Int J Clin Exp Med 2019;12(1):843-848
www.ijcem.com /ISSN:1940-5901/IJCEM0071392

Original Article

Transumbilical single-incision laparoscopic resection of ovarian cysts in the newborn: an analysis of 12 cases

Yong-Liang Sha, Qi Xi, Bin Jiang, Xue-Wu Zhou

Department of Pediatric Surgery, Xuzhou Center Hospital, Xuzhou, Jiangsu Province, China

Received June 29, 2017; Accepted June 8, 2018; Epub January 15, 2019; Published January 30, 2019

Abstract: Objective: The purpose of this article is to describe a safe, simple, minimally invasive technique for ovarian cysts in the newborn. Methods: We reviewed transumbilical single-incision laparoscopic ovarian cysts resections performed by our group from January 2012 to January 2017. All initial ultrasound findings were consistent with simple ovarian cysts greater than 40 mm. We evaluated patient demographics, surgery statistics, and hospital course. Results: Twenty patients were identified with mean age of 1.8±0.7 months (range 0.8-3 months). The procedures were completed uneventfully in all patients. Average operating time was 101.4±21.3 minutes (range 62-156 min). Hospital stay averaged 2.2±0.1 days (range 1-4 days). The mean cyst size was 47.6±13.2 mm (range 44-63 mm) by imaging studies and then during surgery. Pathologic evaluation confirmed ovarian follicular cyst in each patient. All patients had no postoperative complications. During a mean follow-up of 15.7±4.4 months (range 1-25 months), no recurrence was seen in this period. Cosmetic appearance was good in all patients. Conclusion: The authors demonstrated that transumbilical single-incision laparoscopic resection was a technically feasible and safe method in the treatment of ovarian cysts in the newborn, associated with short hospitalization, a good cosmetic appearance.

Keywords: Ovarian cysts, newborn, single-incision, laparoscopic

Introduction

Ovarian cysts, usually unilateral, are the most frequent type of abdominal tumor in female fetuses and newborns. In girls, the frequency of such cysts was reported as approximately 5% of all abdominal masses in the first month of life [1]. Most fetal ovarian cysts are small and not of clinical significance and the majority of them resolve spontaneously during the first month of life. There is general agreement that surgical intervention is required for cysts larger than 4 cm [2]. Resection of ovarian cysts was traditionally performed via laparotomy but in the last few decades, a three or four port laparoscopic approach has become standard [3, 4].

As minimally invasive surgery has progressed, we have seen the advent of transumbilical single-incision laparoscopic surgery in an effort to improve cosmetic outcome. Transumbilical single-incision laparoscopic management of persistent ovarian cysts in adults is well established, but to date, there is limited experience with transumbilical single-incision laparoscopic resection of ovarian cysts in the pediatric population. We reviewed our experience with transumbilical single-incision laparoscopic resection of neonatal ovarian cysts to evaluate the safety and efficacy of this approach.

Materials and methods

Patients

The approval for the study was obtained from the institutional review board of the Xu Zhou Central Hospital. This study is a retrospective review of 12 pediatric patients who underwent transumbilical single-incision laparoscopic surgery for ovarian cysts resections from January 2012 to January 2017. In our institution, twenty female infants who had ovarian cysts larger than 40 mm underwent excision of ovarian simple cysts.

Inclusion and exclusion criteria

Entry criteria for this method in elective cases were ultrasonographic features of simple ovari-

Figure 1. CT scan of the pelvis reveals two huge cysts, with diameter of 23 mm, 63 mm,respectively.

an cyst, and normal specific ovarian tumor markers. In our clinical practice, complex adnexal masses with a high suspicion for malignancy were considered an indication for laparotomy so these patients were not included in the study.

Preoperative preparation

The preoperative evaluation included physical findings, image studies of grey-scale and color duplex ultrasonography, computed tomography (CT) scan (**Figure 1**) and biochemical studies of tumor markers (CA-125, alpha-feto protein, beta-human chorionic gonadotropin). The children were born at full term. Each patient had one/two simple ovarian cyst(s) that had been revealed prenatally by antenatal ultrasound scan. The increase in size of the cysts was the indication for laparoscopy. Data were collected from the patients' clinical files, operation notes, and pathology reports.

