Laparoscopic Bridge Choledochoduodenostomy as a Novel Reliable Palliative Procedure for Advanced Malignant Obstructive Jaundice

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Research article

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Abstract

Background: The aim of this study was to introduce a novel surgical procedure called laparoscopic bridge choledochoduodenostomy (LBCDD) for patients with advanced malignant obstructive jaundice (AMOJ).

Methods: Patients with AMOJ who had LBCDD between January 2017 and August 2020 were identified from databases of two institutions in China.

Results: A total of 35 patients (male 12; female 23) with an average age of 64 (±10.65) years were enrolled. All patients undertook LBCDD within an average operation time of 75(±31) min with a mean blood loss of 32(±14) ml. One patient had controlled bile leakage after operation and two developed SSI involving the epigastric orifices. All of them were solved by conservative treatment. All patients were discharged smoothly after an average hospital stay of 5.5 days, and no conversion to open surgery required.

Conclusion: LBCDD is a safe and efficient palliative surgery, which has a good therapeutic effect on patients with AMOJ.

Background

Malignant obstructive jaundice can cause a sort of adverse events including severe cholangitis, lower the quality of life, increase mortality, etc., which can occur following pancreatic cancer, hilar cholangiocarcinoma, periampullary carcinoma, etc [1–4]. Successful biliary drainage is the most direct and effective way to treat malignant obstructive jaundice [1–6]. For advanced malignant obstructive jaundice (AMOJ) with no chance of radical cure, effective and reliable biliary drainage is the most important palliative treatment. Percutaneous biliary drainage (PTBD), endoscopic biliary drainage (EBD) and bilioenteric anastomosis are the commonly used clinical methods for AMOJ at present [2, 6, 7].

As an external biliary drainage, PTBD may lead to nutritional loss, gastrointestinal dysfunction, and a series of stable immune systems due to the long-term loss of large amounts of bile[3, 6, 8–10]. Moreover, tube outside the body may causes psychological burden and the compliance of patients is relatively low[3, 6, 8]. Therefore, the patient's poor tolerance and compliance as well as its associated problems such as liver bleeding and tube dislocation restrict its application in patients with AMOJ.

EBD and bilioenteric anastomosis both belong to internal biliary drainage. Although them avoid the above problem, them also have shortcomings. For example, EBD have high incidence rate of cholangitis and pancreatitis, and cannot be applied for severe biliary obstruction caused by large tumor[4, 6, 8]. Bilioenteric anastomosis hold the chances of anastomotic leak as well as strictures, which may cause recurrent cholangitis, choledocholithiasis, biliary cirrhosis, and hepatic failure[5, 11, 12].

Therefore, we present a new surgical procedure that performed laparoscopically by bridging the common bile duct and duodenum through a T-tube for bile internal drainage. The new surgical procedure was
called laparoscopic bridge choledochoduodenostomy (LBCDD), which can effectively avoid the shortcomings of PTBD, as the T-tube was acted as a bridge for bile drainage in this surgical procedure. The present study is to assesses the efficacy, safety, and feasibility of this novel surgical procedure.

Methods

General information and grouping:

Patients with AMOJ who had LBCDD between January 2017 and August 2020 were identified from the electronic database of Central Hospital of Dengzhou and Henan Provincial People's Hospital. The present study was approved by the ethics committee of the hospitals. All patients signed the informed consent. A total of 35 patients with AMOJ who had LBCDD were enrolled. All diagnosis was confirmed by B-ultrasound, computed tomography (CT), magnetic resonance imaging (MRI), or magnetic resonance cholangiopancreatography (MRCP). The range of preoperative total bilirubin of all patients was between 135.1-632.5 mol/L, with a mean value of 241.24 ± 11.55 mol/L. All patients had a good clinical record and were identified as being in an advanced stage, losing the chance of radical surgery. Recorded data such as symptoms, comorbidities, blood imaging studies, investigations, surgical data, American Society of Anesthesiologists (ASA) classification, postoperative variables, and follow-up data were collected. Continuous variables are represented by median values.

