Biliary Tract Cancers

CHAPTER 15

Biliary Tract Cancers: Extrahepatic Management

INTRODUCTION
Interventional radiologists first became involved in the management of malignant obstruction of the biliary tree in the late 1960s, when Kaude et al. introduced nonsurgical biliary drainage. Since then, improved diagnostic imaging techniques, significant developments in interventional radiology, and the results of clinical trials have revolutionized and clearly defined the role of percutaneous biliary interventions.

Percutaneous transhepatic cholangiography (PTC) is now rarely employed for purely diagnostic purposes and has been largely replaced by noninvasive imaging techniques, such as ultrasonography (US), computed tomography, magnetic resonance cholangiography (MRC), and endoscopic retrograde cholangiography (ERC). PTC is now reserved for problematic cases and as a prelude to percutaneous intervention.

BILIARY DRAINAGE FOR MALIGNANT STRICTURES
Biliary obstruction is potentially fatal because of the adverse pathologic effects including depressed immunity, impaired phagocytic activity, reduced Kupffer cell function, and paucity of bile salts reaching the gut, with consequent endotoxemia, septicemia, and renal failure. Most patients with malignant obstructive jaundice caused by carcinoma of the gallbladder, carcinoma of the pancreas, and cholangiocarcinoma present with advanced disease and only 20% to 30% of such tumors are resectable at the time of diagnosis. Palliation of the malignant obstruction relieves the patient of itching and jaundice, reduces the risk of infection and septicemia, and generally improves the quality of life. Surgical, endoscopic, and interventional radiologic (IR) percutaneous techniques are available for biliary drainage. Because of the lower morbidity and mortality associated with ERC and percutaneous transhepatic biliary drainage (PTBD) compared to surgical methods, surgery is now rarely employed for palliative purposes.

Because most patients undergo endoscopic retrograde cholangiopancreatographic (ERCP) during the diagnostic workup for obstructive jaundice endoscopic insertion of biliary endoprosthesis is performed more often than percutaneous drainage. If ERCP demonstrates a malignant stricture, an endoprosthesis can be inserted immediately after cholangiography. In patients with strictures below the hilum of the liver, endoscopic drainage achieves a high rate of success, is associated with fewer complications than percutaneous intervention, and avoids the discomfort of a percutaneous biliary catheter.

The majority of strictures of the mid and lower common bile ducts, which are mainly caused by carcinoma of the head of the pancreas, can be drained effectively by the endoscopic approach. Many hilar biliary strictures are difficult to treat endoscopically, however, and are best dealt with interventional radiologic techniques. The indications for PTBD are summarized in Table 15.1.

Preoperative Percutaneous Transhepatic Biliary Drainage
The practice of PTBD prior to surgery is controversial. It has not been shown to decrease surgical morbidity or mortality. It is advocated by some surgeons in certain circumstances before curative resection, however, as a method of correcting metabolic derangements produced by biliary obstruction prior to surgery. Either internal/external biliary drainage catheters or more plastic stents are inserted 2 to 6 weeks prior to elective surgery. Some surgeons favor PTBD because the biliary catheters are easy to locate at surgery, particularly during difficult dissections of lesions at the hepatic hilum.

ROLE OF IMAGING BEFORE PALLIATIVE BILIARY DRAINAGE
Because the method of management of malignant biliary obstruction depends on the resectability of the underlying tumor, patients should undergo accurate staging of the disease. One of the important goals of preoperative imaging is establishing whether there is vascular invasion by a tumor at the hepatic hilum. Previously, angiography was used to identify the vascular anatomy prior to surgery in carcinoma gallbladder and hilar cholangiocarcinoma. Recently, dual-phase helical computed tomography (CT) has been used to evaluate vascular invasion in hilar tumors and may soon be able to provide all the information required to comprehensively evaluate each patient for resectability.

High-quality three-dimensional (3D) reconstruction images made possible by helical CT are uniquely suitable for the depiction of the complex anatomy of the biliary tree.
Three-dimensional reconstructions can be produced successfully by taking advantage of the negative contrast effect of low-attenuation bile in the dilated ducts relative to the adjacent enhanced liver and can determine the level and cause of biliary obstruction.\(^{13,14}\) CT is very helpful in the identification of variant ductal anatomy and in the selection of the most appropriate duct for drainage (FIGURE 15.1).