Operative procedures

Parents of all patients gave their informed consent before surgery for the type of procedure. All procedures were performed by senior surgeons who are experienced in laparoscopic surgery. Before surgery, a Foley catheter was routinely inserted to empty the bladder and allow assessment of urine output during the procedure. The patients were treated under general anaesthesia. One 10-mm port and one 5-mm ports were inserted as shown in (**Figure 2A**). A pneumoperitoneum was created at 8 mm Hg of pressure. A 10-mm, 30° telescope was inserted through the 10-mm port and a grasper was inserted through the 5-mm port. Through the 10-mm supraumbilical scope, the cyst was noted to originate in the ovary. The cysts were punctured transabdominally under direct vision through the laparoscope, using a 9-syringe needle (**Figure 2B**). The contents of the cyst were partially aspirated; the fluid was clear yellow (no malignant cells). The sheath between the 10-mm port and the 5-mm ports was cut to enlarge the sheath incision to facilitate the cyst removal (**Figure 2C**). At surgery, the cyst walls were stripped off the remaining ovarian parenchyma by means of traction exerted in the opposite direction by the use of two atraumatic grasping forceps. When necessary, hemostasis was achieved by applying the bipolar forceps on the ovarian parenchyma after excision of the cystic wall. An uninterrupted suture was placed on the edge of the residual ovarian parenchyma. The cyst walls were sent for routine histologic examination.

Postoperative treatments and follow-up

After the operations, antibiotics were administrated to prevent infection for 1 day in 5 children. 6 h after each operation, the Foley catheter was removed, and all patients then began taking enteral nutrition. No urinary retention was observed. All patients underwent follow-up at 1, 3, 6, 12, 18 and 25 months after surgery.

Statistical analysis

Statistical analysis was carried out using the JMP software version 10.0.0 (SAS, Cary, NC) The measurement data including the age, cyst size, operation time, hospital stay, follow-up time were expressed as mean and standard deviation. The β-HCG level was compared before and after surgery using Student's t-test. A p value < 0.05 was considered significant.

Results

General data of the patients

In a total of twenty cases, four fetuses had an ovarian cyst on the right side, six on the left side, and two had bilateral cysts. The affected ovary and tube were viable without torsion in all cases. The patients had a mean age of 1.8± 0.7 months (range 0.8-3 months). All patients

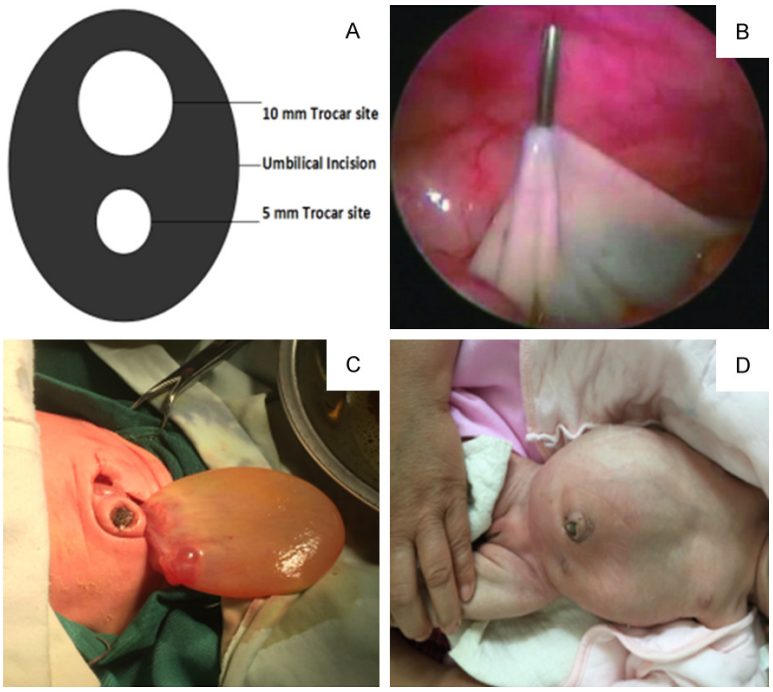

Figure 2. Laparoscopic view of ovarian cyst. A. Port position schematic diagram; B. Percutaneous puncture of the cyst under direct vision; C. Removal of cyst through a minilaparotomy incision; D. Cosmetic appearance after surgery.

