Modified technique for Kasai porto-enterostomy in biliary atresia and its impact on clinical outcome

Ahmed Sallam, Sherif Saleh, Mohamed Taha

Department of Hepatopancreaticobiliary and Liver Transplantation Surgery, National Liver Institute, Menoufia University, Shebeen El-Kom, Egypt

Correspondence to Ahmed Nabil Sallam, MD, Assistant Professor of Surgery, Quesna, Menoufia, 32511, Egypt.
Tel: +20 100 009 2685; fax: +20482871464;
e-mail: special.one82@yahoo.com

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Background
Traditionally, the principle of the Kasai procedure is to remove the atretic extrahepatic ducts so as to establish bile flow to the intestine at an early stage and prevent further progression of the disease. Here, we describe modifications to the procedure via a wider and deeper dissection.
Aim
To assess the new modified technique over the traditional technique used for type III biliary atresia and its impact on the clinical outcome.
Patients and methods
This is a retrospective study that assessed the outcome of 66 patients who underwent Kasai portoenterostomy (KPE) at Hepatobiliary and Pancreatic Surgery Department, National Liver Institute, Menoufia University between July 2014 and December 2017. The patients were divided into two groups and the outcome after the modified KPE were compared with the traditional KPE regarding clinical outcome and overall survival.
Results
In all, 66 patients were identified. Of these, 32 were in the traditional KPE group and 34 in the modified KPE group. The modified technique had better short-term clinical outcome than the traditional technique group at 3 and 6 month postoperatively with statistical significance (P=0.006 and 0.017, respectively). The rate of native liver survival was 68.8 versus 31.5% and overall survival was 88.2 versus 65.6%.
Conclusion
Deep and long incision in fibrous remnant and meticulous anastomosis was associated with favorable outcomes.

Keywords:
biliary atresia, jaundice clearance, Kasai portoenterostomy

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Introduction

Biliary atresia (BA) is a dreadful disease and encompasses the major cause of liver transplant (LT) in the pediatric age group. The Kasai procedure that includes:

Hepatoportoenterostomy (HPE) was developed nearly six decades ago [1].

The results of this procedure depend on the timing of surgery, bile flow achieved at the porta hepatis, and on the status of liver at the time of surgery [2].

Despite a successful Kasai portoenterostomy (KPE), the jaundice clearance rate keeps on decreasing with the passage of time, with liver cirrhosis setting in slowly in more than 50% cases.

Thus, BA remains the main indication for LT in almost 80–90% of the patients [3].

The Kasai HPE procedure still remained widely accepted as a bridge to transplantation that can be performed when the donor could be made available with the decrease in morbidity and mortality [4].

While in developed countries, the diagnosis of BA is made early and there are facilities of LT, the situation in developing countries is far from satisfactory. The outcome after KPE is poor and not more than 10% survive for 2 years with and without jaundice [5].

LT requires expertise, suitable infrastructure, and suitable donors. Thus, there is not much hope to offer to the cases presenting in the advanced stage of liver cirrhosis with ascites, portal hypertension, malnutrition, persistent high jaundice, cholangitis, and liver failure. Hence, we have been offering alternative procedures to these cases [6].

Traditionally, the KPE procedure extracorporealizes the liver to expose the portal plate. Here, we describe modifications to the procedure via a wider and deeper dissection exposing the bifurcation of the portal vein and the transection level was higher than the traditional technique, then a deep and long incision was made in the fibrous remnant by a scalpel making two solid anterior and posterior edges for solid anastomosis with a long Roux-en-Y loop.

Patients and methods

A total of 66 (32 boys and 34 girls) infants suffering from BA type III were treated with HPE (Kasai operation) and were divided into two groups: the first group underwent traditional Kasai operation (32 infants) and the second group underwent the modified technique (34 infants) at our institution over a 3-year period from July 2014 until December 2017. December 2018 was the end time for follow-up.

The traditional technique includes limited dissection of the fibrous remnant at the porta hepatis and the transection level was shallow and multiple small incisions were created in the fibrous remnant to be involved in the anastomosis (limited dissection), while the modified technique includes a wider and deeper dissection exposing the bifurcation of the portal vein and the transection level was higher than the traditional technique, then a deep and long incision was made in the fibrous remnant by a scalpel making two solid anterior and posterior edges for solid anastomosis with a long Roux-en-Y loop (Figs 1 and 2).

