Technical Advances in Pediatric Laparoscopy Have Had a Beneficial Impact on Splenectomy

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Purpose: The aim of this study was to demonstrate the effects of recent technical advances on the safety and benefits of pediatric laparoscopic splenectomy.

Methods: A retrospective review was conducted of patients undergoing laparoscopic splenectomy from January 1998 to January 2000. Technical advances utilized during this period included the harmonic scalpel, a specialized flexible hilar retractor, a larger, wire-rimmed specimen bag, and lateral patient positioning.

Results: Laparoscopic splenectomy was performed successfully on 18 patients aged 3 to 17 years (median, 9). The indications were hereditary spherocytosis (n = 10), idiopathic thrombocytopenic purpura (n = 5), and other (n = 3). Eight patients had concomitant procedures including cholecystectomy (n = 3), resection of an accessory spleen (n = 3), and other (n = 2). The median operating time, including the concomitant procedures, was 125 minutes (range, 70 to 235). Patients tolerated a regular diet on median postoperative day 1 (range, 1 to 3), and 16 were discharged home on or before postoperative day 2. None of the patients required blood product transfusion or conversion to an open technique. There were no complications, and all patients had returned to usual activity by 2 weeks.

Conclusion: With recent technological advances, the laparoscopic approach has become easy to perform, safe, and should be considered the procedure of choice for pediatric splenectomy.

INDEX WORDS: Laparoscopy, splenectomy.

LAPAROSCOPIC splenectomy for hematologic disorders in children was first reported in 1993.[1] A number of series comparing laparoscopic splenectomy (LS) to open splenectomy (OS) have followed.[2-8] Although the minimally invasive approach offered the prospect of less postoperative pain and faster recovery, the early experience was associated with longer operating times and higher costs.[3,4,7] Larger series have shown a trend toward shorter operating times and financial savings.[6,8] A previous report from this institution showed no advantage of LS over OS.[2] We reviewed our recent experience with LS with the aim of showing improved results with LS and identifying the technological advances responsible.

MATERIALS AND METHODS

Patients

The hospital charts and financial records of the 18 patients who underwent laparoscopic splenectomy between January 1998 and January 2000 at the Childrens Hospital Los Angeles were reviewed. The patients' ages ranged from 3 to 17 (both mean and median age of 9). The indications for splenectomy were hereditary spherocytosis (n = 10), idiopathic thrombocytopenic purpura (n = 5), sickle cell disease (n = 2), and hemolytic anemia (n = 1). Selection for a laparoscopic approach was by the attending surgeon. During this same period, 7 patients underwent open splenectomy. Three of these were performed by surgeons who do not perform laparoscopic splenectomies. The other patients required other procedures that precluded a laparoscopic approach: portocaval shunts (n = 2), trauma (n = 1), and massive splenomegaly (n = 1). The records were evaluated for operating time, estimated blood loss, transfusion requirement, time to tolerating diet, length of hospital stay, morbidity, and cost of the procedure.

Surgical Technique

The technique used is a modification of those reported previously.[9-11] After induction of general endotracheal anesthesia and passage of an oral gastric tube, the patient is placed on a beanbag in a modified lateral decubitus position with the left side elevated approximately 70°. With the surgeon and assistant opposite one another and the table rolled to place the patient in the supine position, an umbilical skin incision is made, and the Veress needle is used to insufflate the peritoneal cavity with CO_2 gas. Three or 4 trocars are used. A 30° telescope is introduced through a 5-mm port at the umbilicus. One or 2 additional 5-mm working ports are placed in the upper midline, and a 12-mm port is placed in the left lower quadrant (Fig 1). Bupivacaine hydrochloride (0.25% solution) is injected at each port site. The table is rolled to place the patient back in the lateral decubitus position. This maneuver effectively "hangs" the spleen from its lateral side wall attachments, and the left lobe of the liver falls away without the need for additional retractors.[10]

The surgeon and assistant then stand on the patient's right side with a single video monitor on the left. Dissection is begun by freeing the lower pole of the spleen from its attachments to the colon using the harmonic scalpel (Ethicon Endosurgery, Cincinnati, OH; Fig 2A). The short gastric vessels are next divided with the harmonic scalpel,

