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Original Article

Evaluation of Outcome of Hepaticojejunostomy with or Without Roux-En-Y For the Treatment of Choledochal Cyst

Mahmud MT[1], Tasnim Z[2], Hanif A[3], Hai AHMA[4], Abir A[5]
Hasan GM[6], Mahanta P[7], Shakib SMN[8], Hasan N[9]

Abstract

Background: Background: Choledochal cyst is an uncommon congenital condition marked by single or multiple dilatations of the intra and/or extrahepatic biliary tree. The cause of choledochal cyst is still unknown, despite numerous theories being offered. Choledochal cysts are often classified into numerous groups based on anatomical findings. In this study, choledochal cysts were treated by total cyst excision and biliary-enteric repair via hepaticojejunostomy (HJ) with or without Roux-en-Y.

Aim & Objective: To evaluate the outcomes of hepaticojejunostomy with and without Roux-en-Y.

Methods: It was a Quasi Experimental Study conducted at the Department of Pediatric Surgery, Dhaka Medical College Hospital, Dhaka, from March 2019 to September 2020. All Children with type I & IV choledochal cyst admitted in the Department of Pediatric Surgery, DMCH, were considered as the study population. Total 40 patients were divided into two groups by computer-generated simple random sampling selection. Group A (Study group): Hepaticojejunostomy without Roux-en-Y, Group B (Control group): Hepaticojejunostomy with Roux-en-Y. Statistical analysis was carried out using the Statistical Package for Social Sciences version 23.0 for Windows (SPSS Inc., Chicago, Illinois, USA).

Results: Females made up the majority in both groups 15 (75%) and 16(80%) respectively. One patient (5%) had anastomotic leakage in Group A and two patients (10%) had anastomotic leakage in Group B. The mean time to establish oral feeding in day was 3.70 (±0.65) in Group A and was 5.50 (±1.19) in Group B. The mean duration of hospital stay in day was 8.0 (±1.21) in Group A and in group B it was 9.80 (±1.28). Febrile episodes, after operation at 15 days follow up in group A was 3(15%) and was 4(20%) in group B. At 1st month follow up, fever after operation was 01(5.00%) in group A and was 03 (15.00%) in group B. At 3rd month follow up and 6th month follow up, no USG abnormality was found in both groups. At 15 days follow up the mean SGPT is 72.85 (±11.49) in study group A and is 63.45(±9.52) in study group B, that was statistically significant. Other follow ups such as mean serum bilirubin and mean ALP were not significantly different between two groups.

Conclusion: In choledochal cyst, complete excision of cyst and good bilioenteric anastomosis should be done. Hepaticojejunostomy without Roux-en-Y is a simple, quick procedure with preservation of normal anatomy and physiology and minimum complications. So, it can be adopted as a better approach.

Key word: Hepaticojejunostomy, Roux-en-Y, Choledochal cyst, Complications.

1. Md. Tazmir Mahamud
Registrar, Department of Pediatric Surgery, Dhaka Medical Ccollege Hospital, Dhaka
2. Zerine Tasnim
Medical officer, Department of Pediatric Surgery, Dhaka Medical Ccollege Hospital, Dhaka
3. Professor Dr. Abdul Hanif
Head of the department, Neonatal Surgery, Dhaka Medical Ccollege Hospital, Dhaka
4. A.H.M. Abdul Hai
Assistant Professor, Department of Pediatric Surgery, Dhaka Medical Ccollege Hospital, Dhaka
5. Ashekin Abir
Registrar, Department of Pediatric Surgery, Dhaka Medical Ccollege Hospital, Dhaka
6. Gazi Mahmud Ul Hasan
Assistant Registrar, Pediatric Surgery, Department of Pediatric Surgery, Dhaka Medical Ccollege Hospital, Dhaka
7. Pankaj Mahanta
Indoor Medical Officer Department of Pediatric Surgery, Dhaka Medical Ccollege Hospital, Dhaka
8. S.M. Nazmus Shakib
Indoor Medical Officer, Department of Pediatric Surgery, Dhaka Medical Ccollege Hospital, Dhaka
9. Nayeem Hasan
Registrar, Department of Pediatric Surgery, Dhaka Medical Ccollege Hospital, Dhaka

