



Laparoscopic cholangiogram in biliary atresia: a refinement in the gallbladder hitch technique

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Abstract

Introduction The study describes a refinement in the gallbladder hitch stitch and assesses the value of the laparoscopic cholangiogram in children with suspected biliary atresia.

Methods Twenty children with neonatal jaundice and no drainage as shown on the HIDA scan underwent a diagnostic laparoscopy through an umbilical 5 mm port. A 3 mm laparoscopic needle holder inserted through a 3.5 mm port to the left of the umbilicus was used to hitch the gallbladder to the abdominal wall. The stylet of a large bore 16F IV cannula then was used to penetrate the gallbladder to perform the laparoscopic cholangiogram.

Results There was no need for conversion in all 20 children by this technique. Patent biliary anatomy was demonstrated in 11 children (11/20). These children had no further procedures. In 3 (3/20) children, the common bile duct was demonstrated, while the hepatic ducts were not. These children had a laparotomy for Kasai procedure after an open cholangiogram with a vascular bulldog clamp on the CBD confirmed the finding. Six (6/20) had no demonstrable patency; 3 had it confirmed when the abdomen was opened for the Kasai procedure; only those proceeding to Kasai portoenterostomy (3 hepatic duct atresia, 3 complete biliary atresias) had an epidural catheter placed by the anesthetist. The remaining 3 had no further procedure performed due to the advanced nodular liver with ascites and evidence of portal hypertension.

Conclusion The findings of laparoscopic cholangiogram were confirmed in all six children who underwent laparotomy for Kasai procedure. The laparoscopic cholangiogram using gallbladder hitch reliably demonstrates a patent biliary system (11/11) and was valuable in avoiding further invasive procedures in 70% (14/20) of babies.

Keywords Neonatal jaundice · Biliary atresia · Laparoscopic cholangiogram · Gallbladder hitch

Introduction

Neonatal jaundice presents a unique challenge to both medical and surgical pediatric teams. Conjugated hyperbilirubinemia needs to be differentiated between congenital obstruction/malformations of the biliary system (e.g., biliary atresia, bile duct stenosis, choledochal cyst) and non-surgical

causes (e.g., infectious, metabolic causes, idiopathic hepatitis). Early diagnosis is vital for prompt treatment and better outcomes in surgical causes. One of the most common pathways followed towards this goal is to perform a hepatobiliary iminodiacetic acid (HIDA) scan followed by intraoperative cholangiogram to demonstrate biliary drainage. The laparoscopic cholangiogram is a minimally invasive technique commonly employed in these children, with an obvious advantage over the open procedure. We describe refinements of a laparoscopic technique in which the reliability of a successful cholangiogram was 100% and was of clear benefit to the children with a patent biliary system, who would otherwise have had a negative open procedure.

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Materials and methods

Twenty children with conjugated hyperbilirubinemia and non-drainage demonstrated on the HIDA scan underwent laparoscopic cholangiogram. The anatomy was clearly demonstrated in all babies with normal biliary patency ($n=11$). Three babies with atresia underwent open confirmation and Kasai procedure after epidural placement ($n=3$). In those with atresia but extensive liver fibrosis + ascites and those whose parents opted for a primary liver transplant, a liver biopsy was taken under vision and the port sites were closed, with no further surgical intervention ($n=3$). Babies with only distal patency (Type3, hepatic duct atresia) also underwent Kasai's after open confirmation of the anatomy and epidural placement ($n=3$).

Surgical procedure

An initial 5 mm umbilical port is placed for the camera and pneumo-peritoneum is achieved. Liver cirrhosis is assessed and ascites is noted. Another 3 mm working port is placed just above and to the left of the umbilicus for the needle-holder. A second working port was used, in the first five children, to help load the stay suture needle. In the rest, only one working port was sufficient once the technique was refined as below.

Under vision, a 3.0 prolene needle is partly introduced high in the right subcostal region. The needle is still partly held externally in a position, such that the laparoscopic needle-holder can grasp the internal part in a 'ready to suture' fashion (Fig. 1). This avoids placement of a second working port just to adjust the needle. The stay stitch is taken on the gallbladder at the fundus, preferably on the superior



Fig. 1 Needle maintained in positioned from outside for a 'ready-to-stitch' pick up

surface of the fundus (Fig. 2). This hitch is used to keep the fundus firmly held against the abdominal wall during the cholangiogram.

Meanwhile, a syringe filled with radio-contrast is connected to a 3-way with 10 cm extension. This is in turn connected to the 'stylet' of a 16 or 18-gauge iv cannula (Fig. 3). The entire system is pre-filled and flushed with contrast, ready for the next step. The fluoroscopy machine is set up and the position is confirmed at this stage.

