

Choledochoduodenostomy

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Choledochoduodenostomy was first performed by Riedel in 1888 for an impacted common bile duct stone. The main principle of the procedure is that a side-to-side anastomosis is designed to allow free flow of bile from the common bile duct to the duodenum. It offers some advantages over choledochojejunostomy:

- A more physiologic conduit
- Relatively quick and simple, with fewer anastomotic sites
- Ease of access for future endoscopic interventions

Indications and Contraindications

Indications

Biliary dilatation resulting from:

- Benign distal biliary strictures not suitable for transduodenal sphincteroplasty
- Indeterminate biliary stricture in the head of the pancreas, when a preoperative decision has been made not to react if malignancy cannot be confirmed on exploration and open biopsy
- Unresectable malignant stricture where the duodenum comfortably reaches the dilated bile duct
- Primary or recurrent common duct stones, when endoscopic therapies have failed or are not available
- Impacted common duct stone

Contraindications

- Narrow common bile duct (<8 mm)
- Active duodenal ulceration
- Malignancy preventing easy reach of duodenum to the dilated bile duct
- Obstruction of the 3rd or 4th portion of the duodenum

Preoperative Investigation and Preparation

Preoperative investigation

- *Clinical:* Look for associated symptoms of gastric outlet obstruction, history of duodenal ulceration, evidence of biliary sepsis, coagulopathy, and dehydration
- *Laboratory:* Bilirubin and liver function tests, coagulation parameters, creatinine, electrolytes
- *Radiology:* The most basic imaging study required is ultrasonography, to confirm the degree and site of biliary obstruction. CT scans can aid in the evaluation of mass lesions. The gold standard for noninvasive biliary imaging is MRI/MRCP, which can provide detailed images of biliary anatomy that surpass both ultrasonography and CT.

Preparation

- Adequate hydration
- Correction of any underlying coagulopathy
- Antibiotic prophylaxis

What not to do

Preoperative biliary stenting increasingly has been used as a reflexive treatment for biliary dilatation. If surgical decompression of the biliary tree is necessary and the time to surgery is acceptably brief, preoperative stenting should be avoided, as it increases infectious complications of surgery. Furthermore, the resultant decompression of the common bile duct will make the choledochoduodenal anastomosis more technically challenging. If a delay before surgical intervention is unavoidable, or if there is evidence of cholangitis, preoperative stenting is appropriate.

Procedure: Open Choledochoduodenostomy

Access

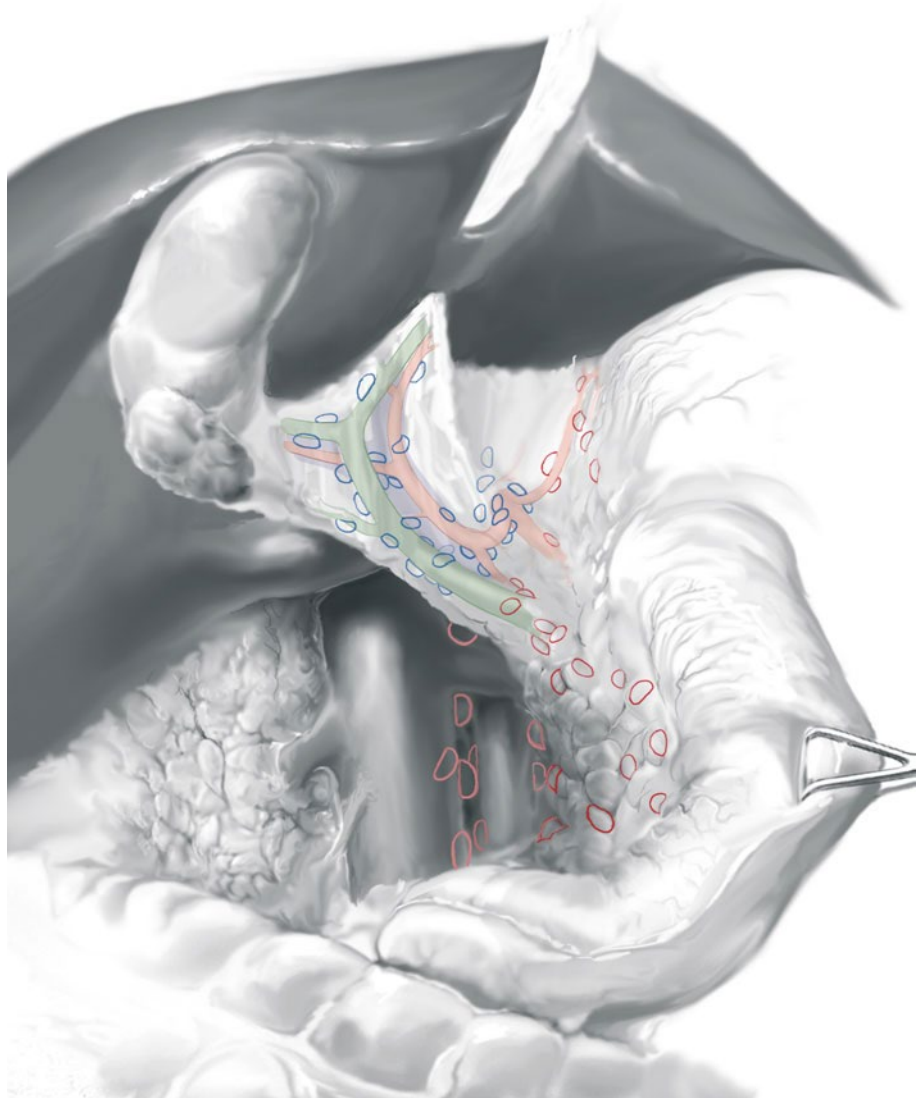
Both right subcostal and midline incisions provide appropriate exposure. (See Part I, ► Chaps. 2 “Positioning and Accesses” and 3 “Retractors and Principles of Exposure.”)

