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Percutaneous drainage in malignant biliary obstructions: Technical success and complication rates

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Abstract

The study aimed to investigate the effect of biliary obstruction level on the technical success and complication rates of transhepatic percutaneous biliary drainage (TPBD). Patients who underwent TPBD due to malignant biliary obstruction were reviewed retrospectively. The study sample was separated into two groups according to the level of biliary obstruction. Patients with obstruction in the proximal cystic duct formed Group 1, and those in the distal of the cystic duct formed Group 2. The level of obstruction was determined based on magnetic resonance cholangiopancreatography (MRCP), computed tomography (CT) examinations, and intraoperative fluoroscopy images. Passing the biliary obstruction and providing percutaneous internal-external TPBD was determined as technical success. The effects of tumor location on technical success were investigated. In addition, patient demographic data and complication, morbidity, and mortality rates were compared between the two groups. The study included 56 patients, comprising 32 males and 24 females, with a mean age of 58.5 years, as 32.1% (n=18) in Group 1 and 67.9% (n=38) in Group 2. The technical success rate was 94.4% in Group 1 and 100% in Group 2. In Group 1, external drainage only was performed in 1 patient (5.6%) because the obstruction could not be passed despite all manipulations. There was no significant difference in technical success rates between the groups (p>0.05). No major complication was determined in either group. During the procedure, there were minor complications in 3 patients (16.6%) in Group 1 and 3 patients (8.5%) in Group 2. Complication rates were similar in both groups (p>0.05). There was no procedure-related morbidity and mortality. In conclusion, the localization of the biliary obstruction did not affect the technical success and complication rates of PTBD.

Keywords: Biliary obstruction, transhepatic percutaneous biliary drainage, biliary obstruction level, technical success, complication rate

Introduction

Percutaneous transhepatic biliary drainage (PTBD) is an imaging-guided minimally invasive procedure aimed at internal-external drainage of bile stasis resulting from biliary stenosis or obstruction [1]. PTBD is life-saving approach in hyperbilirubinemia due to mechanical bile stasis. PTBD is sometimes the only option for patients in whom biliary drainage cannot be achieved endoscopically [1]. The technical success and complication rates of PTBD may be affected by factors related to the patient and the disease-causing the obstruction [1, 2]. The grade of dilatation of the intrahepatic peripheral bile ducts can be considered the most crucial factor affecting the technical success of PTBD. Larger bile ducts may facilitate access to the biliary tract under ultrasound or fluoroscopy guidance [3]. Biliary obstructions can be separated into lower and upper biliary obstruction according to their level [2]. PTBD can be performed in patients with both high and low bile duct obstruction, although the location of the obstruction may affect PTBD technical success and complication rates. This study aimed to investigate the effect of biliary obstruction level on the technical success and complication rates of PTBD.

Materials and Methods

This study was approved by the Local Ethics Committee (decision no: 2021/236, date: 7/7/2021).

Study Population

A retrospective review was made of the interventional radiology department database data of patients who underwent PTBD for

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malignant biliary obstruction between July 2016 and July 2021. The patients' level of bile duct obstruction was identified using magnetic resonance cholangiopancreatography (MRCP), computed tomography (CT) images, and fluoroscopy images. The indications for PTBD were high total bilirubin level, obstructive jaundice, failed endoscopic drainage attempt. Patients were separated into two groups according to the level of obstruction. High bile duct obstruction (Group 1) was defined as biliary obstruction superior to the cystic duct. Low bile duct obstruction (Group 2) was defined as biliary obstruction inferior to the cystic duct. Performing internal-external PTBD bypassing the obstruction in the biliary tract was determined as technical success. Rupture of the biliary tract, subcapsular hematoma in the liver, and intra-abdominal bleeding were defined as intraoperative complications. Fluoroscopic images obtained during the procedure were used to determine the technical success rates. Intraoperative complications were determined using control USG and CT examinations performed after the procedure. Complications causing morbidity and mortality after the procedure were accepted as major complications, while others were considered minor complications.

Patient demographic data, postoperative complications, morbidity, and mortality rates were compared in both groups.

Percutaneous Transhepatic Biliary Drainage Procedure

Local anesthesia was performed through the 10th-11th intercostal space in the angiography suite. Dilated peripheral bile ducts were cannulated distally using an acoustic needle set (Boston Scientific Corporation, Marlborough, USA) with fluoroscopy guidance. Contrast media was injected via needle to make visible dilated bile ducts. After then, dilated bile duct was punctured as possible as peripherally and a microwire was advanced into needle. The obstruction was passed using the microwire, and the duodenum was navigated. An internal-external biliary drainage catheter (Flexima, Boston Scientific Corporation, Marlborough, USA) was placed over the wire. Illustrative cases were presented in Figure 1 a-d and Figure 2 a-d.

