



Percutaneous Transhepatic Cholangiography, Percutaneous Biliary Drainage and Metallic Endoprotesis Applications in Malign Biliary Obstructions

İnoperabl Malign Biliyer Obstrüksiyonlarda Perkütan Transhepatik Kolanjiyografi, Perkütan Biliyer Drenaj ve Metalik Endoprotez Uygulamaları

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Abstract

Objective: We aimed to present the effectiveness of percutaneous transhepatic cholangiography, percutaneous biliary drainage and metallic endoprotesis applications in patients with inoperable biliary obstructions.

Material and Method: Percutaneous transhepatic cholangiographies (PTC) and percutaneous biliary drainages (PBD) were performed in 44 patients with inoperable malignant obstructive jaundice who had been hospitalized in the radiology department of our hospital over a three years period. Six patients (13.6%) underwent external biliary drainage(EBD), 27 patients (61.4%) underwent internal-external biliary drainage(I-EBD) and metallic stents were placed in 11 patients (25%) on average 6 days (1-34 days) after I-EBD. The mean total bilirubin(TB), ALP, ALT, AST, GGT values taken before and after drainage in all patients were compared.

Results: Biliary drainage was technically successful in all patients. In the first two weeks after biliary drainage, 38 cases (86%) had a general condition improvement, weakness and itching decreased. The mean TB;19.41±9.09; 9.39±15.34, ALP; 701.27±352.53; 357.48±268.70, ALT; 122.45±75.42; 62.91±61.90, AST; 129.14±84.31; 94.93±118.79, GGT; 684.48±428.83; 322.39±253.26 values taken before and after drainage in all patients were compared and a significant decrease was found in the post-procedure values ($p<0.050$). In the follow-up, minor complications were observed in 10 patients (22.7%).

Conclusion: It is necessary to prevent inoperable patients from entering hepato-renal failure in order to prolong life time as much as possible. PBD and stent applications significantly improves impaired liver function, allowing the patients general condition improvement. Low complication rates and quickly improving general condition of patients without need for another surgery gradually increase the value of this radiological intervention.

Keywords: Endoprotesis, malign obstruction, percutaneous biliary drainage

Öz

Amaç: İnoperabl malign biliyer obstrüksiyonlu hastalarda, perkütan transhepatik kolanjiyografi (PTK) sonrasında uygulanan perkütan biliyer drenaj (PBD) ve metalik endoprotez uygulamalarının etkinliğini sunmayı amaçladık.

Gereç ve Yöntem: Girişimsel radyoloji ünitemize 3 yıllık süre içerisinde refere edilen, malign tıkanma sarılığı olan inopere 44 hastaya, PTK sonrası PBD uygulandı. Altı olguya (%13,6) sadece eksternal biliyer drenaj (EBD), 27 olguya (%61,4) sadece internal-eksternal biliyer drenaj (İEBD), 11 olguya (%25) ise ortalama 6 gün (1-34 gün) sonra İEBD sonrası metalik stent uygulandı. Drenaj öncesi ve sonrası alınan ortalama total bilirubin (TB), ALP, ALT, AST, GGT değerleri karşılaştırıldı.

Bulgular: Hastaların tümünde safra drenajı sağlanarak işlem başarıyla sonlandırıldı. PBD sonrası ilk 2 haftada 38 olgunun (%86) genel durumunda iyileşme, halsizlik ve kaşıntı gibi şikayetlerde azalma saptandı. Tüm hastalarda drenaj öncesi ve sonrası ortalama total bilirubin (TB); 19,41±9,09; 9,39±15,34, ALP; 701,27±352,53; 357,48±268,70, ALT; 122,45±75,42; 62,91±61,90, AST; 129,14±84,31; 94,93±118,79, GGT; 684,48±428,83; 322,39±253,26 olarak hesaplandı ve işlem sonrası değerlerde anlamlı düşüş saptandı ($p<0,050$). Takipte toplam 10 hastada (%22,7) minör komplikasyonlar izlendi.

