Management of Benign Biliary Stenosis and Injury

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Editors

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A Comprehensive Guide

Editors

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Foreword

In 1920, about 35 years after the introduction of a new operation called cholecystectomy, William Eisendrath of Chicago in the journal we now call *The Journal of the American College of Surgeons* provided case summaries of every bile duct injury that had been reported in the literature up to that time. Already at that time benign biliary stricture, especially iatrogenic biliary stricture, was recognized as a serious problem and a technically challenging one. Throughout the twentieth century many famous surgical leaders including such illustrious names such as Lahey, Maingot, Couinaud, Bismuth, and Blumgart advanced our understanding of the management of benign biliary strictures. The introduction of laparoscopic surgery resulted in a large increase in biliary injuries and challenged us to understand, prevent, and treat this worsening surgical problem. With the advent of biliary endoscopy and interventional radiologic techniques on the biliary tract, new diagnostic and therapeutic options opened for the patient and greatly assisted the performance of surgical operations on the biliary tree.

As a profession we have come a long way in managing the important problems of the biliary tree discussed in this book, but equally we have a long way to go. Dixon, Vollmer, and May—two HPB surgeons and a biliary endoscopist who are well known for their expertise in this area—have produced an outstanding overview of where we are today. Each chapter on a specific topic is balanced by a counterpoint reflecting controversies that still exist. The elephant in the room is still iatrogenic biliary injury but inflammatory causes of benign biliary strictures such as PSC, cholangitis, and pseudotumors receive excellent coverage.

The reader will recognize that the list of authors reads like an international “who’s who” of biliary surgery. Many of the authors have contributed seminal articles to this field in the past decade regarding classification, pathogenesis, diagnosis, and treatment of the various problems. American and Canadian authors are joined by experts from Latin America, Germany, and England. The book is an important contribution to our understanding of this field and will be a resource for all HPB

surgeons and of particular value to HPB fellows. It is hoped that it will need multiple editions due to rapid advances in the treatment of benign disease of the biliary tract. Bon voyage à travers les voies biliaires.

Saint Louis, MO, USA Steven M. Strasberg, F.A.C.S., F.R.C.S(C), F.R.C.S(Ed)

Preface

This book arose following a multidisciplinary session on benign biliary strictures that we co-moderated at a recent Digestive Disease Week/Society for Surgery of the Alimentary Tract (SSAT) meeting. As we discussed the issues surrounding benign biliary strictures and bile duct injuries, we realized that we could not do the topic justice in a short 2-h session—much less a full day event or even a conference. Despite the fact that the biliary system is a cornerstone of the gastrointestinal tract, not to mention a core element of general surgical training, when we tried to come up with a reference list to give to the audience, we were unable to deliver even a few sources that could provide reasonable coverage of this domain in a nuanced way. This book evolved from that inadequacy.

We are very proud to be able to provide you with this compilation, which delivers a diverse group of global thought leaders on these topics. We believe strongly that we have produced a singular text that covers the biliary system in a way that is readable for the novice and, for the expert, highlights areas of controversy. Each chapter is structured in a “point–counterpoint” motif. Each is penned by recognized authorities who offer opposing, sometimes complementary, viewpoints on these often controversial subjects. We believe this allows for a very nuanced discussion of each topic. We hope you enjoy the First Edition of this unique text as much as we have enjoyed crafting it for you.

The first chapter, *Biliary System Anatomy, Physiology, and Embryology*, is expertly written by Cecilia Ethun and Shishir Maithel from Emory University. This offering lays the foundation for the subsequent chapters by providing a comprehensive, but sharp, review of the basics of biliary tract anatomy and function. An important theme the authors emphasize is the biliary tract’s tendency for variation. This will be of major importance for subsequent chapters that concentrate on the anatomic basis of biliary injury. The authors emphasize the importance of the embryologic derivation of the biliary system in an understandable style and discuss the salient elements of biliary physiology in refreshingly simple terms. This is content that each of your students should study before they enter the operating room with you. Moreover, we can attest that even the most seasoned of HPB experts has something to gain by reading this chapter.

