<td>109.9 ± 20.2</td>
<td>99.8 ± 16.1</td>
</tr>
</tbody>
</table>

ANOVA = one-way analysis of variance.

*Empathy was self-assessed by respondents using the English version of the 20-item Jefferson Scale of Physician Empathy-Student Version.†There were no significant differences between empathy scores among female students according to academic year and between empathy scores among male students in other academic years.

Discussion

The current study sought to measure self-assessed empathy levels among a sample of medical students at a public university in Erbil city. The response rate to the questionnaire was much higher than those reported from similar studies in the USA, Iran, Portugal, Japan, Kuwait and the UK.10,11,13–16 The overall mean empathy score among the studied sample in the current study (101.9) was close to scores from studies conducted in Japan (104.3) and Iran (104.1), but lower than those reported from Western countries.11–14 However, the mean empathy score for first-year medical students in the current study (112.9) was similar to that reported in Iran (110.3) and the USA (115.5).11,15 Additionally, the higher level of empathy among female students noted in the current study was consistent with previous research.15,17,18

In the current study, the mean empathy score reported by first-year students was highest, with mean empathy scores declining in the second and subsequent academic years—second-year students displayed higher empathy scores than fourth-year students and final year students displayed lower empathy scores than students in their first academic year. This finding was consistent with other studies, which suggests that levels of empathy decline during clinical training.10,13,14 After empathy scores were adjusted for age, gender and choice of future specialty, the difference in mean scores between first- and fourth-year students in the current study (16.1) was higher than that of an American study (11.9).13 Another study conducted among dental students reported a decline in empathy levels after the introduction of clinical tasks.19 In a longitudinal study of undergraduate nursing students conducted to evaluate changes in empathy levels, Ward et al. found that students showed a decline in empathy over the course of one year.20

There are a number of possible factors which may influence the reduction in empathy levels among students as education progresses. Low levels of empathy may be reflective of the prevalent teaching methods at a particular academic institution. The education and training of medical students may be stressful and include extensive work hours and a lack of sleep. Bedside communication may also become reduced due to time constraints, leading to a decrease in empathy.21 The increasingly emotionally demanding and harsh conditions of their academic career could negatively affect feelings of compassion among medical students.23–24 Furthermore certain
humanities topics are not included in most medical curricula; these subjects may help improve students’ empathetic abilities.25 Another possible explanation for the observed decrease in empathy among medical students is the sense of privilege that grows throughout a doctor’s medical training; being part of an advantaged group has been suggested to contribute to changes in an individual’s capacity for empathy.26

In the current study, students who chose a people-oriented specialty reported significantly higher empathy level scores than those who selected technology-oriented specialties. These findings are similar to another study which found that students who chose internal medicine, family medicine, psychiatry, paediatrics or obstetrics and gynaecology as specialties had higher empathy scores.27 These specialties require more patient contact; students may therefore have scored higher on the empathy scale because of increased patient interaction. The authors of the current study believe that students with higher empathy levels may gravitate towards people-oriented careers. This construct does not imply that future career preference calibrates empathy but rather that students with greater empathy may naturally prefer specialties that require higher levels of patient contact. Nevertheless, it is important to note that the mean differences in empathy levels between the people-oriented and technology-oriented specialty groups were low. This may be because many students were not yet definite in their future specialty career decisions; additionally, many of them may change preferences during the course of their undergraduate studies. Future research should seek to determine whether the promotion of empathy skills impacts students’ career preferences.

One of the limitations of this study was that the measurement of empathy was self-reported, focusing on the students’ perceptions of empathy rather than their performance. A second limitation was the use of a cross-sectional study design, which did not allow for demonstration of causal relationships. Lack of significant clinical exposure may also have affected how the students answered the questions on the survey as the first three years of medical school include only partial clinical exposure; this may have influenced empathy. Furthermore, participation in the survey and understanding of the questionnaire items may have been biased by events during data collection. Finally, as this study was limited to the College of Medicine at HMU in Erbil city, the results cannot be generalised to other medical colleges in Iraq. Nevertheless, the results of this study are still worthy of consideration. The development of empathy is vital to the advancement of a student’s professionalism during their undergraduate education.28 In order to increase levels of empathy among medical students, programmes teaching empathetic skills are recommended for incorporation into medical syllabi. These programmes should involve small group teaching and include training in practical skills that can be maintained and reinforced throughout a student’s medical training, such as effective patient interviewing and interpersonal communication techniques. Further research on empathy among medical students should focus on factors that contribute to the development of high empathy levels and methods for augmenting these factors in both medical education and practice.

Conclusion

Low empathy levels were reported among the studied group of medical students at HMU, which may be a reason for concern. Specifically, males demonstrated significantly lower overall mean empathy levels in comparison to females. Mean empathy scores were also found to decline with academic progression. Programmes highlighting empathy are therefore recommended for incorporation into medical curricula in order to encourage the development of empathetic skills among medical students.

CONFLICT OF INTEREST

The authors declare no conflicts of interest.

References


Attitudes of Saudi Arabian Undergraduate Medical Students towards Health Research

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ABSTRACT: Objectives: This study aimed to evaluate attitudes, perceptions and perceived barriers towards health research among Saudi Arabian undergraduate medical students. Methods: This cross-sectional study took place between August and October 2014 and included 520 students from five medical schools across Saudi Arabia. An anonymous online survey with 21 close-ended questions was designed to assess students' attitudes towards research, contribution to research-related activities, awareness of the importance of research, perception of available resources/opportunities for research, appreciation of medical students' research contributions and perceived barriers to research. Responses were scored on a 5-point Likert scale. Results: A total of 410 students participated in the study (response rate: 77.1%). Of these, 278 (69.3%) were female. A positive attitude towards research was reported by 43.9% of the students. Only 26.4% of the respondents believed that they had adequate resources/opportunities for research. Clinical students had a significantly more positive attitude towards research compared to preclinical students (P = 0.007). Only 26.4% of the respondents believed that they had adequate resources/opportunities for research. According to the students, perceived barriers to undertaking research included time constraints (n = 200; 49.9%), lack of research mentors (n = 95; 23.7%), lack of formal research methodology training (n = 170; 42.4%) and difficulties in conducting literature searches (n = 145; 36.2%). Conclusion: Less than half of the surveyed Saudi Arabian medical students had a positive attitude towards health research. Medical education policies should aim to counteract the barriers identified in this study.

Keywords: Research; Medical Students; Attitudes; Perceptions; Medical Education; Saudi Arabia.

 acceptance and understanding of the attitudes and barriers faced by undergraduate medical students may help educators to identify key areas that need to be addressed in medical education.

Advances in Knowledge
- To the best of the authors' knowledge, this study is the first to investigate the attitudes and perceptions of Saudi Arabian medical students towards health research.
- Less than half of the surveyed medical students were found to have a positive attitude towards research.

Application to Patient Care
- Understanding the attitudes and barriers faced by undergraduate medical students with regards to research may help educators to identify key areas that need to be addressed in medical education.

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THE NUMBER OF PHYSICIAN-SCIENTISTS IN medical practice is declining; over the last two decades, the number of physician-scientists on staff at medical school faculties has decreased by nearly 25%. This suggests that the learning environment in medical schools is not conducive to clinical and basic research. While certain medical schools do include instruction in research methodologies within their curricula, it is also essential to evaluate how medical students respond to these strategies in order to further enhance their medical education. To date, most of the data regarding medical students’ attitudes and perceptions towards research have originated from industrialised countries.

Saudi Arabia is the largest country in the Middle East, with a gross domestic product of USD $24,911 per capita. Over the last decade, there has been a significant shift in medical education in Saudi Arabia and surrounding countries in the Gulf Cooperation Council (GCC) region; Saudi Arabia is currently moving towards a knowledge-based economy, of which research is an important component. New medical schools have been established and large numbers of medical graduates are expected over the next decade. Other GCC and Southeast Asian countries also have greater numbers of graduating medical students and are opening new medical schools. In Saudi Arabia, national efforts are increasingly focused on strengthening the education and health systems; in 2014, 6.9% of government expenditures were directed towards the health sector and there were almost 1,200 medical graduates from Saudi Arabian schools in 2009. The government promotes evidence-based education and policy-making within the medical community. Evidence suggests that Saudi Arabian medical students are increasingly participating in and contributing to health research.

The development of a positive attitude towards scientific research is a fundamental element of modern undergraduate medical education. However, to the best of the authors’ knowledge, there is a paucity of data regarding undergraduate medical students’ attitudes towards research and their perceptions of available resources and opportunities for research. Additionally, no studies from Saudi Arabia on this topic yet exist in the peer-reviewed literature. This study therefore aimed to evaluate attitudes and perceived barriers towards participating in health-based research among a cohort of Saudi Arabian undergraduate medical students.

Methods

This cross-sectional study took place between August and October 2014 and included undergraduate medical students from medical schools across Saudi Arabia. For an estimated population of 3,900 Saudi Arabian medical students, a sample size of at least 407 respondents (370 + 10% to compensate for non-participation) was needed to achieve a 95% confidence interval and a 7% margin of error with a study design effect of two. To calculate the sample size, it was assumed that 57% of medical students were involved in research projects. At least one university from each of the central, eastern, western and northern regions of Saudi Arabia were contacted for permission to access their email database of medical students; of these, six universities (one private and five public universities) from the central, eastern and western regions gave their consent. Five of the six medical schools were randomly selected and all 520 students of these schools were included in the study. Two senior researchers and two medical students were field investigators for the study. First- and second-year students were grouped as preclinical students and students in their third, fourth and fifth years of medical school were grouped as clinical students.

An anonymous self-reported online survey was developed by an information technology expert from the Research Department of the King Khaled Eye Specialist Hospital in Riyadh, Saudi Arabia. The English-language survey was based on a previously validated survey and used LimeSurvey (LimeSurvey Project, Hamburg, Germany). A pilot study on 10 medical students who were excluded from the subsequent study was performed to ensure that the survey was easily accessible and that the language utilised was appropriate and clear. Based on the results of the pilot study, no changes to the questionnaire were required. The survey included 21 close-ended questions to determine the students’ demographic information, past contributions to research-related activities, awareness of the importance of research, attitudes towards health-based research, perceptions of available resources/opportunities for research, appreciation of medical students’ contributions to research and perceived barriers to research.

Each questionnaire item was scored on a 5-point Likert scale; positive responses (completely agree and agree) received scores of 2 and 1, respectively, while negative responses (completely disagree and disagree)
received scores of -2 and -1, respectively. A score of zero was given to neutral answers (do not know). Total scores for questions in each category were then summed and divided by the maximum possible score in order to calculate the percentage proportion of the score. Percentages >75% were considered to be positive.

Data were analysed using the Statistical Package for the Social Sciences (SPSS), Version 22 (IBM Corp., Chicago, Illinois, USA). A univariate analysis was performed to calculate frequencies and proportions of the responses. To compare responses by gender, odds ratios and 95% confidence intervals were estimated. To review the frequency of responses by academic year, a Chi-squared analysis was performed. A \( P \) value of <0.050 was considered statistically significant.

The Institutional Research Board at the King Khaled Eye Specialist Hospital granted ethical approval for this study (#1467-P). As responses were anonymous, the written consent of participants was waived; however, the online survey began with a participation agreement form. Additionally, an introductory email was sent with each survey confirming the voluntary nature of participation and stating the research objectives of the study.

Table 1: Participation in and perceptions of health-based research among surveyed Saudi Arabian undergraduate medical students (N = 401)

<table>
<thead>
<tr>
<th>Item</th>
<th>n (%)</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participation in research projects</td>
<td>278 (69.3)</td>
<td>64.8–73.8</td>
</tr>
<tr>
<td>Participation in medical school research projects</td>
<td>250 (62.3)</td>
<td>57.6–67.1</td>
</tr>
<tr>
<td>Publication of research papers as first author in peer-reviewed journals</td>
<td>13 (3.2)</td>
<td>1.5–5.0</td>
</tr>
<tr>
<td>Positive attitude towards research</td>
<td>178 (44.4)</td>
<td>39.5–49.3</td>
</tr>
<tr>
<td>Adequate resources/opportunities for research</td>
<td>106 (26.4)</td>
<td>22.1–30.7</td>
</tr>
<tr>
<td>Appreciation of contribution to research</td>
<td>161 (40.2)</td>
<td>35.2–44.8</td>
</tr>
</tbody>
</table>

CI = confidence interval.

Table 2: Variations by gender in perceptions of health-based research among surveyed Saudi Arabian undergraduate medical students (N = 401)

<table>
<thead>
<tr>
<th>Item</th>
<th>Male (n = 123)</th>
<th>Female (n = 278)</th>
<th>OR (95% CI)</th>
<th>P value*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive attitude towards research</td>
<td>58 (47.1)</td>
<td>120 (43.2)</td>
<td>1.2 (0.8–1.8)</td>
<td>0.500</td>
</tr>
<tr>
<td>Negative</td>
<td>65 (52.9)</td>
<td>158 (56.8)</td>
<td>1.4 (0.9–2.2)</td>
<td>0.200</td>
</tr>
<tr>
<td>Adequate resources/opportunities</td>
<td>38 (30.9)</td>
<td>68 (24.5)</td>
<td>2.0 (1.3–3.1)</td>
<td>0.001</td>
</tr>
<tr>
<td>Inadequate</td>
<td>85 (69.1)</td>
<td>210 (75.5)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Appreciation of contribution to research</td>
<td>64 (52.0)</td>
<td>97 (34.9)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lack of appreciation</td>
<td>59 (48.0)</td>
<td>181 (65.1)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

OR = odds ratio; CI = confidence interval. *\( P <0.050 \) was considered statistically significant.

Table 1. Of the participants, 188 (46.9%) were aware of the usefulness of research in achieving their long-term medical career goals and 233 (58.1%) were aware of the importance of research in medical education.

Gender variations in attitudes towards and perceptions of available resources/opportunities for research were not statistically significant (\( P = 0.500 \) and 0.200, respectively). However, significantly more male students appreciated contributions to research compared to female students (\( P = 0.001 \) [Table 2]. Clinical students had a significantly more positive attitude towards research compared to their preclinical counterparts (\( P = 0.007 \)). In addition, significantly more clinical students believed they had adequate resources/opportunities for research compared to preclinical students (\( P = 0.007 \); however, the difference was not significant with regards to appreciation of research contributions (\( P = 0.060 \) [Table 3].

According to the participants, there were several perceived barriers to undertaking research. These included time constraints (n = 200; 49.9%), lack of research mentors (n = 95; 23.7%), lack of formal research methodology training (n = 170; 42.4%) and lack of training/difficulties in conducting literature searches (n = 145; 36.2%).

Discussion

Half of the surveyed Saudi Arabian medical students in the current study reported an awareness of the
importance of undertaking research. Less than half of the surveyed students had a positive attitude towards participating in research activities. No significant differences in attitudes towards or perceptions of research were noted between genders. However, appreciation for student contributions to research was greater among male students compared to females. Gender equality is an important consideration worldwide, particularly with regards to education. Although Saudi Arabia was ranked 130 out of 142 countries for gender equality in the Global Gender Gap Report for 2014, the educational attainment score was 0.987, suggesting that Saudi females attain a very high educational level. Due to their positive attitude towards research evidenced in the present study, educated Saudi females seem to be committed to enhancing education and healthcare through research. The higher number of female participants in the current study is also notable, particularly as the average male-to-female ratio of student enrolment in undergraduate medical education in Saudi Arabia was nearly 3:1 in 2011.

In the current study, clinical students were significantly more likely to have a positive attitude towards research than preclinical students, with half of the fifth-year students having a positive attitude compared to less than a third of the first-year students. An increased awareness and maturity among students in their clinical years could explain this observation; this suggests a steady increase in awareness of research throughout the course of a student’s medical education. Similarly, Khan et al. found that both knowledge and attitudes improved significantly the longer a medical student was enrolled in college. Clinical students in the current study were also significantly more inclined to perceive that they had adequate resources/opportunities for research compared to students in their preclinical years. In addition, they were more inclined to value contributions to research. Again, this is likely because older students are more likely to be aware of available resources within their respective medical schools. Furthermore, at this stage in their careers, research participation is considered an asset when applying for residency and postgraduate training programmes.

Medical students in the current study revealed four main barriers to conducting research, including time constraints, lack of mentorship and inadequate training in literature searches and research methodology. Similar barriers to research were reported by medical students in Canada. These results also concur with those of an Irish study which found that lack of time was the greatest barrier to pursuing scientific research among a cohort of undergraduate medical students in the UK. Unnikrishnan et al. observed that time constraints were the main barrier reported by undergraduate medical students in India; medical professors and mentors also confirmed that time constraints precluded supervision of student research projects. The second most important factor was limited training in research among undergraduate students. A randomised controlled trial in the UK found that insufficient instruction on the basics of scientific research in medical colleges hindered

Table 3: Variations by academic year in perceptions of health-based research among surveyed Saudi Arabian undergraduate medical students (N = 401)

<table>
<thead>
<tr>
<th>Item</th>
<th>Preclinical</th>
<th>Clinical</th>
<th>OR (95% CI)</th>
<th>P value*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>First year</td>
<td>Second year</td>
<td>Total</td>
<td>Third year</td>
</tr>
<tr>
<td>Attitude towards research</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Positive</td>
<td>22 (30.1)</td>
<td>29 (38.2)</td>
<td>51 (34.2)</td>
<td>41 (54.0)</td>
</tr>
<tr>
<td>Negative</td>
<td>51 (69.9)</td>
<td>47 (61.8)</td>
<td>98 (65.8)</td>
<td>35 (46.0)</td>
</tr>
<tr>
<td>Resources/opportunities for research</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adequate</td>
<td>11 (15.1)</td>
<td>17 (22.4)</td>
<td>28 (18.8)</td>
<td>27 (35.5)</td>
</tr>
<tr>
<td>Inadequate</td>
<td>62 (84.9)</td>
<td>59 (77.6)</td>
<td>121 (81.2)</td>
<td>49 (64.5)</td>
</tr>
<tr>
<td>Appreciation of contribution to research</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Appreciation</td>
<td>23 (31.5)</td>
<td>22 (29.0)</td>
<td>45 (30.2)</td>
<td>38 (50.0)</td>
</tr>
<tr>
<td>Lack of appreciation</td>
<td>50 (68.5)</td>
<td>54 (71.0)</td>
<td>104 (69.8)</td>
<td>38 (50.0)</td>
</tr>
</tbody>
</table>

OR = odds ratio; CI = confidence interval.
*P < 0.050 was considered statistically significant.
students from participating in or leading research projects. Similarities in results between the current study and those of international research suggest that unified solutions should be developed to overcome these obstacles to research participation.

