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## CHAPTER 7.6

# Biliary Tract Surgery

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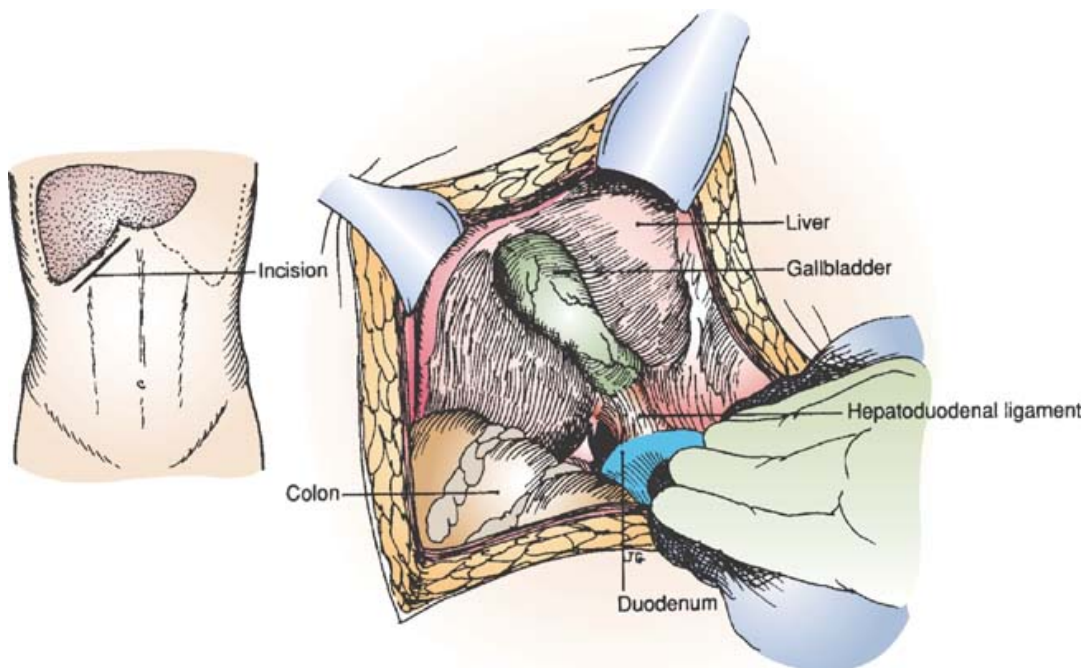
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## Open Cholecystectomy and Common Bile Duct Exploration

### Surgical Considerations

**Description:** With the advent of laparoscopic cholecystectomy, the traditional **open cholecystectomy** has become a rarity and is generally reserved for gallbladders that are expected to be difficult to remove due to inflammation, previous operations and adhesions, or because of other medical problems, such as coagulopathy or cirrhosis. In most institutions, fewer than 10% of cholecystectomies will be begun as open procedures, and perhaps 5% of laparoscopic cholecystectomies will be converted to open cholecystectomies during the course of the operation due to technical difficulties, complications, or unexpected findings. Because of its rarity, the open cholecystectomy may be a more challenging operation for both surgeon and anesthesiologist than it was in previous decades. A small number of open cholecystectomies are performed in an urgent fashion following a complication of an attempted laparoscopic cholecystectomy and may be associated with significant instability from hemorrhage or sepsis related to an iatrogenic injury of abdominal or retroperitoneal structures.

The technical aspects of **open cholecystectomy** have not changed since its original description over 100 years ago. The operation can be performed through a right subcostal (**Kocher**), paramedian, or midline incision. Upward traction is applied to the liver or gallbladder, whereas downward traction on the duodenum exposes the region of the cystic duct and artery and common duct. Adequate exposure is critical to performing a safe operation. Depending on local conditions and the surgeon's preference, the gallbladder may be removed from the top down, excising the gallbladder from the liver bed and isolating the cystic duct and artery as the final stage of the operation. The cystic duct and artery may be isolated and divided first, and the gallbladder removed retrograde from the gallbladder bed as the final step of the procedure. The anatomy of the biliary tree is quite variable, with the classic anatomy present in only 30% of patients, and few surgeons always remove the gallbladder in exactly the same way every time. (Fig. 7.6-1 shows exposure of the gallbladder.)



**Figure 7.6-1. 1.** Incision and exposure of the gallbladder. (Reproduced with permission from Scott-Conner CEH, Dawson DL: *Operative Anatomy*, 2nd edition. Lippincott Williams & Wilkins, Philadelphia: 2002.)





