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Challenges and strategies for single-incision laparoscopic Roux-en-Y hepaticojejunostomy in managing giant choledochal cysts

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ABSTRACT

Background/purpose: Giant choledochal cyst (CDC) is thought to be a challenge for one-stage single-incision laparoscopic hepaticojejunostomy (SILH). We herewith designed the strategies for SILH in surgical management of giant CDC children, and reported its outcomes.
Methods: Twenty-eight patients with giant CDCs successfully underwent SILH between April 2011 and October 2013. With guidance of an extra-long 5-mm 30° laparoscope, anterior cyst wall was punctured extra-corporeally using a 20-gauge angiocatheter. Cyst content was evacuated to create working space. A series of trans-abdominal retraction sutures were placed through serosa of gallbladder fundus, common hepatic duct and proximal to distal portion of anterior cyst wall to facilitate dissection. Cyst excision and hepaticojejunostomy was performed.
Results: Mean age at operation was 6.24 months. Mean operative time was 3.18 h, significantly shorter than 6.3 h in our historical group undergone conventional laparoscopic hepaticojejunostomy. No blood transfusion was required. Post-operative recovery was comparable to that of our historical CLH controls. Median follow-up period was 24 months. No mortality or morbidities of anastomotic stenosis, bile leak, cholangitis or pancreatic leak was observed. Liver function normalized post-operatively.
Conclusions: Following the strategy, SILH for giant CDCs is safe and one can achieve outcomes comparable to those of CLH in experience hands.

1. Introduction

Recently, single-incision laparoscopic surgery has become popular in pediatric surgeons to achieve minimal surgical trauma [1–4]. We have adopted single-incision laparoscopic hepaticojejunostomy (SILH) strategy in CDC children [5]. However, the limitations of single-incision laparoscopic approach render the one-stage definitive surgery for giant choledochal cyst (CDC) more challenging because of 1) extremely limited working space; 2) limited exposure of displaced portal vein, hepatic artery, and surrounding tissues; and 3) difficult dissection for intra-pancreatic portion of CDC and posterior cyst wall. One or two stages open surgery with large painful muscle-cutting wound are usually adopted [6], which significantly increases the mortality and morbidities. We have modified our SILH techniques to treat children with giant CDCs. The current study is the first series to evaluate its safety and efficacy.

2. Methods

Giant CDC is defined as CDC with diameter greater than 10 cm [7,8]. Patients with giant CDCs (Fig. 1a and b, CDC diameter >10 cm) who underwent SILH between April 2011 and October 2013 were reviewed. All SILH procedures were performed by the same surgical team. Ethics approval from the Ethics Committee of Capital Institute of Pediatrics was obtained. Written informed consents were obtained from the parents of CDC patients prior to the study.

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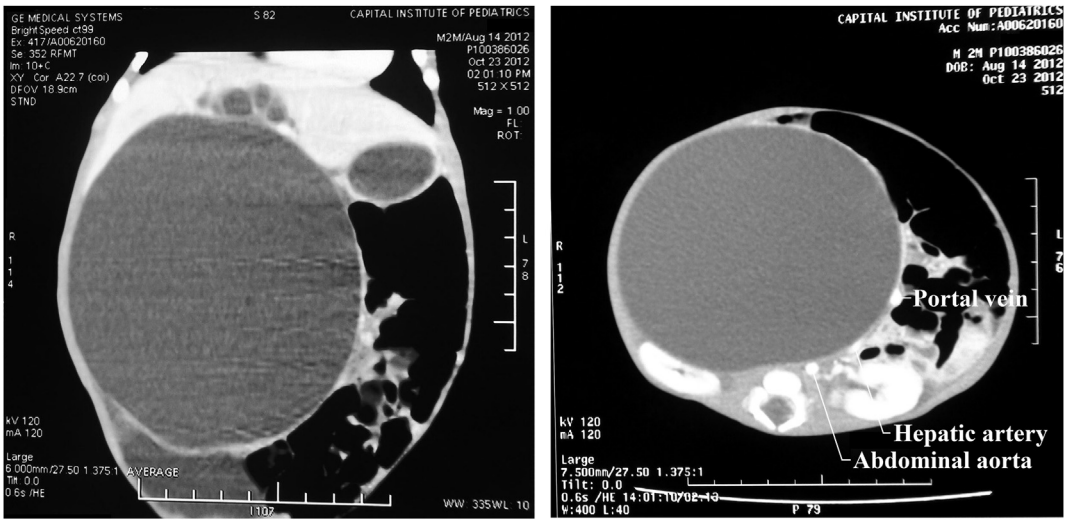

Fig. 1. CT scan of giant choledochal cyst. CT scan of a 2 months old male infant with giant choledochal cyst showed that huge cyst occupies large intra-abdominal space and displaces adjacent structures, including portal vein and hepatic artery.