Sonuç: İnoperabl malign tıkanma sarılıklı hastalarda yaşamı mümkün olduğunca uzatabilmek için hastanın hepato-renal yetmezliğe girmesini önlemek gereklidir. Perkütan biliyer drenaj ve biliyer endoprotez uygulamaları, bozulmuş olan hepatik fonksiyonları büyük ölçüde düzelterek hastanın genel durumunun iyileşmesine olanak sağlamaktadır. Bir başka cerrahi müdahale gerekmeden hızlı bir şekilde hastanın genel durumunu iyileştirmesi ve düşük komplikasyon oranları bu radyolojik girişimin değerini giderek artırmaktadır.

Anahtar Kelimeler: Malign obstrüksiyon, perkütan biliyer drenaj, stent



INTRODUCTION

Obstructive jaundice develops as a result of obstruction of the bile ducts by stones, benign strictures or tumours. The morbidity and mortality of obstructive jaundice is quite high. Stone is the most common cause in adults and the second most common cause is malignancy. Definitive treatment of malignant obstruction is surgery. However, approximately 90% of patients admitted to the hospital with malignant obstruction are inoperable.^[1] In this case, the aim is to minimize the symptoms by ensuring the passage of bile into the duodenum. Percutaneous biliary drainage (PBD) applied by Molnar and Stockum^[2] in the palliative treatment of obstructive jaundice in 1974 was followed by biliary endoprosthesis implantation by Burchardt and Pereiras et al.^[3] percutaneous transhepatic intervention in 1978. With today's technological developments, PBD has gained a solid place in the diagnosis and palliative treatment of obstructive jaundice.

Today, this radiological diagnostic and therapeutic approach, which uses ultrasound (US) and fluoroscopy, has been compared with surgical series, and the preference of percutaneous intervention has increased in the face of high morbidity and mortality rates of surgical treatment. Percutaneous transhepatic biliary drainage has been widely accepted for palliative treatment in patients with advanced stage malignant obstruction jaundice who have lost the chance of operation.^[4-8] Due to the long-term complications of PBD and the discomfort that patients feel owing to carrying catheters continuously, endoprostheses of various shapes and sizes, previously made of plastic, have been used in order to provide bile drainage. Because of the complications of plastic endoprostheses such as high occlusion rates and migration, metal endoprostheses that can create larger lumen when released, have been used in recent years. The purpose of all these methods is to reduce jaundice and drain bile into the intestine.

In our study, the efficacy of PBD and metallic endoprosthesis implantation in inoperable malignant biliary obstruction, short and long term follow-up results, the life span of patients and their contribution to quality of life were evaluated.

MATERIAL AND METHOD

PBD was performed after percutaneous transhepatic cholangiography (PTC) in 44 inoperable patients with malignant obstructive jaundice who were referred to our interventional radiology unit over a period of 3 years. The ages of the patients to whom we applied PBD ranged between 37 and 80 (mean 63) and 29 were male (65.9%) and 15 were female (34.1%). The hilar observation grading of all patients was done according to the Bismuth typing. Accordingly, 4 of the patients were type I (9%), 4 were type II (9%), 11 were type IIIa (25%), 17 were type IIIb (39%), 8 were type IV (18%). 29 of the patients (65.9%) had previously been operated before due to their primaries.

Six cases (13.6%) underwent only external biliary drainage (EBD), 27 cases (61.4%) underwent only internal-external biliary drainage (IEBD), and 11 cases (25%) underwent metallic stent after IEBD. PTC and EBD were applied to one of the patients first from the left, and in the next session, IEBD was applied from the right. IABD catheters were placed in both right and left intrahepatic bile ducts in two patients. Biliary drainage was applied to all other patients (93.2%) by entering from the right. Spontaneously expandable metallic stent was placed in 11 (25%) of the patients underwent IEBD, after 1-34 days (average 6 days). The distribution of the diagnoses of the patients according to the procedure is summarized in **Table 1**.

Table 1. Distribution of patients according to the diagnosis and the procedure

DIAGNOSIS	EBD	IEBD		TOTAL
		Stent (-)	Stent (+)	Number of patients
Biliary system malignancy	2	11	3	16 (36.4%)
Periapillary tumor	-	6	1	7 (15.9%)
Metastasis	4	9	7	20 (45.5%)
Primary liver cancer	-	1	-	1 (2.3%)
TOTAL (Number of patients)	6	27	11	44 (100%)

EBD: External Biliary Drainage, IEBD Internal-External Biliary Drainage

Techniques

Written consent was obtained from all patients before the procedure. Before PBD, it was paid attention that the platelet count of all patients was at least 70,000/mm³ and the INR value was below 1.4. Antibiotic prophylaxis (IV ceftriaxone, 1 g) and IV sedation (IV midazolam, 2.5 mg and IV fentanyl, 0.1 mg) were administered to all patients 30 minutes before the procedure.