Step 1

Step 2**Exposure**

After installation of the retractor (Bookwalter), the hepatic flexure of the colon is mobilized and reflected inferiorly. Next, generous kocherization of the duodenum is performed, as shown in the ► Chap. 68 “Resection of Gallbladder Cancer, Including Surgical Staging.” The duodenal mobility provided by kocherization is critical to ensuring a tension-free anastomosis (■ Fig. 76.1).

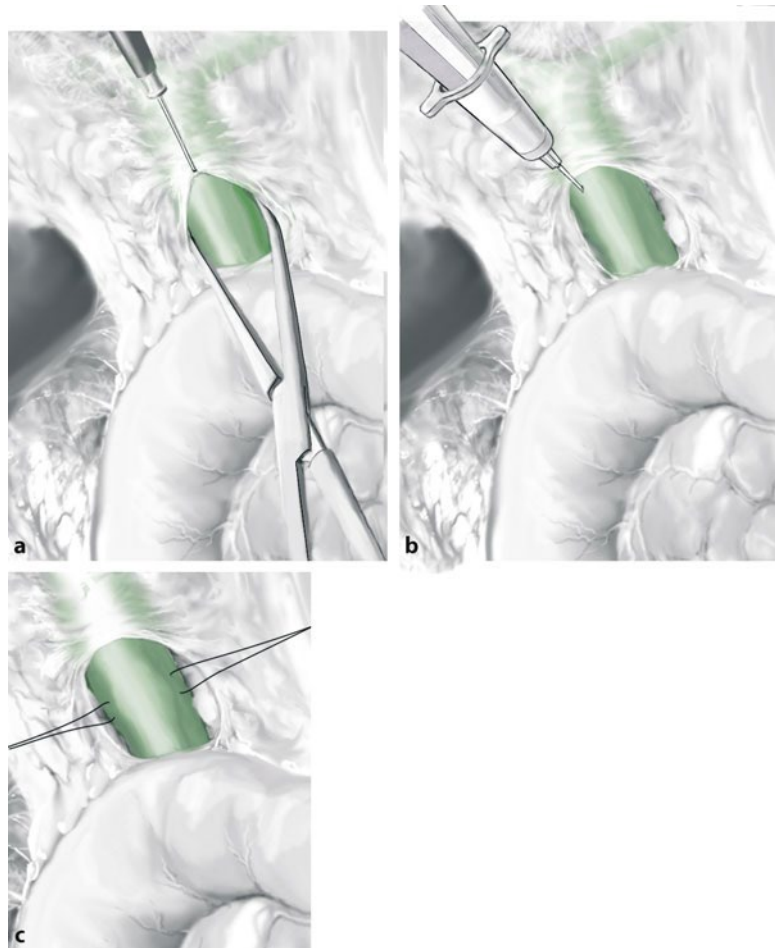
Cholecystectomy should be performed as shown in the ► Chap. 67 “Laparoscopic Cholecystectomy, Open Cholecystectomy, and Cholecystostomy.”



