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Reduced-Port Surgery for Hereditary Spherocytosis with Cholelithiasis in Children

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ABSTRACT

Purpose : The purpose of this study was to evaluate the safety and efficacy of concomitant laparoscopic splenectomy and cholecystectomy (LSC) with fewer and smaller ports for treating hereditary spherocytosis (HS) in children.

Methods : We reviewed 10 LSCs (3 with 5 ports and 7 with 4 ports) for treating HS with cholelithiasis and 18 laparoscopic splenectomies (LSs) with 4 ports for treating HS without cholelithiasis. Perioperative clinical data (operative time, estimated blood loss, length of hospital stay, and complications) were also evaluated.

Results : No conversion to open procedures was required, and no severe postoperative complications occurred. No significant difference was observed in mean operative time, postoperative hospital stay, or estimated blood loss between LSC with 4 ports (239 minutes, 7.1 days, 31 ml) and LSC with 5 ports (257 minutes, 8.0 days, 10 ml).

Conclusions : Our current technique of concomitant LSC with fewer and smaller ports is a safe and effective procedure in children. (Jikeikai Med J 2012 ; 59 : 11-5)

Key words : laparoscopy, splenectomy, cholecystectomy, hereditary spherocytosis, children

INTRODUCTION

Laparoscopic splenectomy (LS) has become the standard treatment for hematologic disorders of the spleen, even in children[1,2]. Reported advantages of LS are decreased pain, shorter hospital stay, and improved cosmesis[3-6]. The indications for LS in children include hereditary spherocytosis (HS) and immune thrombocytopenic purpura (ITP). HS is associated with splenomegaly and, often, with cholelithiasis. In such cases, laparoscopic cholecystectomy (LC) is simultaneously performed through an additional port[7,8].

Previously, we have reported our preliminary results of LS in children[9]. We concluded that controlling hemorrhage from the splenic hilum or capsule, which is the main cause of conversion, is a key to successful LS. Another point was consideration of the method to reduce the number and size of ports to improve cosmesis, especially in concomitant LS and LC (LSC). Since then, we have come up with various ideas to avoid complications and to improve cosmesis. The aim of the present report is to describe our current technique of LSC using fewer and smaller ports and to evaluate its safety and efficacy in children.

MATERIALS AND METHODS

From July 1993 through December 2008, 28 children

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15 years or younger underwent LS or LSC at The Jikei University Hospital or Kawaguchi Municipal Medical Center (Table 1). Ten children were treated with LSC for HS with cholelithiasis ; of these procedures, 3 were with 5 ports and 7 were with 4 ports. Eighteen children were treated with LS for HS without cholelithiasis, using 4 ports. Perioperative clinical data (operative time, estimated blood loss, spleen weight, length of hospital stay, and complications) were reviewed. Statistical analysis was performed with unpaired *t*-tests. A *p*-value less than .05 indicated a statistically significant difference.

Our current technique for LSC and LS

Trocar position

In our early series, 5 ports (4 10- to 12-mm ports and 1 5-mm port) were used for LSC (Fig. 1-A). After the completion of the standard LC procedure, an additional 10-mm port was inserted at the left anterior axillary line to perform LS. With the availability of new and smaller devices and energy sources, such as the flexible linear stapler, the Harmonic Scalpel (Ethicon Endo-Surgery, Cincinnati, OH, USA), the LigaSure vessel-sealing device (Covidien, Mansfield, MA, USA), and the snake retractor, LSC can be

Table 1. Patient demographics

	LSC for HS with cholelithiasis		LS for HS 4 ports
	5 ports	4 ports	
Male : Female	3 : 0	1 : 6	7 : 11
Mean age (range), years	11.3* (9-15)	10.0* (6-14)	7.3 (4-12)
Mean body weight (range), kg	36.0* (26-50)	31.0 (16-44)	24.7 (17-39)

LSC, concomitant laparoscopic splenectomy and cholecystectomy ; LS, laparoscopic splenectomy ; HS, hereditary spherocytosis
*Compared with LS for HS, $p<.05$

