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EVALUATION OF EARLY POSTOPERATIVE OUTCOME OF HEPATICO-DUODENOSTOMY AND ROUX-EN-Y HEPATICOJEJUNOSTOMY FOR THE TREATMENT OF CHOLEDOCHAL CYST: A COMPARATIVE STUDY

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Purpose: Choledochal cyst is a developmental defect of the biliary channel with a wide spectrum of complications. Excision of cyst & biliary reconstruction is the treatment of choice. In our country, Roux-en-Y hepaticojejunostomy (RYHJ) and Hepaticoduodenostomy (HD) both are performed for biliary reconstruction. In this study we have tried to compare the outcome of both of the procedures and whether anyone has superiority in terms of operative technique or early postoperative outcome. **Methods:** It is an observational type of prospective comparative study. The study period was from January 2016 to February 2017. The study has done in the Pediatric Surgery Department of BSMMU, Dhaka, Bangladesh. This included 36 patients with choledochal cyst. The study population was divided into two groups according to the method used for biliary reconstruction. Group A included 18 patients who underwent HD, while group B included 18 patients treated with RYHJ. Demographic and outcome data were compared using unpaired t-test. **Results:** The mean operative time was shorter in group A in 87.78 ± 19.94 minutes than in group B, 166.11 ± 34.45 minutes, p-value <0.001, which is significant. Hospital stay was comparable in both groups 6.83 ± 1.88 days in group A and 9.23 ± 2.27 days in group B, the p-value is significant. There were no major intraoperative complications in either group. Four patients of group B

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and one patient of group A were prolonged ileus. Total four patients had anastomotic leakage, one from group A and three from the group. One patient of each group needed re-laparotomy, the rest of the two patients was improved after conservative management. **Conclusions:** In this study, HD required less operative time and avoidance of intestinal anastomosis, less hospital stay time, and no severe complications in comparison to RYHJ.

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I INTRODUCTION

Choledochal cyst is a rare disease but potentially serious with a wide spectrum of complications. The definitive treatment is an operation aiming at complete cyst excision and reconstruction of the biliary channel [1]. There are various types of operative procedures like Roux-en-Y hepaticojejunostomy, hepaticoduodenostomy, jejunal interposition hepaticoduodenostomy (Chicago Beijing procedure), appendix interposition, cholecystocholedochoduodenostomy, etc. with their advantages and disadvantages. Among all surgical procedures, Roux-en-Y hepaticojejunostomy is widely practiced. Mcwhorter first described cyst excision and hepaticojejunostomy in 1924, this surgery was initially abandoned because of multiple complications [2]. The chance of early complications like intestinal obstruction (intussusception), adhesive bowel obstruction, and anastomotic leakage is more in this procedure. Late complications are caused due to bile stasis in a long blind loop and anastomotic stricture, which subsequently causes ascending cholangitis and stone formation, liver failure, or cancer [3]. Hepaticoduodenostomy was started to avoid these complications. Hepaticoduodenostomy is also suitable for a laparoscopic procedure. But it has some complications like bile reflux and gastric ulcer and adenocarcinoma in gastric mucosa [4]. Some current studies documented no such types of complications [5]. Rather more physiological, as bile drain into very near to the normal drainage site of the duodenum. One study recommended hepaticoduodenostomy in their context as it is less expensive for the patients [6]. In our country, we have no definitive research work to compare the outcome of Roux en Y hepaticojejuno and hepaticoduodenostomy. In our perspective hepaticoduodenostomy may be more beneficial for the patient, because operation time is short, oral feeding can be started early, less morbidity so shorter hospital stay. Less chance of adhesive bowel obstruction and cholangitis, so less chance of reoperation. On the other hand, Roux-en-Y hepaticojejunostomy is a lengthy procedure; it needs a more skilled surgeon, skilled anesthetist. The chance of per operative complications like iatrogenic perforation and excessive blood loss is more, so morbidity is more. Nearby ICU support is sometimes required. So this procedure must be performed in a super-specialized center. So in our study, we shall try to observe any specific benefit that patients can get after hepaticoduodenostomy over Roux-en-Y hepaticojejunostomy.