All patients were treated with US (GE Logic 200 Pro Series) and fluoroscopy (Axiom, Siemens Iconos R 200). After the patients were placed in the supine position, skin cleansing was performed with a baticon. Right side was closed in a sterile manner, keeping the 8-11 intercostal spaces level open. The appropriate intervention location and angle were determined by US, considering the mid axillary line. Local anaesthesia was applied at the site of the intervention with lidocaine. A small incision of approximately 0.5 cm was opened on the skin, and the skin-subcutaneous tissues were gently dissected with a clamp. With real-time US, the patient was kept holding breath, and the dilated intrahepatic bile ducts were entered with a 21G Chiba needle. It was confirmed that the needle was in the bile duct with bile aspiration from the needle. The bile ducts were visualized with fluoroscopy by administering contrast material diluted in half with physiological saline through the connecting piece 'Connecting tube'. PTC procedure was performed by taking cholangiographies of the dilated bile ducts, which were visualized to the level of obstruction.

A 0.018" nitinol tipped guide wire was advanced into the biliary tract through the needle. The access set (Accustick II Introducer System; Boston Scientific) which was advanced over

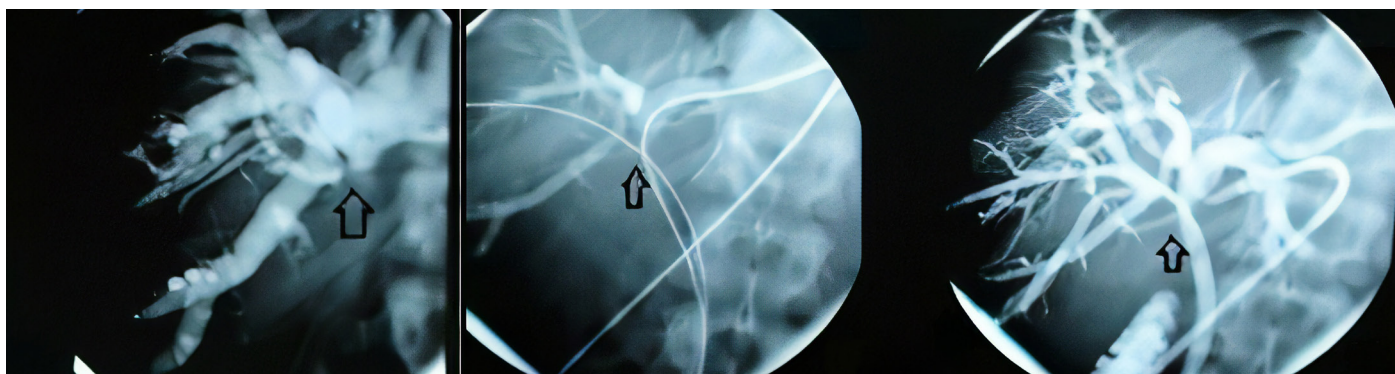


Figure 1. A 37-year-old male patient with Klatskin tumor has a stenosis in the bifurcation in the percutaneous cholangiography image. Bilateral external biliary drainage and internal-external biliary drainage were applied.

the guidewire, was placed in the biliary tract. It was attempted to pass to the distal of the narrow segment with 0.035" hydrophilic guide wire (Terumo; Terumo Corporation). After the stenosis was passed, the hydrophilic wire was replaced with a 0.035" rigid guide wire (Amplatz Super Stiff, Boston Scientific). Afterwards, 10 F external-internal drainage catheter (Flexima, Boston Scientific) was placed (**Figure 1**).

