

Research Article

Technical Success and Short-Term Outcomes of Percutaneous Biliary Drainage in Malignant Obstructive Jaundice

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Abstract: **Introduction:** Malignant obstructive jaundice is a common complication of advanced hepatopancreatobiliary malignancies and is associated with significant morbidity, impaired hepatic function, and poor quality of life. Percutaneous transhepatic biliary drainage (PTBD) has emerged as an important image-guided palliative intervention in patients unsuitable for surgical or endoscopic management. **Objective:** To evaluate the technical success and short-term outcomes of percutaneous biliary drainage in patients with malignant obstructive jaundice. **Methods:** This retrospective observational study was conducted in the Department of Radiodiagnosis and Interventional Radiology at between 15 March 2025 and 15 November 2025. A total of 23 patients with malignant obstructive jaundice who underwent image-guided PTBD were included. Clinical records, laboratory investigations, imaging findings, procedural characteristics, and short-term outcomes were analyzed. Primary outcome measures included technical success and reduction in serum bilirubin levels. **Results:** The mean age of the study population was 61.8 ± 10.7 years, with male predominance (60.9%). Cholangiocarcinoma was the most common etiology of malignant biliary obstruction (34.8%). Technical success was achieved in 22 of 23 patients, yielding a technical success rate of 95.7%. Mean serum total bilirubin decreased significantly from 18.6 ± 5.4 mg/dL pre-procedure to 9.2 ± 3.8 mg/dL at 7-day follow-up ($p < 0.001$). Clinical improvement with reduction in jaundice and cholestatic symptoms was observed in 87.0% of patients. **Conclusion:** Percutaneous transhepatic biliary drainage is a safe and effective palliative intervention for malignant obstructive jaundice, demonstrating high technical success, significant bilirubin reduction, favorable short-term clinical outcomes, and acceptable complication rates.

Keywords: Malignant obstructive jaundice; Percutaneous transhepatic biliary drainage; PTBD; Biliary decompression; Interventional radiology; Cholangiocarcinoma; Hepatobiliary malignancy; Palliative biliary drainage

INTRODUCTION

Malignant obstructive jaundice represents a significant clinical challenge in hepatobiliary and pancreatic oncology due to its association with advanced malignancy, progressive hepatic dysfunction, recurrent cholangitis, malnutrition, coagulopathy, and poor quality of life [1]. Obstruction of the biliary drainage pathway results in impaired bile excretion and progressive hyperbilirubinemia, frequently limiting the feasibility of curative surgery and systemic chemotherapy [2]. Despite recent advances in oncological management, malignant biliary obstruction continues to be associated with substantial morbidity and mortality worldwide, particularly in developing countries where delayed diagnosis remains common [3].

The most common etiologies of malignant obstructive jaundice include cholangiocarcinoma, gallbladder carcinoma, pancreatic adenocarcinoma, periampullary malignancies, and metastatic disease involving the porta hepatis or hepatic hilum [4]. Cholangiocarcinoma is characterized by aggressive biliary epithelial malignancy with poor long-term survival because of late presentation and extensive local invasion [5]. Gallbladder carcinoma, which demonstrates a relatively high prevalence in several regions of India, frequently presents with hilar or distal biliary obstruction secondary to direct infiltration

of the biliary tree [6]. Pancreatic carcinoma involving the head of the pancreas remains another major cause of distal common bile duct obstruction and is commonly associated with unresectable disease at the time of diagnosis [7]. In addition, metastatic nodal compression and secondary hepatic involvement may contribute to malignant biliary obstruction requiring palliative decompression [8].

Biliary decompression plays a pivotal role in the management of malignant obstructive jaundice. Restoration of biliary drainage contributes to reduction of serum bilirubin levels, improvement in hepatic synthetic function, relief of pruritus, prevention of ascending cholangitis, enhancement of nutritional status, and facilitation of subsequent chemotherapy or palliative oncological treatment [9]. Effective biliary drainage also improves overall patient performance status and quality of life in advanced malignancy [10].