The stylet is now slowly introduced into the gallbladder under vision (Fig. 4). A larger gauge cannula visually complements the already magnified image and effectively prevents any errors in this process. An assistant quickly injects the contrast and a cholangiogram is captured in the next few seconds, thus completing the procedure (Fig. 5). A core

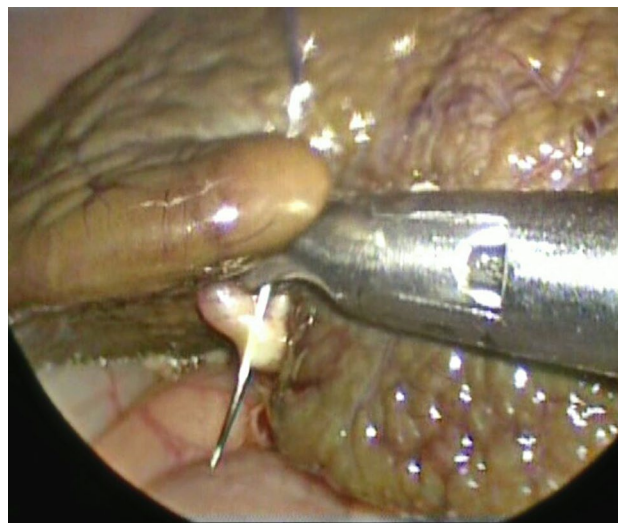


Fig. 2 Hitching suture at the tip of gallbladder fundus

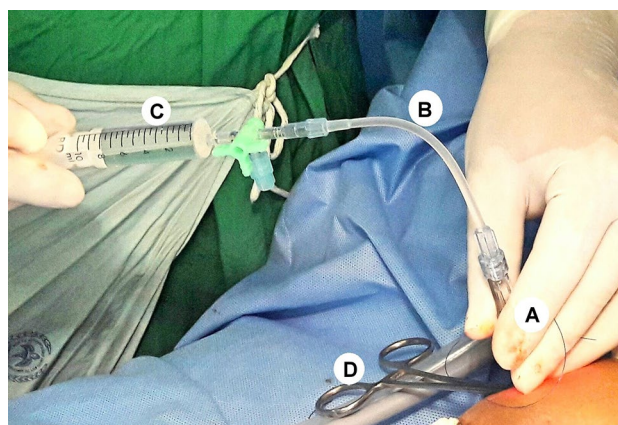


Fig. 3 Hollow metal stylet (A) pre-attached to 10 cm extension (B) and contrast filled syringe (C). A clamp holds the hitch suture outside (D)

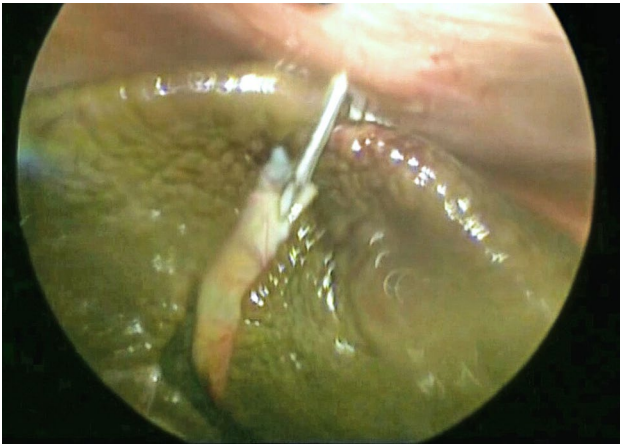


Fig. 4 Good cephalad retraction and stylet introduced into the gallbladder

biopsy needle is introduced and a liver biopsy is taken under vision.

Results

Twenty infants, aged 1–5 months, with conjugated hyperbilirubinemia and no drainage on HIDA scan underwent laparoscopy.

Fourteen children had laparoscopic cholangiogram only. Of these, 11 had normal patent biliary anatomy on cholangiogram, even when some gallbladders looked small and collapsed/atretic. In a patent system, we did not see any bile leak from the puncture site on the fundus. Three children had no drainage. In view of extensive fibrotic lobulations of the liver, ascites, and splenomegaly, Kasai procedure was

deferred and they were referred for primary liver transplantation. All of them tolerated feeds post-op, required minimal analgesia and were discharged in an average of 2.5 days. This early recovery further assured us that there was no significant bile leak.

Six children had a laparoscopy, attempted lap cholangiogram followed by epidural catheter placement by anesthesiologist and then a Kasai procedure. Obstruction was confirmed by an open technique in all these children. Of these, three children had only distal patency (Type 3 biliary atresia). This was first confirmed by open occlusion of common bile duct with a bulldog vascular clamp and demonstrated that no contrast entered the common hepatic ducts.

