Atlas of Gastrointestinal Surgery

胃肠道外科手术图谱

（上卷）

Volume Ⅰ

Emilio Etala

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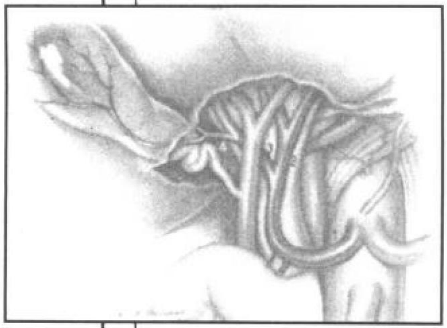

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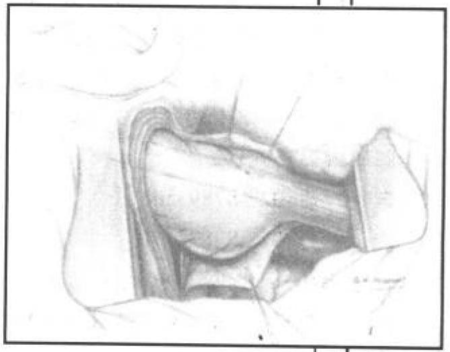
Volume I



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Atlas of
Gastrointestinal Surgery

Volume I

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To my wife Celia
To the memory of my parents

Foreword

I first met Dr. Emilio Etala in Ireland at the meeting of the International Society of Surgery in 1961. A true friendship having been established there, it remains to this day.

Dr. Etala has garnered many honors as a surgeon, among them: membership in the Societe Internationale de Chirurgie (1956) and election to the Honorary Fellowship in the American College of Surgeons (1971). It was my honor as Presenter to him of that election to the ACS.

Without reservation, this is an important work, destined to become an integral part of every general surgeon's library. Unique in its single authorship, *Atlas of Surgery of the Gastrointestinal Tract* provides detailed explanations of all techniques performed on all organs of the gastrointestinal tract and a wealth of exquisitely detailed clinical observations not readily available in the existing surgical literature. This can only serve to improve the safety of each operation and to prevent complications. All of these qualities are evident throughout the book, but none are more evident than in the chapters on *Choledochal Cysts* and *Portal Hypertension,* which mandate reading from anyone who is preparing to perform any of these procedures.

Illustrations are critical to the explanation of any surgical procedure and I give this presentation here the highest possible praise. The outstanding art throughout this volume is the work of a single artist who worked closely with Dr. Etala throughout the performance of every operation depicted. Each illustration rendered is from the surgeon's perspective, which provides the reader with a highly accurate view of the operative field and the related surgical anatomy at each step of each operation.

I am pleased to see this wonderful book come to fruition. Dr. Etala is a surgeon *non pareil.* His work here is destined to become a world classic. Shakespeare may best describe Dr. Etala and his work:

I dare do all that becomes a man, who dares do more is none.

John L. Madden, MD

Preface

The completion of the Atlas of Gastrointestinal Surgery would have filled Master Professor of Surgery Pablo L. Mirizzi, whose name is inseparable from operative cholangiography and biliary tract surgery, with satisfaction.

This book describes the surgical procedures used to treat diseases of the gastrointestinal tract. However, the author has always had the conviction that an atlas of surgery should not be limited to a description of surgical techniques, because this means an incomplete vision of reality. So, in addition to the description of the surgical anatomy, the clinical picture, the preoperative and intraoperative diagnosis, and the surgical indications are also presented. It has been proven that the success of an operation does not depend exclusively on surgical technique but is influenced by other factors, such as the stage of the illness, the opportunity of the operation, and the selection of the procedure to be used. All these factors should be carefully contemplated by the surgeon, since they may be decisive in diminishing the number of complications.

For more than 30 years, the author has conducted courses in gastrointestinal surgery for graduate students with surgical sessions transmitted directly. This has allowed the author to understand the most common difficulties that affect graduates with a desire to learn.

The surgical procedures described in this atlas are those that are practiced by the author, and they have produced good results. Alternative techniques are described in separate chapters for when the usual procedures are inappropriate or contraindicated.

Care has been taken to avoid publishing an encyclopedia which could lead to confusion or uncertainty. Afflictions have been detailed that, though rare, can be mortal if not treated adequately and promptly. These illnesses are not usually included in an atlas of surgery. Examples of these illnesses are complicated diverticuli of the second or third portion of the duodenum, gastric ulcers of the cardia, pancreaticocutaneous fistulas, and duodenal fistulas.