Magnetic resonance imaging (MRI) performs as well as CT in the demonstration of direct spread of the tumor to the liver and in the detection of hepatic metastases. Visualization of intrahepatic bile ducts on MRI depends on the size of the ducts, the concentration of bile, motion artifact, and periportal high signal. CT and US are more sensitive than MRI in detecting intrahepatic bile duct dilatation. Magnetic resonance choangiopancreatography (MRCP) has been a very useful development for imaging the biliary tree.\(^ {13,14,15}\) MRCP can accurately define the extent of ductal involvement in patients with malignant hilar and perihilar obstruction. Ductal dilatation, strictures, and anatomic variation are well depicted by this technique and this ability makes this modality well suited for planning the optimal therapeutic approach for patients with biliary obstruction.

In suspected malignant biliary obstruction, percutaneous fine-needle aspiration (FNA) or biopsy can be used for cytologic or histologic confirmation of the presence of a malignant tumor. Cytologic study is positive in roughly 50% of the patients with cholangiocarcinoma, although the reported sensitivity varies widely.

If FNA fails, percutaneous biopsy can be done by cholangiographic or US guidance. Alternatively the cholangiographic tract could also be used to obtain brushings or a biopsy using forceps, or a cardiac bioptome (FIGURE 15.2).

### Preparation for PTBD

#### Blood Tests

**Coagulation profile:** The International normalized ratio (INR) should be less than 1.5. Vitamin K, fresh frozen plasma, and platelets (as needed) should be administered to correct any coagulopathy.

**Liver function tests:** Serum bilirubin and alkaline phosphatase levels should be checked to obtain baseline values (an elevated alkaline phosphatase level, even in the setting of a near-normal bilirubin indicates a low-grade obstruction).

**Baseline renal function:** Blood urea and creatinine should be checked, especially before administering preprocedure nephrotoxic antibiotics. IV fluids should be administered during drainage as a prophylactic measure against hepatorenal failure.

#### Informed Consent

The procedure should be explained completely to the patient, outlining the risks with specific attention to sepsis and bleeding.

---

**Table 15.1**

<table>
<thead>
<tr>
<th>Indications for Percutaneous Transhepatic Biliary Drainage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. To manage infectious complications of biliary obstruction, such as cholangitis and sepsis</td>
</tr>
<tr>
<td>2. To relieve obstructive jaundice when an endoscopic retrograde approach fails or is not indicated</td>
</tr>
<tr>
<td>3. Preoperative decompression and stent placement to assist in surgical manipulation (controversial)</td>
</tr>
<tr>
<td>4. To gain access to the biliary system to perform other bile duct interventions, such as biopsy, stent placement, and transhepatic brachytherapy for cholangiocarcinoma</td>
</tr>
</tbody>
</table>

---

**FIGURE 15.1**  
A. CT scan shows a large right-sided tumor and therefore the left lobe was chosen for PTC.  
B. Poststenting the left duct.

---
**Prophylactic Antibiotics**

Appropriate antibiotics are administered to avoid biliary sepsis because of the high incidence of bacterial colonization of obstructed biliary systems. The spectrum of antibiotic coverage must include both gram-positive and gram-negative organisms. *Escherichia coli* is the most common organism involved; enterococci, klebsiella species, and *Streptococcus viridans* are other frequently observed organisms. The antibiotics should be continued for 24 to 72 hours following the procedure. Antibiotic therapy should be modified according to the results of positive bile or blood cultures.

**Sedation/Analgesia**

Biliary procedures are most often performed under conscious sedation (midazolam and fentanyl) with liberal infiltration of local anesthetic at the site and up to the capsule of the liver. Use of longer-acting local anesthetics may help to provide long postprocedure pain relief. Intercostal blocks have also been used and in some cases general anaesthetic is required.

**Skin Preparation**

It is best to prepare a wide area, which will permit access to the biliary system from the left and right sides, as needed. Contraindications for PTBD are summarized in Table 15.2.