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**Cholangiography** may be performed at the discretion of the surgeon. Some surgeons perform it in all patients and others perform it only in patients in whom there is some clinical evidence of choledocholithiasis. The cystic duct is opened and a catheter placed into the duct and secured with a ligature, tie, or special cholangiogram clamp. Dye is injected into the biliary tree via the catheter, and x-rays are taken. If stones are found, a **common duct exploration** may be performed. Alternatively, an **endoscopic retrograde cholangiogram** (ERCP) with stone extraction may be carried out postoperatively. Cholangiography usually adds 10–15 min to the procedure.

**Choledochotomy**, or “**common duct exploration**,” is the opening and exploration of the common duct for the purpose of extracting stones. Once commonly performed, it is a procedure reserved chiefly for patients who have failed management of common duct stones with endoscopic (ERCP) or laparoscopic techniques. Common duct stones are visualized by operative cholangiography to determine number of stones, position, and the anatomy of the duct. Ducts smaller than 5 mm in diameter are at greater risk of injury with common duct exploration and should be managed endoscopically. An extensive **Kocher maneuver** is performed to allow exposure and palpation of the entire duct, including the intrapancreatic portion. A longitudinal incision is made in the duct and exploration is carried out through this incision. The duct may be irrigated with NS, balloon catheters may be passed, and various instruments introduced to grasp, remove, or crush retained stones. The duct may be biopsied by this approach and **choledochoscopy**—the direct visualization of the duct's interior using a small flexible scope—can be performed. Rarely, an impacted stone may require electrohydraulic or laser lithotripsy through the choledochoscope, adding considerable time to the operation in centers equipped to perform the procedure. The choledochotomy is closed over a T-tube to allow decompression of the edematous duct and later extraction of stones missed at the initial exploration. In the past, **transduodenal sphincteroplasty** was utilized for stones impacted near the sphincter of Oddi, but this procedure has largely been replaced by endoscopic or percutaneous techniques at specialized centers. It is reserved for highly unusual cases, such as a patient with a previous **Billroth II gastrectomy**. Depending on the complexity of the findings, a common duct exploration can be expected to add from 30 min to over 1 h to the cholecystectomy. In general, the mortality of patients undergoing common duct exploration is 2–5 times that of a simple cholecystectomy. This difference can be explained by the fact that patients undergoing common duct exploration tend to be older and sicker or suffering from concomitant cholangitis—the opening of the duct itself is not necessarily a significant physiologic insult.

**Variant procedure or approaches:** Cholecystectomy remains the mainstay of treatment for symptomatic biliary stone disease. **Nonsurgical treatment of cholelithiasis**, particularly by oral dissolution and/or **lithotripsy**, has very limited usefulness and is rarely used in clinical practice. **Tube cholecystostomy** can be performed as an open procedure or percutaneously. It is generally reserved as a temporary measure in patients too ill to tolerate a more extensive procedure.

**Usual preop diagnosis:** Symptomatic cholelithiasis; acute cholecystitis; chronic cholecystitis; biliary dyskinesia; gallbladder polyps or carcinoma; choledocholithiasis

## Summary of Procedures

	Cholecystectomy	Cholecystectomy/Common Duct Exploration
Position	Supine	
Incision	Right subcostal or midline	Right subcostal and/or midline
Special instrumentation	Costal margin retractor; cholangiocatheter	Choledochotomy instruments; choledochoscope
Unique considerations	Requires intraop x-ray for cholangiogram.	May include choledochoscopy
Antibiotics	Ampicillin, piperacillin, or mezlocillin, 1–3 g iv; gentamicin; or cefotetan 1–2 g iv	
Surgical time	45–90 min	1–2.5 h
Closing considerations	Muscle relaxation	
EBL	Minimal to 250 mL	
Postop care	PACU → ward	
Mortality	0.1% under 50 yr; 0.5% over 50 yr Postop bile leak: 0–9%	0–1.5% under 60 yr; 5% in advanced age





<b>Morbidity</b>	Pancreatitis: 0–4.6%	
	Bile duct injury: 0–0.25%	
	Cardiac and respiratory complications:	2–5%
	Rare, but leading cause of death	
<b>Pain score</b>	Hemorrhage: Rare	
	6	6–7

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## Patient Population Characteristics

