

Comparison of Efficacy and Safety of Hepatico-Duodenostomy versus Hepatico-Jejunostomy after Excision of Choledochal Cyst in Children

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ABSTRACT

Background: Choledochal cyst (CC) is a congenital dilatation of the biliary tract, most commonly the choledochus. Excision with biliary reconstruction has been established as standard management of CC.

Objective: This study aimed to compare the outcome of the two most commonly performed methods of biliary reconstruction after excision of CC: Roux-en- Y hepaticojejunostomy (RYHJ) and hepaticoduodenostomy (HD).

Patients and method: This was a retrospective cohort study included 24 patients diagnosed with CC to assess the outcome of the two biliary drainage methods: HD and RYHJ. Data were collected from patient files. The assessment criteria included: Operative time (OT), length of hospital stay (LOS), postoperative complications and reoperation rate. Outcome data were compared.

Results: The Type Ia to type VIa ratio was 1:1 and there were no patients with other types of CC. HD group had relatively shorter operative time (2.07 hours for HD versus 3.26 hours for RYHJ), which was statistically significant ($P < 0.001$). Also, shorter LOS for HD (4.75 days for HD versus 6.68 days for RYHJ with $P < 0.001$), which was statistically significant. Ascending cholangitis was detected in one patient in HD group, while biliary reflux gastritis was detected in two patients in HD group and were statistically insignificant.

Conclusion: Compared to RYHJ, HD required a single anastomosis and was associated with substantially less surgical time and LOS. It is more anatomical, physiological, and easy to perform but associated with statistically insignificant adverse events in comparison with RYHJ.

Keywords: Choledochal cyst, Hepaticoduodenostomy, Hepaticojejunostomy.

INTRODUCTION

Choledochal cyst (CC) is a congenital dilation of the biliary tract, most frequently affecting the choledochus, though it can appear in any part of the biliary system^[1]. Based on Todani's classification, there are five types of CCs, with type I being the commonest. Together, types I and IVa comprise over 90% of all cases^[2]. Its clinical presentation varies with age and the type of pathology. In infants, it commonly presents with jaundice or an abdominal mass, whereas in older children, abdominal pain is the predominant symptom^[3,4].

Cystic type almost presented with abdominal mass, while fusiform type usually presented with abdominal pain. Other manifestations include vomiting and fever. Minority of cases typically presented with triad of abdominal mass, abdominal pain and jaundice^[5]. Cystoenterostomy without cyst excision is obsolete due to malignant transformation^[6].

Cystectomy and bilio-enteric anastomosis is the gold standard management. The two most commonly used techniques for bilio-enteric anastomosis after complete cyst resection are: RYHJ and HD^[7,8].

Alternative approaches include: end to end hepaticojejunostomy, hepaticoduodenostomy with jejunal interposition, either technique can be achieved

by open approach or minimally invasive by laparoscopy or robotic assisted^[9].

This study aimed to compare the outcome of the two most commonly performed methods of biliary reconstruction after excision of CC: Roux-en- Y hepaticojejunostomy (RYHJ) and hepaticoduodenostomy (HD).

PATIENTS AND METHODS

All patients diagnosed with CC and admitted in paediatric surgery department at Mansoura University Children Hospital through the period from Jan 2018 to Jan 2023. This retrospective cohort study was conducted to assess the outcome of the two biliary drainage methods: Biliary reconstruction was performed by HD (group A) in 8 patients (33.3%) and by RYHJ (group B) in the other 16 patients (66.6%) according to surgeon preference (figure 1).

Diagnosis was confirmed by US and MRCP. The assessment criteria includes: Operative time, intraoperative complications, length of hospital stay, early and late postsurgical adverse events and reoperation rate. The objectives of this study were to compare the operative time, operative and postoperative adverse events of the two approaches HD versus RYHJ.

