

Laparoscopic cholecystectomy in childhood: a review of twenty-four consecutive cases

Esra Ozcakil, Serpil Sancar, Mete Kaya

Department of Pediatric Surgery, University of Health Sciences, Bursa Yuksek Ihtisas Training and Research Hospital, Bursa, Turkey

ABSTRACT

Objectives. The experience with laparoscopic cholecystectomy in children remains limited. Therefore, we aimed to present our experience with this procedure. **Methods.** Between April 2011 and June 2016, retrospectively, data points of children who underwent laparoscopic cholecystectomy reviewed included demographics properties, indication for cholecystectomy, surgical technique, operative time, complications, and length of hospital stay. **Results.** Twenty-four children (5 were males with ages ranging from 2 to 17 years, mean: 10.5 years) underwent laparoscopic cholecystectomy. The indication for surgery was associated to symptomatic gallstones in all patients. The surgery was performed under general anesthesia and classical 4-port approach was done in twenty-two patients, and 2-port approach in combination with 2 portless 2.3-mm percutaneous graspers was used in two patients. The operating time ranged between 45 and 90 minutes (mean: 60 minutes). Two patients ended by open surgery. No complications occurred. Hospital stays ranged from 1-3 days. **Conclusion.** Laparoscopic cholecystectomy is safe and effective in children, and shows the same advantages reported in adult series.

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Keywords: Laparoscopy; cholecystectomy; cholelithiasis; children

Introduction

Gallbladder disease, which is rarely seen in children, is generally accompanied with hemolytic disorders, biliary dyskinesia, parenteral nutrition, cystic fibrosis and recently seen increased obesity in children [1]. Cholelithiasis as one of the gallbladder disease is the most common disorder affecting the biliary system. If cholelithiasis causes symptoms or complications, cholecystectomy is necessary. Even though open cholecystectomy was the generally

accepted conventional method, many pediatric surgery centers have started performing laparoscopic cholecystectomy [2]. Most of the series published on laparoscopic cholecystectomy represent adult cases, and the practice on pediatric patients is still limited.

In this study, we intended to present the clinical characteristics of our patients who had undergone laparoscopic cholecystectomy due to cholelithiasis in the light of the literature.

Address for correspondence:

Mete Kaya, MD., University of Health Sciences, Bursa Yuksek Ihtisas Training and Research Hospital, Department of Pediatric Surgery, Bursa, Turkey
E-mail: kayamete@yahoo.com

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Methods

We retrospectively analyzed the demographic data, clinic features, cholecystectomy indications, preoperative approach, operative technique, complications, duration of hospital stay and postoperative follow-up data of the patients who had undergone laparoscopic cholecystectomy between April 2011 and June 2016.

Procedure

After obtaining an informed consent, the patients prepared for elective laparoscopic cholecystectomy. All procedures were performed under general anesthesia and endotracheal intubation. A single dose of antibiotics (first generation cephalosporin) was given for prophylaxis. The patients were positioned on the supine position. The surgeon and the assistant stand on the patient's left side, and scrub nurse stands on the right. The monitor and laparoscopy rack were placed on right side of the patient's head. The operation was carried out by the same surgical team using the conventional 4-port method in patients. We inserted 10-mm trocar through the umbilicus for telescope, 5-mm trocar through the left abdominal upper quadrant for hook cautery and clip applicator, 5-mm trocar through midclavicular line and below arcus costarum for retraction of liver and gallbladder, and 5-mm trocar at the level of umbilicus and on the anterior

axillary line for the dissectors to be used for retraction of the infundibulum. In two patients, portless 2.3-mm percutaneous graspers were used for retraction of the gallbladder instead of the last two ports (Figure 1A). Laparoscopic cholecystectomy was performed by the conventional method (Figures 1B, C, D, E, F, G, and H). Non-steroidal anti-inflammatory drugs were administered to relieve postoperative pain and oral nutrition was started at the 6th hour. The patients were followed-up for 3-36 months postoperatively.

Results

During the period of 52 months, laparoscopic cholecystectomy was performed on a total of 24 patients, 5 of whom were male. Table I summarizes the demographic characteristics together with the symptoms of our patients. The mean age of the patients was found as 10.5 years (ranging from 2 to 17 years). The six patients aged over 15 years were obese. Cholelithiasis in 10 (41.6 %) patient was diagnosed during the evaluation of acute abdominal pain with the abdominal ultrasonography. In the other patients, it was diagnosed by ultrasonography during the evaluation of different complaints, such as fever, vomiting, and urinary tract infection. It was ascertained that three patients had received ceftriaxone therapy due to previous urinary tract infection. All