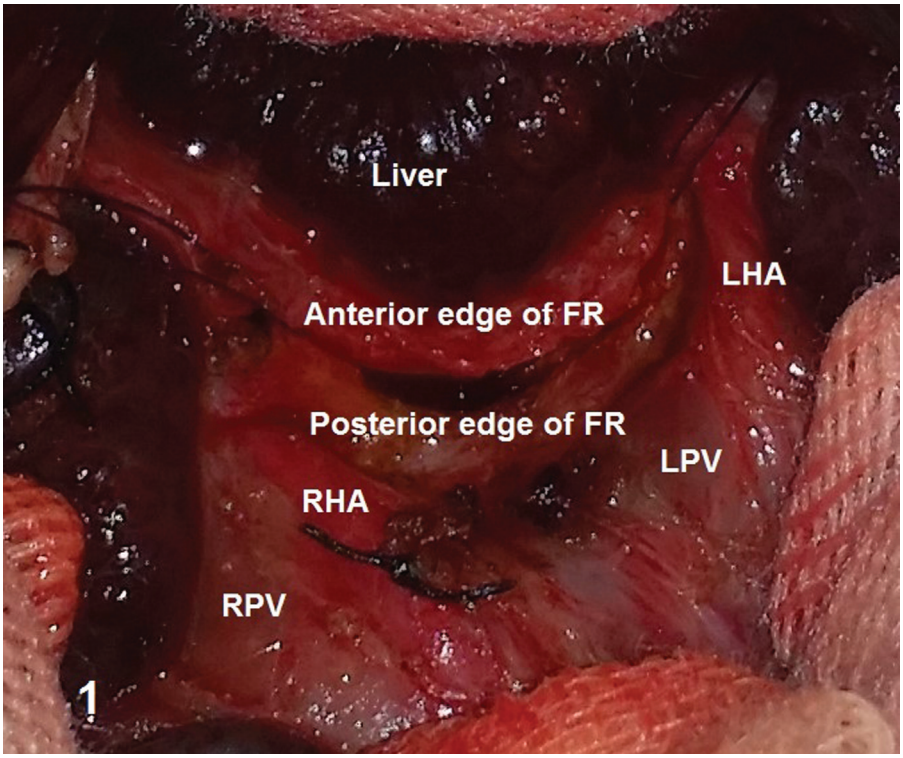
Successful clinical outcome defined by jaundice clearance is defined as total bilirubin levels of less than 2.0 mg/dl.

Statistical analyses were performed using the χ^2-test or Student's *t*-test, where appropriate. The cumulative survival rates were analyzed using the Kaplan–Meier survival curves, and the statistical difference was assessed using the log-rank test. A *P* value of less than 0.05 was considered statistically significant. All analyses were performed with SPSS version 21.0 (SPSS Inc., Chicago, Illinois, USA).

Results

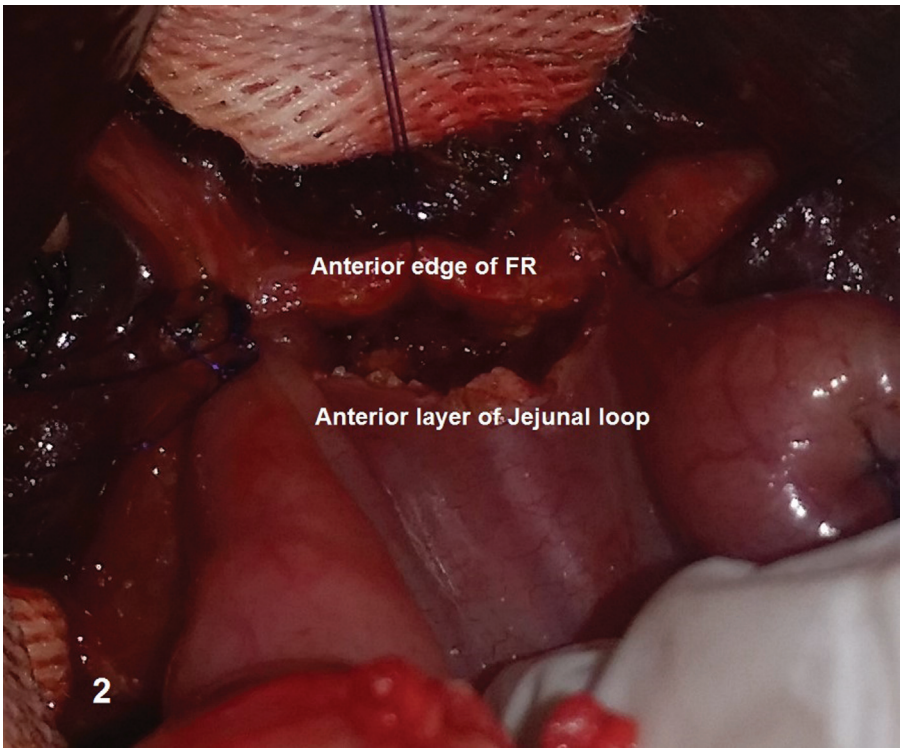
The mean age at the time of operation was 75 days after birth (range: 31–111) with 32 (48.5%) males and 34 (51.5%) females. The mean preoperative weight was 4.6±0.6 kg while the mean preoperative height was 57.4±3.5 cm.

