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A prospective study comparing laparoscopic and conventional Kasai portoenterostomy in children with biliary atresia

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ABSTRACT

Objective: The objective of the study is to evaluate the outcome of laparoscopic Kasai portoenterostomy for type III biliary atresia in children.
Methods: A total of 95 type III biliary atresia patients were treated at the Capital Institute of Pediatrics between September 2009 and August 2011. The patients were randomized into 2 groups preoperatively: the laparoscopic group (LP group, n = 48) and the open group (OP group, n = 47). In the LP group, 4 patients were converted to open operations, whereas the remaining 44 patients in the LP group and 47 patients in the OP group were included in the study.
Results: The gender distribution and age of the LP group did not differ from those of the OP group (LP group F/M 21/23, median age 61.5 days, OP group F/M 24/23, median age 67 days, P = 0.75 and 0.11). The operation time in the LP group was significantly longer than that in the OP group (median 169.5 min vs 146 min, P < 0.01). Intraoperative blood loss in the LP group was significantly lower than in the OP group (median 10 ml vs 15 ml, P < 0.01). The resumption oral intake was significantly faster in the LP group than in the OP group (median 3 days vs 3 days, P < 0.01). There were no significant differences between the postoperative hospital stay in the two groups (median 12.5 days vs 13 days, P = 0.21). The median follow-up period was 16 months in the LP group and 17 months in the OP group. There was no statistically significant difference in the jaundice clearance rate at the end of the third postoperative month or in the incidence of cholangitis, native liver survival rate, and liver function recovery between the 2 groups.
Conclusions: The short-term and mid-term results are comparable between the laparoscopic and open Kasai portoenterostomy groups. The laparoscopic Kasai procedure does not improve the prognosis of biliary atresia.

Biliary atresia (BA) is a severe congenital anomaly, and the Kasai procedure has been the initial treatment of choice for BA. In 2002, Esteves [1] first reported 2 BA patients who underwent laparoscopic hepatoportoenterostomy. One case had a satisfactory outcome. In 2007, Dutta [2] reviewed 10 children who underwent laparoscopic Kasai surgery, and the results showed no difference to the open surgery cases. Wong [3] suggested that laparoscopic surgery had worse results after reviewing 9 cases involving the laparoscopic Kasai procedure. Liem [4] reported 11 cases in 2010 and found that the blood loss in the laparoscopic cases was significantly lower than that in the open cases. Koga [5] completed 5 cases of laparoscopic Kasai surgery, and 4 cases had good outcomes and one of them required subsequent liver transplantation. At the transplant operation, they observed significantly fewer adhesions after the laparoscopic procedure than after the open Kasai operations. Ure [6] performed a prospective comparative study in the same year. They completed 12 procedures, but only 5 patients survived more than 6 months. Also in 2011, Chan [7] conducted a retrospective analysis of 16 cases and concluded that laparoscopic surgery was comparable to open surgery, but the following studies from the same group showed that laparoscopic Kasai surgery had inferior outcome [8,9]. In 2003, we began performing laparoscopic Kasai procedures for biliary atresia [10–12] patients; by 2008, we had completed more than 30 laparoscopic Kasai procedures, and the result was equivalent to those with open surgery. Because there have been few large scale studies and because there is a lack of prospective studies, we designed this prospective clinical controlled study to assess the outcome of the laparoscopic Kasai operation.

1. Methods

Based on our previous work, the jaundice clearance in open Kasai surgery is approximately 50%, which is approximately the same as in the laparoscopic procedure. Considering the learning curve for the procedure, the outcome of laparoscopic surgery might be better, so we set

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the jaundice clearance in the laparoscopic group to 80% and assigned a power of 0.80 and an α of 0.05; we established that the sample size should be 39 in each trial. The prospective randomization was performed by a computer with the minimization technique stratifying for age and gender. The study was performed from September 2009 to August 2011; 95 type III biliary atresia patients were included. All of the diagnoses were confirmed with intraoperative cholangiography (poorly developed gallbladder and obliteration of the extrahepatic biliary system at the porta). Then, they underwent a laparoscopic Kasai procedure (LP group, n = 48) or an open Kasai procedure (OP group, n = 47). In the LP group, 4 patients were converted to open operations because of the failure to stop bleeding; the remaining 44 cases in the LP group and the 47 cases in the OP group were entered into the study. The procedures in both groups were performed by the same surgeon. Ethical approval from the Ethics Committee of Capital Institute of Pediatrics and written parental consents were obtained.