The next section of the book addresses primary pathologies, mainly inflammatory and infectious, that affect the biliary system by invoking benign strictures. The first of these is *Primary Sclerosing Cholangitis*, and Debashis Haldar and Gideon Hirshfield from Birmingham, UK, offer an excellent overview of this frustrating disease. They note this to be the classic HPB manifestation of inflammatory bowel disease and lament its currently irreversible nature. They take us on a journey through histopathology, clinical presentation, diagnostics, and therapeutics of this condition. Management controversies are nicely summarized in a table. In his counterpoint piece, Keith Lindor of the Arizona State University points out the curiosity of demographic disparities in PSC incidence and then hones in on promising approaches that may improve the prognosis of this disease. Like the primary authors, he emphasizes the fact that the etiology is multifactorial and thus will require new management paradigms, such as concentration on the gut biome.

Biliary Manifestations of Chronic Pancreatitis are addressed beautifully by Olivier Strobel, Pietro Contin, and Markus Büchler from the Heidelberg University surgical group. They share their broad familiarity with this problem and emphasize the myriad therapeutic options, none of which are uniquely satisfying. Nonetheless, they suggest that surgical interventions are superior to endoscopic procedures for providing a durable solution. The biggest dilemma for surgeons is the decision between drainage alone and resection for dominant strictures, and the authors reinforce that the treatment of the biliary stricture needs to take into consideration the total manifestations of the disease (i.e., pain, insufficiencies). They offer the full platter of options available to the surgeon, with emphasis on the duodenum-preserving techniques they have promulgated. Furthermore, they touch upon how to manage recurrent strictures after initial endeavors fail. David Adams from the Medical University of South Carolina pens a masterful commentary on this piece, borne from his extensive personal experience with this problem. In it, he suggests a renaissance for the simplest of biliary bypass procedures—the choledocoduodenostomy. Like the authors, he underscores the value of optimal patient selection when choosing among the various therapeutic options.

We are privileged to have contributions from the most recognized authorities on *Autoimmune Pancreatitis*. Neil Sengupta and Sunil Sheth from Beth Israel Deaconess Medical Center/Harvard University describe the latest knowledge on this relatively modern clinical entity. Over the last 20 years, a sea change has occurred in clinical management of AIP from more aggressive surgical interventions to now primarily medical management with steroids. This evolution has been driven by the realization that biliary strictures in this circumstance are not necessarily malignant in nature, as was largely assumed previously because of clinical mimicry with pancreatic cancer. The authors provide us with the absolute latest understandings in pathogenesis, diagnostics, and clinical management, including the dilemma of refractory disease. In his commentary, Suresh Chari from The Mayo Clinic offers insight into the nuances of the IgG4-related diseases.

Primarily a disease of the Orient, *Recurrent Pyogenic Cholangitis* is also prevalent elsewhere in the world where patients of Asian descent live. One such concentration is Canada, and Jerome Laurence and Paul Greig provide us with an exhaustive

literature review, as well as their wisdom from treating this condition over the last three decades at the University of Toronto. They emphasize how successful management of this disease pivots on multidisciplinary care, where the interventional radiologist provides tremendous value. That being said, surgery is commonly required to treat the structural consequences of this inflammatory process, and surgical resection is often the most expeditious path forward. One of the world's foremost biliary surgeons, Henry Pitt, from Temple University in Philadelphia augments this fine chapter.

While this collection does not concentrate on malignant diseases, cancer of the biliary tree is, of course, a terrible diagnosis. Unfortunately (or is it fortunately?) benign conditions masquerade as cholangiocarcinoma. This conundrum of *Proximal Biliary Strictures Mimicking Hilar Cholangiocarcinoma* is adroitly presented by Kelly Nahum, Joshua Smith, and William Jarnagin from the Memorial Sloan Kettering Cancer Center. They note that a handful of rare, benign conditions contribute to proximal bile duct obstruction up to a quarter of the time, and they review the broad array of possibilities from Mirizzi's syndrome to tuberculosis. David Nagorney from The Mayo Clinic reflects on this vexing clinical problem. He emphasizes a practical approach to these patients and indicates how attention to basic clinical intuition, gleaned from a careful history and physical exam, can drive smart decisions. In the end, he rationalizes how a strategy of surgical resection is the most reasonable and prudent approach to this very challenging presentation.