<b>Age range</b>	Mostly adult; increases with age
<b>Male:Female</b>	1:2–3
<b>Incidence</b>	600,000/yr in the United States; ≥ 90% performed laparoscopically
<b>Etiology</b>	See Associated Conditions (below).
<b>Associated conditions</b>	Ileal disease; cirrhosis; hemolytic disorders; choledocholithiasis; cholangitis or active pancreatitis

## Anesthetic Considerations

See [Anesthetic Considerations for Biliary Tract Surgery, p. 565.](#)

## Suggested Readings

1. Blumgart LH: Stones in the common bile duct—clinical features and open surgical approaches and techniques. In *Surgery of the Liver, Biliary Tract, and Pancreas*, 4th edition. Blumgart LH, ed. Saunders Elsevier, Philadelphia: 2007, 528–47.
2. Fried GM, Feldman LS, Klassen DR: Cholecystectomy and common bile duct exploration. In *ACS Surgery: Principles and Practice 2006*. Souba WW, Fink MP, Jurkovich GJ, et al., eds. WebMD, New York: 2006, 651–72.
3. Gertsch P: The technique of cholecystectomy. In *Surgery of the Liver, Biliary Tract, and Pancreas*, 4th edition. Blumgart LH, ed. Saunders Elsevier, Philadelphia: 2007, 496–505.
4. Matthews BD, Strasberg SM: Management of common duct stones. In *Current Surgical Therapy*, 9th edition. Cameron JL, ed. Mosby Elsevier, Philadelphia: 2008, 412–17.
5. Nagle AP, Soper NJ, Hines JR: Cholecystectomy (open and laparoscopic). In *Maingotis Abdominal Operations*, 11th edition. Zinner MJ, Ashley SW, eds. McGraw Hill Medical, New York: 2007, 847–63.
6. Zemon H, Ponsky TA: Acute cholecystitis. In *Current Surgical Therapy*, 9th edition. Cameron JL, ed. Mosby Elsevier, Philadelphia: 2008, 408–12.

## Biliary Drainage Procedures

### Surgical Considerations

**Description:** Biliary drainage procedures may be performed for malignant and nonmalignant indications, and the type of drainage procedure performed depends on factors such as the nature of the biliary obstruction, the patient's overall condition and prognosis,





the need for other surgical procedures, and institutional expertise. Most drainage procedures of the biliary tree are performed with **endoscopic** and/or **transhepatic techniques**. These techniques allow concomitant treatment of biliary stone disease, decompression of obstructive jaundice, relief of cholangitis and delineation of the anatomy of the biliary tree. There remain a significant number of patients, however, for whom a traditional surgical procedure is the most appropriate. With the advent of laparoscopic cholecystectomy, surgical bile duct injuries have become the most common reason for surgical biliary drainage procedures. In general, the (*Print pagebreak 561*) complexity of the different operations that may be performed and the morbidity attendant to these has more to do with the indications for operation than with the procedure that is performed.

All of these operations are performed under GA through an upper midline or right subcostal incision. Self-retaining retractors are used to retract the liver superiorly to expose the region of the porta hepatis. If the gallbladder will not be used for the bypass procedure (**cholecystojejunostomy**), then it usually is removed as the first step in the procedure (see [Open Cholecystectomy, p. 558](#)). If the patient has had previous upper right quadrant surgery, the complexity and duration of the procedure and blood loss may increase significantly. Any associated hepatic cirrhosis may make the procedure particularly demanding. Most patients undergoing surgical biliary drainage procedures have had several nonsurgical instrumentations of the bile duct prior to presenting to surgery. Indwelling stents result in colonization of the biliary tract with any number of bacterial or fungal organisms from which the patient may have already suffered bouts of cholangitis. It is not unusual for the patient to develop bacteremia during the operation while these stents are being manipulated.

**Transduodenal sphincteroplasty** for benign obstruction of the ampulla of Vater or for extensive choledocholithiasis has largely been abandoned in favor of the more well-tolerated and less invasive **endoscopic sphincterotomy**. It remains the treatment of choice for rare cases of early ampullary carcinoma. Endoscopic sphincterotomy and/or placement of an internal stent is the most commonly performed technique for opening the ampulla, and usually is performed by gastroenterologists outside of the OR with iv sedation. **Open sphincteroplasty** is usually reserved for patients in whom endoscopic retrograde cholangiopancreatogram (ERCP) has been unsuccessful or in whom a laparotomy is required for other reasons. For these open procedures, the second portion of duodenum is incised over the region of the ampulla, and the ampulla is cannulated. A longitudinal incision is made over the course of the ampulla, and the mucosa of the ampulla is sutured to the mucosa of the duodenum with fine interrupted sutures with care being taken not to compromise the pancreatic duct. The duodenum is closed with suture, a small closed suction drain is placed, and the wound is closed. A postop stay of 5–7 d can be expected.

