Groin hernias are confusing and exasperating to most students. The anatomy of the groin region is usually presented in great detail and with a plethora of names. The anatomic elements are conceived of as disparate individual components and are not thought of as an integrated unit. Furthermore, the anatomy is just structural elements. Any functional component to the pieces, individually or collectively, is missing. There is an excessive use of eponyms, both anatomic and surgical, which adds to the confusion rather than providing clarity. Above all, no fundamental principle of groin hernia formation or treatment is ever enunciated. Lacking this basic insight into the problem, the student quickly forgets both the isolated, detailed anatomy and the eponyms.

It is as if someone who had never seen an automobile was exposed to the disassembled parts strewn on a garage floor. What could be gleaned about a car and how it works by looking at the pieces? How much better to first see a car moving down the street and then explain the relationship of the parts to one another and the principle of converting fuel into motion.

The aims of this chapter are to (1) review briefly and succinctly the pertinent anatomy of groin hernias, (2) delineate the principle of groin hernia formation and repair, and (3) describe surgical repairs in terms of anatomy for easy conceptualization. Other hernias of the abdominal wall are also described. Based on this knowledge, the student should be able to deduce the common signs and symptoms of groin hernias and their features on physical examination, ascertain their relative risk to the patient (and the reasons for them), and describe the principles of the different repairs.

CASE 1
INDIRECT INGUINAL HERNIA

A 27-year-old male noted the progressive enlargement of a right inguinal bulge over the course of 1 year. Recently, it had extended downward into the scrotum and at presentation was associated with discomfort when the patient coughed, lifted objects, or strained. Although previously the bulge disappeared when lying down, at presentation it was always present. He tried to massage it in a effort to “reduce” it, but experienced discomfort and aborted the attempt.

CASE 2
SLIDING HERNIA

A moderate size left inguinal mass rapidly developed in a 60-year-old male. Concomitantly, he noted some constipation relieved in part by massage of the mass. On physical
examination, bowel could be palpated within the mass. A barium enema showed no intrinsic colon lesion but did show a portion of the colon in the inguinal mass.

**GENERAL CONSIDERATIONS**

The relevant anatomy for groin hernias is pictured in Figure 13.1. Usually this anatomy is vaguely familiar but not integrated. The anatomic schema have been labeled with numbers as well as names. It will be useful to reproduce these simple schematic drawings on a piece of paper as a way to begin to conceptualize the three-dimensional aspects of the anatomy while engaged in depicting them on a two-dimensional surface. The numbering sequence should assist you in your efforts. Figure 13.1A is a frontal view of the relevant anatomy while Figure 13.1B is a transsectional view in the plane X-X' perpendicular to the plane of the paper. This view is comparable to that which the surgeon sees while incising through the tissue layers during the course of an operation.

Figure 13.1A demonstrates that the muscle fibers of the external oblique are not present and that fibers of the internal oblique invest the spermatic cord. These are called the cremasteric fibers.

Hesselbach's triangle is an important eponym. The area of the triangle is important as it is an area of potential weakness because of a lack of muscle. After all, it is muscle that makes the abdominal wall strong. Its lack makes the wall weak.

Note the relationship of the internal and external inguinal rings (9) to the triangle. Direct hernias protrude through Hesselbach's triangle. Indirect hernias, as the name implies, protrude by passing indirectly through the internal ring, descending down the inguinal canal connecting the internal and external rings, and emerging through the external ring. They may enter the subcutaneous tissues of the groin, or descend further down into the scrotum. Recall that the testis is a retroperitoneal structure that descends behind the peritoneum into the scrotum. It occupies the dorsal and lateral aspects of the inguinal region. The inguinal canal, therefore, as it emerges through the internal inguinal ring, is both ventral and medial to the cord structures. This relationship is a consequence of the developmental aspects of the testes and cord structures. It is important for the operating surgeon to identify the indirect hernia sac quickly based on its anatomic position, ventral and medial to the cord structures.

