

Evaluation of short-term surgical outcomes after choledochoduodenostomy and Roux-en-Y hepaticojejunostomy in patients with distal benign biliary disorders, A Prospective Comparative Study

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ABSTRACT

Background: For many benign biliary disorders (BBD), some forms of biliary-enteric anastomosis (BEA) remain the accepted modality of treatment. Choledochoduodenostomy (CD) and Roux-en-Y hepaticojejunostomy (HJ) are considered to be the most commonly used techniques for BEA. This study gives a comprehensive overview on short-term surgical outcomes after both techniques in patients requiring a BEA for BBD affecting distal common bile duct (CBD).

Patients and Methods: It is a prospective comparative randomized study conducted in Ain Shams University Hospitals over a period of one year starting from June 2022. Thirty patients requiring a BEA for BBD affecting distal CBD were randomly divided into two equal groups, first group was operated CD and the other had Roux-en-Y HJ with a follow-up period of about 6 months.

Results: Operative time was longer in HJ group (152.67±14.38 mins) compared to CD group (134±13.52 mins). Postoperative hospital stay was (7.07±1.1) and (6.13±0.99) days in patients of HJ group and CD group, respectively. No mortality happened in either group, and postoperative complications were comparable between both of them, with overall morbidity of (26.7%) after CD versus (20%) after the HJ.

Conclusion: Roux-en-Y HJ is a reliable technique to create a BEA in patients with BBD affecting distal CBD, that couldn't be managed conservatively or via minimally invasive approaches. Technically it is more complex compared to CD, and maybe non-applicable in patients with marked abdominal adhesions or previous bowel surgeries, yet it is associated with less postoperative complications.

Key Words: Biliary-enteric anastomosis, choledochoduodenostomy, Roux-en-Y hepaticojejunostomy.

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INTRODUCTION

Benign biliary diseases (BBD) include a large spectrum of congenital and acquired disorders, which have different prognosis and require different treatment modalities^[1].

Patients with choledocholithiasis, iatrogenic biliary injuries or biliary strictures represent a large percentage of patients examined in general surgery clinics, yet patients with other causes of BBD like cholangitis, pancreatitis or spasm of sphincter of Oddi also present with jaundice.

For many BBD, some forms of biliary-enteric anastomosis remain the accepted and the final modality of treatment after failure of other non-surgical tools^[2]. Surgical decompression achieved via biliary-enteric anastomosis in BBD aims to improve the internal drainage of bile to prevent stasis and its back-pressure effects^[3].

The traditional choledochoduodenostomy (CD) and Roux-en-Y hepaticojejunostomy (HJ) have been in practice for more than a century, both of them are considered to be the most commonly used techniques for biliary-enteric anastomosis^[4-7].

Despite the fact that CD is considered to be the simplest form of biliary-enteric anastomosis - associated with minimal alteration to the normal anatomy- its postoperative reported complications, such as reflux gastritis, anastomotic stricture and recurrent cholangitis, made the creation of a HJ a preferable alternative in the past decades^[8]. On the other hand, Roux-en-Y HJ is associated with lower rates of postoperative complications, yet the procedure is more time consuming and requires longer postoperative hospital stay. Especially for patients with extensive intra-abdominal adhesions or those giving a history of small bowel resections, the creation of a Roux-en-Y limb might pose a challenge^[9].

Several papers looking for the optimal choice of treating BBD have been published recently, focusing on picking the procedure with the lowest postoperative complications^[10].

Although an overall favourable trend exists toward Roux-en-Y HJ, conclusions are not univocal and sharp; this creates some uncertainty, also considering the complexity of this technique: thus, it is essential to continue experimenting to determine whenever a true advantage exists.

According to the belief that biliary-enteric anastomosis presents a definitive solution for many BBD, this prospective study was designed to verify if Roux-en-Y HJ can be proposed as a superior modality of treatment and whether it is associated with better surgical outcomes compared to the traditional CD in managing patients with BBD affecting the distal part of CBD.

