

Bilioenteric Reconstruction after Pediatric Choledochal Cyst Excision

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The standard principles of treatment of choledochal cysts (CDCs) in children include excision along with bilioenteric reconstruction. Nonoperative management is associated with well-documented risks of cholangitis, pancreatitis, secondary biliary cirrhosis, and eventual biliary malignancy. The key controversy in contemporary practice is no longer whether to excise but *how best* to reconstruct the biliary tree. The common methods include the Roux-en-Y hepaticojejunostomy (HJ) or the hepaticoduodenostomy (HD). This debate has persisted for decades, shaped by evolving evidence, technical innovations, very similar functional outcomes, along with institutional and surgeon preferences.¹

In this context, the prospective experience from a tertiary center in the Indian subcontinent, comparing HJ and HD in 57 children following CDC excision, provides important region-specific data and a current perspective on this long-standing surgical dilemma.²

In the present series, 38 children underwent Roux-en-Y HJ and 19 underwent HD after complete cyst excision for type I and IV cysts. Demographic and clinical profiles were broadly comparable between groups, with a median age of 5 years in the HJ cohort and 3 years in the HD cohort and a female preponderance consistent with prior literature.³

Two key findings that stand out in this study. Firstly, operative efficiency clearly favored HD. The mean operative time was approximately 110 minutes for HD vs 176 minutes for HJ, and the median hospital stay was 7 vs 8 days, respectively. All patients were operated by the open technique. Secondly, early- and mid-term complication rates, including bile leak, wound infection, cholangitis, and anastomotic stricture, were similar in both groups. However, clinically evident duodenogastric bile reflux occurred in about 26% of HD patients and none in the patients undergoing HJ.

All bile reflux episodes responded to conservative management, and no strictures, intrahepatic stones, or malignancies were observed during a median follow-up of 36 months. These findings align broadly with the global experience. HD is safe and efficient in the short- to mid-term but carries a higher risk of bile reflux symptoms.

HD vs HJ

The debate around HD and HJ is not new. Narayanan and colleagues, in their systematic review and meta-analysis (SRMA) of pediatric CDC series, compared outcomes of HD and HJ across multiple institutions in 679 patients. Their pooled data analysis suggested that HD and HJ are comparable with respect to overall postoperative morbidity, bile leak, and anastomotic stricture. The HD group had a slightly shorter hospital stay [mean difference (MD): 0.30; 95% confidence interval (CI): -0.22–0.39; $p < 0.00001$], and it showed a higher incidence of postoperative reflux/gastritis [odds ratio

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(OR): 0.08; 95% CI: -0.02–0.39; $p = 0.002$]. HD offered a shorter operative time.¹

Shimotakahara et al. from Japan, in their series, reported a high endoscopically proven duodenogastric reflux of up to 33% in the HD group. In spite of adhesive obstructions in ~7% of their patients in the HJ group, they are strong proponents of complete biliary diversion using the Roux-en-Y HJ.⁴

Recently, Agarwal et al. evaluated laparoscopic HJ vs HD in their SRMA, studied the outcomes in 1,903 patients. Reflux gastritis in the HD was 8.83%, while that from the HJ was 0.87%. Meta-analysis favored HJ [OR: 20.38, 95% confidence interval (CI): 4.24 to 97.94; $p = 0.002$]. For the mean operative time, the pooled MD (MD: -56.93; 95% CI: -66.11, -45.75; $p = 0.00001$) was significant favoring HD.⁵

Nazki et al. reported outcomes of robotic CDC excision with HD reconstruction in 19 patients. They focused on the technical nuance of performing the HD on the down-curving part of the duodenum (away from the pylorus) to mitigate duodenogastric reflux. Their work underscores that outcomes with HD are not only a function of the anastomosis type but also of meticulous operative technique.⁶

The present JPMER article sits squarely within this body of evidence: it confirms, in a South Asian pediatric cohort and in open surgery, the same pattern of comparable medium-term functional outcomes that have been previously described in contemporary literature.²

HJ

Despite the ease of performing HD, Roux-en-Y HJ remains the favored reconstruction for the majority of pediatric surgeons worldwide. Arguments supporting this preference are driven primarily by reduced bile reflux. Complete diversion of bile in the jejunal limb completely eliminates the duodenogastric bile reflux. This finding is echoed and mirrored both in the current study and in pooled data across SRMAs.

