BILIARY TRACT SURGERY

Tactics and Techniques

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Preface

Biliary Tract Surgery Tactics, and Techniques has been written to serve as a rapid and precise source of surgical information for the busy surgeon who is confronted by perplexing questions and difficult technical problems that require practical solutions. It also presents the latest information on surgical tricks and techniques not found in other biliary surgical texts. Finally, this book presents the surgical experience of an author who has dealt with clinical and didactic postgraduate teaching for 40 years, during which time he was associated with the late Dr. Raymond W. McNealy, Chief of Surgery at Cook County Hospital in Chicago. Dr. McNealy was one of the great surgeons and outstanding teachers of his time. Together we wrote many articles and two books on pre- and postoperative care of surgical patients, but never a book on biliary surgical technique. The author thought it was time to rectify this omission.

Some surgeons attend postgraduate courses; others do not have the time. It is the latter group of surgeons who depend upon current surgical journals for their continuing education, to which the author is directing his efforts. For these busy surgeons who require rapid, precise, and authoritative answers to their questions and technical problems, this book offers those specific, complete, and germane answers. This author's concepts are based upon his years of teaching experience in the operating room, anatomy laboratory, and lecture room. The author has long felt that a minimum of prose and a maximum of facts are long overdue in surgical publications. In fact, even the major surgical journals have finally reduced the size of their articles so that now more than twice as many shortened articles are published without the loss of factual content. In this book, the author offers the busy surgeon a concise text that will furnish authoritative, precise, and practical answers to his questions, as well as solutions to his technical problems. As in his postgraduate courses, he will speak to the reader directly and personally—one on one.

Our teaching method at the Cook County Postgraduate School was famous for being factual, practical, and complete. If additional information was required, the surgeon was referred to a recent surgical journal, but never to a surgical text, primarily because of the latter's verbosity and lack of factual specificity. The author believes that the format of this book should be based on these same principles of preciseness and completeness, particularly when discussing the more complex and controversial biliary problems based on personal experiences.

The author's latest models of biliary instruments, including his new biliary balloon catheter, are incorporated into this book as exclusive features. The biliary balloon catheter and the modified helix basket instruments are now completely integrated and can be employed interchangeably when dealing with the impacted or recurrent common duct stone. The author's latest contribution to biliary surgical techniques was exhibited at the American College of Surgeons annual meeting in San Francisco and has been included in this book as an exclusive feature. This new concept deals with flexible filiform stone basket and filiform balloon catheter combinations. The filiform combinations have simplified and markedly increased the chances of extracting the resistant and impacted common duct stone. In the last 20 years, the author has focused primarily on the problem of impacted and

recurrent gallstones in the common duct, and today his instruments and techniques are recommended when all other methods fail.

For the more formidable operative techniques currently employed for the advanced liver diseases, the author directs the reader to the excellent and authoritative writings of T. E. Starzl, and S. I. Schwartz—both pioneers in this field.

The author wishes to remind the reader that operative failures not infrequently necessitate endoscopic therapeutic intervention. For this reason, the author has included a chapter on endoscopic retrograde pancreaticocholangiography as an adjunct or alternative to surgery.

The author expresses his deep gratitude to all his contributors who have taken time from their busy practices to offer their valuable expertise to this book. It is hoped that this book will serve as an updated ancillary contribution to biliary diagnosis and surgery of the biliary tract.

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1989

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Contents

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BRIEF NOTES ON THE ADVANCEMENT OF KNOWLEDGE RELATING TO BILIARY TRACT DISEASES DATING BACK TO THE EARLY HISTORY OF MAN

Parasites were discovered in numerous archaeological digs. The ova of *Ascaris* and *Trichuris* were discovered in preserved bodies about 600 B.C. The ova of *Fasciola hepatica* were found in mollusk shells (intermediate host) about 500 B.C., and calcified *Schistosoma* ova were found in kidney tubules. In a cave near the Dead Sea, fossilized human stool, 1800 years old, revealed cysts of *Entamoeba histolytica*. In Mycenia, a skeleton from about 1500 B.C. was found, revealing cholesterol stones near the costal margin. In the mummy of the Priestess of Amen (21st dynasty), x-rays revealed a gallbladder containing multiple gallstones.