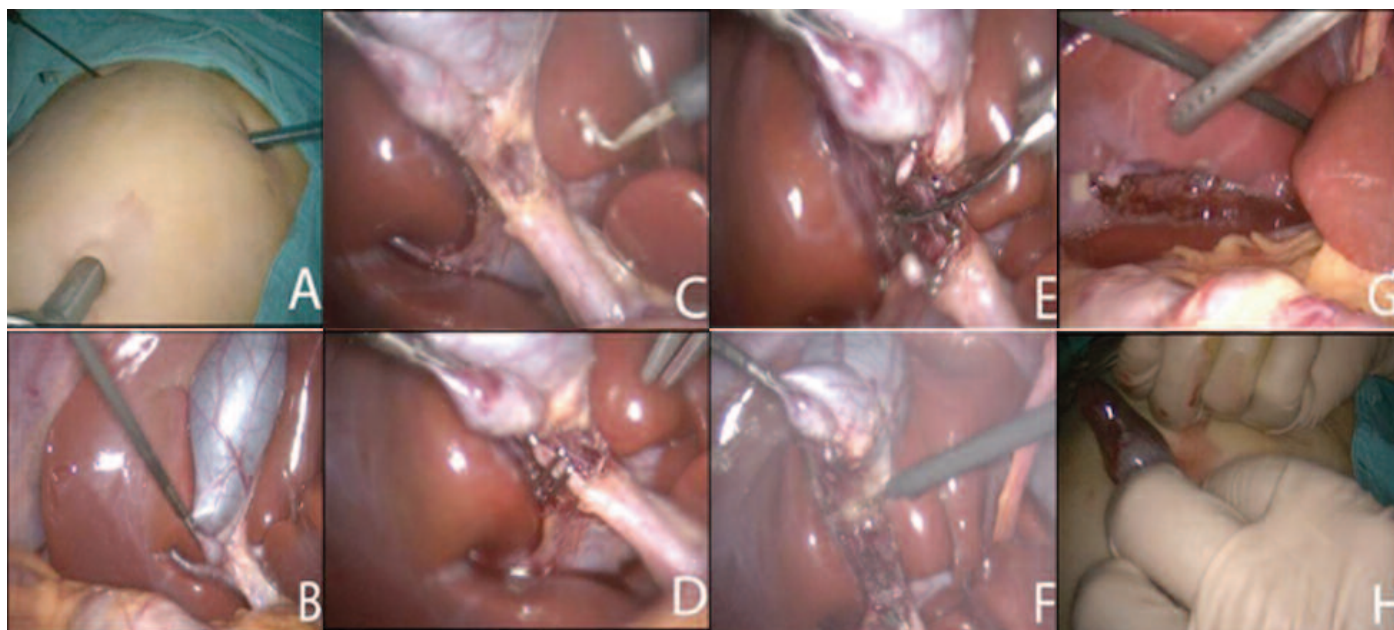


Figure 1. Laparoscopic stages of cholecystectomy. The placement of instruments (A), expose triangle (B), the dissection of cystic duct and vessels (C), the clip placed (D), the cutting of duct and artery (E), the gallbladder is freed from its bed (F), the control of bleeding and bile leakage (G), and the gallbladder is removed through the umbilicus (H).

Table 1. The demographic characteristics and symptoms of patients

Patient No	Gender	Age	BMI	Symptom
1	F	12	N	Abdominal pain
2	F	13	N	Fever/vomiting
3	F	2	N	Abdominal pain
4	F	17	H (27.2)	Abdominal pain
5	F	13	N	Fever/vomiting
6	M	4	N	Fever/vomiting
7	F	15	H (20.7)	Abdominal pain
8	F	11	N	Fever/vomiting
9	F	6	N	Fever/vomiting
10	M	11	N	Abdominal pain
11	F	7	N	Abdominal pain
12	F	13	N	Fever/vomiting
13	F	7	N	Fever/vomiting
14	F	7	N	Fever/vomiting
15	F	10	N	Abdominal pain
16	F	13	H (27.1)	Abdominal Pain
17	F	16	H (33.29)	Abdominal Pain
18	M	6	N	Fever/vomiting
19	F	15	N	Abdominal pain
20	F	6	N	Fever /vomiting
21	F	15	H (37.64)	Fever/vomiting
22	M	9	N	Fever/vomiting
23	F	15	H (33.29)	Fever/vomiting
24	M	7	N	Fever/vomiting

F=female, H=high, M=male, N=normal

patients had a history of acute cholecystitis episode at least once. The diagnosis of cholelithiasis was made via ultrasonography for the patients who had applied to an external medical center with the complaints of vomiting and abdominal pain. All patients were evaluated regarding their hematologic and gastrointestinal disorders. Some of the patients referred from the gastroenterology departments had been receiving ursodeoxycholic acid therapy; however, they could not benefit from the therapy. In six patients who had high body mass index, there wasn't find any risk factors for cholelithiasis except for obesity. The serum amylase and alkaline phosphatase were elevated in two patients. These blood values were reduced before surgery.