The descriptions of surgical techniques have been written to include both manual suturing and staplers. The most accepted laparoscopic procedures have also been described.

This atlas has been written by a single author. This is not the usual present day practice. However, a book written by a single experienced author offers great uniformity and, at times, is a necessity.

The illustrations are the work of the excellent artist Carlos A. Vescovo. The author and the artist have collaborated very closely to present the most representative and, at the same time, didactic illustrations. The illustrations were made directly in the operating room and later modified to make them more representative and explicit for teaching purposes.

This atlas can be useful for both general surgeons and gastrointestinal surgeons. Colonic surgeons and anorectal surgeons will also find it useful, as well as senior surgeons who may need a concise update of infrequently performed procedures.

The atlas was translated into English by Dr. Alfred L. Axtmayer of Puerto Rico, who has realized the difficult task of interpreting the author's concepts with fidelity. The author would like to express his deepest gratitude.

The author has also been privileged by Dr. John L. Madden of New York, who has written the Foreword. Dr. Madden is one of the world's masters of surgery and the author of an Atlas of Surgery that has spread to all the countries of the world. The author is grateful for Dr. Madden's constant encouragement.

Williams and Wilkins has not limited its efforts in producing an excellent book, for which the author expresses deep gratitude.

Mr. Carroll C. Cann, Executive Editor, has been a great proponent of the book, and the author is grateful for the continuous and extraordinary enthusiasm shown by him in overcoming all difficulties

The author is also grateful to Ms. Susan Hunsberger for her excellent work in organizing and coordinating the atlas.

To Mr. Peter Carley, Production Coordinator, whose work was a decisive factor in publishing the Atlas, as well as to Mr. Andrew Potter for his brilliant task in correcting manuscripts, the author gives his sincere gratitude.

Emilio Etala, M.D.
Buenos Aires

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Volume Ⅱ 第Ⅱ卷

PART I

Surgery of the Hepatobiliary Tract and Pancreas

Section A
Surgery of the Biliary Tract

CHAPTER 1

Surgical Anatomy of the Extrahepatic Biliary Tree

Guy de Chauliac (1300–1368), a famous surgeon from Avignon, France, stated that "good surgery cannot be performed without knowing anatomy." This knowledge of anatomy is fundamentally important in surgery of bile ducts. The biliary tract surgeon confronts a situation of innumerable anatomic variations, which may present at the hepatic hilum and extrahepatic bile structures. The surgeon must be thoroughly familiar with the normal anatomy and with the more frequent variations that occur. Before ligating or dividing a structure it must be precisely identified to avoid dire consequences.

GALL BLADDER AND CYSTIC DUCT

The gall bladder is located on the inferior surface of the liver and held to its bed by peritoneum. The dividing line between the right and left lobes of the liver passes through the bed of the gall bladder. The gall bladder is a pear-shaped sac 8 to 12 cm in length and 4 to 5 cm in maximal diameter, with a capacity of 30 to 50 mL. When distended, however, it may reach a capacity of some 200 mL. The gall bladder serves the function of receiving the bile and concentrating it. It is normally bluish in color, a combination of its translucent walls and the contained bile. This translucence is lost when the walls are opacified by inflammation.

The gall bladder is described as divided in three segments, which are, however, without precise demarcation: the fundus, the body, and the infundibulum.

1. The fundus of the gall bladder is that part which projects beyond the anterior border of the liver and is completely covered with peritoneum. The fundus is the segment of the gall bladder that becomes palpable when the gall bladder is distended. The fundus projects onto the anterior abdominal wall at the in-

tersection of the ninth costal cartilage with the lateral border of the right rectus muscle, although numerous variations occur.