In Assyria and Babylonia, liver abscesses were prevalent; they were believed to have been caused by amebic dysentery. A clay tablet was found describing a sick and weary patient who was jaundiced *(ahhzu)* by *Ascaris*. It is well known that *A. lumbricoides* can obstruct the common duct and cause jaundice. The Egyptians also suffered from parasitic infestations such as ankylostoma and bilhariasis. The latter is still rampant in Egypt. Amenophis IV (pharoah) may have also suffered from the complications of bilhariasis, i.e., ascites, distended abdomen, and thin, emaciated face.

Liver disease is often mentioned in the Bible *(kabed)*. The liver was considered a vital organ capable of uncontrollable bleeding: "My liver is poured upon this earth" *(yeraken)*; jaundice was also recognized, as was amebiasis. The earliest Indian reference to "liver and gallbladder" is found in their religious literature *(Atharvaveda)* in 1500 B.C. Then the liver was considered the seat of the bile *(ranjsk-sopitta)*. For early ascites *(jalodora)* they prescribed medicines, and for late ascites surgical intervention.

The Chinese considered the liver the storehouse of blood and the soul, as well as the seat of anger. The Chinese also suffered from flukes, i.e., *F. hepatica* and *Clonorchis senensis*. The Greeks learned their medicine from the ancient Egyptians and later passed it on to the Romans. The liver is mentioned in Homer's *Iliad*. Eurypylus speared Apisaon in the liver, under the diaphragm.

Hippocrates was the first to record a case report on cholecystitis with modern clarity. "A man dined well and drank too much. Vomiting, then fever, and pain in the right hypochondrium followed by fever and chills, and on the 11th day, he died." Erasistratus instituted the first study of *pathological anatomy*. He not only described the liver and biliary tract, but associated the liver with ascites. Galen also recognized biliary tract disease and prescribed appropriate diets.

Al Rhaze (Arabian) was influenced by Hippocrates and Galen. He wrote about the causes of jaundice and described tumors, infection, and obstruction. Al-Rhaze described the urine as dark when the bile does not flow into the intestine but goes into the urine. He stressed the affinity of the liver for sweets: "The liver nourishes and flourishes on those foods that are sweet."

Historical Sketches on the Advancement of Surgery of the Biliary Tract

ALEXANDER TRABIANUS (fifth century), a Greek physician, was probably the *first to describe gallstones in the hepatic ducts*.

AVICENNA-IBN-SINA (979–1037) wrote an encyclopedic book (canon), which became the standard medical work through the Middle Ages. Avicenna was a great anatomical dissectionist and recommended puncture for liver abscess.

GENTILE DA FELIGNO (1314) was the *first to describe gallstones*.

LEONARDO DA VINCI (1452–1519) contributed to the advancement of anatomy by his accurate and painstaking dissections. An example of his superb anatomical dissection of the liver, hepatic ducts, cystic duct, and cystic artery is shown by Kenneth Clark in his book on Leonardo da Vinci (Phaidon Press).

ANDREAS VESALIUS (fourteenth century) was first to negate the teachings of Galen. He corrected and replaced Galen's anatomy with realistic human anatomy as revealed by his dissection. *He accurately described the gallbladder and the common bile duct*.

ANTONIO BENINVIENI (fifteenth century) was the *first to replace the humoral theory with more scientific explanations obtained by autopsy findings*. He explained how gallstones were consistent with the clinical signs and symptoms of the patient. He searched for and found the cause of disease at autopsy.

MATTEO REALDO COLOMBO (1559) described gallstones in the body of Saint Ignatius.

WILLIAM HARVEY (1578–1657) established the true role of the cardiovascular circulation. From this point on in medical history, we shall consider the eponyms assigned to those who contributed so much to the advancement of the anatomy and surgery of the gallbladder and common duct.

JEAN FERNEL (1506–88) *was the first to describe gallstones obstructing the common bile duct*.