In patients in whom stents were planned, a 0.035" rigid body guide wire was advanced through the external-internal biliary drainage catheter up to the duodenum and the catheter was retrieved. The stent lumen was washed with saline solution by using a syringe. The prepared stent was advanced over the guide wire. It was brought to the appropriate location by using two radiopaque markers indicating the proximal and distal ends on the catheter. Contrast material was given from the 'introducer sheath' and the position was confirmed. The stent was placed by using the trigger mechanism. The carrier was withdrawn at a constant speed and the stent was released in a controlled manner. The used stents were placed on a 7-10F carrier catheter, 10 cm long and their fully opened diameters were 10 mm. A 10 cmx10 mm self-expandable Luminexx wallstent (Bard; Angiomed, Karlsruhe, Germany) was used in all patients. After the stent was opened successfully, an internal-external drainage catheter was placed in the biliary tract to be kept for 1 or 2 days. One day after the procedure, contrast material was administered through the drainage catheter, and stent position, expansion and drainage were observed. The catheter was removed after 2-10 days following the control of the passage.

Monthly checkups of the patients were planned. All radiological findings, biochemistry values, interventional radiological technique, complications of the patients, clinical and laboratory course before and after the procedure were recorded in the observation form prepared previously. Patients' most recent total bilirubin (TB), alkaline phosphatase (ALP), alanine amino transferase (ALT), aspartate amino transferase (AST), gamma glutamyl transferase (GGT) values before drainage, in the first week after drainage and in the late period after drainage were recorded. The patients were divided into two groups as those who underwent only EBD and those who underwent IEBD +/-

stent. Primary patency time was defined as the time from the implantation of the stent to the reappearance of obstruction symptoms. If the patient died due to occlusion symptoms, patency time was matched with the patient's life span.

Pre-procedure, post-procedure early and late blood values were compared according to the significance test of the difference between the two pairs (Paired Samples T-Test). Total patient survival and stent patency time were calculated according to the Kaplan-Meier method. Statistical power analysis (power analysis) with the possibility of rejecting the false null hypothesis was used to determine the sample size in the study.

RESULTS

The procedure was successfully completed by providing biliary drainage in all 44 patients who underwent biliary drainage (technical success 100%). The patients were followed for the shortest 2 days and the longest 670 days (median 23 days). In the first 2 weeks after PBD, improvement in the general condition and a decrease in complaints such as weakness and itching of 38 patients (86%) were found.

In 6 patients (13.6%) whose distal stenosis could not be passed in the first session, because their relatives did not want a second procedure, the catheter was left to external drainage only and it was followed. External and internal drainage was performed in the same session in 30 (80%) of 38 patients who underwent IEBD. In 8 of the patients (20%), since the distal of the stenosis could not be passed, an 8 F external drainage catheter was placed first, it was waited for the duration varying between 4-55 days to resolve the edema in the stenosis localization. After the regression of the edema, internal drainage was started.

The catheters of two of the patients in our follow-up; were replaced on day 124 of one patient, the other on day 259 of another, with a new one. The catheters of two patients were dislocated within the first day after the procedure and were corrected with a guide wire.

Stents were implanted in the right lobe using the right transhepatic approach in all patients and in all patients without periampullary tumor, the distal end of the stents was left at the

suprapapillary level in order to minimize the risk of possible ascending cholangitis (Figures 2a, 2b).^[9] In one patient with a periampullary tumor in which the stent was placed, the stent was left before the papillae when the stenosis could not be overcome. Balloon dilatation was performed in 2 patients, one of which was a periampullary tumor, because the stent width did not reach a sufficient diameter (diameter <8 mm). ERCP-guided stent was placed in 3 patients with IEBD at an external center.

Complications were observed in 10 patients (22.7%) during follow-up. Fever was observed in 6 patients (13.7%) the day after the procedure in the early period and resolved within 24 hours following antibiotic treatment. It was observed that the liver enzymes of the patients did not increase compared to the pre-procedure values and the image was not interpreted as cholangitis. Abscess occurred within the first week after the procedure in 2 patients (4.5%) who also had an operation history, and it was recorded as a procedure complication. None

