Laparoscopic Management of Gallbladder Disease in Children and Adolescents

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ABSTRACT

Background: Between July 1991 and April 1996, 40 children and adolescents age 17 or less underwent laparoscopic management of their gallbladder disease. Twenty-eight patients were females and 12 were males. Their average age was 12.7 years (range 2-17 years), and average weight was 50 kilograms, range 12.2-95.9 kilograms. Nine patients had gallstone pancreatitis and seven patients had sickle cell disease. Laparoscopic cholecystectomy was attempted in all patients with or without modifications of the standard technique dictated by the size of the patient.

Methods: The practice of intraoperative cholangiogram varied with the practicing surgeon. Those with clinical or biochemical evidence of common bile duct obstruction underwent preoperative endoscopic retrograde cholangiopancreatography to rule out other causes of hyperbilirubinemia and/or therapy for choledocholithiasis if present. Patients with unsuccessful intraoperative cholangiogram were followed clinically and were subjected to postoperative endoscopic retrograde cholangiopancreatography should they develop clinical or biochemical evidence of common bile duct obstruction. Thirty-six patients were completed laparoscopically (90%). Four patients were converted to open cholecystectomy (10%). Four patients required preoperative endoscopic retrograde cholangiopancreatography and were successfully treated. Postoperative endoscopic retrograde cholangiopancreatography was unsuccessful in one patient who required the procedure because of retained common bile duct stone. Four patients suffered complications (10%). Three patients continued to have abdominal pain that was not helped with surgery.

Conclusions: Based on our experience, laparoscopic cholecystectomy with preoperative endoscopic retrograde cholangiopancreatography if required, is safe and effective in management of gallbladder disease in children and adolescents. However, careful preoperative evaluation is required to avoid persistent postoperative abdominal pain.

Key Words: Laparoscopic cholecystectomy, Cholangiogram, Endoscopic retrograde cholangiopancreatography, Pediatric.

INTRODUCTION

Recent advances in technology have led to a surge of interest in minimal-access surgery. After the initial success in adults, laparoscopic cholecystectomy (LC) has gained a worldwide popularity, and along with the continuously evolving technology, has stimulated general surgeons to consider other procedures using minimal-access surgery. Many pediatric surgeons, on the other hand, have been reluctant to embrace laparoscopy as a diagnostic or therapeutic tool. More recently, there has been increasing interest in performing conventional pediatric procedures using laparoscopy. Many reports were published in the literature about LC in pediatric patients, based largely on adult experience, but modified to suit the different abdominal cavity. The outcome is analogous to that in adults. As our experience with LC in pediatric patients has increased, significant modifications in the technique have been made including the size of the telescope, as well as in the size and location of the trocars. These modifications have helped us to complete the procedure laparoscopically.

We retrospectively reviewed our experience with laparoscopic management of gallbladder disease in 40 pediatric and adolescent patients age 17 or less. Our objectives were to assess the safety and the applicability of the procedure, as well as the role played by the modifications of the surgical technique.

MATERIALS AND METHODS

After the permission to conduct the study was granted by the committee on clinical investigation in each hospital, all patients age 17 or less who had undergone LC at our institutions between July 1991 and April 1996 were retrospectively reviewed. The charts were reviewed for details of presentation, the preoperative and the intraoperative management, as well as the postoperative course. Follow-up
information was gathered from clinic charts. All patients had abdominal pain secondary either to symptomatic cholelithiasis, cholecystitis, or gallstone pancreatitis. Gallstone pancreatitis is defined as sudden onset of upper abdominal pain with elevated serum amylase and/or serum lipase in the presence of sonographic evidence of biliary stones and absence of other causes of pancreatitis. Patients with gallstone pancreatitis were treated with bowel rest and intravenous hydration followed by LC after resolution of abdominal pain and reduction of serum amylase and lipase levels.

The operative technique was similar to that described by Reddick and Olsen in 1989. Some modifications in the technique were dictated by the size of the patient. These include:

1) Umbilical cutdown with blunt trocar insertion.
2) Single 10 mm port, and three 5 mm ports.
3) Moving the epigastric port to the left of the midline.
4) Moving the right lower quadrant port inferiorly towards the right inguinal crease.
5) An intraoperative cholangiogram (IOC) through the gallbladder.
6) All 5 mm ports in very small children.