GABRIELE FALLOPPIUS (1523–62) is credited with providing the *first description of the fallopian tubes*. He was also the first to describe gallstones within the gallbladder and common bile duct.

JOENESIUS (1676) extracted a gallstone from a fistulous tract. He is credited with performing the first cholecystolithotomy.

FRANCIS GLISSON (1597–1677) was *first to describe the hepatic artery, portal vein, and bile ducts.* Glisson was also the first to describe a sphincteric mechanism around the distal orifice of the common bile duct. Glisson was one of the greatest physicians of the seventeenth century, but he is now remembered only for a trivial anatomical feature he didn't feel was significant enough to describe for publication.

JOHANN GEORG WIRSUNG (1600–43), after being shown a pancreatic duct in a rooster by a student (Maurice Hoffmann), proceeded to dissect out the duct in a human pancreas. He described the duct in a letter to Jean Riolan, professor of anatomy at the University of Paris.

ABRAHAM VATER (1684–1751) was the *first to describe a so-called tubercle as "those double ducts [bile and pancreatic ducts]* that come together in no single combination." Paul Gottlob Berger coauthored the term *tubercle or diverticulum*, but only Vater's name lives on.

GIOVANNI DOMINICO SANTORINI (1681–1737) was a brilliant anatomist and professor of medicine. He was the *first to describe a second pancreatic duct*. He named the upper duct the *superior pancreatic duct* and the lower one the *main pancreatic duct*. One hundred years later, Claude Bernard, while studying the physiology of the pancreas in (1856), reaffirmed the priority of Santorini to the eponym.

JAKOB BENIGMUS WINSLOW (1669–1760) held the position of professor of anatomy for 40 years at University of Denmark. Winslow named the anatomical entity he discovered *Duverneys' foramen* after his professor. Other eponyms used were *Scarpa's foramen* and *Winslow's pouch*. Finally, because *Winslow was first to describe the foramen* with such accuracy and clarity, the eponym was bestowed upon him.

LORING HEISTER (1683–1758) was professor of surgery for 38 years at Helmstedt University. He was the *first to illustrate and describe the "valves" in the cystic duct*. Manuel Lichtenstein and Andrew Ivy noted that these valves appeared only in primates, and that they were no more than spiral folds formed embryologically. The valves of Heister are believed to prevent distention or collapse of the cystic duct during pressure changes in the gallbladder and common bile duct.

JEAN-LOUIS-PETIT (1674–1750) demonstrated that the gallbladder could be *aspirated*.

CARRE in 1833 advocated fixing the gallbladder to the abdominal wall in the first stage of surgery, then at the second stage performing a *cholecystostomy*.

THEODORE KOCHER (1841–1915) was professor of surgery in Berne, Switzerland, for 45 years. He won the Nobel Prize in 1909 for his contribution to the *physiology of the thyroid gland. Aseptic technique* is attributed to Kocher. In 1903, Kocher introduced and standardized his *technique for mobilizing the duodenum*. He employed this maneuver to better expedite a gastroduodenostomy. Today the Kocher maneuver is commonly employed to expedite various types of biliary and pancreatic surgical procedures. Kocher is credited with performing the *first successful cholecystostomy for empyema*.

J. L. W. THUDICHUM in 1859 recommended that the gallbladder be marsupialized to the skin, and stones removed.

JOHN BOBBS in 1867 removed gallstones from a hydrops of the gallbladder. It was the first elective cholecystostomy.

CESAR ROUX (1857–1934) was professor of surgery at Lausanne University. In 1897 Roux described his en-Y anastomosis for gastroenterostomy; in 1907 he described the same procedure for bypassing an esophagogastric cancer. Today the term *Roux-en-Y* is often employed in describing numerous bypass procedures.

JAMES RUTHERFORD MORISON (1853–1939) was associated with the Royal Victoria Infirmary in Newcastle, England, for 50 years. In 1894 he described what is now known as *Morison's pouch*. He used this space for biliary drainage postoperatively. The area now known as *Morison's fossa*, also referred to as the *hepatorenal space*, is situated anteriorly and below the right kidney. Penrose or Jackson-Pratt drains are employed in this space to encourage external biliary drainage.