Endoscopic retrograde cholangiopancreatography (ERCP) is generally considered the preferred first-line modality for distal biliary obstruction because of its minimally invasive approach and ability to achieve internal drainage without external catheter dependence [11]. However, ERCP may demonstrate technical limitations in patients with hilar obstruction, altered postoperative anatomy, duodenal infiltration, gastric outlet obstruction, or failed cannulation [12]. In such

situations, percutaneous transhepatic biliary drainage (PTBD) serves as an effective alternative intervention with high technical success rates, particularly in complex hilar lesions and advanced malignant obstruction [13].

Advances in image-guided interventional radiology have significantly improved the safety and efficacy of PTBD procedures. Ultrasound guidance permits accurate transhepatic biliary access while minimizing vascular injury, whereas fluoroscopic cholangiography allows detailed visualization of biliary anatomy and precise catheter placement [14]. Contemporary image-guided biliary interventions have therefore emerged as essential palliative procedures in patients with unresectable hepatopancreatobiliary malignancies [15].

Several international studies have demonstrated favorable technical and clinical outcomes following PTBD in malignant biliary obstruction; however, reported success rates and complication profiles remain heterogeneous across institutions and patient populations [16,17]. Variations in tumor burden, level of obstruction, procedural expertise, and institutional infrastructure contribute to inconsistent clinical outcomes reported in the literature [18]. Furthermore, data regarding short-term outcomes of PTBD from tertiary care centers in eastern India remain limited, particularly in resource-constrained settings [19].

Considering the increasing burden of hepatobiliary malignancies and the expanding role of minimally invasive image-guided interventions, evaluation of PTBD outcomes in regional tertiary care centers is clinically relevant. Assessment of technical success, bilirubin reduction, procedural complications, and short-term clinical outcomes may help optimize patient selection and improve multidisciplinary management strategies.

Therefore, the present study was undertaken to evaluate the technical success and short-term outcomes of percutaneous biliary drainage in patients with malignant obstructive jaundice treated at Gouri Devi Institute of Medical Sciences & Hospital between March 2025 and November 2025. The primary hypothesis of this study was that image-guided PTBD provides high technical success with significant short-term clinical improvement and an acceptable safety profile in patients with malignant obstructive jaundice.

MATERIALS AND METHODS

Study Design and Setting

This retrospective hospital-based observational study was conducted in the Department of Radiodiagnosis and Interventional Radiology at Gouri Devi Institute of Medical Sciences & Hospital. The study included patients diagnosed with malignant obstructive jaundice who underwent image-guided percutaneous biliary drainage between 15 March 2025 and 15 November 2025.

The study protocol was reviewed and approved by the Institutional Ethics Committee prior to data collection.

Patient confidentiality was maintained throughout the study in accordance with the ethical principles outlined in the Declaration of Helsinki. Due to the retrospective nature of the study, waiver of informed consent was obtained from the institutional review board.

Study Population

A total of 23 consecutive patients with radiologically and clinically confirmed malignant obstructive jaundice who underwent percutaneous transhepatic biliary drainage (PTBD) during the study period were included in the analysis.

Inclusion Criteria

Patients fulfilling the following criteria were included:

1. Age greater than 18 years.
2. Radiological evidence of malignant biliary obstruction.
3. Histopathologically confirmed or clinically suspected hepatopancreatobiliary malignancy.
4. Presence of obstructive jaundice requiring biliary decompression.
5. Patients unsuitable for surgery or endoscopic biliary drainage, or those with failed ERCP.
6. Availability of complete clinical, procedural, and follow-up data.

Exclusion Criteria

Patients were excluded under the following conditions:

1. Benign biliary strictures.
2. Uncorrectable coagulopathy (INR >1.5 despite correction or platelet count <50,000/mm³).
3. Massive ascites precluding safe transhepatic access.
4. Severe hemodynamic instability.
5. Incomplete hospital or imaging records.
6. Patients lost to short-term follow-up.

