

Laparoscopic Ovarian Surgery in Children and Adolescents

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ABSTRACT

Background and Objectives: Although laparoscopy is widely used in gynecologic surgery in adults, few studies have been undertaken to examine its use in young and adolescent patients. This study was conducted to investigate the safety and feasibility of laparoscopic surgery for the treatment of benign ovarian disease in children and adolescents.

Methods: A retrospective chart review was conducted on 106 patients (age, <20 years) who underwent laparoscopic surgery at Kangnam Sacred Heart Hospital from 2006 through 2012.

Results: The mean patient age was 17.1 years, and the youngest one was 8. Pathologic analyses revealed that 32 (30.2%) patients had dermoid cyst, 30 (28.3%) had simple cyst, and 15 (14.2%) had endometrioma. Conservative procedures, such as cystectomy (48.1%), aspiration (5.7%), fulguration (4.7%), and detorsion (3.8%), were performed in 65.1% of all cases. A subanalysis revealed that the surgical outcomes of children (age, ≤ 15 years), including operative time, estimated blood loss, postoperative hemoglobin decrease, and postoperative length of hospital stay, were comparable to those of adolescents (age, 16–19 years), despite significant differences in mean height between the 2 groups (156.1 ± 10.71 cm in children vs. 162.1 ± 5.14 cm in adolescents; $P < .0001$). (The age break between the study groups was set at 15 years, because most girls reach their adult height between the ages of 15 and 16 years.) No intra- or perioperative complications were noted. In a comparison study of surgical outcomes in 433 women (age, 20–50 years) and the 106 young and adolescent girls in our sample (age, <20 years), those in our patients were not inferior.

Conclusion: In children and adolescents, laparoscopic surgery can be successfully performed with conventional instruments designed for use in adults.

Key Words: Adolescents, Laparoscopy, Ovarian cyst.

INTRODUCTION

Benign ovarian cysts are common among adolescents and young girls.^{1–3} Management is dependent on clinical circumstances, such as symptoms and the size of the cyst. Surgical intervention is indicated for ovarian torsion and suspected cancer and in some cases of rupture. In particular, ovarian cyst-associated torsion, which is an emergency requiring early surgical intervention, is common in young girls compared with adults.^{4,5} Anatomic differences in young and adolescent females versus adults should be considered in surgical interventions (ie, short stature, thinner abdominal wall around the umbilicus, higher upper margin of the bladder, smaller uterine fundus, relatively elongated cervix, and small ovarian volume), along with preservation of fertility.^{6,7} Regarding the latter, laparoscopic procedures, which have the advantage of reducing the adhesion formation that occurs with open surgery, can be a good option.^{8,9} Therefore, it is highly desirable to use laparoscopic procedures for the treatment of gynecologic disorders in young patients. Laparoscopic surgery has become a widely accepted procedure in the field of gynecology. Although many surgeons agree that careful consideration should be used in performing laparoscopic procedures in children and adolescents, there have been several trials in which laparoscopy was used for the treatment of benign bowel disease and ovarian masses.^{10–12} Minimally invasive surgery provides many benefits over open techniques, including reduced postoperative pain, reduced risk of pelvic adhesions, shorter hospital stay, earlier return to daily activity, and better cosmetic appearance. However, despite the anatomic and physiologic differences in pelvic organs between young and adult females, few laparoscopic instruments for use in young patients are available. Some special trocars and instruments have been developed for laparoscopy in young patients, but they have seen limited use.^{13–15} Moreover,

