

Minimally invasive surgery for ovarian cysts in children: transumbilical versus laparoscopic approach

Amel A. Hashish

Background/purpose A transumbilical approach was recently reported for management of several surgical procedures in children. The aim of this study was to evaluate the feasibility and safety of a minimally invasive transumbilical approach against the laparoscopic approach in the management of ovarian cysts in children.

Patients and methods This prospective study was conducted at Tanta University Hospital and at affiliated hospitals from April 2005 to May 2011. A total of 21 patients aged between 2 days and 8 years with ovarian cysts were included. Patients were randomly divided into two groups: group 1 ($n=11$) underwent the transumbilical approach, whereas group 2 ($n=10$) were treated by laparoscopy. Patients were evaluated with respect to operative time, need to convert to open surgery or to increase umbilical incision, any intraoperative and/or postoperative complication, total hospital stay, and final cosmetic outcome.

Results The ovarian cysts were simple, not complicated, and larger than 5 cm in 12 patients. Mixed cystic and solid parts were present in three patients. In another six patients, the cysts were complicated by torsion ($n=4$) or by hemorrhage inside the cysts ($n=2$). The mean size of the ovarian cysts was not statistically significant in either group (8.2 cm in group 1 vs. 7.8 cm in group 2). The mean operative time was shorter in group 1 compared with that in group 2 (45 ± 12 vs. 55 ± 10 min). Extension of umbilical

incision was needed in one patient in group 1 and in another two patients in group 2 (site of the umbilical port) for the extraction of ovarian cysts containing a solid tumor inside. Duration of hospital stay was comparable in both groups (1–2 days in both groups). No significant intraoperative or postoperative complications were recorded in both groups. Likewise, the cosmetic outcome was excellent in both groups.

Conclusion Both the transumbilical and laparoscopic approaches are feasible and safe for treatment of ovarian cysts in children. The results of both approaches are comparable. The transumbilical approach seems to be an attractive alternative for managing ovarian cysts in children in the absence of appropriate settings for laparoscopy. *Ann Pediatr Surg* 7:117–122 © 2011 Annals of Pediatric Surgery.

Annals of Pediatric Surgery 2011, 7:117–122

Keywords: children, laparoscopy, neonates, ovarian cyst, torsion, transumbilical approach

Department of Pediatric Surgery, Faculty of Medicine, Tanta University Hospital, Tanta University, Egypt

Correspondence to Amel A. Hashish, MD, Associate Professor of Pediatric Surgery, Department of Pediatric Surgery, Faculty of Medicine, Tanta University Hospital, Tanta 31111, Egypt
Tel: +20 12 331 5309; fax: +20 40 340 7734; e-mail: amelhashish@gmail.com

Received 20 May 2011 Accepted 3 July 2011

Introduction

The reported incidence of abdominal cysts in the pediatric population ranges from 0.1 to 0.2%, and many of these are ovarian in origin [1]. Pediatric ovarian lesions are estimated to occur at a rate of approximately two to five cases per 100 000 girls every year [2,3]. In the newborn population, cysts are the most common type of ovarian masses [4]. Most of the ovarian cysts are benign and functional, arising as a part of normal ovulation [5].

Ovarian cysts in children are usually asymptomatic. However, variable symptoms such as acute or chronic lower abdominal pain, increased abdominal girth resulting either from complications such as torsion or hemorrhage inside the cysts or because of pressure on adjacent anatomic structures may occur [6].

Cysts larger than 4 cm are generally removed surgically to prevent complications, which could occur in approximately 36–71% of cases [7–10]. Laparoscopic management of ovarian cysts is considered the surgical approach of choice by many pediatric surgeons [11,12] because of the potential development of less postoperative adhesions compared with conventional open surgery. However, many pediatric surgeons continue to choose laparotomy

for large cysts because of technical difficulties and the possibility of malignancy [13–15].

In 1986, Tan and Bianchi [16] reported the use of a circumumbilical incision for pyloromyotomy. This technique was adopted by many pediatric surgeons for a number of other procedures, including management of ovarian cysts [17,18].

This study was conducted to compare the safety, feasibility, and postoperative cosmetic results of a minimally invasive transumbilical approach with those of a laparoscopic approach for treatment of ovarian cysts in neonates and children.

Patients and methods

This prospective study was conducted at the Tanta University Hospital and at affiliated hospitals from April 2005 to May 2011. All patients were diagnosed by ultrasonography. An additional abdominal computed tomography scan was performed in patients with a complex solid and cystic lesion.