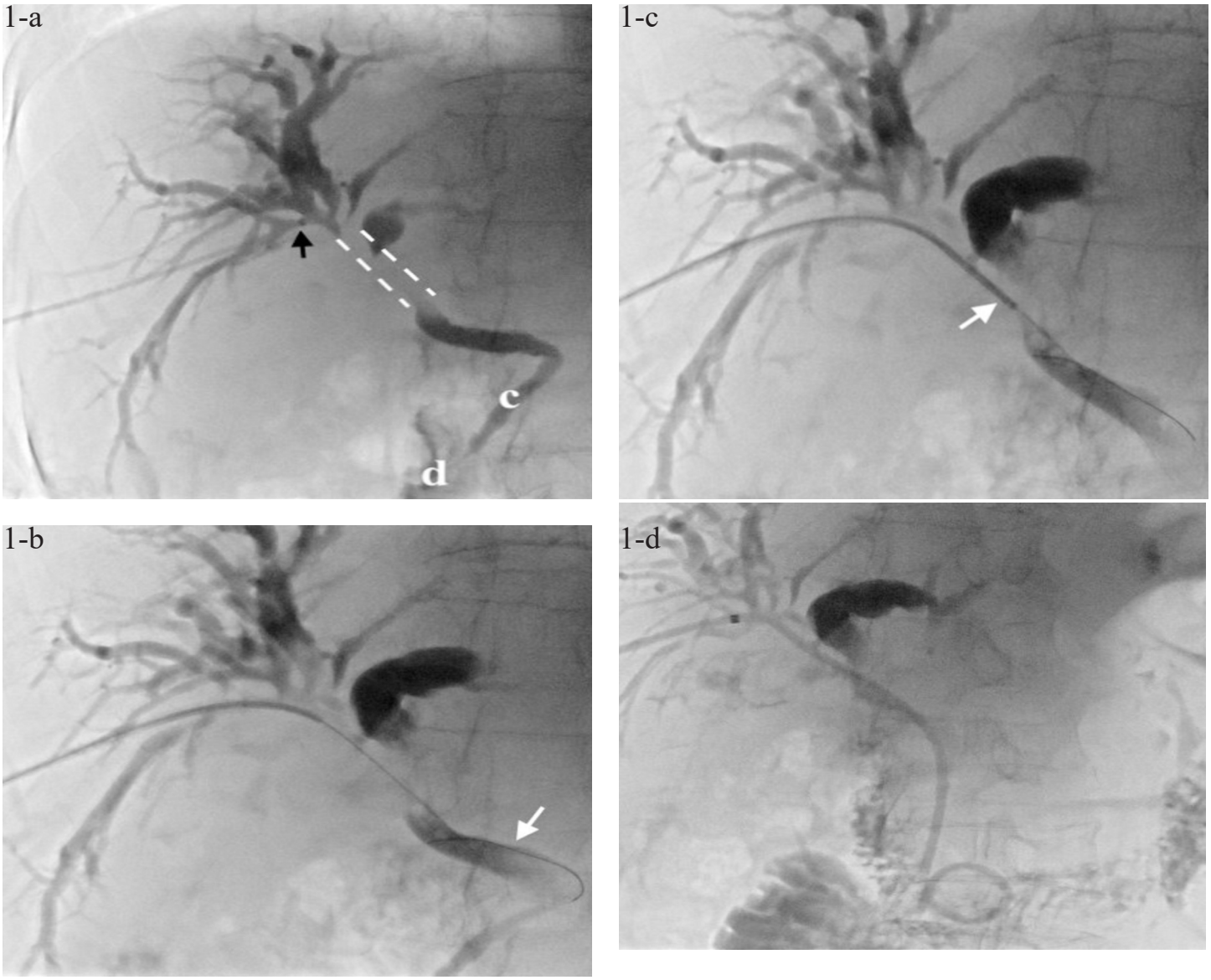

Figure 1. A 72-year-old man patient with high biliary obstruction due to Klatskin tumor. The dilated biliary tree shows in Fig. 1a (black arrow: co-axial introducer, dashed lines: obstruction level, c: choledoch, d: duodenum). Fig. 1b demonstrates passed obstruction level with 0.018-inch guidewire (white arrow). Fig. 1c shows advancing catheter over the wire. Fig. 1d shows the placement of the external-internal drainage catheter

Figure 2. A 58-year-old man patient with low biliary obstruction due to pancreatic cancer. The dilated biliary tree shows in Fig. 1a (black arrow: Accu-stick needle, black star: obstruction level, c: cystic duct). Fig. 1b shows passed obstruction level with 0.018-inch guidewire (black arrow). Fig. 1c shows advancing catheter (dashed lines: obstruction level, white star: duodenum). Fig. 1d demonstrates the placement of the external-internal drainage catheter.

