

American Cancer Society  
*Atlas of*  
**Clinical Oncology**

**Series Volumes**

Blumgart, Fong, Jarnagin	<i>Hepatobiliary Cancer</i>
Cameron	<i>Pancreatic Cancer</i>
Carroll, Grossfeld, Reese	<i>Prostate Cancer</i>
Char	<i>Tumors of the Eye and Ocular Adnexa</i>
Clark, Duh, Jahan, Perrier	<i>Endocrine Tumors</i>
Eifel, Levenback	<i>Cervical, Vulvar and Vaginal Cancer</i>
Ginsberg	<i>Lung Cancer</i>
Grossbard	<i>Malignant Lymphomas</i>
Ozols	<i>Ovarian Cancer</i>
Pollock	<i>Soft Tissue Sarcomas</i>
Posner, Vokes, Weichselbaum	<i>Esophagus, Stomach and Small Bowel Cancer</i>
Prados	<i>Brain Cancer</i>
Raghavan	<i>Germ Cell Tumors</i>
Shah	<i>Head and Neck Cancer</i>
Silverman	<i>Oral Cancer</i>
Sober, Haluska	<i>Skin Cancer</i>
Steele, Richie	<i>Kidney Tumors</i>
Volberding	<i>Viral Causes of Cancer</i>
Wiernik	<i>Adult Leukemias</i>
Willett	<i>Cancer of the Lower Gastrointestinal Tract</i>
Winchester, Winchester	<i>Breast Cancer</i>
Yasko	<i>Bone Tumors</i>

American Cancer Society  
*Atlas of*  
**Clinical Oncology**

**Editors**

GLENN D. STEELE JR, MD  
University of Chicago

THEODORE L. PHILLIPS, MD  
University of California

BRUCE A. CHABNER, MD  
Harvard Medical School

**Managing Editor**

TED S. GANSLER, MD, MBA  
Director of Health Content, American Cancer Society

American Cancer Society  
*Atlas of*  
**Clinical Oncology**

# **Hepatobiliary Cancer**



American Cancer Society  
*Atlas of*  
**Clinical Oncology**

# **Hepatobiliary Cancer**

**Leslie H. Blumgart, MD, FACS, FRCS (Eng, Edin, Glas)**

**Yuman Fong, MD, FACS**

**William R. Jarnagin, MD**

Memorial Sloan-Kettering Cancer Center  
New York, New York

2001

B.C. Decker Inc.

Hamilton • London

B.C. Decker Inc.  
20 Hughson Street South  
P.O. Box 620, L.C.D. 1  
Hamilton, Ontario L8N 3K7  
Tel: 905-522-7017; 1-800-568-7281  
Fax: 905-522-7839  
E-mail: info@bcdecker.com  
Website: www.bcdecker.com



© 2001 American Cancer Society

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without prior written permission from the publisher.

00 01 / UTP / 9 8 7 6 5 4 3 2 1

ISBN 1-55009-132-8  
Printed in Canada

## Sales and Distribution

### *United States*

B.C. Decker Inc  
P.O. Box 785  
Lewiston, NY 14092-0785  
Tel: 905-522-7017; 1-800-568-7281  
Fax: 905-522-7839  
E-mail: info@bcdecker.com  
Website: www.bcdecker.com

### *Canada*

B.C. Decker Inc.  
20 Hughson Street South  
P.O. Box 620, L.C.D. 1  
Hamilton, Ontario L8N 3K7  
Tel: 905-522-7017; 1-800-568-7281  
Fax: 905-522-7839  
E-mail: info@bcdecker.com  
Website: www.bcdecker.com

### *Foreign Rights*

John Scott & Company  
International Publishers' Agency  
P.O. Box 878  
Kimberton, PA 19442  
Tel: 610-827-1640  
Fax: 610-827-1671

### *U.K., Europe, Scandinavia, Middle East*

Harcourt Publishers Limited  
Customer Service Department  
Foots Cray High Street  
Sidcup, Kent  
DA14 5HP, UK  
Tel: 44 (0) 208 308 5760  
Fax: 44 (0) 181 308 5702  
E-mail: cservice@harcourt\_brace.com

