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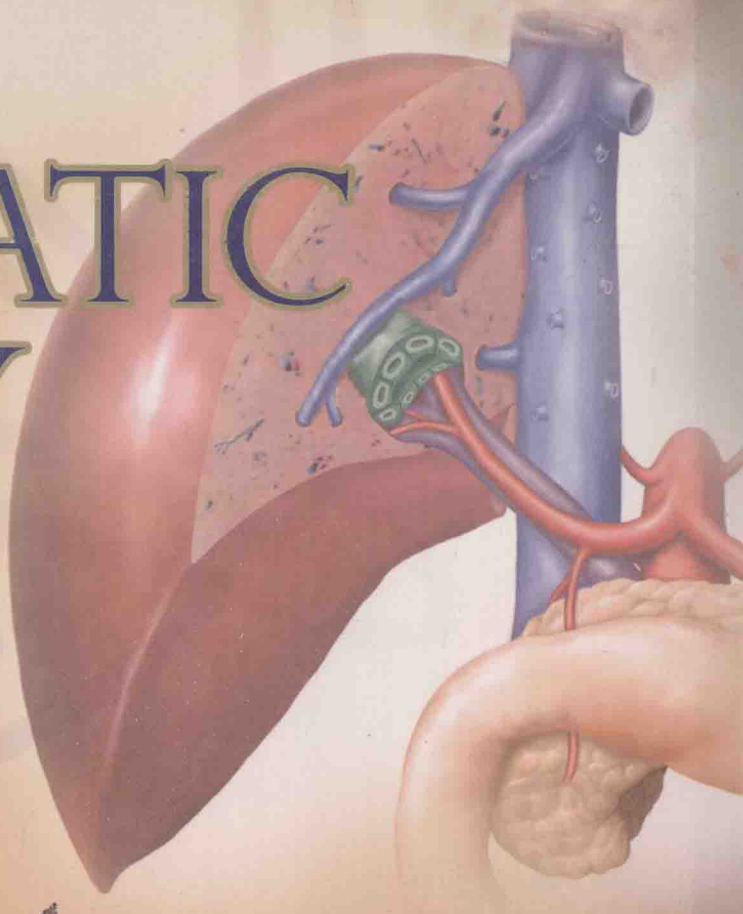
# HEPATOBILIARY AND PANCREATIC SURGERY



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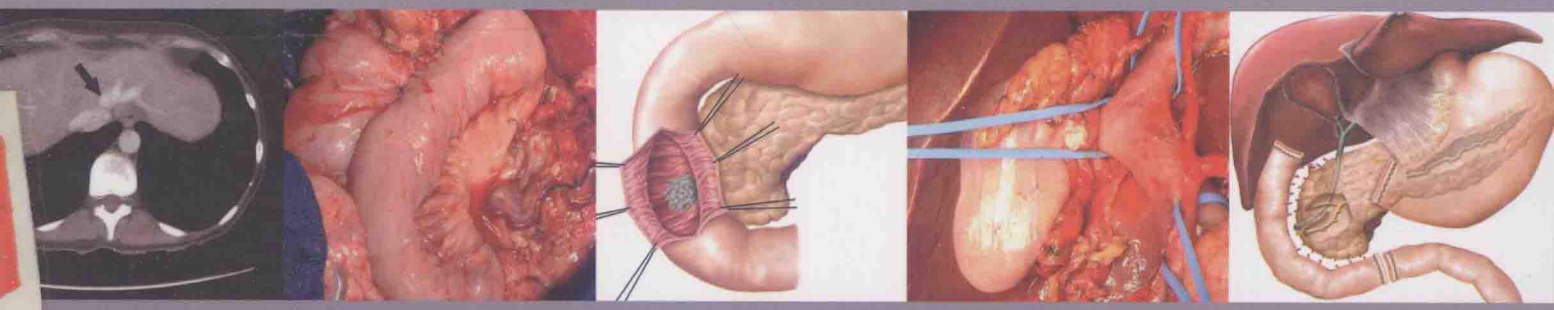

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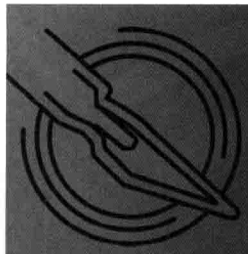