**Cholecystojejunostomy** usually is performed as palliation for malignant obstruction of the distal bile duct. Its advantage is that it does not require dissection of the portal triad, but the long-term results are poor as biliary obstruction typically recurs as the malignancy advances. The abdomen is opened as described above, and the region of the porta hepatis examined to ensure that the cystic duct is not imminently compromised by tumor. The jejunum is then brought up to the gallbladder, usually bypassing the jejunum through the transverse mesocolon. The anastomosis may be performed either to an intact loop of jejunum (**loop cholecystojejunostomy**) or to a Roux-en-Y loop of jejunum (**Roux-en-Y cholecystojejunostomy**), and is carried out with one or two layers of sutures, depending on surgeon's preference. If a Roux-en-Y is created, a second jejunojejunal anastomosis must be performed. This procedure has largely been replaced by transhepatic and endoscopic techniques.

**Choledochoduodenostomy** is an archaic procedure in which the bile duct is incised longitudinally and anastomosed directly to the adjacent duodenum. This was performed historically in patients with gallstones impacted at the ampulla. However, loss of the normal sphincter mechanism at the ampulla allows reflux of duodenal contents directly into the bile duct. Patients may suffer from repeated episodes of cholangitis or obstructive jaundice from debris occluding the anastomosis. Secondary biliary cirrhosis may occur, and the author has seen one case proceed to liver transplantation in which a cast of the biliary tree comprised of fibrous food material was extracted from the choledochoduodenal anastomosis. **Roux-en-y choledochojejunostomy or hepaticojejunostomy** remains the gold standard by which all other biliary drainage procedures are measured. An anastomosis is fashioned between the common bile duct, common hepatic duct, or even the lobar or segmental bile ducts and a Roux-en-Y loop of jejunum. This is often a relatively demanding operation because it requires dissection deep in the porta hepatis to gain access to the bile duct. Furthermore, many patients have had previous surgery in the porta hepatis with extensive formation of adhesions. Long-term results are more reliable, however, and thus surgical drainage is preferred to less invasive procedures for benign disease. Exposure of the biliary tree is the same as for the above procedures. The gallbladder is always removed (if it is still present). The bile duct is dissected free from the surrounding structures in the porta hepatic and traced proximally into the liver to healthy tissue above the level of obstruction.

**Variant procedure or approaches:** Endoscopic or transhepatic placement of temporary or permanent **biliary stents** is an increasingly common alternative to surgical drainage in patients with incurable pancreatic or biliary tract disease.

**Usual preop diagnosis:** Transduodenal sphincteroplasty: extensive choledocholithiasis, often after failed attempt at ERCP; rarely, malignant disease. Cholecystojejunostomy: malignant obstruction of the distal common bile duct, usually due to pancreatic cancer. Choledochojejunostomy or hepaticojejunostomy: benign strictures of the distal bile duct; longstanding stone disease; pancreatitis; iatrogenic injury; Oriental cholangiohepatitis; after resection of some tumors of the pancreas or bile duct.





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## Patient Population Characteristics

Age range	5th–7th decade; may be younger for repair of laparoscopic cholecystectomy injuries
Male:Female	1.1:2.1
Incidence	Procedure-related incidence not available, but clearly declining in favor of techniques by interventional gastroenterology and radiology.
Etiology	See Usual Preop Diagnosis, above.
Associated conditions	Jaundice (very common); fat-soluble vitamin deficiencies; malignancy, especially pancreatic (common); malnutrition (common)



## Anesthetic Considerations

See [Anesthetic Considerations for Biliary Tract Surgery, p. 565.](#)