Statistical analysis

The study data were transferred to the IBM SPSS 20 program. The frequency distribution (number, percentage) for categorical variables and descriptive statistics (mean, standard deviation) for numerical variables were given. The independent sample t-test and Chi-square test were used to examine the relationship between the two categorical variables. A $p < 0.05$ was statistically significant.

Results

The results of this study are shown in Table 1. The evaluation was made of 56 patients, comprising 32 males and 24 females, with a mean age of 58.5 years. According to the fluoroscopy, MRCP, and CT images, 32.1% (n=18) of the patients were in Group 1, and 67.9% (n=38) were in Group 2. All the patients in Group 1 had biliary obstruction due to a Klatskin tumor. In Group 2, 8 (21%) patients had a distal choledochal tumor, 23 (60%) had a pancreatic head tumor, and 7 (19%) had a biliary obstruction caused by other periampullary region tumors. All the patients had a total biliary obstruction. The technical success rates were 94.4% in Group 1 and 100% in Group 2. Only external biliary drainage could be performed in one patient in Group 1 due to proximal obstruction, which could not be passed. There was no significant difference in technical success rates between the groups ($p>0.05$). There were minor complications during the procedure

in 3 patients (16.6%) in Group 1 and 3 patients (8.5%) in Group 2 (Table 1). The self-limiting subcapsular hematoma was observed in 1 patient in both groups. Minor complication rates were similar in the two groups (p>0.05). In one patient in Group 1, diffuse intra-abdominal bleeding was observed on the abdominal US due to a decrease in hemoglobin in the 4th hour after the procedure. The patient underwent erythrocyte replacement and was discharged on the 5th day of hospitalization with a conservative approach. The overall complication rate of this series was 10.7%, and the minor complication rate was 8.9%. Major complications causing morbidity were observed in 1.8% (n=1).There was no mortality from PTBD in any of the patients in this study.

Table 1. Basal demographic characteristics and treatment results of the patients

Variables	Group 1 (n=18)	Group 2 (n=38)	p
Age / Sex	65.1±10.88 / 8F-10M	64.2±11.27 / 16F-22M	>0.05
Causes of Biliary Obstruction			
Klatskin Tumor	18 (100%)	-	
Distal choledochal cancer	-	8 (21%)	-
Pancreatic cancer	-	23 (60%)	
Others	-	7 (19%)	
Complications			
Biliary tract rupture	1 (5.5%)	2 (5.2%)	>0.05
Subcapsular hematoma	1 (5.5%)	1 (2.6%)	
Intra-abdominal bleeding	1 (5.5%)	-	
Technical Success	94.4% (17/18)	100% (38/38)	>0.05

Discussion

The main focus of this study was to analyze the effect on PTBD of the localization of malignant biliary obstruction. According to the present study results, there was no correlation between the technical success and complication rates of PTBD and the localization of the obstruction.

Due to any malignancy, obstructions occurring in the intra, or extrahepatic bile ducts are defined as malignant biliary obstruction. The causes of malignant biliary obstruction are, in order of frequency, pancreatic adenocarcinoma, cholangiocarcinoma, ampullar/duodenal adenocarcinoma, gallbladder adenocarcinoma, and lymphoma [4]. Jaundice and cholangitis resulting from biliary obstruction can cause morbidity and mortality [5]. Therefore, eliminating biliary obstruction and establishing bile flow are necessary to increase the patient's quality of life and duration. Minimally invasive interventional procedures and surgical methods are performed to drain biliary stasis. However, the applicability of surgical methods is limited. Despite developing cancer diagnostic tools and increased accessibility with technological developments, only 20% of periampullary region tumors can be surgically resected [6, 7]. Invasion of the tumor into surrounding tissues and the patient's advanced age play an essential role in this low resection rate [6, 7]. In addition, the mortality rate of surgical anastomoses in malignant biliary obstruction is high, reaching up to 60% [8]. For these reasons, minimally invasive interventional procedures are gaining importance.