A convenient way to illustrate these three-dimensional anatomic relationships is to imagine being in a room with a single door, which is then closed (Fig. 13.2). Imagine that you are a piece of small bowel in a large plastic bag (peritoneum) that fills the room. If the door were structurally weak, every time you (as intestine in the peritoneal sac) leaned against it, it would bulge into the corridor outside. You are mimicking a *direct hernia*. The door, because of its structural weakness, represents Hesselbach's triangle. Now imagine that, while you were leaning against the door, the room was suddenly rotated 90 degrees so that the wall opposite to the door had rotated below you. You would slide away from the bulging door and the door would return to its normal contour. This represents the course of events when a patient with a direct hernia stands erect (door bulges) or lies down (90 degrees rotation from the erect position). Furthermore, whether the door is small or large, there appears to be no intrinsic risk or damage to you (viscus, small bowel).

Now open the door to the room, so that it is ajar. The internal door jamb represents the internal inguinal ring. Note that the door is at one edge of Hesselbach's triangle. The outer door jamb (in the corridor) represents the external inguinal ring at the other margin of Hesselbach's triangle. The oblique passage from inside the room, past the internal door jamb, along the door to the external door jamb, and finally to the corridor outside, represents the passage of the inguinal ring obliquely through the abdominal wall. This is the path of the *indirect inguinal hernia*.

Now, try to pass through the narrow space between the slightly opened door and the door jamb. You might get started out of the door, but if pressure is applied from outside the room to close the door, you would be trapped (or as we say clinically, imprisoned or incarcerated). If you had gone beyond the external door jamb, into the corridor (surrounding tissues leading down to the scrotum) when the door was closed, you would not be able to get back into the room (an irreducible hernia).

In this simple way, it is easy to conceive of the mechanisms responsible for the formation of direct and indirect hernias. One can relate the anatomic features of the inguinal region to each other using the room and door as a three-dimensional model. It also allows us to understand some of the pertinent clinical features of the two different types of hernia, such as the usually easy reducibility of a direct hernia when lying down.

Given this information, which of these hernias would you rather have yourself, and why? To answer that question properly, one must know what the mechanism of hernia formation is and what the consequences of the mechanism might be. Clearly, you do not want a hernia that has a great potential to injure you. From what we have already discussed it is apparent that because an indirect hernia can become incarcerated in a confined oblique passage, it is more apt to lead to swelling of the trapped bowel, with resultant ischemia to its mucosa, gangrene, perforation, and sepsis (Case 1).

The direct hernia is far less apt to produce these changes and, therefore, is the “groin hernia of choice” between the two. To repeat, hernias that are small and in which a viscus (usually small bowel) can pass through a constricting passage or ring, have the potential to entrap the bowel (incarcerate it). Once it is caught in place, the
FIGURE 13.1  (A) Frontal view of relevant anatomy. (B) Transectional view through plane X--X'.
Additional hernias that are apt to incarcerate and strangulate the bowel are umbilical hernias and femoral hernias. The latter are particularly notorious. Femoral hernias occur along the femoral vessels in the groin (Fig. 13.3). Typically, the space (or potential space) along the medial aspect of the vessels is small. It is sharply and rigidly defined by the inguinal ligament above, by the femoral vessels above and laterally, and by the pubic ramus medially. The space, therefore, cannot readily expand to accommodate the intruding viscus. The result is that strangulation and perforation of the bowel are more common with this type of hernia than with any other. Furthermore, because this area is surrounded by generous layers of fat and is deep in the femoral crease, it is not easy to examine and discern the presence of a hernia therein. Furthermore, femoral hernias may entrap only one wall of the bowel (Fig. 13.4), in which case a Richter’s hernia occurs. These hernias do not produce intestinal obstruction such as an incarcerated indirect her-
nia might, because the lumen of the bowel remains patent. Femoral hernias are therefore difficult to recognize clinically because of their deep anatomic position and the lack of gastrointestinal symptoms until gangrene and sepsis ensue.