## Suggested Readings

1. Baker MS, Lillemoe KD: Benign biliary strictures. In *Current Surgical Therapy*, 9th edition. Cameron JL, ed. Mosby Elsevier, Philadelphia: 2008, 420–5.
2. Blumgart LH, DiAngelica M, Jarnagin WR: Biliary-enteric anastomosis. In *Surgery of the Liver, Biliary Tract, and Pancreas*, 4th edition. Blumgart LH, ed. Saunders Elsevier, Philadelphia: 2007, 455–74.
3. Jarnagin WR, Blumgart LH: Biliary stricture and fistula. In *Surgery of the Liver, Biliary Tract, and Pancreas*, 4th edition. Blumgart LH, ed. Saunders Elsevier, Philadelphia: 2007, 628–81.
4. Melton GB, Lillemoe KD: Choledochal cyst and biliary strictures. In *Maingot's Abdominal Operations*, 11th edition. Zinner MJ, Ashley SW, eds. McGraw Hill Medical, New York: 2007, 889–920.
5. Taylor BR, Langer B: Procedures for benign and malignant biliary tract disease. In *ACS Surgery: Principles and Practice 2006*. Souba WW, Fink MP, Jurkovich GJ, et al., eds., New York: 2006, 673–87.

## Excision of Bile Duct Tumor



### Surgical Considerations

**Description:** Primary tumors (cholangiocarcinomas) of the extrahepatic bile ducts, including the hepatic bifurcation (Klatskin tumors) are uncommon malignancies, with the only curative treatment for them being surgical excision. Such tumors are usually classified as being proximal bile duct tumors, involving the hepatic bifurcation and above; middle bile duct tumors, involving the midportion of the common hepatic and common bile duct; and distal bile duct tumors, which involve the distal bile duct, including the intrapancreatic or intraduodenal portion of the bile duct ([Fig. 7.6-1](#)). The gallbladder usually will be removed in any such operation.

Distal bile duct tumors, which carry a significantly higher cure rate than either proximal bile duct or pancreatic tumors, may be treated by **pancreaticoduodenectomy**. (See [p. 618](#) for discussion of this operation.)

Mid-bile duct tumors usually are excised by removing a generous portion of the mid bile duct, resecting the ducts up to the hepatic





bifurcation, and sometimes performing a pancreaticoduodenectomy. Biliary drainage usually is established by anastomosing the proximal bile duct to a Roux loop of jejunum. For proximal bile duct tumors, most of the extrahepatic bile ducts are excised and biliary drainage is established by anastomosis of the right and left hepatic ducts or even multiple segmental ducts to a Roux loop of jejunum. These are often technically demanding operations with the potential for major blood loss. It may be necessary to perform a major hepatic resection at the same time, and the possibility of this should always be assumed when an operation of this sort is carried out. Often, a transhepatic catheter will have been placed radiographically preoperatively to provide relief of jaundice and to facilitate identification of the bile ducts. Colonization of the biliary tract with enteric bacteria or yeast is common, and may result in bacteremia during surgical manipulation. Prolonged cholestasis may lead to fat soluble vitamin deficiencies, in particular Vitamin K deficiency, which may cause coagulopathy. Long-standing biliary obstruction may cause moderate atrophy and portal venous compromise.

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Surgical exposure for any of these operations usually is achieved through a long midline or transverse subcostal incision with midline extension and the use of self-retaining retractors. The liver and gallbladder are retracted superiorly while downward traction is placed on the duodenum. If the gallbladder is still in place, a cholecystectomy is performed (see [p. 558](#)). For proximal bile duct tumors and mid bile duct tumors not requiring pancreaticoduodenectomy, the bile duct is divided distally, just above the duodenum, and the pancreatic portion of the bile duct is oversewn. The bile duct is then resected proximally to the level of the bifurcation of the hepatic ducts. A Roux-en-Y loop of jejunum is anastomosed to the hepatic ducts to establish biliary drainage. Drains are placed and most surgeons place a NG tube for such cases.

**Variant procedure or approaches:** Endoscopic or transhepatic stenting of areas of stricture often is used as a palliative alternative to surgical excision. These are usually performed radiographically and do not require GA. They may be used as an alternative to resection or in preparation for surgery.

