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Technical Considerations and Complication of Percutaneous Transhepatic Biliary Drainage: A Single Center Retrospective Study

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ABSTRACT

Introduction: With comparable outcomes, percutaneous transhepatic biliary drainage (PTBD) is the preferred method for relieving biliary obstruction when the gold standard endoscopic retrograde cholangiopancreaticography (ERCP) fails or is not practicable.
Aims & Objectives: To evaluate the technical success rate, clinical success rate, and complications of PTBD.
Place and duration of study: This study was carried out in Radiology Department of Pakistan Kidney and Liver Institute and Research Center, Lahore, Pakistan from 29th February 2020 to 1st November 2021.
Material & Methods: In this study, consecutive PTBD procedures performed from 29th February 2020 to 1st November 2021 were retrospectively reviewed. We collected data including patients' age, gender, diagnosis, indications, prior ERCP performance, preoperative and post operative bilirubin, and complications. Technical success, clinical success, and complications were documented. SPSS Version 26 was used for data entry and analysis, P-value<0.05 was taken as significant.
Results: A total of 96 procedures were performed in 64 patients with the mean age of 52 years (range: 20 - 91 years). Out of 96, 66 (68.8%) procedures were performed in malignant obstruction with most common cause being cholangiocarcinoma (24%). Technical success was achieved in100% of the cases while clinical success rate was 90.6%. In total 96 procedures, 7 complications were reported. Major complication rate was 5.2%. These included 2 cases of post-procedure cholangitis (2.1%), 2 cases of acute pancreatitis (2.1%), and a case of bilio-venous fistula (1%). Minor complication rate (including 2 cases of pericatheter leakage) was 2.1%.
Conclusion: PTBD is a reliable and effective procedure. In general, complication rate after PTBD is not high, and the patients having malignant disease were more prone to the complications.

Keywords: PTBD; intervention; bile duct; adverse effects; drainage; jaundice

INTRODUCTION

Percutaneous transhepatic biliary drainage (PTBD) is a minimally invasive procedure that involves aseptic insertion of a needle inside peripheral biliary duct after percutaneous access followed by contrast injection and advancement of wire and drainage catheter under image guidance and conscious sedation. Afterwards, external and/or internal biliary catheters are placed with or without stent placement for drainage[1-3]. Although endoscopic retrograde cholangiopancreaticography (ERCP) is the modality of choice for relieving biliary obstruction, PTBD is the ideal procedure when ERCP fails or is not feasible either due to varied anatomy or pyloric obstruction or in the presence of large tumor or periampullary diverticulum[4].

Common indications of PTBD include decompression in acute cholangitis, palliation of symptoms of jaundice, diversion of bile from site of leakage and provision of portal of access to biliary tract for therapeutic purposes; for example, dilation of biliary strictures, removal of bile duct stones, and stent placement in malignant lesions[2,3]. Indications for PTBD often arise in inflammatory/ anastomotic strictures or tumors, which can lead to cholestasis[5].

ERCP and PTBD are comparable in terms of success and complication rates, however, each have its own pros and cons. In PTBD, incidence of cholangitis and pancreatitis are lower, appropriate segments for drainage can be targeted, and it can be

performed without anesthesia and sedation[3,6]. Lately, endoscopic ultrasound-guided biliary drainage (EUS-BD) has also been used as a secondary method of biliary drainage[7,9]. A recent metanalysis published in 2019 reported that EUS-BD and ERCP have similar technical and clinical success[10].

PTBD can be a crucial procedure in many clinical settings, especially in case of severe cholangitis[11]. Complication rates as well as technical and clinical success of PTBD depends on various factors including peripheral biliary ductal dilatation, presence of free fluid around the liver, deranged coagulation profile, and expertise of the interventional radiologist[11,13]. Therefore, this retrospective study was directed to evaluate the technical and clinical success rate, and complications of PTBD.

