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Retrospective Study

Different percutaneous transhepatic biliary stent placement and catheter drainage in the treatment of middle and low malignant biliary obstruction

INTRODUCTION

In patients with unresectable middle and low malignant biliary obstruction, the primary cause is often extrahepatic biliary obstruction and obstruction below the cystic duct opening. Common symptoms include yellowing of the skin and sclera, high fever, abdominal pain, and decreased appetite. In cases of complete obstruction, the stool color may become pale or even clay-like[1]. Percutaneous transhepatic cholangial drainage (PTCD), a widely used palliative care method[2,3], offers advantages such as a straightforward procedure, effective jaundice relief, and convenient bile drainage, making it a popular choice in clinical settings. For the cases of middle and low biliary obstruction with left and right hepatic duct dilatation, how to choose the approach and whether different approaches affect the difficulty of puncture operation and intraoperative and postoperative complications have not been discussed in detail. This study aimed to compare the clinical efficacy of two different puncture paths in treating middle and low biliary obstruction.

MATERIALS AND METHODS

General data

Between March 2016 and March 2022, 424 medical records of patients with inoperable middle and low malignant biliary obstruction were analyzed. Patients were divided into two groups based on the puncture approach: group A, consisting of 224 cases using the subxiphoid left hepatic lobe approach, and Group B, consisting of 200 cases using the right intercostal, right hepatic lobe approach. Inclusion criteria[4,5] were as follows: (1) clinical presentations, magnetic resonance cholangiopancreatography, computed tomography, ultrasound, and other imaging and laboratory examination results indicating inoperable middle and low malignant biliary obstruction; (2) anticipated survival time of more than 3 mo; and (3) successful percutaneous puncture biliary drainage and metal stent implantation. Exclusion criteria included (1) incomplete clinical and follow-up data; (2) patients with multiple organ failure who could not tolerate percutaneous transhepatic biliary drainage and stent implantation; (3) patients who underwent chemotherapy, radiotherapy, or Billroth II subtotal gastrectomy; and (4) abnormal coagulation function. All patients received liver protection treatment post-operation. Preoperative and postoperative total bilirubin (TBil), direct bilirubin (DBil), aspartate aminotransferase (AST), and γ-glutamyl transpeptidase (GGT) values were recorded and calculated at 1 wk and 3 d, and their decline rates were determined. Follow-ups were conducted every 3 mo.

Intervention operation

Traditional disinfection and local puncture anesthesia were employed. The puncture site was typically situated at the lower xiphoid process on the right abdominal wall (left bile duct approach) or between the 8th and 9th intercostal spaces of the right seasonal rib (right bile duct approach). The puncture direction and angle were designed for Digital Subtraction Angiography. A Cook 22 G/15 cm biliary puncture needle was used to access the liver's bile duct, and the needle core was removed. The successful puncture was confirmed by observing the outflow of pale-yellow bile, and a compatible 0.018-inch short guidewire was introduced through the puncture needle. After removing the puncture needle, a matching coaxial introducer sheath (4 F) was inserted along the guidewire. A contrast medium was administered through the introducer sheath to assess the bile duct obstruction's location, extent, and severity. A 0.035-inch ultra-smooth guidewire was inserted through the introducer sheath, and the obstruction site was adjusted. A memory alloy stent was introduced into the biliary system using a pusher along the guidewire, ensuring that the stent's upper end was above the obstruction and its lower end was within the obstructed bile duct and duodenum. Both ends needed to extend approximately 1 cm beyond the narrowed section. After the stent was deployed, the metal stent could open smoothly. An 8.5 F external biliary drainage tube was placed through the guidewire, and contrast medium was injected again to verify the resolution of the bile duct obstruction, adequate bile drainage, absence of clotting in the biliary tract, firm fixation of the drainage tube, and proper connection with the drainage bag. Figure 1 display the imaging data for percutaneous stent placement and catheter drainage of the left/right hepatic ducts, respectively. Prior to the procedure, all patients received an intramuscular injection of 10 mg diazepam, 70 mg pethidine hydrochloride, and 10 mg racemolamine hydrochloride.

