BMC Surgery

RESEARCH

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Analysis of the efficacy of Percutaneous Transhepatic Cholangiography Drainage (PTCD) and Endoscopic Retrograde Cholangiopancreatography (ERCP) in the treatment of Malignant Obstructive Jaundice (MOJ) in palliative drainage and preoperative biliary drainage: a single-center retrospective study

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Abstract

Purpose This study aimed to assess the safety and efficacy of percutaneous transhepatic cholangiography drainage (PTCD) and endoscopic retrograde cholangiopancreatography (ERCP) in palliative drainage and preoperative biliary drainage for treating malignant obstructive jaundice (MOJ).

Methods A total of 520 patients with MOJ who underwent PTCD or ERCP were enrolled and classified into palliative drainage group and preoperative biliary drainage group. Baseline characteristics, liver function, blood routine, complications were compared among the groups.

Results The technical success rates for PTCD and ERCP in palliative group were 97.1% and 85.9%. In palliative drainage group, PTCD had higher levels of total bilirubin (TB) reduction (53.0 (30.0,97.0) vs. 36.8 (17.9,65.0), $p < 0.001$) and direct bilirubin (DB) reduction (42.0 (22.0,78.5) vs. 28.0 (12.0,50.8), $p = 0.001$) than ERCP. However, PTCD was associated with higher rates of drainage tube displacement (20 cases, 11.8%), while ERCP had a higher incidence of biliary infection (39 cases, 22.8%) and pancreatitis (7 cases, 4.1%). In preoperative drainage group, PTCD achieved a 50%

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reduction in total bilirubin faster than ERCP (7.1 days vs. 10.5 days). And the time from palliation of jaundice to surgery was 24.2 days in PTCD group and 35.7 days in ERCP group, a statistically significant difference (Student's t test, $p=0.017$).

Conclusion Both PTCD and ERCP could improve liver function for MOJ patients. PTCD seems to offer better outcomes in jaundice reduction and liver function improvement in palliative drainage, but requires careful postoperative management. In preoperative biliary drainage, PTCD may be a better preoperative bridge to improve liver function and control infection.

Keywords PTCD, ERCP, MOJ, Complication, Efficacy

Introduction

Malignant obstructive jaundice (MOJ) often occurs in different primary and secondary cancers, including those originating in the head of the pancreas, bile duct, gallbladder, liver, and ampulla. Malignant neoplasms invade or compress the extrahepatic or intrahepatic bile ducts, leading to constriction and even obstruction of bile ducts, cholestasis, and elevated bilirubin [1, 2]. Its clinical manifestations include jaundice, nausea, itching, dark urine, and pale stools [3]. If left untreated, MOJ can lead to severe complications such as liver dysfunction, cholangitis, and ultimately liver failure [4]. Laboratory tests typically show elevated serum bilirubin, alkaline phosphatase, and γ-glutamyl transpeptidase levels [5].

MOJ necessitates active intervention to enable patients to undergo subsequent surgeries, radiotherapy, or chemotherapy [6, 7]. Common interventional methods include percutaneous transhepatic cholangiography and drainage (PTCD) and endoscopic retrograde cholangiopancreatography (ERCP) [8]. For patients with advanced tumors, palliative drainage aims to relieve symptoms and provide hospice care [9]. For those eligible for surgery, preoperative drainage helps control infection and improve liver function [10–12]. Despite the prevalence of these procedures, there is ongoing debate about the appropriate application scenarios for PTCD and ERCP, largely influenced by the operating habits of surgeons across different institutions [13]. Notably, there is a scarcity of studies comparing the use of PTCD and ERCP within the same institution [7].

This study aims to compare the safety and efficacy of PTCD and ERCP in treating MOJ for both palliative and preoperative biliary drainage within a single institution.

Materials and methods

Patients selection

From January 2018 to March 2024, we retrospectively analyzed the clinical characteristics of patients diagnosed with MOJ. This study was approved by the Ethics Committee and Institutional Review Board. Written informed consent was obtained from all eligible patients.