**Biliary Drainage Procedure**

**Technique**

**External Drainage**

A percutaneous transhepatic cholangiogram (PTC) is performed prior to biliary drainage to define the biliary anatomy. A 22-gauge needle is inserted into the liver immediately anterior to the midaxillary line and advanced horizontally to the lateral

---

**Table 15.2**

**Contraindications for Percutaneous Transhepatic Biliary Drainage**

- Uncorrectable bleeding diathesis.
- Large volume of ascites (relative; procedure may be difficult with potential for bile peritonitis. Consider a left-sided approach and/or insert an ascitic drain).
- Segmental isolated intrahepatic obstructions that do not cause significant symptoms should not be drained. Bacterial contamination usually occurs when an isolated ductal system is accessed. As a consequence of this contamination, it is often impossible to withdraw drainage even if the drainage is not required clinically. Thus a patient could be left with a permanent, unwanted, and potentially problematic drainage catheter.
- Patients with multiple obstructed and isolated biliary segments, often caused by numerous hepatic metastases. In these patients, drainage is often ineffective in relieving symptoms and can therefore be avoided.
- Unsafe access route because of either interposed bowel or lung.
border of the vertebral column (FIGURE 15.3). Dilated ducts are located by withdrawing the needle and injecting contrast medium or aspirating until bile is obtained. The aspiration method has the advantage of avoiding a large stain of parenchymal contrast if several passes are required. If the ducts are not dilated, the aspiration method is less effective and the injection method should be used. Some radiologists puncture the bile ducts using ultrasound guidance. Once a duct has been located, undiluted contrast medium is injected until the obstructed biliary system is outlined (FIGURE 15.4). A tilting table is helpful to convey contrast to the lower common bile duct (CBD). In many patients with obstruction of the CBD, flow of contrast medium may appear to stop immediately below the hilum, creating a false impression of hilar obstruction; tilting the fluoroscopy table is the best way of demonstrating the lower CBD in such cases.

Although it may be possible to use the duct catheterized by the PTC needle for drainage, the duct is usually at an angle to the needle track, which causes difficulty in catheter manipulations, or is close to the liver hilum, which increases the risk of complications (vascular injury). In most cases it is best to perform a second, peripheral puncture of a suitable duct with a horizontal course (FIGURE 15.5). Lateral screening using a C-arm is very helpful, although not essential, for localization of the duct in the anterior-posterior plane.

Although bile duct catheterization can be achieved with standard 18-gauge needles and guidewires, most radiologists use one of several minimally invasive access sets, such as the Accustick set (Meditech, Boston Scientific Corp, MA) (FIGURE 15.6) or the Neff set (William Cook, Europe), for this purpose. These systems allow the radiologist to drain the biliary tree using an initial puncture with a 21- or 22-gauge needle followed by sequential changes of increasingly larger guidewires and catheters. The use of such systems enables small ducts to be selected for drainage and probably reduces the risk of complications, such as hemobilia and bile leakage. The final result of either method is the placement of a catheter with several side holes deep in the biliary tree. At this stage the tip of the catheter lies above the obstructing lesion, which is referred to as external biliary drainage. The catheter is connected to a gravity drainage bag and the tube is secured to the skin to prevent inadvertent removal.

**External-Internal Drainage**

External-internal drainage refers to percutaneous catheter drainage of the bile ducts with the catheter passed through the stricture so that side holes are placed above and below the obstructing lesion. This offers increased stability compared with external drainage and also allows drainage of bile into the duodenum with the advantages of improved fluid and electrolyte balance. For these reasons, most radiologists aim for internal-external drainage if possible at the time of initial PBD. Most strictures can be catheterized with modern angled-tip catheters and hydrophilic guidewires. Occasionally, a stricture is so tight that it cannot be traversed. In this situation, an external catheter should be inserted. After a few days of external drainage, a channel through the stricture usually appears due to resolution of tissue edema, which can be negotiated by the radiologist at a second session.

Some patients are managed for long periods with internal-external catheters. This type of biliary drainage, however, is
associated with bile leaks, infection, patient discomfort, and psychological problems connected with catheters protruding through the skin. If possible, internal-external catheters should be exchanged for endoprostheses.