The survey used in the current study assessed the attitudes of medical students towards health research and related factors. A Croatian study reported a more positive attitude towards science among students who took mandatory research courses compared to those who did not. Another study found that students enrolled in problem-based learning courses had a healthier attitude towards research compared to those participating in lecture-based learning. This outcome indicates the positive impact of a problem-based curriculum on the attitude of medical students towards health research. Medical schools should consider offering online self-paced courses to address the issues of time constraints and inadequate training as well as web-based consultancy services to guide students who are interested in conducting research studies. The Saudi Digital Library offers unlimited access to over 310,000 articles and offers tutorials on how to search for content and navigate their website. Saudi medical students should therefore be encouraged to use this resource. Databases of available qualified research professionals within Saudi Arabia and the GCC region willing to provide mentorship services could also be made available to medical students.

A previous study from Saudi Arabia reported that publications in medical sciences increased between 1996–2012. This resulted in Saudi Arabia being ranked 45th in the world in 2012 in terms of research productivity. More than half of the students believed that research was relevant to medical education and further increase Saudi Arabia's ranking in the near future. Administrative, research and medical education departments in Saudi Arabia should seek to develop policies targeting students to enhance their understanding of the importance of research. Telmesani et al. noted challenges in executing changes in the Saudi medical education system. They also opined that reforms were directed more toward changing curricula rather than defining the essential skills, knowledge and standards needed for graduating physicians. The results of the current study indicate a need for reforms that will lead to improved perceptions of research among medical students and increased research productivity within the country.

Certain limitations to the current study should be noted when interpreting the results. The findings were based on responses from a self-reported web-based anonymous survey. Furthermore, there are a total of 28 medical schools in Saudi Arabia, only six were targeted in this study. Additionally, these schools were highly ranked and may therefore have had greater research-related resources than other universities in Saudi Arabia. Further studies are recommended to survey the attitudes of students from all medical schools in the country. Nevertheless, despite these limitations, it is important to note that participant responses to the anonymous survey used in the current study may have been more honest than those from other research utilising different methods of data collection.

Conclusion

Half of the surveyed Saudi Arabian medical students were aware of the importance of undertaking research although less than half had a positive attitude towards research. Four main barriers to research participation were identified—time constraints, lack of mentorship and inadequate training in literature searches and research methodology. In order to strengthen the medical research environment in Saudi Arabia, policymakers should take these barriers into account.

CONFLICT OF INTEREST

The authors declare no conflicts of interest.

References


Prevalence of and Reasons for Patients Leaving Against Medical Advice from Paediatric Wards in Oman

Mohamed Al-Ghafri, Abdullah Al-Bulushi, Ahmed Al-Qasmi

ABSTRACT: The objective of this study was to determine the prevalence of and reasons for patients leaving against medical advice (LAMA) in a paediatric setting in Oman. This retrospective study was carried out between January 2007 and December 2009 and assessed patients who left the paediatric wards at the Royal Hospital, Muscat, Oman, against medical advice. Of 11,482 regular discharges, there were 183 cases of LAMA (prevalence: 1.6%). Dissatisfaction with treatment and a desire to seek a second opinion were collectively the most cited reasons for LAMA according to data from the hospital’s electronic system (27.9%) and telephone conversations with patients’ parents (55%). No reasons for LAMA were documented in the hospital’s electronic system for 109 patients (59.6%). The low observed prevalence of LAMA suggests good medical practice at the Royal Hospital. This study indicates the need for thorough documentation of all LAMA cases to ensure the availability of high-quality data for healthcare workers involved in preventing LAMA.

Keywords: Children; Patient Discharge; Documentation; Oman.

LEAVING AGAINST MEDICAL ADVICE (LAMA) is a term that describes the discharge of a patient from a hospital without the agreement of the treating doctor, usually at their own request or that of their caregivers in the case of paediatric patients. LAMA has been documented in numerous healthcare settings and accounts for 1–26% of the discharges of general medical patients worldwide.1–4 When patients choose to leave the hospital before the recommendation of a treating physician, the consequences can involve risks associated with inadequately treated medical conditions, the need for readmission and sometimes loss of life.5–7 In many LAMA cases, a patient is not medically fit to be discharged; however, the treating team are not able to oppose the wishes of a patient or their caregiver. Feeling better or personal/financial obligations are some of the reasons for LAMA reported in the literature.8 Generally, once a patient or their family insists on LAMA, a form is completed which must be signed by both the patient/caregiver and the responsible physician. The reason for the discharge is usually then recorded in the hospital’s electronic system by the physician. The signed LAMA form exists to protect the treating team and their medical institution from legal liability; good clinical practice and thorough documentation remain the best legal protection in cases of LAMA.9 In Oman, hospital staff can obtain an order from the General Prosecutor to refuse to discharge children from hospital before the completion of treatment.10

For children, the problem of LAMA has been addressed in many studies around the world but rarely in countries in the Middle Eastern region.1–3 The
The objectives of this study were to determine the prevalence of LAMA among children from the paediatric wards at the Royal Hospital in Muscat, Oman, and to examine the characteristics of these patients and the reasons for their discharge against medical advice. The Royal Hospital is a tertiary teaching hospital which admits patients from all regions of Oman; it has three general paediatric and subspecialty wards.

**Methods**

This retrospective study was conducted from January 2007 to December 2009. Clinical and patient data were collected from the electronic hospital information system. Manually-filed LAMA forms were also reviewed in order to obtain additional information. The age of the patients, time of LAMA (either during official working hours from 07:30 to 14:30 or during on-call hours from 14:30 to 07:30 the next day, weekdays or at the weekend), length of hospital stay and presence of documented discussion with caregivers regarding LAMA were reviewed. Data on the designated counselling physician (i.e. consultant, registrar, resident or intern), the presence or absence of a follow-up appointment and the reasons for LAMA if mentioned in the discharge notes or the LAMA form were also collected.

Reasons for LAMA were categorised as dissatisfaction with treatment, the desire to seek a second opinion and social and/or financial reasons. The social reasons included unavailability of a caregiver for other children at home or other personal issues that were not disclosed by the patients' parents. The patients’ diagnoses on discharge were also recorded and their diagnoses were categorised into purely acute conditions versus conditions attributed to pre-existing comorbidities (chronic conditions). In cases where the reason for LAMA was missing, the families were contacted by telephone in order to ascertain the reason they discharged their child against medical advice.

Data processing and analysis were carried out using the Statistical Package for the Social Sciences (SPSS), Version 18 (IBM Corp., Chicago, Illinois, USA). In addition to descriptive statistics, hypothesis testing was carried out using the Student’s t-test to make comparisons and Pearson’s Chi-squared analysis to test for independence. Pearson’s correlation coefficient was utilised to examine the relationships between relevant variables. The probability of a type two error was set at 5%.

Ethical approval for this study was obtained from the Medical Ethics & Scientific Research Committee of the Royal Hospital (MESRC #6).

**Results**

Of the 11,482 discharges from the hospital’s paediatric wards during the study period, 183 children left the hospital against medical advice, resulting in a LAMA prevalence of 1.6%. A total of 74 patients (40.4%) were <1 year old, 75 patients (41.0%) were 1–5 years old and 34 patients (18.6%) were >5 years old. The length of stay ranged from 1–34 days with a mean of four days; 58 patients (31.7%) stayed in the hospital for one day, 73 (39.9%) stayed 2–5 days and 52 patients (28.4%) stayed for >5 days.

In terms of diagnosis at discharge, 81 patients (44.3%) had only acute conditions, while 102 patients (55.7%) had chronic conditions. There was no statistically significant difference in the frequency of LAMA between these groups. Counselling on LAMA was undertaken by physicians for the families of 172 patients (94.0%); the counselling designation was missing in 11 cases (6.0%). Of those who underwent counselling, 29 families (16.9%) were counselled by consultants, 98 (57.0%) by registrars, 27 (15.7%) by residents and 18 (10.5%) by interns.

A total of 160 patients (87.4%) were discharged during official working hours while the remaining 23 patients (12.6%) were discharged during. Only 39

**Table 1:** Reasons for leaving against medical advice among paediatric patients in the Royal Hospital, Muscat, Oman, according to hospital electronic records (N = 183)

<table>
<thead>
<tr>
<th>Reason for LAMA</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dissatisfaction with treatment/care</td>
<td>24 (13.1)</td>
</tr>
<tr>
<td>Social issues</td>
<td>20 (10.9)</td>
</tr>
<tr>
<td>Seeking a second opinion</td>
<td>27 (14.8)</td>
</tr>
<tr>
<td>Financial issues</td>
<td>3 (1.6)</td>
</tr>
<tr>
<td>No documentation</td>
<td>109 (59.6)</td>
</tr>
</tbody>
</table>

LAMA = leaving against medical advice.

**Table 2:** Reasons for leaving against medical advice among paediatric patients in the Royal Hospital, Muscat, Oman, according to follow-up telephone interviews (N = 109)

<table>
<thead>
<tr>
<th>Reasons for LAMA</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dissatisfaction with treatment/care</td>
<td>17 (15.6)</td>
</tr>
<tr>
<td>Social issues</td>
<td>36 (33.0)</td>
</tr>
<tr>
<td>Seeking a second opinion</td>
<td>43 (39.4)</td>
</tr>
<tr>
<td>Financial issues</td>
<td>3 (2.8)</td>
</tr>
<tr>
<td>No reply</td>
<td>10 (9.2)</td>
</tr>
</tbody>
</table>

LAMA = leaving against medical advice.
patients (21.3%) were discharged in the morning while 144 (78.7%) were discharged during evening hours. Follow-up appointments were made for 153 patients (83.6%) while no appointments were made for the remaining 30 patients (16.4%).

According to the hospital’s electronic system, a desire to seek a second opinion and dissatisfaction with treatment/care were the most cited reasons for LAMA (14.8% and 13.1%, respectively) [Table 1]. A total of 109 patients (59.6%) had no electronic documentation regarding their reasons for LAMA. The parents of these patients were contacted 1–4 years after LAMA. Table 2 shows that seeking a second opinion followed by social issues were the most cited reasons for LAMA among these 109 patients (39.4% and 33.0%, respectively).

Discussion

In this study, the LAMA prevalence was found to conform to reported rates in the literature; Okoromah et al. and Hong et al. reported a LAMA prevalence of 1.2% and 2% in Nigeria and Singapore, respectively.12,13 In contrast, Al-Sadoon et al. and Abdulateef et al. reported a LAMA prevalence of only 0.32% and 0.11% in Oman and Qatar, respectively.12,13 The setting of the latter study was different from other studies as it was conducted in a paediatric emergency centre within the ideal observation period of 48 hours.13 Al-Turkistani reported a LAMA prevalence of 1.6% in a neonatal intensive care unit at a university hospital in Saudi Arabia.14 Abd El Malek et al. noted a surprisingly high prevalence of LAMA (8.49%) in a recent study carried out in Kuwait.15

In the current study, LAMA was more common for infants under one year of age; a similar finding was reported by Al-Sadoon et al. (n = 24; 63.2%).12 Comparable findings were also reported in other studies which could be partly attributed to the large number of cases admitted from this age group.12,16 In addition, subtle clinical presentations among infants can put them at a higher risk of being admitted for further care. The mean length of hospital stay in the present study was slightly longer compared to that reported by a previous study (3.1 days).4 Moreover, almost a third of patients in the current study stayed for only one day. Al-Sadoon et al. reported a similar finding in their study (n = 15; 39.5%).12 This finding might be attributed to non-critical reasons for admission, including diagnostic uncertainty. In addition, a short observation time in the emergency room along with the unavailability of a short-stay ward may have contributed to the LAMA cases that occurred during the first 24 hours after admission. Interestingly, the majority of patients were discharged during weekdays. On the other hand, Abd El Malek et al. reported a higher number of LAMA cases during the weekend; this was attributed to overcrowding and staff shortages during weekends.15

The majority of cases reviewed in the current study had poor documentation with regards to LAMA data, which conforms to reports from other studies.12,17 Al-Sadoon et al. reported poor documentation in 57.9% of LAMA cases.12 This finding illustrates the need for thorough recordkeeping in all LAMA cases to ensure that physicians, researchers, decision-makers and healthcare planners have the information they require in order to reduce the prevalence of LAMA.

According to the hospital electronic records assessed in the current study, dissatisfaction with treatment and the desire to seek a second opinion were the most cited reasons for LAMA; these findings are similar to those of several other studies on LAMA.16,19 Dissatisfaction with treatment might be attributed to a parent’s unwillingness for their child’s case to be studied for teaching purposes or due to frequent blood sampling or prolonged hospitalisation. These reasons were also the most commonly cited during telephone interviews with the parents in cases without electronic documentation. Social reasons for LAMA were reported by a third of the parents, which could indicate a lack of willingness by the families to fully disclose their reasons for LAMA during the telephone interviews. These reasons might include a lack of care for other children at home or work commitments. Since medical services are free for Omani citizens, financial reasons represented a very small proportion of LAMA cases. As such, financial reasons were only reported by expatriate patients without medical insurance.

Although it was not statistically significant, a greater proportion of the study population with chronic medical problems were discharged against medical advice than those with non-chronic conditions. The higher frequency of LAMA among this group could be attributed to parents of children with chronic conditions being accustomed to caring for them at home with oral medications. The majority of LAMA cases in the current study occurred during on-call hours. This was expected since, in Oman, fathers are anecdotally the ones to decide whether to discharge their children against medical advice, and the majority of fathers arrive at the hospital in the evening after official working hours. Another reason for this result could be the absence of in-house consultants after normal daytime working hours who could potentially counsel patients’ parents in order to minimise LAMA cases. Interestingly, few of the parents who chose to
discharge their children in the current study were counselled by consultants. This strongly suggests the importance of proper communication between physicians and parents.20

Limitations in the current study include a lack of a control group to compare illnesses between patients who were discharged with the recommendation of the physician and those who left against medical advice; a lack of follow-up of the discharged children; unavailability of documentation in many cases; the interval between the telephone interviews and the LAMA case which may have adversely affected the results; and a relatively small sample size leading to an inability to generalise the results. Further studies on cases of paediatric LAMA are needed, particularly multi-centre studies that include a comparison of outcomes between LAMA cases and those with usual discharge decisions.

Conclusion
This study sought to identify the reasons for LAMA among paediatric patients at the Royal Hospital. The results indicate that more effective communication between the treating team and families, along with early interventions, are needed in order to minimise LAMA. There is a need for thorough documentation of all LAMA cases to ensure the availability of high-quality data for physicians, researchers, decision-makers and healthcare planners. Further studies are recommended to assess the outcomes for children who leave paediatric wards before the completion of their treatment.

CONFLICT OF INTEREST
The authors declare no conflicts of interest.

References
Single Breath-Hold Physiotherapy Technique

Effective tool for T2* magnetic resonance imaging in young patients with thalassaemia major

*Surekha T. Mevada,1 Najma Al-Mahruqi,2 Ismail El-Beshlawi,3 Mohamed El-Shinawy,4 Mathew Zachariah,1 Abdul H. Al-Rawas,4 Shahina Daar,4 Yasser Wali9

Abstract: Magnetic resonance imaging using T2* (MRI T2*) is a highly sensitive and non-invasive technique for the detection of tissue iron load. Although the single breath-hold multi-echo T2* technique has been available at the Sultan Qaboos University Hospital (SQUH), Muscat, Oman, since 2006, it could not be performed on younger patients due to their inability to hold their breath after expiration. This study was carried out between May 2007 and May 2015 and assessed 50 SQUH thalassaemic patients aged 7–17 years old. Seven of these patients underwent baseline and one-year follow-up MRI T2* scans before receiving physiotherapy training. Subsequently, all patients were trained by a physiotherapist to hold their breath for approximately 15–20 seconds at the end of expiration before undergoing baseline and one-year follow-up MRI T2* scans. Failure rates for the pre- and post-training groups were 6.0% and 42.8%, respectively. These results indicate that the training of thalassaemic patients in breath-hold techniques is beneficial and increases rates of compliance for MRI T2* scans.

Keywords: Children; Iron Overload; Breath Holding; Physiotherapy; Thalassemia Major; Oman.

Homozygous beta thalassaemia is an inherited blood disorder characterised by deficient synthesis of the beta globin subunits of haemoglobin. Beta thalassaemia carriers comprise 1.5% of the worldwide population; an estimated 60,000 infants are born with this serious defect every year.1 It is most commonly found in people of Mediterranean descent (Italians and Greeks), although it also affects people from other parts of the world such as Africa, the Middle East, the Indian subcontinent and Southeast Asia.2 The Omani population is known to have a high prevalence of alpha thalassaemia and a substantial number of the population are carriers of either haemoglobin S or beta thalassaemia.3 The Genetic Blood Disorders Survey in Oman revealed a prevalence of 9.5% for clinically significant haemoglobinopathy carriers. Beta thalassaemia was found to be the second most common haemoglobinopathy with a carrier rate of 2% in children under five years of age and a prevalence of 0.07% for homozygous beta thalassaemia.4

Patients with thalassaemia major require life-long red blood cell transfusion for survival. Senescence of transfused red cells results in iron deposition within the reticuloendothelial system with progressive deposition in the hepatic parenchyma, endocrine tissues and eventually the myocardium.5 Although serum ferritin is widely used to indirectly assess iron stores, several studies have shown that it does not accurately reflect hepatic or cardiac iron levels.6,7 Liver iron
concentration can be determined by a liver biopsy, but this has high sampling variability. In addition, the procedure is invasive and complications requiring hospitalisation are not uncommon.9,10

Magnetic resonance imaging using T2* (MRI T2*) is a highly sensitive, non-invasive and reproducible technique for the detection of tissue iron load.2,3,9,11 It is recommended that the first T2* cardiac magnetic resonance scan should be performed in thalassaemic patients as early as feasible without sedation to tailor the chelation treatment.12,13 In 2006, the MRI T2* liver and heart technique was introduced at the Sultan Qaboos University Hospital (SQUH), a tertiary care hospital in Muscat, Oman. Initially, only patients over 10 years of age were eligible for the procedure; however, most of the patients failed to complete the procedure due to either movement or an inability to hold their breath in expiration. This prompted hospital staff to implement a training programme designed by an SQUH physiotherapist to enable paediatric patients to successfully complete the procedure. This study therefore aimed to evaluate the effect of this training programme.