Displacement of vessels, severe inflammatory adhesion, wide and deep dissection of intra-pancreatic portion of common bile duct increases the difficulty and risk to the vessels and surrounding tissues injuries. Preoperative computerized tompography and magnetic resonance cholangiopancreatogram images were carried out to identify the displaced portal vein, hepatic artery and adjacent structures (Fig. 1b), the ratio of intra-pancreatic portion to whole common bile duct, and cyst wall thickness.

Giant CDC is often accompanied by severe biliary obstruction, coagulopathy and consequently the increased the risk of perioperative hemorrhage. Preoperative correction of coagulopathy and postoperative anti-hemorrhage remedy are necessary. Vitamin K1 was routinely given. Fibrinogen and/or human prothrombin complex were administered perioperatively if FIB value was lower than 2 g/L and/or partial thromboplastin time was more than 10 s above upper normal limit.

The patients were placed in anti-Trendelenberg position. The operating surgeon stood at the foot of the table and the assistant surgeon stood on the patient's left side holding the camera. A vertical umbilical skin incision was made. Huge CDC occupies large abdominal space and interferes operative field. Hence, the patients are susceptible to accidental tissue injury. We performed biliary decompression before working trocar insertion. With the guidance of an extra-long 5-mm 30° laparoscope (Fig. 2, 26046BA, Karl Storz GmbH & Co. KG, Tuttlingen, Germany), the anterior cyst wall was punctured extra-corporeally by 20-gauge angiocatheter which was connected to a suction tube (Fig. 3a). After intraoperative cholangiograms was completed, the cyst was evacuated by suction to create a working space (Fig. 3b and c). Two 3-mm conventional laparoscopic instruments were inserted through the working ports which were placed each side of the camera port at the ends of horizontal umbilical incision (Fig. 2). Carbon dioxide pneumoperitoneum was established at a pressure of 10 mmHg.

To facilitate dissection of giant CDC with distal cyst deeply embedded in pancreas, a series of retraction sutures were routinely placed through abdominal wall and 1) serosa of gallbladder fundus (this suture was used to retract right liver lobe after subserosal dissection of gallbladder); 2) proximal common hepatic duct; 3) mid- to distal portion of anterior cyst wall (Fig. 3d). Additional transabdominal retraction sutures were placed through falciform ligament, pons hepatis or left margin of incised hepatoduodenal ligament in patient with enlarged left liver lobe to expose medial lateral of cyst wall because portal vein and hepatic artery are situated medial-posteriorly to the cyst (Fig. 3d). The assistant adjusted the tension and direction of suture retraction extracorporeally to facilitate dissection and anastomosis. The cyst dissection was carried out closet to the cyst wall from anterior-lateral to posterior-medial direction orientation direction using a 3-mm hook cautery.

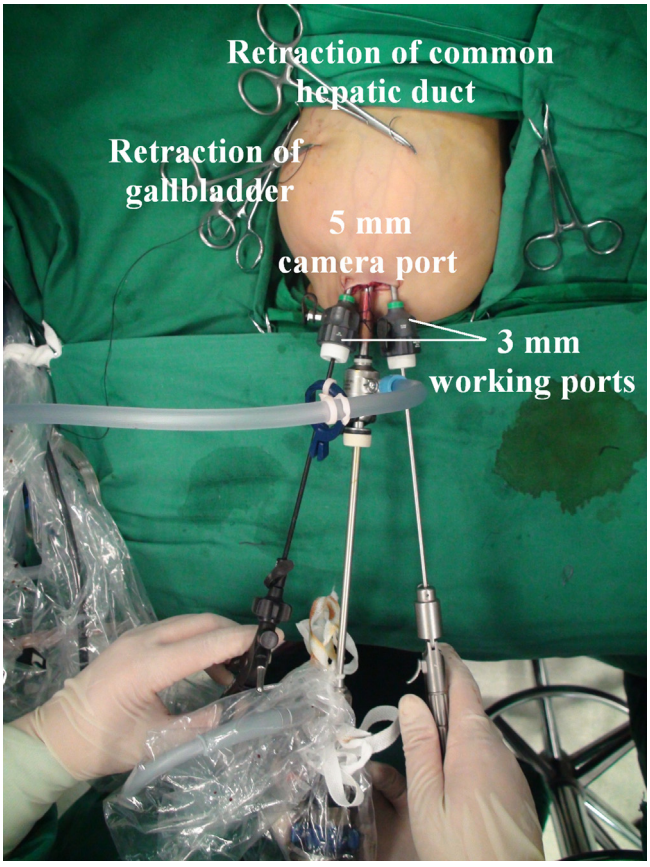

Fig. 2. Transumbilical single-incision with 3 ports and 2 transcutaneous suture retractions in a male neonate with giant choledochal cyst.