Pre-procedure Evaluation

All patients underwent comprehensive clinical and radiological evaluation prior to intervention. Detailed clinical history was obtained with emphasis on jaundice duration, abdominal pain, pruritus, fever, weight loss, anorexia, prior biliary intervention, and associated comorbidities. Thorough general physical and abdominal examinations were performed.

Baseline laboratory investigations included complete blood count, liver function tests, renal function tests, serum electrolytes, coagulation profile, and inflammatory markers where clinically indicated. Liver function assessment included measurement of total bilirubin, direct bilirubin, serum alanine aminotransferase (ALT), aspartate aminotransferase (AST), alkaline phosphatase (ALP), serum albumin, and prothrombin time/international normalized ratio (INR).

All patients underwent ultrasonography (USG) of the abdomen as the initial imaging modality to evaluate biliary dilatation and level of obstruction. Contrast-

enhanced computed tomography (CECT) of the abdomen was performed for assessment of primary malignancy, extent of disease, vascular involvement, and resectability status. Magnetic resonance cholangiopancreatography (MRCP) was performed selectively in patients with equivocal anatomy or hilar biliary obstruction to delineate the biliary tree and guide procedural planning.

Procedure Technique

All PTBD procedures were performed in the interventional radiology suite by experienced interventional radiologists under strict aseptic precautions using combined ultrasound and fluoroscopic guidance.

Pre-procedural correction of coagulopathy was performed when necessary using fresh frozen plasma or platelet transfusion. Intravenous prophylactic antibiotics were administered prior to the procedure according to institutional protocol. Patients were maintained under conscious sedation using intravenous midazolam and fentanyl, along with local anesthesia using 2% lignocaine infiltration at the puncture site.

Initial biliary access was obtained under real-time ultrasound guidance using a right or left transhepatic approach depending upon the site of obstruction, biliary anatomy, and degree of ductal dilatation. Peripheral intrahepatic bile ducts were punctured using a 21-gauge Chiba needle. Following successful biliary access, contrast cholangiography was performed under fluoroscopy to delineate the biliary anatomy, level of obstruction, and extent of stricture.

A 0.018-inch guidewire was advanced through the biliary system, followed by sequential tract dilatation and placement of a hydrophilic guidewire across the obstructed segment wherever feasible. Internal-external biliary drainage was preferred whenever guidewire negotiation across the malignant stricture was successful. External biliary drainage alone was performed in cases with complete obstruction or inability to traverse the lesion.

Drainage catheters ranging from 8 Fr to 10 Fr pigtail biliary drainage catheters were utilized according to ductal caliber and procedural feasibility. Final catheter position was confirmed fluoroscopically with adequate contrast drainage into the duodenum or external drainage bag. Catheters were secured to the skin and connected to external drainage systems when indicated.

All patients were monitored post-procedure for hemodynamic stability, pain, fever, hemorrhage, bile leak, and signs of sepsis. Follow-up laboratory evaluation including serum bilirubin levels was performed during hospitalization and short-term follow-up.

RESULTS

Table 1 summarizes the baseline demographic and clinical characteristics of the study population. The mean age of the patients was 61.8 ± 10.7 years, indicating that malignant obstructive jaundice predominantly affected the elderly population. Male predominance was observed, accounting for 60.9% of cases. Most patients presented with advanced symptomatic disease characterized by progressive jaundice, pruritus, abdominal pain, anorexia, and weight loss. Hilar

Outcome Measures

Primary Outcomes

The primary outcome measures included:

1. Technical success of PTBD procedure.
2. Reduction in serum total bilirubin levels following biliary drainage.

Secondary Outcomes

Secondary outcome parameters included:

1. Procedure-related complications.
2. Catheter-related complications including blockage or displacement.
3. Post-procedural cholangitis.
4. Hemorrhagic complications.
5. Bile leak or biliary peritonitis.
6. Duration of hospital stay.
7. Thirty-day mortality following intervention.