**Internal Drainage**

**Endoprostheses.** Endoprostheses enable internal drainage of bile across the obstructing lesion and avoid the need for external catheters. There are two types of endoprostheses available for use in the biliary tract, plastic and metallic. Both types may be inserted using either the percutaneous or endoscopic route. Metallic stents are not indicated for benign strictures. Therefore, if the diagnosis of malignancy is uncertain, the procedure should be delayed until histologic proof of disease is obtained.

Plastic endoprostheses consist of plastic or Teflon hollow tubes 8 to 14 cm long with end holes (e.g., Carey-Coons, Boston Scientific Corp., Galway, Ireland), and in some cases side holes (Cook prosthesis, W. Cook Europe) (FIGURE 15.7) to allow drainage of bile from above a stricture to the duodenum. As previously mentioned, plastic stents are more easily deployed by the endoscopists. The caliber of radiologic plastic stents varies from 8 to 12 French. Ideally the largest size should always be used to provide optimal biliary drainage and reduce problems of occlusion by bile encrustation. As a result, a relatively large transhepatic track is required for percutaneous insertion. Because of the increased risk of pain, bleeding and perihepatic bile leakage, which may be caused by the creation of a 12 French hole in the liver, insertion of plastic endoprostheses is generally carried out as a two-stage procedure. PBD is performed and an 8F biliary drainage catheter is inserted. After a few days, the patient is brought back to the interventional radiology suite and the biliary catheter is removed over a guidewire. The transhepatic track is dilated from 8 French to 12 French followed by insertion of the plastic endoprosthesis across the stricture so that the upper end is above the stricture and the lower end projects through the ampulla into the duodenum. It is usual to insert a temporary external biliary catheter, which is removed 24 hours later after check cholangiography (FIGURE 15.8).

Self-expanding metallic endoprostheses are metallic springs 6 to 10 cm long, which are introduced into the bile ducts in a compressed state and expand to a much larger diameter (8 to 12 mm) when the stents are released from their introducer (FIGURE 15.9). The main advantage of metallic stents is that they achieve a much larger diameter than plastic stents when deployed, which allows more efficient biliary drainage. Because they are inserted in a compressed state, the transhepatic track required for metallic stent insertion is generally smaller (5 to 7 French) than for plastic stents (10 to 12 French). This means that metallic stents can be inserted during the same procedure as PBD, which avoids the necessity for a period of external biliary drainage.
Percutaneous biliary drainage is performed and a catheter is manipulated across the stricture. Instead of inserting a biliary drainage catheter, the stricture is predilated to 10 mm using a balloon catheter to facilitate rapid expansion of the metallic stent. After predilation, the stent on its introducer system is advanced across the lesion and is deployed so that the lower end projects through the ampulla and the upper end is well above the stricture. After stent deployment, a temporary small catheter is inserted for access in case of complications and is removed the next day after cholangiography. Postprocedure management instructions following biliary drainage are summarized in Table 15.3.