**Usual preop diagnosis:** Cholangiocarcinoma (common); benign strictures of the bile ducts (infrequent); sclerosing cholangitis (rare)

## Summary of Procedures

Position	Supine
Incision	Midline or subcostal
Special instrumentation	Costal retractor
Unique considerations	Many cases prove unresectable at operation. Intraoperative radiation therapy may be used.
Antibiotics	Ampicillin, piperacillin, or mezlocillin, 1–3 g iv, ± gentamicin; or cefotetan 1–2 g iv; Diflucan 200 mg iv; antibiotics may be adjusted based on preoperative bile cultures
Surgical time	3–8 h
Closing considerations	Muscle relaxation required for closure; NG suction.
EBL	500–5000 mL, depending on need for liver resection and presence of portal HTN.
Postop care	ICU postoperatively
Mortality	5–10%
Morbidity	Sepsis; hemorrhage; anastomotic leakage; wound infection; liver failure; VTE
Pain score	7–8

## Patient Population Characteristics

Age range	50–70
Male:Female	Male > female
Incidence	4500 cases of bile duct cancer/yr in the United States.
Etiology	Multifactorial





## Associated conditions

Ulcerative colitis; sclerosing cholangitis; typhoid carrier state; Clonorchis sinensis; choledochal cyst; Caroli's disease; gallstones



## Anesthetic Considerations

See [Anesthetic Considerations for Biliary Tract Surgery, p. 565.](#)

## Suggested Readings

1. Cunningham SC, Schulick RD: Bile duct cancer. In *Current Surgical Therapy*, 9th edition. Cameron JL, ed. Mosby Elsevier, Philadelphia: 2008, 442–7.
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2. Jarnagin WR, DiAngelica M, Blumgart LH: Intrahepatic and extrahepatic biliary cancer. In *Surgery of the Liver, Biliary Tract, and Pancreas*, 4th edition. Blumgart LH, ed. Saunders Elsevier, Philadelphia: 2007, 782–826.
3. Taylor BR, Langer B: Procedures for benign and malignant biliary tract disease. In *ACS Surgery: Principles and Practice 2006*. Souba WW, Fink MP, Jurkovich GJ, et al, eds. WebMD, New York: 2006, 673–87.
4. Whang EE, Zinner MJ: Cancer of the gallbladder and bile ducts. In *Maingot's Abdominal Operations*, 11th edition. Zinner MJ, Ashley SW, eds. McGraw Hill Medical, New York: 2007, 921–35.

## Choledochal Cyst Excision or Anastomosis



## Surgical Considerations

**Description:** This rare congenital anomaly includes various types of dilatation of the biliary tree, and patients may present with cystolithiasis, cholangitis, pancreatitis or, rarely, malignancy. Adults with long-standing obstructive jaundice from a choledochal cyst may present with secondary biliary cirrhosis. Although four types of cysts are commonly recognized, the vast majority consist of fusiform dilatation of much or most of the extrahepatic biliary tree. While the traditional description of choledochal cyst is that of an infant with a palpable abdominal mass and jaundice or cholangitis, this is a relatively rare presentation today. Today, many cysts are found in adults undergoing evaluation for symptoms thought to be due to gallbladder disease. These patients may present with biliary colic, pancreatitis, or cholangitis. Recommended treatment consists of **excision of the cyst** when technically safe. **Cyst-enteric bypass**, usually a Roux loop of jejunum, is almost never performed today because of the small, but real risk of developing malignancy in these cysts. Only in an elderly patient under unusual technical circumstances would this be appropriate.

The operation is performed through a midline or right subcostal incision. The liver is retracted superiorly and the duodenum inferiorly, exposing the biliary tree. The gallbladder is excised, along with as much of the cyst as possible. Intraoperative cholangiogram demonstrates the transition from cyst to normal biliary tract. The duct is divided as distally as possible, just above the duodenum, and the cyst reflected superiorly. The entire cyst should be excised to prevent the development of malignancy in the remnant. This not infrequently requires excision to the hepatic bifurcation; and an anastomosis is performed at this level, often between the common orifice of the right and left hepatic ducts and a Roux loop of jejunum. Diffuse involvement of the intrahepatic bile ducts (Caroli's disease) may require liver resection or transplantation.

Reoperative cases are increasingly common; most follow a cyst-enteric bypass. These cases may be significantly more difficult than first-time operations.

**Variant procedure or approaches:** There is an increasing tendency among gastroenterologists to perform **endoscopic sphincterotomy** in these patients, rather than to refer them for surgical resection, particularly in older patients. It remains to be seen if these patients will develop cancer in the retained cysts.