The mean duration of the operation was 60 minutes (ranging from 45 to 75 minutes). In a female patient, there was a cystic artery variation originated from left hepatic artery. In two patients, the procedure was converted to open surgery because of cystic duct

could not actually differentiate due to severe intra-abdominal adhesions and a big stone located on the choledochocystic junction. None of the patients experienced a complication during laparoscopic cholecystectomy in our series. More than half of the patients needed analgesics for more than 24 hours. Vomiting, shoulder pain, and pain at incision sites were the most common postoperative complaints. The duration of hospital stay ranged from one to three days. Acute abdominal pain episode, characterized by the increase of liver function test values, was observed in one patient three months after the operation; however, it was able to be managed through conservative follow-up.

Discussion

The prevalence of cholelithiasis is very low in children. Although it has been reported to be usually

related to hemolytic diseases (10-40% higher as compared to normal population), the leading cause of gallbladder stone is generally idiopathic in published series and reported to be detected incidentally while investigating other abdominal pathologies [3]. On the other hand, it may also be seen in premature babies or children who have encountered severe nutritional problems and parenteral nutrition, serious abdominal surgery, familial predisposition, cystic fibrosis, ceftriaxone therapy, obesity, dehydration, endocrine disorders, genetic liver diseases or it may be diet-induced [4, 5]. The patients included in this study had undergone hematologic and gastroenterologic investigations preoperatively; no hemolytic, endocrinologic or metabolic disorder was detected. However, it was found out that the patients aged less than six years had received ceftriaxone therapy because of urinary tract infection. Obesity has been reported to be a potential cause of gallbladder stone in children; however, only six of our patients were obese [1, 5]. Nevertheless, it has been claimed that the process of gallstone formation is different in children under the age of 10 when particularly compared to adults, because in pediatric patients, the larger part of the gallbladder stone is composed of pigment stones while the smaller part is of cholesterol stones [6].

Related studies in the field have suggested that 80% of the gallbladder stones is symptomatic in adults whereas only 10-33% is symptomatic in children [4]. Esposito *et al.* [3] stated that non-calcified stones may spontaneously resolve within 3-6 months. Nonetheless, symptomatic or incidentally detected asymptomatic calcified stones should be intervened through a surgical procedure. Although all of gallbladder stones in our series were symptomatic, we detected only 10 (41.6%) patients who have specific symptoms.

Although ultrasound imaging is sufficient for the diagnosis of gallbladder stones, scintigraphy (for ejection fraction) and magnetic resonance cholangiopancreatography have been claimed to be necessary to display bile ducts and the flow of the bile in patients having episodes of cholangitis or biliary dyskinesia [1, 7, 8]. In our series, the diagnosis was made using ultrasonography for all patients. No pathology was detected related to the bile flow in two patients that brought their scintigraphy results from external centers.

There are differences between adults and children regarding the cholecystectomy indications and results. While cholecystectomy is frequently performed due

to acute inflammation in adults, the main reason for cholecystectomy in pediatric patients without inflammation signs is the prophylactic removal of gallbladder stones [7, 9]. In recent years, large series in which cholecystectomy was performed in the presence of biliary dyskinesia, diagnosed by advanced scintigraphic investigations, have been published [8, 10, 11]. However we haven't enough detecting technology for biliary dyskinesia diagnosis but all of our cases have symptomatic gallbladder stone.

Conventional cholecystectomy is performed through the open technique using a subcostal or midline incision; however, extended hospital stay and prolonged wound healing are inevitable in open procedures [4]. Since 1987, the year when it was first performed on an adult patient; laparoscopic cholecystectomy has been increasingly used in gallbladder pathologies [12]. In 1991, laparoscopic cholecystectomy was reported to be safe and effective to use in pediatric patients for the first time [13, 14]. After that date, laparoscopic cholecystectomy has become a standard method implemented in children. Moreover, laparoscopic cholecystectomy can also be performed through the single-incision laparoscopic surgery technique despite the need for longer time and difficulty of the manipulation of the anatomical structures [15]. Notwithstanding, the 4-port laparoscopic cholecystectomy is considered as the gold standard for treatment of gallbladder pathology [16]. It is recommended that if there is need for the transition from open method to the single-incision method, the performer should transit to laparoscopic cholecystectomy first, and then start using the single-incision technique [16]. In the present series, all patients were intervened using the 4-port technique. It is possible to use small-diameter tools; however, large ports are still essential for extraction of both clip applicators and the gallbladder. Similar to the process in adults, the pediatric laparoscopic cholecystectomy is completed with dissection of the gallbladder of the liver bed through identification of the Calot's triangle and subsequent binding of the cystic duct and the cystic artery. However, it should always be kept in mind that the biliary system can vary from patient to patient in the pediatric group just like in the adults [3]. In the present study, one patient had cystic artery variation.