Aim of the work

To compare short-term surgical outcomes after choledochoduodenostomy (CD) and Roux-en-Y hepaticojejunostomy (HJ) in patients requiring a biliary-enteric anastomosis for BBD affecting distal common bile duct (CBD), focusing on five main items, namely postoperative bleeding, bile leakage, ascending cholangitis, intra-abdominal collection and surgical site infection.

PATIENTS AND METHODS:

Type of Study

A comparative prospective randomized study.

Study setting

The study was conducted at Ain Shams University Hospitals, Al-Demerdash, Department of General surgery. Approval of the research ethics Committee of medicine, general surgery department as well as a written informed consent from each participant were obtained.

Study period

The study was conducted over a period of twelve months, starting from date of approval of the protocol by the faculty and the university committee at 29/5/2022.

Study population

Inclusion criteria

Male and Female patients required a biliary-digestive anastomosis for benign biliary diseases (Biliary stones, strictures, traumatic injuries, etc.) affecting distal common bile duct (CBD), that couldn't be managed conservatively or via minimally invasive approaches.

Exclusion criteria

Patients with high CBD lesions or with lesions located above, patients who had a previous biliary surgery or those with concomitant malignant biliary lesions, also patients with bleeding disorders and those who were not fit for surgery were all excluded.

(1) Sample Size: 30 patients divided into two equal groups, 15 patients each.

(2) Randomization: Patients who met the study criteria were randomly allocated using a computer-based program (Random Allocation Software) in one of the two groups, group A (15 patients) included patients underwent choledochoduodenostomy (CD) and group B (15 patients) for those who had a Roux-en-Y hepaticojejunostomy (HJ).

Ethical considerations

Informed consent from patients who were invited to participate in the research. All patients' data are confidential, and they would not be mentioned by name at any published paper. Patients had the right to refuse joining the research or withdraw at any time without affecting their chances to receive the traditional therapy at anytime.

Management and techniques

Preoperative Management

All patients included in the study were candidates for thorough clinical assessment including careful history taking, general condition assessment and an accurate abdominal examination. Investigations for confirming diagnosis, excluding complications and preparing the patient for surgery were done including full labs, pelvi-abdominal ultrasound, CT and MRI abdomen with MRCP. If necessary EPCP or/and PTC was done for achievement of transient preoperative biliary drainage.

Operative management

All patients received subcutaneous low-molecular weight heparin 12 h preoperatively -as a prophylaxis against deep venous thrombosis- and a prophylactic dose of third-generation cephalosporin was administrated 1 h prior to surgery. They were all operated in supine position under general anesthesia by the same general surgery team.

Technique of choledochoduodenostomy (CD)

Side to side CD was the technique of choice to avoid compromising blood supply to the anastomotic end of the duct. After carrying out cholecystectomy, the duodenum is mobilized by Kocher maneuver. The common bile duct is identified and exposed by dissecting its covering peritoneum. Supraduodenal part of the CBD is

longitudinally opened with a scalpel extending proximally for about two cm. Stone extraction, removal of mud with subsequent flushing of the duct or taking biopsy are completed at this stage. The first part of the duodenum is longitudinally -full wall thickness- incised using cautery for a distance of about 1.5 cm. Starting with the posterior wall, a single layer anastomosis using interrupted 4-0 PDS sutures is accomplished with knots positioned on the outside of the anastomosis. The anterior part of anastomosis is carried out in the same technique, keeping a distance of about 3 to 5 mm between sutures all around the anastomosis.