Patients who meet with following criteria were considered for inclusion in our study: (1) Patients of any gender, aged between 18 and 75 years; (2) Malignant tumors comprehensively diagnosed through clinical manifestations, laboratory tests, imaging studies, and/or biopsies. (3) MOJ diagnosed by contrast-enhanced Computed Tomography (CT) and contrast-enhanced Magnetic Resonance Imaging (MRI); The exclusion conditions were as following: (1) Non-tumor related obstructive jaundice; (2) Uncorrected coagulopathy; (3) Pregnancy and breastfeeding; (4) Uncontrolled systemic infection or sepsis; (5) No follow-up data available.

All procedures followed the protocols outlined in Fig. 1. Enrolled patients underwent comprehensive evaluations, including assessments by outpatient physicians and enhanced CT/MRI examinations. All procedures were performed or supervised by experienced interventional radiologists.

PTCD procedures

Under ultrasound guidance, the intrahepatic bile duct was punctured with a 21 (22)G puncture needle, a 1:1 contrast medium was injected to show the intrahepatic bile duct, and then the intrahepatic bile duct was probed with a 0.018-inch guidewire (Merit Medical, USA), the dilated puncture tract was incised at the puncture point, a 3-piece PTCD set was exchanged, and a 1:1 contrast medium was injected through the outer cannula to show the dilation of the intrahepatic bile duct, the location of bile duct obstruction was evaluated, and then the guidewire was repeatedly explored until it entered the intrahepatic bile duct where the lesion was located through the stricture segment. A 7F external drainage tube (with multiple lateral holes) was inserted through the outer cannula with a 0.035' guidewire exchange, the end of which was located in the intrahepatic bile duct, and the lateral foramen crossed the stenosis to the diseased intrahepatic bile duct.

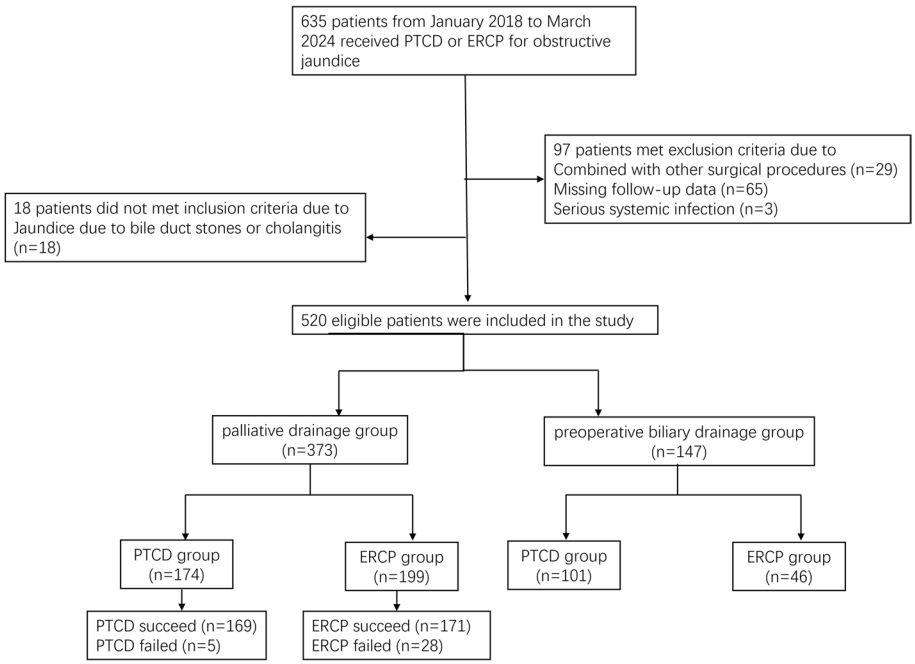

Fig. 1 Flowchart represents study selection process. *MOJ* malignant obstructive jaundice, *PTCD* percutaneous transhepatic cholangiography and drainage, *ERCP* endoscopic retrograde cholangiopancreatography

ERCP procedures

The endoscopic surgeon will evaluate the patient's preoperative imaging to evaluate the feasibility of ERCP. After sedation or anesthesia, the endoscope enters the duodenum through the pylorus, the gastroduodenum is observed through the side view scope, and after the intubation is successful, the imaging is performed to evaluate the intrahepatic and extrahepatic bile duct and common bile duct to find the obstruction site, and the guidewire is passed through the stenosis segment, then place stent (Boston, USA) in the intrahepatic bile duct as needed. Evaluate pancreatic duct scintigraphy.