II METHODOLOGY

A total of thirty-six (36) patients with Type I choledochal cyst patients without the feature of active cholangitis or any acute inflammatory manifestation or associated congenital anomalies admitted in the department of pediatric surgery, BSMMU, Dhaka, Bangladesh during the period of January 2016 to February 2017 for the operation were enrolled for this study. Patients were grouped as Hepaticoduodenostomy (HD) group or group A and Roux-en-Y hepaticojejunostomy (RYHJ) group or group

B according to their operative procedure. The preoperative evaluation was done as per clinical examination, laboratory and radiological findings, and the diagnosis was confirmed by USG and or MRCP. All were acute symptoms free for the last two months. Eighteen patients of group A were treated with Hepaticoduodenostomy,where excision of the cyst was done, then duodenum was mobilized and anastomosed with the normal segment of the hepatic duct by six or seven interrupted suture with vicryl 4-0. In Roux-en-Y hepaticojejunostomy group or group B, the rest of the eighteen patients Roux-en-Y hepaticojejunostomy done. Where after excision of the cyst, the jejunum was divided about 15 cm away from the DJ junction, Roux loop was then passed through omentum making a window, and then anastomosed with the hepatic duct by interrupted suture. The proximal part of the jejunum we anastomosed as a single layer end to side about 30-40 cm distally. Duration of operation and amount of blood loss were measured in both groups. A drain tube was kept in Morison's pouch.

Postoperatively al the patients were monitored in the post-operative ward and treated with intravenous fluids, parenteral broad-spectrum antibiotics with metronidazole, and pain killer along with antiulcer drugs. We monitored the vitals of the patients. NG tube collection and drain tube collection were measured daily (twenty-four hourly). Bowel sound was noted three times a day before the return of bowel movement. Additionally, it was advised to the patient or mother to note the passage of flatus, after then feeding established. Postoperative complications like features of intestinal obstruction, anastomotic leakage, and peritonitis, sepsis, wound infection, and dehiscence were noted. After discharge from the hospital four follow up have been taken place, after 15 days, 1 month, 3 months, and 6 months. Statistical analysis of the data has done by using computer-based statistical software, SPSS windows software, supplied by BSMMU. For normally distributive quantitative data which has been compared by unpaired t-test. A 'P-value of <0.05 has considered statistically significant.

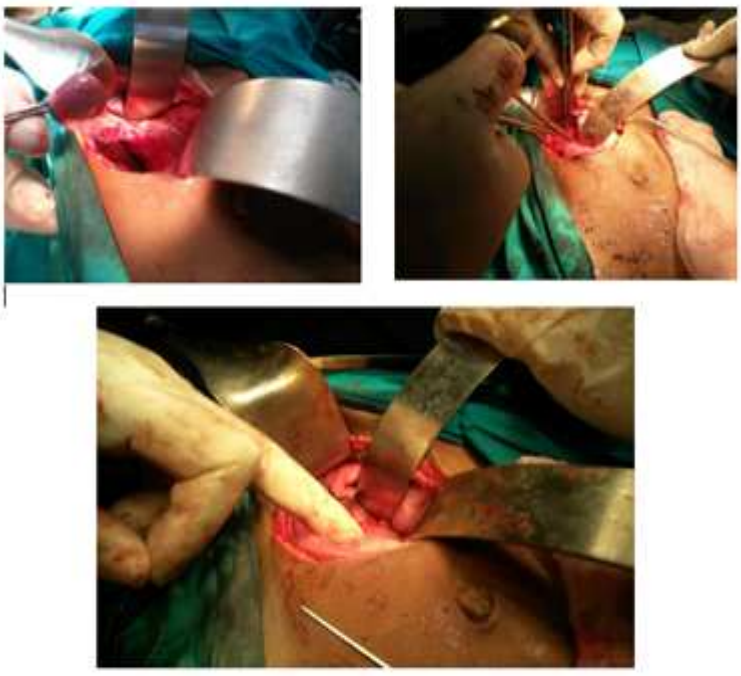

Fig.-1: Some operative photographs of hepaticoduodenostomy.

III RESULTS

A total of thirty-six (36) patients (18 in each group) with Type I choledochal cyst was categorized as Hepaticodudenostomy (HD) group or group A and Roux-en-Y hepaticojejunostomy (RYHJ) group or group B according to their operative procedure. All the patients were acute symptoms free during hospital admission. Preoperative time and early postoperative periods of both groups were observed till six (6) months in four follow-ups. There were no significant differences among the patients in both groups concerning the demographic characteristics of the patients.