Endoscopic biliary drainage (EBD) and PTBD, which are minimally invasive interventional procedures, are frequently used in the palliative treatment of biliary stasis and jaundice caused by malignant biliary obstruction [9]. Various factors, such as the site of obstruction, the expected survival time of the patient, the purpose of drainage, post-procedure therapeutic strategies, and the center's expertise, are effective in deciding which of these two methods is the optimal treatment option [9]. Rizzo et al. [9] published an extensive meta-analysis of the optimal treatment strategy of these two modalities. Comparisons were made of the technical success rates, overall complications, 30-day mortality rates, bleeding risk, pancreatitis / cholangitis risk, and tube/catheter dislocation of both methods [9]. Although both methods had some advantages over the other, it was reported that the technical success rate, total complication risk, 30-day mortality rate, and tube/catheter dislocation risk of PTBD were similar to those of EBD [9]. However, PTBD has a lower risk of pancreatitis and cholangitis [9]. Therefore, PTBD is primarily preferred in our center. In addition, PTBD is frequently performed as a salvage palliative procedure in patients following EBD failure.

The etiology of biliary obstruction may affect the technical success of PTBD. This is because the tumor originates primarily from the intra and/or extrahepatic bile ducts, and tumor invasion into the biliary tract or biliary obstruction due to the compression effect may affect the technical steps of PTBD, such as catheterization of the biliary tract or insertion of the catheter. Choi et al. [10] reported the technical success rate of PTBD as 48% in hepatocellular cancer-induced bile duct obstruction, emphasizing that EBD is a more appropriate treatment strategy. Saluja et al. [11] reported the technical success rate of PTBD as 89% in gallbladder cancer.

Walter et al. [12] stated the technical success rate of PTBD as 98% in the drainage of biliary obstructions due to primary bile duct malignancy. The current study consisted of patients with bile duct obstruction due to cholangiocellular cancer, a primary bile duct malignancy, and the overall technical success rate of this study was high in parallel with findings in the literature.

Another factor that can affect the technical success of PTBD is the level of biliary obstruction. There are various classifications of peripheral type cholangiocellular carcinoma according to its localization. The most well-known of these is the Bismuth-Corlette classification [13], based on the ductal involvement and rate of perihilar cholangiocarcinomas. According to tumor infiltration in the common bile duct and right and left main bile ducts, there are five different groups [13]. Although the Bismuth-Corlette classification provides information about the stage of the disease, it does not contain data on tumor infiltration in the distal common bile duct. Another classification that covers all bile ducts and includes two subgroups was described by Covey et al. [2]. Concerning the cystic duct, obstructions above the normal junction of the cystic duct with the common bile duct are classified as "high bile duct obstruction" and obstructions below this junction level as "low even duct obstruction". This classification seems more straight forward and more beneficial than the Bismuth-Corlette classification for PTBD, because it is not always easy to determine the presence of tumor infiltration in the Bismuth-Corlette classification in detail with imaging methods. The classification of Covey et al. [2] was more useful for the current study because it includes two classes according to the level of obstruction and is more inclusive. In the current study, 32.1% of the patients had high bile duct obstruction, and 67.9% had lower bile duct obstruction. Khashab et al. [14] reported a 39.2% complication rate with an excellent technical success rate of PTBD in low malignant biliary obstruction. In the current study patients with low malignant biliary obstruction, the technical success rate of PTBD was 100%, and the complication rate was 8.5%. EBD is generally preferred more frequently in low biliary obstructions [15]. However, the endoscopist's experience significantly influences the technical success and complication rates of EBD [15]. PTBD has a lower complication rate than EBD, except for bleeding, and its technical/clinical success rate is similar to EBD, which makes PTBD preferable [16]. According to the Asia-Pacific consensus recommendations for endoscopic and interventional treatment of hilar cholangiocellular carcinoma, PTBD is superior to EBD [15]. Jo et al. [17] reported a technical success rate of 97.3% and a complication rate of 27.9% for PTBD in upper malignant biliary obstructions. The technical success rate in the current series was 94.4% in upper malignant biliary obstructions, and complications were observed at the rate of 16.6%. These results were consistent with the literature.

This study had some limitations, primarily that it was single-centered and retrospective in design. In addition, the small number of patients made it difficult to interpret statistical data. However, these limitations can be considered not to have diminished the value of the study because the effect was investigated of malignant biliary obstruction localization on the technical success and complication rates of PTBD, and it will contribute to the literature.

Conclusion

In conclusion, PTBD is a safe method in the palliative treatment of malignant biliary obstruction due to its low complication and high technical success rates. The localization of the biliary obstruction did not affect the technical success and complication rates of PTBD. PTBD was a safe method in both low and high malignant biliary obstructions.

Conflict of interests
The authors declare that they have no competing interests.

Financial Disclosure
All authors declare no financial support.

Ethical approval
This study was approved by the Local Ethics Committee (decision no: 2021/236, date: 7/7/2021).

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