Data and follow-up

Clinical data collected included patient demographics, clinical presentation, pathological examination, laboratory findings, imaging results, and complications. Inadequate drainage was defined as the need for additional intervention within one week due to inadequate bilirubin reduction. Biliary infection was identified by abdominal pain and fever requiring antibiotic treatment. Pancreatitis is defined as to the small of the back radiation of abdominal pain, accompanied by elevated serum amylase and lipase > 3 times normal limit and imaging findings consistent.

Statistical analysis

Statistical analyses were conducted using SPSS version 12.0 for Windows (Chicago, USA). Data were presented as mean ± standard deviation (SD). Independent sample t-tests were used for normally distributed data, evaluated by the Kolmogorov-Smirnov test, and compared by chi-squared test or Fisher's exact test as appropriate. For non-normally distributed data, the Mann-Whitney U test was used. A p-value < 0.05 was considered statistically significant.

Results

Study population and baseline characteristics

The study flowchart illustrates the selection process of the 520 patients enrolled between January 2018 and March 2024. Based on the inclusion and exclusion criteria, patients were categorized into the palliative drainage group ($n = 373$) or the preoperative biliary drainage group ($n = 147$). In palliative drainage group, the success rates for PTCD and ERCP were 97.1% (169/174) and 85.9% (171/199), respectively. Unsuccessful surgeries were excluded from the statistical analysis to better evaluate the curative effect. Table 1 summarizes the baseline demographic characteristics, showing no significant differences in demographical characteristics.

Table 1 Baseline demographical characteristics of enrolled patients

Variables		Palliative Drainage group ($n=340$)		*p* value	Preoperative Biliary Drainage group ($n=148$)		*p* value
		PTCD group ($n=169$)	ERCP group ($n=171$)		PTCD group ($n=101$)	ERCP group ($n=46$)	
Gender	Male	116	114	0.697	67	28	0.572
	Female	53	57		35	18	
Age, years		61.7 ± 11.8	61.9 ± 13.9	0.892	64.5 ± 9.2	62.8 ± 9.5	0.275
Primary tumor				0.054			0.075
	Liver	49	51		12	2	
	Bile duct	5	32		40	15	
	Gall bladder	22	21		8	4	
	Pancreas	23	46		32	17	
	Gastroduodenum	15	9		6	8	
	Colorectum	5	9		0	0	
	Others	0	3		0	0	
Hypertension		81	77	0.592	19	7	0.596
Diabetes		45	59	0.115	21	5	0.144
Previous treatment				0.660			
None		14	8	0.177			
Chemotherapy/ radiotherapy		155	163				
ECOG-PS	0	90	101	0.209	80	39	0.551
	1	55	41		19	5	
	2	24	29		3	2	
Drainage path							
	Unilateral	151 (89.3%)	156 (91.2%)	0.558	95 (94.1%)	40 (87.0%)	0.145
	Bilateral	18 (10.7%)	15 (8.8%)		6 (5.9%)	6 (13.0%)	
Level of biliary obstruction	Lower CBD	35	106	0.307	30	24	0.285
	Middle CBD	25	21		21	8	
	Superior CBD	15	9		10	8	
	Hepatic hilar bile duct	76	27		40	6	
	Hepatic hilum and intrahepatic bile ducts	18	8		0	0	
Postoperative length of stay days		3.58 (1.93)	3.3 (1.68)	0.154	5.26 (3.26)	4.28 (2.93)	0.082

Abbreviations: ECOG-PS eastern cooperative oncology group performance status, *CBD* common bile duct