Technique of Roux-en-Y hepaticojejunostomy (HJ)

For patients operated in Roux-en-Y HJ technique, side-to-side HJ was the selected technique. Following Cholecystectomy, the Roux limb is created by dividing the jejunum about 30-40 cm downstream from the Ligament of Trietz. The efferent cut end of the Roux limb is brought up in a retrocolic route and anastomosed to the common hepatic duct side to side. The anastomosis is performed with interrupted sutures using 4/0 PDS at a distance of 3-5 mm between sutures. Finally, the entero-enterostomy is created at a distance of 40 cm distal to the efferent cut end; the afferent limb is anastomosed at this point in double layered fashion using interrupted sutures.

Following either technique, two drains were placed, one in the Morison's pouch and the other at the sub-diaphragmatic area. Proper hemostasis after thorough lavage was done followed by closure of abdomen in layers.

Postoperative management, follow-up

Patients were kept NPO until intestinal sounds became audible, followed by starting SIPs of clear fluids, gradual upgrade in meals as long as the patient showed tolerance. Patients received I.V fluids, broad spectrum antibiotics, potent analgesics and proton pump inhibitors. Narcotics and anti-emetics was tailored according to each patient's condition. Anticoagulants were administered guided by Caprini score for assessment of VTE risk.

Close monitoring of patients' vital data, drain fluid volume and color, together with daily abdominal examination and every other day dressing was provided for all patients. Labs was routinely withdrawn daily for two days, then every other day unless more frequent follow-up was indicated.

Drains were removed after 4-5 days. In some patients with annoying discharge (volumes > 50 cc/day, or/and colors other than the traditional serous straw color) it was kept in place for few more days. Patients were allowed to be discharged with normal vital data, accepted labs, regained traditional bowel habits, and absence of any complication that necessitates hospital management. Follow-up included

two visits weekly, three visits monthly, and one more visit three months after the last monthly one.

Any suspected complication was carefully assessed, further investigated and promptly managed if confirmed, together with accurate documentation.

RESULTS:

A total of 30 patients underwent biliary-enteric anastomoses (BEA) for benign lesions affecting the distal common bile duct (CBD). They were divided into two equal groups, 15 patients each, the first group were operated on choledochoduodenostomy (CD), while the second group had Roux-en-Y hepaticojejunostomy (HJ). The Demographic data showed non-significant difference between the two groups regarding their age and sex (Table 1). Despite that nine patients had CD due to choledocholithiasis compared to five patients operated on HJ for the same cause; still non-significant difference could be detected between indications for BEA in either group, $P=0.208$ (Table 2).

Three patients (20%) in each group had a history of previous laparotomy; of which two patients (13.3%) in the HJ group and one patient (6.7%) in the CD group underwent a concomitant bowel resection. History of previous biliary or/and pancreatic inflammations was close between the two groups (26.7%, 33.3%) for CD and HJ group, respectively. No major discrepancy detected between the two groups focusing on their preoperative relevant surgical history (Table 3).

Operative time was longer in HJ group compared to CD group (152.67±14.38 mins) and (134±13.52 min), respectively ($P=0.001$). Length of postoperative hospital stay was 7.07±1.1 days in patients of HJ group, compared to 6.13±0.99 days for patients underwent CD, $P=0.021$, that gave rise to significant difference between the two groups (Table 4).

No mortality happened in either group, and postoperative complications were comparable between both of them, with overall morbidity of 4/15 (26.7%) patients in the CD group and 3/15 (20%) patients in the HJ group, $P=0.666$ (Table 5).

The most common postoperative complication in both groups was surgical site infection (13.3%, 20%) for CD and HJ respectively. Postoperative bleeding occurred with equal percentage in both groups (6.7%), while ascending cholangitis developed in two patients (13.3%) of the CD group and was totally absent for the HJ patients. Bile leakage was encountered in one patient following CD (6.7%), it was a minor leak which precipitated a sub-hepatic intra-abdominal collection (Biloma) that was managed conservatively via pig-tail insertion. No bile leakage or intra-abdominal collection was reported in patients of the HJ group (Table 5).