■ Fig. 76.1

Step 3**Defining the common bile duct**

Incise the peritoneum of the hepatoduodenal ligament to expose the anterior surface of the common bile duct (■ Fig. 76.2a). If the anatomy is unclear or the surgery is reoperative, the site of the common bile duct can be confirmed by the aspiration of bile through a small-diameter (26 or 27 gauge) “seeker needle” (■ Fig. 76.2b). The target site for the choledochotomy is then identified. Typically, this is distal to the cystic duct/common duct junction. Next, 3-0 silk is used to place two stay sutures at the lateral aspects of the anterior common bile duct wall (■ Fig. 76.2c).



■ Fig. 76.2

Step 4**Opening of the bile duct and the duodenum**

A 2-cm longitudinal choledochotomy is performed, with the distal extent of the choledochotomy near the superior border of the mobilized duodenum. This location will ensure that the duodenum comfortably reaches the choledochotomy.

A longitudinal duodenotomy is performed on the antimesenteric aspect of the duodenum. The length of the duodenotomy should be approximately 70 % of the choledochotomy's length, as it will stretch to become the same size (■ Fig. 76.3).



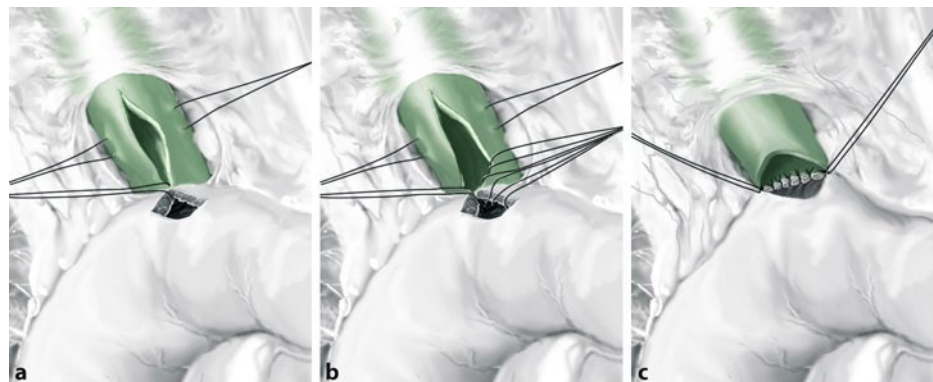
■ Fig. 76.3

Step 5**Posterior wall anastomosis**

The anastomosis is performed using interrupted 4-0 sutures (Maxon, PDS, or Vicryl) with the knots inside the lumen for the posterior wall. The tendency to place too many sutures is a common mistake; 12 sutures are usually sufficient.

Visualizing the anastomosis as a clock face, the first stitch should be placed at the 6 o'clock position, going inside-to-outside on the duodenum and outside-to-inside the lumen on the bile duct (■ Fig. 76.4a). The suture is left untied and secured with a Crile clamp. Gentle traction on this suture aids in exposure and placement of the subsequent posterior wall sutures. Three additional sutures are placed at regular intervals between the 6 o'clock and 3 o'clock positions. Similarly, three sutures are placed between the 6 o'clock and 9 o'clock positions. All of the posterior row sutures should be placed prior to tying (■ Fig. 76.4b).

The silk stay sutures can now be cut and removed. The posterior row sutures are all tied, and all but the 3 o'clock and 9 o'clock sutures are cut (■ Fig. 76.4c).