Positions of trocars and trimming of T tube of LBCDD

Patients were placed in supine position or slightly inclined to the left on the operation table. After performing general anesthesia and intubation, the operating area was then disinfected. A 10 mm incision was first made at the right edge of the umbilicus and a 10 mm trocar placed. Then the laparoscope was placed after the pneumoperitoneum was constructed. Under the guidance of the laparoscopy, two trocars for surgical instruments were placed below the xiphoid process (10 or 12 mm) and 2 cm below the costal margin of the right upper quadrant along the median line of the clavicle (5 mm), respectively (Fig. 1A). If assistance is required, a trocar (5 mm) can also be placed along the midline of the clavicle at 2 cm below the costal margin of the right upper quadrant. The T-tube serves as a bridge for bile from the common bile duct into the duodenum, retaining a length of 10-12cm to ensure that the distal T-tube of the duodenum can pass through the duodenal papilla (Fig. 1B).

Surgical Procedure Of Lbcdd

After the exploration of the abdominal cavity, the common bile duct was exposed first (Fig. 2A). A distal stoma section was reserved in the duodenum below the common bile duct, and the prestitched double-layer purpouch suture was performed around (Fig. 2B). The trimmed T-tube was placed in the common bile duct and fixed (Fig. 2C). After the reserved distal stoma section of the duodenum was opened (Fig. 2D), the distal end of the T-tube was placed into (Fig. 2E), and the presutured double-layer purpouch suture line was tightened (Fig. 2F). Then the adjacent greater omentum tissue was pulled toward the
exposed T tube (Fig. 2G) and the T tube was covered by suture (Fig. 2H). Finally, an abdominal drainage tube was placed (Fig. 2I).

**Results**

A total of 35 patients were enrolled, which include 12 males and 23 females with a mean age of 64 (± 10.65) years. The average body mass index of all patients was 26.15 (± 3.5). All operation was performed within an average operating time of 75 (± 31) min with a mean blood loss of 32 (± 14) ml. Patients developed co-morbidities were kept in ICU for one day after operation. There was one patient developed controlled bile leak and two had SSI involving epigastric port. All of them resolved through conservative way. The drain tube was removed 3 days postoperatively after a routine abdominal imaging examination, except the case who had bile leak. All the patients were discharged smoothly with a mean hospital stay of 5.5 days and no conversion to open surgery required. During the mean follow-up duration of 14 (± 4.3) months, no anastomose-related long-term complications has been found, which include strictures, cholangitis, or pancreatitis (Table 1).

| Variable                          | Value | Value (mean ± SD) |
|----------------------------------|-------|-------------------|
| Age (years)                      |       | 64 ± 10.65        |
| Sex                              |       |                   |
| Male                             | 12    | (34.3%)           |
| Female                           | 23    | (65.7%)           |
| Body mass index (kg/m2)          |       | 26.15 (± 3.5)     |
| Co-morbid conditions             | 12    | (34.3%)           |
| CBD diameter (cm)                | 1.5   | (± 0.7)           |
| Operative time (min)             | 75    | (± 31)            |
| Blood loss (mL)                  | 32.0  | (± 14)            |
| Hospital stay (days)             | 5.5   | (± 2.5)           |
| Complication                     | 3     | (8.6%)            |
| Bile leak                        | 1     | (2.9%)            |
| SSI-superficial                  | 2     | (5.7%)            |

SD standard deviation, ASA American Anesthesiology Association, CBD common bile duct, SSI surgical site infection
Discussion

Our study showed that the majority of AMOJ patients were elderly (64 ± 10.65 years), and females were 1.92 times as many as males. Since there was no opportunity of radical surgery for AMOJ patients, solving jaundice was the most important way to prolong life and improve their life quality. LBCDD is an internal drainage, which avoid a series of external drainage related complications such as the weakened immunity and impaired gastrointestinal function caused by the chronic and massive bile loss. Besides, it does not need wear any tubes outside the body, and the patient compliance is high.