Master Techniques in Surgery

# HEPATOBILIARY AND PANCREATIC SURGERY

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*To my wife, Cheryl, and children Chris, Shannon, Becky, and Heather, for your many years of support; and to the surgical trainees who drive each of us to be at our best each and every day.*

*—K.L.*

*To my family, my colleagues, and mentors, but most of all to my trainees and patients, who motivate us to always to strive for excellence.*

*—W.J.*

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This series of mini atlases, of which this is the fourth, is an outgrowth of Mastery of Surgery. As the series editor, I have been involved with Mastery of Surgery since the third edition, when I joined two greats of American surgery Lloyd Nyhus and Robert Baker who were the editors at that time. At that time, in addition to Mastery of Surgery, which really was, almost in its entirety, an excellent atlas of how to do operations, atlases were common and some quality atlases which existed at that time by Dr. John Madden of New York, Dr. Robert Zollinger of Ohio State, and two other atlases, with which the reader may be less familiar with is a superb atlas by Professor Pietro Valdoni, Professor of Surgery at the University of Rome, who ran 10 operating rooms simultaneously, and as the Italians like to point out to me, a physician to three popes. One famous surgeon said to me, what can you say about Professor Valdoni: "Professor Valdoni said to three popes, 'take a deep breath,' and they each took a deep breath." This superb atlas, which is not well known, was translated by my partner when I was on the staff at Mass General Hospital, Dr. George Nardi from the Italian. Another superb atlas was that by Dr. Robert Ritchie Linton, an early vascular surgeon whose atlas was of very high quality.

However, atlases fell out of style, and in the fourth and fifth editions of Mastery of Surgery, we added more chapters that were "textbooky" types of chapters to increase access to the increasing knowledge base of surgery. However, atlases seem to have gone out of favor somewhat. In discussing with Brian Brown and others of Lippincott, as well as some of the editors who have taken on the responsibility of each of these mini atlases, it seemed that we could build on our experience with Mastery of Surgery by having individual books which were atlases of 400 to 450 pages of high quality, each featuring a particular anatomical part of what was surgery and put together an atlas of operations of a sharply circumscribed area. This we have accomplished, and all of us are highly indebted to a group of high quality editors who will have created superb mini atlases in these sharply circumscribed areas.

Why the return of the atlas? Is it possible that the knowledge base is somewhat more extensive with more variations on the various types of procedures, that as we learn more about the biochemistry, physiology, genetics and pathophysiology in these different areas, there have gotten to be a variation on the types of procedures that we do on patients in these areas. This increase in knowledge base has occurred simultaneously at a time when the amount of time available for training physicians—and especially surgeons—has been diminished time-wise and continues to do so. While I understand the hypothesis that brought the 80-hour work week upon us, and that limits the time that we have for instruction, and I believe that it is well intentioned, but I still ask the question: is the patient better served by a somewhat fatigued resident who has been at the operation, and knows what the surgeon and what he or she is worried about, or a comparatively fresh resident who has never seen the patient before?

I don't know, but I tend to come down on the side that familiarity with the patient is perhaps more important. And what about the errors of hand off, which seem to be more of an intrinsic issue with the hand off which we are not able to really remedy entirely rather than poor intentions.

This series of mini-atlases is an attempt to help fill the voids of inadequate time for training. We are indebted to the individual editors who have taken on this responsibility and to the authors who have volunteered to share their knowledge and experience in putting together what we hope will be a superb series. Inspired by their

experience of teaching residents and medical students, a high calling, matched only by their devotion and superb care they have given to thousands of patients.

It is an honor to serve as the series editor for this outstanding group of mini-atlases, which we hope will convey the experiences of an excellent group of editors and authors to the benefit of students, residents and their future patients in an era in which time for education seems to be increasingly limited.

Putting a book together, especially a series of books is not easy, and I wish to acknowledge the production staff at Lippincott, Wolters Kluwer's including Brian Brown, Julia Seto, Brendan Huffman and many others, and my personal staff in the office who include Edie Burbank-Schmitt, Ingrid Johnson, Abigail Smith and Jere Cooper. None of this would have been possible without them.

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# Preface

Forty years ago, many of the operations described in this volume were performed rarely, if at all, and almost never outside of a few highly specialized referral centers. Over that relatively short span of time, hepatobiliary/pancreatic (HPB) surgery has progressed from a high-risk proposition, practised by a small band of pioneering surgeons, to relatively common practice, with the expectation of good outcomes for the vast majority of patients. Indeed, HPB surgical procedures are now widely performed, from academic tertiary referral centers to community hospitals, and the indications for many procedures continue to expand.