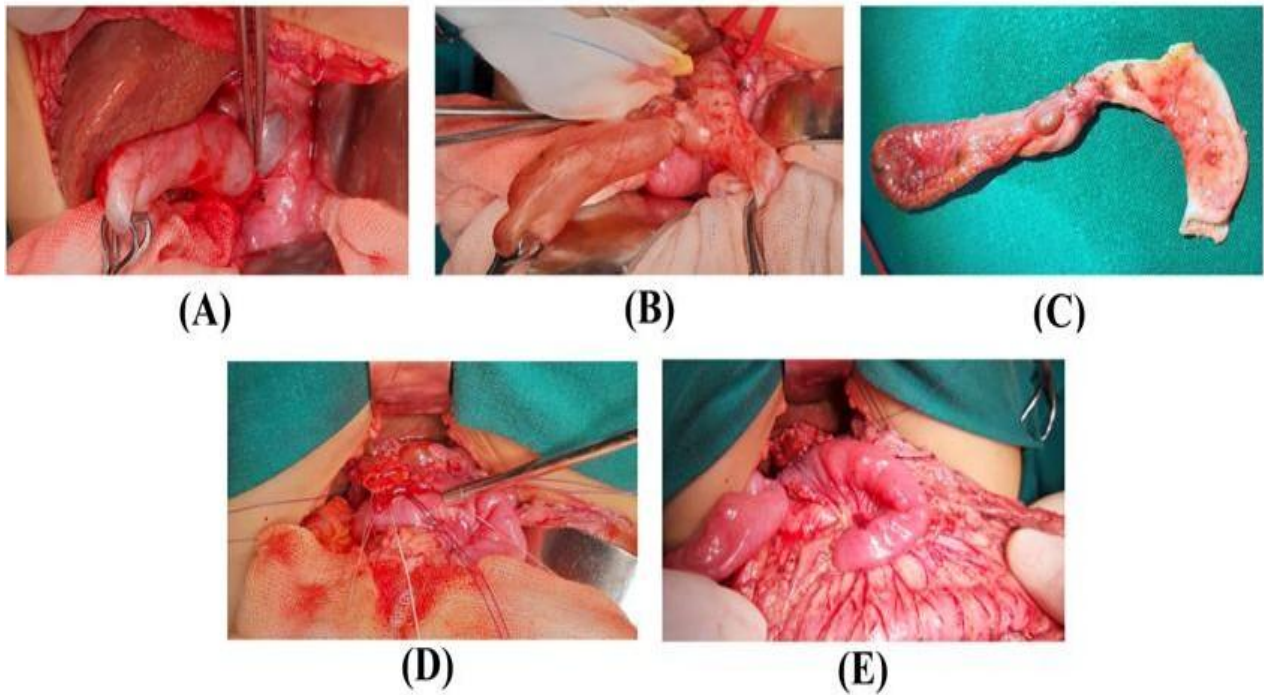


Figure (1): RYHJ and HD. (A) Identification of choledochal cyst, (B) Cyst dissected down to the level of the duodenal papilla & separated, (C) Resected cyst, cystic duct & gall bladder, (D) Hepaticoduodenostomy, (E) Hepaticojejunostomy and jejunum loop passing via transverse mesocolon.

Ethical approval: The Ethics Committee of Mansoura Faculty of Medicine authorized this study. Parents provided written informed consents to participate in the study. The Helsinki Declaration was followed throughout the course of the investigation.

Statistical analysis

Data were collected from patients’ files and processed using a commercially available software package (SPSS®, version 22 for Windows). Outcome data were compared using student’s t-test and Fisher’s exact test. $P \leq 0.05$ was deemed significant.

RESULTS

Twenty-four patients with CC were included in the study, some patients (16.6%) presented under age of 3 years, while other patients (83.4%) presented during childhood ranged from 2 – 15 years with median age of 7.3 years. Infant patients presented mainly with abdominal mass and jaundice, while children patients presented mainly by jaundice and abdominal pain. Male to female ratio was (1:2). Type Ia CC to type VIa CC ratio was (1:1), with no other types of CC (Table 1).

