



## Laparoscopic Choledochoduodenostomy in the Management of Obstructive Biliary Tract in the ERCP Era

Pablo Priego\*

Department of Bariatric and Minimally Invasive Surgery, Hospital Universitario Ramón y Cajal, Spain

### Abstract

**Background:** With the advent of endoscopic retrograde cholangiopancreatography (ERCP), indications for choledochoduodenostomy have been drastically reduced. Furthermore, and even although laparoscopic common bile duct (CBD) exploration (LCBDE) is being increasingly used for management of CBD stones, due to the technical challenge associated with a laparoscopic biliary-enteric anastomosis, laparoscopic choledochoduodenostomy (LCDD) has not widely adopted.

**Patients and Methods:** A review of the literature limited to studies published from 1989 to 2013, reported in English language and performed on humans was conducted on Pubmed using the following key words: “laparoscopic choledochoduodenostomy”. Operative details, perioperative outcomes and follow-up data were examined.

**Results:** A total of 5 studies reporting the outcomes of 90 patients undergoing LCDD for benign (choledocholithiasis, cholangitis, chronic pancreatitis and distal CBD stricture) and malignant (unresectable pancreatic neoplasm) indications were included. The mean age of patients was 60.34 years. There were 69 female and 21 male patients. Mean operative time was 180.16 minutes. Average hospital stay was 6 days. The overall success rate in achieving a CBD clearance was 100%, with a morbidity rate of 11% and a mortality rate of 3.3%. Recurrence of symptoms was reported in only one patient(1%).

**Conclusions:** Laparoscopic choledochoduodenostomy is a safe and feasible surgical procedure in the management of obstructive biliary duct with a low morbidity and mortality rates. However, the number of cases of LCDD in our review is small and more long-terms and randomized studies in compare with ERCP and open surgery should be done to validate the results.

**Keywords:** Laparoscopic choledochoduodenostomy; Choledocholithiasis; ERCP; Obstructive biliary tract; Benign biliary strictures; Common bile duct stones

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#### \*Correspondence:

Pablo Priego Jiménez, Department of Bariatric and Minimally Invasive Surgery, Hospital Universitario Ramón y Cajal, Madrid, Spain, Tel: 667858557; E-mail: papriego@hotmail.com

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### Introduction

Choledochoduodenostomy (CDD) is an excellent technique for internal drainage of an obstructed and dilated common bile duct (CBD) [1-3]. However, with the advent of endoscopic retrograde cholangiopancreatography (ERCP) and the expansion of laparoscopic common bile duct exploration (LCBDE), indications for choledochoduodenostomy have been drastically reduced [4-8].

Although laparoscopic choledochoduodenostomy (LCDD) seems to be an attractive alternative in selected cases, technical difficulty in intracorporeal suture associated with laparoscopic biliary-enteric anastomosis, explains this technique has not widely adopted [9,10].

In fact, and although LCDD was firstly performed by Franklin et al. [11] in 1991 for benign recurrent bile duct obstruction, very little has been published in the literature except a few cases series with limited number of patients [12-16].

The purpose of the article is to review the current status of laparoscopic choledochoduodenostomy for the management of obstructive biliary tract in the ERCP era.

### Patients and Methods

A review of the literature limited to studies published from 1989 to 2013, reported in English language and performed on humans was conducted on PubMed using the following key word: “laparoscopic choledochoduodenostomy”. Articles retrieved by the PubMed search were reviewed. Case reports, series related to laparoscopic hepaticojejunostomies (LHJ), bypass combined with

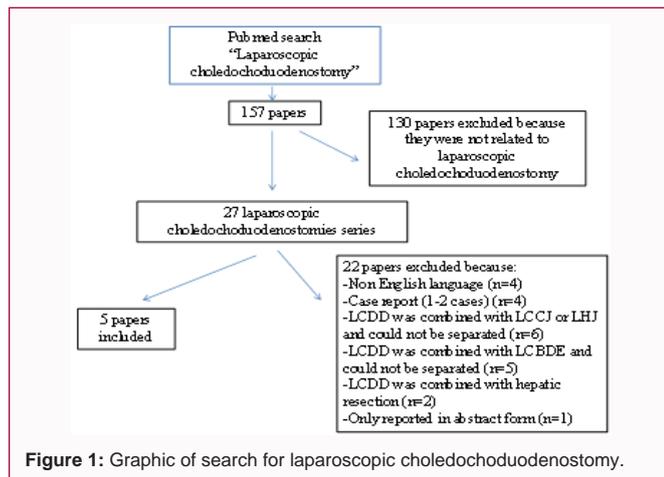


Figure 1: Graphic of search for laparoscopic choledochoduodenostomy.

excision of choledochal cyst, and LCDD combined with LCBDE or LHJ/Laparoscopic cholecystojejunostomy (LCCJ) were excluded. Figure 1 shows a graphic with the number of abstracts and full publications reached with our search. Operative details, perioperative outcomes, and follow-up data were examined.