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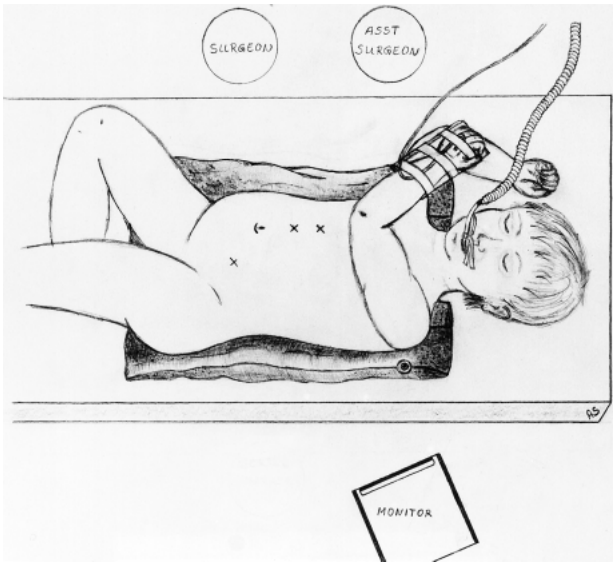

Fig 1. The patient is placed in a modified lateral decubitus position with the surgeon and assistant on the right. A camera is inserted through a 5-mm umbilical trocar, and 3 additional working ports are placed (2 5-mm in the upper midline and 1 12-mm in the left lower quadrant).

thus exposing the splenic hilum (Fig 2B). A flexible hook retractor (Esophageal retractor; Deknatel, Snowden, Pencer, Fall River, MA) is used to encircle the hilum (Fig 2C). Because the spleen's lateral attachments are still intact, medial traction with this device tents up the vessels for easy division with a 35-mm endogastrointestinal stapler with vascular load (Ethicon; Fig 2D). The lateral attachments are taken down last using the harmonic scalpel or scissors, depending on vascularity. The spleen, completely free at this point, is placed in a large, wire-rimmed specimen bag (Endocatch II; Autosuture- USSC, Norwalk, CT), which is inserted through the existing left lower quadrant incision after removing the 12-mm trocar. The open end of the bag is delivered through the skin, and the specimen is morcellated with a finger and extracted with a sponge clamp. Care is taken to prevent splenic implants in the wound. After a search for accessory spleens, the trocars and orogastric tube are removed and the peritoneal cavity desufflated. The fascial defect of the 12-mm port is closed with 2-0 polyglycolic acid suture and all skin incisions with subcuticular 4-0 polyglycolic acid suture and steristrips. If a concomitant cholecystectomy is required, it is performed with the patient in the supine position using an additional right upper quadrant 5-mm port.

RESULTS

Laparoscopic splenectomy was completed successfully on all 18 patients. The overall median operating time was 125 minutes (range, 70 to 235). The median operating time for splenectomy without an additional procedure was 105 minutes (range, 70 to 150). Eight patients had concomitant procedures including cholecystectomy (n = 3), resection of accessory spleen (n = 3), liver biopsy (n = 1), and repair of umbilical hernia and bone marrow aspiration and biopsy (n = 1). The average blood loss was 60 mL. No patient required transfusion of blood products or conversion to an open technique. Patients tolerated regular diet on median postoperative day 1 (range, 1 to 3). Seven patients were discharged home on postoperative day 1, and 9 on day 2. The other 2 patients, the first 2 in this series, were discharged on postoperative day 4.

There were no complications or readmissions within 30 days. All patients had resumed normal activity by 2 weeks. Follow-up has ranged from 2 months to 26 months. There have been no long-term complications, and no patient has required reoperation for further splenic surgery. The average operating room charges for laparoscopic splenectomy were $11,365. The charges for comparable open splenectomies averaged $10,709. Charges for total hospitalization were not available.

DISCUSSION

Splenectomy is an important treatment for many pediatric hematologic disorders, and the laparoscopic approach recently has gained favor among surgeons. Rescorla et al[8] have reported the largest series to date with 50 laparoscopic splenectomies over a 3-year period. These results and others have shown that laparoscopic splenectomy is safe and effective in children.[3,4,6,7] The advantages of laparoscopy are less pain, shorter hospital stays, improved appearance, and possibly fewer adhesions. The disadvantages cited include longer operating times and increased costs.

In a previous report from this institution, Beanes et al[2] compared 7 laparoscopic (LS) and 14 open splenectomies (OS) in a case-controlled study over the period from 1993 to 1994. Because this study showed longer operating times with LS, and no significant difference in the time to regular diet, hospital stay, or narcotic usage, the investigators concluded that LS did not offer an advantage over OS. The current series covers the institution's experience over the past 2 years and allows for some comparison with the previous results. There were only 3 comparable open splenectomies performed during the recent interval, which makes a new case controlled study impossible.