Methods

This study was carried out between May 2007 and May 2015 at SQUH. All patients between seven and 17 years old with thalassaemia major who were undergoing regular hypertransfusion at the SQUH Paediatric Thalassaemia Day Care Center were included in the study. Between May 2007 and May 2009, seven patients underwent a baseline MRI T2* scan using the single breath-hold multi-echo T2* technique. Between June 2009 and May 2015, all patients who fit the inclusion criteria, including the seven aforementioned patients, were individually reviewed by a physiotherapist during regular transfusion-related hospital visits (every 3–4 weeks). All patients subsequently underwent two or more training sessions designed to teach them to hold their breath at the end of expiration for approximately 15–20 seconds.

During the first training session, the required breath-hold procedure was demonstrated to each patient individually by the physiotherapist. The patients were shown how to take a deep breath and then exhale slowly, holding their breath at the end of expiration for approximately 15–20 seconds. The necessity of adequate breath-holding was emphasised as crucial for the procedure. The breath-hold at the end of expiration was timed with a stopwatch in order to achieve the required time for the procedure. Each patient was asked to repeat the breath-holding exercise until they could perform it correctly. The patients were simultaneously instructed to remain still and avoid movement during breath-holding. They were also counselled to continue practicing breath-holding at home. In subsequent sessions, patients were reassessed by the physiotherapist. All patients who were able to hold their breath at the end of expiration for 15–20 seconds were scheduled for MRI T2* scans. Children who were still unable to hold their breath at the end of expiration were continuously reassessed at subsequent visits. Most of the patients were fully trained in less than three visits. During these sessions, the doctors and nurses also interacted with the patients in order to allay their anxieties regarding the procedure and to build their confidence. All of the patients received the physiotherapy training during scheduled transfusion appointments in order to minimise hospital visits and school absenteeism.

After the completion of the physiotherapy training, all patients underwent baseline cardiac MRI T2* scans using the single breath-hold multi-echo T2* protocol without general anaesthesia or sedation.14,15 Approximately a year later, the patients were given a follow-up MRI T2* scan. Failure was defined by an inability to complete the procedure either due to inadequate breath-holding or due to movement resulting in artefacts appearing on the scan. T2* values measured during the MRI were calculated using CMRtools (Cardiovascular Imaging Solutions Ltd., London, UK).

Continuous variables were presented as means, ranges and standard deviations. Categorical variables were presented as frequencies. A t-test was used to compare continuous variables in both groups. Fisher’s exact test was used for 2 x 2 contingency tables. A P value of <0.050 was considered significant.

This study was approved by the Medical Research & Ethics Committee of the College of Medicine & Health Sciences at Sultan Qaboos University (MREC #980).

Results

Among the 50 patients who were included in the study, seven patients underwent MRI T2* scans before physiotherapy training. These patients were aged 10–16 years old (mean: 11.28 ± 2.13 years). Of these patients, three (42.9%) failed the procedure. A total of eight follow-up MRI T2* scans were performed one year later, as one patient had two follow-up MRI scans. At follow-up, three patients (37.5%) failed the procedure.

All 50 patients subsequently received physiotherapy training. These patients were aged 7–17 years old (mean: 10.45 ± 2.51 years). Of these patients, three
Single Breath-Hold Physiotherapy Technique
Effective tool for T2* magnetic resonance imaging in young patients with thalassaemia major

Table 1: Age and magnetic resonance T2* failure rates among young patients with thalassaemia major before and after physiotherapy breath-hold training (N = 50)

<table>
<thead>
<tr>
<th></th>
<th>Before training (n = 7)</th>
<th>After training (n = 50)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean age in years ± SD (range)</td>
<td>11.28 ± 2.13 (10–16)</td>
<td>10.45 ± 2.51 (7–17)</td>
<td>0.372</td>
</tr>
<tr>
<td>Baseline MRI T2* failure, n (%)</td>
<td>3 (42.9)</td>
<td>3 (6.0)</td>
<td>0.021*</td>
</tr>
<tr>
<td>Follow-up MRI T2* failure, n (%)</td>
<td>3 (37.5)</td>
<td>2 (2.9)</td>
<td>0.007*</td>
</tr>
</tbody>
</table>

SD = standard deviation; MRI = magnetic resonance imaging.

*Significant at P <0.050. †There were eight total scans for this group as one patient had two follow-up MRI scans. ‡There were 68 total scans for this group as 18 patients had two follow-up scans.

(6.0%) failed to complete the baseline MRI T2* scan. All three of these patients were nine years old. A total of 68 follow-up MRI T2* scans were performed one year later, as 18 patients underwent two follow-up MRI scans. Of these, two patients (2.9%) aged 13 and 15 years old failed the procedure [Table 1].

Discussion

Although breath-holding for MRI T2* scans is difficult for young children, the results of this study indicated that physiotherapy training among young patients with thalassaemia was effective in improving compliance to the MRI T2* procedure. Children as young as seven years of age were subsequently able to undergo MRI T2* scans without general anaesthesia or sedation, resulting in a reduced failure rate. In the group of patients who did not receive physiotherapy training, the results were suboptimal; it was this finding that prompted the researchers to adapt a uniform approach to prepare paediatric patients with thalassaemia for the MRI T2* procedure.

The major limitations of cardiac MRIs in young children are the need to remain relatively still within the scanner and the need for breath-holding to acquire images without artefacts. Breath-holding problems are well documented in adults and it is likely they are more of an issue in children. These problems include an inability to understand and follow instructions for breath-holding, an inability to maintain the breath-hold for the whole scan (15–20 seconds) and fear of the procedure. Few studies have been reported on the use of MRI T2* in children and it appears that most centres either use sedation or general anaesthesia for the procedure.

Some of the alternative approaches used to obtain high-quality MRI scans include the use of a mock MRI scanner or Cinemavision (Salvadorini Consulting LLC, Lexington, North Carolina, USA). A study by de Bie et al. evaluated the use of a mock scanner training protocol as an alternative for sedation and for preparing young children for MRI scans. In their cohort of 90 children aged 3.65–14.5 years old, 85 children passed the mock scanner training sessions. The mock scanner is a full-scale replica of an MRI system without magnets and requires the services of a doctor to conduct the training sessions for several days to a maximum of three weeks before the real MRI is carried out. The purpose of Cinemavision (Salvadorini Consulting LLC) is to allow patients to forget their surroundings while they watch a movie/television or listen to music/radio. Neither mock scans nor Cinemavision (Salvadorini Consulting LLC) are presently available at SQUH.

In the current study, severe cardiac iron overload (<10 ms) was observed in a 7-year-old child as a result of the physiotherapy training and subsequent successful completion of the MRI T2* scan. This had not previously been noted by serial serum ferritin monitoring or echocardiography. The patient underwent physiotherapy training prior to the initial MRI T2* scan. During this scan, he was detected to have a cardiac T2* value of 9.3 ms at a serum ferritin level of 2,605 ng/mL. Subsequently, he was put on chelation with desferrioxamine; however, he had sub-optimal compliance to the treatment. On follow-up, the patient was subsequently reassessed by the physiotherapist.

Despite extensive counselling and chelator dose optimisation, a repeat MRI T2* scan performed after 18 months revealed a cardiac T2* value of 4.8 ms at a serum ferritin level of 2,796 ng/mL, indicating that the cardiac siderosis had worsened despite the fairly constant serum ferritin level. As a result, the patient was prescribed to combination chelation therapy with deferiprone and desferrioxamine. A repeat MRI after a further nine months revealed an improved cardiac T2* value of 8.1 ms at a serum ferritin level of 3,197 ng/mL. In the case of this patient, the physiotherapy training enabled the successful completion of the initial and follow-up MRI scans allowing the detection and subsequent treatment of the severe cardiac siderosis.

The use of physiotherapy training is advantageous to prepare paediatric patients with thalassaemia for MRI T2* scans using the single breath-hold, multi-echo T2* technique. Aside from the time-saving benefits, training also reduces the logistical issues of re-booking patients in busy hospital MRI departments and avoids the risks associated with general anaesthesia or sedation. Baseline and one-year follow-up MRI T2* scans, together with careful monitoring of iron overload progression, offers timely intervention for
optimal chelation and improved quality of life among young thalassaemic patients.

**Conclusion**

In this study, a high failure rate for MRI T2* scans was noted in a group of young thalassaemic patients who had not received physiotherapy training. However, among those who took part in a training programme that prepared patients to hold their breath for 15–20 seconds after expiration, the failure rate was significantly lower. This indicates that a training programme for paediatric thalassaemic patients is indeed beneficial and increases compliance. Breath-hold training also ensures paediatric patients avoid the complications of sedation or general anaesthesia.

**ACKNOWLEDGEMENTS**

We thank the SQUH Paediatric Day Care Centre nursing staff, in particular Ms. Alia A. Al-Siyabi, as well as the SQUH physiotherapy team and the MRI technicians for their invaluable support throughout this study. We also thank the patients and their parents for their participation and cooperation in this study.

**CONFLICTS OF INTEREST**

The authors declare no conflicts of interest.

**References**


Use of Prophylactic Inferior Vena Cava Filters in Trauma

Ahmed A. Naiem, Alreem K. Al-Hinai, Rashid Al-Sukaiti, Hani Al-Qadhi

ABSTRACT: Venous thromboembolisms, specifically pulmonary embolisms (PEs), represent a significant burden on healthcare systems worldwide, particularly within the setting of trauma. According to the literature, PEs are the most common cause of in-hospital death; however, this condition can be prevented with a variety of prophylactic and therapeutic measures. This article aimed to examine current evidence on the use, indications for prophylaxis, outcomes and complications of prophylactic inferior vena cava filters in trauma patients.

Keywords: Inferior Vena Cava Filters; Trauma; Veins; Thromboembolisms.

Despite recent outstanding breakthroughs in thrombosis research, venous thromboembolisms (VTEs)—notably pulmonary embolisms (PEs)—continue to be a major health concern around the world. Possibly due to its abrupt onset, non-specific symptoms and relatively difficult diagnosis, PE is the most common cause of in-hospital death worldwide. In addition, it is a major cause of preventable mortality in hospitalised trauma patients. Although PEs are preventable through a variety of prophylactic and therapeutic measures, data from the USA suggests that PE is the cause of 50,000–100,000 deaths each year.

In 1961, Sevitt et al. reported an incidence of 65% and 20.3% of deep venous thrombosis (DVT) and PE, respectively, among a cohort of trauma and burn patients. Moreover, a study published in 1990 by Shackford et al. found a VTE incidence of 7% among trauma patients, despite the use of mechanical or pharmacological prophylactic measures. However, more recent data have suggested lower incidences of VTE. A cohort study from the UK of acute trauma patients admitted between 2010–2011 found the incidence of PE to be 0.8%; most of these patients had lower limb fractures. Ho et al. found that fatal PEs accounted for 11.9% of all deaths among 971 consecutive trauma patients. One reason for the variability in reported VTE incidences could be differences in the techniques used to confirm or diagnose the condition, while another explanation could be under-reporting, perhaps due to a reluctance to perform autopsies in cases of sudden death. Several studies have attempted to identify risk factors for VTEs following trauma. In 1994, a comprehensive prospective study of 349 patients by Geerts et al. showed various associations between developing VTE and older age, scores on the Abbreviated Injury Scale, lower limb orthopaedic injuries and fractures, spinal cord injuries, blood transfusions within 24 hours of admission and surgical interventions. Similar factors were associated with the risk of developing VTE in a study by Kudsk et al. in 1989, including spinal, pelvic or lower limb fractures, age (>45 years old), bed rest (>3 days) and previous venous repairs.

Inferior vena cava (IVC) filters interrupt the vena cava flow and the migration of a potential thrombus. Trauma patients usually present with multiple injuries involving organs such as the brain or spinal cord which leaves them at risk of fatal bleeding if pharmacological anticoagulation is attempted. In addition, to further complicate matters, extremity injuries in trauma are often severe enough to render the use of mechanical...
pneumatic compression devices unsuitable.\textsuperscript{5} Two types of IVC filter exist: permanent and non-permanent. Permanent filters are designed to function indefinitely while non-permanent filters are subdivided into temporary filters which must be removed or retrievable filters that can either be removed or left in place as a permanent implant, depending on the patient’s clinical condition.\textsuperscript{6} Since the introduction of percutaneously-inserted IVC filters approximately 30 years ago, there has been extensive development of filter designs aiming to improve success rates and lower complication rates.\textsuperscript{11}

This article aimed to examine the available published literature on the use of prophylactic IVC filters in trauma patients and their effect on reducing morbidity and mortality. Articles were identified through a search on the MEDLINE and Cochrane Central Register of Controlled Trials databases using the following keywords: “inferior”; “vena”; “cava”; “filter”; and “trauma”.

Choice of Placement

The placement of IVC filters is usually done in an angiography suite by an interventional radiologist or in an operating room by a vascular surgeon. Venous access is gained via the femoral or internal jugular vein.\textsuperscript{12} The ideal position for the placement of an IVC filter depends on the extent of the \textit{thrombus} within the inferior \textit{vena cava}; deployment at an infrarenal position is often chosen to protect against renal vein thrombosis in the event of an IVC occlusion. Another approach involves using intravascular ultrasound probes.\textsuperscript{12} This technique offers some advantages as it can be performed at the patient’s bedside and avoids exposing trauma patients to the effects of an iiodinated contrast injection; however, this approach is relatively expensive.\textsuperscript{12}

Indications for Prophylaxis

Considerable controversy exists regarding the use of IVC filters in VTE prevention, despite a reported VTE prevention rate of 98%.\textsuperscript{11} In 2002, the Eastern Association for the Surgery of Trauma (EAST) recommended that insertion of a prophylactic IVC filter should be considered only in extremely high-risk trauma patients who were unable to receive anticoagulation treatment because of their increased risk of bleeding.\textsuperscript{14} In addition, eligible patients included those who would remain immobile for prolonged periods of time, potentially due to one of the following: severe closed head injuries (Glasgow Coma Scale score <8); incomplete spinal cord injuries with paraplegia or quadriplegia; complex pelvic fractures with associated long bone fractures; or multiple long bone fractures.\textsuperscript{14} In addition, the EAST guidelines also state that patients at high risk for bleeding complications for 5–10 days after injury have an increased need for prophylactic IVC filters, particularly those with intracranial haemorrhage, ocular injuries with associated haemorrhage, solid intra-abdominal organ injuries and/or pelvic or retroperitoneal haematomas requiring transfusion.\textsuperscript{14} In contrast, the American College of Chest Physicians recommended against the use of prophylactic IVC filters regardless of VTE risk in 2012.\textsuperscript{15} This recommendation was based on low-quality evidence (grade 2C) suggesting frequent complications with IVC filters and unclear long-term benefits.\textsuperscript{15} These conflicting recommendations, which were issued 10 years apart, exist due to the continuing absence of high-quality evidence to either support or refute the prophylactic use of IVC filters. As a result, the final decision as to IVC filter insertion in a critical trauma patient remains with the treating physician.

Outcomes

There are very limited data in the form of randomised controlled trials to ascertain the outcomes of the prophylactic use of IVC filters to prevent PEs. To date, the only evidence available is in the form of observational studies, the majority of which were conducted before 2010.\textsuperscript{16} Since then, the use of low-molecular-weight heparin has become a widely accepted method of thromboprophylaxis against DVTs and PEs.\textsuperscript{15} A meta-analysis of seven observational studies on the prophylactic use of IVC filters in trauma patients reported that the pooled odds ratio of developing a PE was significantly lower (OR = 0.21; 95% CI = 0.09–0.49) among patients who received an IVC filter in comparison to matched control subjects.\textsuperscript{16} In contrast, a clinical trial observed an increase in the odds of DVT with IVC filter placement, reaching up to 87%.\textsuperscript{17} In weighing these outcomes, the absolute risk reduction of PE is compared to the absolute increased risk of DVT. Such reported outcomes further contribute to the controversy regarding IVC filter use.\textsuperscript{14}

Complications

Early and late complications can occur at various stages during and after the placement of IVC filters. Access-site thrombosis is an early complication which has been found to occur in 1–3% of cases with low-profile filter delivery systems.\textsuperscript{19} Delivery system complications, such as sheath kinking or air embol-
isms, penetration of the IVC filter into neighbouring organs and post-procedural bleeding are other early complications.20–22 Late complications include filter fracture, migration, IVC occlusion, venous stasis, chronic venous insufficiency and PE recurrence.23–25 The risk of fracture rises the longer a filter is in place; research shows a 40% risk of filter fracture after 5.5 years.25 The incidence of migration varies with the type of filter used. For one of the most extensively used filters, the Greenfield26 filter (Boston Scientific Corp., Marlborough, Massachusetts, USA), the migration rate is 8–15%.24 Recurrence of PE has been reported to be as high as 4%.24 An increased risk of IVC occlusion and distant embolism despite IVC filter use has also been previously reported.25

Conclusion

Trauma is a major risk factor for VTE. Trauma patients usually present with multiple injuries that preclude the use of pharmacological or mechanical thromboprophylaxis. Thus, IVC filters are sometimes used to prevent the occurrence of a fatal PE in high-risk trauma patients. However, there is a lack of high-quality evidence available to standardise protocols for IVC filter use. In addition, there remain concerns over the long-term benefits of IVC filters. The final decision as to whether IVC filter insertion is suitable for a severely injured trauma patient remains a decision best guided by clinical judgment and available evidence.

