Chapter

Preoperative Biliary Drainage: Methods, Advantages, and Complications

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Abstract

Malignant biliary obstruction is very difficult to treat; only 10–20% of the patients are suitable for curative resections. Obstructive jaundice is associated with a pro-inflammatory state, altering the normal physiology and affecting multiple organ systems. So, patients with malignant obstructive jaundice are at increased risk of postoperative complications. Nevertheless, the preoperative biliary drainage (PBD) remains controversial, because the procedures themselves can be associated with septic and other complications. The main therapeutic options for PBD in malignant biliary obstruction are percutaneous biliary drainage and endoscopic biliary drainage. The knowledge of the approaches, their advantages, and complications are essential for the management of patients with pathologies that produce biliary obstruction such as bile duct cancer. The aim of this chapter is to review the methods for biliary drainage and its indications, advantages, and complications.

Keywords: biliary drainage, obstructive jaundice, cholangiocarcinoma, endoscopic biliary drainage, percutaneous biliary drainage

1. Introduction

Malignant obstructive jaundice is a common condition caused by various adenocarcinomas, including cholangiocarcinoma [1–7]. Hilar cholangiocarcinoma, which is also known as Klatskin's tumor, accounts for about 50% of cholangiocarcinoma cases [3, 8]. Due to the silent tumor growth, curative resection is often not suitable at diagnosis. Only 10–20% of cases will be candidates for curative resection [1, 2].

Biliary obstruction from cholangiocarcinoma has been identified as an important risk factor for postoperative mortality. Biliary obstruction alters the normal physiology and affects multiple organ systems and can lead to jaundice, coagulopathy, and hepatic and renal dysfunction [2, 9–11]. Jaundice has been recognized as a major risk factor for performing pancreatic and liver surgery [12]. The presence of toxic substances such as bilirubin and bile salts, impaired liver function, and altered nutritional status has been proposed as responsible factors for increased infectious complications. Evidence suggests that biliary drainage may improve immune function and nutritional status and reduce the risk of infection [2, 13].

Despite these apparent advantages of performing a preoperative biliary drainage, the safety of the conventional preoperative biliary drainage has not been

widely acknowledged, and the benefit remains controversial [3, 14]. Endoscopic biliary drainage (EBD) and percutaneous transhepatic biliary drainage (PTBD) are the two preoperative biliary drainage procedures available [2, 15]. Endoscopic drainage methods may be more suitable for type I and II tumors, while type III and IV tumors may be more easily drained percutaneously; nevertheless, there is not a guideline, and no consensus has been reached about the preferred approach, so the choice is usually made according to the local expertise and availability [5, 15]. Thus, the knowledge of the approaches, their advantages, and complications are essential for the management of patients with pathologies that produce biliary obstruction such as the bile duct cancer. The aim of this chapter is to review the methods for biliary drainage and its indications.

1.1 Indications

Obstruction of the bile duct: pancreatic neoplasm, cholangiocarcinoma, and gallbladder neoplasm.

The target of the biliary drainage is:

- Relieve obstructive jaundice
- Complications of biliary obstruction as cholangitis or sepsis
- Palliative treatment in patients not candidates for surgery
- Biopsy, stent placement, and brachytherapy

Currently, drainage of the bile duct is accepted in the preoperative period of icteric patients with poor general condition, bilirubin >10 mg/dl, and those patients who are going to undergo neoadjuvant treatment [5, 13].

2. Endoscopic biliary drainage

There are two techniques for endoscopic biliary drainage, internal with endoscopic retrograde cholangiopancreatography (ERCP) and with external drainage performing endoscopic nasobiliary drainage (ENBD). Endoscopic transpapillary biliary drainage was first introduced by Soehendra and Reynders-Frederix [16]. Initially, only plastic stents were available, with the largest available stent being 11.5 Fr. Nowadays, uncovered metal stents became available, and multiple trials showed that self-expanded uncovered metal stents were associated with lower stent failure and cholangitis [15, 16].

Transpapillary stent placement with endoscopic retrograde cholangiopancreatography has been the preferred treatment modality for the palliation of malignant distal biliary obstruction [3, 19]. However, the performance in patients with resectable tumors is unclear. Most of the patients referred to speciality centers for surgical treatment have already undergone endoscopic drainage before referral [20]. But, a wide array of complications stemming from the procedure as pancreatitis, cholangitis, and stent dysfunction in untimely reintervention has continued to present a significant challenge [9, 19].