MATERIAL AND METHODS

This study is a retrospective evaluation of the patients who underwent PTBD procedure from 29th February 2020 to 1st November 2021 in a tertiary referral hospital. This study was approved by the Institutional Review Board of Pakistan Kidney and Liver Institute and Research Center on 19-10-2022 (Reference number: PKLI-IRB/AP/85). All the PTBD procedures were preceded by informed written consent. All PTBD procedures were performed under ultrasound and fluoroscopic guidance by a consultant interventional radiologist with field experience of 5 years.

We collected data including patients' age, gender, diagnosis, indications, preoperative platelets, and international normalized ratio (INR), preoperative and post operative bilirubin, complications, and prior ERCP performance. All the patients included in the study had dilated bile ducts. Dilated bile ducts were considered on the basis of pre-procedural CT and intraprocedural ultrasound when the diameter of an intrahepatic peripheral bile duct was more than 2mm[5]. In this study, complication is a PTBD procedure-related event within 6 weeks after the last procedure was performed. The technical success and clinical success were also recorded. Technical success was defined as the placement of PTBD with the distal end in the small intestine. Clinical success was defined as subsequent decrease in serum bilirubin levels after the procedure[2].

All procedures were performed in angio-suite (Innova IGS 540, GE Healthcare) after local anesthesia using 2% lignocaine injection as well as analgesia (3 - 5 mg nalbuphine HCl) under aseptic measures. If possible, a right sided approach was preferred for all patients. Biliary access was done under real time ultrasound guidance with 21G Chiba needle (Cook Medical) and secured with Neff Percutaneous Access Set (Cook Medical). A5 Fr KMP (Impress, Merit Medical) catheter was maneuvered into duodenum over hydrophilic guidewire, followed by exchange with Amplatz guidewire (Boston Scientific).

Subsequently, appropriate size external cum internal biliary catheter was adequately parked over Amplatz guidewire (Boston Scientific) and position was checked under fluoroscopy after contrast administration [mixture of sodium chloride solution and iodine contrast (Ultravist® 370)]. Plastic or metallic stents were placed when required. Plastic stents were used for the resectable mass or benign disease while metallic stents were used for palliative purpose in the patients having irresectable mass or malignant disease. Catheter was fixed to skin with silk 1/0 and connected to drainage bag. In one case, biliary access was obtained, bile was draining freely into the duodenum so only cholangiography was performed, and drain was not inserted. No prophylactic antibiotics or preoperative sedation was given. Data was analysed using IBM SPSS version 26 and descriptive statistics were recorded.

RESULTS

A total of 96 procedures were performed in 64 patients, including 36/64 men (56.2%) and 28/64 women (43.8%). The mean age was 52 years (range: 20 - 91 years). In compliance with the Society of Interventional Radiology (SIR) standard guidelines, preoperative INR was within range of 1.5 – 1.8 or less and platelets more than 50 x 10^9/L in all the cases except the two cases had INR 2.1 for which two units of fresh frozen plasma were transfused just prior to the procedure.

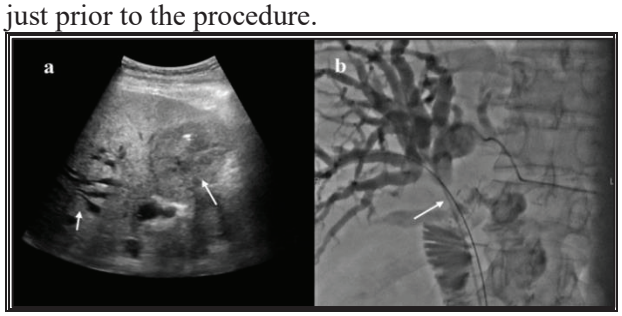

Fig-1: A 53-year-old patient with history of Whipple procedure for pancreatic carcinoma and tumour recurrence in right lobe of the liver **a.** Ultrasound shows moderate intrahepatic biliary dilatation (short arrow), and liver mass (long arrow). **b.** Cholangiography shows malignant CBD stricture (arrow) with bilateral PTBD catheters.