2. The body of the gall bladder follows the fundus, and its diameter diminishes progressively more distally. The body is not totally covered with peritoneum; the peritoneum binds it to the inferior surface of the liver. Thus the inferior surface of the gall bladder is covered by peritoneum while the superior surface is in contact with the inferior surface of the liver, from which it is separated by a layer of areolar connective tissue through which blood vessels, lymphatics, nerve fibrils and, occasionally, accessory hepatic ducts traverse. At cholecystectomy, the surgeon should enter and exploit this areolar cleavage plane. This will permit bloodless surgery. When the cleavage plane has been obliterated by disease, the hepatic parenchyma is frequently traumatized and bleeding results.
3. The infundibulum, the third portion of the gall bladder, follows the body with diminishing diameter and is covered by peritoneum. It is within the hepatoduodenal ligament and usually protrudes anteriorly. The infundibulum is referred to as Hartmann's pouch, but we believe that Hartmann's pouch is the result of a pathologic process consequent to impaction of a calculus at the inferior infundibulum or in the neck of the gall bladder. This in turn produces dilation of the infundibulum and this dilation results in the formation of the pouch. The pouch, in turn, hinders the cholecystectomy owing to the adhesions it provokes to the cystic or the common duct. Hartmann's pouch is to be considered a pathologic alteration insofar as the normal infundibulum does not have the form of a pouch.

The gall bladder consists of a layer of tall epithelial cylindrical cells and a thin fibromuscular layer consisting of longitudinal, circular, and oblique muscle fibers plus fibrous tissue covering the mucosa. The gall bladder has no submucosa nor muscularis mucosa. It has no mucous glands and occasionally may present scant mucous glands, which may be more numerous in cases of inflammation. The mucous glands are located almost exclusively in the neck. The fibromuscular layer is covered by a layer of areolar connective tissue through which blood and lymphatic vessels and nerves traverse. This is the plane to be sought to perform a subserosal cholecystectomy. This areolar plane is in continuity with that which separates the gall bladder from the liver at the hepatic bed. The infundibulum is in continuity with the neck whose length is 15 to 20 mm and angles acutely upward with the angle opening superiorly.

CYSTIC DUCT

The cystic duct joins the gall bladder and the hepatic duct to form the choledochus. It is 4 to 6 mm long, although it may measure up to 10 to 12 cm. It may be short or even nonexistent. The proximal diameter of the cystic duct is usually 2 to 2.5 mm, somewhat smaller than the distal diameter, which is some 3 mm. Viewed from the outside it appears irregular and convoluted specially in its proximal half or two-thirds owing to the presence of Heister's valves. Viewed from the inside, it presents Heister's valves, which are semilunar and present in alternate sequence giving the impression of a continuous spiral. This is inexact, however, since the valves are individually separate from each other. Heister's valves regulate the flow of bile between the gall bladder and the biliary passages. The cystic duct usually joins the hepatic duct in the superior half of the hepatoduodenal ligament, usually at the right border of the hepatic duct and usually at an acute angle, thus forming the cystohepatic angle. The cystic duct may enter the common duct perpendicularly. The cystic duct may also join the hepatic duct after coursing parallel to the hepatic duct joining it behind the first portion of the duodenum, in the pancreatic area, and even near to or at the papilla forming a parallel junction. It may join the hepatic duct in front or behind the hepatic duct, entering it, not on the right side of the hepatic duct, but on its left border or its anterior wall. This rotation about the hepatic duct would be described as a spiral union. Mirizzi has called this variant a banding cystic duct. This may give rise to the hepatic syndrome of Mirizzi (27, 29). Rarely the cystic duct enters the right or left hepatic duct.

HEPATIC DUCT

The biliary ducts originate within the liver as bile canaliculi that receive the bile excreted by the hepatic cells and join among themselves, forming larger and larger ducts, giving rise to the right and left hepatic ducts from the right and left lobes of the liver respectively. The right and left hepatic ducts join to form the common hepatic duct, usually extrahepatically. The right hepatic duct is generally more intrahepatic than the left. The length of the common hepatic duct is very variable and depends on the level at which the left and right hepatic ducts join. The length of the common hepatic duct also depends on the level of its union with the cystic duct to form the choledochus. The common hepatic duct is usually 2 to 4 cm long, although a length of 8 cm is not infrequent. The diameter of the common hepatic and the common bile duct is usually 6 to 8 mm. The normal diameter may be up to 12 mm. However, ducts of normal diameter may harbor calculi as seen in recent cases

(27, 30). There is obviously an overlap of normal and pathologic common ducts as to their size and diameter. Previously cholecystectomized patients may increase the diameter of their choledochus and so may the elderly. The hepatic duct is covered with high cylindrical epithelium over a lamina propria that contains mucous glands. A fibroelastic tissue layer covers the mucosa and contains some muscular fibers. Mirizzi described a sphincter at the distal portion of the hepatic duct. Because no muscle cells were found, he labeled it a functional sphincter of the common hepatic duct (27, 28, 29, 32). Lang (23), Geneser (39), Guy Albot (39), Chikiar (10, 11), and Hollinshead and others (19), have demonstrated muscle fibers in the hepatic duct. To demonstrate these muscle fibers, it is essential to proceed immediately to fixation of the tissue upon obtaining the sample, since autolysis rapidly supervenes both in biliary and in pancreatic ducts. With these precautions in mind, we have confirmed with Dr. Zuckerberg the presence of muscle fibers in the hepatic duct.