Many factors have played a role in the transformation of this field, not the least of which has been improvements in operative and perioperative care generally. Another major factor has been the evolution of HPB surgery into a recognized area of specialization. The early practitioners, many of them legendary figures in surgery, laid a solid foundation and passed on the knowledge of many hard lessons learned over the years. The next generation expanded this knowledge base and refined the surgical techniques and management approaches that propelled HPB surgery into the mainstream. With the framework established, it then became possible to shift the focus to improving outcomes in patients with HPB-related diseases, rather than merely surviving the perioperative period. It is our charge now to continue to advance the field, not only by further improving the safety of the operations, but to better align the indications with an increasing understanding of the disease processes in order to improve patient selection.

We are the beneficiaries of these several decades of hard work on the part of many surgeons, to whom we owe a large debt of gratitude. While their efforts set the stage to allow the routine performance of major HPB surgical procedures, the margin of error remains very narrow. These operations can be very challenging from a technical standpoint, and even minor miscalculations can have profound adverse consequences.

This atlas is meant to provide detailed description of the technical aspects of liver, biliary and pancreatic operations, many commonly performed but others less so. We are indebted to our co-authors, all experts in the field, who have shared their insights into these procedures based on their extensive experience. Although the focus is on the technical conduct of operative procedures, efforts are made to include discussion of indications/contraindications, preoperative assessment and perioperative management. Our aim was to provide a volume valued equally by trainees and established HPB surgeons.

We wish to express our thanks and appreciation to all who have contributed to the publication of this book, especially our esteemed publisher, Wolters Kluwer, for their patience and tremendous assistance throughout the project and for providing first class artistic support for the many illustrations.



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# 1 Pancreaticobiliary Surgery: General Considerations

**Steven C. Cunningham, Aram N. Demirjian, and Richard D. Schulick**

## Surgically Relevant Anatomy

The pancreas is a large, asymmetric gland lying in the central retroperitoneum, consisting of the head, neck, body, and tail. The pancreatic head lies at just right of the L2 vertebral body and extends in an oblique course to the left over the spine, cephalad, and then slightly posterior until the tail terminates near the splenic hilum, at the level of T10. The neck is often defined as that portion of the gland overlying the superior mesenteric artery and vein (SMA and SMV), and separating the head to the right from the body to the left. The dividing line between the body and tail hardly exists and is not surgically relevant. The uncinate process of the pancreas is embryologically separate from the rest of the pancreas and in adults extends from the inferior lateral head of the gland, extending slightly posterior to the SMV and terminating at the SMA (Fig. 1.1).

The arterial supply to the pancreas is abundant and comes via multiple named and unnamed vessels from both the celiac axis and the SMA, a fact largely responsible for the ability of the pancreaticoduodenectomy resection specimen to bleed abundantly until the last fibers of tissue are divided. The head is richly supplied by anastomosing branches of the pancreaticoduodenal arteries, while the body and tail are predominantly supplied by branches of the splenic artery and jejunal branches. The collateral flow often present between the SMA and the celiac axis, chiefly through the gastroduodenal artery (GDA), becomes very important at pancreaticoduodenectomy, during which the GDA is typically divided. In all cases, flow in the hepatic artery is confirmed during clamping of the GDA to detect cases in which hepatic artery flow is significantly dependent on SMA-celiac axis collaterals. In such cases, arterial bypass, preservation of the GDA, or division of a median arcuate ligament may be necessary, depending on the clinical scenario. In all cases, one must be aware of aberrant hepatic arterial anatomy (vida infra), which is common (>25% of cases) and is more commonly replaced than accessory (Fig. 1.2).