Correspondence to: Dr. Md. Tazmir Mahamud
Registrar, Department of Pediatric Surgery, Dhaka Medical Ccollege Hospital, Dhaka, Email : naserobayed@gmail.com

Introduction:

Choledochal cyst represents congenital abnormal dilatation involving in any part of bile duct commonly extrahepatic. Dilatation may be cystic, fusiform, multiple saccular or may be in the form of a diverticulam without distal duct stenosis. Overall incidence ranges from 1 in 100,000 to 150,000 live births in western populations but higher in asian populations, with rates as high as 1 in 1000 in japan. Approximately 85% of cases are reported in children under the age of 15 and females are more likely to be affected (male female ratio is 3 to 4:1) [1]. Choledochal cyst may be classified in different types depending on the nature of dilatations and site of involvement of bile duct. Currently, Todani's five-type CC classification method is widely accepted. Type I consists of saccular or fusiform dilatation of common bile duct (CBD) and type II represents a diverticulum of CBD. Type III, also known as choledochocele is described as dilatation of the intraduodenal portion of CBD. Type IVA represents multiple extrahepatic and intrahepatic cysts, but type IVB shows only extrahepatic cysts. Type V, termed as Caroli's disease involves intrahepatic bile duct cysts. Choledochal cysts are thought to be congenital but several etiologic theories have been proposed and most widely accepted theory is that cystic dilatation of bile duct is due to an abnormal pancreaticobiliary ductal union (APBDU) [2]. Clinical feature varies with the age & type of the choledochal cyst. Infants present with abdominal mass, progressive jaundice but children and adolescents commonly present with triad of symptoms like jaundice, right upper quadrant mass, and abdominal pain. Ultrasonography is the initial diagnostic tool with a sensitivity of 71 to 97%. CECT is a useful imaging method, but MRCP is the diagnostic modality of choice. It accurately visualizes the cyst & ductal structures and reasonably detects APBJ [1]. The surgical treatment of choledochal cysts is determined by the type of cyst and the associated hepatobiliary pathology. Patients with type I, II, or IV cysts are considered to be good surgical candidates, ERCP with sphincterotomy or endoscopic resection are two procedures that can be used to treat type III cysts [3]. In search of the best procedure for the management of CCs, surgery has undergone a lot of development. Historically, cystenterostomy was considered the surgical method of choice for CCs. Later studies proved that cystenterostomy itself was associated with recurrence of symptoms and also high risk of malignancy in the remaining cyst wall. So complete excision of the cyst along with anastomosis with extra hepatic bile ducts to create a new pathway for hepati co-enteric bile drainage done currently) [4]. Basic principle of surgical management of choledochal cyst is excision of abnormally dilated bile duct & reconstruction of a new biliary channel between liver and intestine. Some surgeons prefer cyst excision with hepaticoduodenostomy as it takes significantly less opearitve time and needs single anastomosis. Ray B. K, 2017[5] states that the average operating time was less in HD group (1 hour & 25 min) as compared to RYHJ group (2 hours & 10 min). This difference is statistically significant (p=0.006) and is the major advantage in HD group. The closeness of the anastomosis to the stomach makes hepaticoduodenostomy have a greater chance of cholangitis and bile gastritis. A study showed cholangitis in 1.7% and bile gastritis in 3.8% of patients underwent hepaticoduodenostomy [6]. This study was designed to evaluate and compare the early postoperative outcome of hepaticojejunostomy without Roux-en-Y and hepaticojejunostomy with Roux-en-Y.

Methodology:

Type of Study: This was a Quasi-Experimental Study.

Place of Study: The study was conducted in the Department of Pediatric Surgery, Dhaka Medical College Hospital (DMCH), Dhaka, Bangladesh.

Duration of Study: The study was conducted from March 2019 to September 2020.

Study Population: Children with Type I and Type IV choledochal cysts admitted to the Department of Pediatric Surgery, DMCH, during the study period were selected as the study population.

Sample Size: A total of 40 patients were included in the study, with 20 patients in Group A & 20 patients in Group B.