The principles behind the repair of an inguinal hernia can be understood by examining Figure 13.1B. Note the relationship of the indirect hernia sac medial and ventral to the cord structures. The operation begins by mobilizing this sac and ligating it at the level of the internal inguinal ring, after which it is amputated. The direct sac is merely pushed inward to return it to the abdomen. Laterally lie the inguinal ligament and Cooper's ligament, both tough immobile structures that serve as anchoring tissues. There are no other tissues in the immediate area that can be mobilized and brought medially. Medially lies the internal oblique muscle and the transversalis fascia, which forms the conjoined tendon. This tissue is supple and mobile, and serves as excellent material to buttress a weak area devoid of muscle. The principle of all uncomplicated inguinal hernia repairs, therefore, is to anchor the supple and mobile medial tissue to the immobile strong ligaments found laterally. The concept follows logically from a consideration of the anatomy. The other consideration is whether the tissues used for repair should pass beneath or over the cord structures (Fig. 13.1B), or whether the cord should be displaced to some other position (i.e., subcutaneous). The student is invited to reproduce Figure 13.1B in as many different ways as possible using variations of the above principle. Each of these repairs carries its own eponym and is listed in the Glossary and depicted in Figure 13.5.
Femoral hernias are repaired by reducing the bowel from the femoral canal and closing or obliterating the defect by approximating the tissues on either side of it.

Laparoscopic repair of groin hernias has provided a view from the inside out. The orifice of the internal inguinal ring can be readily seen and closed, and the femoral space inspected and closed, if necessary. To repair a direct hernia defect, the peritoneum overlying the area of Hesselbach's triangle is opened, a piece of synthetic mesh overlaid, and the peritoneum reapproximated over it. To use our earlier analogy, the weak door is buttressed by a piece of strong plywood tacked over it. A particularly confusing hernia is the so-called sliding hernia, in which a portion of the hernia sac is composed of a hollow viscus such as the colon or bladder. Think of an indirect hernia on the left side, which appeared rather suddenly in an elderly male and rapidly achieved a large size. In addition, the patient noted some difficulty in moving his bowels since the appearance of the hernia and massaged it during evacuation to assist in defecation (Case 2). On physical examination, you might readily appreciate bowel in the hernia, which is difficult if not impossible to reduce. All these findings are characteristic of a sliding hernia with sigmoid colon forming part of the hernia sac. Again, think of yourself in a plastic bag in a room with the door slightly ajar. This time, however, between the plastic sac and the wall leading to where the door opens, there is a large horizontal collapsed tube at about waist height. As you and the plastic sac proceed out through the slightly opened door (internal inguinal ring) the tube beneath the plastic (retroperitoneal sigmoid colon) is dragged out as well. Seen from the outside, from the corridor looking at the external door jamb, there is a large plastic tube partially collapsed and behind it and to one side of it is the bulge of a plastic sac. The importance of recognizing a sliding hernia is to prevent inadvertent injury to the blood supply or inadvertent enterotomy during repair. Once properly identified, the hernia is repaired by reducing the bowel, closing the internal ring, and strengthening the area as with other inguinal hernias.

Hernias in other portions of the abdominal wall usually occur generally through defects in the fascia. These are either congenital, related to physical stress or exertion, or from previous operations. As a generalization, such hernias may produce pain or discomfort with physical activity, or may be an unsightly and occasionally disabling protrusion, but only rarely are they the cause of obstruction and gangrene of bowel and/or omentum. Their repair consists of reducing the hernia contents in the abdominal cavity and then closing and/or reinforcing the weakened fascial tissues.
LUMBAR HERNIAS

The lumbar region, divided into superior and inferior triangles, is also subject to weakness of presumed congenital origin. These rare hernias should be considered in patients complaining of lumbar pain and discomfort on exertion. The hernias are difficult to detect on physical examination in many instances because of the overlying tissues. The most common is a superior triangle (Grynfelt) hernia bounded by the sacrospinalis muscle, internal oblique muscle, and the inferior margin of the 12th rib. A lower triangle, or Petit’s hernia, is bounded by the lateral margin of the latissimus dorsi, the medial margin of the external oblique, and the iliac crest. Repair of the weakened area is performed with synthetic mesh for coverage.