■ Fig. 76.4

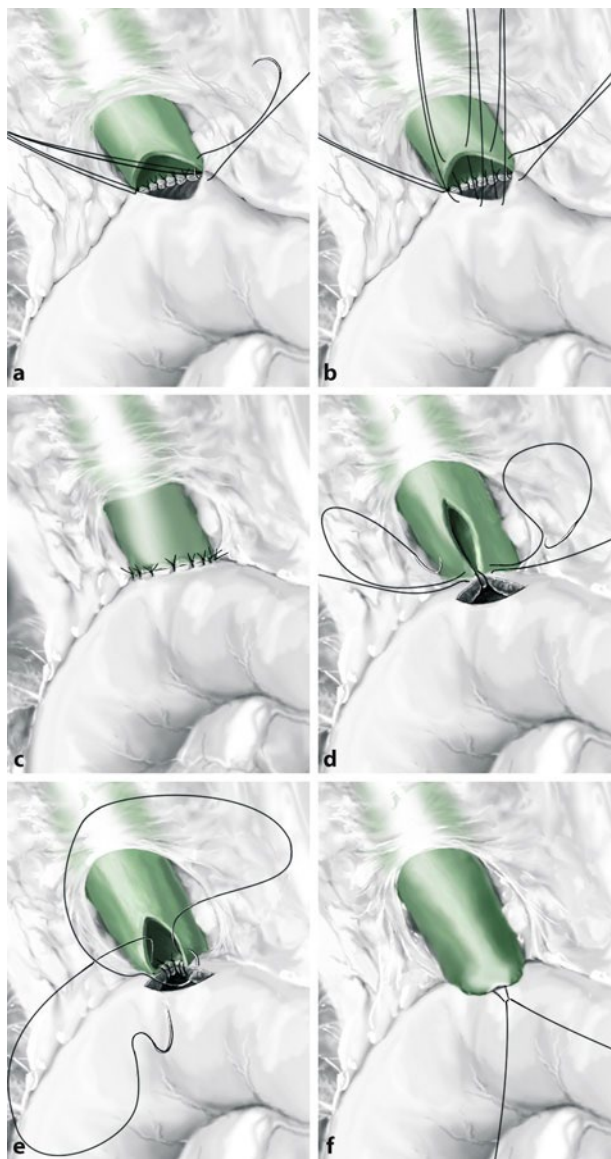
Step 6

Anterior wall anastomosis

Traction on the corner sutures ensures that the corner is inverted. All of the anterior row sutures are placed from outside-to-inside on the duodenum and then inside-to-outside on the bile duct, so that the knots will be on the outside of the lumen (■ Fig. 76.5a). All of the sutures are placed prior to tying them (■ Fig. 76.5b).

The enterotomy is intentionally created shorter than the choledochotomy, as the duodenum always stretches during the creation of the anastomosis. Despite planning for this stretching, there still may be a size mismatch between the duodenum and bile duct. Care should be taken to make sure the sutures are placed evenly on both the bile duct and the duodenum (■ Fig. 76.5c). Stenting of the anastomosis is not necessary.

Though we prefer the interrupted anastomosis, a running anastomosis has also been described. Two 3-0 absorbable sutures are placed at the 6 o'clock position (■ Fig. 76.5d) and are then sewn in a running fashion to 12 o'clock (■ Fig. 76.5e) and tied (■ Fig. 76.5f).



■ Fig. 76.5

Procedure: Laparoscopic Choledochoduodenostomy

The basic principles of a laparoscopic choledochoduodenostomy are essentially the same as the open procedure, with several important exceptions that are outlined below.

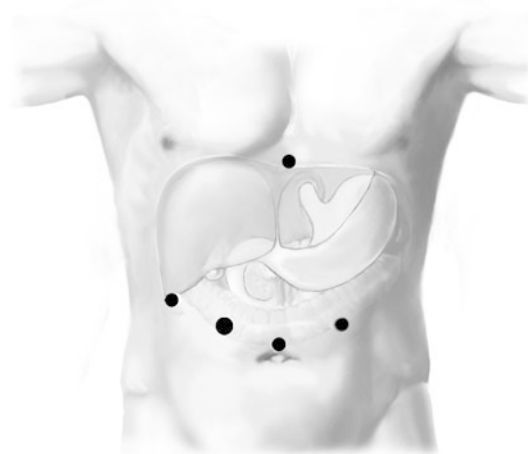
Advantages and disadvantages

There are no randomized data comparing laparoscopic and open choledochoduodenostomy, but the proposed benefits are similar to those of laparoscopy in general. These include the potential for decreased pain, shorter hospital stays, and lower rate of large hernias and wound infections. The main disadvantages are increased operative time and technical difficulty. Therefore, laparoscopic choledochoduodenostomy should be attempted only by experienced biliary surgeons who are facile with laparoscopic suturing.

