Laparoscopic choledochoduodenostomy as an optional treatment for complex choledocholithiasis

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Abstract

**Introduction:** Choledochoduodenostomy is indicated for unresolved choledocholithiasis and biliary malignant or benign stenosis. This surgical procedure has been feared due to its potential complications. This article demonstrates our initial experience with this laparo-endoscopic approach.

**Methods:** We performed laparoscopic choledochoduodenostomy in seven elderly patients with recurrent or unresolved choledocholithiasis. Additionally, laparo-endoscopic extraction of gallstones was performed in cases where necessary. We gathered and analyzed the demographic data, diagnostic evidence and follow-up of the patients.

**Results:** Average age of patients was 71 years, with 57.1% of females in our population. Main comorbidities of our patients included obesity (71.4%), type 2 diabetes mellitus (57.4%), and arterial hypertension (42.85%). Patients had on average 2.7 previous episodes of choledocholithiasis and/or cholangitis and the average diameter of the removed stones was 22.6 mm. Average follow-up was 155 days (range: 28-420).

**Discussion:** Laparoscopic choledochoduodenostomy has proven to be safe, effective and superior to open surgery. Appropriate patient selection and surgeon experience in laparoscopic techniques are necessary. All these factors reduce long-term complications that have been related to this surgical procedure.

**Conclusions:** Laparoscopic choledochoduodenostomy is an option for the definitive surgical treatment of “difficult choledocholithiasis” in elderly patients with multiple comorbidities while offering advantages of minimally invasive approaches.

**Key words:** laparoscopic choledochoduodenostomy, complex choledocholithiasis, cholangitis.
The medical records were reviewed, including diagnostic tests (transabdominal ultrasound, abdominal computed tomography, liver function tests and blood counts), videos and cholangiographies of the ERCP, videos of the surgery, progress notes during and after the hospital stay, as well as videos and reports of postoperative upper gastrointestinal endoscopies. Descriptive statistics were used for analysis of the information.

**Surgical Procedure**

The surgical technique was systematic and performed in the same manner for all patients. There were two 10-mm trocars used: one supraumbilical and the other left subcostal, as well as one 5-mm right subcostal trocar. Diagnostic laparoscopy was performed followed by meticulous release of adhesions with electrocautery, as well as blunt and sharp dissection. This is due to the fact that many of our patients had multiple adhesions secondary to prior surgical procedures: four patients had undergone open cholecystectomy, one had a cesarean section and another had a hysterectomy. Dissection was continued until the duodenum and the portal triad were identified and defined. A cholecystectomy was done in those patients with gallbladder in situ. To ensure a tension-free anastomosis, a Kocher maneuver was carried out in all cases. Next, an intraoperative cholangiography was performed with a 20-gauge needle with water-soluble contrast at 50% so as to outline the biliary anatomy and corroborate whether or not there were residual stones. An anterior longitudinal cholecystomy ~1.5 cm was performed below the cystic duct.

Choledochoscopy was performed with a gastroscope (Olympus GIF-180) through a 10-mm left subcostal port. In cases of unresolved choledocholithiasis, the stones were located and various endoscopic instruments were used for their removal: baskets, balloons, and polypectomy handles and even laparoscopic graspers (Figure 1).

At this point the previously placed stent was removed by ERCP. Copious irrigation was also carried out with sterile solution for extraction of the debris from the bile duct, corroborating via choledochoscopy the total absence of stones. The anastomosis was begun with a simple extracorporeal suture with a Gea monofilament knot of long absorption 3-0 (Monocryl Poliglecaprone 25, Ethicon) starting at the inferior angle of the choledochotomy towards the posterior face of the first portion of the duodenum. From there the site was chosen and extension of the transverse duodenotomy was performed. We used the technique of triangulation of the anastomosis as described by Gliedman, also with simple sutures and Gea absorbable monofilament 3-0 knots (Figure 2). Once the anastomosis was complete, intraoperative upper GI endoscopy was carried out to ensure the adequacy and hermetic closure of the choledochoduodenanastomosis.

A closed drain was placed in the lateral position to the anastomosis and headed toward Morrison space. Fascia and skin were sutured as per routine. Patients were continuously monitored as outpatients with clinical examinations, liver function tests and upper GI endoscopy for revision of the anastomosis (Figures 3 and 4).
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Results

The average age of the patients was 71 years (range: 52-85 years) with females representing 57.1%. Mean body mass index was 28.15 (range: 22.34-33.75). The median score (ASA physical status classification of the American Society of Anesthesiologists) was III and average preoperative albumin was 2.95 g/dL (range: 2.0-3.8). Comorbidities of our patient group are presented in Table 1. The characteristics of the biliary pathology of patients are shown in Table 2. All patients received preoperative prophylactic preoperative antibiotics in cases where an episode of cholangitis had been resolved, or the continuation of the treatment regimen initiated for the treatment of cholangitis. Average intraoperative bleeding was 186 mL (range: 30-600 mL) and mean operative time was 286 min (range: 150-390 min) (Figure 5).