FASCIAL HERNIAS

These hernias are thought to arise from physical straining, producing defects in the linea alba or midline (preperitoneal or epigastric hernia) or linea semilunaris (lateral border of the rectus, spigelian hernia). The hernias tend to be small, with preperitoneal fat protruding through the defect. They produce pain and discomfort on effort limited to the small defect. Repair consists of simple closure of the defect.

UMBILICAL HERNIA

Although common in infancy, most umbilical hernias close with time. In the adult, umbilical hernias are associated with increases in intra-abdominal pressure, such as with pregnancy, obesity, and ascites. The defect is usually small, so that incarceration and strangulation are common. The principles of repair are to reduce the contents and simply close the defect.

INCISIONAL HERNIA

By far the most common of the abdominal wall hernias is related to previous operations. Often there is a history of wound infection or wound disruption (“popping of the sutures”) followed by a gradually increasing bulge in the wound with associated discomfort. If the defect is small, incarceration and strangulation of the contents can ensue. Repair is done by opening the old incision, reducing the contents after ensuring their viability, removing old suture material in the area (presuming it to be infected), and rerepairing the fascia directly if possible. When direct repair is not possible, synthetic mesh is used to cover the defect.

SUGGESTED READINGS


A comprehensive and detailed text by experts on all aspects of hernia. The many different approaches to inguinal hernia repair by the proponents are presented. Useful in providing a broad background in surgical approaches to inguinal herniorrhaphy.

Ponka JL: Hernias of the Abdominal Wall. WB Saunders, Philadelphia, 1980

A very well-illustrated text on a wide range of hernia repairs. Excellent resource delineating the individual steps of a hernia repair.
QUESTIONS

1. *The indirect inguinal hernia is much more dangerous than the direct inguinal hernia because?*
   A. Direct hernia’s occur in an area of weakness (Hesselbach’s triangle) that has no areas of construc-
      tion likely to trap bowel.
   B. Indirect hernia’s protrude indirectly through the abdominal wall along the inguinal canal, a poten-
      tially narrow, confining region.
   C. Bowel entrapped (incarcerated) within the inguinal canal can become strangulated, leading to
      necrosis and sepsis.
   D. All of the above.

2. *The principle of all uncomplicated inguinal hernia repairs is?*
   A. Excision of the hernia sac.
   B. To anchor supple medial tissue to lateral immobile
      ligaments.
   C. To elevate the cord structures above the repair.
   D. None of the above.

3. *Femoral hernias are clinically difficult to detect because?*
   A. They are “deep seated” (i.e., in an anatomic region
      that is hard to examine).
   B. They may entrap only a small piece of bowel or
      only one wall of the bowel (Richter’s hernia).
   C. They may produce few symptoms until late.
   D. All of the above.

(See p. 603 for answers.)
Halstead I: Cord is placed in subcutaneous position fascia, with external oblique closed beneath it. Conjoined tendon is then sutured to inguinal ligament. This procedure is no longer indicated.

Halstead II (Bassini): Conjoined tendon is brought beneath cord and anchored to inguinal ligament. Fascia of external oblique is closed over cord. This is a standard primary repair of indirect hernia (after ligation of sac at internal inguinal ring) and small direct hernias.

Halstead III (Ferguson): After high ligation of indirect hernia sac, conjoined tendon is brought over (ventral) to cord and sutured to inguinal ligament. This procedure is commonly done in infants.

McVay: Conjoined tendon is anchored to Cooper’s ligament with cord above (ventral). This procedure is often employed in recurrent hernias.