Statistical analysis

SPSS23.0 statistical software was used for data analysis. Measurement data were expressed as mean ± SD, and count data were expressed as numbers (percentage). An Independent sample *t*-test was used for comparison between the two groups. The chi-square test was used for comparison between groups. The survival rate was analyzed with the Kaplan-Meier survival curve, and $P < 0.05$ was considered statistically significant.

RESULTS

Basic data of patients

A total of 424 patients participated in the study, with no severe adverse events (such as death, critical cardiac or cerebrovascular incidents) observed during the follow-up period. The cohort included 227 males (53.5%) and 197 females (46.5%), with an average age of 68.92 ± 0.36 years. Among the patients, 46 cases (10.8%) had diabetes, 79 cases (18.6%) were smokers, 101 cases (23.8%) had coronary heart disease, and 45 cases (10.6%) experienced hypertension. Additionally, 33 cases (7.8%) presented with hyperlipidemia. No significant differences in the baseline characteristics were identified between the two groups ($P > 0.05$) (Table 1).

Comparison of clinical efficacy between the two groups

No significant differences were observed between the two groups regarding the incidence of postoperative biliary bleeding and the duration of postoperative pain ($P >$ 0.05). A comparison of postoperative liver function indices revealed that the total bilirubin reduction rate, direct bilirubin reduction rate, and alkaline phosphatase reduction rate were significantly higher in Group A during the first week after surgery. Moreover, the γ-glutamyltranspeptidase reduction rate in Group A was considerably faster than in Group B at both 3 d and 1 wk post-surgery ($P < 0.05$). Group A also exhibited significantly lower leakage of peritoneal effusion around the drainage tube compared to Group B ($P < 0.05$). The survival rate for patients in Group A surpassed that of Group B ($P < 0.05$) (Table 2 and Figure 2).

For patients with jaundice undergoing treatment for middle and low-level malignant biliary obstruction, those receiving percutaneous left hepatic puncture demonstrated significantly better liver function improvement, reduced peritoneal effusion leakage around the drainage tube, and enhanced survival compared to patients undergoing percutaneous right hepatic puncture.

DISCUSSION

Pancreatic head cancer and periampullary cancer (including ampullary cancer, lower common bile duct cancer, and duodenal papilla cancer) are frequent causes of middle and low biliary obstruction, as well as a group of gastrointestinal malignancies characterized by insidious onset, rapid progression, and poor treatment outcomes and prognosis[6-10]. Many patients are diagnosed at advanced stages, missing the opportunity for curative surgery. Hence, interventions to alleviate biliary obstruction are necessary to extend survival and improve patients' quality of life[11,12]. Kubo *et al*[13] demonstrated that interventional surgery for malignant obstructive jaundice has broad applicability, minimal invasiveness, high success rates, and rapid postoperative recovery, with PTCD being a common procedure[14-16].

Currently, there is some debate surrounding the advantages and disadvantages of percutaneous left hepatic biliary stent placement and catheter drainage *vs* percutaneous right hepatic biliary stent placement and catheter drainage for treating low malignant obstructive jaundice. Dumonceau *et al*[17] investigated the benefits of PTCD and endoscopic retrograde cholangiopancreatography (ERCP) in treating biliary obstruction, concluding that PTCD is a simpler procedure with shorter transhepatic access and broader drainage coverage, making it more effective than ERCP for patients with biliary obstruction. However, Inoue *et al*[18] reported that improper puncture during percutaneous liver biliary drainage and stent implantation might result in vascular damage and biliary bleeding, with percutaneous right hepatic puncture causing more liver parenchyma damage and liver injury. Additionally, patients carrying a drainage bag on their right side experience a significant reduction in their quality of life. Due to the limited selection of percutaneous left hepatic puncture routes and scarce literature, many believe this approach is challenging and exposes patients to high radiation levels. Thus, few studies in China have investigated the treatment of low malignant obstructive jaundice with biliary stent placement and catheter drainage *via* percutaneous left hepatic puncture.