received transumbilical single-incision laparoscopic ovarian cysts resections without conversion to laparotomy or to 3-port laparoscopy. The β-HCG level before and after surgery was significant difference (423.87 *vs.* 1.81 mIU/mL, $P < 0.05$).

Surgery-related factors of the patients

The mean duration of the surgery was 101.4± 21.3 minutes (range 62-156 min). The mean cyst size was 47.6±13.2 mm (range 44-63 mm) by imaging studies and then during surgery. The mean hospital stay was 2.2±0.1 days (range 1-4 days).

Pathological results

Pathologic evaluation confirmed ovarian follicular cyst in each patient. Histopathological diagnostic studies of the surgically removed cysts revealed that simple cysts were follicular cysts. No cysts were noted to have malignant features (**Table 1**). No ovarian tissue was found.

Follow-up

During a mean follow-up of 15.7±4.4 months (range 1-25 months), no difference was detected between the ovary sizes on the operated side and the contralateral side. No patients had postoperative wound infections or incisional hernias during follow-up (**Table 1**). Cosmetic appearance was good in all patients (**Figure 2D**).

Discussion

The etiology of fetal ovarian cysts is still unknown, but hormonal stimulation by fetal gonadotrophins, maternal estrogens and placental human chorionic gonadotrophin, may be the significant factors in cyst development [5]. The association of fetal ovarian cysts with maternal diabetes or fetal hypothyroidism has been reported by many authors [6, 7]. None of our patients presented with the above-mentioned diseases.

In the majority of cases, the ovarian cysts are diagnosed in the third trimester of pregnancy. Fetal ovarian cysts are usually unilateral and almost always functional and benign in nature, so the question of malignancy is not important in prenatal diagnosis [8]. When a cystic abdominal mass is diagnosed in the female fetus, differential diagnosis should be established for renal cyst, hydronephrosis, megacystis, anorectal atresia, urachal cyst, persistent cloaca, meconium pseudocyst, hydrometrocolpos, mesenteric cyst, liver cysts, splenic cysts and hemangioma [9].

Diameter and echogenicity are the main criteria for establishing fetal ovarian cysts prognosis. The cysts were classified according to their size as “small” for cysts smaller than 40 mm in diameter and “large” for those larger than 40 mm. Besides, according to their ultrasonographic features they were classified as “simple” and “complex”. The Nussbaum criteria were used for discrimination between complex and simple cysts [10]. According to these criteria, the sonographic features of simple cysts are anechogenic and round 40 mm in diameter, unilocular, intrapelvic or more often intraabdominal, unilateral or seldom

Table 1. Patients' characteristics, findings and results

Total number of newborns with ovarian cyst	12
Cyst diameter	
40-50 mm	5
50-70 mm	4
> 70 mm	3
Location	
Left ovary	6
Right ovary	4
Bilateral ovary	2
Operative time, mean, minutes	101.4 (62-156)
Postoperative length of hospital stay, mean, day	2.2 (1-4)
Operative and postoperative complications	0
Pathology	
Hemorrhagic cyst	0
Corpus luteum cyst	0
Follicle cyst	12
Serous cystadenoma	0
Postoperative follow-up time, mean, months	15.7 (1-25)
Recurrence	0

bilateral, thin-walled, and more or less mobile with the mother's positions. On the other hand, sonographic features of complicated cysts are heterogeneous with hyperechogenic components, thickwalled, containing free-floating material, with intra-cystic septations [10].

