Laparoscopic management of variant ductal and vascular anatomy in children with choledochal cysts

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Introduction

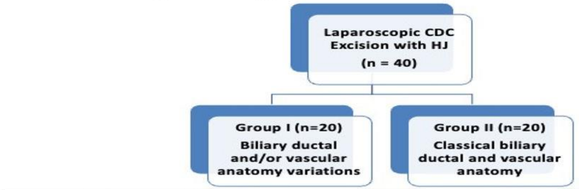
- Variations in biliary ductal and hepatic vascular anatomy significantly increase the surgical complexity.
- These often necessitate additional techniques to manage these variations.
- Failure to properly identify and address these variations during surgery can result in severe complications.
- The laparoscopic approach for the management of paediatric CDCs with variant anatomy is underreported.

Aims

- This study aimed to describe anatomical variations, operative techniques and early outcomes of laparoscopic hepaticojejunostomy (HJ) in children with CDCs and variant anatomy.

Methods and Materials

- ***Study design: retrospective*** review of prospectively maintained electronic medical records
- ***Study duration:*** November, 2019 to June, 2024
- ***Inclusion criteria:*** children who underwent laparoscopic CDC excision with HJ in a single surgical unit
- ***Exclusion criteria:*** Patients who underwent open or robotic CDC excision with HJ during the study period were excluded



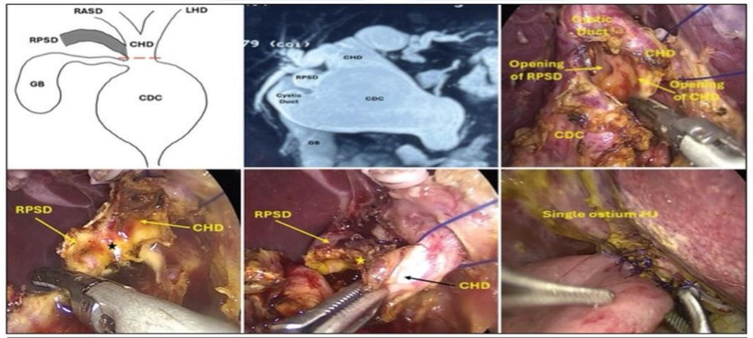


Fig. 1: (a) Aberrant RPSD joining the CHD (b) MRCP showing aberrant RPSD joining CHD (c) Laparoscopic image (d and e) CHD divided below the confluence with RPSD retaining a thin rim of tissue between the CHD and the aberrant duct (star) (f) completed single ostium HJ

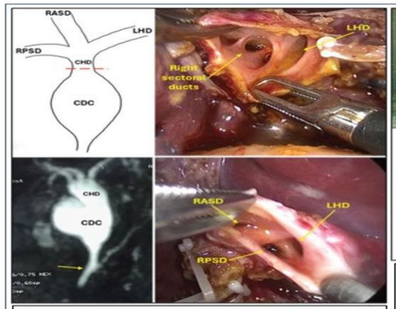


Figure 2: (a) Triple confluence anatomy (b) MRCP & (c and d) Laparoscopic images of triple confluence ductal anatomy

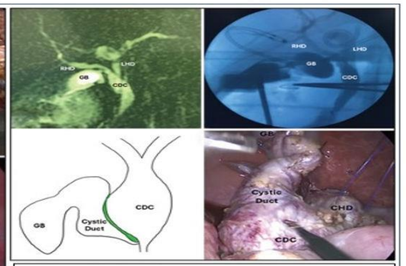


Figure 3: (a and b) MRCP image and laparoscopic POC of a patient showing cystic duct joining the right hepatic duct (c and d)dilated and bulbous cystic duct with low and parallel insertion into the choledochal cyst

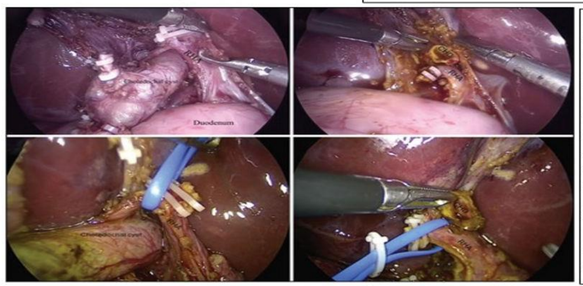


Figure 4: (a) Anteriorly crossing RHA in a patient (b) RHA transposed posterior to CHD for HJ in the same patient (c) Anteriorly crossing RHA in another patient (d) RHA transposed posterior to CHD for HJ in the same patient

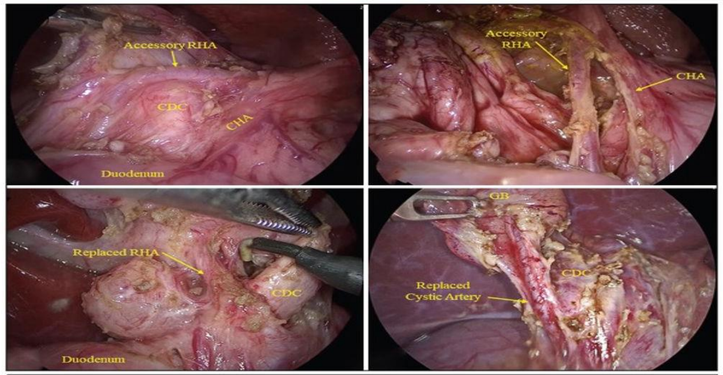


Figure 5: Vascular anomalies (a) Accessory right hepatic artery (RHA) (b) In the same patient, CDC has been excised and accessory RHA dissected (c) Replaced RHA dissected along the right postero-lateral border of CDC (d) Replaced cystic artery arising from common hepatic artery