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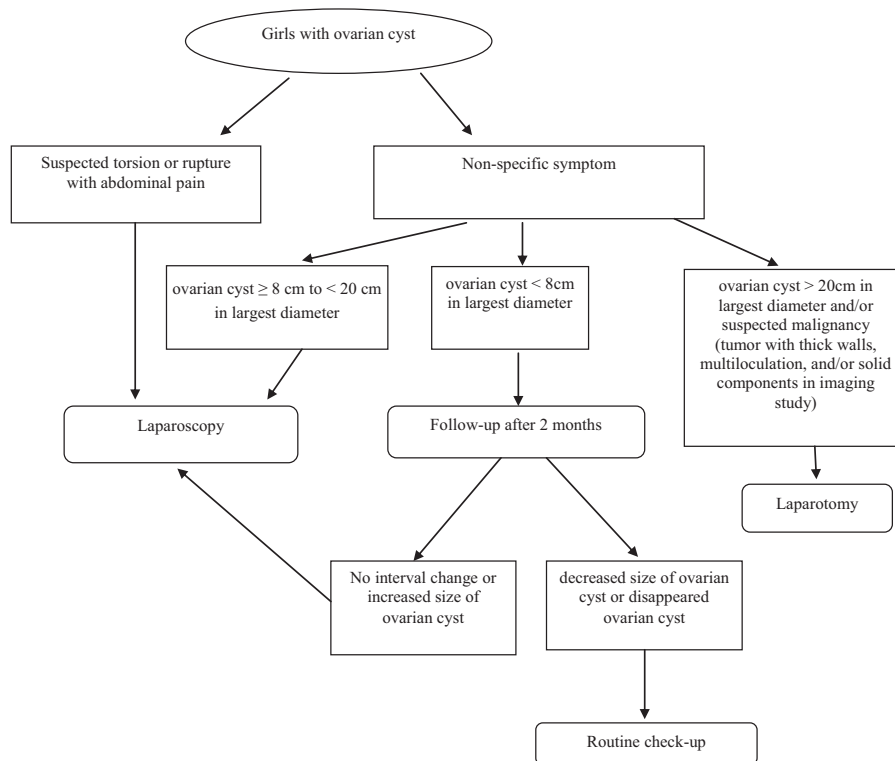


Figure 1. Flow chart for triage protocol shows triage for young patients (age, <20 years) with ovarian cyst. All who had large ovarian cysts (≥ 8 cm in the largest diameter) and those with small cysts (<8 cm in the largest diameter) that did not disappear after 2 months of follow-up were advised to undergo laparoscopic surgery, even if they were asymptomatic. Extremely large ovarian cysts (≥ 20 cm in the largest diameter) or radiologic suspicion of malignant disease (tumor with thick walls, multiloculation, and solid components in ultrasonography) were contraindications for laparoscopic surgery.

only a few small studies have been conducted to evaluate the efficacy and safety of laparoscopic adnexal surgery in children and adolescents.^{1,16–18} Therefore, we evaluated the safety and feasibility of the use of conventional instruments in laparoscopic adnexal procedures in children and adolescents.

MATERIALS AND METHODS

All adolescent and pediatric girls who underwent laparoscopy at our institution from January 1, 2006, through December 31, 2012, were identified from an electronic database of laparoscopies. Data were collected from a retrospective chart review and transferred to an electronic data set by the first author.

All the patients had their height and weight measured before the day of surgery. Pathology results, laparoscopic procedures, and surgical outcomes were retrieved from medical records. Surgical outcomes included operative time; estimated blood loss; postoperative hemoglobin decrease (change in hemoglobin level between the preop-

erative level and postoperative day 1); postoperative length of hospital stay; intraoperative conversion to laparotomy because of complications, such as visceral injury and hemorrhage that required an intraoperative transfusion; and perioperative complications, such as fever, hemorrhage, infection, and ileus.

We obtained approval from our hospital's institutional review board for this study. All patients underwent ultrasonography for the diagnosis of ovarian cyst. Young and adolescent girls with symptomatic ovarian cyst, in whom torsion or rupture was suspected, underwent laparoscopic procedures. In addition, those with large ovarian cysts (≥ 8 cm in the largest diameter) and those with small cysts (<8 cm in the largest diameter) that did not disappear after 2 months of follow-up were advised to undergo laparoscopy, even if the condition was asymptomatic. Extremely large ovarian cysts (≥ 20 cm largest diameter) and radiologic suspicion of cancer (tumor with thick walls, multiloculation, and solid components in ultrasonography) were contraindications for laparoscopy