Immediate Postoperative Period

Patients initiated oral feeding on average on day 3 (range: 2-5 days) after having undergone an esophagogastroduodenoscopy (EGD) with water-soluble contrast. A graph with the evolution of direct bilirubin of patients from their initial period of cholangitis and/or choledocholithiasis until the last visit to the outpatient clinic is shown in Figure 6. The mean follow-up time is 155 days, with a minimum of 28 days and maximum of 420 days. So far, there have been no immediate postoperative complications considered directly related to the surgical procedure.

Discussion

According to Jeyapalan et al., in 1888 Riedel performed and described the first open choledochoduodenostomy in a patient with residual choledocholithiasis.3 Franklin and Balli performed the first latero-lateral laparoscopic choledochoduodenostomy in 1991 in a patient with benign recurrent biliary stricture.4 This surgical procedure has caused great controversy since its initial description and, recently, several authors have reviewed the morbidity and mortality associated with this surgical technique performed in benign and malignant biliary diseases.1

The most common indication for a choledochoduodenostomy is multiple gallstones in the common bile duct,
impacted stones, intrahepatic stones and recurrent lithiasis. Although this surgical procedure has been used less in recent years due to the therapeutic possibilities of ERCP, a choledochoduodenostomy is still a valuable procedure for extraction of "difficult stones", benign biliary stenosis and even in biliary reconstruction during liver transplants. Choledochoduodenostomy is also particularly useful in cases in which medical circumstances indicate that a bilioenteric anastomosis is preferable and when there are technical difficulties such as multiple intestinal adhesions, thus making the construction of a Roux-en-Y difficult and risky. All our patients had multiple comorbidities and intestinal adhesions due to their extensive surgical history, thus making them ideal candidates for a laparoscopic latero-lateral choledochoduodenostomy.

A key factor for the success of the anastomosis is the maximum possible duodenal mobilization when performing a generous Kocher maneuver. Another condition described for the success of the choledochoduodenostomy and low long-term morbidity is that the common bile duct should measure between 1.2 and 1.5 cm at the time of surgery to prevent anastomotic stricture and maintain adequate biliary drainage. Both conditions were present in our patients; therefore, we anticipate low long-term morbidity.

It is reported that the main complications of a choledochoduodenostomy are cholangitis, biliary stenosis

**Table 2. Characteristics of the biliary pathology of the study population**

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Measurement</th>
</tr>
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<tbody>
<tr>
<td>Episodes of choledocholithiasis and/or previous cholangitis</td>
<td>2.71 episodes range 1-7</td>
</tr>
<tr>
<td>Gallbladder <em>in situ</em></td>
<td>3 patients</td>
</tr>
<tr>
<td>Caliber of extrahepatic biliary atresia in ERCP</td>
<td>22.57 mm range 18-35 mm</td>
</tr>
<tr>
<td>Purulent cholangitis in ERCP</td>
<td>2 patients</td>
</tr>
<tr>
<td>Resolutive stone extraction in ERCP</td>
<td>3 patients</td>
</tr>
<tr>
<td>Localization of the endoprosthesis in ERCP</td>
<td>4 patients</td>
</tr>
<tr>
<td>Diameter of the stones according to intraoperative cholangiography</td>
<td>22.6 mm range 5-35 mm</td>
</tr>
</tbody>
</table>

ERCP, endoscopic retrograde cholangiopancreatography.
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and sump syndrome. These complications can occasionally be severe and require a surgical re-intervention or cause severe long-term morbidity. It has been proposed that some factors influencing the success of the bilioenteric anastomosis are age of the patient, comorbidities, nutritional status, level of preoperative serum bilirubin, presence of chronic liver disease, nature and extension of the primary disease, as well as the type of anastomosis performed. Zafar et al. demonstrated, in a retrospective study that included 79 patients who had bilioenteric anastomosis performed due to benign causes, that the surgical technique and the type of surgery were not directly associated with the occurrence of the complications. Some independent factors associated with an elevated rate of complications were low levels of serum albumin and high ASA scores in the presurgical evaluation. In our patients, the mean ASA score was III and the level of the average score for albumin was 2.95 g/dL. Still, only one of our patients had immediate postoperative complications and these were not related with the surgical procedure per se, but as a result of preoperative complications: cholangitis, age (85 years), congestive heart failure secondary to essential systemic hypertension, sequelae of cerebrovascular disease and chronic obstructive pulmonary disease secondary to heavy smoking for 40 years.

Moreover, the literature has reported inconsistent complication rates. The total rate of biliary complications was <5% in two series, whereas it was 20% in another group of patients. and up to 43% as reported from a Pakistani group. Due to the concern of long-term outcomes in patients, particularly in relation to the occurrence of cholangitis and sump syndrome, the prevailing view among most surgeons is that choledochoduodenostomy should be carried out exclusively in older adults and should be avoided in young patients with a life expectancy >10 years. However, Escudero-Fabre et al. reported the results of 71 patients who underwent this procedure with follow-up between 5 and 15 years and average age 59 years (range 21-95 years). They found a 28% morbidity and mortality rate of 1%. They state that success of a choledochoduodenostomy lies in the correct indication for surgery, a bile duct of <15 mm and an anastomosis of <14 mm. Even so, our group has decided to reserve this surgical procedure for older adults.