Distribution of duration of operation in two groups:

Table I shows the mean ± SD of the duration of the operation. Duration of operation was 87.78 ± 19.94 minutes in group A and 166.11 ± 34.45 minutes in group B, p-value <0.001, which is significant.

Table I: Distribution of duration of operation in two groups (n=36)

Parameters	Group		p-value
	Group A (HD)	Group B (RYHJ)	
Duration of operation (minutes)	87.78 ± 19.94	166.11 ± 34.45	<0.001

P value <0.05 is significant.

Distribution of the number of anastomosis in both groups:

Table II shows the number of anastomosis 1.22 ± 0.73 in group A and 2.00 ± 0.00 in group B, p-value <0.001. Here p-value is significant.

Table II: Distribution of the number of anastomosis in both groups.

Parameters	Group		
	Group A (HD)	Group B (RYHJ)	p-value
Number of anastomosis	1.22 ± 0.73	2.00 ± 0.00	<0.001

P-value is <0.05 is significant.

Distribution of time of the return of gut motility:

Table III shows the time of the return of gut motility in both groups after the operation. Prolonged ileus was detected clinically by the appearance of bowel sound, abdominal distention, and amount of nasogastric tube collection. Prolonged ileus was noted in 4 patients in group B and one in group A. Among the four patients, one had returned bowel motility on 3rd POD, one on 4th, and another two on 5th POD. In HD group, bowel sound returned on 3rd POD

Table III: Postoperative prolonged ileus in two groups (n=36)

Postoperative Prolonged Ileus	Group		
	Group A (HD)	Group B (RY)	p-value
On the 3rd postoperative day	1 (5.6%)	1 (5.6%)	
On 4th postoperative day	0 (0.0)	1 (5.6%)	
On 5th postoperative day	0 (0.0)	2 (11.1%)	<0.05

P <0.05 is significant.

Distribution of abdominal distention first noted in the postoperative period:

Table IV shows the distribution of abdominal distention in both groups. Abdominal distention is an important indicator for prolonged ileus and anastomotic leakage in the postoperative period. In the HD group or groupA, distention was noted on 2nd and 5th POD in one patient each time. In the 2nd POD, it was due to prolonged ileus, and in the 5th POD due to anastomotic leakage, which needed reoperation. On the other hand, in the RYHJ group distention was noted on 2nd, 3rd, 4th, 5th, and 6th POD. In 2nd and 3rd POD it was noted in two patients, one in each day, it was due to prolonged ileus. But in the 4th POD distention noted in three patients, among them two had prolonged ileus, one had anastomotic leakage. In the 5th and 6th POD, abdominal distention was also observed in two patients with excessive drain tube collection, which were diagnosed as anastomotic leakage.

Table IV: Distribution of abdominal distention noted for the first time in the postoperative period.

	Group A (HD)	Group B (RYHJ)
2nd POd	1 (5.6%)	2 (11.11%)
3rd POD	0	1(5.6%)
4th POD	0	3(16.6%)
5th POD	1(5.6%)	1(5.6%)
6th POD		1(5.6%)

Distribution of anastomotic leakage in the postoperative period in both groups:

Table V shows the distribution of anastomotic leakage in both groups. Anastomotic leakage was diagnosed clinically by abdominal distention, amount and color of the drain tube, absence of bowel sound. In group A it occurred on only one patient on the 5th postoperative day, who had needed re-laparotomy. In group B anastomotic leakage was noted in three patients, which were 16.7% of the total group. It was observed in each patient on the 4th, 5th, and 6th postoperative days. Among them one patient needed a relaparotomy, another two patients improved by conservative treatment.

Table V: Postoperative anastomotic leakages in two groups (n=36)

Postoperative complications	Group		
	Group A (HD)	Group B (RYHJ)	p-value
On the 4th postoperative day	0 (0.0)	1 (5.6)	1.000
On the 5th postoperative day	1 (5.6)	1 (5.6)	1.000
On the 6th postoperative day	0 (0.0)	1 (5.6)	1.000

Distribution of amount of drain tube collection in both groups:

Table VI shows the drain tube collection of both groups from 1st to 6th POD. In 1st POD drain tube collection was more in the RYHJ group than HD group, which is statistically significant. The drain tube collection was gradually reduced in 2n, 3rd, and 4th POD in HD group, but static in 5th POD as anastomotic leakage happened then. The same result is noted in the RYHJ group, where drain tube collection was gradually diminished in 2nd and 3rd POD, but almost static in 4th, 5th, and 6th POD because anastomotic leakage was noted in three patients.