JEAN FRANCOIS CALOT (1861–1944) wrote his doctoral thesis in Paris (1890) entitled "De la Cholecystectomie." He described an isosceles triangle with the common hepatic duct as the base, and the inferior edge of the cystic duct and the superior borders of the cystic artery as the sides. This triangle has since been enlarged so that the liver's edge serves as the superior border. In this important zone are located the cystic artery, hepatic artery, and accessory bile ducts. It is now referred to as *Calot's triangle*. A gland referred to as *Calot's gland* may also be found in this triangle.

HENRI HARTMANN (1860–1952), throughout his long, successful career, meticulously recorded 30,000 operative procedures. At the Hotel Dieu, Paris, Hartmann performed about 1000 operations each year for 30 years. His operation for carcinoma of the rectosigmoid is still referred to as the *Hartmann procedure*. In 1891, Hartmann described the

ampulla of the gallbladder as a *vesicle or pouch*. He is now remembered for the eponym *Hartmann's pouch*.

RUGGIERIO ODDI (1864–1913) became director of the Physiology Institute in Genoa at the age of 29. His doctoral thesis, on the workings of the sphincter, demonstrated that removal of the gallbladder resulted in dilatation of the bile ducts. For his accurate observations on the sphincter, the eponym *sphincter of Oddi* was bestowed upon him.

LUDWIG C. COURVOISIER (1843–1918) was the *first to remove a gallstone from the common bile duct*. He wrote, "with stone obstruction of the common duct, dilatation is most common—consequently, we have an important diagnostic point in the differential diagnosis of common duct obstruction." As a result of this work, Courvoisier was awarded the eponyms *Courvoisier's gallbladder* and *Courvoisier's law*.

CARL LANGENBUCH of Germany in 1882 performed the *first successful cholecystectomy for cholelithiasis*.

VON WINIWARTER of Germany in 1882 performed the *first cholecystoenterostomy*.

JUSTUS OHAGE of Minnesota in 1886 performed the *first cholecystectomy in the United States*.

WILLIAM STEWART HALSTED and SIR WILLIAM OSLER in 1897 concluded that common bile duct surgery was feasible, but that it should be undertaken only by the most skillful and experienced surgeons. Halsted's first common duct patient died 10 days postoperatively.

EVARTS GRAHAM and WARREN COLE in 1923 and 1924 reported that they were able *to visualize stones in the gallbladder roentgenologically;* they employed an iodized oral dye. Not too long thereafter, *IV cholangiography* came into use; more recently, *percutaneous transhepatic cholangiography* was introduced. Today ultrasonography, computed tomograph scanning, and magnetic resonance imaging have revolutionized gallbladder and common duct visualization.

C. P. HENRIK DAM and ARMAND J. QUICK in 1929 and 1935, working independently, *discovered a bleeding tendency due to a blood deficiency of prothrombin*.

C. P. HENRIK DAM (1939) independently *recognized that a blood deficiency of prothrombin was relieved by the administration of vitamin K*.

EDWARD A. DOISY (1939) *isolated vitamin K*.

ANSBACHER in 1940 *synthesized vitamin K (menadione)* in the laboratory.

The greatest strides in studying the gallbladder were made in the nineteenth and twentieth centuries. Only through the bold and knowledgeable undertakings of the great surgeons of that era was the rapid progress in gallbladder treatment made possible. It was the great researchers in the laboratories who developed the adjuvant and related medical discoveries that made cholecystostomy, cholecystectomy, and choledochotomy the safe and successful procedures they are today. Though surgery today is the accepted curative treatment, it is conceivable that in the not too distant future the medical treatment of cholelithiasis will become the method of choice. Hopefully, before the year 2000 we may yet witness *its prevention*.