**Usual preop diagnosis:** Choledochal cyst, the most common type involving fusiform enlargement of the entire extrahepatic biliary tree





## Summary of Procedures

<b>Position</b>	Supine
<b>Incision</b>	Midline or right subcostal
<b>Special instrumentation</b>	Costal retractor
<b>Antibiotics</b>	Ampicillin, piperacillin, or mezlocillin, 1–3 g iv, ± gentamicin; or cefotetan 1–2 g iv
<b>Surgical time</b>	2–4 h
<b>Closing considerations</b>	NG suction
<b>EBL</b>	250 mL, with potentially greater blood loss in re-operations
<b>Postop care</b>	PACU
<b>Mortality</b>	Very rare
<b>Morbidity</b>	Anastomotic leak Wound infection Pulmonary complications Pancreatitis
<b>Pain score</b>	5–7

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## Patient Population Characteristics

<b>Age range</b>	Classically, 60% < 10 yr of age, although this may be changing; also adults of all ages
<b>Male:Female</b>	1:3
<b>Incidence</b>	Rare in the United States; more common in Japan
<b>Etiology</b>	Unclear
<b>Associated conditions</b>	Jaundice; pancreatitis; malignancy within the cyst

## Suggested Readings

1. Locke JE, Lipsett PA: Cystic disorders of the bile ducts. In *Current Surgical Therapy*, 9th edition. Cameron JL, ed. Mosby Elsevier, Philadelphia: 2008, 430–7.
2. Melton GB, Lillemoe KD: Choledochal cyst and biliary strictures. In *Maingot's Abdominal Operations*, 11th edition. Zinner MJ, Ashley SW, eds. McGraw Hill Medical, New York: 2007, 889–920.
3. Nagorney DM: Bile duct cysts in adults. In *Surgery of the Liver, Biliary Tract, and Pancreas*, 4th edition. Blumgart LH, ed. Saunders Elsevier, Philadelphia: 2007, 991–1004.
4. Nagorney DM, Sarmiento JM: Surgical management of cystic disease of the liver. In *Surgery of the Liver, Biliary Tract, and Pancreas*, 4th edition. Blumgart LH, ed. Saunders Elsevier, Philadelphia: 2007, 1021–33.

## Anesthetic Considerations for Biliary Tract Surgery

(Procedures covered: open cholecystectomy; cholangiography; choledochotomy; biliary drainage procedures; transduodenal sphincterotomy or sphincteroplasty; cholecystojejunostomy; excision of bile duct tumor; choledochal cyst excision/anastomosis)





## Preoperative

Patients presenting for biliary tract surgery are an extremely diverse group, ranging from the otherwise healthy to the extremely ill. With the increasing popularity of laparoscopic surgery, open cholecystectomies will be performed rarely, or when it is not possible to complete the laparoscopic procedure. Cirrhosis, even of a mild degree, substantially increases the risk of cholecystectomy, with hemorrhage being the greatest danger. Patients with bile duct tumors are usually jaundiced at presentation and have undergone transhepatic and/or endoscopic studies for diagnostic purposes. Often an external transhepatic biliary drain may be present and jaundice may have been relieved in this way. Rarely, a hepatic resection may be performed as part of the procedure. Prior operation or the presence of portal HTN may substantially increase the duration, complexity, and blood loss of the procedure.

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### Respiratory

Pain 2° an acute abdominal process may impair respiratory function ( $\downarrow$  FRC, hypoventilation, atelectasis). For patients undergoing laparoscopic cholecystectomy, intraabdominal  $\text{CO}_2$  insufflation may  $\rightarrow$  atelectasis,  $\downarrow$  FRC,  $\uparrow$  PIP, and  $\uparrow$   $\text{PaCO}_2$ . Studies comparing patients undergoing open vs laparoscopic cholecystectomy reveal that respiratory function is less impaired and function is recovered more quickly in those undergoing laparoscopic cholecystectomy. Tachypnea, hyperpnea, and acute respiratory alkalosis can be signs of sepsis, or due solely to pain associated with inflammation of the gallbladder.

**Tests:** Consider CXR and others as indicated from H&P.

Patients may be dehydrated from fever, vomiting, and decreased oral intake; assess hemodynamic status by evaluating BP and HR in the supine and standing positions. Fluid resuscitate if patient shows Sx of orthostatic  $\downarrow$  SBP until hemodynamic status improves. Patients undergoing laparoscopic cholecystectomy may experience hemodynamic compromise 2° positioning (reverse Trendelenburg  $\rightarrow$  excessive intraabdominal pressure with subsequent impairment of venous return). Epigastric discomfort is common with biliary tract disease and can mimic symptoms of myocardial ischemia.

**Tests:** ECG; others as indicated from H&P.

In patients with obstructive jaundice, preop administration of bile salts po may prevent renal insufficiency following surgery.