Step 1

Access, port placement, and setup

The patient is placed in the supine position and access to the abdomen can be obtained with a Veress needle or open Hasson technique. Our preferred port placement is shown in the diagram below. With the surgeon standing on the patient's right, 5-mm and 12-mm ports are placed in the right upper quadrant. These are the two main working ports. The assistant stands on the patient's left and uses the periumbilical port for the camera and the left upper quadrant port to assist with retraction and suctioning. An additional 5-mm subxiphoid port is placed to be used for liver retraction. All ports should be at least one hand-breadth away from the other ports, to provide enough working space. Use of a 5-mm, 30-degree laparoscope is ideal, as it provides more flexibility than a 0-degree camera (■ Fig. 76.6).



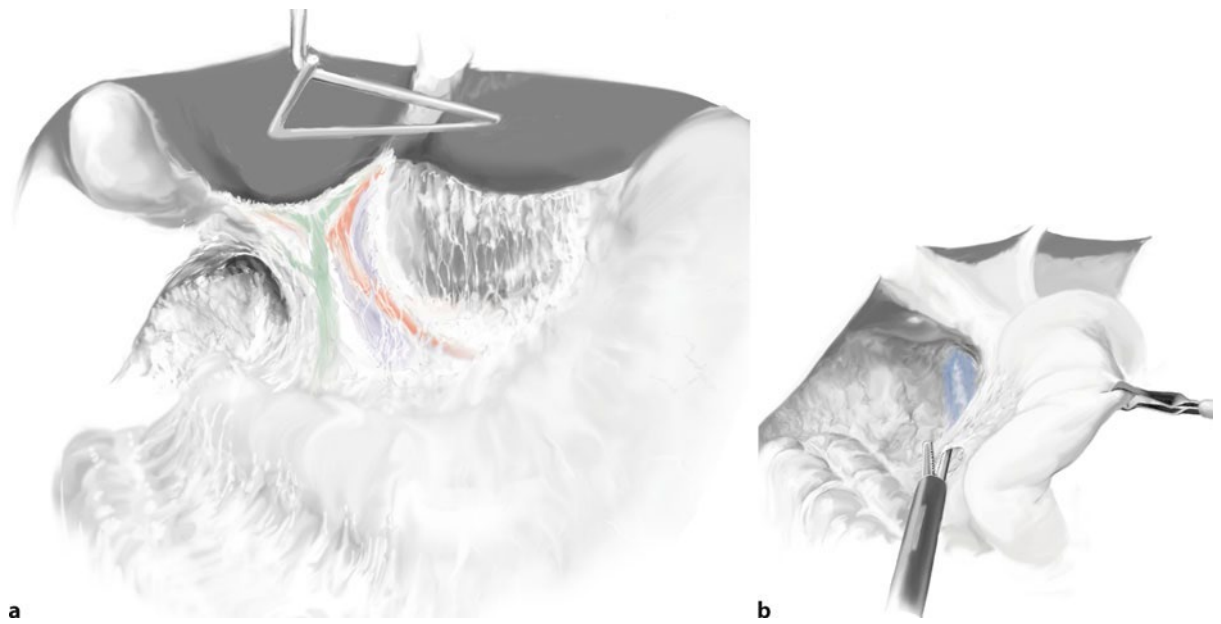
■ Fig. 76.6

Step 2**Exposure**

If a cholecystectomy has not been performed, this should be completed first, as shown in the ► Chap. 67 “Laparoscopic Cholecystectomy, Open Cholecystectomy, and Cholecystostomy.” The subxiphoid port can be used as the main operative port and the right-sided ports can be used for retraction for this portion of the procedure.

Once the cholecystectomy is completed, place a liver retractor (Snowden-Pencer® Diamond Flex Liver Retractor, Snowden-Pencer® Fast Clamp) in the subxiphoid port. This provides exposure to the duodenum and hepatic hilum.