Figure 1



The modified dissection technique shows deep and long incision through the fibrous remnant (FR). LHA, left hepatic artery; LPV, left portal vein; RHA, right hepatic artery; RPV, right portal vein.

Figure 2



The application of the jejunal loop after finishing posterior layer anastomosis.

The mean preoperative serum total bilirubin was 11.29 ±3.5 mg/dl while the mean direct bilirubin level was 8.01±2.8 mg/dl. Regarding the clinical data, the onset of jaundice was since birth in 19 (28.8%) cases, developed after birth in six (9.1%) cases, and with insidious onset in 41 (62.1%) cases, while clay stool was reported in all 66 cases. One (1.5%) case had a history of intracranial hemorrhage; PDA was observed in one case; and PFO also in one case. Regarding US finding, the GB was contractile in 13 (19.7%) cases, noncontractile in 26 (39.4%) cases, and atretic in 27 (40.9%) cases. TC sign was positive in 22 (33.3%) cases and negative in 44 (66.7%) cases. Hepatomegaly was observed in 48 (72.7%) cases and splenomegaly in 33 (50%) cases. Unfortunately ascites was found in two (3%) cases. Regarding liver biopsy according to the Biliary Atresia Research Consortium portal fibrosis grading was as follows: five cases with absent or fibrous expansion of some portal tract.

Thirteen cases with fibrous expansion of most portal tracts. Forty cases were with focal portal–portal bridging. Eight cases were with marked bridging. Regarding upper endoscopy duodenal aspirate was negative in almost all cases (98.5%) except for one case with positive aspirate. Regarding postoperative complications 11 (16.7%) cases were complicated by signs of portal hypertension in the form of ascites and GIT bleeding, one (1.5%) case with synthetic liver failure, eight (12.1%) cases with infection (including chest, wound and peritonitis), and three (4.5%) cases with burst abdomen. Regarding mortality there was 15 (22.7%) cases who died postoperatively from various causes: eight (12.1%) cases died from liver failure, five (7.6%) cases of pneumonia, one (1.5%) case of septicemia, one (1.5%) case from a sudden event. The level of total bilirubin at 1 month postoperatively was observed to be lower in cases that underwent the modified technique (mean 6.61 ±2.8) than in cases that underwent the traditional technique (mean 7.27±3.5) but there was no significant correlation (P=0.409), while the level of total bilirubin at 3 and 6-month postoperatively were observed to be much lower in cases that underwent the modified technique (mean 4.89±4.3 and 4.10±3.9, respectively), than in cases that underwent the traditional technique (mean 8.262±5.7 and 9.10±6.7, respectively), and there was significant correlations (P=0.004 and 0.000). Also, it was observed that the group that underwent the modified technique had better short-term clinical outcome (jaundice clearance) than the traditional technique group at 3 and 6-month postoperatively with statistical significance (P=0.006 and 0.017, respectively). Also, the modified group had better long-term clinical outcome than the traditional technique group at 1 and 2-year postoperatively with no statistical significance (P=0.07 and 0.09, respectively).

Regarding postoperative complications it was observed higher complications in the traditional technique group (60.9%) than in the modified technique group (39.1%) without any statistical significance (*P*=0.14). The 3-year native liver survival rate was higher in the modified group (68.8%) than in the traditional technique group (31.2%) with statistical significance (*P*=0.007).

The overall mortality was higher in the traditional technique group (73.1%) than in the modified technique group (26.7%) with statistical significance (*P*=0.028).

Better overall survival was observed in modified KPE (88.2%) than in traditional KPE (65.6%) with statistical significance (*P*=0.046; Fig. 3).

Discussion

Standardization of KPE remains challenging, and, without clear landmarks, it is difficult to determine optimal dissection of the fibrous remnants at the porta hepatis. Moreover, disease severity and BA phenotypes affect the outcome [7].