Table (1): Demographic data of patients

Age (median, range)	<ul style="list-style-type: none"> • Under 3 years old • Above 3 years old 	7.3 (2-15) 4 (16.6%) 20 (83.4%)
Sex (1:1)	<ul style="list-style-type: none"> • Male • Female 	12 (50%) 12 (50%)
Choledochal cyst type	<ul style="list-style-type: none"> • Type Ia • Type VIa 	12 (50%) 12 (50%)

Surgery was performed via open approach in all cases. Biliary reconstruction was performed by HD in 8 patients (33.3%) and by RYHJ in the other 16 patients (66.6%) according to surgeon preference (figure 1). Mean operative time for HD group was 2.07 hours versus 3.26 hours for RYHJ group, which was statistically significant ($P=0.001$). Mean LOS was 4.75 days for HD group versus 6.68 days for RYHJ group, which was also statistically insignificant ($P = 0.001$). Early postoperative leak occurred in one case from each group, which was statistically insignificant ($P = 0.99$). Late postoperative adhesive intestinal obstruction occurred in one case (6.25%) of RYHJ group, and it was insignificant ($P = 0.99$), that required exploration and adhesiolysis after failed conservative management. Ascending cholangitis was detected in one patient (12.5%) of HD group, while biliary reflux gastritis was seen in two patients (25%) of HD group. Patient files didn’t show intraoperative complications (Table 2).

Table (2): Comparing outcomes of HD and HJ

		HD (8 patients)	RYHJ (16 patients)	P value
Operative time (Hours)		(1.8: 2.5) Mean = 2.07	(2.5 : 4.5) Mean = 3.31	p<0.001 (S)
Length of hospital stay (Days)		(4 : 6) Mean = 4.75	(5: 9) Mean = 6.68	p<0.001 (S)
Early Complications	Bile Leak	1	1	0.99
Late Complications	Adhesive Intestinal obstruction	0	1	0.99
	Ascending cholangitis	1	0	0.33
	Biliary gastritis	2	0	0.10
Reoperation		1 diversion to (RYHJ)	1 (intestinal obstruction)	0.99

t-test for continuous data (operative time and hospital stay) and Fisher's exact test for categorical data (complications).

DISCUSSION

Choledochal cysts (CCs) are congenital dilations of the biliary tree, with an estimated incidence about one in 100,000 live births in western countries with higher incidence in Asian countries [10, 11]. It is more predominant in females as confirmed in our study where male to female ratio was 1:2, which suggests potential genetic and hormonal factors to this high prevalence in females [1, 3, 12, 13].

In this study, patients younger than 3 years old (16.6%) primarily presented with jaundice and abdominal mass, while older children (83.4%) mainly showed symptoms of jaundice and abdominal pain. **Mukhopadhyay et al.** [14] reported that abdominal pain was the main presenting symptom (86%), while **Silva-Baez et al.** [3] mentioned that jaundice and abdominal pain were commonest symptoms representing 78.5% and 85.7% of cases respectively.

Among types of CCs, type I is the most prevalent form representing around 90% of patients followed by type IV cysts [16]. In the current study Type Ia to type VIa ratio was 1:1. In contrast, **Mukhopadhyay et al.** [14] reported that type I cysts represents 79.7% of cases and type IV cysts were 15% of their study. Despite being the surgical method for CC for many years, cholecystoenterostomy is no longer used because of the significant risk of adverse events, including cholangitis, pancreatitis, and cancer [13, 16]. Complete excision of CC became essential for surgical management of choice leading to decrease incidence of malignancy (0.7%) and other complications [17, 18]. Lilly's technique is used when pericyclic fibrosis is present, allowing the adherent cyst wall to remain while the mucosal lining is stripped or ablated with diathermy [19].

HD is considered more physiologic, easier, with short operative time, single anastomosis and shorter length of hospital stay. But, on the other hand, resulting biliary reflux and subsequent cholangitis and biliary gastritis are very distressing if occurred. It will significantly impair patient's quality of life and overweight any claimed advantages of this technique. Moreover, it may require reoperation [10].