### *Australia, New Zealand*

Harcourt Australia Pty. Limited  
Customer Service Department  
STM Division  
Locked Bag 16  
St. Peters, New South Wales, 2044  
Australia  
Tel: (02) 9517-8999  
Fax: (02) 9517-2249  
E-mail: stmp@harcourt.com.au  
Website: www.harcourt.com.au

### *Japan*

Igaku-Shoin Ltd.  
Foreign Publications Department  
3-24-17 Hongo  
Bunkyo-ku, Tokyo, Japan 113-8719  
Tel: 3 3817 5680  
Fax: 3 3815 6776  
E-mail: fd@igaku.shoin.co.jp

### *Singapore, Malaysia, Thailand, Philippines, Indonesia, Vietnam, Pacific Rim*

Harcourt Asia Pte Limited  
583 Orchard Road  
#09/01, Forum  
Singapore 238884  
Tel: 65-737-3593  
Fax: 65-753-2145

**Notice:** The authors and publisher have made every effort to ensure that the patient care recommended herein, including choice of drugs and drug dosages, is in accord with the accepted standard and practice at the time of publication. However, since research and regulation constantly change clinical standards, the reader is urged to check the product information sheet included in the package of each drug, which includes recommended doses, warnings, and contraindications. This is particularly important with new or infrequently used drugs.

# Contributors

H. RICHARD I. ALEXANDER JR., MD  
Head, Surgical Metabolism Section  
Surgery Branch  
National Cancer Institute  
National Institutes of Health  
Bethesda, Maryland  
*Isolated Hepatic Perfusion*

DAVID L. BARTLETT, MD  
Senior Investigator  
National Cancer Institute  
National Institutes of Health  
Assistant Professor, USUHS  
Bethesda, Maryland  
*Gallbladder Cancer, Isolated Hepatic Perfusion*

LESLIE H. BLUMGART, MD, FACS, FRCS  
(ENG, EDIN, GLAS)  
Enid A. Haupt Chair in Surgery  
Chief, Hepatobiliary Service  
Director, Hepatobiliary Disease Management  
Program  
Member, Memorial Sloan-Kettering Cancer Center  
Professor of Surgery, Weill Medical College of  
Cornell University  
New York, New York  
*Metastatic Liver Cancer, Techniques of Hepatic  
Resection, Hilar Cholangiocarcinoma*

KAREN T. BROWN, MD  
Associate Attending Radiologist  
Memorial Sloan-Kettering Cancer Center  
Associate Professor of Radiology  
Weill Medical College of Cornell University  
New York, New York  
*Nonsurgical Ablative Techniques for Liver Tumors*

RONALD S. CHAMBERLAIN, MD, MPA  
Assistant Attending Surgeon  
Montefiore Medical Center  
Assistant Professor of Surgery  
Albert Einstein College of Medicine  
Bronx, New York  
*Benign Liver Lesions, Incidentally Discovered  
Hepatic Lesions*

DOUGLAS DECORATO, MD  
Assistant Attending Radiologist  
Memorial Sloan-Kettering Cancer Center  
New York, New York  
*Benign Liver Lesions, Incidentally Discovered  
Hepatic Lesions*

RONALD P. DEMATTEO, MD  
Assistant Professor of Surgery  
Weill Medical College of Cornell University  
Assistant Attending Surgeon  
Memorial Sloan-Kettering Cancer Center  
New York, New York  
*Metastatic Liver Cancer, Gene Transfer for the  
Treatment of Hepatobiliary Neoplasms*

YUMAN FONG, MD, FACS  
Member, Memorial Sloan-Kettering Cancer Center  
Attending Surgeon, Memorial Hospital  
New York, New York  
*Primary Hepatic Malignancies, Metastatic Liver  
Cancer, Techniques of Hepatic Resection,  
Gallbladder Cancer, Gene Transfer for the  
Treatment of Hepatobiliary Neoplasms*

GLENROY HEYWOOD, MD  
Mayo Clinic, Department of Surgery  
Rochester, Minnesota  
*Hepatic Surgery for Metastatic Gastrointestinal  
Neuroendocrine Tumors*