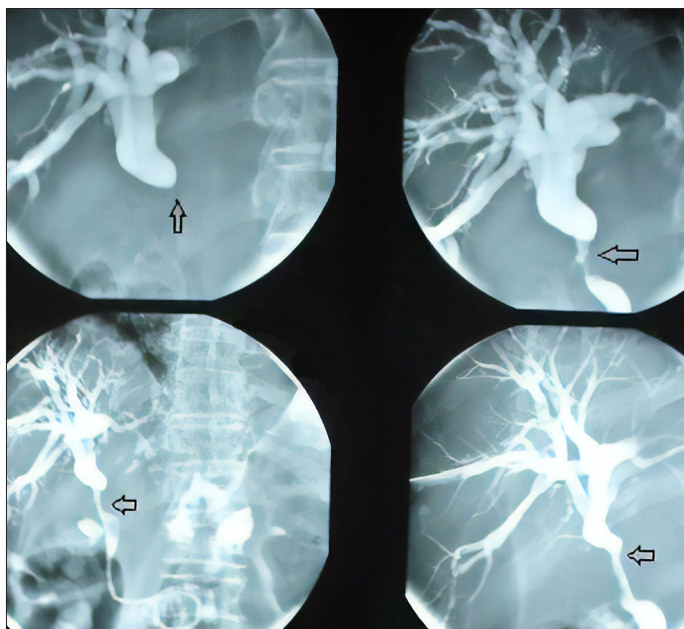


Figure 2a, 2b. In the percutaneous cholangiography image, a 73-year-old male patient with operated gastric carcinoma and liver metastasis has stenosis in the middle part of the common bile duct. Internal-external biliary drainage and stent was applied.

Table 2. Paired Samples T-Test analysis results before and late period after the procedure in patients with drainage

Parameter (Before and after the procedure)	Average	Standard deviation	95% Confidence Interval Lower limit	95% Confidence Interval Upper limit	t-value	Degree of Freedom	Significance Level
TB	10.02	13.04	6.06	13.99	5.09	43	0.000
ALT	59.54	75.26	36.66	82.42	5.24	43	0.000
AST	34.20	103.45	2.75	65.65	2.19	43	0.034
ALP	343.79	270.32	261.61	425.98	8.43	43	0.000
GGT	362.09	363.57	251.55	472.62	6.60	43	0.000

TB: Total bilirubin, ALT: Alanine aminotransferase, AST: Aspartate aminotransferase, ALP: alkaline phosphatase, GGT: gamma-glutamyl transferase

Table 3. Paired Samples T-Test analysis results before and early/late period after the procedure in patients with external biliary drainage

Parameter (Before and after the procedure)	Average	Standard deviation	95% Confidence Interval Lower limit	95% Confidence Interval Upper limit	t-value	Degree of Freedom	Significance Level
Early phase TB	7.91	6.36	5.65	10.16	7.14	32	0.000
Late phase TB	9.23	14.59	4.05	14.40	3.63	32	0.001

TB: Total bilirubin

Table 4. Paired Samples T-Test analysis results before and early/late period after the procedure in patients with stent

Parameter (Before and after the procedure)	Average	Standard deviation	95% Confidence Interval Lower limit	95% Confidence Interval Upper limit	t-value	Degree of Freedom	Significance Level
Early phase TB	9.93	6.63	5.47	14.38	4.96	10	0.001
Late phase TB	12.40	6.44	8.07	16.73	6.37	10	0.000

TB: Total bilirubin

of the patients had hematoma, major bleeding, hematuria, hepatic arteriovenous fistula, hemothorax, sepsis, peritonitis after bile leakage, contrast allergy, or procedural death, which were reported as complications of PBD procedure in the literature. In the long term, obstruction developed in the stent of 2 patients (18.2%). While external drainage was provided again in one of the patients, the other died due to the deterioration of his general condition.

The mean TB, ALP, ALT, AST, GGT values obtained before and after drainage in all patients were compared with the significance test of the difference between the two partners, and a significant decrease was found in the post-procedure values (Paired Samples T Test, $p < 0.050$) (**Table 2**). While no significant TB decrease was detected in the first week in patients who were applied only EBD, the decrease in TB detected in the late period was significant ($p = 0.006$) (**Table 3**). In patients who underwent IEBD +/- stent, a significant decrease in TB was found both in the early ($p = 0.000$) and late periods ($p = 0.005$) (**Table 4**).