2.1 Technique

Before the procedure, it is important to perform image studies such as computed tomography or magnetic resonance to assess biliary anatomy and plan the approach

for intervention. It is important to evaluate the risk of cholangitis in each patient, and we suggest administrating broad-spectrum antibiotics prior to the procedure. Using a therapeutic duodenoscope, the bile duct is selectively cannulated using a wire-guided sphincterotome. After a retrograde cholangiography is performed to localize the site of obstruction, the guide wire is maneuvered through and above the biliary stenosis followed by a catheter. The endoprosthesis is then pushed in position over the catheter (**Figure 1**) [17, 18].

2.1.1 ENBD

A guide wire is passed down the endoscope channel and through the bile duct, and the tip is advanced and looped high in the common hepatic duct or liver. A suitable drainage tube is then advanced through the endoscope to the tip of the wire. The guide wire is withdrawn, and the proximal end of the tube is rerouted from the mouth to the nose using temporary nasopharyngeal intubation.

2.2 Advantages

In addition to achieving imaging of the biliary duct and biliary drainage, endoscopic biliary drainage is also used for tissue diagnosis using brush cytology or fine-needle aspiration, but a definitive diagnosis is only made in approximately 50% of cases [21]. This method is optimal particularly in distal obstruction as Bismuth I and II. A technical success rate of 66.7% and a clinical success of 86.7% were found in a multicenter clinical trial [19]. The internal drainage by EBD is the less invasive technique and the most comfortable for the patient [14].

The endoscopic nasobiliary drainage was introduced at the beginning of the 1980s with similar advantages and complications. The availability of an external drain allows contrast cholangiography at any time via the nasobiliary tube and permits evaluation of the volume and color biliary secretions [20]. Success rates of the initial procedure ranged from 24 to 78%. Although the discomfort of the patient is imposed by nasal drainage, endoscopic nasobiliary drainage is a better way to improve the durability and reduce cholangitis than endobiliary stenting [3].

Figure 1.
ERCP.

2.3 Complications

One of the major disadvantages of an endoscopic approach is the contamination of the sterile environment of the biliary tree; this can lead to severe cholangitis and biliary sepsis. Other complications that have been reported include pancreatitis, duodenal perforation, post-sphincterotomy bleeding, biliary perforation, and tube occlusion. The morbidity reported rates are of 44.3% for the endoscopy biliary drainage [15]. Cholangitis is reported in 27–33% of the patients. The initial technical failure rate is reported in 16–21.5% of the drainages, and the rate of conversion to other procedures is of 26.5%. The pancreatitis is reported in 9% of the procedures [5, 15]. The retroperitoneal or duodenal perforation is only presented in 2% of the patients and bleeding in 1% [5].

3. Percutaneous biliary drainage

Interventionism is defined as the practice of diagnostic and therapeutic procedures through minimal incisions, performed with catheters, guides, balloons, and stents and controlled and guided by fluoroscopy, ultrasound, computed tomography, or magnetic resonance. The application of percutaneous biliary tract has been, for at least a decade, an advance in the management of seriously ill patients, which are sometimes inoperable [14, 22].

3.1 Types of drainage

Depending on the drainage site, these can be classified into three types [23]:

- Internal: the prosthesis used in the obstruction point communicating the segment prestenotic with poststenotic. The drainage is always toward the interior of the duodenum (**Figure 2**).

- External: the catheter lodged above the obstruction, the drainage of the bile, is always outward (**Figure 3**).

- Internal/external: the distal end of the catheter with orifices is placed in the duodenum; if the external drainage is open, the bile will leak to the outside, and if it is closed it will drain to the duodenum like an internal drainage (**Figure 4**).

3.1 Technique

The procedure is performed with conscious sedation. Pre-procedural planning should involve evaluation and extension of the exact level and extension of the stenosis and selection of the most appropriate liver segments for drainage and assessment of an appropriate access route, mostly by ultrasound guidance. This is particularly important when segmental bile duct obstruction is suspected, and every attempt should be made to avoid contaminating regions of the biliary tree that will not be drained (**Figure 5**).