The sample size was calculated using the following formula:

$$n = \frac{(Z_\alpha + Z_\beta)^2(\sigma_1^2 + \sigma_2^2)}{(\mu_1 - \mu_2)^2}$$

Where:

- n = desired sample size
- Z_α = 1.96 (standard normal deviate for 95% confidence level)
- Z_β = 1.28 (standard normal deviate for 90% power)
- μ_1 = Mean serum bilirubin in Roux-en-Y group = 41.6 µmol/L (Raafat et al., 2023)[7]
- μ_2 = Mean serum bilirubin in other group = 44.5 µmol/L (Raafat et al., 2023)[7]
- σ_1 = Standard deviation in Roux-en-Y group = 8.7 µmol/L
- σ_2 = Standard deviation in other group = 10.2 µmol/L

$n = 23.59 \approx 23$ per group

Due to time limitations and availability of patients, 20 patients per group were included.

Sampling Technique

Patients were recruited consecutively using a non-randomized sampling technique and allocated into two groups:

- **Group A (Study Group):** Hepaticojejunostomy without Roux-en-Y
- **Group B (Control Group):** Hepaticojejunostomy with Roux-en-Y

Selection Criteria

Inclusion Criteria:

- Children with Type I or IV choledochal cyst
- Age up to 14 years

Exclusion Criteria:

- History of previous hepatobiliary surgery
- Legal guardians who refused consent
- Children with other severe congenital anomalies

Study Procedure

The study was conducted at the Department of Pediatric Surgery, DMCH. All children with choledochal cysts scheduled for surgery during the study period were evaluated. Diagnosis was established clinically and supported by investigations including ultrasonography (USG) of the whole abdomen, magnetic resonance cholangiopancreatography (MRCP), and biochemical tests (SGPT, ALP, serum bilirubin). The study purpose, procedure, and benefits were explained to parents or guardians, and informed written consent was obtained. Ethical approval was obtained from the Ethical Review Committee (ERC) of DMCH. Preoperative assessment included complete blood count, serum creatinine, urinalysis, and chest X-ray. Parents were counseled regarding surgical procedures, outcomes, and potential complications. Patients were then allocated into two groups using computer-generated simple random sampling:

- **Group A:** Hepaticojejunostomy without Roux-en-Y
- **Group B:** Hepaticojejunostomy with Roux-en-Y

Operative Procedure

All patients received prophylactic intravenous antibiotics (Cefuroxime 10 mg/kg and Metronidazole 1.5 mg/kg/dose). A right supraumbilical transverse incision was made, and the cyst and gallbladder were dissected and excised.

Group A: A loop of jejunum 30 cm from the duodenojejunal (DJ) junction was used for end-to-side hepaticojejunostomy with vicryl 5-0 suture.

Group B: A Roux-en-Y limb was created by dividing the jejunum 15–20 cm from the DJ junction. The efferent limb was anastomosed to the common hepatic duct with vicryl 5-0 suture.

In both groups, hemostasis was secured, a drain was placed, and the abdomen was closed in layers.

Postoperative Care and Follow-up

Immediate postoperative monitoring included:

- Vital signs
- NG tube output (24-hourly)
- Drain tube output (24-hourly) to detect bile leakage
- Bowel sounds and return of bowel movements
- Documentation of flatus

Follow-up after discharge:

- 1st follow-up: 15 days
- 2nd follow-up: 1 month
- 3rd follow-up: 3 months
- 4th follow-up: 6 months

Follow-up included febrile episodes, USG of abdomen (hepatobiliary system & pancreas), SGPT, ALP, and serum bilirubin levels.

Data Collection

Data were collected using a preformed data collection sheet containing history, clinical examination, investigations, operative details, and follow-up findings.

Data Processing and Analysis

Data were analyzed using SPSS version 26.0. Continuous variables were expressed as mean ± standard deviation (SD), and categorical variables as frequency and percentage. Chi-square test was applied for categorical variables, and $p < 0.05$ was considered statistically significant.