(Figure 1). All procedures were performed by 1 of the 3 senior surgeons, who had performed laparoscopies in adults or adolescents more than 30 times before the start of the study. One surgeon performed 59, another performed 29, and the third performed 18 of the operations in the patients included in the study. All the procedures were performed in a conventional manner with conventional instruments designed for use in adults. Entry was made into the peritoneal cavity by closed technique with a Veress needle. After the insertion of the first trocar (10–12 mm in diameter; Karl Storz, Tuttlingen, Germany) through the inferior umbilical fold, the second and third trocars (5 mm in diameter) were inserted in the suprapubic (2 cm above the symphysis pubis) area and counter-McBurney point, respectively. The only difference between the surgical parameters in the pediatric and adult patients was the maximum intra-abdominal pressure and the maximum flow. The maximum intra-abdominal pressure was kept at 10 mm Hg and the maximum flow at 5 L/min in the children and adolescents; the levels in adults were 15 mm Hg and 8 L/min, respectively. Monopolar devices were used for electrocauterization. The ovarian cyst was extracted via surgical pouch. At the end of the operation, all port sites were closed with Nylon 3-0 sutures.

Statistical analysis was performed with SPSS for Windows (version 18.0, SPSS Inc., Chicago, Illinois). Dichotomous variables were compared by Fisher's exact test or the χ^2 test. Continuous variables were compared by the *t* test. For all results, *P* < .05 was considered significant.

RESULTS

The mean patient age was 17.1 years, and the youngest patient was 8 years of age. In the 106 cases reviewed, ultrasonography (transabdominal or transrectal) was used as the primary diagnostic tool in 55 (51.4%), combined ultrasonography and computed tomography (CT) in 49 (45.8%), and CT alone in 2 (1.88%). In addition, tumor markers, including CA125, CA19-9, α -fetoprotein, and human chorionic gonadotropin, were checked for cysts with thick walls, multiloculation, and solid components. The most common pathologic diagnosis was dermoid cyst (30.2%), with 7 of those cases associated with torsion (Table 1). The second most common diagnosis was simple cyst (28.3%), followed by endometrioma (14.2%), and tubo-ovarian abscess (14.2%). More than half (65.1%) of the patients underwent a conservative procedure, such as cystectomy (49.1%), aspiration (6.6%), fulguration (4.7%), or detorsion (4.7%) (Table 2). Salpingectomy and abscess drainage were performed in 8 patients (7.5%) with severe

Pathology	Number (Percentage)
Simple cyst	30 (28.3)
Endometrioma	15 (14.2) ^a
Dermoid cyst	32 (30.2) ^b
Serous cystadenoma	4 (3.8)
Mucinous cystadenoma	6 (5.7) ^b
Tubo-ovarian abscess	15 (14.2) ^a
Others ^c	6 (5.7)

N = 106. Data are expressed as the number of patients, with the percentage of the total sample in parentheses.

^a One patient with coexisting endometrioma and tubo-ovarian abscess was included.

^b One patient with coexisting dermoid cyst and mucinous cystadenoma was included.

^c Two patients with paratubal cyst, and 4 with no pathologic report who underwent detorsion were included.

Procedure	Number (Percentage)
Cystectomy	51 (48.1)
Aspiration	6 (5.7)
Oophorectomy	13 (12.3)
Salpingectomy	11 (10.4)
Salpingo-oophorectomy	16 (15.1)
Fulguration	5 (4.7)
Detorsion	4 (3.8)

N = 106. Data are expressed as the number of patients, with the percentage of the total sample in parentheses.

tubo-ovarian abscess who did not respond to antibiotic therapy for 72 hours.

Surgical outcomes were compared by age group (Table 3). The study sample was divided into 2 subgroups—young (group 1, age \leq 15 years) and adolescent (group 2, age, 16–19 years)—because more than 80% of girls reach their adult height at 15 to 16 years of age.¹⁹ The most common diagnosis in groups 1 and 2 were dermoid cyst and simple cyst. However, tubo-ovarian abscess was more frequently observed in group 2 than in group 1 (17.2% vs 4.0%). Torsion was more frequently observed in group 1 than in group 2 (20.0% vs 2.5%; *P* = .008). Type of surgery was not different between the 2 groups (conservative surgery: 8.0% in groups 1 vs 66.7% in group 2, *P* = .092). Despite significant differences in height (156.1 \pm 10.71 cm in children vs 162.1 \pm 5.14 cm in adolescents; *P* < .0001),