Results

Table 1: Variations in biliary ductal and vascular anatomy

Anatomical variation	Number of patients (*n*=20)	Surgical technique to manage variations
Biliary ductal variations	8	
Aberrant RPSD joining CHD	2	CHD divided below the confluence with RPSD, single ostia HJ
Trifurcation at hilum	3	No implications on surgical technique
Cystic duct joining RHD	1	Cystic duct meticulously dissected till its junction with RHD and then clipped and divided
Dilated and bulbous cystic duct with parallel, low insertion in CBD	2	Cystic duct meticulously dissected till its junction with CBD and then clipped and divided
Vascular variations	10	
Anteriorly crossing RHA	6	RHA transposed posterior to the divided CHD with HJ done anterior to RHA
Accessory RHA	2	Identified early, carefully dissected away from the CDC and preserved
Replaced RHA	1	Identified early, carefully dissected away from the CDC and preserved
Replaced cystic artery arising from CHA	1	Cystic artery carefully dissected, clipped and divided
Both ductal and vascular variations	2	
RPSD joining CHD	1	CHD divided below the confluence with RPSD, single ostia HJ
Anteriorly crossing RHA		RHA transposed posterior to the divided CHD with HJ done anterior to RHA
RPSD joining CHD	1	CHD divided below the confluence with RPSD, single ostia HJ
Accessory cystic artery arising from LHA		Cystic artery carefully dissected, clipped and divided

Table 2: Comparison of demographic and pre-operative variables between Group I and Group II patients

Variable	Group I (*n*=20)	Group II (*n*=20)	*P*
Age (years)*	7.32 (5.23)	3.57 (3.10)	0.014
Infants, *n* (%)	1 (5)	4 (20)	0.339
Male:female	8:12	9:11	1.0
Clinical presentation, *n* (%)			
Recurrent abdominal pain	5 (25)	6 (30)	1.0
Cholangitis	9 (45)	5 (25)	0.32
Pancreatitis	6 (30)	7 (35)	1.0
CDC perforation with biliary peritonitis/ascites	0	2 (10)	0.468
Classification of CDC's on MRCP, *n* (%)			
Type 1	16 (80)	17 (85)	1.0
1A (cystic dilatation)	4	6	0.715
1B (focal saccular dilatation)	2	0	0.468
1C (smooth fusiform dilatation)	10	11	1.0
Type 4A	3 (15)	2 (10)	1.0
Forme fruste	1 (5)	1 (5)	1.0
Pre-operative ERCP with stenting, *n* (%)	5 (25)	2 (10)	0.405
Stent *in situ* at surgery	3	2	
Mean duration with biliary stents before surgical intervention (months)	5.4	2.5	

Table 3: Comparison of intraoperative and post-operative variables between Group I and Group II patients

Variable	Group I (*n*=20)	Group II (*n*=20)	*P*
POC, *n* (%)	3 (15)	1 (5)	0.552
Operative time (min)*	415 (36)	364 (48)	<0.0001
Intraoperative complications, *n* (%)	2 (10)	3 (15)	0.634
Requirement of blood transfusion	0	0	-
Conversion to laparotomy, *n* (%)	2 (10)	3 (15)	0.634
Post-operative bile leak, *n* (%)	2 (10) resolved conservatively	1 (5) resolved conservatively	0.552
Post-operative complications, *n* (%)	8 (40)	6 (30)	0.495
Clavien–Dindo Grade I–II	Port site infection (2), ascites (1), prolonged ileus (2), bile leak (2)	Port site infection (1), fever (1), bile leak (1)	
Clavien–Dindo Grade III–IV	HJ stricture (1)	Intra-abdominal collection requiring PCD (1), adhesive intestinal obstruction (1) liver failure (1)	
Readmission, *n* (%)	2 (10) 1 within 2 weeks for ascites 1 after 18 months for re-do HJ	0	0.139
Time to full enteral feeds (h)*	72 (8.5)	80 (6.2)	0.015
Switch to oral analgesia (h)	Within 48 h in all	Within 48 h in all	1.0
Hospital stay (days)*	10.89 (5.44)	8.06 (2.56)	0.058
Follow-up duration (months)*	27.84 (13.36)	30.24 (14.17)	0.605
Last follow-up serum GGT (U/L)*	51.32 (10.66)	20.71 (16.71)	0.246
Last follow-up serum albumin (g/dL)*	4.66 (0.36)	4.60 (0.74)	0.744

Conclusions

- This study provides valuable insights into the laparoscopic management of CDCs with variant ductal and vascular anatomy in children
- The findings highlight the necessity of thorough pre-operative imaging, meticulous intraoperative assessment and individualised surgical techniques to manage anatomical variations effectively
- While challenges remain in reliably identifying all anatomical variations preoperatively, the study demonstrates that with careful surgical planning and execution, successful outcomes can be achieved

References

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