Results

This study was conducted at the Department of Pediatric surgery, Dhaka Medical College Hospital, Dhaka from March 2019 to September 2020 to evaluate the outcomes of hepaticojejunostomy with or without Roux-en-Y. The analysis data are presented in the table in this chapter. The results are as follows:

Table 1: Gender distribution of the study population (N=40)

Gender	Group				Total
	Group A		Group B		
	n=20	%	n=20	%	
Male	05	25	04	20.0	09
Female	15	75	16	80.0	31
Total	20	100	20	100.0	40

Table showing in study group A, 15(75%) were female and 05(25%) were male. And in study group B, 16(80%) were female and 04(20%) were male.

Table 2: Distribution of study patients according to anastomotic leakage (n=40)

Anastomotic leakage	Study group				Total	p value
	Group A		Group B			
	n=20	%	n=20	%		
Present	01	5.00	02	10.00	03	0.54
Absent	19	95.00	18	90.00	37	
Total	20	100.00	20	100.00	40	

p value reached from chai-square test (Fisher exact test)

Table showing in study group A, 01(5%) had anastomotic leakage and 19(95%) had no anastomotic leakage. And in study group B, 02(10%) had anastomotic leakage and 18(90%) had no anastomotic leakage.

Table 3: Comparison between mean time to establish oral feeding with study groups (n=40)

	Study group		p value
	Group A n=20	Group B n=20	
	Mean ±SD	Mean ±SD	
Time to establish oral feeding in day	3.70 (±0.65)	5.50(±1.19)	<0.05

p value reached from Unpaired t test

Table showing in study group A, the mean time to establish oral feeding in day is 3.70 (±0.65) and in study group B, the mean time to establish oral feeding in day is 5.50 (±1.19). That was statistically significant (p<0.05).

Table 4: Mean duration of postoperative hospital stay (in day) between study groups (n=40)

	Group		p value
	Group A n=20	Group B n=20	
	Mean ±SD	Mean ±SD	
Duration of hospital stay	8.0 (±1.21)	9.80(±1.28)	<0.05

p value reached from Unpaired t test

Table showing in study group A, the mean duration of hospital stay is 8.0 (±1.21) and in study group B, the mean duration of hospital stay is 9.80(±1.28). That was statistically significant (p<0.05).

Table 5: Comparison between febrile episodes in different follow up after operation with study groups (n=40)

Fever	Group				Total	p value
	Group A		Group B			
	n=20	%	n=20	%		
At 15 days	03	15.00	04	20.00	07	0.28
At 1st month	01	5.00	03	15.0	04	0.24
At 3rd month	00	00.0	00	00.0	00	--
At 6th month	00	0.00	00	00.0	00	--

Table showing fever after operation at 15 days follow up in study group A is 3(15.00) % and is 4(20.00%) in study group B. At 1st month follow up, fever after operation is 01(5.00%) in study group A and is 03 (15.00%) in study group B. At 3rd month and 6th month follow up, no participant experienced febrile episode. This rate of deduction was not significant statistically.

Table 6: Comparison between USG abnormalities in different follow up after operation with study groups (n=40)

USG	Group				Total
	Group A		Group B		
	n=20	%	n=20	%	
At 15 days	03	15.00	04	20.00	07
At 1st month	01	5.00	03	15.0	04
At 3rd month	00	00.00	00	00.0	00
At 6th month	00	00.0	00	00.0	00

Table showing USG abnormality after operation at 15 days follow up in study group A is 3(15.00) % and is 4(20.00%) in study group B. At 1st month follow up, USG abnormality after operation in study group A is 1(05.0%) and is 3(15.00%) in study group B. At 3rd month follow up and 6th month follow up; no USG abnormality was found in both groups.

Table 7: Comparison between mean SGPT (IU/L) in different follow up with study groups (n=40)

SGPT	Group		p value
	Group A n=20	Group B n=20	
	Mean ±SD	Mean ±SD	
At 15 days	72.85 (±11.49)	63.45(±9.52)	<0.001
At 1st month	45.25(±7.40)	43.85(±10.19)	0.24
At 3rd month	39.35 (±3.63)	38.27(±3.19)	0.17
At 6th month	32.71(±2.58)	29.10(±16.91)	0.19

p value reached from Unpaired t test

Table showing at 15 days follow up, the mean SGPT is 72.85 (±11.49) in study group A and is 63.45(±9.52) in study group B. At 1st month follow up, the mean SGPT is 45.25(±7.40) in study group A and is 43.85(±10.19) in study group B. At 3rd month follow up, the mean SGPT is 39.35 (±3.63) in study group A and is 38.27(±3.19) in study group B. In the follow up at month number 6, the mean SGPT is 32.71(±2.58) in study group A and is 29.10(±16.91) in study group B.