Patients were randomly divided into two groups: group 1 ($n=11$) underwent surgical management through a

transumbilical approach, whereas patients in group 2 ($n = 10$) were treated by laparoscopic surgery.

An informed consent was obtained from parents, and the research protocol was approved by the Research Ethics Committee of the Faculty of Medicine, Tanta University (Egypt).

Surgical techniques

1. The transumbilical approach

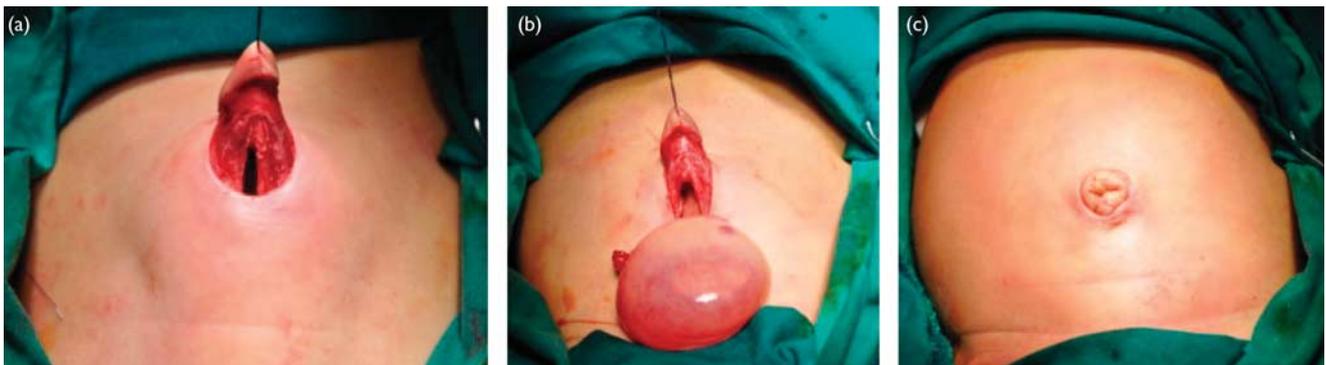
Through a semicircular infraumbilical incision, the peritoneal cavity was entered into through a midline vertical fascial incision (Figs 1 and 2). The cyst was pushed to the site of the incision by external manipulation that allows its exposure. Aspiration of a part of the fluid contents of large cysts allowed external exteriorization of the partially collapsed cyst. Caudal extension of the fascial incision was needed for the extraction of cysts with solid parts (Fig. 3). The cysts were managed by cystectomy, partial deroofing, or adnexectomy outside the abdominal cavity. The fascia was closed by an interrupted 3/0 Vicryl suture (Ethicon, Johnson and Johnson, Somerville, New Jersey, USA), and the skin incisions were closed by a subcuticular 4/0 Vicryl suture.

2. The laparoscopic approach

This was carried out through three trocars. A 5 mm camera port was placed through the umbilicus using the open method. Another two 3 mm trocars were inserted at both right and left iliac fossae. Pneumoperitoneum was established with a pressure of 6–8 mmHg and a CO₂ flow of 3 l/min. A 5 mm 0 lens was placed through the camera port to observe the ovarian cyst. A grasper was used to gently hold the gonad and dissecting scissors were used to enter the peritoneum overlying the cyst, which was carefully dissected down toward the ovary.