Liver function and blood routine variables

A comparison of liver function and blood routine variables before and after PTCD and ERCP is shown in Table 2. Both PTCD and ERCP improved liver function in the palliative and preoperative biliary drainage groups. In the palliative group, the PTCD group had higher preoperative total bilirubin (TB) (227.4 ± 142.7 vs. 189.9 ± 131.5 μmol/L, $p < 0.05$), direct bilirubin (DB) (178.8 ± 112.0 vs. 151.2 ± 106.2 μmol/L, $p < 0.05$), and lactate dehydrogenase (LDH) (234.5 (183.0, 283.8) vs. 210.0 (185.5, 241.0) U/L, $p < 0.01$) compared to the ERCP group. In the preoperative group, the PTCD group showed lower postoperative aspartate aminotransferase (AST) (53.0 (40.0, 89.0) vs. 61.0 (46.0, 126.0) U/L, $p < 0.05$) and higher preoperative alanine aminotransferase (ALT) (196.0 (77.0, 286.0) vs. 125.0 (72.0, 237.0) U/L, $p < 0.05$). This suggests that the liver function of the PTCD group was at a poorer baseline compared to the ERCP group.

Table 2 Baseline liver function and blood routine characteristics of enrolled patients

Variables		Palliative Drainage group ($n=340$)		*p* value	Preoperative Biliary Drainage group ($n=147$)		*p* value
		PTCD group ($n=169$)	ERCP group ($n=171$)		Preoperative PTCD ($n=101$)	Preoperative ERCP ($n=46$)	
Total bilirubin level (μmol/L)	before procedure	227.4 (142.7)	189.9 (131.5)	0.012	190.0 (142.0,263.0)	200.0 (112.5,309.2)	0.692
	after procedure	158.9 (122.2)	144.4 (113.3)	0.257	115.0 (72.0,161.0)	116.0 (71.5,239.0)	0.516
Direct bilirubin level (μmol/L)	before procedure	178.8 (112.0)	151.2 (106.2)	0.020	150.0 (111.0,220.0)	172.0 (83.0,255.4)	0.752
	after procedure	126.1 (97.5)	116.5 (95.6)	0.362	93.4 (54.7,149.5)	85.6 (46.1,147.1)	0.551
AST (U/L)	before procedure	160.8 (136.7)	138.1 (120.5)	0.107	148.2 (92.3)	141.3 (94.4)	0.679
	after procedure	85.7(71.2)	99.1 (91.9)	0.143	53.0 (40.0,89.0)	61.0 (46.0,126.0)	0.030
ALT (U/L)	before procedure	157.7 (136.2)	150.4 (147.7)	0.640	196.0 (77.0,286.0)	125.0 (72.0,237.0)	0.031
	after procedure	102.8 (85.9)	118.2 (107.6)	0.144	126.4 (90.8)	117.2 (81.6)	0.563
ALP (U/L)	before procedure	521.4 (297.0)	470.7 (294.4)	0.119	507.2 (297.4)	614.1 (449.2)	0.096
	after procedure	396.2 (239.8)	428.3 (267.4)	0.250	328.0 (213.0,518.0)	323.0 (224.5,624.5)	0.155
LDH (U/L)	before procedure	234.5 (183.0,283.8)	210.0 (185.5,241.0)	0.002	228.6 (65.7)	227.4 (86.0)	0.939
	after procedure	242.8 (158.7)	226.1 (144.7)	0.458	184.0 (170.0,215.0)	189.0 (167.0,216.5)	0.278
Hemoglobin (g/L)	before procedure	114.2 (18.0)	113.7 (18.8)	0.821	118.3 (16.1)	112.9 (19.8)	0.083
	after procedure	109.7 (19.6)	109.7 (18.2)	0.986	115.2 (17.0)	107.0 (18.5)	0.010
WBC (X10^9/L)	before procedure	7.1(3.3)	7.1 (4.1)	0.931	6.7 (2.2)	6.5 (2.3)	0.675
	after procedure	7.9(4.1)	0.7.5 (3.5)	0.272	7.3 (2.4)	6.5 (1.9)	0.043
Platelet count (X10^9/L)	before procedure	215.0 (96.1)	226.1 (95.5)	0.286	236.7 (73.4)	253.0 (74.3)	0.219
	after procedure	217.3 (98.9)	222.5 (93.7)	0.624	252.2 (78.8)	253.3 (79.1)	0.938

Abbreviations: TB total bilirubin, *DB* direct bilirubin, *AST* Aspartate aminotransferase, *ALT* Alanine aminotransferase, *ALP* alkaline phosphatase, *LDH* lactate dehydrogenase, *WBC* white blood cell