Recommended Reading

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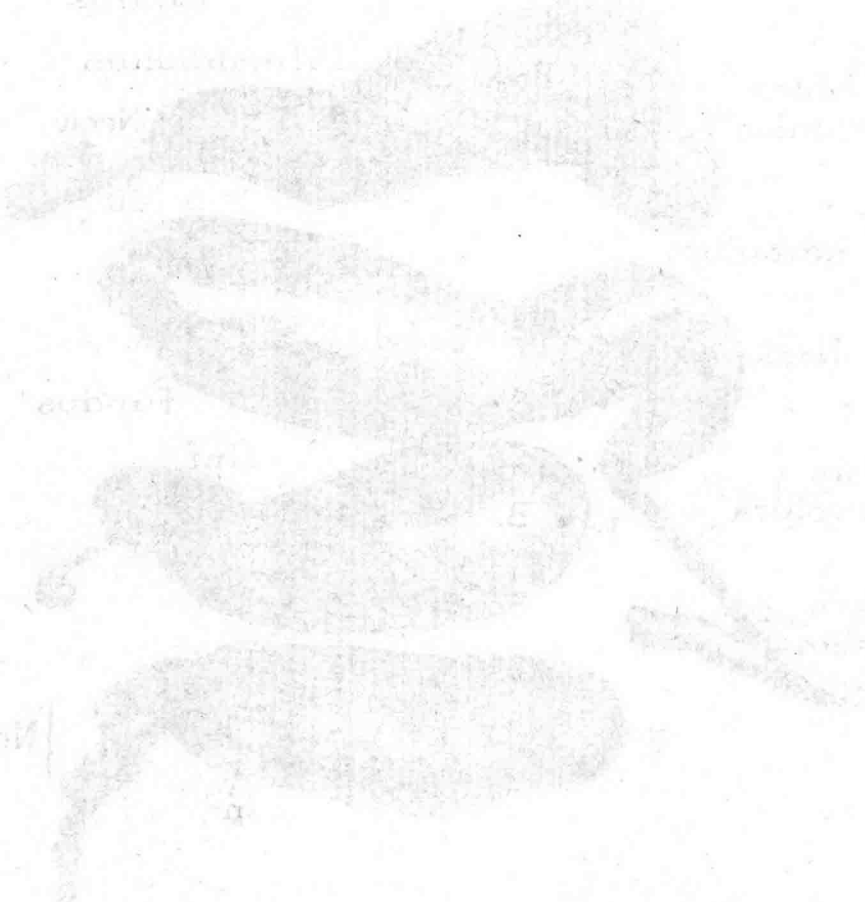
2