**Tests:** UA and others as indicated from H&P.

Patients with peritonitis will exhibit guarding and may develop abdominal distention and paralytic ileus. Therefore, full-stomach precautions are warranted. Laparoscopic approach is contraindicated in these patients. Ensure adequate hydration and consider administration of lactulose or bile salts.

**Tests:** Bilirubin; AST (SGOT); ALT (SGPT); alkaline phosphatase; albumin

Leukocytosis is often present with a moderate left shift. coags. Administer vitamin K as needed (10 mg iv/sc).

**Tests:** CBC, with differential and Plt

Other tests as indicated from H&P.

Meperidine (0.5–0.6 mg/kg iv) is thought to cause less sphincter of Oddi spasm than other opiates. Sphincter spasm can interfere with intraop cholangiograms and cause pain; reverse opiate-induced spasm with naloxone in 40 mcg increments. Atropine (0.4–0.6 mg im or iv) or glycopyrrolate (0.2–0.3 mg im or iv) may help decrease spasm of the sphincter and can be given in combination with the opiate. Parenteral vitamin K is indicated if PT is prolonged (10 mg/d po or im for 3 d). Administer  $\text{H}_2$  antagonists (ranitidine 50 mg iv); metoclopramide (10–20 mg iv) may be given if patient is at risk for gastric aspiration.

### Cardiovascular

### Renal

### Gastrointestinal

### Hematologic

### Laboratory

### Premedication





## Intraoperative

**Anesthetic technique:** GETA. In patients at risk for aspiration, ET intubation should be accomplished following a rapid-sequence iv induction (see [p. B-4](#)).

<b>Induction</b>	Standard induction (see <a href="#">p. B-2</a> ) if no aspiration risk. In patients at risk of aspiration, a rapid-sequence induction should be performed (see <a href="#">p. B-4</a> ).
<b>Maintenance</b>	Standard maintenance (see <a href="#">p. B-2</a> ). Muscle relaxants facilitate surgery and are indicated.
<b>Emergence</b>	If there is a risk for aspiration of gastric contents, patient should be extubated awake after return of protective airway reflexes; otherwise, no special considerations.
<b>Blood and fluid requirements</b>	Minimal blood loss  Possible 3rd-space loss IV: 16–18 ga × 1–2 NS/LR @ 5–8 mL/kg/h  Blood products usually not required. Anticipate that patient maybe dehydrated and require generous iv hydration (e.g., 10–15 mL/kg) before anesthetic induction.
<b>Monitoring</b>	Standard monitors (see <a href="#">p. B-1</a> ).  IV size and number according to risk of significant blood loss. Others as clinically indicated.
<b>Positioning</b>	and pad pressure points eyes  A steep, reverse Trendelenburg position may be required, causing cardiorespiratory impairment: venous return → ↓ CO
<b>Complications</b>	Atelectasis 2° surgical retraction ↓BP  These complications are unique to laparoscopic procedures.

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## Postoperative

<b>Complications</b>	Ventilatory impairment Pneumothorax Atelectasis PONV VTE Subcutaneous emphysema  Monitor patients for hypoxemia in the postop period. Administer supplemental O <sub>2</sub> and consider a portable CXR to aid in the diagnosis.
<b>Pain management</b>	PCA (See <a href="#">p. C-3</a> )  Shoulder pain  See <a href="#">p. B-1</a> See <a href="#">p. B-2</a> Intercostal nerve blocks, intrapleural analgesia, or epidural analgesia are also useful techniques. Prolonged PCA meperidine is associated with ↑ normeperidine → CNS disorder, seizures. 2° subdiaphragmatic gas trapping

## Suggested Readings

1. Marco AP, Yeo CJ, Rock P: Anesthesia for a patient undergoing laparoscopic cholecystectomy. *Anesthesiology* 1990; 73 (6):1268–70.
2. Nakeeb A, Ahrendt SA, Pitt HA: Calculous biliary disease. In *Greenfield's Surgery: Scientific Principles and Practice*, 3rd edition. Mulholland MW, Lillemore KD, Doherty GM, et al, eds. Lippincott Williams & Wilkins, Philadelphia: 2006, 978–98.
3. Pain JA, Cahill CJ, Gilbert JM, et al: Prevention of post-operative renal dysfunction in patients with obstructive jaundice: a multicenter study of bile salts and lactulose. *Br J Surg* 1991; 78:467–9.