The venous drainage of the pancreas is predominantly portal, excepting small unnamed retroperitoneal veins that may drain posteriorly into the lumbar system and

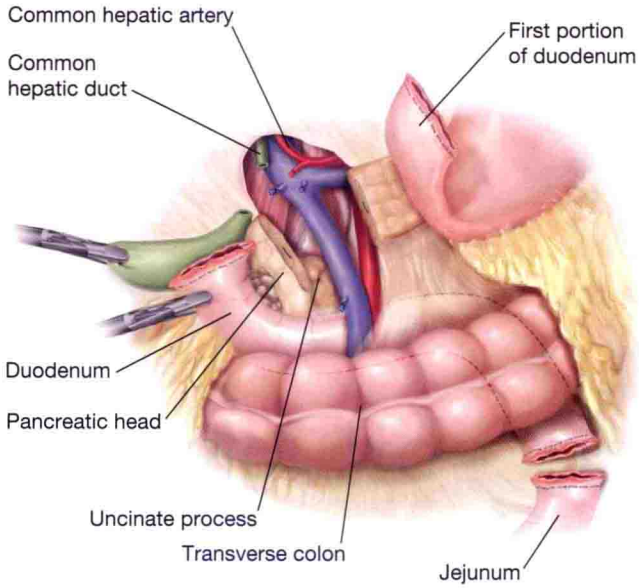


**Figure 1.1** Illustration showing the relationship of the divided duodenum, common hepatic duct, jejunum, and pancreas to its surrounding structures.

may in cases of portal hypertension become clinically relevant. The predominantly portal drainage of the pancreas accounts for the preponderance of liver metastases compared with lung metastases in cases of advanced pancreatic cancer. The pancreatic head and uncinate process drain via pancreaticoduodenal veins that run with the pancreaticoduodenal arteries and drain into the SMV and portal vein, while the body and tail drain via the splenic vein. During pancreaticoduodenectomy several prominent named veins must be ligated and divided at their confluence with the SMV in order to dissect the neck of the pancreas from the SMV. These include the gastroepiploic vein caudal and to the left, and the vein of Belcher, cephalad and to

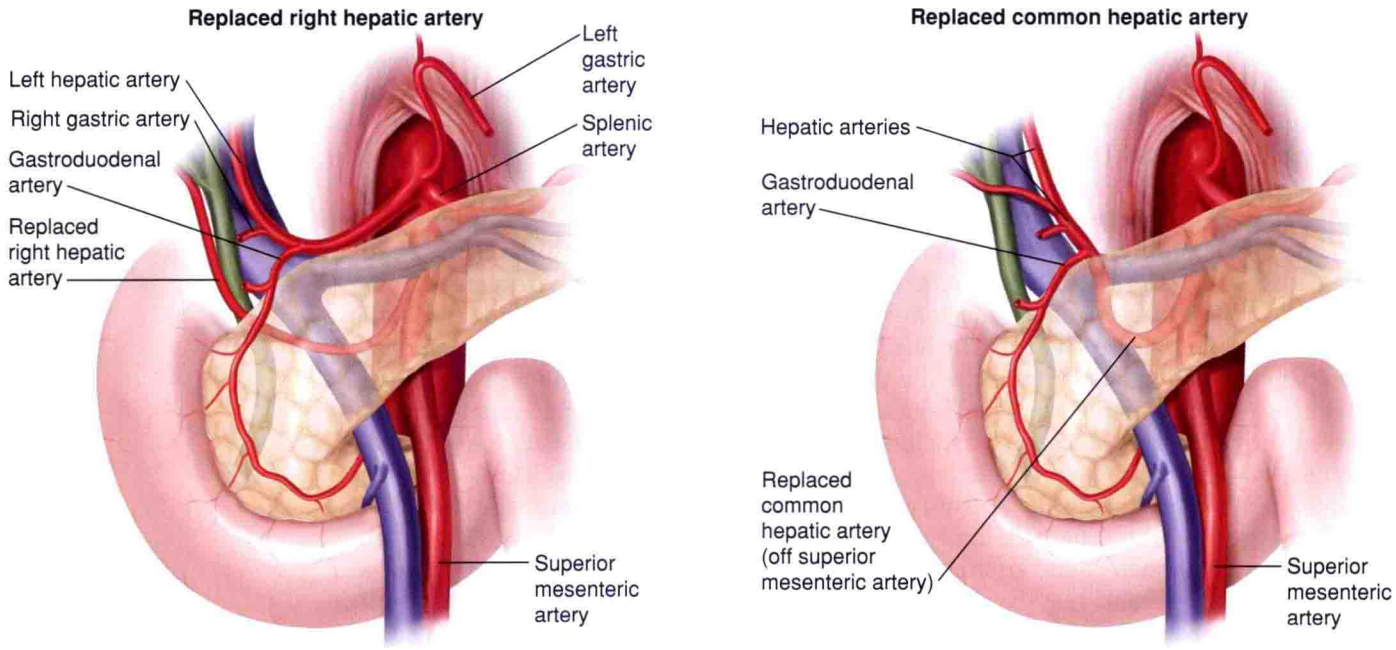


**Figure 1.2** Illustrations demonstrating the variable arterial anatomy that can be encountered during pancreaticoduodenectomy. Also noted is the relationship of the neck of the pancreas to the celiac axis, the superior mesenteric artery, the hepatic artery, and the portal vein/superior mesenteric vein confluence.