Table 8: Comparison between mean serum bilirubin (mg/dl) in different follow up with study groups

Serum Bilirubin	**Group**		**p value**
	Group A n=20	**Group B n=20**	
	Mean ±SD	Mean ±SD	
3rd POD	1.67(±1.06)	1.46(±1.18)	0.56
At 15 days	0.972 (±0.27)	0.98(±0.38)	0.76
At 1st month	0.86(±0.19)	0.84(±0.17)	0.21
At 3rd month	0.79 (±0.21)	0.81(±0.17)	0.46
At 6th month	0.67(±0.21)	0.71(±0.35)	0.57

p value reached from Unpaired t test

Table showing the mean serum bilirubin in initial stage is 1.67(±1.06) in study group A and is 1.46(±1.18) in study group B. At 15 days follow up, the mean serum bilirubin is 0.972 (±0.27) in study group A and is 0.98(±0.38) in study group B. At 1st month follow up, the mean serum bilirubin is 0.86(±0.19) in study group A and is 0.84(±0.17) in study group B. At 3rd month follow up, the mean serum bilirubin is 0.79 (±0.21) in study group A and is 0.81(±0.17) in study group B. In the follow up at month number 6, the mean serum bilirubin is 0.67(±0.21) in study group A and is 0.71(±0.35) in study group B.

Table 9: Comparison between mean ALP (IU/L) with study groups (n=40)

ALP	**Group**		**p value**
	Group A n=20	**Group B n=20**	
	Mean ±SD	**Mean ±SD**	
At 15 days	67.59 (±12.80)	71.75(±17.67)	0.33
At 1st month	62.25(±7.40)	65.82(±10.19)	0.25
At 3rd month	49.35 (±3.63)	51.27(±3.19)	0.83
At 6th month	42.71(±2.58)	43.10(±6.91)	0.81

p value reached from Unpaired t test

Table showing at 15 days follow up, the mean ALP (IU/L) were 67.59 (±12.80) in study group A and is 71.75(±17.67) in study group B. At 1st month follow up, the mean serum ALP is 62.25(±7.40) in study group A and is 65.82(±10.19) in study group B. At 3rd month follow up, the mean serum ALP is 49.35 (±3.63) in study group A and is 51.27(±3.19) in study group B. In the follow up at month number 6, the mean serum ALP is 42.71(±2.58) in study group A and is 43.10 (±6.91) in study group B.

Discussion

This Quasi Experimental Study was carried out in the Department of Pediatric Surgery, Dhaka Medical College, Dhaka. The main aim of this study was to evaluate the outcomes of hepaticojejunostomy with or without Roux- en-Y. During the above period total 40 patients of choledochal cysts were admitted to the department of pediatric surgery. Total number of patients in group A was 20 and in group B were 20. Type I choledochal cyst was the most common finding seen in 29 cases. It is followed by Type IV cysts, but Type II cyst was not detected in this study group. In this study 31(80%) were female and 09 (20%) were male. Congo et al., (2012) revealed that 11 females (92%) and 1 male with a median age at surgery of 4.2 years (range 1.1-9.3 years). Similar observation was found Tamang et al., (2014) they reported there were nine males (45%) and 11 females (55%). Ray et al.,[8] reported that the female predominance of this disease is widely reported with female to male ratio of 3-4:1 [1,8]. Current study, it was observed that among the 20 patients in study group A, 01(5.00%) had anastomotic leakage and 19 (95.00%) had no anastomotic leakage. Among the 20 patients in study group B, 02 (10.00%) had anastomotic leakage and 18(90.00%) had no anastomotic leakage. These anatomotic leakages were