Table 15.3

Postprocedure Management Instructions Following Biliary

- Patients should be hospitalized for at least 24 hours following biliary drainage and monitored for sepsis and vital signs.
- An appropriate antibiotic combination should be continued after drainage is established.
- The internal-external biliary drainage catheter should be used for external drainage for the first 12 to 24 hours. If the catheter permits drainage of bile into the bowel, then the drainage catheter can be capped to allow internal drainage. If the patient is able to tolerate internal drainage for 8 to 12 hours, then he/she can be discharged. If internal drainage is not possible, then external bag drainage must be maintained. Bile output can range from 400 to 800 mL/day. With external drainage, dehydration can occur, unless adequate steps are taken to replace the lost fluids.
- Biliary drainage catheters should be forward flushed with normal saline every 48 hours. This helps prevent debris from accumulating in the catheter and causing it to occlude.
- If patients are to be sent home on internal drainage, they should not be discharged until the ability to have their bile drained internally is demonstrated adequately without evidence of sepsis or pericatheter leakage.
- Complete instructions for tube care are given prior to discharge. Patients should be instructed to flush the tube gently with 10 cc of saline once or twice per day to keep it debris free. They should be instructed to call if they experience pain, chills, fever, or nausea or vomiting. Any malposition of the tube, bleeding within it, or leakage around the tube should also be taken seriously.
- The dressing around the drainage catheter should be changed at least every 48 hours and bathing avoided. Also, the biliary drainage catheters should be changed every 3 to 4 months.
- Pericatheter leakage is the result of catheter kinking, occlusion, or displacement. Fluoroscopic evaluation is essential for determining and correcting this problem depending on the causes as mentioned. Sometimes upsizing the catheter is the only solution.
- Serum bilirubin values may be followed as an indicator of adequate drainage. Depending on the size and type of drain, it takes, on an average, 10 to 15 days for the bilirubin levels to drop by 50%. If the bilirubin level starts rising, catheter occlusion should be suspected.
- After adequate drainage, biliary sepsis should be relieved. If sepsis remains a problem, then additional studies should be performed to determine the cause, which can be catheter occlusion or undrained biliary ducts. A thorough cholangiogram with special attention to the ductal anatomy can sometimes identify a missing ductal segment, indicating an isolated undrained system. Alternatively, an MRCP or a CT cholangiogram can be performed.
- Late sepsis, manifesting as fever several days or weeks after the patient has been adequately drained, is usually indicative of obstruction of the drainage catheter. If the patient has a capped biliary catheter, the tube should be uncapped to allow the bile to drain externally. If externalizing the drainage catheter resolves the infection, then fluoroscopic evaluation of the catheter can be performed electively. If fever persists after externalization, however, then an emergency catheter evaluation should be performed. If catheter obstruction is not the source of sepsis, then the patient should be evaluated for undrained ductal segments.
can still be accomplished if metallic stents are used. A metallic stent is placed from one hepatic duct to the other across the hepatic duct confluence, followed by placement of a second long stent from the ipsilateral lobe to the duodenum ([FIGURE 15.11]). Although this T configuration achieves drainage of both liver lobes, the Y configuration is preferable because it allows easier intervention if the stents become occluded. Biliary side branches covered by the uncovered stents during placement are not associated with branch occlusion.

It is important to be aware of the anatomy of the right and left hepatic ducts. The right hepatic duct is short, unlike the left, which is 2 to 3 cm long, until its bifurcation into the segmental ducts. Thus a catheter placed in the right system initially drains a greater part of the liver because of the size difference between the lobes. Once the tumor grows, the situation reverses because the catheter placed in the right side now drains only one segment, whereas the left-sided catheter drains the entire left lobe. Thus, for type 2 lesions either the right anterior system or the left system is chosen (left is chosen if the left lobe of the liver is of good size). For type 3a lesions, if there is extensive involvement of the right secondary confluence, we do either a single left-sided drainage or ideally combine it with right anterior or posterior drainage (keeping in mind the cost of the procedure, life expectancy and the subjective assessment of the amount of liver to be drained as seen on CT). It has been shown that drainage of 25% of the liver volume using a single catheter/endoprosthesis may be sufficient.21 An endoscopic study has shown that drainage both lobes in patients with hilar lesions prolongs life expectancy.22 For type 3b lesions the approach is similar. For type 4 lesions one should use at least two drains. Lobes and segments that are atrophic or have extensive tumor burden are not drained unless they are infected. Another approach in type 4

**FIGURE 15.10** Right and left hepatic duct to CBD metallic stents (Y configuration)
lesions is to perform T (chi configuration) stenting, which allows drainage of the entire major segmental ducts. One stent extends from the left duct through the hilar stricture to the right anterior duct; the other stent is placed across the right posterior segmental duct through the hilar stricture into the CBD or through the papilla into the duodenum. Stent deployment should be performed simultaneously. Ultimately the two stents form a chi-shaped configuration.

It is generally advisable to have the distal end of the stent project just through the ampulla into the duodenum. This is because the rigid nature of the stent can sometimes cause kinking of the lower part of the CBD, which may cause obstruction (with the newer flexible nitinol stents, this may probably be unnecessary). Additionally, it is easier to cannulate them endoscopically for clearance or for additional endoprosthesis insertion. If the stent projects too far into the duodenum, it can cause erosion of the opposite wall.