Table 3 Effects between PTCD and ERCP in palliative drainage group and preoperative drainage group

Variables	Palliative Drainage group ($n=340$)		*p* value	Preoperative Biliary Drainage group ($n=147$)		*p* value
	PTCD group ($n=169$)	ERCP group ($n=171$)		PTCD group ($n=101$)	ERCP group ($n=46$)	
TB alleviation (μmol/L)	53.0 (30.0,97.0)	36.8 (17.9,65.0)	< 0.001	80.8 (61.5)	56.0 (48.9)	0.018
DB alleviation (μmol/L)	42.0 (22.0,78.5)	28.0 (12.0,50.8)	0.001	61.9 (45.6)	45.1 (37.1)	0.031
AST alleviation	52.0 (5.0,116.0)	19.0 (2.0,56.0)	0.001	79.8 (76.5)	53.4 (65.4)	0.046
ALT alleviation	34.0 (12.5,73.5)	15.0 (2.0,48.0)	0.002	57.8 (46.6)	42.6 (57.2)	0.001
Hemoglobin alleviation	0.0 (3.0,8.0)	4.0 (-2.0,10.0)	0.701	3.2 (10.6)	5.8 (9.7)	0.161
WBC alleviation	-0.9 (3.2)	-0.4 (3.8)	0.198	-0.7 (2.2)	-0.01 (2.0)	0.060

Abbreviations: TB total bilirubin, *DB* direct bilirubin, *AST* Aspartate aminotransferase, *ALT* Alanine aminotransferase, *WBC* white blood cell

Effects of PTCD and ERCP on liver function

Table 3 illustrated postoperative reduction of jaundice and changes of blood routine. In palliative drainage group and preoperative drainage group, PTCD group demonstrated superior reduction in jaundice and improvement in liver function compared to the ERCP group. There were significant differences in TBil, DBil, AST, ALT (Mann–Whitney U test, $p<0.001$, $p=0.001$, $p=0.001$, $p=0.002$ respectively) between two groups in palliative group. The results in preoperative drainage group were consistent, TBil, DBil, AST, ALT has significant statistical differences between the two groups (Student's t test, $p=0.018$, $p=0.031$, $p=0.046$, $p=0.001$ respectively).

Safety of PTCD and ERCP treatment

During the follow-up time, Table 4 showed the complications in palliative drainage group and preoperative

Table 4 Complications between PTCD and ERCP in palliative drainage group and preoperative drainage group

Variables	Palliative Drainage group ($n=340$)		*p* value	Preoperative Biliary Drainage group ($n=147$)		*p* value
	PTCD group ($n=169$)	ERCP group ($n=171$)		PTCD group ($n=101$)	ERCP group ($n=46$)	
Biliary infection	13 (7.7%)	39(22.8%)	< 0.001	0	3(6.5%)	0.010
Inadequate drainage	9 (5.3%)	7(4.1%)	0.592			
Drainage tube/stent displacement	20(11.8%)	9(5.3%)	0.030			
Pancreatitis	0	7(4.1%)	0.008			
Bleed	10 (5.9%)	9(5.3%)	0.793			

Table 5 Details of ERCP and related procedures

Variables		ERCP group (n=217)	
		Palliative Drainage group (n=171)	Preoperative Biliary Drainage group (n=46)
Stent type, n (PS: SEMS)		121:50	43:3
Details of the stents used (n)			
PS, straight type			
	5-Fr	1	0
	7-Fr	25	10
	8.5-Fr	92	33
	10-Fr	3	0
SEMS, fully covered type			
	10 mm in diameter	50	3

Abbreviations: PS plastic stent, *SEMS* self-expandable metal stent

Table 6 Type of biliary complications and their treatment in ERCP group and based on type of biliary stent