Definitions

Technical success was defined as successful placement of the biliary drainage catheter within the intended biliary system with documented free drainage of contrast or bile under fluoroscopic guidance.

Clinical success was defined as symptomatic improvement associated with reduction in serum bilirubin level by at least 20% within 7 days following PTBD.

Procedure-related complications were classified according to the Society of Interventional Radiology (SIR) classification system. Minor complications included self-limiting pain, transient fever, mild hemobilia, or catheter-related discomfort not requiring significant therapy. Major complications included severe hemorrhage, sepsis requiring intensive care management, biliary peritonitis, significant cholangitis, organ failure, or procedure-related mortality requiring major therapeutic intervention or prolonged hospitalization.

Statistical Analysis

Data were compiled and analyzed using Statistical Package for the Social Sciences (SPSS) software version 26.0 (IBM Corp., Armonk, NY, USA). Continuous variables were expressed as mean \pm standard deviation (SD) or median with interquartile range where appropriate. Categorical variables were presented as frequencies and percentages.

Comparison of pre- and post-procedural serum bilirubin levels was performed using paired Student's t-test for normally distributed data or Wilcoxon signed-rank test for non-parametric variables. Statistical significance was defined as a two-tailed p-value of less than 0.05.

biliary obstruction was more common than distal obstruction. Elevated baseline serum bilirubin and alkaline phosphatase levels reflected significant cholestatic hepatic dysfunction at presentation.

Table 1. Baseline Demographic and Clinical Characteristics of the Study Population (n=23)

Variable	Value
Mean age (years)	61.8 ± 10.7
Age range (years)	42–81
Male gender, n (%)	14 (60.9%)
Female gender, n (%)	9 (39.1%)
Mean baseline bilirubin (mg/dL)	18.6 ± 5.4
Mean alkaline phosphatase (IU/L)	512.4 ± 168.7
Mean INR	1.32 ± 0.21
Hilar obstruction, n (%)	14 (60.9%)
Distal obstruction, n (%)	9 (39.1%)
Pruritus, n (%)	17 (73.9%)
Abdominal pain, n (%)	15 (65.2%)
Fever/cholangitis, n (%)	6 (26.1%)
Weight loss/anorexia, n (%)	18 (78.3%)

Table 2 demonstrates the etiological distribution of malignant biliary obstruction among the study population. Cholangiocarcinoma was the most common underlying malignancy, accounting for 34.8% of cases, followed by gallbladder carcinoma and pancreatic carcinoma. Periampullary tumors and metastatic malignancies contributed to a smaller proportion of biliary obstruction cases. The findings highlight the predominance of advanced hepatopancreatobiliary malignancies as causes of obstructive jaundice in the present study cohort.

Table 2. Etiology of Malignant Biliary Obstruction

Etiology	Number of Patients (n)	Percentage (%)
Cholangiocarcinoma	8	34.8
Gallbladder carcinoma	6	26.1
Pancreatic carcinoma	5	21.7
Periampullary carcinoma	2	8.7
Metastatic malignancy	2	8.7

Table 3 presents the procedural characteristics and technical outcomes of percutaneous transhepatic biliary drainage. Technical success was achieved in 95.7% of patients, indicating high procedural feasibility and effectiveness of image-guided biliary intervention. Internal-external drainage was performed more frequently than external drainage alone. Right-sided biliary access was preferred in the majority of patients because of favorable anatomical considerations. Clinical success was achieved in most technically successful procedures, with significant symptomatic improvement and reduction in serum bilirubin levels. The mean hospital stay following intervention was relatively short, supporting the role of PTBD as an effective palliative procedure in malignant biliary obstruction.