1.1. Operation

Standard preoperative preparations were used for the open and laparoscopic Kasai groups. During the operation, a nasogastric tube and a Foley urinary catheter were used to decompress the stomach and bladder, respectively. The patients were placed in a head up supine position. A 5 mm longitudinal midline laparotomy was first made through the umbilicus; carbon dioxide (CO_2) pneumoperitoneum was created via a 5 mm trocar at a pressure of 8–12 mmHg, and a 5 mm 30° camera was introduced. Three additional trocars were inserted in the right hypochondrium (5 mm), right abdomen (3 mm) and left hypochondrium (5 mm). The surgeon stood on the right side of the patient. The assistant stood on the opposite side (Fig. 1). Under laparoscopic guidance, the fundus of the gall bladder was exteriorized through right hypochondrium incision, and catheterized for cholangiography. Then, the diagnosis was confirmed using the cholangiogram. Hitch-sutures were employed on the gallbladder and the liver tissue just above the hepatic hilum for retraction. Then, the cystic artery and cystic duct were cauterized and divided. The dissection was started by opening the peritoneum overlying the hepatoduodenal ligament, and the extrahepatic ductal remnant was identified, isolated and transected at the level of the cystic duct. The middle hepatic artery was ligated and transected for better exposure of the hepatic hilum. By pushing the camera close to the hepatic hilum, a magnified view was created to help the delicate and precise dissection. After the fibrous cord was separated from the right hepatic artery by using the hook diathermy and dissected toward the porta, the bifurcation of the main portal vein into the right and left branches was visualized. Then, the connective tissue between the portal veins and the fibrous mass was divided by gentle blunt dissection; the small vessels in the tissue were identified and divided close to the remnant using the hook cautery. Subsequently, one to two small branches from the portal vein to the caudate lobe near the remnant were visualized, ligated and divided without cautery. These small branches could result in bleeding and conversion if not properly controlled before the division. The fibrous remnant was dissected to the levels of segmental branches of the right portal vein on the right side and the umbilical point of the left portal vein on the other side (Fig. 2). After complete dissection, the fibrous remnant was split in the middle into two fibrous cones (Fig. 3). In the plane of the fibrous plate, a pair of 3 mm laparoscopic scissors was employed to transect the left and right fibrous cones (Fig. 4). This maneuver was helpful for identifying the plate between the liver parenchyma and the fibrous biliary remnant and for avoiding injury to the liver. After the fibrous cones were transected, a Surgiseal (Ethicon, USA) was placed on the portal hilum for hemostasis from the transected portal plate until later portoenterostomy. The use of cautery on the portal plate was usually unnecessary to control the bleeding. The ligament of Treitz was identified under laparoscopy, and the proximal jejunum 10 cm distal to the ligament was captured with a bowel clamp and exteriorized through umbilical trocar site after extending the incision by 1.5 or 2.0 cm [13]. Roux-en-Y jejunojejunostomy was performed manually using a one-

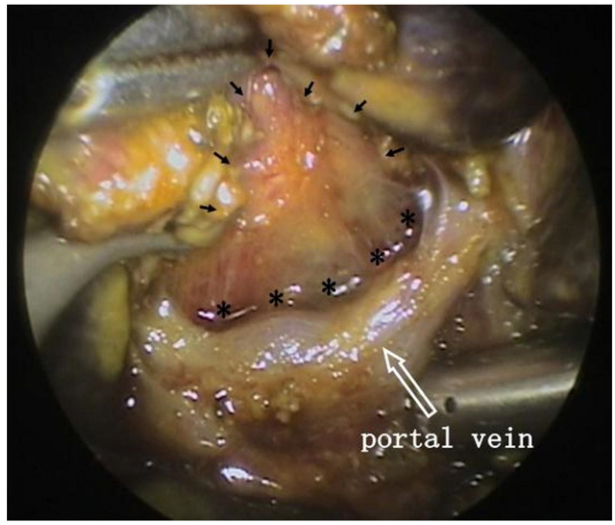

Fig. 2. Portal fibrous cone (arrows) is dissected away from the portal vein (white hollow arrow): asterisks: portal plate.

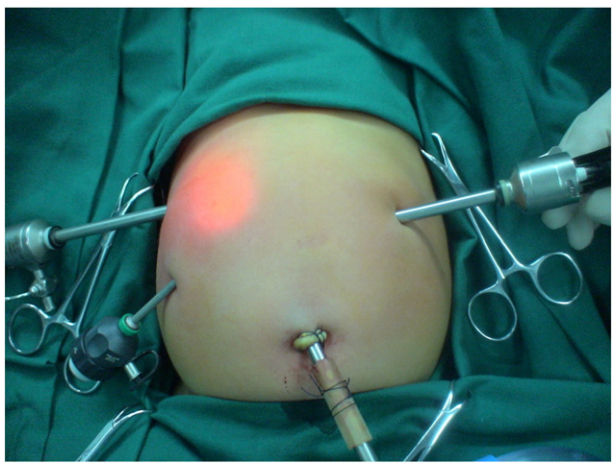

Fig. 1. Ports setting for laparoscopic Kasai portoenterostomy.

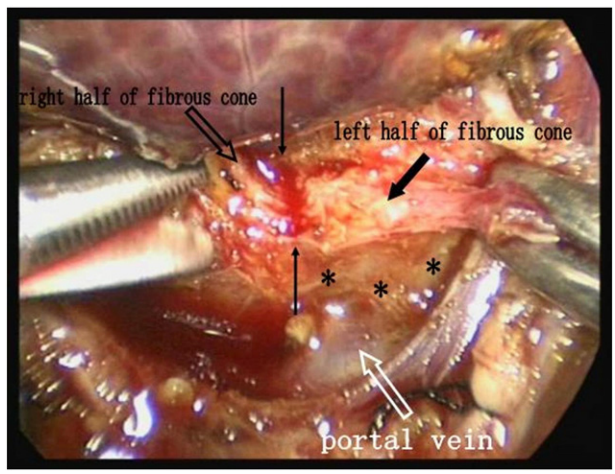

Fig. 3. The fibrous cone is split into two halves in the middle (black arrow), deep to the portal plate (asterisks).