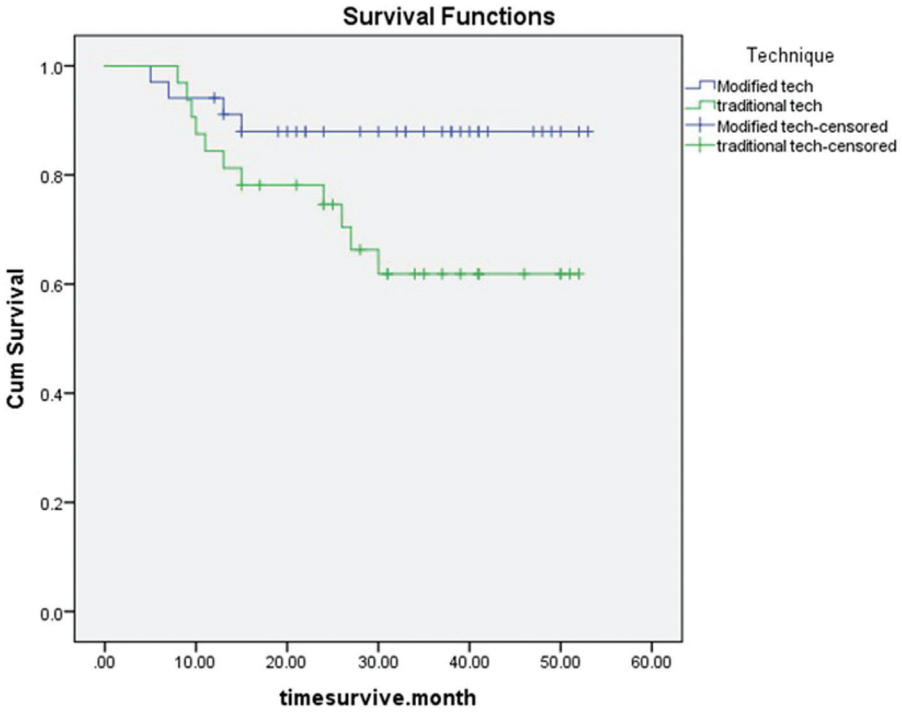
Cholangitis is the most serious complication following KPE. Many pediatric surgeons have attempted to prevent the development of cholangitis by modifying reconstructive surgery. However, no modification prevented cholangitis more effectively than the original KPE. Consequently, most pediatric surgeons currently use the original KP procedure with a long Roux-en-Y loop [7].

In this study, we applied a new modified technique regarding the way of dissection in the fibrous remnant at the porta hepatis by increasing the dissection level to become wider and instead of multiple incisions at the fibrous remnant only one deep and long incision was done through the whole length of fibrous tissues without injuring the liver capsule, hoping to open more bile ductules and avoid cauterization by diathermy as much as possible.

Nio *et al.* [7] divide the patients in his study to four groups according to the level of transection of the fibrous remnants and the type of reconstruction. Groups one and two had the same level of transection of the fibrous remnants (outside the hepatic capsule) but only differ in the type of reconstruction; group 1 had double Roux-en-Y procedure and group 2 had Suruga II procedure.

During the third period (in group 3), extended dissection was pursued, and the level of transection was wider and deeper, extending beyond the hepatic capsule with double-valve Roux-en-Y procedure which believed that later on that dissection beyond the liver capsule worsens the outcomes due to excessive scar formation and/or regenerative liver tissue may

Figure 3



Cumulative survival rate among all cases.

obliterate the minute bile ductules at the porta hepatis following extensive dissection [7].

In group 4, the extended dissection was abandoned, and the remnants were consistently transected at the level of the hepatic capsule with Roux-en-Y procedure with a spur valve [7].

Nio *et al.* [7] believe that the level of transection of the extrahepatic fibrous remnants at the porta hepatis is far more important than the type of reconstruction or length of the Roux-en-Y loop or valve equipment. In this study, it was observed that the group that underwent the modified technique had better short-term clinical outcome (jaundice clearance) than the traditional technique group at 6 months postoperatively (67.9 and 32.1%, respectively). Nio *et al.* [7] reported a higher jaundice clearance percentage in group 4 in his study (87.2%) but the explanation for his best clinical outcome was all types of BA were involved in his study including type I and type II but, in this study, only type III was involved.

The three year native liver survival rate in this study was comparable with Nio *et al.*, study (68.8%) versus (73.7%).

Overall, the 3-year survival in our modified technique was 85% while Nio *et al.* [7] reported 97% 3-year survival

Conclusion

Our modified KPE, consisting of wide dissection and careful transection of the fibrous remnants at the porta hepatis, a long Roux-en-Y loop, and meticulous anastomosis was associated with favorable outcomes, although long-term follow-up results are required to infer a final conclusion.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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