Bile duct injury is a frequently reported complication of cholecystectomy in adult patients [3, 9]. However, the bile duct and cystic canal junction can be easily observed in children by exposing the

Calot's triangle during binding the cystic canal. The presence of stone in the bile duct is another problem. Although intra-operative cholangiography can be performed in such cases, it is not always a necessity, since this situation is relatively rare. None of our patients needed intra-operative cholangiography during laparoscopy. Postoperative endoscopic retrograde cholangiopancreatography has been suggested to be performed following laparoscopic cholecystectomy in patients in whom such a situation is suspected [3, 9]. If the surgical team encounters difficulties related to previous cholecystitis (e.g. bleeding, perforation of the gallbladder), they may use the alternative of open procedure; however, the open technique was not necessary for any of our patients [9].

Conclusions

In conclusion, as adult population the gallbladder diseases requiring surgery is increasing in childhood. Nonetheless this laparoscopic cholecystectomy procedure can be applied easily in a wide age range. Laparoscopic cholecystectomy is an efficient method for gallbladder pathologies with the advantages it provides in children and surgeons should be encouraged to perform laparoscopic cholecystectomy.

Conflict of interest

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References

- [1] Garey CL, Laituri CA, Keckler SJ, Ostlie DJ, Stagg HW, Little DC, et al. Laparoscopic cholecystectomy in obese and non-obese children. *J Surg Res* 2010;163:299-302.
- [2] Mesas Burgos C, Ghaffarpour N, Almstrom M. Single-site incision laparoscopic cholecystectomy in children: a single-center initial experience. *J Pediatr Surg* 2011;46:2421-5.
- [3] Esposito C, Gonzalez Sabin MA, Corcione F, Sacco R, Esposito G, Settini A. Results and complications of laparoscopic cholecystectomy in childhood. *Surg Endosc* 2001;15:890-2.
- [4] Gowda DJ, Agarwal P, Bagdi R, Subramanian B, Kumar M, Ramasundaram M, et al. Laparoscopic cholecystectomy for cholelithiasis in children. *J Indian Assoc Pediatr Surg* 2009;14:204-6.
- [5] Koebnick C, Smith N, Black MH, Porter AH, Richie BA, Hudson S, et al. Pediatric obesity and gallstone disease. *J Pediatr Gastroenterol Nutr* 2012;55:328-33.
- [6] Bailey PV, Connors RH, Tracy TF, Jr., Sotelo-Avila C, Lewis JE, Weber TR. Changing spectrum of cholelithiasis and cholecystitis in infants and children. *Am J Surg* 1989;158:585-8.
- [7] Curro G, Iapichino G, Lorenzini C, Palmeri R, Cucinotta E. Laparoscopic cholecystectomy in children with chronic hemolytic anemia. Is the outcome related to the timing of the procedure? *SurgEndosc* 2006;20:252-5.
- [8] Siddiqui S, Newbrough S, Alterman D, Anderson A, Kennedy A, Jr. Efficacy of laparoscopic cholecystectomy in the pediatric population. *J Pediatr Surg* 2008;43:109-13.
- [9] St Peter SD, Keckler SJ, Nair A, Andrews WS, Sharp RJ, Snyder CL, et al. Laparoscopic cholecystectomy in the pediatric population. *J Laparoendosc Adv Surg Tech A* 2008;18:127-30.
- [10] Haricharan RN, Proklova LV, Aprahamian CJ, Morgan TL, Harmon CM, Barnhart DC, et al. Laparoscopic cholecystectomy for biliary dyskinesia in children provides durable symptom relief. *J Pediatr Surg* 2008;43:1060-4.
- [11] Lacher M, Yannam GR, Muensterer OJ, Aprahamian CJ, Haricharan RN, Perger L, et al. Laparoscopic cholecystectomy for biliary dyskinesia in children: frequency increasing. *J Pediatr Surg* 2013;48:1716-21.
- [12] Reynolds W, Jr. The first laparoscopic cholecystectomy. *JSL* 2001;5:89-94.
- [13] Holcomb GW, 3rd, Olsen DO, Sharp KW. Laparoscopic cholecystectomy in the pediatric patient. *J Pediatr Surg* 1991;26:1186-90.
- [14] Newman KD, Marmon LM, Attorri R, Evans S. Laparoscopic cholecystectomy in pediatric patients. *J Pediatr Surg* 1991;26:1184-5.
- [15] Ergun O, Tiryaki S, Celik A. Single center experience in single-incision laparoscopic surgery in children in Turkey. *J Pediatr Surg* 2011;46:704-7.
- [16] Chandler NM, Danielson PD. Single-incision laparoscopic cholecystectomy in children: a retrospective comparison with traditional laparoscopic cholecystectomy. *J Pediatr Surg* 2011;46:1695-9.