Out of 96, 66 (68.8%) procedures were performed in malignant obstruction with most common cause being cholangiocarcinoma (n = 23, 23.9%) followed by gall bladder carcinoma (n = 18, 18.8%),

pancreatic mass (n = 8, 8.3%) and periampullary tumor (n = 8, 8.3%) (Tables-1&2, Fig-1 & Fig-2). The most common benign cause for performing procedures was hepaticojejunostomy stricture (n = 13, 13.5%) followed by post living donor liver transplant anastomotic stricture (n = 8, 8.3%) and choledochal cyst (n = 5, 5.2%). (Table-1)

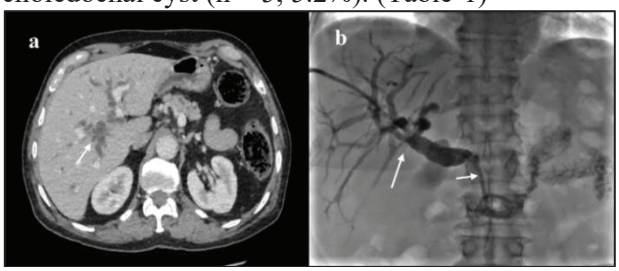

Fig-2: A 64-year-old male presented with symptoms of jaundice and abdominal pain and was diagnosed as having periampullary carcinoma. After ERCP failure, PTBD was performed. **a.** Contrast enhanced CT of the patient performed before the procedure shows moderate intrahepatic biliary dilatation. **b.** Cholangiography shows intrahepatic biliary dilatation (long arrow) with CBD stricture (short arrow) and in situ biliary drainage catheter, and contrast in the duodenum.

Causes of biliary obstruction	Frequency (%)	Pre-existing Cholangitis - Frequency (%)
Benign		
Anastomotic stricture post LDLT	8 (8.33%)	-
Biliary stricture post cholecystectomy	3 (3.13%)	-
CBD calculi	1 (1.04%)	1 (1.04%)
Choledochal cyst	5 (5.21%)	-
Hepaticojejunostomy structure	13 (13.54%)	1 (1.04%)
Malignant		
Cholangiocarcinoma	23 (23.96%)	2 (2.08%)
Gallbladder Carcinoma	18 (18.75%)	-
Gastric carcinoma	2 (2.08%)	-
Hepatocellular carcinoma	5 (5.21%)	-
Liver Mass	1 (1.04%)	-
Metastasis	1 (1.04%)	-
Pancreatic Mass	8 (8.33%)	1 (1.04%)
Periampullary carcinoma	8 (8.33%)	-
Total	96 (100%)	5 (5.21%)

Table-1: Causes of biliary obstruction.

LDLT: living donor liver transplant; CBD: common bile duct.

After a failed ERCP, 30 (31.3%) procedures were performed as salvage PTBD. The technical success rate was 100% (96/96 procedures) while clinical success rate was 90.6% (87/96 procedures). The overall complication rate was 7.3% (7 complications in 96 procedures). Major complication rate was 5.2%. These included 2 cases of post-procedure cholangitis (2.1%), a case each of acute pancreatitis (1%), and bilio-venous fistula (1%). Minor complication rate (pericatheter leakage) was 2.1%. (Table-2)

In thirty-two patients, PTBD procedure was repeated for replacement, repositioning, and stricture dilatation.

Outcomes	Number of procedures (N = 96)
Technical success rate, N (%)	96 (100%)
Clinical success rate, N (%)	87 (90.6%)
Complications, N (%)	2 (2.1%)
Acute pancreatitis	1 (1.0%)
Bilio-venous fistula	1 (1.0%)
Post-procedure cholangitis	2 (2.1%)
Pericatheter leakage	2 (2.1%)
Overall complication rate	7 (7.3%)
Mortality	0 (0%)

Table-2: Outcomes and complications of PTBD procedures

In (Table-3), details of the complications are mentioned in relation to the cause (benign or malignant), time interval from procedure to the day of development of complications, and the treatment offered after the complication. Most of the complications occurred in malignant cases (5 out of 7 complications).