The harm caused by ovarian cyst to human body is mainly triggered by complication. The common complications include pedicle torsion, intracystic hemorrhage, rupture, dystocia during birth, pressure on nearby structures such as blood vessels, uterus, intestines and urinary system. Most simple ovarian cysts less than 40 mm do not cause torsion and show spontaneous regression within a few months after birth. Larger cysts are more likely to torse and less likely to resolve spontaneously. Brandt et al reported that 69 of 257 cases of antenatally diagnosed ovarian cyst led to ovarian torsion and that torsion was more likely in cysts greater than 40 mm [11]. Other large series have reported an incidence of torsion as high as 42% [10]. In conclusion, cysts larger than 40 mm were operated on without delay because we were anxious about the potential complications; moreover, the availability of a therapeutic choice such as minimally invasive surgery facilitated management.

Once the surgical treatment is decided for ovarian cyst, individualized treatment is selected for different types cysts. With the development of laparoscopy in pediatric surgery, some scholars have reported successful treatment for ovarian cyst under laparoscopy [12, 13]. At the late period, this study also adopted three-port laparoscopy, and three small incisions at 3 mm and 5 mm around the navel as well as 5 mm in the hypogastric region were taken. Compared with traditional laparotomy, laparoscopic surgery has small trauma and the postoperative scar is not obvious.

Several series of transumbilical single-incision laparoscopic ovarian surgeries have been described in adults [14, 15]. At this time, minimal data are available about transumbilical single-incision laparoscopic procedures for ovarian surgery in children. Several studies describe a combination technique using laparoscopic identification and extracorporeal cystexcision [16, 17]. In our series, we have utilized a transumbilical single-incision technique using a 10-mm and 5-mm operative laparoscope. The cysts were punctured transabdominally under direct vision, using a 9-syringe needle, and the contents of the cysts were accurately aspirated. Then the cysts were extracted through the umbilical access, and the cysts' walls were stripped off the remaining ovarian parenchyma.

The results of our study support the use of transumbilical single-incision surgery for resection of ovarian cysts in the newborn. Its benefits include a shortened hospital stay, the cosmetic result of an inconspicuous scar hidden within the umbilicus, which is especially beneficial to patients who do not want a visible scar on the abdomen.

Our mean operative time for this procedure was 101.4 minutes, which is longer than the 79 minutes previously reported for single-port surgery [18] and 82 minutes reported elsewhere for laparoscopic removal of large ovarian cysts by the open technique [19]. Several factors may account for the difference, including our health care system's calculation of operative time

starting from the completion of anesthesia instead of the time of actual surgical intervention, and our repeated cleansing of the abdominal cavity with a large amount of normal saline after resection of the cysts. Postoperative stay in our series was similar to reports of traditional laparoscopic approach (range 26-60 h) [19]. None of our patients had postoperative complications, and all of them have invisible scars. Due to the retrospective nature of this analysis, no standard measure was used for cosmesis, although subjectively our patient satisfaction was consistent with previous reports [20].

In order to spare ovarian tissue, we suggest careful use of electrosurgical coagulation on the residual tissue after excision of the cyst; in fact, small vessels may be identified and safely coagulated with bipolar forceps.

This study has several limitations. The retrospective nature of the analysis allows for selection bias and prevents quantification of patient satisfaction. The cohort studied is very small with limited follow-up time. Confirmation will await experience with a larger group of patients and longer follow-up.

In conclusion, we conclude that transumbilical single-incision laparoscopy, when performed by practitioners experienced in pediatric endoscopy, is a safe and practical approach to the surgical management of neonatal ovarian cysts, and that this method was associated with short hospitalization, a good cosmetic result. For these reasons, we recommend transumbilical single-incision laparoscopy as the first treatment option in infants with ovarian cysts greater than 40 mm in size.

Disclosure of conflict of interest

None.

Address correspondence to: Xue-Wu Zhou, Department of Pediatric Surgery, Xuzhou Center Hospital, 299 Jiefang South Road, Xuzhou 221000, Jiangsu, China. Tel: +86-15365886971; E-mail: cvd-120@163.com

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