During the follow-up, 35 (79.5%) of the patients died due to terminal malignant diseases. Seven patients (15.9%) are still living with their catheters or stents, and 2 patients (4.5%) are out of follow-up. Average lifetimes according to the type of performed transaction were found to be 218 (SE, 52) days in cases with EBD, 192 (SE, 41) days in cases with IEBD alone, and 182 (SE, 103) days in cases with stent implantation. When compared according to the Log-Rang test, no significant difference was found between the groups ($p > 0.05$).

According to the statistical power analysis, 44 observations, 0.05 significance level and Cohen d value as 0.7, test strength for two identical duplex tests was calculated as 0.90008.

DISCUSSION

The prognosis of patients with malignant biliary obstruction is generally poor. The majority of patients with pancreatic cancer, which is the most common cause of malignant obstructive jaundice, are inoperable when diagnosed.^[1] Resectability rate in patients with cholangiocarcinoma varies between 10-20% depending on the location of the carcinoma. Therefore, palliative treatment is an appropriate and necessary form of treatment in the majority of patients.^[10,11] In appropriate palliative treatment, morbidity and mortality should be low and complications should be less. In the surgical palliative treatment of pancreatic carcinoma, the mortality rate was found to be 15-25%, and the operative morbidity rate as 30%.^[12] These rates are far from expected results for successful surgical palliative treatment. The results are related to the natural history of the underlying disease as well as the intraoperative morbidity and mortality. When the causes of mortality and morbidity in these patients are evaluated; It has been reported that carcinomatosis is the main factor and surgical by-pass mortality is close to zero in the absence of metastases and/or infiltrations of the primary disease.^[13]

With the rapidly developing PBD applications, a more selective approach has been taken for bilioenteric by-pass, as a result, the operative mortality has decreased to 0-6%. For these reasons, surgical by-pass applications can be recommended in patients with low risk in the palliative treatment of patients with malignant biliary obstruction such as pancreatic carcinoma.^[14] PBD is a useful and effective palliative treatment option in patients considered inoperable.^[8] However, the effect of routine preoperative decompression on decreasing morbidity and mortality in cases dependent on different etiologies, or who have not lost the chance of operability or benign and uncomplicated, is controversial.^[9,14] Various studies have been conducted to evaluate the morbidity and mortality of surgical decompression of the biliary system due to malignant obstruction. Feduska et al.^[15] reported the curative and palliative operative mortality of pancreatic adenocarcinoma as 44% and 33%, respectively. They also stated that when serum bilirubin level is between 10 and 30 mg/dL, renal failure occurs in 8% of the patients, hemorrhage in 15%, and operative mortality in 17%. Allison et al.^[16] reported the frequency of postoperative renal failure as 17% and operative mortality as 25% in patients with obstructive jaundice, and showed that glomerular filtration rates decreased in patients with jaundice. Dixon et al.^[17] reported that serum bilirubin level being 6 mg/dL and alkaline phosphatase level being 600 IU/L increased the risk of operative morbidity and mortality. Nakayama et al.^[18] found in a study of 105 patients that operative mortality as 6% in patients with PBD and 28% in patients without it. The mortality rate in cases with pancreaticoduodenectomy with serum bilirubin levels more than 20 mg/dL was found to be 2 times higher than in cases with less jaundice.^[19,20]

Since PBD is more prolonged in malignant cases, occlusion, migration of the catheter and other mentioned complications related to the catheter are more common. In addition, since the average age of the patients in the malignant group is generally higher, complications are more common when the general condition is added to this.^[13,21] On the other hand, as the immune system of malignant patients is suppressed due to the underlying pathology or the used antineoplastics, the tendency to infections has increased. In various series, major complications (cholangitis, sepsis, pleural effusion, biliary peritonitis, major hemorrhage) have been reported between 4.6% and 25% and procedural death rates between 0% and 5.6% for PBD.^[22,23] The most common complication in patients undergoing PBD is reported as cholangitis.^[24]