Complications	Cause (Benign or Malignant)	Time interval after procedure (days)	Treatment
Acute pancreatitis	Malignant	1	Medical
Acute pancreatitis	Benign	3	Medical
Bilio-venous fistula	Malignant	Immediatly	Embolization
Post-procedure cholangitis	Malignant	38	Medical
Post-procedure cholangitis	Malignant	41	Medical
Pericatheter leakage	Malignant	19	Reposition/ Reinsertion
Pericatheter leakage	Benign	29	Reposition/ Reinsertion

Table-3: Details of complications after PTBD procedures (6-weeks follow up)

DISCUSSION

In this retrospective study including 96 PTBD procedures, it was established that PTBD is an effective and safe procedure for decompressing obstructed biliary system, with technical success rate of 100% and clinical success rate of 90.6%. These success rates are comparable to the expected thresholds defined by the Society of Interventional Radiology (SIR) Quality Improvement Standards (2020) for percutaneous transhepatic biliary interventions (92% and 75% thresholds for technical success and clinical success for dilated ducts, respectively)[2]. Other studies have also reported similar success rates[5,14,15,16]. Weber et al in their study reported technical success rate of 97%, that is higher than the required threshold of 92% from SIR[17]. Improved technique, latest instruments, multiple similar cases in specialized centers, and experience of interventional radiologist may be the factors attributed to good technical and clinical success.

In this study, overall complication rate was 7.3% (7 complications in 96 procedures). Of these 7 complications, 5 were associated with the malignant disease. Similar to our study, Mukund et al reported complications in 9.1% patients after salvage PTBD[18]. In contrast to our study, Turan et al[4] and Ferrucci et al[19] have reported higher compilations rates in 61.9% and 24.2% of patients, respectively. The difference in higher complications rate could be due to pre-existing infections in the patients, more patients with malignant disease, larger sample size, and technique and skill of the interventional radiologist. In our study, the complication rate (major complication rate: 5.2%, minor complication rate: 2.1%) was within the suggested threshold of SIR 2022 (major complication rate: 10%, minor complication rate: 45.2%). In this study, most of the complications occurred were associated to the malignant disease. Similarly, Turan et al[4] reported that most of the patients having complications had malignant biliary obstruction. A possible explanation to these findings could be that the malignancy is usually accompanied by cholangitis and sepsis, and most patients with a malignant cause are having a poor performance status as well.

After the procedure, all the patients in the study had placement of drainage catheter except one case in which only cholangiography was performed. In PTBD, internalization is desirable and has multiple benefits including decreased chance of metabolic derangements and improved patients' quality of life (QoL)[4, 20].

None of the patients included in this study received antibiotic prophylaxis. Currently, in our center there is no definite protocol for administering prophylactic antibiotics for PTBD procedures, but according to the literature antibiotic prophylaxis in PTBD reduces risk of cholangitis from 24-46% to 4.6%[4, 16]. So, it is suggested to prescribe intravenous antibiotics to all the patients before the procedure, especially in immunocompromised patients and procedures with high rate of infectious complications.

The distinguishing feature of this study is that it is the first such study from a tertiary referral hospital of Pakistan and includes a comprehensive analysis and assessment of complications and success rates of PTBD procedure. Nevertheless, this study has its own limitations. This study was performed retrospectively; so, inherent biases could not be excluded. Data collection was dependent on the available data and follow-up information in the hospital record system; therefore, the study design is more prone to bias. Sample size was small therefore robust and inferential analysis of multiple factors associated with the complications after PTBD was not performed.

CONCLUSION

PTBD is a safe and technically feasible procedure. Overall complication rate after PTBD is not high, and the patients having malignant disease were more prone to the complications. To further decrease the complication rate after PTBD, we suggest quality control of PTBD procedures, and antibiotic prophylaxis prior to the procedure, and interventional radiologists to be extra vigilant in malignant cases and patients having pre-existing infection.

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