Although robust long-term comparative data is limited, the proponents of HJ voice a concern that chronic bile reflux into the stomach and eventually esophagus may carry risks of metaplasia or carcinoma. HJ sidesteps this potential issue by diverting bile from the duodenogastric axis.

HJ has a long track record, with well-described surgical techniques. Surgeons are more comfortable performing a wide mucosa-to-mucosa HJ than tailoring a technically ideal HD across variable anatomy.

However, these advantages come with costs. HJ requires creation of a Roux limb and two anastomoses. It also entails surgical intervention in both supra- and infracolic compartments. This significantly increases operative time, the potential for adhesive small bowel obstruction, and the risk of internal herniation around the mesenteric defect.¹ In the current series, only patients in the HJ group required reoperation for adhesive obstruction, echoing similar observations, especially, in infants.

Endoscopic access to the biliary tree is also more challenging after HJ, particularly in small children, potentially complicating management of future stones or strictures should they arise.

HD

HD, by contrast, is often cited as a more physiological reconstruction. It restores bile flow directly into the duodenum, preserves continuity of the alimentary tract, and confines the anastomosis to the supracolic compartment. It has several advantages, including a shorter operative time and simpler supracolic dissection.⁷ There is a potentially lower risk of adhesive obstruction and internal herniations.

The HD also has far more superior endoscopic access. A straightforward route for endoscopic evaluation, stone extraction, or dilation of strictures is a reasonable consideration in long-term survivors.

The HD is more compatible with minimal access approaches owing to easier dissection and a single anastomosis. It is technically more nuanced with better ergonomics and decreased operative and pneumoperitoneum time and surgeon fatigue.⁸

The major counterweight is duodenogastric bile reflux. In the current study, about 26% of HD patients developed clinically evident reflux symptoms, though none required conversion to HJ and all responded to conservative management. Narayanan's meta-analysis similarly documented a higher incidence of reflux after HD, though often mild and treatable. Robotic experience published by Nazki et al. suggests that careful attention to the site of HD may attenuate this risk.

Long-term implications of chronic bile reflux in children remain incompletely defined. Existing series, including the present one, generally have follow-up in the range of a few years, which is insufficient to fully assess risks of peptic changes, Barrett's esophagus, or malignancy. This gap fuels continuing caution among proponents of HJ.

INDIVIDUALIZING RECONSTRUCTION: BEYOND A BINARY CHOICE

Rather than positioning HD and HJ as mutually exclusive, the cumulative literature, including the current study, supports a more nuanced, individualized approach.

Important considerations include various factors such as variable biliary anatomy at the hilum. Multiple ducts, high

confluence, or aberrant ducts may be more amenable to a tailored HJ, a jejunal interposition, or even double anastomosis.⁹

Centers with strong endoscopy support tend to favor HD to facilitate future intervention. Age and general performance status may be an important determinant of the chosen procedure. In conditions such as CDC rupture or biliary peritonitis, in a sick child the algorithm may point toward quicker surgery and minimal damage control surgical choices.

In centers with limited experience with minimal-access surgery, most surgeons align with Roux-en-Y HJ, whereas those with all approaches at their disposal usually lean toward HD. HD may align better with steep learning curves of minimal-access approaches.

The current JPMER study's strengths include prospective data collection, uniform technique by a single surgeon, and explicit comparison of perioperative metrics. This makes it a valuable addition to the pediatric CDC literature in the Indian subcontinent. Its limitations, however, must temper interpretations due to nonrandom allocation, modest sample size, and absence of long-term follow-up.

WHERE DO WE GO FROM HERE?

The available evidence suggests that both HJ and HD are acceptable reconstructive options after pediatric CDC excision, each with distinct advantages and trade-offs. HJ offers a reflux-free, time-tested pathway at the cost of operative complexity and potential adhesive complications, while HD provides a simpler, more physiological reconstruction with easier endoscopic access, but a higher incidence of bile reflux.

For individual surgeons and institutions, the choice should be guided by patient factors, anatomical considerations, team expertise, and the availability of long-term endoscopic follow-up, rather than by an assertive adherence to one technique.

Future research priorities include multicenter, prospective registries with standardized reporting of late outcomes, especially to clarify the clinical significance of bile reflux in children. Rather than seeking a single "best" anastomosis, pediatric surgeons may best serve their patients by mastering both HD and HJ and by applying them judiciously, case by case, with vigilant long-term follow-up.

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