### Results

A total of 5 studies cumulative reporting the outcomes of 90 patients undergoing LCDD were identified utilizing the above search criteria. The majority of the procedures were performed for benign disease (84 cases=93.3%). The mean age of patients was 60.34 years (range, 19-89 years). There were 69 female and 21 male patients (Table 1). ERCP was preoperative performed in attempt of CBD clearance in 32 patients of 59 possible because there were not dates available in two series (54.23%).

Mean operative time was 180.16 minutes and conversion to open surgery was necessary in 5 cases (7.7%) (Table 2). Average hospital stay was 6 days (range, 2-32 days). The overall success rate in achieving a CBD clearance was 100%, with a morbidity rate of 11% and a mortality rate of 3.3% (3 patients).

However, there was no operative mortality or procedure related complications: One patient died after a reoperation on the sixth day, through a laparotomy, for mesenteric ischemia. The second patient with known severe coronary artery disease, hypertension and hiperlipidemia did well in the early postoperative period but died as an outpatient on the 28<sup>th</sup> day due to acute myocardial infarction. The last death, in an 86 years old patient, was due to unrelated causes (atrial fibrillation, aortic insufficiency, acute renal failure, and myocardial infarction).

Among the postoperative complications, three of the patients

Table 1: Patient demographics.

Series	Nº Patients	Mean age	Sex	Indications for surgery	Previous ERCP
Chander et al. [9]	27	45.7 years (range, 19-70 years)	21 female (77.78%) 6 male (22.22%)	CBD stones: 27 cases	5 patients (18.5%)
Khajanchee et al. [10]	20	61 years (range, 33-89 years)	17 female (85%) 3 male (15%)	Choledocholithiasis: 15 cases Chronic pancreatitis: 3 cases Distal CBD stricture: 2 cases	15 patients (75%)
Tinoco et al. [12]	25	68.7 years (range, 40-82 years)	19 female (76%) 6 male (24%)	Choledocholithiasis: 19 cases Unresectable pancreatic neoplasm: 6 cases	NA
Tang et al. [13]	12	62 years (range, 40-77 years)	9 female (75%) 3 male (25%)	Cholangitis: 12 cases	12 patients (100%)
Jeyapalan et al. [14]	6	64.3 years (range, 41-86 years)	3 female (50%) 3 male (50%)	Cholangitis: 6 cases	NA

NA: Not available.

developed a biliary leak (3.3%) but were resolved with a conservative management.

After a mid-term follow-up, recurrence of symptoms, cholangitis or any evidence of sump syndrome was reported in only one patient (1%). This patient was found to have recurrent jaundice and fever, but responded to antibiotics (Table 3).

### Discussion

Historically, choledochoduodenostomy has been an excellent technique for internal drainage of an obstructed and dilated CBD [1-3]. However, nowadays, with the advent of ERCP and the expansion of LCBDE, indications for choledochoduodenostomy have been drastically reduced [4-8].

Although ERCP is the first line of treatment in patients with choledocholithiasis, it is not without risk of morbidity and even mortality. The reported incidence of post-ERCP complications varies widely from study to study and ranges for pancreatitis (1-5%), hemorrhage (1-4%), perforation (1-2%) and cholangitis (1-5%) [17-22].

Moreover, reported rates of failure to clear the CBD by ERCP ranged from 4.4% to 10% [23]. Additionally, recurrent bile duct stone formation is not uncommon following endoscopic sphincterotomy, with a variable incidence ranging from 4-24% [17].

On the other hand, LCDD is an attractive alternative in cases of multiple CBD stones with a dilated biliary duct, benign distal strictures, recurrent CBD after failed ERCP, cholangitis and even for treatment of unresectable pancreatic neoplasm [24-28]. Proponents of LCDD argue that this laparoscopic approach avoids the morbidity of open surgery and provides definitive relief of jaundice while avoiding the risks of ERCP.

Although there have been some concerns about the bile reflux, cholangitis and sump syndrome after LCDD [27], the worry is not substantiated by well-designed comparative studies and large scale cohort studies [29,30]. The rate of recurrent cholangitis after CDD range from 0% to 6% of patients, but this problem is more frequent related to anastomosis stricture rather than an ascending cause [31].

In fact, and although the first LCDD was reported in 1991 by Franklin et al. [11], very little has been published in the literature except a few cases series with limited number of patients [9,10,12-16]. Technical difficulty in intracorporeal suture associated with laparoscopic biliary-enteric anastomosis, explains this technique has not widely adopted.