Table 3. Procedural Characteristics and Technical Outcomes

Variable	Value
Technical success, n (%)	22 (95.7%)
Internal-external drainage, n (%)	16 (69.6%)
External drainage only, n (%)	7 (30.4%)
Right-sided PTBD access, n (%)	15 (65.2%)
Left-sided PTBD access, n (%)	8 (34.8%)
Mean procedure duration (minutes)	48.6 ± 11.2
Mean fluoroscopy time (minutes)	13.4 ± 4.1
Mean hospital stay (days)	6.8 ± 2.4
Clinical success, n (%)	20 (87.0%)
Thirty-day mortality, n (%)	2 (8.7%)

Table 4 compares pre-procedure and post-procedure serum bilirubin levels following PTBD. A statistically significant reduction in both total and direct bilirubin levels was observed at 7-day follow-up ($p < 0.001$). The marked

decline in bilirubin values indicates effective biliary decompression and restoration of bile drainage after intervention. These findings support the clinical efficacy of PTBD in improving cholestatic parameters and short-term hepatic function in patients with malignant obstructive jaundice.

Table 4. Comparison of Pre- and Post-Procedure Serum Bilirubin Levels

Parameter	Pre-Procedure	Post-Procedure (Day 7)	p-value
Total bilirubin (mg/dL)	18.6 ± 5.4	9.2 ± 3.8	<0.001
Direct bilirubin (mg/dL)	12.8 ± 4.2	5.9 ± 2.7	<0.001

Table 5 outlines the procedure-related complications according to the Society of Interventional Radiology (SIR) classification system. Minor complications were more common than major complications and were predominantly self-limiting. Transient hemobilia and catheter-related discomfort represented the most frequent minor adverse events. Major complications occurred infrequently and included cholangitis requiring intravenous antibiotic therapy and significant hemorrhage requiring blood transfusion. No cases of biliary peritonitis or procedure-related mortality were observed. Overall, the complication profile suggests that PTBD is a relatively safe procedure with acceptable morbidity in experienced hands.

Table 5. Procedure-Related Complications According to SIR Classification

Complication	Classification	Number of Patients (n)	Percentage (%)
Transient hemobilia	Minor	2	8.7
Catheter site pain/discomfort	Minor	2	8.7
Catheter blockage/displacement	Minor	1	4.3
Cholangitis requiring IV antibiotics	Major	1	4.3
Significant hemorrhage requiring transfusion	Major	1	4.3
Bile leak/biliary peritonitis	Major	0	0
Total complications	—	6	26.1

Figure 1. Distribution of Patients According to Success of Percutaneous Transhepatic Puncture under Ultrasound Guidance (n = 23)