SPIROS P. HIOTIS, MD, PHD  
Surgical Oncology Fellow  
Department of Surgery  
Memorial Sloan-Kettering Cancer Center  
New York, New York  
*Nonsurgical Ablative Techniques for Liver Tumors*

WILLIAM R. JARNAGIN, MD  
Assistant Professor of Surgery  
Weill Medical College of Cornell University  
Assistant Attending Surgeon  
Memorial Sloan-Kettering Cancer Center  
New York, New York  
*Benign Liver Lesions, Incidentally Discovered  
Hepatic Lesions, Techniques of Hepatic  
Resection, Hilar Cholangiocarcinoma*

RONALD P. KALEYA, MD, FACS  
Attending Surgeon  
Montefiore Medical Center  
Associate Professor  
Albert Einstein College of Medicine  
Bronx, New York  
*Surgical Ablative Therapy for Liver Tumors*

HOWARD M. KARPOFF, MD  
Surgical Oncology Fellow  
Department of Surgery  
Memorial Sloan-Kettering Cancer Center  
New York, New York  
*Techniques of Hepatic Resection*

NANCY E. KEMENY, MD  
Attending Physician  
Department of Medicine  
Memorial Sloan-Kettering Cancer Center  
Professor of Medicine  
Weill Medical College of Cornell University  
New York, New York  
*Chemotherapy for Liver Tumors*

ANYA KISHINEVSKY, MD  
Surgical Resident  
Montefiore Medical Center  
Bronx, New York  
*Surgical Ablative Therapy for Liver Tumors*

JONATHAN KOEA, MD  
Hepatobiliary Surgical Oncology Fellow  
Department of Surgery  
Memorial Sloan-Kettering Cancer Center  
New York, New York  
*Primary Hepatic Malignancies*

JOSÉ MELENDEZ, MD  
Associate Attending Anesthesiologist  
Memorial Sloan-Kettering Cancer Center  
Associate Professor of Anesthesiology  
Weill Medical College of Cornell University  
New York, New York  
*Techniques of Hepatic Resection*

CHARLES M. MILLER, MD  
Alfred and Florence Gross Professor of Surgery  
Mount Sinai School of Medicine  
Director, Recanati/Miller Transplantation Institute  
Mount Sinai Hospital  
New York, New York  
*Liver Transplantation for Tumors*

DAVID M. NAGORNEY, MD  
 Professor of Surgery  
 Mayo Medical School  
 Consultant in Surgery  
 Division of Gastroenterologic and  
 General Surgery  
 Mayo Clinic  
 Rochester, Minnesota  
*Hepatic Surgery for Metastatic  
 Gastrointestinal Neuroendocrine Tumors*

SAMUEL OBIKWE, MD, MPH  
 Hepatobiliary Research Fellow  
 Department of Surgery  
 Memorial Sloan-Kettering Cancer Center  
 New York, New York  
*Chemotherapy for Liver Tumors*

FLORENCIA G. QUE, MD  
 Assistant Professor of Surgery  
 Mayo Medical School  
 Senior Associate Consultant  
 Division of Gastroenterologic and  
 General Surgery  
 Mayo Clinic  
 Rochester, Minnesota  
*Hepatic Surgery for Metastatic  
 Gastrointestinal Neuroendocrine Tumors*

THANJAVUR S. RAVIKUMAR, MD, FACS  
 Chairman, Department of Surgery  
 Montefiore Medical Center  
 Professor of Surgery  
 Albert Einstein Medical College  
 Bronx, New York  
*Surgical Ablative Therapy for Liver Tumors*

PIERRE F. SALDINGER, MD  
 Instructor in Surgery  
 Harvard Medical School  
 Surgical Director, Liver and Gastrointestinal  
 Program  
 Beth Israel Deaconess Medical Center  
 Boston, Massachusetts  
*Hilar Cholangiocarcinoma*