A SHORT PRACTICAL REVIEW OF SURGICAL ANATOMY OF THE BILIARY TRACT



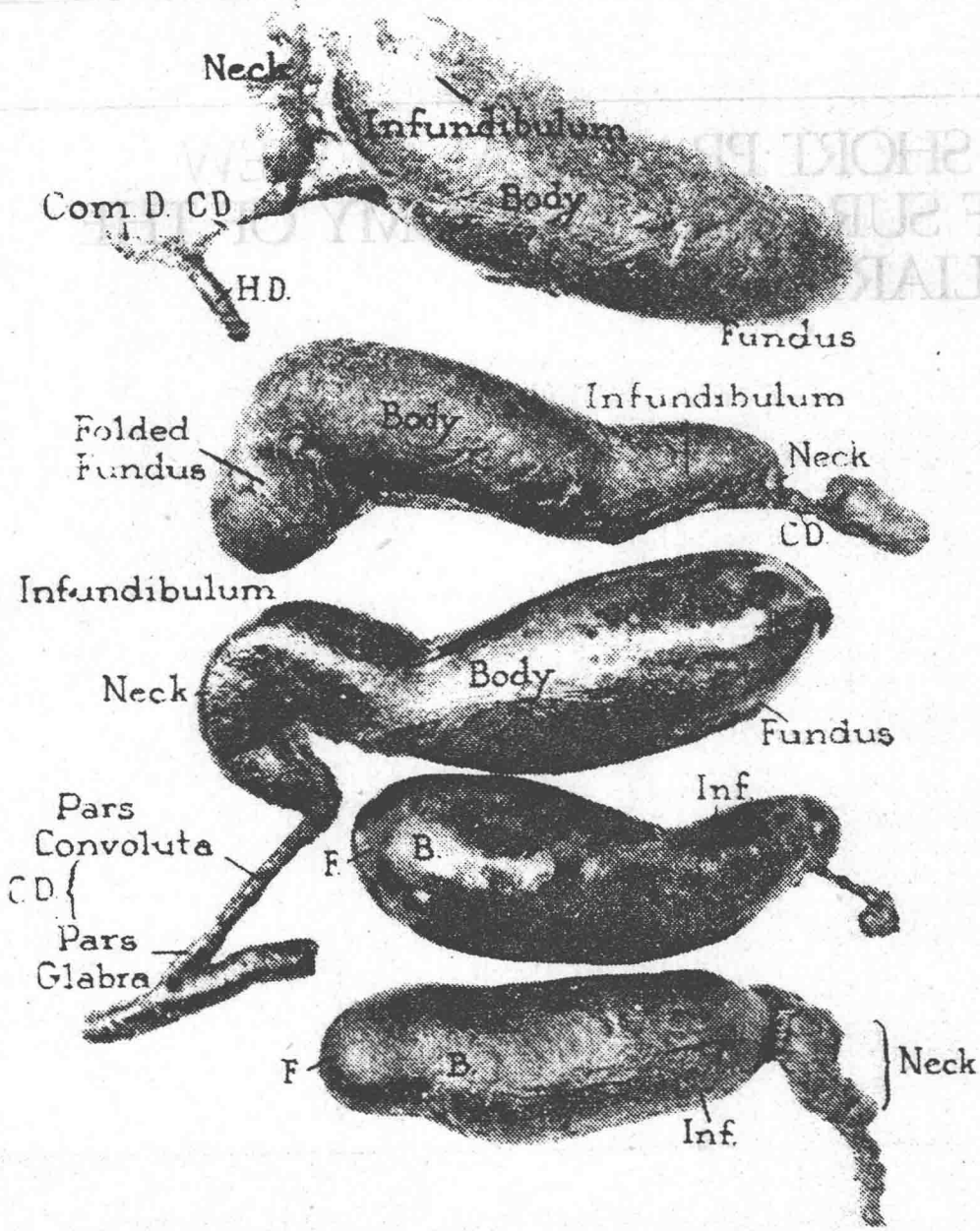


Figure 1. Gallbladders prepared by drying process before being filled with air. Andrew C. Ivy and Manuel Lichtenstein in this illustration show the varying shapes of the body and cystic duct of the gallbladder.

The gallbladder is part of the extrahepatic biliary system. It varies in size, contour, and capacity. Because the fundus (Fig. 1) of the gallbladder is completely invested in the peritoneum, it becomes extremely tender when inflamed; this feature makes it highly diagnostic. The body of the gallbladder tapers to a funnel shape that is referred to as the *infundibulum*. The neck of the gallbladder extends from the first valve of Heister to the cystic duct; it is often kinked, and may be the site of obstruction and acute cholecystitis.

The cystic duct joins the common hepatic duct to form the common bile duct. It varies in size: 50% are between 2 and 4 cm long, about 20% are less than 2 cm long, and about 25% are longer than 4 cm. A small percentage of gallbladders have no

cystic duct; the neck of the gallbladder empties directly into the common duct. The diameter of the cystic duct is about 6 mm, sometimes more and often less. Within the lumen of the cystic duct are projections that are arranged spirally; they are called *valves of Heister*. In short cystic ducts they are found along its full length; in long cystic ducts they may be absent at the distal end. After cholecystectomy, this distal nonvalvular portion may enlarge and may be mistakenly diagnosed as regenerated or "reformed" gallbladder.