Table VI: Distribution of drain tube collection in both groups (n= 36)

	HD(n=18) (ml)	**RYHJ (n=18) (ml)**	**P value**
1st POD	100 ± 15	200 ± 15	<0.05
2nd POD	70 ± 10	160 ± 15	0.126
3rd POD	60 ± 5	100± 7	0.986
4th POD	50 ± 10	90 ± 10	0.543
5th POD	50 ± 5	80 ± 10	0.864
6th POD	30 ± 5	80 ± 4	0.076

P value < 0.05 is significant.

Distribution of time of discharge from hospital:

Table VII shows the distribution of discharges from the hospital in both groups. Discharged from hospital in group A was 6.83 ± 1.88 postoperative day and in group B 9.23 ± 2.27 postoperative day. P-value is 0.002 and is significant.

Table VII: Distribution of time of discharge from hospital.

	Group		p-value
	Group A (HD)	Group B (RY)	
Discharged from the hospital (POD)	6.83 ± 1.88	9.23 ± 2.27	0.002

P-value is significant.

Follow up of postoperative sign symptom of intestinal obstruction in both of the groups

Table VIII shows the distribution of postoperative signs and symptoms of both groups. In four follow up none of the groups were presented with any symptoms and signs of intestinal obstruction

Table VIII: Postoperative signs and symptoms of intestinal obstruction in two groups (n=36)

Symptoms of intestinal obstruction	Group		p-value
	Group A (HD)	Group B (RY)	
1st follow up	0 (0.0)	0 (0.0)	
2nd follow up	0 (0.0)	0 (0.0)	
3rd follow up	0 (0.0)	0 (0.0)	
4th follow up	0 (0.0)	0 (0.0)	

Follow up of features of postoperative cholangitis in both groups:

Table IX shows the distribution of features of postoperative cholangitis in four (4) follow up. None of the patients in each presented with any features of cholangitis in four follow up within six months of surgery.

Table IX: Postoperative symptoms of cholangitis in two groups (n=35)

Symptoms of cholangitis	Group		p-value
	Group A (HD)	Group B (RY)	
1st follow up	0 (0.0)	0 (0.0)	
2nd follow up	0 (0.0)	0 (0.0)	
3rd follow up	0 (0.0)	0 (0.0)	
4th follow up	0 (0.0)	0 (0.0)	

Postoperative serum bilirubin level in both groups:

Table X shows postoperative serum bilirubin levels in both groups. In 1st postoperative follow up the level was 0.73 ± 2.90 in group A and 0.73 ± 2.90 in group B. subsequently on 2nd, 3rd and 4th follow up it was 0.73 ± 2.90, 0.56 ± 0.45 and 0.54 ± 0.61 in group A and 0.61 ± 0.00, 0.79 ± 1.89 and 0.58 ± 0.94 in group B. All the values are statistically insignificant.

Table X: Preoperative and postoperative serum bilirubin level in both groups in two groups (n=36)

	Group		p-value
	Group A (HD)	Group B (RYHJ)	
On 1st follow up	0.73 ± 2.90	0.79 ± 3.01	0.865
On 2nd follow up	0.57 ± 0.73	0.61 ± 0.00	0.893

On 3rd follow up	0.56 ± 0.45	0.79 ± 1.89	0.975
On 4th follow up	0.54 ± 0.61	0.58 ± 0.94	0.889

Postoperative CBC findings in 1st follow up in both groups:

Table XI shows hemoglobin was10.09 ± 2.00(gm/dl) in group A and 10.64 ± 2.5 in group B. WBC was 7.83 ± 3.11 in group A and 7.54 ± 2.90 in group B. platelet count was 1.50 ± 1.0 in group A and 1.15 ± 1.09 in group B. p values of all are non-significant .

Table XI: Distribution of hemoglobin level, total WBC counts, and platelet counts in follow up periods.