Biliary drainage is most often performed using fluoroscopic guidance, after initial puncture of a bile duct using ultrasound guidance. There is no consensus as to whether stents should be placed from the hilum all the way down to the common bile duct through the papilla of Vater in the duodenum. Although many authors advocate stenting through the papilla in distal obstructions, there is no evidence

Figure 2.
Internal drainage of the bile duct.

Figure 3.
External drainage of the bile duct.

that this improves patency in proximal bile duct strictures. As hilar cholangiocarcinomas are often very rigid, it may in some cases be useful to pre-dilate the stricture to facilitate the insertion of a stent.

Self-expanding metal stents are preferred because they have higher patency rates, lower overall cost, and less hospital stay than plastic stents. Metallic stents have thermal memory and expand to their maximum width when they reach body temperature, which usually occurs in 24–48 hours. If the expansion is not adequate after 28 hours, dilatation of the stent with balloon catheter may be necessary for successful drainage [24, 25].

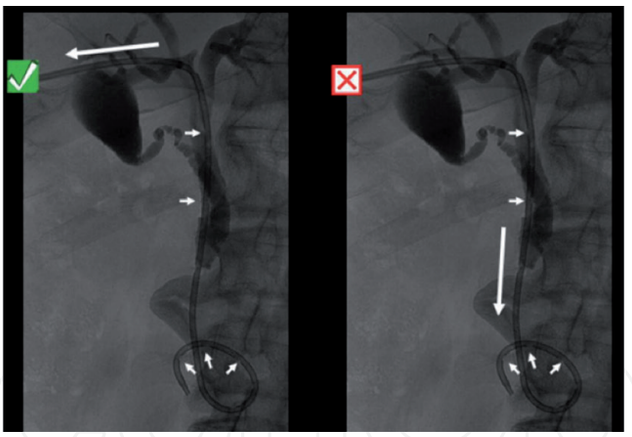

Figure 4.
Internal/external drainage.

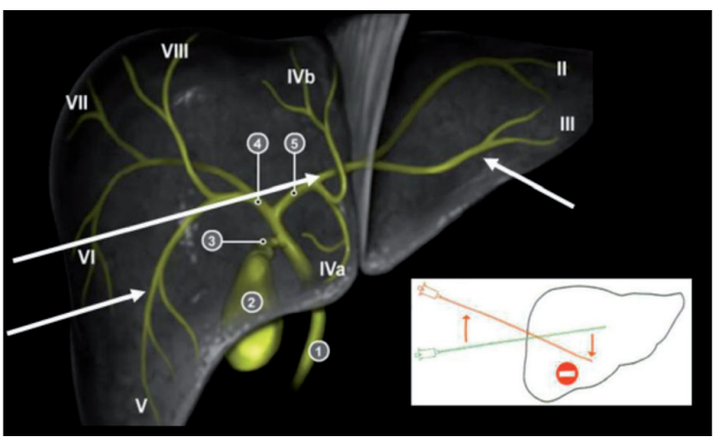

Figure 5.
Puncture external access to the biliary tree.

3.2 Advantages

The PTBD is associated with higher rates of successful biliary drainage and lower rates of cholangitis. Also, it has a distinct advantage over ERCP in that with ultrasound guidance, one or more appropriate segments for drainage can be chosen and injection of contrast medium in segments that are too small to be drained can be prevented. This is the method of drainage of the bile duct in patients with cholangiocarcinoma Bismuth types III and IV. And it is the method for election if the endoscopic drainage presented failure. This technique presents only a 5% conversion rate compared with 26.5% for EBD. The incidence of pancreatitis after PTBD has been reported in 0% compared with the 9% for EBD [15, 19, 26].

3.3 Complications

The incidence of PCT with metal stents varies from 8 to 42% complications which can be classified into early (occurring within 30 days) and late. Early complications, with exception of pain, are observed in approximately 25% to 50% of patients. Of which approximately a half were related to the procedure. These include: pain at te puncture site, bile leak with risk of biliary peritonitis and formation of biloma, hemorrage that includes hemobilia, biliovenous fistula, arterial injury, cholangitis and septicemia, acute pancreatitis, and problems related to the cateter such as sprain or dislocation.

The punctures of the right lobe are painful since the needle has to cross the intercostal space. The left lobe punctures are associated with an increased risk of bile loss and, therefore, biliary peritonitis that can cause an acute abdomen. The punctures on the right side are also associated with the risk of pneumothorax and hemothorax.