Table 3.
Comparison of the Study Groups

	Group 1 ≤15 Years (n = 25)	Group 2 16-19 Years (n = 81)	<i>P</i>
Pathology, No. (%)			.395
Simple cyst	7 (28.0)	23 (28.4)	
Endometrioma	2 (8.0)	13 (16.0)	
Dermoid cyst	9 (36.0)	23 (28.4)	
Serous cystadenoma	2 (8.0)	2 (2.5)	
Mucinous cystadenoma	1 (4.0)	5 (6.1)	
Tubo-ovarian abscess	1 (4.0)	14 (17.2)	
Others	3 (12.0)	3 (3.7)	
Type of surgery, No. (%)			.092
Conservative surgery	12 (48.0)	54 (66.7)	
Radical surgery	13 (52.0)	27 (33.3)	
Torsion, No. (%)			.008
Yes	5 (20.0)	2 (2.5)	
No	20 (80.0)	79 (97.5)	
Height, cm	156.1 ± 10.71	162.1 ± 5.14	<.0001
Weight, kg	53.3 ± 12.36	56.9 ± 10.02	.189
Surgical outcomes			
Operative time, minutes	61.6 ± 23.79	66.0 ± 29.25	.497
Estimated blood loss, mL	135.2 ± 90.47	168.5 ± 100.87	.125
Postoperative hemoglobin decrease, g/dL	-1.3 ± 0.83	-1.3 ± 1.00	.933
Postoperative length of hospital stay, days	3.56 ± 1.98	4.12 ± 2.24	.235

Data are expressed as the number of patients, with the percentage of the total sample in parentheses, or as the mean ± 2 SD.

surgical outcomes such as operative time, estimated blood loss, postoperative hemoglobin decrease, and postoperative length of hospital stay were not significantly different between the 2 groups. No intra- or perioperative complications, such as conversion to laparotomy; visceral inju-

ries including bowel, bladder, or uterus; hemorrhage; infection; or ileus, were noted.

In addition, the surgical outcomes in our study group (n = 106) were comparable to those of a group of adults (n =

Table 4.
Comparison of Surgical Outcomes in Child and Adult Age Groups

	Child <20 Years (n = 106)	Adult 20-50 Years (n = 433)	<i>P</i>
Operative time, minutes	64.9 ± 28.01	77.3 ± 30.95	<.0001
Estimated blood loss, mL	160.7 ± 99.1	171.2 ± 227.4	.472
Postoperative hemoglobin decrease, g/dL	-1.3 ± 0.96	-1.4 ± 0.96	.223
Postoperative length of hospital stay, days	4.91 ± 2.23	4.45 ± 0.507	.037

Data are expressed as the mean ± 2 SD.

433) aged 20 to 50 who underwent laparoscopic adnexal surgery in our hospital from 2006 through 2012 (**Table 4**). Estimated blood loss and postoperative hemoglobin decrease were not different between the young and the adult patients. Also, operative time was significantly shorter in the young patients than in the adults ($P < .0001$). We concluded that the difference is due to the higher rates of pelvic adhesions in endometriosis and pelvic inflammatory disease, which need adhesiolysis and make surgical procedures more difficult and prolonged in adults. Postoperative hospital stay was longer in the young patients than in the adults (4.91 days vs 4.45 days; $P = .037$), but it seemed to have no clinical significance.

DISCUSSION

In young girls, especially in adolescents who are in a hormonally active phase, ovarian cysts are common and usually benign.^{20,21} Although most ovarian cysts in children and adolescents are asymptomatic, ovarian complications such as torsion and rupture may present with acute symptoms. In particular, torsion is more likely to occur in children and adolescents than in adults and may be due to the immature development of the pelvic organs.⁵ In children and adolescents, the oviduct is relatively longer, the uterus is smaller, and the position of the ovary is higher; the latter is due to underdeveloped supporting connective tissue surrounding the ovary.⁵

As in all other age groups, the primary diagnostic tool for ovarian cysts in adolescents is ultrasonography.^{22,23} For the differential diagnosis from appendicitis or other gynecologic conditions, CT or magnetic resonance imaging (MRI) may be helpful.