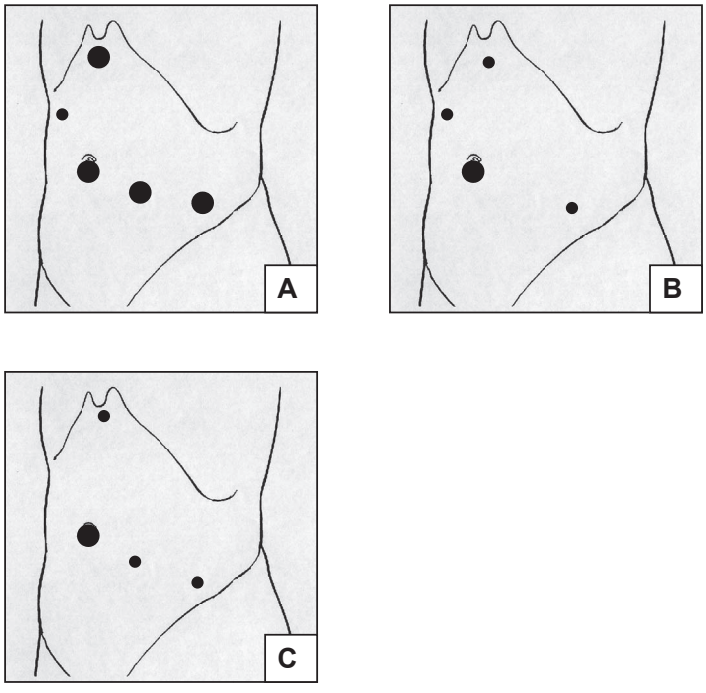

Fig. 1. Trocar position
In our early series, 5 ports were used for LSC to treat HS with cholelithiasis (A). B shows LSC with 4 ports for treating HS with cholelithiasis, and C shows LS for treating HS without cholelithiasis.
Large closed circles indicate port sites for 10- or 12-mm trocars, and small closed circles show 5-mm ports.

performed with 4 smaller ports (Fig. 1-B, C). The key factor of this method is the modified port position. For LS with 4 ports, a 12-mm cannula is inserted at the umbilicus, and 3 additional 5-mm ports are inserted in the subxiphoid position, in the left lower quadrant, and in the left posterior flank. For LSC with 4 ports, a 5-mm port is inserted under the right costal margin instead of in the left lower quadrant.

Patient position

A lateral approach, as described by Rothenberg[1], was used for LS. The patient was positioned in an approximately 45° right semilateral and reverse Trendelenburg position. For LSC, we modified this position by elevating the patients' left side by approximately 15°. For LC, we rotated the operative table to the left until the patient was positioned in a left semilateral and reverse Trendelenburg position. After the gallbladder was removed through the umbilical site, the table was rotated to the right to perform LS in an approximately 45° semilateral position.

Surgical approach for LS and LSC with 4 ports

For LS, a 10-mm, 30-degree laparoscope was inserted through the umbilical cannula. The subxiphoid and left lower quadrant sites were used as working ports with a 5-mm Babcock forceps, a Harmonic Scalpel, or a LigaSure device. The spleen was retracted and elevated with the snake retractor through the left posterior flank opening. When either a flexible linear stapler or a specimen retrieval bag (Endo Catch-II, Ethicon Endo-Surgery) was inserted through the umbilical site, a 5-mm laparoscope, instead of a 10-mm laparoscope, was inserted through the 5-mm port.

For the LC part of LSC, the subxiphoid and umbilicus openings were used as working ports. The right costal port was used to retract the gallbladder, and a 5-mm, 30-degree laparoscope was placed through the left posterior flank site. Then LC was performed in the standard fashion. For the subsequent LS, the subxiphoid and the right costal margin sites were used as working ports with a 5-mm Babcock forceps, a Harmonic scalpel, and a LigaSure device. A 10-mm, 30-degree laparoscope, flexible linear stapler, and specimen retrieval bag were inserted through the umbilical site. The spleen was retracted and elevated with the snake retractor through the left posterior flank opening.

Our surgical approach for LS is a modification of procedures described previously by Rothenberg[1] and Rescorla et al.[2] in which the spleen is mobilized with a Harmonic scalpel or a LigaSure device before the hilar vessels are divided. The main difference in our approach from those of Rothenberg and Rescorla et al. is that the snake retractor is used to elevate the spleen, and the splenic hilum is ligated extracoporeally before en bloc transection of the distal splenic hilum with a flexible linear stapler. In more recent cases, a LigaSure device has been used for clipless/stapleless dissection of the splenic hilum. The spleen was placed into a 15-mm specimen retrieval bag. This retrieval bag also can be inserted directly through the umbilical incision. No drain was placed.

Results

No conversion to open procedures was required, and no severe postoperative complications, such as bleeding requiring transfusion, postoperative pancreatitis, wound infections, and accidental injury, occurred (Table 2). The mean operative times of LSC with 4 ports or with 5 ports were significantly longer than that of LS alone, but there was no significant difference between LSC with 4 ports and LSC with 5 ports. The estimated blood loss and spleen weight were similar in all groups. The postoperative hospital stay for LSC with 5 ports was significantly longer than that for LS, but there was no significant difference in the postoperative stay between LSC with 5 ports and LSC with 4 ports.