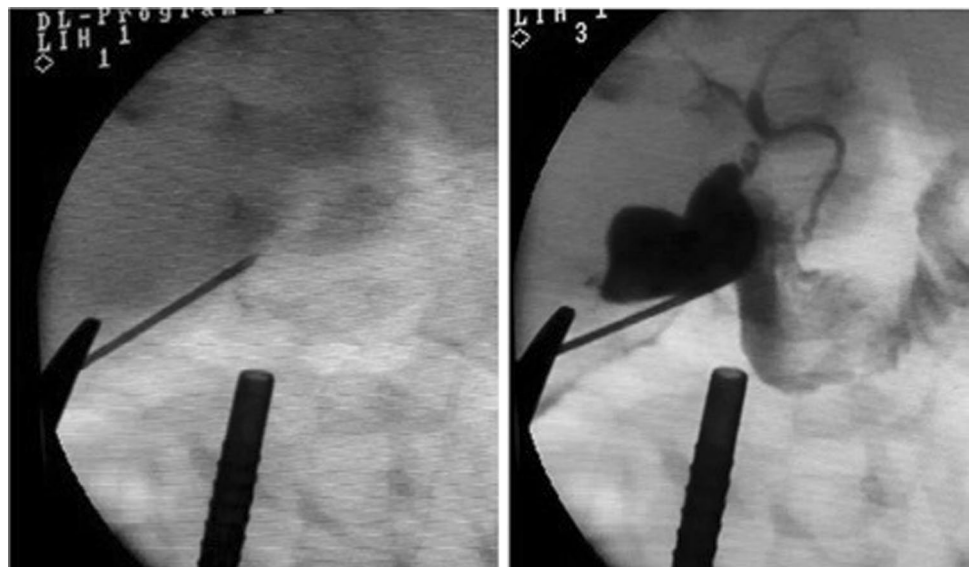
Discussion

Demonstration of a patent biliary system is vital in ruling out biliary atresia in babies with obstructed jaundice. Though traditionally done by open technique, an early laparoscopy has definite advantages, as shown first by Hirsig and Rickham [1].

Various diagnostic tools, other than direct inspection and a cholangiogram, lead to unnecessary delay in the diagnosis of biliary atresia even today in the majority of healthcare settings. A simple, reliable technique followed by a quick recovery and discharge of those with the patent system has an important effect in convincing pediatricians to refer these children early, as shown by Murat et al. [2]. They describe the introduction of a Chiba needle through the hepatic tissue, into the gallbladder.

Shao-Tao Tang et al. described a lap-assisted technique exteriorizing the gallbladder fundus [3]. Meyers et al. [4], Nwomeh et al. [5] and Lee [6] emphasized that

Fig. 5 Cholangiogram showing a patent biliary system



ultrasound-guided cholangiogram avoids general anesthesia. The accuracy of this technique depends on visualization and successful cannulation of the lumen, which is difficult in case of collapsed and contracted gallbladders. Houben et al. described the gallbladder hitch technique [7], which we have refined further to successfully push the limit where we have found patent system even in atretic looking gall bladders. These gall bladders would have otherwise lead to an open exploration, if only their laparoscopic appearance was relied upon.

The following are the refinements described in the procedure:

1. The stay stitch is introduced much higher in RUQ, so that the gallbladder is retracted further cephalad enabling a better exposure.
2. The suture needle is introduced under vision and is maintained in a position, from outside, that the needle driver can pick up it in a 'ready to suture' manner. This avoids placement of another working port just to adjust the needle.
3. Stay stitch on gallbladder is taken either at the tip of the fundus or even on the superior aspect of the fundus, so that entire globe of the fundus and inferior exposed surface is available for the stylet to enter.
4. GB is hitched tightly to the abdominal wall with a clamp externally on the abdominal wall. A loose hitch can result in poor control and unwanted movements between the stylet and the gallbladder.
5. The 16-gauge hollow metal stylet of i.v cannula is used. The plastic sheath of the cannula is not used, since it may kink at some point and cause difficulty introducing the contrast. The larger gauge needle allows for a successful cannulation of the lumen.
6. The contrast filled syringe, three-way connector with 10 cm extension and the injecting needle are connected and flushed before introducing into the abdomen. This avoids unnecessary movements after the cannula is introduced. The 10 cm extension gives extra working space and stability to the whole setup.

Attention to the above details has resulted in a quick successful study, thereby reducing any undue delays and errors. The findings were used to avoid an invasive line, epidural catheter placements and laparotomy in 14/20 (70%) babies (11 with normal patency and 3 with an advanced liver disease).

Conclusion

This technique fully utilizes the magnification and ergonomics of laparoscopy, which is unavailable in an open cholangiogram. In other words, it is much easier and faster than the open study. In addition, only those children proceeding to Kasai's procedure were then given spinalepidural catheter for peri and operative analgesia.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethics declaration This article does not contain any studies with animals performed by any of the authors.

Informed consent Informed consent was obtained from all individual participants included in the study.

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