During the follow-up period after diagnosis, most ovarian cysts disappear in children and adolescents and therefore do not require surgery. However, young patients with acute symptoms and suspicion of ovarian complications should undergo emergent surgery. For the development of normal puberty and preservation of future fertility, conservative ovarian surgery is important in these patients²⁴ and may include cyst aspiration, excision, fenestration, or unroofing.²⁰ In our study, we performed conservative surgery in 62.3% of all cases, including cystectomy (48.1%), aspiration (5.7%), fulguration (4.7%), and detorsion (3.8%). Our findings are compatible with those of Seckin et al¹⁶ in a report of laparoscopic surgery in adolescents (age, 12–19; $n = 79$) and young adults (ages 20–25; $n = 203$). They performed an ovarian cystectomy in 77.2% of the cases, and ovary-conserving surgery was possible in 99.8% of the adolescents. Considering that

our study group included adolescents with tubo-ovarian abscess (14.2%), which required a salpingectomy or salpingo-oophorectomy, our results appear to be comparable to those of Seckin et al.

With the advent of laparoscopic procedures, there have been several studies in which the operations were evaluated for gynecologic surgery in children and adolescents.^{16,18,21} During laparoscopic surgery in young girls, especially in premenarchal girls, it is most important to be cognizant of the anatomic differences in pelvic organs between young and adult females. For instance, the abdominal wall around the umbilicus is thinner in young girls than it is in adults, and the aorta is present directly under it.⁶ Therefore, damage to a major blood vessel is more likely to occur during the insertion of the first trocar.⁶ In addition, the upper margin of the bladder is in a higher position, which carries the risk of bladder injury when establishing the suprapubic port.⁶ In our series, neither major vessel damage nor bladder injury occurred.

The feasibility and safety of laparoscopic surgical techniques have been well described in large adult series.^{25,26} The advantages of laparoscopic surgery include better visualization, shorter hospital stay, faster recovery, less postoperative pain, less adhesion formation, and better cosmetic results.^{17,27,28} Particularly for children and adolescents, in whom it is desirable to preserve fertility if at all possible, less adhesion formation is the greatest advantage of laparoscopic surgery.^{29,30} Therefore, laparoscopic procedures are advantageous in the treatment of benign adnexal disease in young patients. Recently, several studies have reported the safety and feasibility of laparoscopic procedures in children and young women; however, the study populations were very small.^{16–18,21} The largest series was reported by Seckin et al.¹⁶ It comprised 79 adolescents aged younger than 20 who underwent laparoscopic surgery for a presumed benign ovarian cyst.¹⁶ Takeda et al¹⁷ studied 12 girls aged 15 years or younger¹⁷ and reported that 7 of them had dermoid cysts; in 3 of them, the cysts were associated with adnexal torsion. None of the patients experienced intra- or postoperative complications.¹⁷ In our study, we included adolescents with ovarian cysts as well as those with an adnexal mass. Of interest, 15 patients (14.2%) had tubo-ovarian abscesses, and all of them successfully underwent the laparoscopic procedure with no complications. In addition, we compared surgical outcomes by age group, which revealed that no significant differences were observed between children (age, ≤ 15 years) and adolescents (age, 16–19 years), even if there was a significant differences in mean height between the 2 groups.

Moreover, our data revealed that surgical outcomes in the young girls were comparable to those in the adults who underwent laparoscopic adnexal surgery. Notably, operative time was even shorter in the young patients than in the adults.

In our data, the postoperative hospital stay was relatively longer than the usual admission in the United States, which needs some explanation. The medical insurance system in Korea is quite different from that in the United States. In Korea, the medical insurance fee is relatively lower than in other developed countries, and all patients are eligible to receive benefits from the National Health Insurance Corporation. Therefore, most patients are discharged after the passing of gas indicates resumption of bowel activity and the stitches have been removed, making the stay longer than in hospitals where the stitches are removed after discharge.

Our findings support the safety and efficacy of laparoscopic procedures in children and young girls, with the use of conventional instruments designed for adults, despite differences in body size. Therefore, we suggest that a laparoscopic procedure using conventional instruments could be the treatment of choice for benign adnexal disease in children and adolescents.

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