Patients with persistent clinical or sonographic evidence of common bile duct (CBD) stones underwent preoperative endoscopic retrograde cholangiopancreatography (ERCP) whenever technically possible; otherwise an IOC was done, although this practice varied with the operating surgeon. Some surgeons attempted IOC in every case, while others attempted the procedure only in the presence of questionable anatomy or a history of common bile duct pathology. The compiled data was then subjected to statistical analysis using a two-tailed student’s T test comparing operative time, blood loss and postoperative hospital stay between patients completed laparoscopically and those converted to open cholecystectomy.

RESULTS

Twenty-eight patients were female and 12 were male. Average age was 12.7 years with a range of 2-17 years. Average weight was 50 kg with a range of 12.2-95.9 kg. Seven patients had sickle cell disease and nine had gallstone pancreatitis. LC was completed successfully in 36 patients (90%). The operation in eight of nine patients with gallstone pancreatitis was completed laparoscopically (88.8%). Four patients were converted to open procedure (10%). Of the conversions, one patient had acute cholecystitis with severe adhesions. Another patient had an intrahepatic gallbladder which could not be safely removed. A third patient had a dilated CBD by ultrasound; however, an IOC failed due to technical difficulties. There was a large bile leak under pressure indicative of possible distal obstruction. After conversion, a large stone was removed by CBD exploration. The last patient was converted because of equipment failure and inadequate visualization.

IOC was completed in 16 patients (40%) and failed in six patients (15%). Reasons for failure of IOC included technical difficulties with size and/or angulation of the cystic duct or because of Heister’s valves. Only one patient had evidence of possible CBD stone and was removed by an open procedure. Four patients underwent successful preoperative ERCP and sphincterotomy for dilated CBD, CBD stone and/or jaundice. Eight out of nine patients with gallstone pancreatitis were successfully treated laparoscopically. Four patients suffered complications (10%). Two had postoperative bleeding that was recognized later. One patient had postoperative ileus, believed to be secondary to postoperative bleeding since he dropped his hematocrit to 21% from 35%. He was hemodynamically stable and was discharged after transfusion to a hematocrit of 28%. The second patient was readmitted four days after surgery because of abdominal pain, nausea and vomiting. His hematocrit dropped to 16% from 32%. His CT scan showed free fluid, presumably blood, in the abdomen and pelvis. He was also hemodynamically stable and was discharged after transfusion to a hematocrit of 30%. In both cases, we believe that bleeding occurred at the gallbladder bed. One patient had a postoperative pneumonia that was treated with IV antibiotics. Another patient had a missed CBD stone that was identified intraoperatively, but was thought to be flushed out with saline after giving the patient IV glucagon. The patient was admitted a month later with cholangitis. ERCP failed to remove an 8 mm impacted stone in the CBD. The patient subsequently required an open CBD exploration.

Interestingly, three patients continued to have postoperative abdominal pain that was not helped with surgery. Two, in retrospect, were found to be related to sickle cell crises, and both patients were probably asymptomatic from their cholelithiasis. The cause of the pain in the third patient was never identified.

Our mean operative time, mean blood loss and median postoperative stay are shown in Table 1.

DISCUSSION

Because cholelithiasis in children is uncommon, the number of pediatric surgeons who have attempted to learn the technique of LC has been on the increase.
Table 1. Intraoperative and Postoperative Data.

| Operation                | Operative Time (M) | Blood Loss (CC) | Postop Stay (Days) |
|--------------------------|--------------------|----------------|-------------------|
|                          | Mean | Range    | Mean     | Range    | Mean | Range    |
| Lap                      | 100  | 65-205   | 38.5     | 5-100    | 1.5  | (0-10)   |
| Converted to Open        | 209  | 80-320   | 93.5     | 55-125   | 4    | (4-6)    |
|                          |       |          | P < 0.05 | P < 0.05 | P < 0.05 |

The several advantages offered by this technique are true in children as well as in adults: shorter postoperative stay, less pain and quicker return to normal activities. One group of patients in whom cholelithiasis remains relatively common are patients with sickle cell disease. LC has been found to be beneficial in this patient group.

In this series, we are reporting a large experience with LC in children and adolescents. Through this experience, we have found that several modifications of the technique are useful for optimal visualization and manipulation of the tissues. Similar recommendations have been made by others. In children weighing less than 30 kg, we move the epigastric port toward the left midclavicular line and the right lower quadrant port toward the right inguinal crease (Figure 1). The use of long acting anesthetics has been reported by Tagge, et al., as a way to improve postoperative breathing. We believe that both instantaneous and long acting pain relief are important ways to provide preemptive analgesia. To provide this, we infiltrate the skin, subcutaneous tissues and subperitoneal layer with a 1:1 mixture of 0.5% bupivacaine with epinephrine (1:100,000) and 2% lidocaine prior to making the skin incision. The subperitoneal injection is easy to perform by injecting under direct vision just prior to trocar insertion.