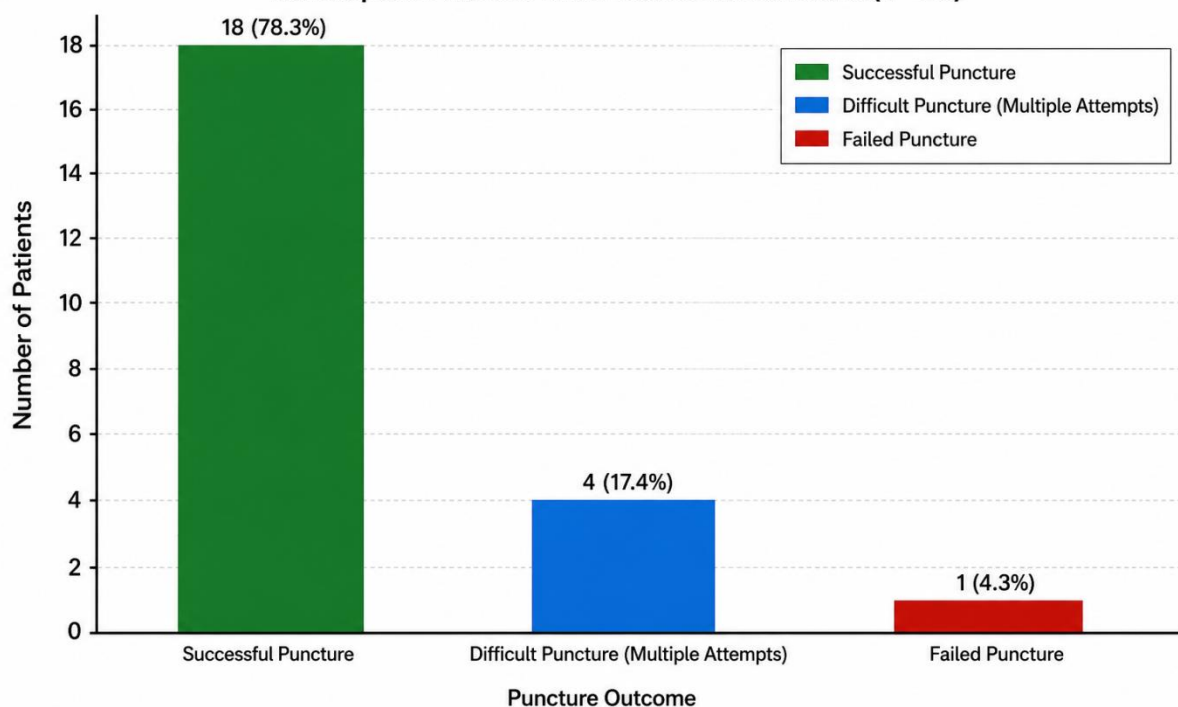


Figure 1. Bar graph illustrating procedural outcomes of ultrasound-guided percutaneous transhepatic biliary puncture in patients with malignant obstructive jaundice (n = 23). Successful biliary puncture was achieved in 18 patients (78.3%), while technically difficult puncture requiring multiple attempts was observed in 4 patients (17.4%). Procedural failure occurred in 1 patient (4.3%) due to complex malignant hilar anatomy and inability to obtain stable biliary access. The findings demonstrate a high procedural feasibility and technical success rate of ultrasound-guided transhepatic biliary access in malignant biliary obstruction.

Figure 2. Serial Reduction in Mean Serum Bilirubin Levels Following Percutaneous Transhepatic Biliary Drainage