CHOLEDOCHUS

The choledochus is 5 to 15 cm in length (usually 8 to 10 cm). It is situated, like the common hepatic duct, at the free border of the hepatoduodenal ligament. To its left and in the same anterior plane is the hepatic artery. The portal vein is in a posterior plane and closer to the hepatic artery than to the choledochus. The cystic duct joins the hepatic duct generally superior to the first portion of the duodenum. The choledochus passes behind the first portion of the duodenum, continues downward and to the right along a groove or tunnel provided by the head of the pancreas, and enters the second portion of the duodenum along the internal (lesser curvature) portion of the duodenum and at an angle of 45 degrees. The choledochus enters the wall of the duodenum and joins the pancreatic duct, forming a common channel that empties through the duodenal papilla.

The common duct may be described in four segments:

1. Supraduodenal, usually 20 mm long. This is the segment more readily accessible at surgery and with the lower hepatic duct provides access for choledochotomy and biliary tract exploration (39).
2. Retroduodenal segment, 15 to 20 mm in length.
3. Infraduodenal extrapancreatic segment, 20 to 30 mm in length, which courses along the head of the pancreas in a groove or tunnel to reach the duodenum at its second portion.

   A cleavage plane between the choledochus and the pancreas can usually be found because the pancreas and choledochus do not adhere to each other except in cases of chronic pancreatitis in the area of the head of the pancreas. In these cases it is quite impossible to separate the choledochus and the pancreas, and the choledochus may even be obstructed by the pancreatic thickening and fibrous tissue infiltration. If the situation of choledochal-pancreatic fusion does not exist, retropancreatic choledochotomy may be performed to remove an impacted calculus that has not been removable from above nor by transduodenal sphincterotomy.
4. Intraduodenal or intramural segment. As the choledochus traverses the wall of the duodenum its caliber diminishes considerably and its walls get thicker. This is to be borne in mind when interpreting cholangiography. Furthermore, at operative cholangiography the dye that has passed into the duodenum can give rise to superimposition of shadows, hindering a clear view of the intramural segment of the choledochus. In these cases films should be repeated and a clear view of the terminal choledochus obtained. The length of the intramural choledochus is very variable but always more than the thickness of the duodenal wall. This is explained by the oblique trajectory of the choledochus as it traverses the duodenal wall. The length of the transduodenal choledochus is 14 to 16 mm (39). During its intramural path the choledochus and the pancreatic duct join in various forms. These may be described as occurring in three principal manners (18, 21, 22, 48), as follows:
   I. The choledochus and the pancreatic duct join shortly after penetrating the wall of the duodenum sharing a short common tract. This is the more frequent occurrence.
   II. Both ducts course in parallel fashion, in contact but not joined, emptying separately into the duodenal papilla. Occasionally the pancreatic duct may empty 5 to 15 mm below the papilla.
   III. The pancreatic duct and the choledochus join at a higher level before entering the duodenal wall forming a common channel longer than usual. Only in few occasions does the union of Type I or Type III present a dilation giving rise to being designated as an "ampulla" (10, 11, 16, 18, 48, 50).

HISTORICAL REVIEW OF PAPILLA OF VATER AND AMPULLA OF VATER

Abraham Vater, in 1720 (49), gave a lecture at the University of Wittenberg, Germany, titled "Novus bilis diverticulum," in which he described a diverticulum localized at the distal end of the choledochus. Vater thus described a diverticulum of the choledochus, a most rare instance of choledochocele (10, 50). Vater searched for another such case, but was not successful in finding one (10, 50). Vater never made reference to the papilla, nor did he describe the ampulla that bears his name. However, in the medical literature both the papilla and the ampulla bear his name. What is called the ampulla of Vater is the duct formed by the union of the choledochus and the pancreatic duct as these pass through the wall of the second portion of the duodenum to empty at the papilla. This generally short but occasionally longer joined segment has the configuration of a duct and not of an ampulla. This duct can dilate when the papilla is obstructed by inflammation or by an impacted stone. It is probable that the duct may acquire a larger diameter "post mortis" owing to autolysis of the choledochus and pancreatic duct (10) without obstruction. We believe, as other authors do, that the term "ampulla" should not be used because what is observed is a duct and not an ampulla. The eponym "Vater" should also not be used, since he never referred to it (10). Some authors believe that the error in naming it ampulla of Vater arose from Claude Bernard (1, 10, 11, 50), who, in writing his book in 1856, quoted Vater as saying "ampoule commune nommé ampoule de Water," and spelling Vater with a "W" instead of with a "V."