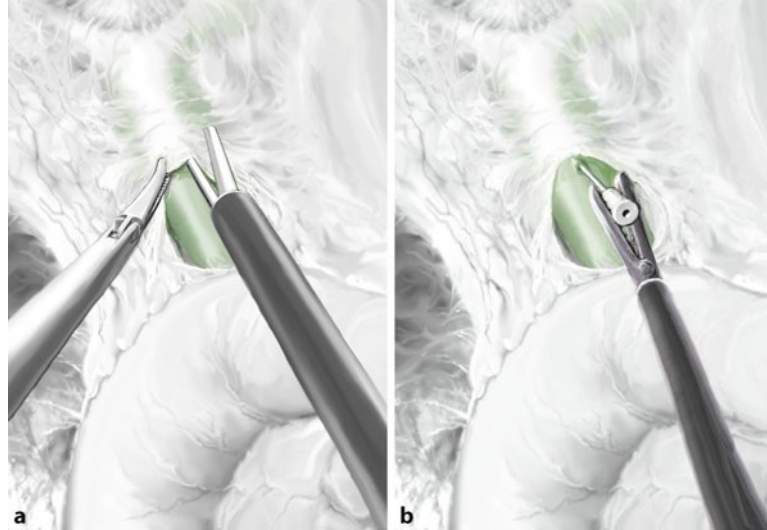
With the assistant providing gentle medial retraction of the duodenum, the peritoneum lateral to the duodenum is opened and kocherization of the duodenum is carried out using a LigaSure™ (Covidien) or Harmonic ACE® (Ethicon). Hook electrocautery can also be used, but we prefer the LigaSure™ because in addition to its hemostatic characteristics, it can also be used as a dissecting instrument (■ Fig. 76.7).



■ Fig. 76.7

Step 3**Defining the common bile duct**

Incise the peritoneum of the hepatoduodenal ligament to expose the anterior surface of the common bile duct. This is often most easily initiated with hook electrocautery. If the anatomy is unclear, the common bile duct can be confirmed by using a seeker needle. Under direct visualization, a 25-gauge butterfly needle is introduced through the 12-mm port and inserted into the bile duct. The presence of bile confirms the duct (■ Fig. 76.8).



■ Fig. 76.8

Step 4**Opening of the bile duct and the duodenum**

A 2-cm longitudinal choledochotomy is performed using hook electrocautery. Just as in the open procedure, the distal extent of the choledochotomy should be close to the superior border of the mobilized duodenum.

A longitudinal duodenotomy (70% of the choledochotomy's length) is similarly performed on the antimesenteric aspect of the duodenum, using hook electrocautery (■ Fig. 76.9).



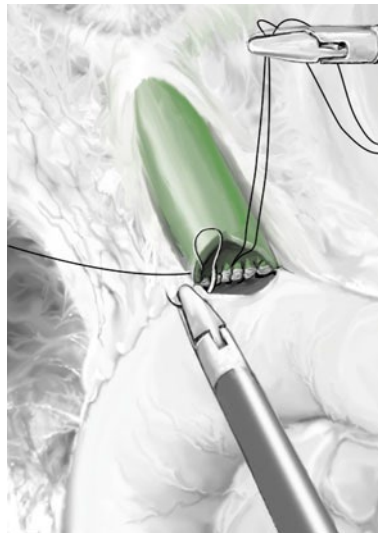
■ Fig. 76.9

Step 5**Posterior wall anastomosis**

The anastomosis is performed in a similar fashion to the open technique. The posterior wall is completed first using interrupted sutures (3-0 or 4-0 Vicryl, 4-0 Maxon, or 4-0 PDS) with the knots inside the lumen. Any of these suture choices would be appropriate, but Vicryl is the easiest to handle laparoscopically. Either a free needle or the EndoStitch™ device (Covidien) can be used. Using the EndoStitch™ is faster and less technically demanding than suturing with a free needle, but care should be taken not to excessively torque the short, straight needle of this device when passing it through the wall of the bile duct.

The first stitch should be placed at the 6 o'clock position, going inside-to-outside on the duodenum and outside-to-inside the lumen on the bile duct. Unlike in the open technique, this suture is tied and then handed to the assistant. Gentle traction on this suture aids in exposure and placement of the subsequent posterior wall sutures.

Three additional sutures are placed at regular intervals between the 6 o'clock and 3 o'clock positions. Similarly, three sutures are placed between the 6 o'clock and 9 o'clock positions. Because managing untied suture laparoscopically can be clumsy and challenging, all sutures are tied and cut as they are placed, with the exception of the 3 o'clock and 9 o'clock sutures, which are tied but not cut (■ Fig. 76.10).



■ Fig. 76.10

Step 6**Anterior wall anastomosis**

All of the anterior row sutures are placed from outside-to-inside on the bile duct and then inside-to-outside on the duodenum so that the knots will be on the outside of the lumen.