Discussion

HS is often associated with hemolytic crisis and premature cholelithiasis. In their series of children undergoing LS for HS, Rescola et al. observed cholelithiasis in 27% of children younger than 10 years and in 56% of children 10 years or older[16]. In the present study, we also found that the mean age of children who had HS without cholelithiasis was less than that of children who had HS with cholelithiasis. In most reported LSC series, a 5th port is used for LC[7,17], and only a few cases of LSC with 4 ports have been reported[19]. Patient position and trocar positions differ between LC and LS. To obtain adequate exposure for safe dissection of the gallbladder and spleen in LSC, the use of a 5th port may be necessary. The use of fewer ports may

Table 2. Perioperative data

	LSC for HS with cholelithiasis		LS for HS 4 ports
	5 ports	4 ports	
Mean operative time (SD), minutes	257* (28)	239* (49)	180 (57)
Mean estimated blood loss (SD), ml	10 (0)	31 (38)	31 (45)
Mean spleen weight (SD), g	270 (89)	350 (189)	268 (151)
Mean postoperative hospital stay (SD), days	8.0* (1.0)	7.1 (0.9)	6.1 (1.3)
Conversion to open procedure	0	0	0
Postoperative pancreatitis	0	0	0

LSC, concomitant laparoscopic splenectomy and cholecystectomy ; LS, laparoscopic splenectomy ; HS, hereditary spherocytosis
*Compared with LS for HS, $p<.05$

prolong operations or affect the mortality rate. In our series, however, there was no significant difference in mean operative time between LSC with 4 ports and LSC with 5 ports. The mean operative time of LSC with either 4 or 5 ports was approximately 60 minutes longer than that of LS and can be attributed to the duration of LC. Therefore, we believe that our 4-port technique for LSC did not affect the operative time of LS. Furthermore, we did not have any major perioperative complications while performing LSC with 4 ports. On the basis of our data, we conclude that LSC can be performed safely with our method of trocar positioning and fewer ports. A significant additional benefit of this method is improved cosmesis due to fewer and smaller cannulas. This is particularly beneficial for younger children. Further comparative studies of 4 ports versus 5 ports regarding postoperative pain scores, pain medication use, and perceived cosmetic outcome might support our conclusions.

LS have been widely accepted as the standard method for treating hematological disorders of the spleen in adults and children. The avoidance of hemorrhage from the splenic hilum or fragile parenchyma, which is the major reasons for conversion to an open procedure, is a fundamental step during LS and a key to its success. To help prevent hemorrhage, several techniques have been developed and include hand assistance[10], preoperative splenic artery embolization[11], the lateral approach[12], and the hanged spleen technique[13]. Clips, sutures, staplers, the Harmonic scalpel, and vessel-sealing devices have been used to achieve hemostasis. In our preliminary report, 2 laparoscopic procedures for ITP were converted to open procedures because of bleeding from the splenic hilum[9]. In these 2 cases, the splenic artery and vein were individually clipped and divided before the spleen was mobilized. During dissection, a hilar vessel was injured, and the bleeding could not be controlled under laparoscopic guidance. Because of these experiences, we changed our procedure so that the ligament is divided and the spleen is mobilized as the first step of surgery, instead of treating the splenic hilum to interrupt the blood supply to the spleen. Although complete mobilization may increase the risk of splenic migration and complicate exposure of the splenic hilum, the snake retractor is useful for preventing splenic migration. This retractor is also useful to ensure the spleen is completely mobilized from the posterior space and is completely elevated so that a flexible linear stapler can be placed across the splenic hilum.

In the final step of the surgery, the splenic hilum was ligated, and the distal splenic hilum was divided en bloc with a flexible linear stapler. Ligation of the splenic hilum reduces its size and provides easier access for the flexible linear stapler. For recent cases we have used the LigaSure vessel-sealing device for a clipless/stapleless method. Several advantages of LigaSure over other instruments have been reported[14,15]. We believe that LigaSure is also useful to prevent pancreatitis or pancreatic fistulas when only a short distance separates the pancreas tail from the splenic hilum.

Recently, single-incision LSC in children has been reported[18]. Although more experience is needed to investigate its safety and benefits, the pursuit of "scarless" and "painless" surgery is, and will always be, an important

theme for the pediatric population.

We conclude that our current technique, which uses fewer and smaller ports and newer energy sources, achieves a better cosmetic appearance with smaller wounds and a lower risk of complications. Concomitant LSC is a safe and effective procedure in children.

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