Hemorrhage usually resolves spontaneously; if persistent, a CT angiogram should be performed, and if it shows extravasation of active contrast or pseudoaneurysm, it is necessary to perform an embolization. The biliovenous fistulae present with hemorrhage in the catheter or hemobilia and can be diagnosed with cholangiography with a filling of venous vascular radicles or portal hepatic radicles. They can be managed by temporarily holding the catheter or by changing the catheter to a larger orifice catheter.

The occlusion of the stent may be due to tumor growth, excessive tumor growth, or mud. Recurrent cholangitis due to stent occlusion is observed in approximately 30% of cases, which requires repeat stenting [1, 13, 24].

4. Conclusion

There are certain advantages to both PTBD and EBD. In clinical practice, it is recommended to choose PTBD or EBD, depending on the location of the obstruction, the purpose of drainage (as a preoperative procedure or palliative treatment), and the level of experience in biliary drainage in hospital centers, so it is of great importance to individualize each case and in case of initial failure to perform the conversion of the procedure with the purpose of improving the prognosis of patients with cholangiocarcinoma.

Conflict of interest

We have no conflict of interests.

Acronyms and abbreviations

PBD	preoperative biliary drainage
EBD	endoscopic biliary drainage
PTBD	percutaneous biliary drainage
ERCP	endoscopic retrograde cholangiopancreatography
ENBD	endoscopic nasobiliary drainage

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References

[1] Shim DJ, Gwon DI, Han K, Kim Y, Ko G-Y, Shin JH, et al. Percutaneous metallic stent placement for palliative management of malignant biliary hilar obstruction. Korean Journal of Radiology. 2018;**19**(4):597

[2] Moole H, Bechtold M, Puli SR. Efficacy of preoperative biliary drainage in malignant obstructive jaundice: A meta-analysis and systematic review. World journal of surgical oncology. 2016;**14**(1):182. Available from: http://wjso.biomedcentral.com/articles/10.1186/s12957-016-0933-2

[3] Liu J, Wu J, Wang J, Shu G, Wang Y, Lou C, et al. Endoscopic biliary drainage versus percutaneous transhepatic biliary drainage in patients with resectable hilar cholangiocarcinoma: A systematic review and meta-analysis. Journal of Laparoendoscopic & Advanced Surgical Techniques. Part A. 2018;**28**(9):1053-1060

[4] Van Heek NT, Busch OR, Van Gulik TM, Gouma DJ. Preoperative biliary drainage for pancreatic cancer. Minerva Medica. 2014;**105**(2):99-107

[5] Hameed A, Pang T, Chiou J, Pleass H, Lam V, Hollands M, et al. Percutaneous vs. endoscopic pre-operative biliary drainage in hilar cholangiocarcinoma: A systematic review and meta-analysis. HPB. 2016;**18**(5):400-410

[6] Soares KC, Kamel I, Cosgrove DP, Herman JM, Pawlik TM. Hilar cholangiocarcinoma: Diagnosis, treatment options, and management. Hepatobiliary Surgery and Nutrition. 2014;**3**(1):18-34

[7] Xu X, Li J, Wu J, Zhu R, Ji W. A systematic review and meta-analysis of intraluminal brachytherapy versus stent alone in the treatment of malignant obstructive jaundice. Cardiovascular and Interventional Radiology. 2018;**41**(2):206-217

[8] Lu J, Guo J-H, Zhu H-D, Zhu G-Y, Wang Y, Zhang Q, et al. Palliative treatment with radiation-emitting metallic stents in unresectable Bismuth type III or IV hilar cholangiocarcinoma. ESMO Open. 2017;**2**(4):e000242

[9] Wiggers JK, Groot Koerkamp B, Cieslak KP, Doussot A, van Klaveren D, Allen PJ, et al. Postoperative mortality after liver resection for perihilar cholangiocarcinoma: Development of a risk score and importance of biliary drainage of the future liver remnant. Journal of the American College of Surgeons. 2016;**223**(2):321-331.e1

[10] Ramanathan R, Borrebach J, Tohme S, Tsung A. Preoperative biliary drainage is associated with increased complications after liver resection for proximal cholangiocarcinoma. Journal of Gastrointestinal Surgery. 2018;**22**(11):1950-1957

[11] Li M, Li K, Qi X, Wu W, Zheng L, He C, et al. Percutaneous transhepatic biliary stent implantation for obstructive jaundice of perihilar cholangiocarcinoma: A prospective study on predictors of stent patency and survival in 92 patients. Journal of Vascular and Interventional Radiology. 2016;**27**(7):1047-1055.e2