Table 1: Comparative demographic data between the two groups

Demographic data	CD group Number=15	HJ group Number=15	Test value	P value	Sig.
Age (years)					
■ Mean±SD	51.13±6.36	51.67±6.76	-0.223•	0.825	NS
■ Range	38–62	38–61			
Sex					
■ Female	8 (53.3%)	9 (60.0%)	0.136*	0.713	NS
■ Male	7 (46.7%)	6 (40.0%)			

P value > 0.05: Non-significant; *P value* < 0.05: Significant; *P value* < 0.01: Highly significant.

*Chi-square test.

•Independent t-test.

Table 2: Comparative indications for biliary-digestive bypass between the two groups

Indication for biliary -digestive bypass	CD group Number=15	HJ group Number=15	Test value	P value	Sig.
Calcular	9 (60.0%)	5 (33.3%)	3.143*	0.208	NS
Stricture	4 (26.7%)	4 (26.7%)			
Biliary injury	2 (13.3%)	6 (40.0%)			

P value > 0.05: Non-significant; *P value* < 0.05: Significant; *P value* < 0.01: Highly significant.

*Chi-square test.

Table 3: Comparative relevant surgical history between the two groups

Relevant surgical history	CD group Number=15	HJ group Number=15	Test value	P value	Sig.
History of previous laparotomy					
■ Negative	12 (80.0%)	12 (80.0%)	0.000*	1.000	NS
■ Positive	3 (20.0%)	3 (20.0%)			
History of previous bowel resection					
■ Negative	14 (93.3%)	13 (86.7%)	0.370*	0.543	NS
■ Positive	1 (6.7%)	2 (13.3%)			
History of biliary/Pancreatic inflammation					
■ Negative	11 (73.3%)	10 (66.7%)	0.159*	0.690	NS
■ Positive	4 (26.7%)	5 (33.3%)			

P value > 0.05: Non-significant; *P value* < 0.05: Significant; *P value* < 0.01: Highly significant.

*Chi-square test.

Table 4: Comparative operative time and postoperative hospital stay between the two groups

	CD group Number=15	HJ group Number=15	Test value	P value	Sig.
Operative Time (min)					
■ Mean±SD	134.00±13.52	152.67±14.38	-3.663•	0.001	HS
■ Range	110–150	130–170			
Postoperative Hospital Stay (day)					
■ Mean±SD	6.13±0.99	7.07±1.10	-2.442•	0.021	S
■ Range	5–8	5–9			

P value > 0.05: Non-significant; *P value* < 0.05: Significant; *P value* < 0.01: Highly significant.

•Independent t-test.

Table 5: Comparative postoperative complications between the two groups

Postoperative complications	CD group Number=15	HJ group Number=15	Test value	P value	Sig.
Bleeding	1 (6.7%)	1 (6.7%)	0.000*	1.000	NS
Bile leakage	1 (6.7%)	0 (0.0%)	1.034*	0.309	NS
Ascending Cholangitis	2 (13.3%)	0 (0.0%)	2.143*	0.143	NS
Intra-abdominal Collection	1 (6.7%)	0 (0.0%)	1.034*	0.309	NS
Surgical site Infection	2 (13.3%)	3 (20.0%)	0.240*	0.624	NS
Morbidity					
Negative	11 (73.3%)	12 (80.0%)	0.186*	0.666	NS
Positive	4 (26.7%)	3 (20.0%)			

P value > 0.05: Non-significant; P value < 0.05: Significant; P value < 0.01: Highly significant.

*Chi-square test.

DISCUSSION

BBD are common problems encountered in surgery clinics and represent a major medical and socioeconomic concern. Multiple etiologies have been associated with BBD including choledocholithiasis, iatrogenic biliary injuries and biliary strictures. Other rare causes include cholangitis, pancreatitis or spasm of sphincter of Oddi^[11-13].

Management of BBD varies from conservative treatment up to surgery which is actually indicated for patients subjected to failed conservative or minimally invasive choices^[14-16].