In the next chapter *Traumatic Biliary Strictures*, Chad Ball from the University of Calgary, Canada, marks a shift in the book's content to iatrogenic injuries to the biliary system. Dr. Ball is uniquely qualified to author this particular piece—being fellowship trained in both Trauma and Critical Care, as well as HPB surgery. He provides a very practical “how-to” approach to a rare (0.5 % of traumatic laparotomies) but extremely challenging clinical event. While offering his complete tool set for these injuries, he emphasizes drainage approaches (particularly for patients in extremis) and dissuades against direct biliary ligation. One of the most seasoned trauma surgeons in the world, William Schwab from the University of Pennsylvania, provides a sage opinion piece. He, too, emphasizes the importance of damage control of the patient's overall condition in that these injuries rarely occur in isolation and usually involve significant, concurrent vascular and hepatic damage. He also advocates complex cases first be temporized, and then consideration for more complex definitive management be deferred, and furthermore endorses the involvement of HPB specialists at that juncture. The reader will enjoy the handful of pearls Dr. Schwab provides, which can only be delivered by someone who “has been there before.”

Next, the book moves toward rich content on the problem of bile duct injury (BDI). From the time these problems were first recognized and reported, we have often wondered “How could this happen?” Lygia Stewart from the University of California at San Francisco addresses this in her outstanding chapter, *Perceptual Errors Leading to Bile Duct Injury During Laparoscopic Cholecystectomy*. Dr. Stewart uses abundant illustration to help us understand what our mind sees as we carry out laparoscopic cholecystectomy (LC). She introduces us to the field of

neurocognition and to phrases such as “visual perceptual illusion,” “surgical sense making,” “haptic perception,” “human error analysis,” and “framing.” Former SAGES President Nathaniel Soper’s opinion piece beautifully complements the primary chapter. In it, he offers practical tips to overcome the “error traps” that our mind may set. He emphasizes a systematic approach to safety during LC including developing the “critical view.” The principles he preaches in this piece have not wavered in the two decades since he pioneered the operation.

The Heuristics and Psychology of Bile Duct Injuries by Francis Sutherland of the University of Calgary is, quite simply, a must-read. This builds on the more abstract notions offered in the previous chapter by Dr. Stewart to provide a framework of how to interpret the operative field during cholecystectomy. An apropos analogy would be that Dr. Sutherland gives us the insight for “slowing down the game” as many championship athletes are able to do when under pressure. We would encourage you to introduce this chapter to all your trainees who are learning LC. John Hunter from the Oregon Health Sciences University, another past-President of SAGES and the SSAT, urges you to develop a “strategy” to this operation. He also offers tools that might help you emerge when you get lost in the imagery during dissection.

Early in the progression of laparoscopic cholecystectomy (early 1990s), it was alarmingly evident that bile duct injury was on the rise. Once enough case reports had accrued, it became obvious that certain patterns of injury were occurring, and better understanding of the problem would benefit from some standardized nomenclature. Edmund Bartlett and Charles Vollmer from the University of Pennsylvania provide us with *The Classification and Injury Patterns of Iatrogenic Bile Duct Injury During Cholecystectomy*. In this chapter, they describe some of the important initial systems (Strasberg/Way) and review the now dizzying array of extensions. They emphasize the balance sought with these systems between utility and granularity and lament the poor association of these schemes with outcomes. Dirk Gouma, a globally recognized authority on this topic from the Academic Medical Center in Amsterdam, provides an astute commentary based on his experience. In it, he espouses the merits of the most modern, comprehensive, and flexible system—ATOM.

Legal Implications of Biliary Injury is a special contribution to the book. Steven Raper from the University of Pennsylvania is a savvy gastrointestinal surgeon who also holds a degree in law. He is uniquely qualified to provide insight to a very difficult problem that many general surgeons will likely encounter at least once in their career. Bile Duct Injuries are among the most litigious events in surgery, and Steve navigates us through the choppy waters that they bring. Specifically, he focuses on the process of informed consent and also cautions proper documentation habits for our operative reports. Keith Lillemoe, the Chairman of Surgery at the Massachusetts General Hospital, is a widely recognized expert in the management of biliary injury. His plain talk commentary provides practical advice on how one can defend against, or even avoid, malpractice claims. Importantly, he alerts us as to what really goes on in the courtroom. Due to the paucity of literature on this subject, this particular dyad is essential reading that you will be unable to find elsewhere.