References


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### CME Quiz Questions

1. How is venous access for an IVC filter gained?
   a. Basilic vein
   b. Femoral veins
   c. Internal jugular veins
   d. Femoral or internal jugular veins
   e. All of the above

2. What are possible indications for prophylactic use of IVC filters in trauma patients?
   a. Severe closed head injury
   b. Incomplete spinal cord injury with paraplegia or quadriplegia
   c. Complex pelvic fractures with associated long bone fractures
   d. Multiple long bone fractures
   e. All of the above
   f. None of the above

   a. Migration
   b. Thrombosis
   c. Air embolisms
   d. Post-procedure bleeding
   e. Chronic venous insufficiency

   a. Fracture
   b. Solid intra-abdominal organ injury
   c. Migration
   d. Lower limb venous stasis
   e. Chronic venous insufficiency

5. What is the risk of IVC occlusion and distant embolism despite IVC filter use?
   a. Decreased
   b. Increased
   c. The same

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IVC = inferior vena cava.

**Answers:** 1: d; 2: e; 3: b, c, d; 4: a, c, d, e; 5: b.
Atypical Presentations of Respiratory Syncytial Virus Infection

Case series

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The respiratory syncytial virus (RSV) usually causes a lower respiratory tract infection in affected patients. RSV has also been infrequently linked to extrapulmonary diseases in children. We report four children admitted to the Royal Hospital in December 2013 with severe and rare manifestations of RSV. All patients had a positive outcome and made a full recovery.

Keywords: Respiratory Syncytial Virus Infections; Epidemiology; Encephalitis; Hepatitis; Croup; Case Series; Oman.

The respiratory syncytial virus (RSV) belongs to the Paramyxoviridae family and, along with the recently identified human metapneumovirus, belongs to the Pneumovirinae subfamily. RSV is further classified into subtypes A and B; subtype A usually causes a more severe form of the disease.1 Both subtypes occur more commonly in cold weather and rainy seasons.2 Around the world, it has been noted that RSV is highly prevalent in five-year-old children.3 In the United States, 4–5 million children younger than four years of age annually contract RSV infections and 125,000 require hospital admission.4 In most cases, the virus is not fatal; however, in certain groups of high-risk patients, an RSV infection can lead to a more severe morbidity or result in death.5 In order to manage affected patients appropriately, clinicians need to be aware of severe intrapulmonary and extrapulmonary manifestations of RSV infections.6

RSV mainly causes lower respiratory tract infections in children younger than two years of age or upper respiratory tract infections in older children and adults.5,6 RSV rarely causes severe extrapulmonary manifestations like cerebellitis, encephalitis, fatal interstitial myocarditis, hepatitis or Reye’s syndrome.6–9 This case series reports four children admitted to the critical care area of the Royal Hospital, Muscat, Oman, in December 2013 with severe and rare manifestations of RSV. All patients had a positive outcome and made a full recovery.

Case One

A previously healthy 11-month-old female infant was admitted to the Royal Hospital in December 2013 with a three-day history of fever, a runny nose and cough followed by drowsiness and respiratory distress. She had been in contact with her sibling who had an upper respiratory tract infection. A physical examination revealed fever, drowsiness and response only to painful stimuli. She was tachypnoeic, had marked hepatomegaly (8 cm below the costal margin with a liver span of 13 cm) and her spleen was not palpable.

Investigations showed a normal complete blood count (CBC), high aspartate transaminase (AST)
levels of 9,000 IU/L (normal range: 5–60 IU/L), normal alkaline phosphatase levels of 163 IU/L (normal range: 90–210 IU/L), high alanine transaminase levels of 52 IU/L (normal range: 0–40 IU/L) and normal albumin levels of 37 g/L (normal range: 35–50 g/L). The patient had a deranged coagulation profile, a prothrombin time of 27.9 seconds (normal range: 9.1–11.6 seconds), activated partial thromboplastin time of 40.4 seconds (normal range: 27.3–39.1 seconds), fibrinogen 1 levels of 0.03 g/L (normal range: 1.5–4.2 g/L) and a thrombin time of 23.80 seconds (normal range: 12–16 seconds). She was diagnosed with acute fulminant hepatic failure with encephalopathy.

A nasopharyngeal swab viral multiplex polymerase chain reaction (PCR) test revealed a positive result for RSV and a negative result for other respiratory viruses, including influenza A and B, coronaviruses, parainfluenza viruses, rhinoviruses, adenoviruses, enteroviruses, paraechoviruses, human metapneumovirus, bocavirus and *Mycoplasma pneumoniae*. Plasma PCR tests were negative for herpes simplex virus and human immunodeficiency virus. Hepatitis E immunoglobulin (Ig) M, hepatitis A IgG and IgM, hepatitis B surface antigen and hepatitis C virus antibodies were negative. No growth was observed on blood and urine cultures. The metabolic work-up showed normal ammonia and urine organic acid with mildly elevated levels of methionine and phenylalanine; these were likely secondary to the hepatic dysfunction.

Five days after admission, a repeat CBC showed leukocytosis with lymphocytosis. A chest X-ray (CXR) revealed right upper lobe consolidation [Figure 1A]. Computed tomography (CT) of the head was normal. The patient was stabilised in the Paediatric Intensive Care Unit (PICU) and did not require ventilation. She was prescribed cefotaxime and acyclovir empirically. Five days later, her AST levels dropped to 1,500 IU/L. She improved gradually and regained a normal level of consciousness. Within seven days her liver had returned to a normal size and her CXR showed complete resolution of the consolidation [Figure 1B].

**Case Two**

A nine-year-old boy diagnosed with a recurrent medulloblastoma was admitted to the Royal Hospital in December 2013 with a two-day history of fever,
Atypical Presentations of Respiratory Syncytial Virus Infection
Case series

Case Three
A 33-day-old male infant was admitted to the PICU at the Royal Hospital in December 2013 with a two-day history of fever, cough and poor feeding. On examination, he was febrile, tachycardic, tachypnoeic and required 3 L of oxygen via nasal prongs for maintained saturation. Investigations showed a normal CBC, urea electrolyte panel, bone profile and urine analysis. A CXR revealed bronchopneumonia with multiple pneumatoceles [Figure 3A]. The day after admission, he became distressed and was found to be hypotensive with right pneumothorax. He required intubation, ventilation, intercostal drainage (ICD) catheter insertion and inotropic support for three days. He began to improve on the fourth day of admission and the ICD catheter was removed and the inotropic support discontinued. He was extubated on the same day. The endotracheal secretion showed positive *Haemophilus influenzae* growth. A nasopharyngeal swab viral multiplex PCR test was positive for RSV and negative for other viruses. For a period of two weeks, he received intravenous ceftriaxone and clindamycin followed by oral clindamycin. A repeat CXR on the 12th day of admission showed resolved pneumonia and a pneumatocele. On the 14th day of admission, another CXR showed complete resolution of the pneumatoceles [Figure 3B]. On the same day, he was discharged on oral clindamycin to complete the four-week course of treatment.

Figure 3 A&B: Chest X-rays of a 33-day-old male infant (case three) with respiratory syncytial virus infection showing (A) right-side pneumatoceles on admission and (B) the resolution of the pneumatoceles four days after admission.

Case Four
A previously healthy six-year-old female was admitted to a peripheral hospital in Oman in December 2013 with a one-day history of fever, runny nose, cough and lethargy, followed by altered sensorium and an inability to walk. One day prior to admission, she received an oral antibiotic from a local health centre. On examination, she was drowsy, mute, febrile and unable to stand or walk without support. She did not have any meningeal signs, although a lumbar puncture showed significant leukocytosis (red blood cell count [RBC]: 10,000/UL; white blood cell count [WBC]: 50/UL; neutrophils: 70%). Her cerebrospinal fluid (CSF) glucose level was 4.5 mmol/L and her protein level was 0.4 g/L. Her CSF Gram stain, bacterial antigen and culture stains were negative. A viral study was not performed. A nasopharyngeal swab viral multiplex PCR test was positive for RSV and negative for other viruses and *Mycoplasma*. The patient was suspected to have meningoencephalitis and was prescribed ceftriaxone, vancomycin and acyclovir empirically. On the same day, she developed recurrent abnormal movements—sudden twisting of the head to the right side, blankness in the eyes and generalised stridor, a barking cough and respiratory distress. On examination, he was febrile with bilateral equal breath sounds and an expiratory wheeze. He had received high-dose chemotherapy seven days prior to admission. His investigations showed high levels of C-reactive protein. A nasopharyngeal swab viral multiplex PCR test was positive for RSV and negative for other viruses. The patient’s CBC showed severe leukopenia 0.1 x 10^9/L (normal range: 1.4–9.0 x 10^9/L) with no neutrophils. His CXR showed a narrowing of the upper third of the trachea [Figure 2A] with compensatory hyperinflation and no consolidation. The patient was diagnosed with croup and was prescribed adrenaline and dexamethasone. He had severe stridor requiring intubation [Figure 2B] and a three-day course of ventilation. Six days later, a repeat CBC, neck X-ray and CXR showed resolution of the aforementioned signs. He completely recovered and was discharged seven days after admission.
body stiffness which would last for a few seconds. These movements were eased by the administration of diazepam. When assessed, the patient scored between 8–11 on the Glasgow coma scale.

On the subsequent day, the patient was transferred to the PICU at the Royal Hospital for further evaluation and management. On arrival, she was obtunded, only opened her eyes to painful stimuli, did not respond to verbal commands and showed some withdrawal of the flexor response of the limbs to deep painful stimuli. There were bilateral pyramidal tract signs involving both the upper and lower limbs. She was ventilated due to her low Glasgow coma score and a depressed gag reflex. She developed a severe allergic skin reaction to ceftriaxone and was subsequently prescribed meropenem instead, although she continued to receive acyclovir. Upon her admission to the PICU, results of a brain CT scan were normal. Fluid-attenuated inversion recovery magnetic resonance T2 imaging of the brain on the second day of admission revealed multiple subcortical white matter hyperintense lesions involving the periventricular white matter, internal capsule, left anterior midbrain, corpus callosum, posterior brainstem tract, cerebellar peduncles and left optic nerve [Figure 4]. This was suggestive of acute necrotising encephalopathy (ANE). She was treated with intravenous methylprednisolone pulse therapy for five days. As no improvement was seen from the methylprednisolone treatment, this was followed by intravenous immunoglobulin at a dosage of 2 g/kg over the next five days.

The patient had multiple episodes of generalised tonic posturing and was treated with phenytoin and levetiracetam. As there were no clinical signs of improvement, a lumbar puncture was repeated on day nine of admission, which showed a negative culture with normal analysis (WBC: 5/UL; RBC: 20/UL; glucose: 4.6 mmol/L; proteins: 0.2 g/L). The patient’s CSF viral PCR study was negative for herpes simplex viruses 1 and 2, enteroviruses, varicella zoster virus and mumps virus. Blood serology showed positive Mycoplasma IgG and negative IgM and IgA. On the 11th day of admission, the patient received five sessions of plasmapheresis over the following seven days. She showed dramatic clinical improvement and was extubated at the end of the third week of admission.

With an extensive rehabilitation programme, the patient made excellent progress. When she was discharged, despite mild left upper limb weakness, she had normal speech, cognitive function and could walk with support. She was advised to continue physiotherapy. Three months after discharge, she was seen in a paediatric neurology outpatient clinic and was found to have no neurological deficits.

**Discussion**

Almost all children acquire a RSV infection by the second year of life. A minority (0.5–2.0%) of infected children will require admission and most of them will be less than six months old. All of the patients in this case series were asymptomatic apart from upper respiratory tract infections for two days prior to admission. Three of the children were unique in that they had a complicated course with an extrapulmonary manifestation of RSV infection, while the remaining patient had such a severe lower respiratory tract infection that he was found to have a pneumatocele in association with RSV. Only one child was known to be immunocompromised; the other three had no known risk factors.

Pneumatoceles are caused primarily by *Staphylococcus aureus*, although they may also be associated with other pathogens like *Streptococcus pneumoniae*, *H. influenzae* and *Klebsiella pneumoniae*. Pneumatoceles are a very rare complication of RSV bronchiolitis.
Almost 85% of RSV pneumatoceles resolve completely and spontaneously. Lobar emphysema may also be associated with RSV pneumonia. One patient (case three) had symptoms of a viral infection with a runny nose and cough, then developed pneumonia and a pneumatocele which completely resolved within two weeks. Endotracheal secretions were positive for RSV PCR findings and H. influenzae non-type B culture, but his blood culture was negative. In this patient, it is likely that RSV was the primary infection; H. influenzae may have been a colonisation or secondary infection. Previous research has shown that serious bacterial infections are present in 0.6–1.2% of children admitted with RSV infections. To determine the aetiology of the pneumatoceles and pneumonia in the previously reported patient (case three), a lung biopsy was necessary. However, it was not carried out as the patient had improved; as such, a biopsy would not have added to the clinical management of the case.

Acute laryngeal croup is most often associated with parainfluenza viruses, RSV, rhinoviruses and enteroviruses. Usually croup presents in children of five years of age or younger. Unusually, one patient in this case series (case two) had severe croup due to RSV at the age of nine years; this can be explained by his secondary immunodeficiency following chemotherapy. Acute fulminant hepatic failure with encephalopathy is another rare atypical manifestation of RSV infection. Acute hepatitis can be a manifestation of other viruses such as the hepatitis, Epstein-Barr, cytomegalovirus and influenza viruses. One patient in this series (case one) had acute fulminant hepatic failure with encephalopathy and deranged coagulation. A liver biopsy was not performed; with supportive management, she recovered both clinically and biochemically within one week.

ANE is a rare, rapidly progressive, potentially fatal, parainfectious encephalopathy with specific neuroimaging findings that affect mainly healthy children between five months and 11 years of age. ANE seems to be more prevalent in children from Japan. It has a high mortality rate, reaching up to 30%, with a severe neurological handicap occurring in 15% of survivors. ANE has been reported in patients with influenza types A and B, parainfluenza viruses, enteroviruses, reoviruses and M. pneumoniae. However, to the best of the authors’ knowledge, ANE has not previously been reported in the English literature in association with RSV infections. The pathogenesis of RSV-related encephalitis is still not fully understood. However, it has been hypothesised that RSV may enter into the central nervous system through the haematogenous/blood-brain barrier route or through invasion with the release of several humoral neurotoxic cytokine mediators.

It has been shown that treatments for ANE have limited efficacy. A recent report showed that treatment with steroids within the first 24 hours for three children without brainstem involvement improved outcomes, whereas the use of non-steroidal anti-inflammatory drugs has been associated with a poor prognosis and increased mortality rates. Methylprednisolone pulse therapy and high-dose γ-globulin treatment have been used to modulate immune-mediated neurovascular and cell injury. Plasma exchange can be used in patients who respond poorly to corticosteroids in order to modulate immune-mediated neurovascular and cell injuries. Although no data from randomised trials are available, successful treatment with plasma exchange has been reported. Alternative treatments for RSV infections that have been initiated in an attempt to improve mitochondrial function include carnitine, coenzyme Q10 and pyridoxine; hypothermia has also been tried as a treatment modality. The use of these interventions has been associated with a decrease in mortality rate (30% to 15%). Currently, there is no clear evidence that the use of ribavirin improves the clinical outcome of critically ill infants with RSV infections.

One patient in this case series (case four) had encephalopathy which rapidly progressed within 48 hours preceded by an upper respiratory tract infection. The respiratory viral panel showed positive RSV PCR results with negative findings for other viruses and M. pneumoniae. The patient was managed with methylprednisolone, plasmapheresis and extensive physiotherapy. She improved gradually and had fully recovered within three months. In this case, the most likely cause of ANE was the RSV infection. It is very difficult to confirm that ANE is caused only by RSV in the absence of a brain biopsy. A brain biopsy was not performed on this patient as it was thought to be an invasive procedure and the patient was in an unstable condition. Clinicians should consider ANE in cases of RSV infection with rapid progressive encephalopathy and start aggressive management accordingly.

Conclusion

In healthy children, an RSV infection usually causes a mild respiratory tract infection; however, some patients present with rare atypical and severe manifestations. Testing for RSV in these cases is therefore indicated. Clinicians should have a high suspicion of ANE when treating a patient with a respiratory infection and acute neurological manifestations. Early recognition of ANE is important for the initiation of effective supportive treatment in order to improve patient outcomes.
References


Mitochondrial Disorders May Mimic Amyotrophic Lateral Sclerosis at Onset

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**Case Report**

A 48-year-old Caucasian male presented to the Neurological Hospital Rosenhügel, Vienna, Austria, in February 2001. The patient had first noticed occasional weakness of the left brachial biceps muscle at 36 years of age. Four years later, fasciculations occurred for the first time in the shoulder girdle muscles which spread bilaterally to other muscles and the lower limbs during the following years. By the age of 46 years, the patient’s muscle weakness had spread to the left intrinsic hand muscles, particularly those of the left thumb and fifth finger. The muscle weakness increased when it was present bilaterally to other muscles and the lower limbs during the following years. By the age of 46 years, the patient’s muscle weakness had spread to the left intrinsic hand muscles, particularly those of the left thumb and fifth finger. The muscle weakness increased when it was cold and led to involuntary muscle contractions. He was an amateur cyclist, regularly cycling 4,000 km per year. After cycling, he often experienced aching of the neck extensor muscles which prevented him from sleeping. Previous creatine kinase values for the patient were unavailable.

One year before presentation, the patient was diagnosed with ALS by a neurologist based on clinical and electrophysiological findings. There was an amateur cyclist, regularly cycling 4,000 km per year. After cycling, he often experienced aching of the neck extensor muscles which prevented him from sleeping. Previous creatine kinase values for the patient were unavailable.

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slight wasting of the shoulder girdle muscles and diffuse wasting of the left upper limb muscles with predominance of the left intrinsic hand muscles. Fasciculations were seen in all muscles of the left upper limb and the shoulder girdle, tendon reflexes were exaggerated and pyramidal signs were bilaterally positive. Cerebral magnetic resonance imaging (MRI) was normal and an MRI scan of the cervical spine showed only mild degenerative alterations. The diagnosis of ALS was confirmed by other neurologists. The patient was prescribed riluzole and high-dose vitamin D without effect. Immunoglobulins were prescribed without rationale or beneficial effect. Following the initiation of riluzole treatment, the patient developed muscle cramps in the distal lower limb muscles and his resting pulse occasionally reached 130 beats/minute. Although levothyroxine was prescribed by endocrinologists to prevent growth of diffuse multinodular goitres, the patient was non-compliant with the treatment.