Two techniques of biliary-enteric anastomosis are most widely used nowadays; choledochoduodenostomy (CD) and Roux-en-Y hepaticojejunostomy (HJ). However, although they may be the last definitive option for patients exhausted their conservative or minimally invasive chances, complications such as postoperative bleeding, bile leakage, ascending cholangitis, intra-abdominal infected collections and surgical site infection, represents the most commonly encountered problems in the early postoperative period. As a result, various studies discussed and highlighted the outcomes expected after either technique^[17].

This prospective study compared patients undergoing choledochoduodenostomy (CD) with patients undergoing Roux-en-Y hepaticojejunostomy (HJ) for benign disease affecting distal common bile duct (CBD) and showed comparable short-term postoperative results. Although postoperative bile leak, ascending cholangitis and intra-abdominal collection occurred more frequently in patients underwent CD; yet it caused non-significant difference between the two groups outcome. On the operative level, CD was significantly superior to HJ regarding the procedure duration and the postoperative hospital stay.

In our study, the overall postoperative morbidity was (26.7% & 20%) for CD and Roux-en-Y HJ respectively, with no mortality detected. Complications after biliary-enteric anastomotic procedures have ranged from 3% to 43% in the previous reports^[18,19].

However, most of these studies were focusing on BEA following iatrogenic injuries of the biliary tract. The differing indication for surgery and techniques of the procedures make it difficult to make accepted logical comparisons.

In a recent study carried out by Schreuder and his colleagues, the overall morbidity after CD and HJ for benign causes was comparable: 30.8% versus 26.9% respectively^[9].

Schreuder *et al.* reported in their study that postoperative bleeding and bile leakage were encountered more frequently in patients underwent CD to those of the HJ group; (7.69% in CD; 0% in HJ) for bleeding, and (3.84% in CD; 0% in HJ) for bile leakage^[9]. In our study, postoperative bleeding occurred equally in both groups 1/15 (6.67%), while for bile leakage the percentage was (6.67%: 0%) for CD and HJ respectively.

Incidence of cholangitis in our study was (13.3% in CD: 0% in HJ), with (6.67%) average overall incidence for patients of both groups compared to close incidence rates in a previous study carried out by Zafar *et al.* (8.9%)^[20].

Intra-abdominal collection incidence was more common in CD group compared to HJ group (6.67%: 0%) respectively, with close results reported by Schreuder (10%: 0%)^[9].

Sicklick *et al.* and Zafar *et al.* reported surgical site infection as the most frequent post BEA complication,

it developed in 8%^[18] to 22.8%^[20] of the patients of the two studies respectively. Our study demonstrated about (16.6%) overall incidence of wound infection with lower incidence in CD group compared to HJ group (16.67%: 20%) respectively.

Although there are many preferences for Roux-en-Y HJ compared to CD as regards postoperative comparing parameters in our study; yet the differences still insignificant; and this could be explained by the limited sample size or/and follow-up period.

The evident privilege for CD over Roux-en-Y HJ reported by this and other studies was the shorter operative time and quicker postoperative discharge, which was markedly significant, together with the simpler and more feasible operative technique regardless the patient's previous surgical history.

CONCLUSION

Roux-en-Y hepaticojejunostomy is a reliable technique to create a biliary-enteric anastomosis in patients with benign biliary diseases affecting distal common bile duct, that couldn't be managed conservatively or via minimally invasive approaches. Technically it is more complex compared to the traditional choledochoduodenostomy; requiring an additional entero-enterostomy, more operative time, longer postoperative hospital stay and maybe non-applicable in patients with marked abdominal adhesions or previous bowel surgeries, yet it is safe, effective and associated with less postoperative complications. A limitation of the present study can be identified in the small size of the sample and the limited follow-up, that propose a need for further evaluation in larger series and for longer follow-up periods.

CONFLICT OF INTEREST

There are no conflicts of interest.

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