[12] Sakata J, Shirai Y, Tsuchiya Y, Wakai T, Nomura T, Hatakeyama K. Preoperative cholangitis independently increases in-hospital mortality after combined major hepatic and bile duct resection for hilar cholangiocarcinoma. Langenbeck's Archives of Surgery. 2009;**394**(6):1065-1072

[13] Ruys AT, Rauws EA, Busch ORC, Lameris JS, Gouma DJ, van Gulik TM. Preoperative biliary drainage. In: Lau WY, editor. Hilar Cholangiocarcinoma. Dordrecht, Netherlands: Springer; 2013. pp. 139-146

Available from: http://link.springer.com/10.1007/978-94-007-6473-6_13

[14] Kagedan DJ, Mosko JD, Dixon ME, Karanicolas PJ, Wei AC, Goyert N, et al. Changes in preoperative endoscopic and percutaneous bile drainage in patients with periampullary cancer undergoing pancreaticoduodenectomy in Ontario: Effect on clinical practice of a randomized trial. Current Oncology. 2018;**25**(5):e430-e435. Available from: http://current-oncology.com/index.php/oncology/article/view/4007

[15] Al Mahjoub A, Menahem B, Fohlen A, Dupont B, Alves A, Launoy G, et al. Preoperative biliary drainage in patients with resectable perihilar cholangiocarcinoma: Is percutaneous transhepatic biliary drainage safer and more effective than endoscopic biliary drainage? A meta-analysis. Journal of Vascular and Interventional Radiology. 2017;**28**(4):576-582

[16] Soehendra N, Reynders-Frederix V. Palliative bile duct drainage: A new endoscopic method of introducing a transpapillary drain. Endoscopy. 1980;**12**(01):8-11

[17] Knyrim K, Wagner HJ, Pausch J, Vakil N. A prospective, randomized, controlled trial of metal stents for malignant obstruction of the common bile duct. Endoscopy. 1993;**25**(03):207-212

[18] Stern N, Sturgess R. Endoscopic therapy in the management of malignant biliary obstruction. European Journal of Surgical Oncology. 2008;**34**(3):313-317

[19] Paik WH, Lee TH, Park DH, Choi J-H, Kim S-O, Jang S, et al. EUS-guided biliary drainage versus ERCP for the primary palliation of malignant biliary obstruction: A multicenter randomized clinical trial. The American Journal of Gastroenterology. 2018;**113**(7):987-997

[20] Kloek JJ, van der Gaag NA, Aziz Y, Rauws EAJ, van Delden OM, Lameris JS, et al. Endoscopic and percutaneous preoperative biliary drainage in patients with suspected hilar cholangiocarcinoma. Journal of Gastrointestinal Surgery. 2010;**14**(1):119-125

[21] Parsi MA, Li A, Li C, Goggins M. DNA methylation alterations in endoscopic retrograde cholangiopancreatography brush samples of patients with suspected pancreaticobiliary disease. Clinical Gastroenterology and Hepatology. 2008;**6**(11):1270-1278

[22] Inamdar S, Slattery E, Bhalla R, Sejpal DV, Trindade AJ. Comparison of adverse events for endoscopic vs percutaneous biliary drainage in the treatment of malignant biliary tract obstruction in an inpatient national cohort. JAMA Oncology. 2016;**2**(1):112

[23] Sebastián/ES D-S. Manejo de la obstrucción maligna de la vía biliar en radiología intervencionista. In: Poster presented at Seram 2012; Granada, España; 2012

[24] Inal M, Aksungur E, Akgul E, Oguz M, Seydaoglu G. Percutaneous placement of metallic stents in malignant biliary obstruction: One-stage or two-stage procedure? Pre-dilate or not? Cardiovascular and Interventional Radiology. 2003;**26**(1):40-45

[25] George C. Interventional radiology in the management of malignant biliary obstruction. World Journal of Gastrointestinal Oncology. 2010;**2**(3):146

[26] Heedman PA, Åstradsson E, Blomquist K, Sjödahl R. Palliation of malignant biliary obstruction: Adverse events are common after percutaneous transhepatic biliary drainage. Scandinavian Journal of Surgery. 2018;**107**(1):48-53