However, there are some technical aspects that remain controversial. The choledochoduodenal anastomosis can either

**Table 2:** Operative details.

Series	Diameter of CBD	Technique anastomosis	Suture anastomosis	Operative time	Conversion to open rate
Chander et al. [9]	19.6 mm (range, 15-32 mm)	Diamond-shaped	Vicryl 3/0 Interrupted suture	156.3 min (range, 90-190 min)	0%
Khajanchee et al. [10]	15-20 mm	Side-to-side	Absorbable (Interrupted or running suture)	270 min	5 patients (25%)
Tinoco et al. [12]	20 mm	Side-to-side	Polyglycolic 3/0 Running suture	115 min (range, 45-180 min)	NA
Tang et al. [13]	20 mm (range, 15-33 mm)	Diamond-shaped	Monocryl 2-0 (Interrupted posterior wall and continuous anterior wall)	137.5 min (range, 90-270 min)	0%
Jeyapalan et al. [14]	NA	Diamond-shaped	Seromuscular: interrupted suture with silk 3-0. Mucosa: Vicryl, Monocryl, Polyabsorb 3-0	222 min (range, 125-277 min)	0%

NA: Not available.

**Table 3:** Postoperative and follow-up outcomes.

Series	Postoperative stay	Complications	Mortality	Follow-up	Recurrence of symptoms or cholangitis (sump syndrome)
Chander et al. [9]	6.4 days (range, 4-21 days)	1 patient (3.7%): Leak	0%	2 months to 9 years	0%
Khajanchee et al. [10]	6 days (range, 2-32)	6 patients (30%): -Reaguditation of COPD -PVT-PD -Mesh infection -Leak -Wound dehiscence -Anemia	1 patient (5%)	21 months	1 patient (5%)
Tinoco et al. [12]	4.2 days (range, 3-8 days)	1 patient (4%): Mesenteric ischemia	1 patient (4%)	NA	NA
Tang et al. [13]	7.5 days (range, 5-20 days)	1 patient (8.3%): Leak	0%	37.6 months (range, 6-91 months)	0%
Jeyapalan et al. [14]	6 days (range, 5-8 days)	1 patient (16.67%): -Atrial fibrillation, aortic insufficiency, acute renal failure and myocardial infaction.	1 patient (16.67%):	NA	0%

NA: Not available.

be side-to-side, end-to-side, diamond-shaped or even Roux-en Y hepaticojejunostomy (LHJ). There has been controversy over the years as to which of these procedures is best. Cuschieri and Adamson [32] have advocated complete transection of the common bile duct with an end-to-side CDD, believing that exclusion of the terminal or intrapancreatic bile duct will improve bile flow and reduce pooling of debris. Toumi et al. [24] and Date and Siriwardena [25] prefer Roux-en Y hepaticojejunostomy, but technically is more difficult and does not completely eliminate the risk of cholangitis.

While the diamond-shaped anastomosis is generally the gold standard in the open approach, the side-to-side is relatively easy to perform laparoscopically, and it is the most frequent in most series. However, in this review, the diamond-shaped anastomosis was performed in 3 of the five studies, trying to replicate the open procedure. The principal concern regarding to this side-to-side approach is the potential development of "sump syndrome" and cholangitis. To avoid this potential complication, the anastomosis should be constructed at the most distal part of CBD, to minimize the length of blind segment of CBD [13]. According to the authors analyzed [9,10,12-14], the anastomosis should be at least 15-20 mm in size to avoid anastomosis stricture and facilitate bile can drain without problems into duodenum, which is particularly important in order to prevent ascending cholangitis. However, nowadays, there is not comparative data to suggest superiority of one technique of CDD over another.

Having mentioned the technical aspects of LCDD, the type of suture is different between all the series studied [9,10,12-14] (running

or interrupted sutures), but in all the cases, the material preferred to perform the anastomosis was absorbable (Vicryl or Monocryl).

LCDD appears to be safe, because although 3 deaths (3.3%) were described in the review, authors did not consider them such as operative mortality or procedure related complications. Furthermore, the morbidity rate was only 11%, being the rate of biliary leak 3.3%. These results are excellent if we compared to outcomes reported in large open series [1,2,6-8], where the morbidity and mortality rates after open CDD range from 9.8% to 22% and 0-11.2% respectively. Moreover, LCDD offers the advantages of a minimally invasive technique: less postoperative pain, less demand for analgesics, reduced hospital stay, faster return to normal life and better cosmetic results.

Finally, the overall success rate in achieving a CBD clearance was 100% in the reviewed studies and after a mid-term follow-up, recurrence of symptoms, cholangitis or any evidence of sump syndrome was reported in only one patient (1%). These results improve those obtained if we compare with the reported rates of failure to clear the CBD by ERCP that ranges between 4.4% and 10% [23].

## Conclusion

To our knowledge, this is the largest review of the literature of laparoscopic choledochoduodenostomy for the management of obstructive biliary tract, and especially for the treatment of biliary stone diseases. This review shows LCDD is a safe, single-stage and feasible surgical procedure in cases of CBD disease with a low

morbidity and mortality rates, and that offers a definitive solution of CBD stones and jaundice. However, the number of cases of LCDD in our review is small and more long-terms and randomized studies in compare with ERCP and open surgery should be done to validate the results. Due to the limited keyword used in this search, it is possible that there were further reports that may not be detected by the searchers carried out by this study.

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