The function of the valves of Heister is not known; it is conjectured that they prevent the sudden distention of the cystic duct when the pressure in the gallbladder or common duct rises. Their presence decreases the caliber of the cystic duct and thus may impede or modify the flow of thick bile from the gallbladder. The valves of Heister may thicken or swell as a result of inflammation (chemical or bacterial) and possibly allergy; the lumen of the cystic duct then narrows and impedes the flow of bile. Small calculi may become lodged in the small pits or crypts created by the valves. It is probable that gallbladder debris collects in these crypts, becomes impacted, and forms gallstones. Because of its small lumen and peculiar architectural design, the cystic duct becomes a vulnerable site for pathological changes leading to obstruction, cholecystitis, cholelithiasis, and empyema. To prevent gallbladder disease, a free flow of diluted bile is desirable. It is least likely to produce gallbladder disturbances that are usually associated with cystic duct obstruction (Fig. 2).

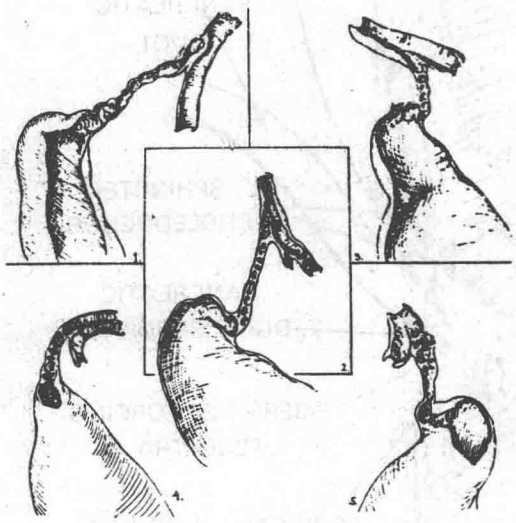


Figure 2. Ivy and Lichtenstein have dissected the gallbladder and allowed it to dry, then filled it with air. Their purpose was to reveal the valves of Heister.

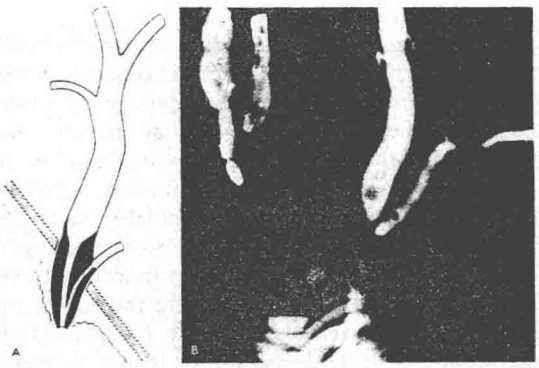


Figure 3. A. A diagrammatic representation of the common bile duct, showing a notch that divides it into two distinct parts, an upper wide-lumened, thin walled portion and a lower narrow-lumened, thick-walled portion. The lower portion is seen to lie mainly in the submucous layer of the duodenum. B. Cast and cholangiogram of specimen showing a well-marked notch on the bile duct. The narrow-lumened lower portion, called the "thickened segment," and the common channel are well shown. Similar appearances are seen in the pancreatic duct. (From Hand BH: Br J Surg *50:486, 1963. Reproduced with permission.)*

Walters and Snell[1] reported that in about two-thirds of a group of cases studied, the head of the pancreas surrounded the distal common duct. In about one-third the distal common duct positioned itself behind the pancreas. In many instances, the common bile duct is joined by the distal pancreatic duct (Wirsung) before terminating in the lower (descending) portion of the duodenum. The point of juncture may be high or low. Not infrequently, the common bile and pancreatic ducts empty separately into the duodenum. It is this varying anatomy that is the underlying cause of bile reflux, either into the common bile duct or the pancreatic duct or both (Fig. 3). The duct of Santorini serves as an accessory duct of the pancreas, emptying into the common duct at a point higher than the termination of the duct of Wirsung. Rarely, the duct of Wirsung becomes atresic or congenitally obliterated, in which case the duct of Santorini becomes the primary outlet for pancreatic juice.

When a stone is impacted at the ampulla, the bile will most often reflux into the pancreas (pancreatitis). If the pressure is great enough, it will continue to reflux into the gallbladder and then onto the liver canaliculi. Jaundice becomes more intense as the serum bilirubin level rises. Carcinoma of the head of the pancreas, or ampulla, will gradually but continuously obliterate the stoma. In the absence of chronic cholecystitis, the gallbladder