**Metallic or plastic stents?** Both types of stents provide good palliation of malignant obstructive jaundice. Plastic stents are placed by many endoscopists because of their acceptable patency rates, retrievability, low cost, and the ability of the endoscopist to insert plastic stents in a single-stage procedure.

Metallic stents are more expensive than plastic endoprostheses and there has been considerable debate since metallic stents were introduced as to whether the results of metallic stents compared with plastic devices justify their additional costs. Although most retrospective studies suggest that both types of stents produce acceptable palliation, the results of randomized
trials indicate that metallic stents have significantly longer patency rates than plastic stents.26–28 These trials reported that metallic stents are, in fact, more cost effective than plastic devices because of the reduced number of reinterventions required for the patients with metallic stents compared with plastic stents and the shorter stay in hospital.26–28 As a result of these data and the smaller introducer systems of metallic stents, most interventional radiologists choose metallic endoprostheses for internal biliary drainage.29

**Percutaneous management of the occluded stent.** Plastic stents are prone to occlusion by bile encrustation. The main cause of occlusion of metallic stents is tumor ingrowth or overgrowth; bile encrustation seldom occurs. The best method of treatment of blocked biliary stents is endoscopic replacement, in the case of plastic endoprostheses, or endoscopic insertion of a plastic stent inside a metallic endoprosthesis. Percutaneous evaluation and therapy of occluded stents is usually reserved for patients in whom endoscopy has been unsuccessful or is not possible. The percutaneous method involves an initial PTC to confirm stent occlusion and to define the biliary anatomy, followed by catheterization of a suitable duct. If the occluded stent is plastic, the stent must be removed before a new endoprosthesis is inserted. Plastic stents can be removed either by withdrawing them through the transhepatic track by grasping them with a wire loop snare or balloon catheter, or by pushing them into the duodenum and allowing them to pass through the digestive tract.

Most metallic stents cannot be removed (there are a new generation of retrievable metallic stents now available). Occlusion of metallic stents is managed percutaneously by inserting a new metallic endoprosthesis coaxially within the first stent. If the cause of occlusion is overgrowth of tumor, the new device must extend beyond the upper limit of the tumor.

**Access loops.** Surgeons often affix the afferent loop of jejunum to the parietal peritoneum at the time of the creation of the bilioenteric anastomosis to allow easy percutaneous access to the biliary tree if a stricture occurs at a later date. The apex of the loop is marked by a circle of metallic clips, enabling the entry site of the loop to be visualized on fluoroscopy. If an access loop is present, it can be punctured with a fine needle under fluoroscopic guidance. Contrast medium is injected to opacify the loop and identify the route to the bilioenteric anastomosis. A minimally invasive access set (e.g., Accustick) is used to dilate the percutaneous track and to pass a catheter and guidewire to the site of the anastomosis. The catheter is advanced across the stricture into the biliary tree and a stiff guidewire is inserted into the intrahepatic ducts. This method of access allows repeated percutaneous dilatation of the stricture without the discomfort of the transhepatic route.

**Covered biliary stents.** Covered stents represent an evolution of bare stents and are aimed mainly to prevent obstruction caused by tumor ingrowth within the stent lumen.30 The first clinical studies of polyurethane-covered Wallstents showed that these stents can be safely implanted.29,30 The 6-month patency rate was found to be inferior to that of non-covered Wallstents (46.8% vs. 67%), however, partly because of a breach in the covering membrane that allowed tumor ingrowth.31 It was concluded that such a type of covered stent had no significant advantages versus bare stents.31,32 Now polytetrafluoroethylene and fluorinated ethylene propylene (ePTFE/FEP)–covered metallic stents have been introduced. The stent consists of an inner ePTFE/FEP lining and an outer supporting structure of nitinol wire. Multiple wire sections elevated from the external surface provide anchoring. Stents are available in two versions, with or without holes in the proximal stent lining. Holes should provide drainage of the cystic duct or biliary side branches when covered by the proximal stent end. They are more effective than polyurethane-covered Wallstents.33,34 In 10% of cases, however, one can still get branch duct obstruction.34,35 These early studies are promising; however, significant improvements in patency would be still desirable.