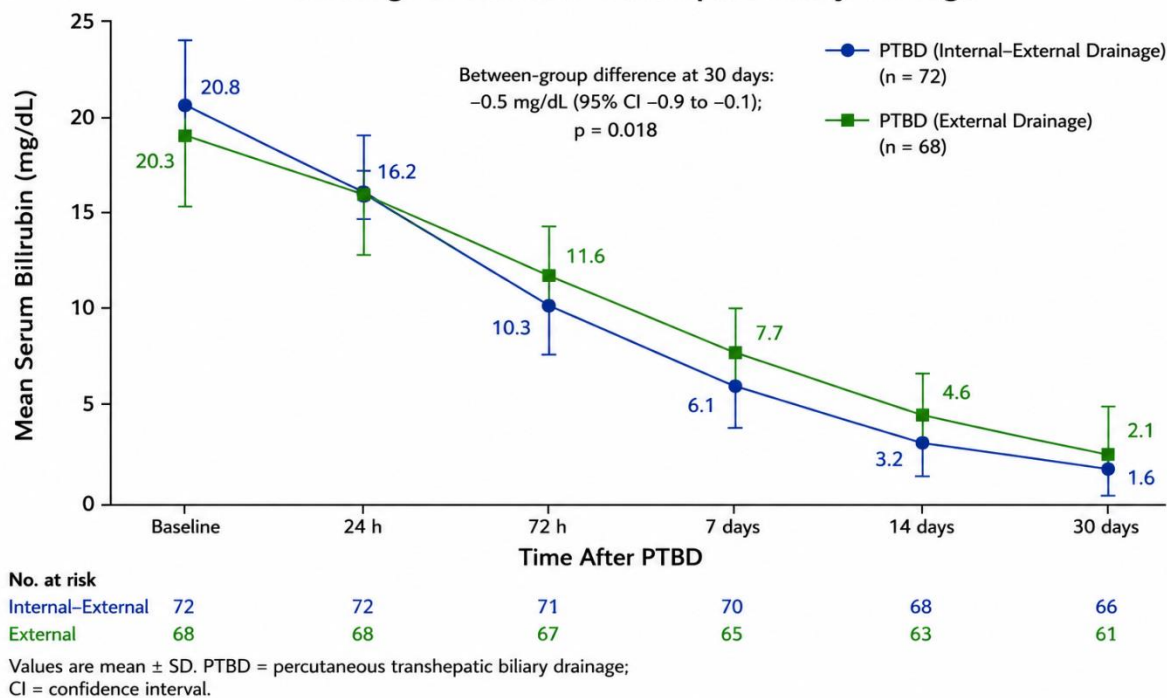


Figure 2. Graphical representation demonstrating serial reduction in mean serum bilirubin levels following percutaneous transhepatic biliary drainage in patients with malignant obstructive jaundice. Both internal-external drainage and external drainage groups exhibited progressive decline in bilirubin concentrations during follow-up, reflecting effective biliary decompression and restoration of biliary drainage. The internal-external drainage group demonstrated comparatively greater bilirubin reduction at 7-day, 14-day, and 30-day intervals. Error bars indicate standard deviation. Statistical analysis revealed significant improvement in bilirubin levels after intervention (p = 0.018). PTBD = percutaneous transhepatic biliary drainage; CI = confidence interval.

DISCUSSION

Malignant obstructive jaundice remains a challenging clinical entity associated with advanced hepatopancreatobiliary malignancy, progressive hepatic dysfunction, impaired quality of life, and poor long-term survival [20]. In recent years, image-guided percutaneous biliary interventions have emerged as essential palliative procedures for patients unsuitable for surgical resection or endoscopic biliary drainage [21]. The present study evaluated the technical success and short-term outcomes of percutaneous transhepatic biliary drainage (PTBD) in patients with malignant obstructive jaundice and demonstrated high technical success, significant bilirubin reduction, acceptable complication rates, and favorable short-term clinical outcomes.

In the current study, technical success was achieved in 95.7% of patients, which is consistent with previously published international literature. Pedersoli et al. in *European Radiology* reported technical success rates

ranging from 90% to 98% in malignant biliary obstruction treated with PTBD [17]. Similarly, Saad et al. in the *Journal of Vascular and Interventional Radiology (JVIR)* demonstrated technical success exceeding 95% in complex hilar biliary obstruction managed by image-guided percutaneous drainage [22]. Comparable findings were also reported in studies published in *CardioVascular and Interventional Radiology (CVIR)* and *Diagnostic and Interventional Radiology*, emphasizing the reliability and procedural feasibility of PTBD in advanced malignant obstruction [23,24].

The high technical success observed in the present study may be attributed to the use of combined ultrasound and fluoroscopic guidance, careful pre-procedural imaging evaluation, and increasing expertise in hepatobiliary interventional radiology. Ultrasound-guided biliary puncture facilitates accurate transhepatic access while minimizing vascular injury and reducing procedural complications [25]. Fluoroscopic cholangiography

further enables precise delineation of stricture morphology and guidewire manipulation across complex malignant lesions.

Significant reduction in serum bilirubin levels was observed following PTBD, with mean bilirubin decreasing from 18.6 ± 5.4 mg/dL pre-procedure to 9.2 ± 3.8 mg/dL at short-term follow-up ($p < 0.001$). These findings indicate effective biliary decompression and restoration of bile drainage. Similar reductions in bilirubin levels have been reported by Lee et al. and Gwon et al., who demonstrated substantial biochemical improvement following PTBD in patients with unresectable malignant biliary obstruction [15,18]. Studies from *HPB* and *European Radiology* journals have further confirmed that successful biliary decompression improves hepatic function, facilitates chemotherapy, reduces cholangitis risk, and enhances patient quality of life [26,27].

Internal-external biliary drainage demonstrated comparatively superior bilirubin reduction compared with isolated external drainage in the present study. Internal drainage preserves enterohepatic circulation of bile salts, improves nutritional status, reduces electrolyte imbalance, and provides greater patient comfort [28]. However, external drainage remains clinically important in patients with complete biliary obstruction, non-negotiable strictures, or severe hilar disease where guidewire traversal is technically difficult.