Variables		Palliative Drainage group ($n=171$)			*p* value	Preoperative Biliary Drainage group ($n=46$)			*p* value
		All patients ($n=171$)	Plastic ($n=121$)	Metallic ($n=50$)		All patients ($n=46$)	Plastic ($n=43$)	Metallic ($n=3$)	
Complications									
	Biliary infection	39 (22.8%)	33 (27.3%)	6 (12.0%)	0.030	3 (6.5%)	2 (4.7%)	1 (33.3%)	0.052
	Inadequate drainage	7 (4.1%)	8 (6.6%)	2 (4.0%)	0.508				
	Stent displacement	9 (5.3%)	4 (3.3%)	4 (8.0%)	0.186				
	Pancreatitis	7 (4.1%)	6 (5.0%)	1 (2.0%)	0.374				
	Bleed	9 (5.3%)	6 (5.0%)	3 (6.0%)	0.781				
Treatment of complications				..					
	Stent replacement	18 (10.5%)	14 (11.6%)	4 (8.0%)	0.489				
	PTCD	19(10.5%)	14 (11.6%)	5 (10.0%)	0.736				
	Drug therapy only	34 (20.5%)	24 (20.7%)	10 (20.0%)	0.587	3 (6.5%)	2 (4.7%)	1 (33.3%)	0.052

group. Biliary infection is the most common complication during palliative drainage, there were 13 cases (7.7%) in PTCD group and 39 cases (22.8%) in ERCP group. Inadequate drainage occurred in 16 patients, including 9 patients (5.3%) in PTCD group and 7 patients (4.1%) in ERCP group. And for preoperative biliary drainage, 3 patients appeared infection after ERCP.

Refer to Table 5 for details of ERCP and related procedures. In addition, we compared biliary complications based on type of biliary stent in ERCP group, as shown in Table 6

For preoperative drainage group, in the PTCD group, the 50% reduction in total bilirubin occurred for 7.1days, which was statistically better than in the ERCP group (10.5 days) (Table 7).

Discussion

Previous studies on malignant obstructive jaundice (MOJ) were limited by small sample sizes and varying operator experiences across different institutions [12, 14–16]. Our study retrospectively enrolled over 500 patients to evaluate the efficacy and safety of PTCD and ERCP in both palliative and preoperative drainage settings. All patients underwent comprehensive preoperative laboratory and imaging examinations, and the procedures were conducted by interventional radiologists and endoscopic surgeon with over ten years of experience.

Our study showed a 97.1% success rate for PTCD and an 85.7% success rate for ERCP, which is similar to previous findings [7, 14, 17]. Our finding suggests PTCD is more effective in reducing jaundice with fewer complications. However, PTCD patients require careful management of the drainage tube to avoid displacement. The results showed that compared to ERCP, PTCD serve as an ideal preoperative bridging method for its efficient jaundice reduction.

Improvement in quality of life is positively correlated with symptom relief, suggesting successful drainage. In our study, the PTCD group showed better improvements in jaundice and liver function compared to the ERCP group. Firstly, the high success rate of ultrasound-guided puncture of the dilated intrahepatic biliary tract in PTCD lead to establish a drainage tube and drain successfully [18, 19]. Secondly, PTCD accurately assess the degree of bile duct dilatation and the relationship between the left and right bile ducts, and experienced doctors can perform targeted catheterization [16]. Thirdly, PTCD porous drainage catheter improve its superiority in solving the jaundice curative effect [17]. According to our follow-up experience, the installation of pain pump and iodine-125 seed implantation can relieve pain, and the drainage tube placed by PTCD provides convenience for biliary seed implantation under local anesthesia, which is conducive to improving the quality of life of patients.

In addition, in the preoperative drainage group, the 50% reduction time of total bilirubin was shorter for PTCD group (7 days) compared to ERCP group (10 days). And the time from palliation of jaundice to surgery was 24.2 days in PTCD group and 35.7 days in ERCP group, a statistically significant difference (Student's t test, $p=0.017$). This indicates PTCD is a preferable choice for preoperative bridge treatment. Firstly, its shorter operating path and smoother angle help navigate obstructed segments. Secondly, the established drainage path during the initial PTCD procedure can facilitate subsequent treatments [15], such as intrabiliary radiofrequency ablation and 125I Seeds Implantation [20].