**COMBINED BILIARY AND DUODENAL OBSTRUCTION**

In some advanced cases of pancreatic cancer, metastasis or malignant lymphadenopathy patients can present with both biliary and duodenal obstruction. As a palliative procedure the combined stenting of both the biliary stricture and duodenal stricture can be performed in one sitting by the radiologist. The biliary stent is placed from the percutaneous route as described previously, whereas the duodenal stent can be placed via the transoral route. There are essentially two ways for these placements, that is, placing the duodenal stent first and then the biliary stent just through the mesh of the duodenal stent (FIGURE 15.12) or placing both stents side to side within the duodenal lumen.

![FIGURE 15.12 Transoral duodenal and percutaneous biliary stent placements in a patient with pancreatic carcinoma](image-url)
**Combined Transhepatic Endoscopic Approach (Rendezvous Procedure)**

Transhepatic placement of a catheter of small diameter across the obstructed duct and into the duodenum offers a second chance for the endoscopist. This arrangement is very useful when the endoscopist has initially failed to negotiate the obstruction at an earlier attempt, and it is not advisable to create a large transhepatic track because of the risk of bile leakage into the peritoneum, or in patients with coagulopathy. With a transhepatically inserted 4 or 5 French catheter negotiated across the obstruction into the duodenum, a 450-cm exchange guidewire, such as Zebra (Microvasive), is inserted into the catheter. The patient is placed in the prone oblique position for the insertion of the endoscope. The endoscopist grasps the lower end of the guidewire with a snare or biopsy forceps and brings it out of the proximal end of the endoscope biopsy channel while the radiologist keeps feeding the wire at the skin entry site. The transhepatic catheter is now withdrawn so that its tip lies in the intrahepatic portion of the biliary tree above the malignant stricture. The endoscopist now proceeds with the placement of a large-bore biliary endoprosthesis in the standard fashion while the guidewire is held taut between the endoscopic and percutaneous ends. When the endoprosthesis is in position and free egress of bile is documented, the transhepatic catheter can be removed. If adequacy of decompression is questionable, the transhepatic catheter may be retained for observation and reintervention, if required.

**COMPLICATIONS**

Complications of percutaneous biliary interventions can be divided into early, that is, procedural complications and late complications. Most procedural complications are related to the initial biliary drainage with mortality ranging from 0% to 2.8% and major complications occurring in 3.5% to 9.5%. Also, higher procedure-related deaths have been reported for malignant diseases (3%) compared to benign diseases (0%). This is also true of procedure-related complications (7% vs. 2%). Minor complications, such as mild self-limiting hemobilia, fever, and transient bacteremia, occur in up to 66% of patients.

**Immediate Complications**

These may be the following:

1. Sedation: Problems may occur if care is not taken to constantly monitor patients during and after the procedure for complications of cardiorespiratory depression. Pulse oximetry should be used for monitoring all patients undergoing procedures involving conscious sedation.
2. Hemorrhage: Mild hemobilia is common, occurring in up to 16% of cases. More severe bleeding requiring transfusion occurs in approximately 3% of patients. Hemorrhage is minimized by the correction of coagulation defects and avoidance of percutaneous intervention in patients with severe incorrectable coagulopathies. It is usually self-limited and seldom requires treatment. If bleeding is mild and venous in origin, repositioning the catheter so that the trailing side holes are located within the biliary tree and not within the hepatic parenchyma, and, if required, upsizing the catheter to tamponade the bleeding point usually suffices. The catheter should be regularly irrigated with saline to maintain its patency and to clear any thrombus from the bile ducts (FIGURE 15.13). If hemobilia does not resolve with these measures or is severe, vascular embolization should be performed through the transhepatic track or by hepatic arteriography (FIGURE 15.14).
3. Sepsis: Manipulation of catheters and guidewires within an infected biliary tract can produce rapid bacteremia, which may progress to septicemia shock if antibiotic coverage is not administered prior to the procedure. Intravenous antibiotics should be continued following biliary drainage until the catheter is removed.
4. Pericatheter leak in approximately 15% of the patients.
5. Pneumothorax, hemothorax, bilothorax (<1%).
6. Contrast reaction (<2%).