The safety profile observed in the present study was acceptable and comparable to previously published international data. Overall complication rate was 26.1%, with minor complications occurring more frequently than major complications. Transient hemobilia and catheter-related discomfort represented the most common minor adverse events, whereas cholangitis and significant hemorrhage constituted major complications. Similar complication patterns have been described in studies from *JVIR*, *CVIR*, and *Diagnostic and Interventional Radiology* [22–24]. The relatively low incidence of major complications in the current study may reflect careful patient selection, correction of coagulopathy prior to intervention, and adherence to standard interventional radiology procedural protocols. Post-procedural cholangitis remains an important complication following PTBD and is generally associated with incomplete drainage, infected bile, prolonged catheter manipulation, or inadequate antibiotic coverage [29]. Hemorrhagic complications may occur secondary to hepatic arterial or portal venous injury during transhepatic puncture, particularly in patients with advanced cholestatic coagulopathy [30]. In the present study, major hemorrhage was infrequent and was successfully managed conservatively with blood transfusion and close monitoring.

The role of PTBD continues to be particularly important in patients unsuitable for endoscopic retrograde cholangiopancreatography (ERCP). Although ERCP remains the preferred first-line modality for distal biliary obstruction, its efficacy is limited in patients with hilar cholangiocarcinoma, altered gastrointestinal anatomy,

duodenal infiltration, or failed cannulation [31]. Several comparative studies have demonstrated that PTBD may provide superior drainage outcomes in complex hilar obstruction because of direct segmental biliary access and improved drainage of isolated hepatic segments [32]. Furthermore, PTBD offers the advantage of precise imaging-guided access and the ability to perform staged drainage procedures in advanced hilar malignancies.

The findings of the present study are particularly relevant in resource-limited healthcare settings where advanced hepatobiliary malignancies frequently present at unresectable stages. In many tertiary care centers across developing countries, access to advanced endoscopic interventions may remain limited, whereas ultrasound and fluoroscopy-guided PTBD can be performed effectively with relatively lower infrastructure requirements [33]. Therefore, PTBD represents a clinically valuable and cost-effective palliative intervention in patients with advanced malignant obstructive jaundice.

The present study also highlights the expanding role of interventional radiology in multidisciplinary oncological care. Modern image-guided biliary interventions not only provide palliation of obstructive symptoms but also facilitate subsequent chemotherapy, improve liver function, and enhance overall treatment planning in hepatopancreatobiliary malignancies [34]. Increasing procedural expertise and advances in imaging guidance are expected to further improve clinical outcomes and procedural safety in the future.

LIMITATIONS

The present study has several limitations. First, the sample size was relatively small, which may limit the generalizability of the findings and reduce statistical power for subgroup analysis. Second, the study was conducted at a single tertiary care center, thereby reflecting institutional procedural expertise and patient selection patterns that may not be universally applicable. Third, the retrospective observational design may introduce selection bias and dependence on the accuracy of available medical records. Finally, the follow-up duration was limited to short-term outcomes, and long-term catheter patency, quality-of-life assessment, and survival outcomes were not evaluated.

CONCLUSION

Percutaneous transhepatic biliary drainage demonstrated high technical success and significant short-term clinical efficacy in patients with malignant obstructive jaundice. The procedure resulted in substantial reduction in serum bilirubin levels, effective symptomatic palliation, and acceptable complication rates with low procedure-related morbidity. PTBD proved particularly valuable in patients with unresectable hepatopancreatobiliary malignancies and in cases unsuitable for endoscopic intervention. The findings of the present study reinforce the important role of image-guided interventional radiology in the multidisciplinary management of advanced malignant biliary obstruction, especially in

resource-limited tertiary care settings where timely biliary decompression remains essential for improving patient outcomes and facilitating subsequent oncological treatment.

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