	Group A(HD) (Mean ± SD)	**Group B(RYHJ) (Mean ± SD)**	**P-value**
Blood Hemoglobin (g/dl)	10.09 ± 2.00	10.64 ± 2.5	1
Total WBC count (K/mcL)	7.83 ± 3.11	7.54 ± 2.90	0.981
Total platelet count (K/mcL)	1.50 ± 1.0	1.15 ± 1.09	0.994

IV DISCUSSION

A choledochal cyst is a potentially serious disease with its complications if it is not treated. The treatment of choledochal cyst has been changed in the past three decades. In the past, type I, II, and IV choledochal cysts have been treated by choledochal cystdudenostomy or Roux-en-Y cystjejunostomy. Both of the approaches were complicated by recurrent cholangitis and biliary cirrhosis in most patients because of stasis within the cyst and chronic inflammation occurs within a retained cyst, and the possibility of malignant degeneration [7]. Currently, excision of the cyst and internal drainage by biliary reconstruction is the standard treatment for choledochal cyst. This approach is considered the most effective method of avoiding recurrent cholangitis and the late possibility of malignant degeneration in the wall of the cyst [6]. There are so many approaches practiced worldwide widely for biliary reconstructions, like Roux-en-Y hepaticojejunostomy, hepaticoduodenostomy, jejunal interposition hepaticoduodenostomy (Chicago-Beijing procedures), appendix interposition. But none of the techniques can fulfill the normal physiology of bile drainage without complications, which are produced by the operative procedure. Till now surgeons are searching for newer techniques, which will be more convenient. Among all the procedures Roux-en-Y hepaticojejunostomy is widely practiced because it thought that it has more sphincter function which is artificially created. But it has some immediate postoperative and long-term complications like anastomotic leakage, postoperative adhesive bowel obstruction, and peptic ulcer [4]. Some authors reported many complications in RYHJ like stone formation in an elongated pouch of Roux en Y jejunal limb due to stasis of bile, bowel obstruction caused by adhesions between the elongated blind pouch and small bowel, duodenal obstruction caused by compression by a high Roux en Y limb vascular arch [8]. On the other hand delivery of bile into the duodenum, rather than into a Roux en Y limb

of the jejunum is considered to be more physiological. But this procedure had also some complications like recurrent cholangitis, [7] duodenogastric bile reflux associated with gastritis or esophagitis [9]. Shimotakahara A and his colleague emphasized that the postoperative complications related to RYHJ like adhesive bowel obstruction and cholangitis (7.1%) were significantly lower than HD like bilious gastritis (33.3%) [11]. On the other hand, Elhalaby E et al did not notice any statistically significant difference in complications in RYHJ and HD groups. But they had some limitations [6]. Their sample size was small (27) and the number was not equal in both groups (18 in RYHJ and 9 in the HD group) [6]. All the patient of this study was admitted in this hospital as a known case of choledochal cyst for operative management. They have no acute presentation, like fever, abdominal pain, and jaundice for the last two to three months. All were diagnosed by ultrasonography and or MRCP. Most of the patients had normal levels of serum bilirubin preoperatively. Other liver function tests and complete blood count were pre-operatively normal in both groups. All patients were undergone as a routine operation. Roux-en-Y hepaticojejunostomy is considered an ideal technique, but hepaticoduodenostomy now a day had wide acceptance among the open as well as laparoscopic surgeons for its advantage over RYHJ. Hepaticoduodenostomy requires less operative time, allows faster recovery of bowel function, and produces fewer complications requiring reoperation [10]. In this study, bowel peristalsis was returned earlier in the HD group. Bowel sound returned within 48 hours in all the patients of this group except one, which returns on 3rd POD. On the other hand, four patients had prolonged post-surgical ileus in the RYHJ group. The bowel sound of those patients was heard on the 3rd, 4th, and 5th POD, all patients were managed conservatively. Hepaticoduodenostomy had fewer complications, like adhesive bowel obstruction, anastomotic leakage, and peptic ulcer in comparison to RYHJ [4]. This study also supports that statement. Anastomotic leakage is less in the HD group than in the RYHJ group in this study. Three patients (16.7%) of the RYHJ group had anastomotic leakage, whereas only one patient (5.6%) in the HD group. Among the four patients, two were improved after conservative management, but two patients of each group needed re-operation. It is advocated not to perform HD, when intrahepatic biliary channels are dilated or when the diameter of the common hepatic duct is more than 10 mm. Because duodenal contents are likely to reflux easily into the intrahepatic bile duct through HD anastomosis. These contents remain in the intrahepatic duct for a longer time and damage the duct mucosa, causes cholangitis or anastomotic stricture formation [11]. A relatively high incidence of duodenogastric bile reflux is associated with either gastritis or esophagitis after HD [9]. Takada et al studied the duodenogastric reflux in 8 patients and reported excessive duodenogastric biliary reflux in the HD group (3/3) compared to RYHJ (0/5), though there was no significant difference in the histology of gastric mucosa in both groups [9]. They recommended RYHJ rather than HD for the technique of biliary reconstruction for pediatric patients with choledochal cyst. But their conclusion can't be justified due to the very small sample size. Similarly, Shimatakahara et al reported a current epigastric discomfort postoperatively in 33.3% of patients who had HD [11]. A high incidence of duodenogastric bile reflux associated with either gastritis or esophagitis proven by endoscopy was reported in their patients. But Elhalaby E et al reported no duodenogastric biliary reflux clinically in their study [6]. In this study, no patient of either group was clinically presented with symptoms of bile reflux within six months after surgery. Stricture at the anastomotic site is another complication in all types of biliary