At presentation to the Neurological Hospital Rosenhügel, the patient had developed liquid dysphagia and chewing difficulties. He had often complained of hyperhidrosis over the preceding years. Additionally, his history was positive for hyperlipidaemia and there was a family history of hypacusis and gibbus deformity from his paternal grandfather. Re-examination of the patient revealed wasting of the tongue edges, frequent fasciculations of the tongue, distal weakness with left-sided predominance, diffuse wasting, exaggerated tendon reflexes, positional tremors with left-sided predominance, fasciculations in all muscles and positive pyramidal signs for the upper limbs. With regards to the lower limbs, there was weakness of the left foot extensors (grade M5-), exaggerated tendon reflexes and bilateral positive pyramidal signs.

The results of multiple nerve conduction studies performed over the following years are shown in Table 1. Needle electromyography of the right brachial biceps muscle showed fibrillations and fasciculations with bizarre morphology at 20/20 sites, increased mean motor unit action potential duration, increased polyphasia and satellite potentials and a reduced interference pattern at maximal voluntary contractions. His creatine kinase levels were slightly elevated (maximal value: 97 U/L; normal value: <70 U/L) and he had hypercholesterolaemia. However, the results of a lactate stress test were normal. Transcranial magnetic stimulation revealed increased central motor conduction time (CMCT) of the C8 motor neuron on the right side, normal CMCT of the C8 motor neuron on the left side and normal CMCT of the S1 nerve root bilaterally. Ganglioside GM1 antibodies were normal. An abdominal ultrasound revealed a double kidney on the right side. Based on the patient’s history and the existence of atypical clinical features—including hyperhidrosis, goitre and hyperlipidaemia—MIMODS involving the central nervous system, the peripheral motor, sensory and vegetative nerves, the endocrine system and the skeletal muscles was suspected. A muscle biopsy from the lateral vastus muscle showed neurogenic features with grouped atrophic fibres and a fibre-type grouping; however, the biopsy also showed indications for a MID, including a coarsening of the mitochondrial pattern on oxidative enzyme and Gomori trichrome stains. Immunohistochemistry revealed cytochrome c oxidase-hyporeactive/negative fibres and electron microscopy indicated the subsarcolemmal accumulation of abnormally-shaped mitochondria. Biochemical investigations of the muscle homogenate revealed a combined complex-II/III defect consisting of succinate cytochrome c-oxidoreductase related to non-collagen protein and citrate synthase. No tests for coenzyme-Q activity were carried out. Screening for common mitochondrial DNA (mtDNA) mutations causing the following conditions was non-informative: mitochondrial encephalomyopathy, lactic acidosis and stroke-like episodes; myoclonic epilepsy with red-ragged fibres; chronic progressive external ophthalmoplegia; Leber hereditary optic neuropathy; neuropathy, ataxia and retinitis pigmentosa; maternally-inherited Leigh syndrome; non-syndromic myopathy; cardiomyopathy; dementia; diabetes; or encephalopathy. Despite repeated attempts to contact the patient for further investigations, he was subsequently lost to follow-up.

Discussion

Misinterpretation of a MID as ALS may occur with mild or unnoticeable MIMODS or when the MID starts primarily with motor manifestations and spasticity due to additional cerebral involvement.4–6 In the presented case, the implications of the thyroid dysfunction, hyperhidrosis, hyperlipidaemia and autonomic and sensory involvement were neglected. In order to avoid misdiagnosis, clinical manifestations should not be ignored and a common cause of seemingly unrelated manifestations should not be excluded. Under these circumstances, patients with suspected ALS should be investigated for a MID. Since most MIDs develop into MIMODS during the disease course, it is usually just a matter of time before MIMODS becomes evident.4,5 Nevertheless, it is important to note that ALS may also show morphological evidence of a mitochondrial defect. Hirano et al. reported a 65-year-old ALS patient whose muscle biopsy showed 10% ragged-
Mitochondrial Disorders May Mimic Amyotrophic Lateral Sclerosis at Onset

There are indications that mtDNA deletions are more common in individuals with sporadic ALS as compared to healthy controls. Mitochondrial dysfunction in ALS is often regarded as secondary following the exposure of mtDNA to increased oxidative stress. In the current case, the diagnosis of ALS was eventually excluded due to the long duration of red fibres and 3% cytochrome c oxidase-negative fibres. However, contrary to the present case, no biochemical abnormalities were detected. A number of other reports have described mitochondrial dysfunction in ALS, including decreased complex-I activity, decreased superoxide dismutase 1 function and energy production, increased apoptosis, abnormal calcium homeostasis, impaired axonal transport of mitochondria, respiratory chain dysfunction and alterations of the mitochondrial genome and transcriptome. There are also indications that mtDNA deletions are more common in individuals with sporadic ALS as compared to healthy controls. Mitochondrial dysfunction in ALS is often regarded as secondary following the exposure of mtDNA to increased oxidative stress.

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L = left; R = right; dL = distal latency; ms = milliseconds; CMAP = compound muscle action potential; mV = millivolt; NCV = nerve conduction velocity; m/s = metres per second; SNAP = sensory nerve action potential; μV = microvolts; NP = not performed.

*Values represent the distal and proximal measurements.
the clinical course, the multisystemic nature of the phenotype (MIMODS), the muscle biopsy findings, the normal cerebral MRI scan and the biochemical findings. The strongest arguments in favour of a diagnosis of a primary mitochondrial defect were the multi-organ phenotype and the presence of a complex II/III defect. On the other hand, the histochemical findings did not match the biochemical findings. Since no mtDNA mutations could be detected, the complex II/III defect may have instead been due to a mutation in a nuclear DNA-located gene rather than a mtDNA-located gene. However, the precise genetic defect still requires confirmation.

Another point of interest with regards to the current case is the late onset of the disease and its slow progression. The frequency and severity of MIDs are usually increased in children and the disease usually progresses slowly in adults.7,18 Often, only a single organ is initially affected and other organs are consecutively affected after long periods of time.19 There is no consistent pattern of organ involvement and no regular sequence among the organs which are affected. Factors which drive the pattern of organ involvement and the speed of progression may include the type of mutation (e.g. protein, transfer/ribosomal ribonucleic acid, helicase or polymerase mutations) or modifying genes and the heteroplasmy rate or the threshold effect in the case of mtDNA mutations.20

Conclusion

This case suggests that a MID can mimic ALS at the onset of the disease and that it may start as a mono-organ disorder and subsequently turn into a multi-organ disease after slow progression over a prolonged period of time. The exclusion of ALS may indicate the presence of a MID and a complex II/III defect may manifest with bulbar involvement. Patients with apparent ALS should be investigated for a MID if atypical manifestations have been noted.

References

Primary Combined Latissimus Dorsi and Serratus Anterior Flap Repair of Right-Sided Congenital Diaphragmatic Agenesis in a Neonate

*Madan Samuel¹ and Rajiv Parapurath²

Abstract: Large diaphragmatic defects can be repaired with latissimus dorsi and serratus anterior muscle flaps. We report the first successful primary repair of complete congenital diaphragmatic agenesis using a combination of autologous living bio-tissue and synthetic mesh in a neonate born in the NMC Specialty Hospital in Dubai, United Arab Emirates, in May 2014. Poor Apgar scores, a scaphoid abdomen and absent breath sounds over the right hemithorax were observed at birth. Chest and abdominal X-rays revealed a diaphragmatic hernia. The neonate was stabilised using high-frequency oscillatory ventilation, nitric oxide and sildenafil. The right diaphragm was reconstructed using combined latissimus dorsi and serratus anterior muscle flaps reinforced by a flexible composite mesh. At 12 months old, the infant had normal respiratory function and the diaphragm was intact. No disabilities of the shoulder or scapula were observed. This case indicates that a combination of living tissue and synthetic mesh can be used to reconstruct a functional diaphragm with efficient pleuroperitoneal separation.

Keywords: Congenital Diaphragmatic Hernia; Neonate; Reconstrucitive Surgical Procedures; Autologous Transplantation; Surgical Mesh; Sildenafil Citrate; Case Report; United Arab Emirates.

Agenesis is an extreme congenital defect which occurs due to the complete absence of the septum transversum and pleuroperitoneal membranes with an associated impaired development of the thoracic intercostal muscles.¹,² The incidence of CDA is one in 250,000 births.³,⁴ CDA forms a rare part of the congenital diaphragmatic hernia (CDH) spectrum. In comparison, the prevalence of CDH is one in 2,200–2,450 births.³,⁶ The mortality rate of CDH is high (85–95%) due to lung hypoplasia, pulmonary hypertension and associated cardiac anomalies.³,⁴ However, the survival rate of children with large congenital diaphragmatic defects has increased due to recent advances in neonatal care.⁵

Reconstruction of a functional diaphragm among young patients with large diaphragmatic defects can be a difficult surgical procedure. The neo-diaphragm should be an intact muscular entity that grows with the child and ensures pleuroperitoneal separation. The disadvantages of a synthetic mesh repair include recurrence of the defect, patch migration or infection, progressive chest wall deformities and restrictive pulmonary function.⁶,¹¹ In previous reports, diaphragms with large defects have been reconstructed in two or more stages.²,³,⁶,⁹
A primary neonatal synthetic patch is usually subsequently replaced by a reversed *latissimus dorsi* muscle flap in childhood; the secondary reconstructed autologous living tissue flap provides a high-quality and functional diaphragm.\(^2,9,12\) Primary reconstruction of a diaphragm utilising combined *latissimus dorsi* and *serratus anterior* muscle flaps on a matrix of flexible composite mesh has not yet been reported in the literature. This report describes the preoperative stabilisation and primary reconstruction of the diaphragm of a neonate with complete CDA utilising living autologous bio-tissue and synthetic mesh.

**Case Report**

A 26-year-old *primigravida* woman gave birth at 39 gestational weeks to a full-term male infant weighing 2,580 g via supervised vaginal delivery at the NMC Specialty Hospital in Dubai, United Arab Emirates, in May 2014. The infant was born to consanguineous parents who were first cousins with an inbreeding coefficient of >0.0156. Poor Apgar scores, a scaphoid abdomen and absent breathing sounds over the right *hemithorax* were observed at birth. Combined chest and abdominal X-rays revealed a right-sided diaphragmatic hernia [Figure 1]. Cytogenetic analysis indicated a normal male karyotype (46,XY). Further neonatal and metabolic screening tests were also normal.

Despite optimal mechanical ventilation, preductal partial pressure of oxygen and carbon dioxide in the arterial blood were 6.6–7.8 kilopascals (kPa) and ≥6.0 kPa, respectively. The persistent hypoxia was associated with severe pulmonary hypertension with a three-dimensional (3D) echocardiogram showing a mean pulmonary artery versus mean systemic artery pressure ratio of >1. The illness severity and mortality risk of the neonate was assessed using the validated Score for Neonatal Acute Physiology-Perinatal Extension-II (SNAPPE-II) [Figure 2].\(^13\) At six hours old, the infant required high-frequency oscillatory ventilation and 20 parts per million of inhaled nitric oxide due to persistent hypoxia, severe pulmonary hypertension and a high SNAPPE-II score (67). Haemodynamic instability necessitated inotropic support with dobutamine (10.0 µg/kg/minute) and dopamine (20.0 µg/kg/minute). A high oxygenation index of >45 prompted the administration of sildenafil (1 mg/kg every six hours). Subsequently, a post-loading dose infusion of 0.6 µg/kg/minute of milrinone was administered. The neonate was gradually stabilised over a period of 15 days and was weaned onto conventional mechanical ventilation by the age of 18 days.

The neonate underwent a right-sided thoracotomy through the eighth intercostal space at 22 days old. The three lobes of the right lung were atelectatic, hypoplastic and consolidated. The diaphragm was absent in the anterior, posterior and lateral aspects. The phrenic nerve was identified along the *pericardium* and was traced to the small fibrous rim of tissue in the medial aspect of the posterior costophrenic recess and subsequently preserved [Figure 3A]. The right adrenal gland, kidney, liver and small and large bowel formed the hernial contents. The appendix had herniated through the mesoappendix causing a partial cecal *volvulus* and was attached to the posterior chest wall by fibrovascular adhesions. Adhesiolysis freed the inflamed appendix and *caecum* and an appendectomy was performed. The non-rotated intestines and solid viscera were returned to the peritoneal cavity.
The dermo-adipose skin flaps were raised to allow visualisation of the right hemithorax and the neurovascular and muscular anatomy. The head of the latissimus dorsi was transected and the muscle was freed from the chest wall. The thoracodorsal artery, vein and nerve were identified and maintained with the flap. The latissimus dorsi flap also had an intact wide-based vascular pedicle observed through the lumbar perforators. Following the harvesting of the latissimus dorsi, the thoracodorsal vascular pedicle supplying the lower three slips of the serratus anterior muscle was observed along with the long thoracic nerve. The slips were exposed from their origin on the inferior angle of the scapula to the rib insertions. The artery and nerve to the serratus were dissected proximally and mobilised by intrafascicular dissection. The thoracodorsal artery was divided into two large branches. These two branches, the thoracodorsal vein and the circumflex scapular vascular bundle were identified and preserved. The lower edge of the serratus was delineated at the ninth rib. The posterior plane was developed up to the angle of the scapula. Posterior insertions of the muscle to the scapula and anterior insertions to the seventh, eighth and ninth ribs were detached using monopolar cautery. The absence of a distinct plane required cauterisation of several small perforating vessels from the intercostal muscles. This allowed the isolation of the major vascular pedicle (≥15 cm) up to the subcapular artery. The superior border of the 10th rib was retracted and the intercostal muscles were freed.

A combined tension-free flap was placed into the chest through the space created. To avoid the possibility of pedicle torsion, the latissimus dorsi and serratus anterior tissue formed the posterolateral dorsal and anterolateral ventral aspects of the neo-diaphragm, respectively [Figure 3B]. A flexible composite mesh (Ethicon PHYSIOMESH® #PHY1515Q, Johnson & Johnson Medical GmbH, Norderstedt, Germany) formed the matrix. The composite muscle and mesh were sutured to the periosteum using 3-0 non-absorbable polypropylene sutures with a double-loop mattress interrupted suture technique. The suture line was reinforced by subcostal anchoring sutures. An end-to-side neural co-optation of the thoracodorsal nerve and phrenic nerve was performed using 9-0 polypropylene sutures. The nerve supply to the upper slips of the serratus anterior was meticulously maintained throughout the reconstruction in order to prevent winging of the scapula.

The postoperative recovery period was uneventful and the neonate was extubated on the third postoperative day. At two months of age, he was breathing room air with normal respiratory function and had achieved full oral feeds. Administration of sildenafil was tapered and subsequently stopped when the infant was three months old. By the time he was 12 months old, neurological developmental, hearing and ophthalmic evaluations were normal. Anthropometric measurements of weight (50th percentile), length (75th percentile) and head circumference (75th percentile) were all age-appropriate. Results of the Denver Developmental Screening Test II were normal (75th percentile). An intact right hemidiaphragm with uniform non-paradoxic movements during respiration and complete right lung expansion was observed via ultrasonography and fluoroscopy [Figure 4]. Electromyography showed normal function of the skeletal muscles with a phrenic nerve conduction.
velocity of 20–22 metres/second. The heart was normal as per a 3D echocardiograph. There was no winging of the scapula or any other chest deformities and the right shoulder and arm had normal function.

Discussion

CDA is a rare anomaly occurring in 5% of neonates diagnosed with CDH.\(^1\) In 98% of reported cases, CDA is a left-sided defect with a high mortality rate of 85–95%.\(^3\) Right-sided CDA has a high mortality rate in comparison to right-sided CDH (95–98% versus 50–70%).\(^2\) The present report details a unique case of right-sided CDA with complete hemidiaphragmatic agenesis associated with impaired development of the thoracic intercostal muscles and oesophageal mesentery. The defect was repaired using an autologous living bio-tissue flap to facilitate the development of a compliant neo-diaphragm that would provide effective pleuroperitoneal separation.

In the current case, preoperative stabilisation of the patient was enhanced by the use of selected vasodilators and phosphodiesterase type five and type three enzyme inhibitors. These agents increase the levels of cyclic guanosine monophosphate, resulting in vascular smooth muscle relaxation and increased pulmonary blood flow.\(^15\) The synergistic action of inhaled nitric oxide, sildenafil and milrinone therefore improve circulatory haemodynamics.\(^15\) The uncomplicated postoperative recovery course was likely due to improved lung angiogenesis and alveolar growth in association with a compliant diaphragm. Sildenafil may also have prevented any worsening of the contralateral bronchopulmonary dysplasia.\(^15\)

In most instances, large diaphragmatic defects in neonates are primarily repaired using a synthetic mesh which invariably leads to recurrence due to mesh migration, abscess formation/sepsis due to infection, progressive chest wall deformities due to mesh constriction or deterioration of pulmonary function due to noncompliance.\(^2,10\) Synthetic durable patches and acellular collagen matrices that can be remodelled by the host tissue cannot be used as neo-diaphragms due to poor compliance.\(^16\)

Primary reconstruction with living bio-tissue avoids the complications of synthetic mesh repairs. The serratus anterior muscle originates from the lateral scapula and fans anteriorly into the first nine ribs. A medium-sized flap can be obtained by harvesting the lower three slips which have an independent blood and nerve supply. The latissimus dorsi and serratus anterior muscle flaps are nourished by a substantial anatomically reliable subscapular-thoracodorsal vascular pedicle and lumbar perforators. Double-loop mattress interrupted sutures also help to form a compliant resilient hemidiaphragm.\(^14\) Approximately 25% of the population have two thoracodorsal arteries.\(^17\) In the current case, this phenomenon may have helped to sustain good vascularity to the harvested flaps. Neuroanastomosis between the phrenic and the thoracodorsal nerve also ensured function. Additionally, the domed neo-diaphragm was both vascular and tensile to ensure growth and retain compliance and function, respectively; this resulted in efficient pleuroperitoneal separation and adequate cardiopulmonary function. Utilising a similar procedure with left-sided latissimus dorsi and serratus anterior muscle flaps may potentially repair left-sided CDA.