In our study, hematoma, major bleeding, hematuria, hepatic arteriovenous fistula, hemothorax, sepsis, post-bile leakage peritonitis, contrast allergy, and procedural death did not occur in none of the patients who underwent PTC with a 21G Chiba needle, then to whom it was placed a 10 Fr PBD catheter and for whom it was switched to biliary endoprosthesis. It is also very pleasing that cholangitis, which was reported as the most common complication in long-term biliary drainage patients in the literature, was not observed in any of our patients. In accordance with the literature, we also think that leaving the

distal end of the stent in the suprapapillary region in order to protect the papilla may be quite effective in reducing the possibility of cholangitis, especially in patients with stent implantation.^[25] We attribute the fact that we did not encounter early and late complications related to the procedure, which are quite common in the literature, in any of our patients, to the fact that we use a thin (21G Chiba) needle for PTC, after it, that we use a single puncture technique in the drainage phase. On the other hand, we think that close control of patients during PBD plays an important role in minimizing complications such as catheter migration and occlusion.

The complications we observed in a total of 10 patients during follow-up are well below the rates reported in the literature. Cholangitis, which is accepted as a condition that increases mortality considerably in the literature and which has been reported with rates varying between 3.4% and 4.8%, is one of the most troublesome complications of the procedure and its treatment is difficult under these conditions. Cholangitis table was not observed in the patients in our study. High fever was evaluated depending on the acute stress response secondary to the procedure. Although the high success rates of biliary drainage performed by endoscopic way are known, the necessity of passing the papillae during the procedure increases the possibility of cholangitis.^[26] One of the important advantages of the percutaneous approach is the preservation of the papilla by US-guided access to the desired bile duct. The rate of patients with abscess (4.5%) is similar to the literature.^[23,24,27]

Due to the late complications of PBD and the psychological trauma and physical difficulties caused by continuous catheter carrying, it has revealed the necessity to use permanent catheter parts that are long enough to include only the obstruction level, for the purpose of providing drainage and that are not related to the outside of the body. With the advancing technology, we applied these permanent stents, which are made of plastic and metallic material and called endoprosthesis, to our 11 patients that we applied PBD as long as the clinical condition and social conditions of our patients allow. Our patients are still under follow-up and express their satisfaction with the endoprostheses due to the comfort of being free from the physical and mental discomfort of their catheters.

In our study, there was no difference in life expectancy between patient groups underwent EBD, IEBD, and stent according to the procedure. However, we think that the validity of this result will only be possible with extended studies with a large number of patients.

It has been reported in many studies in the literature that PBD generally decreases the level of TB and does not change other liver enzymes.^[5,7,28] In our study, a significant decrease in TB, ALT, AST, ALP, GGT was found after drainage. In addition, the results we found in our study showed that; while only late period TB decrease is significant in patients who undergo EBD, significant TB decrease is found in both early and late periods in patients

who undergo IEBD. We believe that this result emphasizes the value of IEBD application.

In the study conducted by Kozlov et al.^[24], PBD was applied on a group of patients guided with US, to the other group guided with fluoroscopy and it has been shown that US guidance significantly reduces the complication and mortality rate, enables 3 times reduction in taken radiation dose, and 2 times reduction in needle punctures. Obviously, the use of US during puncture in addition to scopic imaging, which is indispensable during manipulation of the wire and catheter, significantly reduces the complication and mortality rates.

CONCLUSION

In patients with inoperable malignant obstructive jaundice, it is necessary to prevent the patient from entering hepato-renal failure in order to prolong life as much as possible. Percutaneous biliary drainage and biliary endoprosthesis applications improve the general condition of the patient by substantially correcting impaired hepatic functions.^[29] Considering the patient's primary, clinical condition, inoperability, previous operation history, its rapid improvement on the general condition of the patient without the need for another surgical intervention and its low complication rates gradually increase the value of this radiological intervention.

ETHICAL DECLARATIONS

Ethical Situation: It was produced from Gülşah Bayram İlkan's thesis titled "Percutaneous Transhepatic Cholangiography, Percutaneous Biliary Drainage and Metallic Endoprosthesis Applications in Inoperable Malign Biliary Obstructions". The defense was made in Ankara Numune Training and Research Hospital in 2007 under the consultancy of İlkyay Akmangit, and the thesis was published in 2008.

Informed Consent: All patients signed the free and informed consent form.

Referee Evaluation Process: Externally peer-reviewed.

Conflict of Interest Statement: The authors have no conflicts of interest to declare.

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Author Contributions: All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

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