reconstruction. Vijay Patil and his colleagues suggested that hepaticoduodenostomy had an advantage over Roux-en-Y hepaticojejunostomy in that case; because stricture may be corrected endoscopically in case of HD, but not in RYHJ [5]. Development of biliary cancer is significantly decreased following cyst excision, but the possibility can still occur in any remnant of a retained cyst. Todani et al encountered a case of biliary cancer that developed 19 years after choledochal cyst excision with Hepaticoduodenostomy [13]. They now have abandoned this maneuver for biliary reconstruction. On the other hand, Shimatakahara et al still performing this procedure, but they recommended careful close observation and several radiologic investigations for any patients who have had hepaticoduodenostomy [12]. In a retrospective study, Elhalaby E et al had not faced this complication even in older patients of 18 years old [6]. In another retrospective study, Patil V et al shown their 25 years' experience with hepaticoduodenostomy, out of 56 patients none of them suffered from any kind of biliary tract cancer [5]. Elhalaby E et al concluded their study with a recommendation for HD due to its shorter operative time, their mean operative time was 160.4 minutes in the RYHJ group and 131.1 minutes in the HD group and avoidance of intestinal anastomosis [6]. Patil V et al also preferred HD as a relatively safe procedure with very low complication rates [5]. In this study mean operative time in both groups was 87.78 ± 19.94 minutes in the HD group and 166.11 ± 34.45 minutes in the RYHJ group, which is statistically significant. In HD, only one anastomosis was done in the subhepatic region after mobilization of the first and second part of the duodenum, the rest of the abdomen remains virgin. On the other hand, in RYHJ small intestine is transected in two sites, anastomosis was done in two points, the whole of the abdomen is disturbed during these lengthy procedures. Per operative blood loss was minimal in both groups, no blood transfusion was needed. No iatrogenic injury happened in surrounding structures. All patients were kept with a nasogastric tube and a drain tube in the subhepatic region. The nasogastric tube was removed when the tube collection was significantly diminished. In the HD group, nine patients on 4th POD, eight patients on 5th POD. In RYHJ nasogastric tube was removed on 5th POD in all patients except four patients, who had anastomotic leakage. Oral feed was tolerated by both groups at the same time, on the 5th postoperative day, except for the four patients with biliary leakage. Two of them improved after conservative management and restarted feeding after four days. Another two patients had not improved after conservative management and they underwent reoperation. All patients of the HD group had mobilized early from bed, came into regular bowel habits earlier. But most of the patients in the RYHJ group complained of pain for a longer time and passed stool in delayed. So they had stayed a long time in hospital. The difference between the time of discharge from the hospital is statically significant in both HD and RYHJ groups. The mean of these two groups is 6.83 ± 1.88 days in HD and 9.23 ± 2.27 days in the RYHJ group. During the four postoperative follow up, a detailed history was taken from the patient's mother. None of the patients had any history that elicited cholangitis or postoperative intestinal obstruction. They had no complaint of fever, jaundice, abdominal pain or abdominal pain, distention, vomiting, or constipation. Even though, we have done serum bilirubin and total blood count (CBC). These reports were normal in all patients. We did not do any USG as; none of the patients had any complications.

V CONCLUSION

There is no significant difference in early postoperative outcome in RYHJ and HD in terms of complications, but HD had some advantages over RYHJ for its shorter duration

of operation and shorter hospital stay. So we can conclude, that we can practice HD for the treatment of choledochal cyst in our context, but it needed a long-term follow-up.

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