However, it was reported PTCD is associated with increased mortality [21], contrary to our finding. This discrepancy can be related to the fact that the performance status of the patients enrolled in our study were mainly distributed in the range of 0 to 1. In addition, all the patients enrolled in our study were receiving PTCD or ERCP for the first time. Other research centers demonstrated PTCD may have more complications, such as drainage tube displacement [7, 22]. Observed in our study, in palliative drainage group, 29 cases experienced inadequate drainage after PTCD procedure, of which 20 cases (11.8%) were due to displacement of the drainage tube. This may be due to long-term traction, bending, folding or incorrect care of the drainage tube after discharge, causing the front hose of the drainage tube to flow out of the target bile duct or even fall off [13]. However, this situation can be improved based on our experience. The operating doctor can reserve sufficient drainage tubes during procedure to enter the target bile duct, and the drainage tubes can be effectively fixed,

Table 7 Follow-up in preoperative drainage group

Variables	Preoperative Biliary Drainage group ($n=147$)		*p* value
	PTCD group ($n=101$)	ERCP group ($n=46$)	
Total Bilirubin drops to 50% on days	7.1	10.5	< 0.001
Time to surgery	24.2 (26.1)	35.7 (26.8)	0.017
Postoperative length of stay days	5.26 (3.26)	4.28 (2.93)	0.082

providing effective and scientific postoperative education [12]. And biliary infection is also a common complication, there was statistically significant difference between the PTCD group (13 cases, 5.9%) and the ERCP group (39 cases, 22.8%). Additionally, we compared the effects of stent materials placed during ERCP on complications, and compared to metal stents, plastic stents were more likely to develop biliary tract infections (27.3% vs. 12.0%, $p=0.030$), consistent with previous studies [23, 24]. ERCP group of 7 cases of patients with postoperative pancreatitis.

One study mentioned no significant difference was observed between ERCP and PTCD in clinical efficacy [14]. This may be attributed to the source of primary lesions. In our study, this was influenced by the high prevalence of primary pancreatic cancer in the palliative drainage group. Pancreatic cancer invasion into the duodenum caused duodenal papilledema, obstructing ERCP or induce inflammation, thereby affecting its efficacy [25]. In clinical practice, whether similar patients are transferred to ERCP or PTCD depends more on the understanding of the primary physician. We believe that multidisciplinary treatment is the most clinically beneficial approach to the treatment of malignant obstructive jaundice.

Our study has several limitations. Firstly, it was an observational single-center retrospective cohort study. Therefore, further multi-center trials are suggested. Secondly, we have inadequately quantified the effects of PTCD and ERCP on patients' quality of life after surgery, and the use of quality of life scales is expected. Thirdly, refining the effect of PTCD and ERCP on reducing jaundice at different sites of biliary obstruction may be helpful to deepen our understanding of the choice of drainage methods.

Conclusion

Both PTCD and ERCP play an important role in the palliative and preoperative drainage of malignant obstructive jaundice. Compared with ERCP, PTCD significantly improves the effect of reducing jaundice, especially in perioperative period, PTCD rapidly reduces jaundice, and gains time for surgical operations targeting the primary focus.

Acknowledgements
None.

Conflict of interest
All authors declare that (i) no support, financial, or otherwise has been received from any organization that may have an interest in the submitted work and (ii) there are no other relationships or activities that could appear to have influenced the submitted work.

Informed consent
All enrolled patients were informed and written informed consent was obtained.

Authors' contributions
Study concept and design: RL and WZ. Acquisition of data: YHC, SGL, and LTS. Analysis and interpretation of data: YHC, DYZ. Drafting of the manuscript: YHC, ZYF, and GWY. Critical revision of the manuscript for important intellectual content: RL and WZ. Statistical analysis: ZYF, GWY and DYZ. Study supervision: RL.

Funding
This study was funded by Natural Science Foundation of Fujian Province (2023J011689).

Availability of data and materials
We certify that we have participated sufficiently in the work to take public responsibility for the appropriateness of the experimental design and method, and the collection, analysis, and interpretation of the data. All the data are valid and available.

Data availability
No datasets were generated or analysed during the current study.

Declarations

Ethics approval and consent to participate
This study was approved by the Ethics Committee of Zhongshan hospital, Fudan University (B2024-279).

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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Received: 5 August 2024 Accepted: 26 September 2024
Published online: 12 October 2024

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