In line with a humanistic care approach and aiming to enhance patients' long-term survival, our hospital predominantly opted for percutaneous left hepatic biliary stent placement and catheter drainage in treating middle-low malignant obstructive jaundice. We compared the clinical efficacy of two distinct puncture paths in addressing low biliary obstruction. Our study revealed that the reduction rates of TBil, DBil, AST, and GGT in Group A were significantly faster than those in Group B pre- and post-surgery ($P < 0.05$). Liver function recovery was notably superior in comparison to percutaneous right hepatic puncture. Factors contributing to these results include the slender left hepatic duct, the small left hepatic lobe, and minimal liver damage. Furthermore, stent implantation ensures an unobstructed common bile duct.

Owing to the intact bile duct in the right hepatic lobe, increased bile duct tension accelerates bile excretion. After the right hepatic puncture, the bile duct was exposed to the external environment, leading to a decrease in intrahepatic bile duct tension and a slower bile excretion rate. Consequently, patients experienced a gradual decrease in bilirubin levels and a prolonged recovery period from liver damage in the short term. We observed and analyzed the significantly lower peritoneal effusion leakage around the drainage tube in Group A compared to Group B, considering the diminished liver function and protein synthesis in patients with advanced tumor stages, which contributed to ascites development. The puncture location for patients who underwent percutaneous right hepatic puncture resulted in a relatively low puncture point in both supine and lateral positions. Excessive abdominal pressure frequently accompanies abdominal fluid leakage from the puncture site, substantially diminishing patients' quality of life. In contrast, the elevated puncture point in patients receiving percutaneous left hepatic puncture led to minimal fluid exudation at the puncture site, whether standing, lying laterally, or supine, resulting in a negligible impact on the patient's quality of life. Group A displayed a marginally higher survival rate, which we attributed to the reduced effect on patients' quality of life, improved mood and comfort, and consequently better mental state, dietary intake, and nutrition, ultimately leading to a longer patient survival time.

Both domestic and international findings combined with our study reveal that percutaneous left hepatic biliary stenting and catheter drainage for treating low biliary obstruction substantially enhance liver function, quality of life, postoperative pain duration, leakage of peritoneal effusion around the drainage tube, and overall patient survival.

This research was carried out retrospectively and reflected the experiences of a single institution. Additionally, our study acknowledges the constraint posed by the limited sample size, which may result in variations among some of the documented findings.

CONCLUSION

In managing low biliary obstruction, percutaneous left hepatic biliary stent placement and catheter drainage demonstrate superior therapeutic efficacy compared to percutaneous right hepatic stent placement and catheter drainage. Consequently, for patients experiencing low biliary obstruction, prioritizing percutaneous left hepatic biliary stenting and catheter drainage is recommended.

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Figure 1 Images of cholangiography and fixation of skin drainage tube. A, B: Cholangiography and fixation of skin drainage tube after subxiphoid percutaneous puncture biliary stent placement and drainage of the left liver; C, D: Fixation of skin drainage tube in cholangiography after percutaneous puncture biliary stent placement and catheter drainage under xiphoid process.

Figure 2 Kaplan-Meier survival curve analysis of the two groups. The survival rate for patients in Group A surpassed that of Group B (P < 0.05).