Vater never referred to the papilla that bears his name. The papilla was first described by Sir Francis Glisson in England in 1654 (15) in the first edition of his book *Anatomie Hepatis*, the second edition of which was published in 1681 (3–5, 15). Some authors (48) attribute the first description of the papilla to Gottfried Bidloo of the Hague in 1685 (2). Other authors attribute it to Giovanni Domenico Santorini (42) in 1724, that being the reason why in some texts the duct is called the papilla of Santorini. Santorini did make an excellent description of the papilla in the dog, sheep, and ox, but he was not the first to describe it. Santorini did not add a drawing to his description.

The sphincter of Oddi was also first described by Sir Francis Glisson in 1654, when he described the papilla (3, 4, 5, 15). In his description Glisson describes the annular muscle fibers of the terminal choledochus, affirming that these muscular fibers served to close off the choledochus to avoid reflux of duodenal content. In 1887 (36), Ruggiero Oddi also described the terminal sphincter of the choledochus and related it to biliary physiology. Thus we find that the papilla described by Glisson has been named after Oddi. The ampulla named Vater has not been described by anyone and there are serious doubts that it exists under normal, nonpathologic circumstances, but it is still called the ampulla of Vater.

Hendrickson (17) studied the sphincter at the end of the choledochus in 1898, in the United States. He added details unknown at that time. In 1937, Schwegler and Boyden (46) studied the sphincter of Oddi, and Boyden later added much to our knowledge of the sphincter of Oddi (3, 4, 5).

To avoid confusion in nomenclature we believe that the following should be considered as synonyms: papilla of Vater, papilla of Santorini, papilla of Bedloo, duodenal papilla, major duodenal papilla, and major duodenal caruncle.

PAPILLA OF VATER

This is ovoid in shape and projects into the lumen of the duodenum at its posteromedial wall somewhat beyond the midportion of the second portion of the duodenum. At times the papilla may be more distally located, close to the third portion of the duodenum (19, 21, 22, 39). The usual distance from the pylorus to the duodenal papilla is 10 cm. It may be closer to the pylorus, with the choledochus emptying into the proximal half of the second portion of the duodenum, or more rarely because it empties into the first portion of the duodenum. In patients with duodenal ulcer or postbulbar ulcer with pancreatic penetration and fibrous retraction of the duodenum, the papilla may come to be dangerously close to the pylorus and should be kept in mind during gastrectomy.

The papilla is covered by duodenal mucosa, but its lumen is lined by choledochal mucosa. The two mucosas meet at the orifice of the papilla (10). At its superior border, the papilla is usually partially covered by a transverse fold that gives the impression of a eave (39, 48). Less frequently a vertical duodenal fold is located under the papilla and with the previously mentioned transverse fold forms a "T"(19, 48).

At the end point at the papilla the choledochus occupies the superior portion of the papilla and the terminal end of the pancreatic duct is situated interiorly corresponding to the 4, 5, or 6 o'clock positions.

The papilla is easily recognized in more than 60% of cases because of its size when it is increased, owing to its prominence into the duodenal lumen, because it is erect or because of the folds disposed as a "T" indicate its presence. Because of its fibrous and muscular fiber its consistency is palpably enhanced (22, 48). But the papilla may be difficult to detect in the absence of these factors (48) or owing to its being completely covered by duodenal folds (48).