Although LBCDD is an internal drainage, it is very different from other internal drainage procedures like EBD or bilioenteric anastomosis. EBD have high incidence rate of cholangitis and pancreatitis. Bilioenteric anastomosis are reported including choledodudodenostomy and choledojejunostomy. Laparoscopic choledudodenostomy is mainly used for the treatment of benign biliary diseases [13–15]. Laparoscopic choledojejunostomy have the risk of complications such as anastomotic leak and strictures [11, 12, 15, 16]. LBCDD applied T tube to drainage bile from common bile duct to the duodenum. T tube length was controlled in 10 to 12 cm, so as to crossed the duodenal papilla, which ensures that various digestive enzymes are activated away from the duodenal opening. Those measures have effectively reduced the risk of anastomotic leak. Moreover, we used the greater omentum to cover the T tube between the bile duct and duodenum, which may further avoid the risk of anastomotic leak. Duodenal leak the is considered dreaded for this procedure when we begin the procedure, however, none of case had this complication. Although the published leak rate of choledojejunostomy is 2–7% [11–13], such co-comorbidity can be avoided through our procedure. There are only one case of biliary leakage and two cases surgical site infection. All of them were occurred in the early stages of our learning curve in beginning this operation. During that period, our lack of experience in anastomosis and covering of duodenal and common bile duct openings, as well as some patients with duodenal mucosal valvation, were the reasons leading to the above complications. After that, our experience has been very mature. Since 2018, no perioperative complications have occurred and all patients have been discharged smoothly.

Biliary tract infection often occurs after choledochojejunosotomy, and the main cause is anastomotic stricture or cholestasis [17]. In our study, T tube used as a bridge, can effectively establish the channel between bile duct and duodenum with an ideal effect of bile drainage, which reduced the risk of cholangitis, pancreatitis, and strictures. During the average follow-up of 14 ± 4.3 months in our group, no delayed postoperative complications such as cholangitis and pancreatitis occurred. Moreover, for patients with large tumor volume who cannot be treated with EBD or choledochoduodenostomy, bridge choledochoduodenostomy may also be an alternative for internal drainage.

In addition, the operation process of the present operation is simple and the operation time is short. Most of them can be completed around 1 hour in later stage of the term curve, with an average operative time of 75(± 31) minutes. On the one hand, the simplified surgical procedures can reduce the complications related to the operation, on the other hand, it also can reduce the operation cost and speed up
postoperative recovery. The patient can have a liquid diet on the second day after the operation. Early eating can improve patient's in-patient experience and satisfaction as well as ensures the patient's smooth postoperative recovery. The current study reported a comparable short hospital stay with a median length of 5.5 days.

Our study shows that this novel surgical procedure is a safe and efficient treatment for AMJO. Compared with choledochojunostomy, bridge choledochoduodenostomy does not need to cut the small intestine, it has a simpler surgical procedure, with less bleeding risk, requires no expensive supplies, and is more physiological. Therefore, this surgical method is worthy of recommendation. Since our study enrolled only 35 patients, the number is small, and the implementation of this technique requires sophisticated laparoscopic techniques, the replication of similar results may not be achieved during the early stages for performing this procedure. Moreover, this procedure requires an opening in the duodenum, there is a theoretical possibility of duodenal leakage for inexperienced physicians or patients with poor postoperative management, we would like to suggest LBCDD as an alternative option.

Conclusion

With small invasion and fast recovery time, LBCDD is a safe and efficient palliative surgery, which has a good therapeutic effect on patients with AMOJ.

Abbreviations

AMJO: advanced malignant obstructive jaundice; LBCDD: laparoscopic bridge choledochoduodenostomy; OS: overall survival; PTBD: percutaneous transhepatic biliary drainage; EBD: endoscopic biliary drainage; SD: standard deviation; ASA: American Anesthesiology Association; CBD: common bile

Declarations

Ethics approval and consent to participate

Ethical approval was obtained from the respective institutional review boards of the Ethics Committee of Henan Provincial People's Hospital and Central Hospital of Dengzhou. All patients provided written informed consent to participate in this study.

Consent for publication

Not applicable

Availability of data and materials

Not applicable.
Competing interests

All the authors declare that they have no conflicts of interest.

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Authors' contributions

TLY and LDY designed the overall project; TLY and ZXX analyzed the data and wrote the manuscript; TLY, ZXX and LDY collected and analyzed the data; TLY and ZXX performed the research; TLY did the statistical analysis. All the authors (ZXX, XHS, LDZ, TLY and LDY) have read and approved the final manuscript.

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