Table 1 Comparison of baseline characteristics between the two groups

Clinical features	Group A (n = 224)	Group B (n = 200)	t value	P value
Male	124	103	0.632	0.427
Age (yr)	69.76 ± 12.24	68.46 ± 14.45	0.816	0.675
Diabetes	21	25	1.06	0.302
Smoking	45	34	0.665	0.415
Coronary heart disease	53	48	0.07	0.935
Hypertension	23	22	0.06	0.870
Hyperlipidemia	14	19	1.555	0.212

Table 2 Comparison of liver function levels and clinical efficacy before and after operation between the two groups

	Group A (n = 224)	Group B (n = 200)	t value	P value
Biliary tract bleeding	2	1	0.232	0.630
Duration of postoperative pain (h)	2.10 ± 0.99	2.40 ± 1.89	-0.443	0.663
Peritoneal fluid leaking from around the drainage tube	13	31	10.681	0.001
Survival time (mo)	26.2 ± 7.39	16.1 ± 2.72	4.054	0.001
Total bilirubin (umol/L)				
Preoperative	208.23 ± 81.81	233.52 ± 92.41	-0.648	0.525
After 3 d	152.11 ± 86.21	141.15 ± 46.55	0.354	0.728

After a week	64.09 ± 26.89	88.29 ± 45.40	-1.451	0.164
Rate of decline 3 d after surgery	30.40 ± 11.84	37.59 ± 13.65	-1.259	0.224
Rate of decline one week after surgery	69.23 ± 4.50	63.79 ± 5.65	2.379	0.029
Direct bilirubin (umol/L)				
preoperative	170.73 ± 69.82	194.38 ± 72.66	-0.742	0.468
After 3 d	106.62 ± 61.87	114.37 ± 38.77	-0.336	0.741
After a week	34.26 ± 23.37	72.83 ± 33.03	-3.014	0.007
Rate of decline 3 d after surgery	39.96 ± 12.05	40.05 ± 12.78	-0.015	0.988
Rate of decline one week after surgery	79.30 ± 11.19	63.62 ± 5.64	3.956	0.001
Alanine aminotransferase (U/L)				
preoperative	127.20 ± 95.72	170.10 ± 109.80	-0.931	0.364
After 3 d	64.60 ± 24.35	102.20 ± 51.81	-2.077	0.052
After a week	31.60 ± 14.72	43.00 ± 13.40	-10.810	0.087
Rate of decline 3 d after surgery	35.99 ± 33.13	34.46 ± 9.89	0.140	0.890
Rate of decline one week after surgery	67.84 ± 22.83	60.38 ± 25.41	0.691	0.498
Aspartate aminotransferase (U/L)				
preoperative	254.00 ± 192.84	144.90 ± 42.79	1.746	0.098
After 3 d	51.60 ± 13.14	71.40 ± 12.17	-3.495	0.003
After a week	36.60 ± 15.12	38.60 ± 16.04	-0.287	0.778
Rate of decline 3 d after surgery	72.31 ± 15.13	46.81 ± 18.41	3.383	0.003
Rate of decline one	80.45 ± 13.15	68.51 ± 18.28	1.676	0.111

week after surgery				
Alkaline phosphatase (IU/L)				
preoperative	995.00 ± 398.24	587.70 ± 199.03	2.893	0.010
After 3 d	798.00 ± 161.08	467.00 ± 155.36	4.677	0.001
After a week	371.60 ± 129.25	305.80 ± 115.78	1.199	0.246
Rate of decline 3 d after surgery	14.24 ± 17.92	19.27 ± 15.73	-0.666	0.514
Rate of decline one week after surgery	60.51 ± 12.23	42.68 ± 23.56	2.125	0.048
γ-glutamyl transpeptidase (IU/L)				
preoperative	704.30 ± 364.56	434.80 ± 111.44	2.236	0.038
After 3 d	417.00 ± 202.68	293.80 ± 71.79	1.812	0.087
After a week	181.40 ± 78.62	161.70 ± 52.93	0.657	0.519
Rate of decline 3 d after surgery	40.56 ± 10.32	32.22 ± 5.12	2.286	0.035
Rate of decline one week after surgery	73.1 9 ± 7.05	58.81 ± 18.98	2.246	0.038

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