**Delayed Complications**

These include the following:

1. Cholangitis: Approximately 50% of bile cultures will be positive when obtained at initial puncture. When an internal-external drainage is performed with an 8F catheter, recurrent cholangitis secondary to inadequate drainage is possible. The rate of sepsis will decrease if this is replaced by a 10 to 12 French drain.
2. Catheter dislodgment (approximately 15%–20%).
3. Peritonitis (1%–3%).
4. Hypersecretion of bile (0%–5%): This can cause significant fluid and electrolyte imbalance and is usually seen within several days of drainage.
5. Cholecystitis caused by blockage of the cystic duct by covered stents. To address this complication, holes in the proximal stent lining are made, which should hypothetically allow for drainage of cystic or branch biliary ducts when their orifice is covered by the stent. But still, this complication may be seen, for which percutaneous cystic duct stent placement, percutaneous cholecystostomy, or cholecystectomy may be required.
7. Skin infection, irritation.
8. Intrahepatic/perihilar abscess.
9. Metastatic seeding of the serosa or tract with cholangiocarcinoma and pancreatic carcinoma has been reported.

**FIGURE 15.13** Cholangiogram demonstrating significant filling defects consistent with hemobilia
Some routine precautions that help in significantly reducing the incidence of complications are provided in Table 15.4.

### CLINICAL RESULTS AND PATIENT SURVIVAL

In general, the technical success rate has varied from 86% to 100% with successful drainage rates of 81% to 96%. The 30-day mortality rate has been 1% to 49% and complication rate of 6% to 58%. This marked variation in results is probably caused by differences in the criteria for patient selection, the experience and expertise of different operators, and the criteria used to define success and complications.

Patient survival after metallic stent placement is difficult to estimate and compare among various reports and this would be attributable to variations in population, additional treatment, patient selection, and the stage of the tumor. In the literature, patients receiving this treatment have been reported to live 93 to 420 days longer. In patients with hilar obstruction, longer survival rates have been observed after both lobes have been drained as compared to those who had one lobe drained. This may be attributable to the higher septic complications that may occur in patients with unilateral drainage. The drawbacks for multisegment drainage, however, are increased cost, longer procedure time, and greater technical difficulty.

<table>
<thead>
<tr>
<th>Sepsis</th>
<th>Antibiotic prophylaxis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hemorrhage</td>
<td>Minimal manipulation</td>
</tr>
<tr>
<td>Bile leak</td>
<td>Restrict volume of contrast injected and aspirate bile prior to contrast injection</td>
</tr>
<tr>
<td>Cholangitis</td>
<td>Normalize coagulation factors</td>
</tr>
<tr>
<td>Catheter dislodgment</td>
<td>Fine-needle coaxial technique</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Peripheral duct puncture</th>
</tr>
</thead>
<tbody>
<tr>
<td>Careful positioning of side holes to avoid communication with an intrahepatic vessel</td>
</tr>
<tr>
<td>Avoid puncture of extrahepatic ducts</td>
</tr>
<tr>
<td>Single puncture site in liver capsule</td>
</tr>
<tr>
<td>Careful positioning of side holes</td>
</tr>
<tr>
<td>Ensure adequate drainage by careful positioning of side holes</td>
</tr>
<tr>
<td>Irrigation of catheter with sterile saline</td>
</tr>
<tr>
<td>Large-diameter catheters (12 French) for long drainage</td>
</tr>
<tr>
<td>Routine tube exchange every 2 to 3 months</td>
</tr>
<tr>
<td>Safety stitch method</td>
</tr>
<tr>
<td>Self-retaining (pigtail) catheter</td>
</tr>
</tbody>
</table>
REFERENCES

16. Cope C. Conversion from small (0.018 inch) to large (0.038 inch) guide wires in percutaneous drainage procedures. AJR Am J Roentgenol 1982;138:170–171.