To locate the papilla, a longitudinal incision is made at the second portion of the duodenum starting at about its midpoint and continuing distally where it is usually to be found (22). Palpation should complement visual exploration passing the finger posteromedially along the second portion of the duodenum. It is often possible to palpate a small ovoid mound of consistency greater than the duodenal folds (22). During the exploration, excessive traction of the duodenum is to be avoided as this maneuver distorts and irons out the duodenal folds (48). The transverse fold present in some cases and that forms as it were a shed over the papilla can completely cover and hide it. If the papilla has not been identified and the gall bladder is present, this may be gently squeezed to provoke visual exit of bile through the papilla thereby revealing it. If the gall bladder has been previously removed another recourse is to introduce a physiologic solution or a catheter or dilator through the cystic duct or through a supraduodenal choledochotomy. A jutapapillar duodenal diverticulum may add to the difficulty in identifying the papilla (22, 48). The papilla is easily identified by endoscopy and an experienced endoscopist may expeditiously catheterize the ampulla and perform papillotomy (22).

SPHINCTER OF ODDI

Boyden's description of the sphincter of Oddi, which he studied extensively, is today the most accepted (2–5). Boyden describes four groups of muscle fibers:

1. Superior sphincter of the choledochus
2. Inferior sphincter of the choledochus
3. Sphincter of the pancreatic duct
4. Sphincter of the papilla

The fibers of the superior sphincter are not constantly found, and the fibers of the inferior sphincter are not all annular. Muscles fibers of the pancreatic sphincter are not constant, being present in only 20% of cases, and are rarely annular. Boyden affirms that the sphincter of Oddi is embryologically and functionally distinct from the muscular fibers of the duodenum (5). Several authors hold that there exists an interconnection leading to functional interplay between the muscular fibers of the sphincter of Oddi and those of the duodenum. The structure of this sphincter complex varies according to the manner of union of the choledochus with the pancreatic duct. There are also bundles of longitudinal fibers that connect both ducts which in turn connect with muscular fibers of the duodenum. There are other fibers, designated as reinforcing fibers, which go from the muscular fibers of the duodenum proper to the longitudinal fibers.

Cinecholangiographic, manometric, and electromyographic studies confirm that the muscular fibers of the sphincter of Oddi and the muscular fibers of the duodenum act synchronously (7, 8, 20, 22, 33, 34, 38, 44, 45, 51). Relaxation of the sphincter of Oddi and relaxation of the adjacent duodenal musculature occur synchronously; contraction of both also occurs at the same time. It has been established that the sphincter of Oddi opens from above downward and closes from below upward (22). These cycles of contraction–relaxation–contraction can be initiated by the presence of food in the duodenum, by the injection of cholecystokinin, or by a duodenal peristaltic wave passing through the sphincter zone. This sequence is known as duodenosphincteric synergy (22).

HEPATIC ARTERY, CYSTIC ARTERY, AND VENOUS CIRCULATION IN THE EXTRAHEPATIC BILIARY TREE

Hepatic Artery

After giving off the gastroduodenal artery, the hepatic artery courses vertically upward within the hepatoduodenal ligament in an anterior plane to the left of the choledochus, which occupies the free border of the hepatoduodenal ligament. The portal vein courses behind the hepatic artery. Proximal to the hepatic hilus the hepatic artery divides into right and left hepatic arteries. The right hepatic artery passes behind the common hepatic duct and enters the triangle of Calot. In some cases the right hepatic artery, as will be seen later, passes in front of the common hepatic duct.

Cystic Artery

In the majority of cases, the cystic artery takes its origin from the right hepatic artery within the triangle of Calot to the right of the hepatic duct. Hence it approaches the cystic duct and the neck o. the gall bladder, usually passing above and in a rather posterior plane. On arriving at the gall bladder it divides into two branches, one anterior, which travels in the subperitoneal surface of the gall bladder, the other posterior, which travels in the bed between the gall bladder and the liver. The cystic artery may present numerous variations. It may arise from the right hepatic but course behind the common hepatic duct instead of anterior to it. It may also originate from the left hepatic artery and course in front of the common hepatic duct. The cystic artery may arise from the common hepatic artery, the gastroduodenal artery, the left gastric artery, the right gastric artery, or the superior mesenteric artery. In 20% of cases there may be two cystic arteries, one anterior and one posterior (19, 21, 26, 48).

Triangle of Calot

In 1891, Jean François Calot described a triangle that is of crucial importance to gall bladder surgery. This triangle is formed by the cystic duct and neck of the gall bladder on the right and the common hepatic duct on the left (this is the hepatocystic angle), with the inferior base of the liver forming the triangle. It is in this triangle that the hepatic and the cystic arteries are identified.

Arterial Supply to the Hepatocholedochus

The arterial supply to the hepatocholedochus is very variable. Multiple small-caliber arteries arise from the su-