The next few chapters focus specifically on the management of bile duct injuries when they occur. We have broken these chapters down into what we believe are the commonest scenarios that occur in the real world. Kicking this off is a chapter written by Jeff Barkun and Prosanto Chaudhury from McGill University. *Intraoperative Management of Bile Duct Injuries by a Non-biliary Surgeon* puts the reader in the operating room during a difficult cholecystectomy and discusses actual scenarios and how these can be best managed by a nonexpert in biliary surgery. It is extremely pragmatic and should be required reading for all general surgeons and trainees. Dr. Mark Callery from Harvard University provides the “counterpoint” to this and continues with a very practical discussion of what is a rare, but extremely anxiety provoking, scenario. This especially resonates in a time when conversion from laparoscopic to open cholecystectomy is not viewed by many new graduates as good option for the difficult cholecystectomy.

There is some debate and some variability in how bile duct injuries are approached when they are not identified at the index operation. To highlight the difference in how these might be approached, we have compiled three separate chapters. *Management of Bile Duct Injuries Within the First Forty-Eight Hours* is written by John Christein and countered by Miguel Mercado—both are among the most experienced surgeons in the world with this problem. *Operative Repair of Common Bile Duct Injury* follows and is deftly authored by Dr. OJ Garden from Edinburgh (counterpoint by Dr. Javier Lendoire). These chapters walk the reader through all the different presentations and injury patterns and discuss how best to manage them. There is significant dispute and controversy surrounding these topics, which is nicely highlighted in the counterpoint pieces. The chapter *Non-operative Management of Bile Duct Injury During Laparoscopic Cholecystectomy* presents expert perspectives from both a therapeutic endoscopist (Guido Costamagna), as well as that of an interventional radiologist (Rich Shlansky-Goldberg), emphasizing the truly critical nature of multidisciplinary collaboration in the successful management of the variety of clinical presentations of benign biliary strictures and injuries.

As a result of the relatively common occurrence of isolated right-sided posterior sectoral duct injuries, and the debate about how best to manage this injury, we have a separate chapter on *Management of Isolated Sectoral Duct Injury* written by Dr. Michael House with the counterpoint covered by Dr. Reid Adams. This topic always raises debate: repair, simply ligation, Roux-en-Y hepaticojejunostomy reconstruction, or liver resection? Even for expert biliary surgeons, very few groups have amassed a significant series of these injuries. These experts walk us through the possibilities and discuss the ideal management algorithm for this injury.

The chapters *Liver Resection for Bile Duct Injury* and *Liver Transplantation for Common Bile Duct Injury* written respectively by Drs. Michael McCall/Elijah Dixon and Alex Bressan/Will Chapman discuss the management of certain patients who progress down the treatment algorithm tree to the most severe and significant injuries. Both chapters provide succinct summaries of the worldwide literature on these topics and offer simple and practical approaches to the scenarios where these procedures potentially come into play in the treatment armamentarium.

The corresponding counterpoints written by Tim Pawlik and Al Hemming highlight how little we truly know about these patients because of the rare need to perform these unconventional procedures.

Finally the last two chapters *Biliary Strictures from Liver Transplantation* written by Shimul Shah (counterpoint by Dr. Kim Olthoff) and *Recurrent Biliary Strictures After Initial Biliary Reconstruction* authored by Eduardo De Santibanes from Argentina both discuss advanced reoperative hepatobiliary and transplantation surgery. These are both relatively rare scenarios—even for the expert HPB or transplant surgeon. Using an evidence-based approach, the authors have highlighted the important principles of management for these patients. These chapters will appeal to the expert biliary surgeon.

In this First Edition, we believe we have crafted a single reference book that covers benign biliary strictures and injury in their entirety, while doing justice to the areas of controversy. Large sections of this book apply to the general surgeon in training, the practicing general surgeon, and even the expert biliary surgeon. We wish to thank the fine authors for all the thought and effort that has gone into each chapter. Hopefully you, the reader, find this to be an invaluable reference over the course of your career.

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