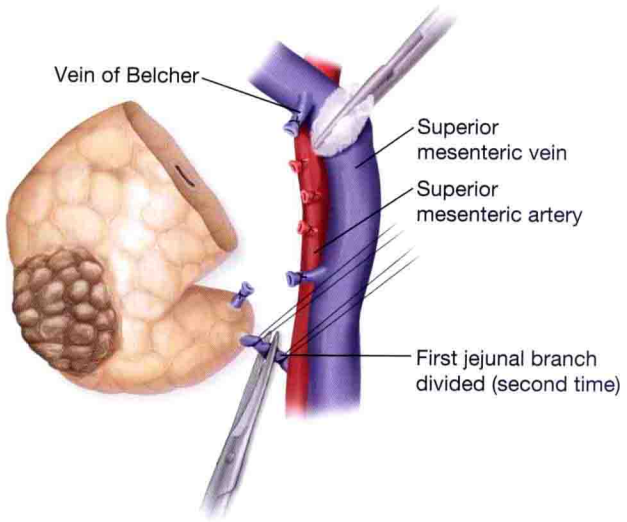


**Figure 1.3** Figure illustrating the portal vein/superior mesenteric vein confluence and the superior mesenteric artery following division of the neck of the pancreas and the uncinate process. Note the Vein of Belcher and the First Jejunal branch which can be particularly troublesome if not properly identified, ligated, and divided.



the right. After division of the neck of the pancreas, a first jejunal vein is sometimes ligated and divided at its confluence with the SMV during division of the uncinate process (Fig. 1.3).

The vascular anatomy of the pancreas and surrounding structures is crucial to the surgical care of pancreaticobiliary patients, and in fact, often determines resectability of malignant masses. Typically, patients without metastatic disease are grouped into three categories of resectability, depending on the vascular involvement by the tumors: Resectable, borderline, and unresectable. Borderline patients were first defined by the MD Anderson group and may have either encasement of a short segment of the hepatic artery (but no extension to the celiac axis) that is amenable to resection and reconstruction, or tumor abutment (viz, <180 degrees) of the SMA, or short-segment occlusion of the SMV or portal vein that is amenable to resection and reconstruction. Tumor encasement (viz, ≥180 degrees) of the SMA by the tumor typically constitutes a locally advanced, unresectable tumor.

Pancreatic lymphatic vessels travel from the acini and follow the arteries to drain into peripancreatic lymph nodes. The head and neck of the pancreas drain widely into pancreaticoduodenal nodes, superior mesenteric nodes, hepatic artery nodes, pre-aortic, and celiac axis nodes. The body and tail drain predominantly into pancreaticosplenic nodes with a minority of channels draining into pre-aortic nodes. The pancreatic islets have no lymphatics.

The exocrine pancreas is richly innervated with both sympathetic and parasympathetic fibers (the endocrine pancreas is innervated almost exclusively by the parasympathetic system). Sensory fibers from the pancreas travel through the celiac plexus, at which point they are available for ablation, typically via ethanol splanchnicectomy in cases of severe, chronic pain from pancreatitis or locally advanced malignancy.

The extrahepatic biliary tree, as well as associated arteries, is aberrant in one way or another at least as often as they are typical. Although discussion of all the variations of the hepatic, cystic, and common bile ducts, as well as the cystic and hepatic arteries, is beyond the scope of this chapter, aberrancies of the right and left hepatic arteries are worthy of further mention. The most reliable measurement of the frequency and type of hepatic artery aberrancies likely comes from autopsy studies in the 1950s by Michels, who described in a series of 200 autopsies, that 26% of bodies had aberrant right, and 27% aberrant left, hepatic arteries. On both sides, replaced was more common than accessory arteries (60% replaced on the right and 70% on the left). The practicing pancreaticobiliary surgeon must be familiar with standard as well as aberrant anatomy of the extrahepatic biliary tree and associated arteries (Fig. 1.2).

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