MYRON E. SCHWARTZ, MD  
 Associate Professor of Surgery  
 Mount Sinai School of Medicine  
 Deputy Director and Chief, Hepatobiliary  
 Surgery  
 Recanati/Miller Transplantation Institute  
 Mount Sinai Hospital  
 New York, New York  
*Liver Transplantation for Tumors*

ANDREW J. SMITH, MD, MS, FRCSC  
 Surgical Oncologist  
 Toronto Sunnybrook Regional Cancer Center  
 Assistant Professor  
 Department of Surgery  
 University of Toronto  
 Toronto, Ontario  
*Metastatic Liver Cancer*



# Contents

<b>1</b>	<b>Benign Liver Lesions</b> .....	<b>1</b>
	Ronald S. Chamberlain, Douglas DeCorato, William R. Jarnagin	
<b>2</b>	<b>Incidentally Discovered Hepatic Lesions</b> .....	<b>31</b>
	Ronald S. Chamberlain, William R. Jarnagin, Douglas DeCorato	
<b>3</b>	<b>Primary Hepatic Malignancies</b> .....	<b>43</b>
	Jonathan Koea, Yuman Fong	
<b>4</b>	<b>Metastatic Liver Cancer</b> .....	<b>75</b>
	Andrew J. Smith, Ronald P. DeMatteo, Yuman Fong, Leslie H. Blumgart	
<b>5</b>	<b>Hepatic Surgery for Metastatic Gastrointestinal Neuroendocrine Tumors</b> .....	<b>97</b>
	Florencia G. Que, Glenroy Heywood, David M. Nagorney	
<b>6</b>	<b>Surgical Ablative Therapy for Liver Tumors</b> .....	<b>117</b>
	Ronald P. Kaleya, Anya Kishinevsky, Thanjavur S. Ravikumar	
<b>7</b>	<b>Nonsurgical Ablative Techniques for Liver Tumors</b> .....	<b>145</b>
	Spiros P. Hiotis, Karen T. Brown	
<b>8</b>	<b>Techniques of Hepatic Resection</b> .....	<b>159</b>
	Howard M. Karpoff, William R. Jarnagin, José Melendez, Yuman Fong, Leslie H. Blumgart	
<b>9</b>	<b>Hilar Cholangiocarcinoma</b> .....	<b>193</b>
	Pierre F. Saldinger, William R. Jarnagin, Leslie H. Blumgart	
<b>10</b>	<b>Gallbladder Cancer</b> .....	<b>213</b>
	David L. Bartlett, Yuman Fong	

**11 Chemotherapy for Liver Tumors**

**A Intra-arterial Chemotherapy for Liver Tumors . . . . . 225**

Samuel Obiekwe, Nancy E. Kemeny

**B Isolated Hepatic Perfusion . . . . . 245**

David L. Bartlett, H. Richard I. Alexander Jr.

**12 Gene Transfer for the Treatment of Hepatobiliary Neoplasms . . . . . 255**

Ronald P. DeMatteo, Yuman Fong

**13 Liver Transplantation for Tumors . . . . . 267**

Myron E. Schwartz, Charles M. Miller

# Preface

Only three decades ago, occurrence of tumor in the liver or biliary tree almost uniformly resulted in death. The recent technological advances in imaging and therapy of hepatobiliary tumors as well as the increasing understanding of the natural history of these tumors, have combined to provide effective treatment and potential cure for patients afflicted with these malignancies. This volume on hepatobiliary tumors published by the American Cancer Society is meant to provide a brief but current summary of the status of the field. Each of the major tumor types is discussed separately. The technical advances in liver surgery and tumor ablation are also emphasized because they represent the most effective and only potentially curative therapies for hepatobiliary tumors. In addition, systemic and regional chemotherapy are discussed. Other exciting areas of treatment are covered, such as gene therapy and liver transplantation which are likely to become important in the near future.

We thank all of the authors for their fine contributions. We are also indebted to Maria Reyes for her expert editorial assistance. We hope that the information contained in this volume will not only help in setting a standard of therapy for one of the most common solid organ tumor groups, but also stimulate further clinical and basic research that will continue the current evolution of clinical care for patients with hepatobiliary cancers.

LHB

YF

WRJ

September 2000