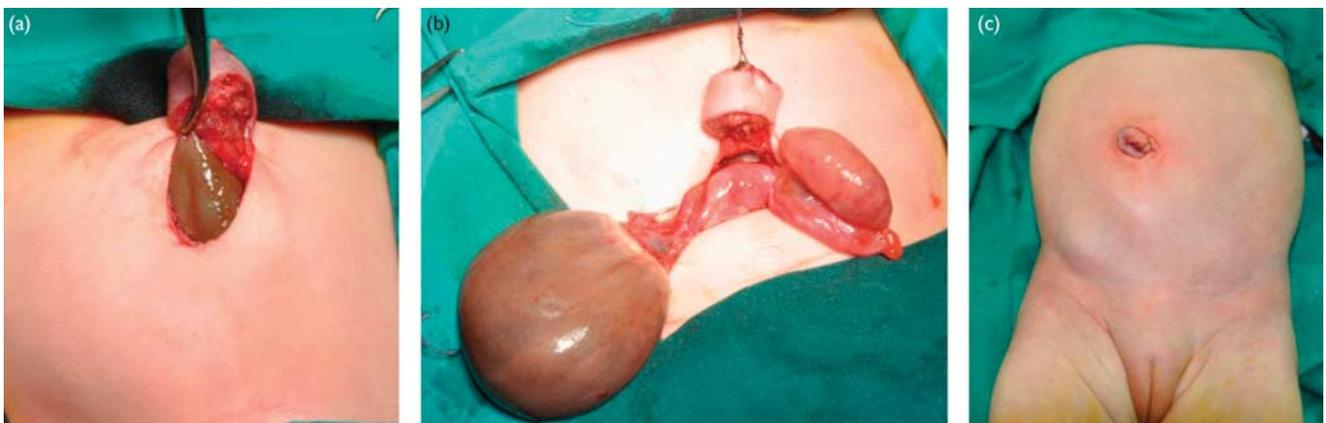
In case of a simple cyst, the cyst was carefully dissected down toward the ovary. The content of the cyst was then aspirated after a small puncture incision had been made. The cyst was unroofed and marsupialized close to the ovary. The surface of the cyst that remained on the ovarian tissue was cauterized, and the specimen was removed through the lateral port. In cases of torsion, salpingo-oophorectomy was performed. The umbilical port site was enlarged in two patients in this group to facilitate the extraction of mixed cystic and solid lesions. Vicryl 4/0 sutures were used to close the umbilical and trocar site

Fig. 1



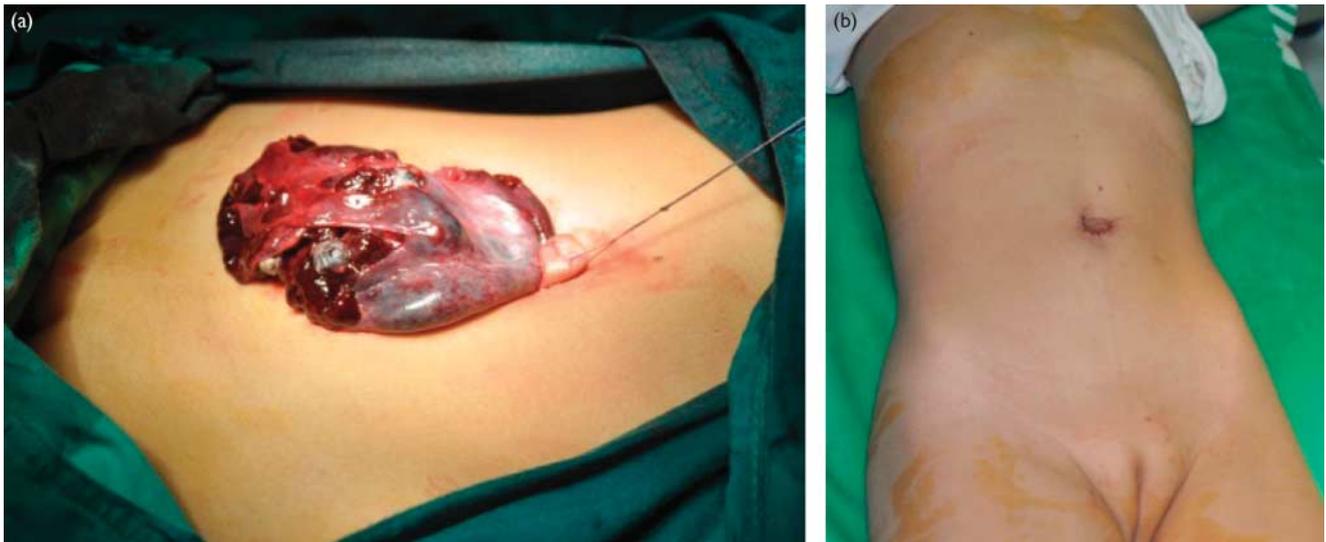
Excision of a simple noncomplicated ovarian cyst. (a) Exposure through semicircular infraumbilical skin incision and infraumbilical midline caudal fascial incision. (b) Extraction of the cyst outside the abdomen. (c) Immediate postoperative appearance.

Fig. 2



Excision of an ovarian cyst complicated by torsion. (a) Incomplete extraction of the cyst before decompression by partial aspiration of its contents. (b) Extraction of both ovaries and uterus outside the peritoneal cavity. (c) The immediate postoperative appearance.