We have confirmed that LS is a safe and effective procedure. There were no complications; blood loss was minimal even in patients with low platelet counts; no transfusions of red cells or platelets were required. Unlike the earlier series from this institution in which 14% of the cases required conversion to an open technique, all of the splenectomies in the current series were performed successfully laparoscopically.[2] This is consistent with the range of 0% to 6% found in other large pediatric series.[6,8] All but 2 of our patients were discharged by the second postoperative day, which is shorter than the published average of 3- to 4-day stays for OS.[2-7]

The disadvantage of longer operating times associated with laparoscopic procedures is becoming less of an

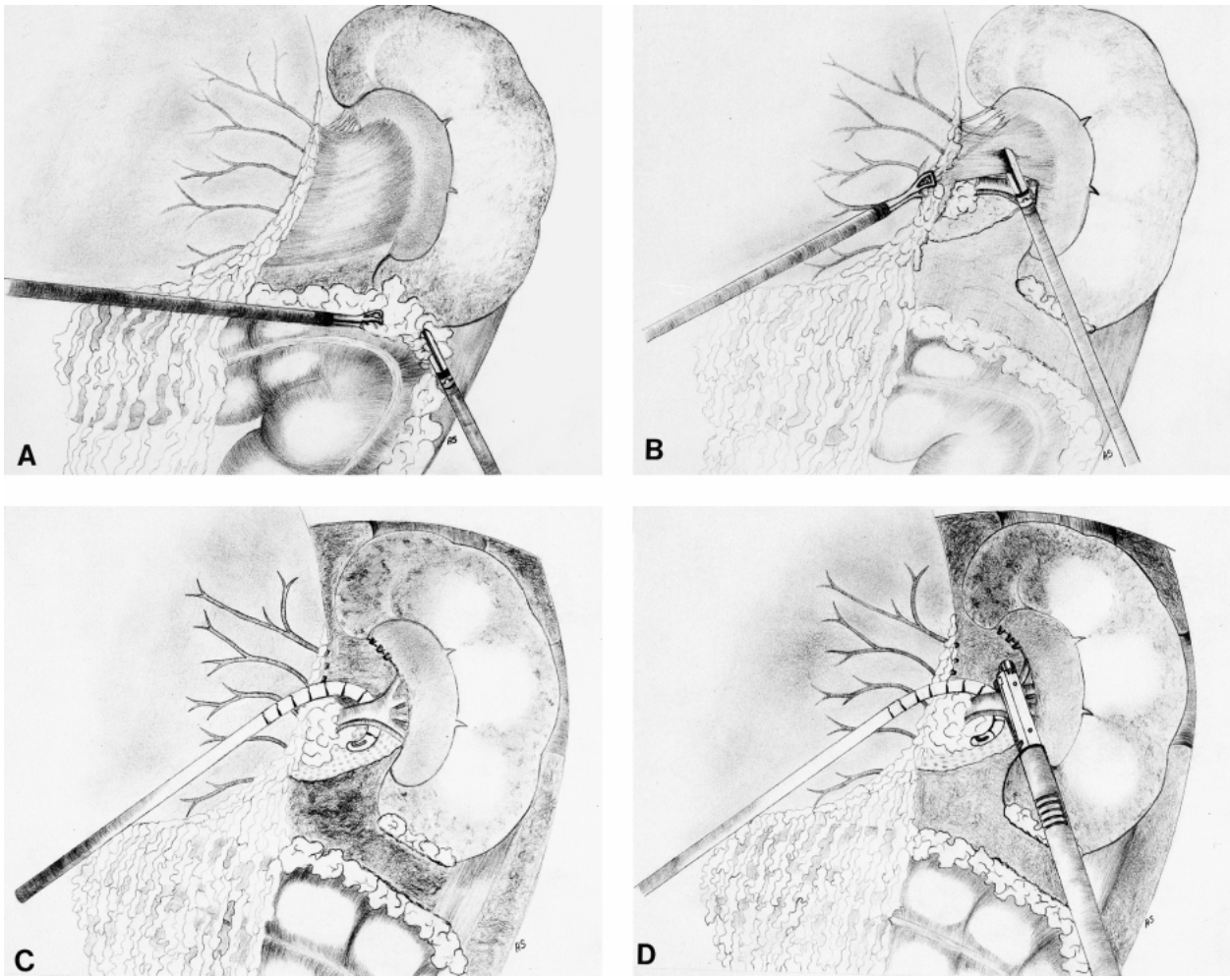

Fig 2. (A) In the initial step of dissection, the colon is retracted medially, while the harmonic scalpel is used to free the inferior pole of the spleen. (B) With the patient in the lateral decubitus position, the left lobe of the liver falls medially allowing traction on the stomach and division of the short gastric vessels with the harmonic scalpel. (C) The spleen is now suspended by its attachments to the abdominal wall permitting the passage of a flexible esophageal retractor around the hilum. (D) Medial traction on the retractor tents up the hilar vessels for division with an endostapler.