Conclusion

This is the first report of a successful primary reconstruction utilising combined latissimus dorsi and serratus anterior muscle flaps on a matrix of flexible composite mesh in a neonate with complete right-sided CDA. At a 12-month follow-up, the neo-diaphragm was functional and the infant had no disabilities of the shoulder or scapula.

References

Primary Combined Latissimus Dorsi and Serratus Anterior Flap Repair of Right-Sided Congenital Diaphragmatic Agenesis in a Neonate


Unusual Presentation of Dengue Fever
A child with acute myocarditis

Moaz Aslam,1 Numra A. Aleem,1 *Mohammad F. Zahid,1 Arshalooz J. Rahman2

Dengue Fever (DF) is a potentially life-threatening vector-borne tropical disease caused by a single-stranded positive-sense ribonucleic acid virus belonging to the Flaviviridae family. Outbreaks have increased in severity over the past few years, especially in developing countries in South Asia. The World Health Organization (WHO) estimates that approximately 2.5 billion individuals are susceptible to DF and a 100 million are infected every year.3 While DF is a self-limiting illness in the majority of patients, about 0.5% of patients develop a complicated course requiring specialised therapy. A total of 20,000 deaths are reported annually worldwide due to complications associated with severe DF.3 According to the WHO Eastern Mediterranean Regional Office, there have been 16,580 confirmed cases of DF and 257 deaths due to the disease in Pakistan alone since 2010.4 There have been several preventable DF deaths in Pakistan, such as those in the dengue outbreak of 2011.5 As such, optimal management and treatment of DF and dengue shock syndrome presents a challenge for healthcare professionals.

Involvement of the cardiovascular system (CVS) with decreased cardiac indices and performance has been observed among patients with this disease.6 In addition, other cardiac abnormalities, such as supraventricular tachycardia and atrioventricular conduction defects, have also been noted.7 Although isolated myocarditis has previously been reported in association with the disease, it is still rare.8 This case report presents a child with worsening DF signs and symptoms associated with myocarditis. Management with fluid therapy and inotropic support resulted in spontaneous recovery and normalisation of ejection fraction (EF) and cardiac parameters.

**Abstract:** Dengue fever (DF) is an acute febrile illness that follows a self-limiting course. However, some patients suffer from complications, including myocarditis, due to the involvement of other organs. A child presented at the Aga Khan University Hospital in Karachi, Pakistan, in June 2013 with a high-grade fever, malaie and epigastric pain radiating to the chest. Positive DF antigen and immunoglobulin M assays confirmed the diagnosis of DF. Persistent bradycardia with low blood pressure led to further cardiac investigations which showed a decreased ejection fraction and raised serum cardiac enzymes, indicating myocardial damage. With supportive care and use of inotropes, the spontaneous normalisation of cardiac enzyme levels and ejection fraction was observed. The child was discharged five days after admission. This case highlights the importance of identifying myocarditis in DF patients suffering from cardiac symptoms that are not explained by other potential aetiologies. Awareness, early suspicion and supportive care are essential to ensure favourable outcomes.

**Keywords:** Dengue Fever; Myocarditis; Complications; Child; Case Report; Pakistan.

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Case Report

A 12-year-old girl presented to the Emergency Department of the Aga Khan University Hospital, Karachi, Pakistan, in June 2013 with a five-day history of high-grade fever associated with lethargy, fatigue, malaïse and vomiting. She also complained of palpitations and persistent epigastric pain radiating to the chest. Her past medical history was unremarkable, revealing a developmentally normal child with up-to-date immunisations and no history of significant medical illnesses, hospitalisation or congenital abnormalities.

On general physical examination, the child was irritable and had a temperature of 38.9 °C. She was tachypnoeic with a respiratory rate of 30 breaths per minute; otherwise, the remainder of her respiratory examination was normal. A cardiovascular and precordial assessment revealed no audible murmurs or other cardiac abnormalities. Bradycardia (minimum of 50 beats per minute [bpm]) accompanied by intermittent tachycardia (maximum of 112 bpm) and low blood pressure (90/65 mmHg) were noted. The heart monitor showed a sinus rhythm during both bradycardia and tachycardia. The patient did not have a rash and her systemic examination was unremarkable. A complete blood count showed leukopenia (white cell count: 3.2 x 10⁹/L) and thrombocytopaenia (platelet count: 106 x 10⁹/L). The patient’s electrolytes were within normal limits; however, her erythrocyte sedimentation rate was raised (42 mm/hour).

The patient was admitted to the inpatient ward and prescribed intravenous fluid replacement with paracetamol to relieve the fever. Empiric intravenous ceftriaxone was started for a possible enteric fever. Further work-up revealed normal serum amylase levels (52 U/L), making pancreatitis unlikely. A typhidot test and peripheral smear for malarial parasites were both negative. Liver function tests showed elevated alanine aminotransferase and aspartate aminotransferase levels of 49 U/L and 153 U/L, respectively. The patient’s symptoms and a reverse ratio of liver function tests suggested a viral fever as a likely possibility. The Platelia Dengue NS1 Antigen (Bio-Rad Laboratories Inc., California, USA) and immunoglobulin M (IgM) assays came back positive, which established the diagnosis of DF. Ceftriaxone was discontinued and serial platelet counts continued to show a persistent decline with a minimum count of 25 x 10⁹/L during the following 48 hours.

Subsequently, the patient defervesced and her lethargy improved; however, her bradycardia continued (range: 45–50 bpm) with low blood pressure (95/65 mmHg). Prolonged causes of bradycardia and hypotension were explored with a 12-lead electrocardiography with postural changes. The findings demonstrated a prolonged R-R interval with no changes in the P-R and Q-T intervals, S-T segment or Q-R-S abnormalities, indicating sinus bradycardia. A bedside echocardiogram showed global hypokinesia and a decreased EF of 52%. There was no evidence of pericarditis or pericardial effusion. A creatine phosphokinase-MB test was elevated (455 IU/L). A clinical diagnosis of myocarditis, most likely due to the dengue virus, was made. Although a myocardial biopsy was advised to establish the diagnosis, the procedure was not performed due to the financial constraints of the patient’s family.

The patient was prescribed inotropic support with dopamine to improve her cardiac output and maintain normal blood pressure. Management was focused on the symptomatic treatment of DF with serial monitoring of platelet counts. On the fourth day of hospital admission, the patient’s platelet count, heart rate and blood pressure had stabilised at 56 x 10⁹/L, 55–65 bpm and 115/78 mmHg, respectively. A limited follow-up echocardiographic assessment was performed which showed EF normalisation at 62%. She was kept under observation for the following 24 hours. The patient was discharged from the hospital after being prescribed paracetamol and omeprazole with instructions to attend weekly follow-up appointments as an outpatient.

Discussion

Dengue is a non-specific febrile illness, presenting most commonly as either DF or the more severe dengue shock syndrome.¹,⁷ Heart involvement and cardiac abnormalities in association with DF have previously been reported in the literature, although they are rare complications.¹,⁸–¹¹ The clinical manifestations of heart involvement in DF greatly differ—patients can be completely asymptomatic, have very mild symptomatology or can suffer from severe myocardial damage leading to ventricular failure, global hypokinesia and cardiogenic shock.³,¹²–¹⁵ The incidence of cardiac involvement greatly varies. Following the dengue outbreak of 1996 in India, Agarwal et al. reported that only one of 206 patients infected with DF showed evidence of cardiac involvement upon CVS examination.¹⁶ In a more recent outbreak of DF in India, 9% of patients showed evidence of myocarditis during the course of their illness.¹⁷ During a DF outbreak in southern Taiwan in 2006, only one of 107 patients with DF had a course complicated by acute myocarditis.¹ Similarly, Kabra et al. reported cardiac involvement in 16.7% of 54 paediatric DF patients.⁹ In contrast, other studies have
shown a staggering incidence of cardiac involvement in cases of dengue. Wali et al. reported the incidence of cardiac involvement to be 70% in a series of 17 patients. In addition, following the dengue outbreak of Sri Lanka in 2005, cardiac dysfunction was reported to be the dominant abnormality (80%) among patients.6

This disparity in the proportion of cardiac abnormalities likely arises due to the fact that DF is a spectrum disease which can present with atypical manifestations, haemorrhagic fever or shock syndrome. While tachycardia and a transient decline in cardiac function may vary in intensity, they are present across the spectrum.6 It is important to differentiate tachycardia due to myocardial involvement; reported incidences of 70–80% may be overestimations.3,11 The majority of the patients in the aforementioned studies exhibited diminished cardiac performance, hypotension and reduced EF; however, some did show electrocardiographical changes.4 Several other viruses may give rise to myocarditis.3,19,20 Although, the possibility of such viruses was not objectively excluded in the present case, other disease processes responsible for high-grade fever and her initial symptoms—particularly enteric fever and malaria—were ruled out. Hence the temporal relationship with the febrile illness, positive IgM and dengue NS1 antigen tests and the presence of leukopenia with thrombocytopenia confirmed the dengue virus to be the most likely aetiological agent.

Recently, isolated DF cases with cardiac involvement have been reported. Guadalajara-Boo et al. reported a 65-year-old woman who developed severe hypotension and circulatory collapse due to dengue myocarditis.14 She required mechanical ventilation and inotropic support with noradrenaline. Additional therapy with methylprednisolone and ribavirin resulted in the resolution of the cardiac manifestations and a favourable outcome.14 However, fatal outcomes have also been reported. Miranda et al. reported a 37-year-old woman with DF who developed fulminant cardiopulmonary failure.3 Despite treatment with mechanical ventilation, vasoactive drugs and inotropic support with dopamine and noradrenaline, the patient died of cardiogenic shock.3

Immune response to the viral infection and the resulting cascade of inflammatory mediators, such as tumour necrosis factor, chemokines and inflammatory cells, plays a key role in myocardial damage.5 In vitro research indicates that the dengue virus raises intracellular calcium in the myocardium, leading to the opening of mitochondrial membrane pores and activation of the intrinsic apoptotic pathway.22 This may be one of the mechanisms that leads to myocardial injury in DF patients and myocarditis associated with other viral illnesses.22 Direct damage by the virus may be another mechanism of injury, as is seen in myocarditis caused by other viruses.1

In the present case, based on the unremarkable medical history and up-to-date immunisations, it was concluded that the dengue virus was the most likely cause of the myocarditis. Unfortunately, due to the lack of a biopsy and histopathological examination of the cardiac tissue, the complete characterisation of dengue myocarditis was not possible. Another aspect to be explored is the genetic susceptibility to developing specific symptoms of dengue infections in local populations, due to different leucocyte antigens and single nucleotide polymorphisms.

The effect of myocarditis is not only limited to the mechanical functioning of the heart but may also involve electrical conduction. Cardiac rhythm abnormalities have been observed in cases of dengue myocarditis. These include but are not limited to atrial fibrillation, S-T segment abnormalities, low Q-R-S amplitude, sinus bradycardia, first-degree atrioventricular block, premature atrial contractions and premature ventricular contractions.6,21 Such conduction defects, which are asymptomatic and self-limiting in the vast majority of patients, can potentially evolve into fatal cardiac arrhythmias.8

Hypotension and decreased cardiac function during the course of DF could be attributable to capillary leakage and intravascular volume depletion, leading to haemodynamic instability in these patients.18 The latter seemed to be unlikely in the current patient, given the fact that she had persistent hypotension which was non-responsive to fluid resuscitation and required inotropic support with dopamine to maintain adequate blood pressure. In such cases, fluid management may need to be reassessed if haemodynamic stability is not achieved with conservative management and fluid resuscitation to avoid volume overload and prolonged tissue hypoperfusion. Children require very specific volumes for fluid resuscitation/therapy and are prone to volume overload states such as pulmonary oedema or superimposed infections.11,13 In such circumstances it is necessary to heighten the index of suspicion by reporting to physicians cases with myocarditis as an underlying cause, allowing them to change their approach rather than pursuing vigorous fluid therapy which might be detrimental to the child.13,14 Steroids may arguably act as adjuvants to standard therapy due to their anti-inflammatory properties; nevertheless, their role and efficacy has not been established due to a lack of evidence.7 The role of cardiac imaging, especially cardiac magnetic resonance imaging, also needs to be assessed in conjunction with electrocardiographical...
Unusual Presentation of Dengue Fever
A child with acute myocarditis


Renal Tuberculosis Presenting as a Mass Lesion in a Two-year-old Girl
Report of a rare case

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Abstract: Genitourinary tuberculosis usually occurs in young adults and the middle-aged and is very uncommon in the paediatric population. It generally presents with haematuria, pyuria, irritative voiding symptoms and flank pain; presentation as a renal mass is highly unusual. We report a two-year-old girl who was referred to the Nil Ratan Sircar Medical College, Kolkata, India, in June 2014 with abdominal pain. Subsequent radiological investigations revealed a left renal hypoechoic mass lesion. A left nephroureterectomy was performed on suspicion of a Wilms’ tumour. Histopathology indicated an epithelioid granuloma with lymphocytic infiltration, suggestive of a tubercular aetiology. A Mantoux tuberculin skin test was positive; however, there was no evidence of tuberculosis detected elsewhere in the body and the source of the infection could not be identified. A diagnosis of renal tuberculosis was made and the child was treated with antitubercular drugs. The patient was asymptomatic at a six-month follow-up.

Keywords: Renal Tuberculosis; Urogenital Tuberculosis; Abdominal Pain; Granuloma; Case Report; India.

According to the World Health Organization, the annual tuberculosis (TB) burden in India was 2.2 million in 2012; this figure constitutes one quarter of global TB cases per year.1 Genitourinary TB is a common form of extrapulmonary TB, accounting for 27% (range: 14–41%) of all cases of extrapulmonary TB in developed countries.2 Usually, genitourinary TB is a complication in 3–4% of pulmonary TB cases.3 Active genitourinary TB generally occurs between five and 15 years after a primary pulmonary infection with Mycobacterium tuberculosis.4 Despite its status as the most common form of genitourinary TB, renal TB is very rare in the paediatric population.5

Genitourinary TB mostly presents with irritative voiding symptoms, haematuria and flank pain.6 Presentation as a mass lesion is extremely rare and few cases have been published in the literature to date.7–10 This report describes a two-year-old child who presented with a renal mass and was diagnosed with renal TB via a post-nephroureterectomy histopathological examination.

Case Report
A two-year-old girl presented to a private health clinic in Kolkata, India, with non-specific abdominal pain of three months’ duration. As she did not improve with symptomatic management and anthelmintic therapy, she was referred to the Nil Ratan Sircar Medical College, Kolkata, India, in June 2014 for further evaluation. There was no history of fever, vomiting, altered bowel habits, abdominal distension or changes in urinary frequency or colour over the preceding three months. In addition, no appetite or weight loss had been observed by the parents. The child

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had been delivered at full term at home and was not immunised. She had no prior significant illnesses and her developmental history was normal. There were no signs of pallor, icterus, palpable lymphadenopathy or malnutrition. An abdominal examination revealed no palpable organomegaly or tenderness. The results of routine biochemical tests and a complete haemogram were within normal ranges and the child was negative for human immunodeficiency virus infection.

Ultrasonography of the abdomen revealed a hypoechoic mass lesion in the left kidney along with mild hepatomegaly without any abdominal lymphadenopathy, splenomegaly or ascites. Subsequently, a computed tomography scan of the abdomen was performed with intravenous and oral contrast. A well-defined hypodense space-occupying lesion (28 x 23 x 32 mm) with heterogeneous enhancement was observed at the mid-pole of the left kidney compressing the left renal pelvis [Figure 1]. No other abnormalities were observed. The liver was mildly enlarged, but otherwise normal in terms of position, shape and contour. The intrahepatic biliary radicles were also normal. These findings were suggestive of a Wilms’ tumour and a left nephroureterectomy was deemed necessary.

Following the surgery, a histopathological examination of the excised mass revealed granulomatous interstitial nephritis with central areas of caseous necrosis. An epithelioid granuloma was observed along with Langhans giant cells and dense lymphoplasmacytic infiltrate with lymphoid follicle formation. The granuloma was found within the perinephric fat [Figure 2]; however no evidence of acid-fast bacilli (AFB) was found with Ziehl-Neelsen staining. A Mantoux tuberculin skin test using two tuberculin units of purified protein derivative RT-23 was positive with an induration of 12 mm. The patient underwent further evaluations for congenital TB; however, her chest X-ray was normal and a gastric lavage was negative for M. tuberculosis. Morning urine samples taken on three consecutive days were AFB-negative and a urine culture was also negative for M. tuberculosis. There was no evidence of active TB on chest X-rays or AFB in sputum examinations for any of the patient’s family members. An endometrial biopsy was requested from the child’s mother; however, this was not performed as she was completely asymptomatic and did not give consent for the investigation.

The patient was diagnosed with renal TB based on the findings of the renal histopathology and ancillary investigations. She subsequently underwent two months of intensive phase antitubercular therapy with isoniazid, rifampicin, pyrazinamide and ethambutol, followed by four months of continuation phase therapy with isoniazid and rifampicin, as per the guidelines of the Revised National Tuberculosis Control Programme (RNTCP). She improved symptomatically and the abdominal pain subsided within one month of beginning the treatment. By the end of the six-month antitubercular therapy, she was completely asymptomatic. At the time of writing, the patient was being followed up at regular intervals.