managed conservatively. Li, et al [9] developed a grading system for bile leakage severity for use in pediatric patients following Roux-en-Y hepaticojejunostomy. By applying the criteria to 267 patients, grade I, II, or III bile leakage was determined in 103 patients (8.7%), 115 patients (9.8%), and 49 patients (4.2%) patients, respectively. Our findings showed that in study group A, the mean time to establish oral feeding in day is 3.70 (±0.65) and in study group B, the mean time to establish oral feeding in day is 5.50 (±1.19). Ray et al., [8] reported bilious RT aspirate was seen up to 4 days postoperatively in group A and the average time to start oral feeds was 6 days. RT aspirate was bilious upto 3 days on an average in group B patients and the feeding was started on 4 days after surgery. Shah et al.,[10] also reported postoperative enteral feeding 3.3 (0.5) days vs 5.0 (0.7) days; (P=<.0001). In study of Tang et al.,[11] also reported time to oral intake (3.73±0.21 vs 3.77±0.20 days, P=0.889). Present study observed that in study group A, the mean duration of postoperative hospital stay is 8.0 (±1.21) and in study group B, the mean duration of hospital stay is 9.80(±1.28). Ray et al.,[8] reported mean duration of hospitalization was 9 days in both the groups and there was no mortality in any group. Shah et al.,[10] reported length of hospital stay 7.5 (0.7) days vs 9.7 (1.2) days; (P=<.0001). Tang et al.,[11] also observed postoperative hospital stay (7.60±0.25 vs 7.41± 0.21 days, P=0.627), the differences were also non-significant. In this study showed 15 days follow up, the mean SGPT is 72.85 (±11.49) in study group A and is 63.45(±9.52) in study group B. At 1st month follow up, the mean SGPT is 45.25(±7.40) in group A and is 43.85(±10.19) in group B. At 3rd month follow up, the mean SGPT is 39.35 (±3.63) in group A and is 38.27(±3.19) in group B. In the follow up at month number 6, the mean SGPT is 32.71(±2.58) in study group A and is 29.10(±16.91) in study group B. Shah et al.,[10] reported postoperative Serum SGPT, IU/L were significantly different between two groups (<0.05). Present study showed that the mean serum bilirubin in initial stage is 1.67(±1.06) in study group A and is 1.46(±1.18) in study group B. At 15 days follow up, the mean serum bilirubin is 0.972 (±0.27) in group A and is 0.98(±0.38) in group B. At 1st month follow up, the mean serum bilirubin is 0.86(±0.19) in group A and is 0.84(±0.17) in group B. At 3rd month follow up, the mean serum bilirubin is 0.79 (±0.21) in group A and is 0.81(±0.17) in group B. In the follow up at month number 6, the mean serum bilirubin is 0.67(±0.21) in group A and is 0.71(±0.35) in group B. Jaundice and abdominal pain were also prominent features in the study by Silva-Baez et al accounting for 78.5% and 85.7% of cases respectively. Shah et al.,[10] reported postoperative Serum bilirubin, µmol/L were significantly different between two groups (<0.05). Present study showed that, at 15 days follow up, the mean ALP (IU/L) were 67.59 (±12.80) in study group A and is 71.75(±17.67) in study group B. At 1st month follow up, the mean serum ALP is 62.25(±7.40) in group A and is 65.82(±10.19) in group B. At 3rd month follow up, the mean serum ALP is 49.35 (±3.63) in group A and is 51.27(±3.19) in group B. In the follow up at month number 6, the mean serum ALP is 42.71(±2.58) in group A and is 43.10(±6.91) in group B. Shah et al.,[10] reported postoperative Serum ALP, IU/L were significantly different between two groups (<0.05).

Conclusion

In choledochal cyst, complete excision of cyst and good bilioenteric anastomosis should be done. Hepaticojejunostomy without Roux-en-Y is a simple, quick procedure with preservation of normal anatomy and physiology and minimum complications. It also avoids multiple intestinal anastomoses and so can be adopted as a better approach.

Limitations

- Operations were not done by same surgeon.
- Was not multicenter study.
- Lack of long time follow up.

Recommendations

- Further multicenter studies can be undertaken by including large number of patients.
- However, multicenter data are needed for undertaking comparative analysis.

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