Demirel et al. analyzed the information corresponding to an ERCP performed in 70 patients with suspicion of complications from a choledochoduodenostomy. They found stenosis of the anastomosis in 14 patients (20%), benign biliary stenosis proximal to the anastomosis in 13 (18.6%), sump syndrome in 11 (15.7%), cholecystolithiasis in eight (11.4%), malignancy in 4 (5.7%), hepatolithiasis in one patient (1.4%), secondary sclerosing cholangitis in one patient (1.4%) and normal ERCP in 18 patients (25.8%).

Sump syndrome is a rare complication of the latero-lateral choledochoduodenostomy, with a reported prevalence between 0 and 9.6% in prior studies. The segment of the bile duct found between the anastomosis and the ampulla of Vater acts as a bile reservoir along with debris, food, stones and bacteria. Although the anastomosis may remain permeable, the passage of food particles into the bile duct is facilitated and falls toward its distal portion and is trapped there. Without a concomitant alteration in biliary drainage through the duodenal papilla it is unlikely that cholangitis would occur. Thus, in our patients who underwent a wide endoscopic sphincterotomy, it is unlikely that this complication would occur. If it should occur, endoscopic treatment would be the treatment of choice.

Another advantage of choledochoduodenostomy over other types of biliodigestive bypasses, mainly hepatojejunostomy, is the possibility of endoscopic treatment for postoperative complications different from sump syndrome, including bile duct stenosis or of the anastomosis itself, thus preventing the risks associated with a new surgical procedure in this group of patients.

In an attempt to avoid the sump syndrome, many surgeons prefer to perform a choledochojunoanastomosis or hepatojejunostomy with Roux-en-Y reconstruction for the management of benign biliary diseases. However, this process is more complex, requiring longer operative time and is more costly. It also requires an additional intestinal anastomosis with potential leakage, which can occur especially in patients with poor nutritional status, as in our patients. On the other hand, it has the potential for changes in motility associated with a Roux-en-Y, which can also lead to enterobiliary reflux. Postoperative morbidity after a choledochojunoanastomosis for benign biliary diseases ranges from 20-33% and with 0-2% general mortality. Therefore, the evidence does not suggest that the choledochojunoanastomosis has less morbidity than the choledochoduodenostomy.

The laparoscopic approach of the biliary bypass that includes latero-lateral choledochoduodenostomy has proven to be safe and effective and to have advantages over the open approaches when there is proper patient selection and adequate surgeon experience in the advanced laparoscopic techniques. A systematic review demonstrated that laparoscopic approach of biliary bypass for the treatment of obstructive jaundice from benign sources offers important advantages with definitive resolution of the jaundice and with low complication rate (11.7%), low rate of re-intervention and operative mortality of 5.9%. These authors report a lower rate of complications with the laparoscopic approach (11.7% vs. 25%) in their review than the informa-
tion published for biliary bypass with open technique performed for benign biliary stenosis. Thus they demonstrate that although both surgical approaches offer good results in terms of resolution of the jaundice, the laparoscopic technique offers reduced morbidity and mortality, less post-operative pain, less demand for analgesics, less hospital stay, cost reduction, a more rapid return to activities of daily living, better cosmetic results and, in general, less complications related with surgical incisions (postincisional hernias at the surgical site, etc.), which make this approach appropriate in older adults and frail patients. These advantages resulted in being factual in our study.

With respect to a comparison in another study that was exclusively carried out using laparoscopic latero-lateral choledochoduodenooastmosis, the operative time reported by Chander et al. was 156.3 min, whereas our time was 286 min. In this sense, consideration must be given to the fact that the experience of the Chandler group is 25 years, whereas our group barely surpasses 1 year. However, the surgical time of our group has been decreasing and the greater quantity of minutes recorded has been for those patients who had active extraction of the stones during surgery.

**Study Limitations**

Given the low frequency of this pathology, this study includes only seven patients so it is necessary to increase the size of the sample through a longer follow-up in order to draw conclusions that may be valid for the general population.

In conclusion, our hospital is a reference center for performance of ERCP and is experienced in laparoscopic-endoscopic approaches. Choledocholithiasis is a pathology that is difficult to resolve and we believe that laparoscopic latero-lateral choledochoduodenooastmosis should be the surgical treatment of choice for patients of advanced age in whom the usual endoscopic treatment has not been successful, with persistent cholestasis secondary to biliary duct dilatation, multiple comorbidities and surgical antecedents. In addition to being a definitive and safe treatment and to offer the benefits of minimally invasive surgery, we believe that if biliary complications arise secondary to the procedure, these could be resolved endoscopically.

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**References**