Discussion

Genitourinary TB is most commonly encountered between the second and fourth decade of life. This form of TB represents less than 5% of paediatric extrapulmonary cases worldwide and is very infrequently reported in the literature. Chattopadhyay et al. observed only nine cases of paediatric genitourinary TB over a span of seven years among patients aged 5–12 years old. A case of congenital renal TB was reported in a 34-day-old infant presenting with exsanguinating haematuria. Another report described miliary TB with focal
renal involvement in a five-month old male infant.\textsuperscript{15} Commonly, patients with renal TB present with dysuria, haematuria, sterile pyuria, flank pain, recurrent urinary tract infections and constitutional symptoms.\textsuperscript{6,13} However, the radiographic appearance of the condition is variable and depends on the stage of infection.\textsuperscript{16} An enhancing renal mass is a rare presentation; in such cases, renal cell carcinomas, renal metastasis, lymphomas or abscesses are usually considered in the differential diagnosis.\textsuperscript{17} Similarly to the present case, Dhua \textit{et al.} noted a well-defined hypodense renal mass in a case of renal TB.\textsuperscript{13} Kumar \textit{et al.} reported a pseudotumoural manifestation of genitourinary TB in a 34-year-old woman, which was initially suspected to be a renal cell carcinoma.\textsuperscript{7} A solid tubercular large mass mimicking a tumour in a horseshoe kidney has also been described in the literature.\textsuperscript{6}

Haematogenous dissemination from an active TB infection site usually results in the formation of metastatic tubercles in the kidney which either heal spontaneously or as a result of antitubercular therapy. Renal lesions may sometimes progress during primary infection or enlarge after several years.\textsuperscript{3} In the current case, the route of infection could not be ascertained. There was no evidence of active TB elsewhere in the body or among family members. Additionally, the case did not meet the revised criteria for a diagnosis of congenital TB as described by Cantwell \textit{et al.}.\textsuperscript{18} Nevertheless, it is often very difficult to differentiate congenital TB from acquired neonatal TB when the baby is infected after birth. Unfortunately, a maternal endometrial biopsy could not be performed to rule out this possible source of infection.

Renal TB can be cured without surgical intervention; however, this requires timely diagnosis and a high degree of clinical suspicion.\textsuperscript{6} Unfortunately, the tubercular aetiology of the tumour-like mass in the current case was not suspected preoperatively and early radical surgery was performed. Fine-needle aspiration cytology (FNAC) is a recommended diagnostic procedure to avoid surgical intervention and retain the affected kidney.\textsuperscript{7} Additionally, the interferon gamma release assay (IGRA) test, which can detect \textit{M. tuberculosis} infection anywhere in the body, is generally considered a more effective diagnostic tool than a conventional tuberculin skin test.\textsuperscript{18} However, this test was not carried out in the present case due to a lack of IGRA performance data in paediatric populations below five years of age.\textsuperscript{19} In addition, certain nontuberculous mycobacteria—including \textit{M. kansasii}, \textit{M. szulgai} and \textit{M. marinum}—may produce false-positive results which could complicate the diagnostic procedure.\textsuperscript{19}

Short-course chemotherapy is the standard pharmacological treatment for genitourinary TB, as per the RNTCP guidelines.\textsuperscript{1,2} A six-month course of category I therapy can be highly efficacious; Singh \textit{et al.} described positive urinary AFB, mycobacterial cultures or polymerase chain reaction tests in 86.4% of genitourinary TB cases which became negative within three months of antitubercular therapy.\textsuperscript{6} Nevertheless, surgery still plays an important role in genitourinary TB management despite the advent of modern antitubercular therapy. A partial nephrectomy is recommended for localised polar lesions containing calcification which fail to respond to six weeks of intensive chemotherapy or for areas of calcification which slowly increase in size and threaten to gradually destroy the entire kidney.\textsuperscript{6} Complete nephrectomies are indicated only for non-functioning tubercular kidneys with calcification or for cases of extensive disease involving the whole kidney occurring with other complications (e.g. hypertension or a coexistent renal cell carcinoma).\textsuperscript{20} A minimum of four weeks of antitubercular therapy is recommended before any major surgical intervention as it stabilises the lesion and allows greater accuracy during reconstructive surgery.\textsuperscript{6,21}

Conclusion

Renal TB should be considered in the differential diagnosis of a paediatric renal mass. A high degree of suspicion is warranted, especially for patients from countries with a high prevalence of TB. Close family members should be thoroughly investigated in cases of suspected congenital TB to determine the source of infection. Preoperative diagnosis is recommended to avoid the need for radical surgery.

References


Combination of a Giant Dissected Ascending Aortic Aneurysm with Multiple Fistulae into the Cardiac Chambers Caused by Prosthetic Aortic Valve Endocarditis

Feridoun Sabzi and *Reza Faraji

Aneurysmal dilatation of a dissected ascending aortic aneurysm (AA) is an uncommon phenomenon in contrast to an isolated dissection or aneurysm. The incidence of this complication is even rarer following aortic valve replacement (0.2% and 2%). The combination of dissected ascending AA with multiple fistulae to the surrounding structures such as the pulmonary artery and left atrium, along with the concomitant presence of paravalvular leaks, is an exceedingly rare complication of prosthetic aortic valve endocarditis. Research has shown that aortic valve replacement is an independent variable for the development and progression of ascending AAs that may lead to dissection or rupture.

Predisposing factors for the occurrence of post-aortic valve replacement aneurysms are well described in the literature. The infected medial aortic wall may be dilated by the haemodynamic burden of aortic regurgitation and a paravalvular leak may be a risk factor for the occurrence of prosthetic aortic valve infective endocarditis (IE). By inducing a high flow velocity, these paravalvular leaks produce a turbulent flow across the aortic valve which collides with the aortic wall and leads to the gradual dilatation of the ascending aorta. Related mechanisms can cause ascending AAs in other native valve pathologies such as aortic stenosis or aortic regurgitation, even in the absence of a haemodynamic gradient in patients with...
bicuspid aortic valve. The high volume of regurgitated blood by paravalvular leakage causes turbulent flow in the weakened area of the aortic root and subsequent fistula formation. This case report describes the successful surgical repair of a giant dissected ascending AA associated with double fistulae to the pulmonary artery and left atrium and the concomitant presence of a small paravalvular leak to the left ventricle.

Case Report

A 47-year-old woman who had undergone an aortic and mitral valve replacement 10 years previously was admitted to the emergency room of the Imam Ali Hospital, Kermanshah, Iran, in January 2015 with severe dyspnoea and cold perspiration. A physical examination showed pitting oedema on the lower extremities, pulmonary rales and elevated jugular venous pressure. In addition, the patient's skin was cold and damp. The patient history revealed two separate admissions to local hospitals two years earlier for incidences of high fever. She had been treated with appropriate antibiotics during these previous hospital admissions; however, no echocardiographic results were available. She had received oral warfarin and her international normalised ratio was 3–3.5 IU. The patient had had an uneventful postoperative course following her previous primary aortic and mitral valve replacement. At the time of her initial surgery, her native aortic valve was calcified and the diameter of the AA at the sinotubular junction was 4 cm.

At admission, the patient’s chest radiography exhibited enlargement of the cardiac silhouette and pulmonary congestion. An electrocardiogram showed atrial fibrillation rhythm with rapid ventricular response. A physical examination revealed an irregular heart rhythm, low blood pressure (100/30 mmHg), tachycardia (120 beats per minute), tachypnoea, cyanosis, a prominent jugular vein and a diastolic 3/6 murmur along the left sternal border. The rales were heard diffusely in both lung fields. A transthoracic echocardiogram (TTE) revealed normal functioning of the prosthetic mitral and aortic valve and a giant ascending AA involving the sinuses of Valsalva. The dissection flap was not detected by TTE. The aneurysm's transverse diameter was measured as 7.5 cm with an aortic root contrast injection [Figure 1].

A transoesophageal echocardiogram (TOE) showed a high- and low-velocity continuous pulse conforming with fistulae from the right and left Valsalva sinuses to the left atrium and pulmonary artery, respectively. Pulmonary artery angiography documented a large left-to-right shunt with a pulmonary-systemic flow ratio of 2.5. Angiography revealed that the coronary arteries were normal. The aortic root angiogram detected the path of the fistulae. The patient was intubated due to severe respiratory dysfunction. She was prepared for urgent cardiac surgery and immediately taken to the operating room.

Due to abnormal preoperative coagulation tests, the patient received fresh frozen plasma. Before the sternotomy, the femoral artery was cannulated; a cardiopulmonary bypass was established after reopening the sternum and right atrial cannulation. A giant AA with severe inflammatory adhesion to the neighbouring organs was observed. The normal diameter of the AA was just below the innominate artery and it was encircled with a tape. After establishing the cardiopulmonary bypass by inducing systemic and local hyperthermia, the giant aorta was transected just above the sinotubular junction. Although a preoperative TTE did not reveal
Discussion

Aortic valve replacement is a risk factor for postoperative IE, aortic dilatation, dissection and paravalvular leaks. On the other hand, the presence of a paravalvular leak may be a predisposing factor for IE and subsequent fistulae formation. The aortic root may become flaccid following the disruption of supporting tissues by primary surgical procedures, such as the releasing of tissue in the aortopulmonary groove, iatrogenic trauma to the aortic wall due to the tip of the needle, extensive decalcification of the aortic ring, calcification of the aortic wall, coronary ostium vault perforation by turbulent flow of the cardioplegia catheter’s tip, aortic-mitral fibrous continuity disruption in the primary valve replacement, uncontrolled traction on the aortic wall by the surgeon’s assistants or infection of the prosthetic valve and aortotomy suture line.

The current patient had three interrelated cardiac characteristics: fistulae, an aneurysm and a history of IE. These complications could be attributed to the patient’s previous aortic valve replacement. Complications of the aortic root apparatus following aortic valve replacement is a well-known event and may be associated with high morbidity and mortality. A key complication of aortic valve replacement is ascending aorta dissection, which can lead to various cardiac problems, including ruptures, aneurysms, fistulae formation to a cardiac chamber, haemolytic anaemia, stroke, peripheral emboli and endocarditis. Aorto-cardiac fistulae may be a rare complication of IE.

Aortic root IE has been associated with a myriad of complications such as congestive heart failure, stroke, emboli, respiratory failure, pneumonia and dehiscence of a prosthetic valve. The frequency and type of complications caused by IE have changed with advances in diagnosis and modern antibiotic therapy. Previously common complications of extravalvular cardiac complications of IE—such as fistulae to the cardiac chamber—are infrequent today. Only 3% of prosthetic valve IE with Staphylococcus aureus (confirmed by autopsies and retrospective studies) have been associated with cardiac fistulae. It has been postulated that the formation of aorto-cardiac fistulae are caused by a bacterial invasion following a valve replacement; the spread of bacteria from the infected prosthetic valves into the surrounding organs and structures can lead to periannular abscess formation. The invasion of an abscess into the adjacent tissues can be facilitated by surgical handling or iatrogenic injuries to the aortic wall. Periprosthetic aortic valve infections with involvement of the aortic ring and Valsalva sinuses may extend upwardly and cause infectious aortitis and a subsequent dilatation or rupture of the aorta, erosion of the fibrous trigone or interventricular septum, which could lead to the formation of aorto-left atrial or left ventricular fistulae. A periannular abscess in the left Valsalva sinus can sometimes erode into the aortopulmonary groove and lead to an aortopulmonary fistula.
known that no cardiac chamber can be excluded by IE-induced fistulae and no preponderance from any type of aortic sinus to a specific cardiac chamber can be predicted.3,4,8–11

Conclusion

The combination of aorto-cardiac fistulae with a dissected ascending AA is a very rare and fatal complication of aortic valve replacement. Both complications may be caused by IE or they may each have a specific aetiology. The diagnosis of aorto-cardiac fistulae with a dissected ascending AA should be considered in patients with a history of aortic valve replacement and in those admitted with a diastolic murmur, congestive heart failure or shock in the setting of a post-aortic valve replacement AA. Prompt surgical intervention is necessary for patient survival.

References


A 19-year-old male patient presented to the Emergency Department at Hazrat-e Ali Asghar Hospital, Shiraz, Iran, in May 2015 four hours after ingesting 200 mg of methadone in a suicide attempt. His past medical and family history were negative for any hereditary diseases. He had a history of opium addiction but had been abstinent for the preceding six months; he had previously been prescribed 40 mg of methadone per day as treatment for his opiate dependence. On examination, the patient was conscious, well-oriented and had stable vital signs. Laboratory tests and arterial blood gas analysis were within normal limits.

A 12-lead electrocardiogram (ECG) was performed [Figure 1A]. Although the ECG initially seemed normal, further inspection revealed that the QTc interval in the patient was approximately 500 milliseconds (ms). Moreover, the PR interval exceeded 200 ms and a small deflection after the T wave (known as the U wave) was detected. Interestingly, another ECG performed 48 hours later, just before the patient was discharged, revealed the complete normalisation of these abnormalities without the administration of antiarrhythmic agents [Figure 1B].

**Figure 1A & B:** 12-lead electrocardiograms (ECGs) in a patient with methadone intoxication (A) within the first hour of admission showing T (black arrowheads) and U (white arrowheads) waves and (B) 48 hours later. Note the complete normalisation of the abnormalities in the second ECG which occurred without the use of antiarrhythmic agents.
Acquired long QTc intervals are associated with the use of certain medications, including antihistamines, class I and class III antiarrhythmics, antidepressants, antipsychotics, antibiotics and antifungals. Genetic factors, the co-administration of the aforementioned drugs or hepatic enzyme inhibitors can also increase the risk of developing a long QTc interval. Methadone is a long-acting opioid usually prescribed for opiate withdrawal or as an analgesic for patients suffering from side-effects due to narcotics. Methadone exerts its effects through μ-opioid receptors and has an antagonistic effect on N-methyl-D-aspartate receptors which results in the relief of neuropathic pain. Considering its long half-life, methadone is considered an optimal medication for chronic pain management in opioid-tolerant cancer patients.

Despite being in use for more than 40 years, the cardiovascular effects of methadone have only recently been identified. Methadone use, either chronic use or an acute increase in dosage, leads to the blockage of the voltage-activated delayed potassium current (the IK channel) and causes prolonged repolarisation of the ventricular myocardium. As a result, methadone use is associated with prolonged QTc intervals on ECGs. Moreover, interruption of the repolarisation causes a decrease in the charge difference across the myocardial cell membrane, resulting in early post-depolarisation; thus, signifying an association with the U wave. As the prominent U wave and prolonged QTc interval are signs of early post-depolarisation, doctors should be wary of triggering polymorphic ventricular tachycardia (also known as torsade de pointes). This is especially important when the QTc interval is more than 500 ms, as this may adversely lead to syncope or sudden cardiac death.

Patients who have been prescribed methadone should be assessed in order to identify those who are at potential risk of QTc interval prolongation. Baseline ECGs before treatment and routine ECGs on a biannual basis and upon hospital admission are recommended. Furthermore, as an acute increase in methadone dosage induces prolongation of the QTc interval, a 12-lead ECG should be considered during routine evaluation of these patients. Moreover, close inspection of the ECG is necessary, as prolonged QTc intervals may lead to severe complications.

References

A 70-YEAR-OLD MALE WITH A NINE-YEAR history of chronic hepatitis B infection and liver cirrhosis was admitted to the Kuala Lumpur General Hospital in Kuala Lumpur, Malaysia, in November 2012 with chills and jaundice. A physical examination revealed a distended abdomen without tenderness or masses. There were no other signs of chronic liver disease and the patient was haemodynamically stable. Liver function tests revealed elevated total bilirubin (172.0 μmol/L), alkaline phosphatase (163.0 U/L) and gamma-glutamyl transferase (134.0 U/L) levels. Alanine aminotransferase, white cell count and C-reactive protein levels were within normal limits. However, the patient’s serum α-fetoprotein levels were elevated (919.3 ng/mL).

An ultrasound examination of the abdomen showed a cirrhotic liver with fusiform dilatation of the right portal vein. Contrast-enhanced abdominal computed tomography (CT) confirmed the presence of a fusiform aneurysm of the distal right portal vein [Figure 1]. The aneurysm measured 2.2 cm in diameter and the remainder of the right portal vein was also diffusely dilated. The main portal vein and its left branch, as well as the hepatic veins, were not dilated. These veins were patent with no filling defects to suggest thrombosis. The spleen was mildly enlarged (14.5 cm) and there were multiple varices in the perigastric region and splenic hilum. An ill-defined mass in segment V of the liver was observed which demonstrated heterogeneous enhancement in the arterial phase and relative contrast washout in the portal venous phase. The greatest diameter of the enhancing component of the lesion in the arterial phase was 4.0 cm. There was extrinsic compression of the mass on the adjacent right intrahepatic duct resulting in dilatation of the proximal biliary system. A
Intrahepatic Portal Vein Aneurysm with Concurrent Hepatocellular Carcinoma

However, the incidence of portal hypertension and PVA is disproportionate, suggesting the existence of other contributory factors. Other secondary causes of PVA include pancreatitis, trauma and invasive malignancy. To the best of the authors’ knowledge, no data yet exist in the available English scientific literature evidencing a direct relationship between HCC and PVA. As such, this remains an exciting avenue to be explored. It is likely these two conditions have an indirect relationship as both are related to chronic liver disease and cirrhosis.

The present case demonstrates the imaging appearances of PVA on CT scans. Doppler ultrasonography and contrast-enhanced abdominal CT scans are reliable methods of diagnosing PVA; furthermore, these imaging techniques can help identify complications and are useful during the follow-up period. Contrast-enhanced CT allows multi-planar 3D image reconstruction and can clearly demonstrate the size, location and extent of an aneurysm. Within the PVA, CT or magnetic resonance imaging differentiate slow-flowing blood from thromboses. More invasive imaging techniques such as direct or indirect portography are other potential confirmatory investigations, particularly if a portocaval fistula is suspected. However, these procedures are not usually necessary.

In general, PVAs require no treatment and careful follow-up is adequate. The decision to treat a PVA depends on its size and location, the existence of symptoms and the presence of thrombosis. It is important to be familiar with the imaging appearance and nature of PVAs to allow for appropriate management of the condition.

Figure 2: Complementary three-dimensional computed tomography volume-rendered image showing fusiform aneurysmal dilatation at the distal part of the right portal vein (arrow) in a 70-year-old male with concurrent hepatocellular carcinoma. The remainder of the right portal vein was also diffusely dilated.