issue. Our median LS operating time of 105 minutes is less than half the institution's previous time of 221 minutes and compares favorably with other investigators who report average operating times of 115 to 211 minutes for LS.[4,8] This approaches the traditional operating times for OS reported in the literature (averages range, 59 to 100 minutes).[2,5] Moreover, when splenectomy is combined with cholecystectomy, the laparoscopic approach has already been shown to be faster in 1 case-controlled study.[8]

The other perceived disadvantage of laparoscopic procedures is increased cost. In a cost analysis review of fundoplications, cholecystectomies, appendectomies, and splenectomies performed at a children's hospital, the laparoscopic approach had higher operating costs, but the subsequent shorter hospital stays resulted in overall cost savings per procedure.[12] The 2 largest series comparing LS and OS also found lower average hospital charges for LS, although not statistically significant.[6,8] However, 3 smaller series found OS to be significantly less expensive.[3,4,7] With shortened operating time and the use of reusable instruments, our average operating charges for LS and OS performed during the same time period were nearly equal. The data for total hospitalization were not available; however, because the LS patients had a shorter hospital stay, this would suggest an overall savings.

The improved results in LS as compared with earlier experience is multifactorial. Laparocopic skills of pediatric surgeons have improved with experience. We also have made a number of changes in the surgical technique in the last 2 years. Changing from a supine to a modified lateral position of the patient improves exposure decreasing the number of retractors needed and avoiding the need to grasp the spleen. Dissection is faster with the

harmonic scalpel, and the use of clip appliers is rarely needed. Early laparoscopic bags were too small to accommodate the spleen, and mini-laparotomy was sometimes needed for specimen removal. The bag material also was prone to tearing risking splenosis and double bagging of the specimen often was required. With the advent of larger, stronger specimen bags, these problems are avoided. The use of an esophageal retractor to hook the hilum has made exposure of the vessels for division easier.

These technical advances have transformed LS from a long, difficult and costly operation into a fast, safe, and effective procedure. The issue of cost has not been resolved, but recent findings suggest a savings associated with laparoscopy. For these reasons, LS remains our preferred technique.

REFERENCES

1. Tulman S, Holocomb GW, Karamanoukian HL, et al: Pediatric laparoscopic splenectomy. J Pediatr Surg 28:689-692, 1993

2. Beanes S, Emil S, Kosi M, et al: A comparison of laparoscopic versus open splenectomy in children. Am Surg 61:908-910, 1995

3. Janu PG, Rogers DA, Lobe TE: A comparison of laparoscopic and traditional open splenectomy in childhood. J Pediatr Surg 31:109-114, 1996

4. Waldhausen JH, Tapper D: Is pediatric laparoscopic splenectomy safe and cost-effective? Arch Surg 132:822-824, 1997

5. Esposito C, Corcione F, Garipoli V, et al: Pediatric laparoscopic splenectomy: Are there real advantages in comparison with the traditional open approach? Pediatr Surg Int 12:509-510, 1997

6. Farah RA, Rogers ZR, Thompson WR, et al: Comparison of laparoscopic and open splenectomy in children with hematologic disorders. J Pediatr 131:41-46, 1997

7. Curran TJ, Foley MI, Swanstrom LL, et al: Laparoscopy improves outcomes for pediatric splenectomy. J Pediatr Surg 33:1498-1500, 1998

8. Rescorla FJ, Breitfeld PP, West KW, et al: A case controlled comparison of open and laparoscopic splenectomy in children. Surgery 124:670-676, 1998

9. Rothenberg SS: Laparoscopic splenectomy using the harmonic scalpel. J Laparoendo Surg 6:S61-S63, 1996

10. Delaitre B: Laparoscopic splenectomy: The hanged spleen technique. Surg Endosc 9:528-529, 1995

11. Fitzgerald PG, Langer JC, Cameron BH, et al: Pediatric laparoscopic splenectomy using the lateral approach. Surg Endosc 10:859-861, 1996

12. Luks FI, Logan J, Breuer CK, et al: Cost-effectiveness of laparoscopy in children. Arch Pediatr Adoles Med 153:965-968, 1999