IOC has been strongly advocated for all pediatric patients preferably prior to clipping and division of the cystic duct to prevent misidentification of the small common bile duct. Recently, Holcomb, et al., have advocated a new atraumatic clamp (Kumar clamp) to facilitate IOC in very small cystic ducts. The clamp is applied at the infundibulum and a 23-gauge sclerotherapy needle is advanced into the cystic duct through a side port. In our series, the practice of IOC varied according to the practicing surgeon. However, all agreed that it should be attempted in patients with ultrasonic evidence of a dilated CBD without jaundice. Those with ultrasonic evidence of CBD stones or clinical and/or biochemical evidence of common bile duct obstruction, e.g. direct reacting hyperbilirubinemia, should undergo preoperative ERCP in an effort to remove any CBD stones. We had four patients who fell into this category. All were successfully treated with preoperative ERCP with sphincterotomy and removal of CBD stones.

As experience with LC has increased, not all surgeons in our group have insisted on performing IOC in patients without preoperative evidence of CBD pathology. If IOC is not performed, the patients are observed for any postoperative signs of jaundice or recurrent pain. Only if these symptoms occur and jaundice or CBD dilatation are present would patients be referred for ERCP. Unfortunately, the one patient in our series who was referred for a postoperative ERCP was not able to be successfully treated endoscopically and underwent the removal of a CBD stone via an open CBD exploration. In spite of this anecdotal experience, we believe that postoperative ERCP probably stands an equal chance to preoperative ERCP in extracting retained CBD stones. Since ERCP, especially with sphincterotomy, can be challenging in small children, we prefer to limit its preoperative use to those situations in which it is clearly indicated.

Holcomb, et al., have debated the value of LC for children with CBD obstruction or gallstone pancreatitis. Nine of our patients had gallstone pancreatitis. Eight patients were successfully treated laparoscopically after allowing the patient’s pancreatitis to resolve. None of these patients had evidence of common bile duct obstruction at the time of their LC. Eight out of the nine also underwent IOC. One patient was converted to an open procedure because of equipment failure and inadequate visualization. Regarding patients with sickle cell disease, whenever possible, these patients were gradually prepared for surgery using repeated transfusions of small amounts of packed red blood cells. The goal was to lower the hemoglobin S levels to below 30% while maintaining the overall hematocrit to at least 30%. The patients were routinely admitted to the hospital on the day prior to surgery to insure adequate preoperative hydration. In a jaundiced patient with sickle cell disease,
Figure 1. Proposed size and site of trocar insertion in pediatric patients.

the fractionation of total bilirubin may help determine whether the elevated bilirubin is due to obstruction or hemolysis. IOC is recommended in these patients even in the presence of normal size CBD.

The finding of cholelithiasis in children is increasing with the routine use of ultrasound for the evaluation of childhood abdominal pain. Technical advances in imaging and the refinement of laparoscopic surgical instruments, such as the availability of a 5 mm clip applier, have enabled removal of the gallbladder using only 5 mm ports. The improvements in the external appearance of the patient following LC might give one the impression that the procedure has fewer risks than an open cholecystectomy. Successful performance of LC has been reported in neonates and infants. The combination of these facts is likely to lead to an increase in the number of patients being referred for LC. Some authors have reported that symptoms, when present, are not as specific as in adults and consist of repeated attacks of abdominal pain and vomiting and that these patients benefit from cholecystectomy. We would tend to disagree with this. We have seen some patients in whom nonspecific symptoms or pain, which was not characteristic of biliary colic, returned following cholecystectomy. Based upon our experience with recurrent pain in children following LC, we would emphasize the importance of careful preoperative evaluation. A clinical history of postprandial epigastric or right upper quadrant pain, jaundice or pancreatitis should be present in any patient with gallstones undergoing a LC. In other words, the indications for the procedure should not change just because the apparent complications or side effects are less. Until data is available to the contrary, at the present time we are not recommending removal of asymptomatic gallstones in children.

In conclusion, LC has proven to be both a safe and effective method of treating symptomatic gallstones in children and adolescents. ERCP is becoming a useful preoperative adjunct to the evaluation and management of patients with common bile duct stones. When used in combination with LC, open operations can usually be avoided. Gallstone pancreatitis in children can be safely treated with LC once the pain has resolved. We would emphasize that a careful preoperative evaluation be performed in an effort to maximize the benefit that pediatric patients receive from LC.

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