Comment

Portal vein aneurysms (PVAs) are extremely rare, with a worldwide prevalence of 0.43%; however, the condition is increasingly detected with modern imaging technology. In most cases, patients are asymptomatic and the PVA is discovered incidentally during routine imaging. The aneurysm is located most frequently in the main portal vein and the confluence of the splenic and superior mesenteric veins. Generally, PVA is divided into congenital and acquired forms; however, the exact aetiology is unclear and remains controversial. The most common cause of acquired PVA is portal hypertension related to chronic liver disease, such as cirrhosis. Long-standing portal hypertension causes intimal thickening with compensatory medial hypertrophy of the portal vein. With time, the medial hypertrophy is replaced with fibrous tissue leading to a weakening of the vein wall, thus making it susceptible to aneurysmal dilatation. However, the incidence of portal hypertension and PVA is disproportionate, suggesting the existence of other contributory factors. Other secondary causes of PVA include pancreatitis, trauma and invasive malignancy. To the best of the authors’ knowledge, no data yet exist in the available English scientific literature evidencing a direct relationship between HCC and PVA. As such, this remains an exciting avenue to be explored. It is likely these two conditions have an indirect relationship as both are related to chronic liver disease and cirrhosis.

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References

31-YEAR-OLD MALE PATIENT PRESENTED to the surgical outpatient department at the Armed Forces Hospital, Muscat, Oman, in September 2014 with a swelling on the left side of his forehead that had been on-going for 10 months. A clinical examination showed a subcutaneous, mobile and non-tender swelling. He had a past history of a similar swelling at the same site, which had been operated on four years previously at another hospital. No reports were available regarding the nature of this previous swelling.

At presentation, the swelling was diagnosed clinically as a recurrent dermoid cyst and was excised and sent for histopathological examination. The pale grey firm nodular mass (1.2 x 1.0 x 0.8 cm) showed a solid cystic mass when sliced. An irregular cyst lined by hyperplastic synoviocytes forming broad villi and papillae with hyalinised cores infiltrated by lymphocytes and plasma cells was observed on microscopic examination [Figure 1]. Foci of chondroid metaplasia, haemorrhage and pigment-laden macrophages surrounded by skeletal muscle with atrophic changes and giant cell formation were noted. A histopathological diagnosis of cutaneous metaplastic synovial cyst (CMSC) was made. Immunohistochemistry (IHC) showed vimentin-positive [Figure 2A] and cluster of differentiation (CD) 68-positive [Figure 2B] synoviocytes. However, IHC was negative for pan-cytokeratin and CD34.

Comment

Also known as synovial metaplasia of the skin, CMSC is a rare cystic tumour first described in 1987 by Gonzalez et al.1 The tumour is located intradermally or subcutaneously and is lined by a hyperplastic synovium-like membrane associated with transepidermal fistulae.2 The aetiology remains unknown, although a history of trauma or surgery is noted in most cases, suggesting that surgical or...
Cutaneous Metaplastic Synovial Cyst

non-surgical trauma is the precipitating cause. The spontaneous development of these cysts in Ehlers-Danlos syndrome indicates the occurrence of cutaneous fragility and anomalous scarring after microtrauma. Cases of CMSC have been associated with basal cell carcinomas, rheumatoid arthritis and arthrosis. Within the embryo, the normal synovium develops from a mechanical disruption of the connective tissue; CMSCs form due to the disruption of connective tissue following trauma or surgery. The cyst develops between a few weeks to several years following the trauma. It has no predilection for site, gender or age. Clinically, CMSCs are tender, erythematous, cutaneous or dermal nodules with or without drainage.

CMSC remains a lesser known entity in clinical dermatology. It is commonly misdiagnosed and the lack of clinical awareness is an impediment to establishing its true incidence. The swelling is commonly misdiagnosed as a suture granuloma or an epidermal inclusion cyst following surgery or trauma. Other differential diagnoses include foreign body granulomas, leiomyomas, eccrine poromas and other cutaneous cysts. Epidermal cysts are distinguished from CMSCs as they are true cysts with an epithelial lining. In comparison, CMSCs lack a true epithelial lining and are pseudocysts with papillary and villous projections towards the centre of the cavity. The lining is similar to a synovial membrane and is composed of hypo- and hypercellular areas with a mixture of fibroblasts, epithelioid cells, mononuclear inflammatory cells and occasional multinucleated giant cells. Hypocellular areas show fibrin deposits and hyalinisation. When located close to a joint cavity, these lesions need to be differentiated from the fluid-filled sacs of bursitis, which are deeper in the subcutaneous tissue and located over the bony prominences. IHC testing in CMSC cases shows positive staining for vimentin and negative staining for the S100 protein, carcinoembryonic antigen and CD34. CD68 shows a variable reaction. However, IHC is not mandatory for the diagnosis, as CMSC can be diagnosed histologically.

References
**Fox-Fordyce Disease**


**A 42-year-old woman presented to the Department of Dermatology & Venereology, Virgen de las Nieves Hospital, Granada, Spain, in May 2015 with a severe pruritic rash and hair loss in both axillary regions. Physical examination showed skin coloured papules and alopecia [Figure 1A], which showed no fluorescence under a Wood’s lamp. Dermoscopy revealed hair follicle-centred papules,**
traumatised terminal hairs and blackheads [Figure 1B]. The histology of the skin biopsy indicated an inflammatory infiltrate of lymphocytes affecting the follicle [Figure 1C] and the obstruction of the eccrine and apocrine sweat glands [Figure 1D]. The patient was diagnosed with Fox-Fordyce (FF) disease. Following treatment with tretinoin (0.05%), she demonstrated moderate symptomatic improvement.

Comment

FF disease is a rare and chronic condition usually seen in adolescent women which affects the apocrine gland-bearing areas. The underlying aetiology of FF remains unclear, although a history of trauma caused by laser hair removal or hormonal factors may be triggers.1–4 The pathophysiology consists of the obstruction of the apocrine gland due to the insertion of a keratin plug in the hair follicle wall. This causes secretion retention with consequent rupture of the glandular structure and secondary inflammation of the dermis.3,5 The extravasation of the glandular content can be the cause of the pruritus.3 Clinically, the lesions are uniform, firm, folliculocentric papules, which can range in colour from normal skin colour to slightly brownish.3–5 The axillae are the most common areas involved, as in the present case, although FF also can involve the anogenital and periareolar areas, lips, umbilicus, sternum, perineum and upper medial aspects of the thighs.3,4

The diagnosis of FF disease is based on characteristic clinical features, as well as non-specific histopathological features.1–5 The histopathological features include dilatation of the follicular infundibula with hyperkeratosis, acanthosis and spongiosis of the infundibular epithelium and perifollicular infiltration of lymphocytes and foamy histiocytes, leading to hair loss.3–5 Differential diagnoses which can be considered include Graham-Little-Piccardi-Lasseur syndrome and trichostasis spinulosa; however, patients with FF disease would not have cicatricial alopecia or lesions elsewhere on the body or the mucosa.5

Various treatments for FF disease have been suggested with limited improvement, including the administration of oral contraceptives; topical, intralesional or systemic corticosteroids; topical clindamycin; pimecrolimus; phototherapy; surgical treatments like electrocoagulation and curettage with liposuction; and topical and oral retinoids, as prescribed in the current case.1–5

References

Sir,

A seven-year-old girl was referred to the emergency ward at the Khatamolanbia Hospital, Zahedan, Iran, in March 2012 after she fell face-first onto a pencil she was holding. The blunt end of the pencil had entered the orbit beneath the medial canthus. Upon ophthalmological examination, the ocular globe was intact but laterally displaced and vision in the left eye had diminished to only light perception. Moreover, the examination revealed a positive relative afferent pupillary defect in the left eye. Further funduscopic examinations were not performed due to the patient’s condition. Her vital signs were normal and she was conscious without any neurological deficits. Computed tomography (CT) scans of the brain without contrast revealed a foreign body in the medial left orbit which had passed through the superior orbital fissure into the cranium near the temporal lobe and was positioned laterally to the cavernous sinus [Figure 1]. The foreign body had passed next to the petrous apex, tangentially to the brainstem and had entered the cerebellum to a depth of 4 cm. A four-vessel angiography produced a normal angiogram [Figure 2].

The pencil was removed slowly along the route of entry while the patient was under general anaesthesia. The pencil measured 18 cm, of which 14 cm had entered into the orbit. A surgical team remained on standby to perform an emergency craniotomy in case of sudden intracranial haemorrhage. Fortunately, a postoperative CT scan showed no evidence of haematomas or vascular leaks. The wound was irrigated and sutured. The patient was prescribed prophylactic antibiotics and high-dose corticosteroids for the ophthalmic nerve injury. She recovered well with no signs of postoperative infection. At follow-up ophthalmological and neurological examinations 10 months later, she showed normal eye movements with 10/20 visual acuity and no neurological deficits.

Impalement through the eye orbit accompanied by transorbital penetration of the calvarium is rare. Most cases are reported in children. Stab injuries of
the orbit more frequently occur among young male children; this may be due to an increased participation in riskier forms of play. The majority of reported cases of transorbital injury in children are accidental.1,2 There have been some reports of intracranial complications due to transorbital brain injuries.1,2 Most accidental transorbital penetrating injuries are reported to be caused by pens.3 In such cases, because of the pyramid shape and weak structure of the orbital apex, the treating physician must be aware of potential brain injuries.1 Since these injuries are classified as low-velocity, the trajectory of the foreign object and the injured anatomical elements in the path determine the extent of the neurological damage.1,2,4

Sections of the frontal, ethmoid, lacrimal, maxillary, zygomatic and greater wing of the sphenoid bones are joined together and form the pyramidal shape of the orbital cavity. The opening of the optic nerve, superior and inferior orbital fissures are positioned at the apex of this cavity. The ocular globe is adjacent to the lateral in comparison to the medial orbital wall; because of its mobile property, a penetrating object is usually directed next to the medial wall, reaching the cranial cavity through the orbital plate or superior orbital fissure.1,4 The optic nerve, cavernous sinus, suprasellar cistern, internal carotid artery, temporal lobe, pons and brainstem are all vulnerable to injury during transorbital penetration.1,2,4 Depending on the site of the injury, intracranial penetration can be immediately fatal or present asymptomatically for some time.1,2,4 Penetration through the orbital roof and superior orbital fissure are the most common events in transorbital penetrating injuries, resulting in a trajectory into the frontal lobe passing near the optic nerve or internal carotid artery, respectively, to the brainstem.3

Turbin et al. concluded that penetrating injuries involving the superior orbital fissure may result in temporal lobe, cavernous sinus and brainstem or cerebellar injuries.1 In the case of low-velocity penetrating brain injuries, immediate complications are associated with anatomical damage and could include cranial nerve or cerebral vascular injuries and haemorrhagic complications.4 Di Roio et al. reported two cases of craniocerebral injury with transfemoralpenetration.2 The first was a four-year-old boy who fell onto a metal rod; his mother subsequently pulled the metal rod out of the entry site near the left internal canthus. On examination, the child was in a coma and developed meningeal syndrome with a cerebral abscess. In the second case, a six-year-old boy had poked a chopstick in his left eye. The child remained asymptomatic for some time before developing a cerebral abscess.2 Al-Otaibi et al. reported a case of transorbital brain injury without serious neurological deficits in which the bulk of the pencil was removed under general anaesthesia.2 However, this approach carries some risks as the foreign object may shred the vasculature and cranial nerves within its path.

The most common cause of delayed death due to a penetrating brain injury is intracranial infection. Al-Otaibi et al. proposed that prophylactic antibiotics be prescribed as soon as possible after the removal of wooden foreign object fragments prone to microbial contamination.3 This recommendation is congruent with that of Di Roio et al.; both of the reported patients were treated with wide-spectrum antibiotics with no subsequent sign of post-surgical infection.2 The authors of this letter advocate non-invasive surgical management for transfemoral penetrating brain injuries due to smooth objects, particularly for patients with normal angiograms and without haemorrhage. In the present patient, a craniotomy was not deemed necessary as the only complication was an ophthalmic nerve injury with light perception. Nevertheless, surgical teams should be ready to perform an emergency craniotomy in the event of unexpected complications.

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References
Sir,

I have two comments regarding the interesting study by Mahyar et al. published in the SQUMJ November 2015 issue.1 Firstly, apart from the two limitations addressed by the authors—failure to estimate serum zinc concentrations after patients had completed their course of treatment and the small sample size—I believe that there is another important limitation to this study. Giardiasis is highly prevalent in developing countries.2 It is commonly linked to chronic diarrhoea and malabsorption; available data indicate that giardiasis is the aetiological agent in 7.0% of childhood cases of acute diarrhoea.3 In Iran, paediatric giardiasis still represents a substantial health threat, with an estimated prevalence of 10.6%.4 Moreover, giardiasis has been shown to be markedly associated with hypozincaeemia in the Iranian population.5 In Mahyar et al’s study, stool cultures were used to determine the causative pathogens in their studied population.1 No growth was seen in 32 (53.3%) patients while 28 (46.7%) patients were found to have bacterial diarrhoea caused by pathogenic \textit{Escherichia coli} \((n = 15)\), \textit{Shigella} \((n = 10)\) and \textit{Salmonella} \((n = 3)\).1 General stool examinations were not carried out prior to the cultures; this could have resulted in the exclusion of a significant number of patients with giardiasis-associated acute diarrhoea.1 Accordingly, this might affect the accuracy of Mahyar et al’s results.

Secondly, Mahyar et al. studied the correlation between serum zinc levels and various inflammatory and non-inflammatory variables.1 The study showed a non-significant correlation between these variables and serum zinc levels; thus, these variables could not be considered predictors of zinc deficiency in Iranian children with acute diarrhoea.1 This is an interesting observation as it contrasts with previously reported observations; Strand et al. studied the association between plasma zinc concentration and several clinical and biochemical variables in a cohort of Nepalese children with acute diarrhoea.6 The study revealed an association between axillary temperature and plasma zinc concentrations. As such, a reduction was seen in the mean plasma zinc concentration per degree of increased axillary temperature \((0.59 \mu\text{mol/L per } ^\circ\text{C}).\) Reduced plasma zinc levels were also associated with elevated levels of C-reactive protein, dysentery and decreased plasma albumin levels. The study also found that there were increased levels of plasma zinc in children who were dehydrated compared to those who were not.6

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References


Response from the Authors

Sir,

We thank you for your comments on our recently published article. As mentioned in our article, the main objectives of our study were to compare serum zinc levels in children with acute diarrhoea and in healthy control subjects, as well as to compare serum zinc concentration in children with acute watery versus bloody diarrhoea, regardless of the identification of aetiological factors such as rotavirus infection or giardiasis.

The diagnosis of acute diarrhoea, acute watery diarrhoea and dysentery was based on the definitions of the World Health Organization. In general, our goal was to prove that patients with acute diarrhoea, particularly acute bloody diarrhoea, have low concentrations of serum zinc. We aimed to suggest that zinc should be prescribed to all patients with acute diarrhoea regardless of their aetiologic factors. In developing countries, certain diagnostic facilities (including cultures, rapid diagnostic or polymerase chain reaction tests) for the diagnosis of aetiological agents are unavailable. Giardiasis can present as acute diarrhoea and the diagnosis is traditionally established by microscopic evidence of trophozoites or cysts in stool specimens. However, stool enzyme immunoassay or direct fluorescent antibody tests for *Giardia* antigens are the tests of choice for giardiasis. Under certain conditions, it may be necessary to use other diagnostic methods such as aspiration or biopsy of the duodenum or upper jejunum.

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مهسا آكاهي، وحيد شكوري، سيد مهدي مرعشي

2. تمدد الوريد البابي داخل الكبد بالتزامن مع سرطان خلايا الكبد
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7. رد: مستوى معدن الزنك في مصل دماء الأطفال المصابين بإسهال دموي أو مائي حاد
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8. نعمة مرض بعد إصابة عميقة جدا احترقت الحجابي الجمجمي
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12. رد: مستوى معدن الزنك في مصل دماء الأطفال المصابين بإسهال دموي أو مائي حاد
محمد ضاهر المندلاوي

13. نعمة مرض بعد إصابة عميقة جدا احترقت الحجابي الجمجمي
حامد رزاعي، أنيتا ألينابي، مصطفى داهمارده، زينب نصري-نصرابادي، سيد مهدي مرعشي

14. ظهور السل الكلوي كأصلة كثيفة في طفلا عمرها سنتان
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سلوك طبل الطب السعودي نجاح الأطباء في المجال الصحي
سارة محمد عاملي، إيمان القحطاني، راجيف خاندكار، عبد الله الشهري، دينيس إدوارد

مدى انتشار الأسباب التي تؤدي إلى مغادرة المرضى لأجنحة طبل الأطفال ضد المشاعر الطبية في عمان
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الاستخدام الوقائي لمرشحات الوريد الأجوف السفلي في حالات الصدمة
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الجلة الطبية لجامعة السلطان قابوس:

لا تنشر البحوث بدون مقابل

ال مجله الطبية لجامعة السلطان قابوس تصدر أربع مرات في السنة وتوزع مجانا لكل الكليات والمعاهد الطبية في عُمان ودول الخليج ومنطقة شرق المتوسط والهند والولايات المتحدة. 

تكتب مجلات طبية وعكسيونية، تحث على الوعي في التطورات الطبية والعلوم المساعدة عند العاملين في مجال الطب داخل عُمان وخارجها. تعد المجلة منتدا للتبادل ونشر المعارف الطبية والبحوث مجانا.

تشجع وتحفيز البحث الطبي والنشر العلمي في عُمان ومنظمة الخليج وجذب الجامعة السلطان قابوس نشرة وطنية وعالمية محكمة للأبحاث الطبية البايولوجية. تنشر المجلة البحوث الأصيلة مطبوعة والكترونيا، حيث يمكن الحصول على كامل البحوث بالمجرد أن يكون المنشور مباحا.

التعليم في مجال الطب في عُمان والخليج والشرق الأوسط وأسيا.

تحتفي المجلة بالفهرس الطبي لمنظمة الصحة العالمية - المكتب.

تتضمن المجلة المقالات البحثية الفوتوغرافية، والمحاضرات، والمناقشات، والxFFFFFFFFXX

البحث الطبي والنشر العلمي في عُمان ومنظمة الخليج وجذب

المجلة الطبية لجامعة السلطان قابوس تصدر أربع مرات في السنة وتوزع مجانا لكل الكليات والمعاهد الطبية في عُمان ودول الخليج ومنطقة شرق المتوسط والهند والولايات المتحدة.

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تحتفي المجلة بالفهرس الطبي لمنظمة الصحة العالمية - المكتب.

تتضمن المجلة المقالات البحثية الفوتوغرافية، والمحاضرات، والمناقشات، والxFFFFFFFFXX

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