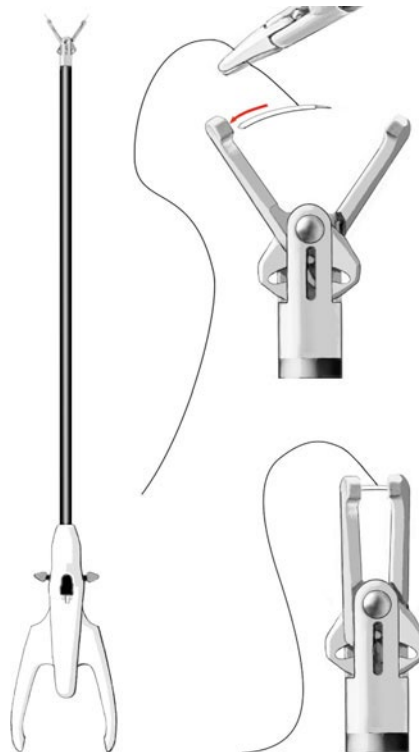
Sutures are placed at 2 o'clock and 10 o'clock. These are tied and cut.

When there are approximately three sutures remaining to be placed (11, 12, and 1 o'clock), these sutures are placed and left untied. Tying these sutures as they are placed will make placing the final stitches quite difficult. Once the final sutures are placed, they are all tied and cut.

If the EndoStitch™ device is being used, the final three sutures are left untied, as described above. To do this, the needle must be released from the device after placing each stitch. The needles are left attached to the suture inside the abdomen. These final sutures can either be tied as one would tie a free suture, or they can be reloaded on an empty EndoStitch™ inside the abdomen and then tied using the standard EndoStitch™ technique (■ Figs. 76.11 and 76.12).



■ Fig. 76.11



■ Fig. 76.12

Postoperative Tests

- Bilirubin and alkaline phosphatase.

Local Postoperative Complications

■ Short-term

- Wound infection can occur; the incidence is increased in patients who have had preoperative biliary stenting.
- Bile leakage is uncommon and generally indicates a technical issue with the anastomosis. The priority in management is to establish a controlled fistula and to determine whether there is unobstructed biliary-enteric continuity. A CT scan and fistulagram via drain are the initial investigations. Most biliary fistulas will heal spontaneously if there is no downstream obstruction.

■ Choledochoduodenostomy

Surgical drain is not requisite, but the placement of drain to Morrison's pouch or Winslow foramen might be appropriate in some cases after choledochoduodenostomy.

■ Medium to long-term

- Recurrent cholangitis can present with symptoms of pain, jaundice, and right upper quadrant pain with signs of sepsis. Cholangitis is most often the result of anastomotic stricture, but can also result from sump syndrome, development of choledocholithiasis, or disease in the more proximal biliary tree. A CT scan or MRI will aid in identifying the level of the obstruction. Endoscopic retrograde cholangiopancreatography (ERCP) is necessary to define the anatomy of the biliary tree and provides therapeutic interventions for several causes of cholangitis.
- Anastomotic stricture typically presents with cholangitis as described above, but in some patients it can present with progressive jaundice without other signs of cholangitis. Strictureing is more likely if the choledochotomy at the time of surgery was less than 2 cm. Some patients may respond to endoscopic dilation and stenting, but patients who fail endoscopic management require conversion to Roux-en-Y hepaticojejunostomy.
- Sump syndrome results from reflux of intestinal contents and biliary stasis within the extrahepatic biliary tree. The typical presenting signs are pain, cholangitis, jaundice, and, less commonly, pancreatitis. Hepatic abscesses can also be seen in association with sump syndrome. The onset is typically months to years postoperatively. Diagnosis is confirmed on ERCP, where the blind end of the common bile duct is found to be full of food debris or calculi. The initial treatment is endoscopic, and revision to Roux-en-Y hepaticojejunostomy is rarely indicated. The risk of developing sump syndrome after choledochoduodenostomy has deterred some surgeons from using this technique, but the incidence of sump syndrome is quite low (about 2.5%) and it is readily treated with endoscopic interventions.
- Cholangiocarcinoma usually occurs 10 to 20 years postoperatively in patients with a long history of recurrent cholangitis. Early symptoms are nonspecific and include pain, weight loss, and cholestasis. The workup of suspected cholangiocarcinoma is detailed elsewhere.

Tricks of the Senior Surgeon

- Anticipate a 50% stenosis and make the choledochotomy at least 2 cm long.
- Position the choledochotomy and the enterotomy relatively close together, to minimize tension.
- Generous Kocherization is essential to ensuring that there is no undue tension on the anastomosis.