The mean OT for the HD group was 2.07 hours, compared to 3.26 hours for the RYHJ group, a difference that was significant (P = 0.001). In a study by **Ray et al.** [1], the HD group also had a shorter average OT (1 hour and 25 minutes) versus the RYHJ group (2 hours and 10 minutes), with this difference being significant (p = 0.006).

The mean LOS was shorter for the HD group at 4.75 days, compared with 6.7 days for the RYHJ group, and also this difference was statistically significant (P=0.001). While, some authors have observed a shorter LOS in HD cases where **Ray et al.** [1] found that the average duration of LOS to be comparable between both groups.

Narayanan et al. [20] reported in their systematic review and meta-analysis cases with postoperative biliary leak in either group, but statistically insignificant (P = 0.46) that is similar to our study.

In this study, biliary reflux gastritis was observed in two children (25%) within the HD group with no detected cases in RYHJ group. One of the two patients needed reoperation and diversion to RYHJ due to sever gastritis irresponsive to medical treatment. **Ray et al.** [1] similarly noted a higher incidence of biliary reflux gastritis in the HD group (25%) compared to the RYHJ group (20%). In same vein, **Shimotakahara et al.** [7] recorded a high incidence of duodenogastric bile reflux (33.3%) in HD cases, which led them to favor RYHJ for bilioenteric anastomosis. Postoperatively, ascending cholangitis occurred in one patient (12.5%) in the HD group, while adhesive intestinal obstruction was found in a single case (6.25%) in the RYHJ group. **Ray et al.** [1] reported that both postsurgical cholangitis and adhesive intestinal obstruction were more frequent in the RYHJ group, with adhesive bowel obstruction (ABO) noted in 10% of the RYHJ group and absent in the HD group. In the same line, **Shimotakahara et al.** [7] observed ABO in 7.1% of RYHJ cases.

Anastomotic stricture was recorded in 4.1% of cases following bilioenteric anastomosis for CC [21], and fortunately was not seen in this study, likely due to the wide anastomosis created between the intestine and

common hepatic duct as recommended by **Ray et al.**^[1].

Intrahepatic stone formation after cyst excision has been documented in 10–16.7% of pediatric patients, but we didn't have this complication in our patients during the follow up period. Novel study that was conducted by **Narayanan et al.**^[20] demonstrated no significant difference in postsurgical adverse events, which included anastomotic leaking, stenosis, cholangitis, and ABO between HD and RYHJ biliary reconstruction following CC removal. The excision of CC significantly decreases the risk of malignant tumor development, but intrahepatic cholangiocarcinoma is noticed on long term follow up^[4]. Mortality after surgery for CC was recorded in 1.27% and 5.7% CC patients in series recorded by **Mukhopadhyaya et al.**^[14] and **Sharma et al.**^[8] for HD group and RYHJ group respectively. The mortality in the series recorded by **Yamataka et al.**^[22] was observed in RYHJ group. Mortality wasn't observed in our study, which is similar to what reported by **Shimotakahara et al.**^[7] and **Todani et al.**^[23].

The optimal surgical approach for managing choledochal cysts (CC) remains a topic of debate among surgeons, with RYHJ being the most frequently used reconstructive approach following cyst excision^[15]. **Mukhopadhyaya et al.**^[14] advocated for hepaticoduodenostomy (HD) describing it as a straightforward procedure that maintains normal anatomy and physiology and offers the benefit of easier access for endoscopic interventions if needed postoperatively. In contrast, **Shimotakahara et al.**^[7] advised against HD due to its association with a high incidence of duodenogastric biliary reflux and gastric carcinoma, favoring RYHJ exclusively as their preferred technique.

CONCLUSION

Compared to RYHJ, HD required a single anastomosis and was associated with substantially less surgical time and LOS. It is more anatomical, physiological, and simple to conduct but accompanied by statistically insignificant adverse events as compared to RYHJ. A long-term follow up study is required to identify if there is significant difference between the two techniques as regards complications.

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