Fig. 3



(a) Excision of a mixed cystic and solid ovarian mass in a 4-year-old girl; generous fascial incision was needed. (b) Immediate postoperative surgical site.

incisions. The excised cysts and its fluid were sent for histopathologic examination.

Patients were evaluated as regards operative time, need to convert to open surgery or to increase umbilical incision, any intraoperative and/or postoperative complication, total hospital stay, and final cosmetic outcome.

Results were tabulated, studied, and statistically analyzed using Statistical Package for the Social Sciences version 16.0.2 (Chicago, Illinois, USA). The mean difference in continuous data was analyzed using the Student's *t*-test, whereas categorical data were analyzed using the Fisher's exact test.

Results

A total of 21 patients with ovarian cysts were included in the study. The right side was affected in 11 cases. The left was involved in six cases. There were four cases with bilateral pathology. The size of the cysts was larger than 4 cm in all patients as measured by preoperative ultrasonography.

Age distribution

The ages of patients at the time of surgery ranged from 2 days to 8 years. Ten patients were younger than 1 month; the ages of six patients ranged from 1 to 12 months, and five children were older than 1 year. The ages were comparable in both the groups (Table 1).

Pattern of presentation

The various patterns of presentation were similar in both groups (Table 2). Nine cases were detected by prenatal ultrasound scan and referred for consultation either prenatally ($n = 5$) or after birth ($n = 4$). Only in three cases was the prenatal diagnosis precisely defined as ovarian cysts, whereas six cases were prenatally diagnosed as pelvic or abdominal cyst for differential diagnosis. The definitive diagnosis was confirmed after birth in all cases discovered prenatally.

Table 1 Age distribution

Age at surgery	Group 1 (transumbilical) ($n = 11$)	Group 2 (laparoscopic) ($n = 10$)	Total	<i>P</i> value
< 1 month	6	4	10	0.7
1–6 months	3	2	5	1
6–12 months	0	1	1	1
1–3 years	1	2	3	0.6
> 3 years	1	1	2	1

Age difference in all categories is not significant.

Table 2 Clinical presentation

Clinical presentation	Group 1 (transumbilical) ($n = 11$)	Group 2 (laparoscopic) ($n = 10$)	Total (%)
Asymptomatic incidental discovery	6	4	10 (47.6)
Acute abdominal pain \pm vomiting	2	4	6 (28.6)
Recurrent lower abdominal pain and/or pelviabdominal mass	3	2	5 (23.8)

Ten patients were asymptomatic at the time of diagnosis. These patients were identified by ultrasound examination either prenatally during routine antenatal examination ($n = 5$) or incidentally after birth for non-specific symptoms ($n = 5$).

Acute abdominal pain presented by crying, restlessness, or refusal of feeding with or without associated vomiting were the salient symptoms in six patients with complicated ovarian cysts either by torsion ($n = 4$) or by intracystic hemorrhage ($n = 2$).

Five patients presented with nonspecific symptoms such as persistent lower abdominal pain or fullness resulting from the pressure on adjacent anatomic structures. A palpable pelviabdominal mass was observed in four of them.

Operative data

The size of the cysts as measured by ultrasonography and confirmed during surgery ranged from 4.5 to 12.5 cm. The mean size of the ovarian cysts was not statistically significant in either group (8.2 vs. 7.8 cm). The operative time was shorter in group 1 compared with group 2 (45 ± 12 vs. 55 ± 10 min), almost reaching statistical significance ($P = 0.053$).

It was possible to preserve a part of the ovarian tissue in 12 patients [eight (72%) in group 1 and four (40%) in group 2]. This difference was not statistically significant ($P = 0.198$). Those patients had either cystectomy or partial deroofing. (Fig. 4). Complete excision of the cyst and ovary was mandated in six patients (two in group 1 and four in group 2) with complicated cysts by torsion or intracystic hemorrhage (Fig. 5). Excision of the cyst and ovary was carried out in another three patients with solid parts in the cyst because of the uncertain nature of the solid parts (one in group 1 and two in group 2). All specimens were benign and contained benign serous cystadenoma.

There were no intraoperative complications. Postoperative superficial wound infection occurred in one patient in group 1. The cosmetic appearance was excellent in all cases. Hospital stay ranged from 1 to 2 days in both groups.

Discussion

There is no clear guideline with regard to the optimal management of ovarian cysts in infants and children. Many small ovarian cysts can be managed conservatively.

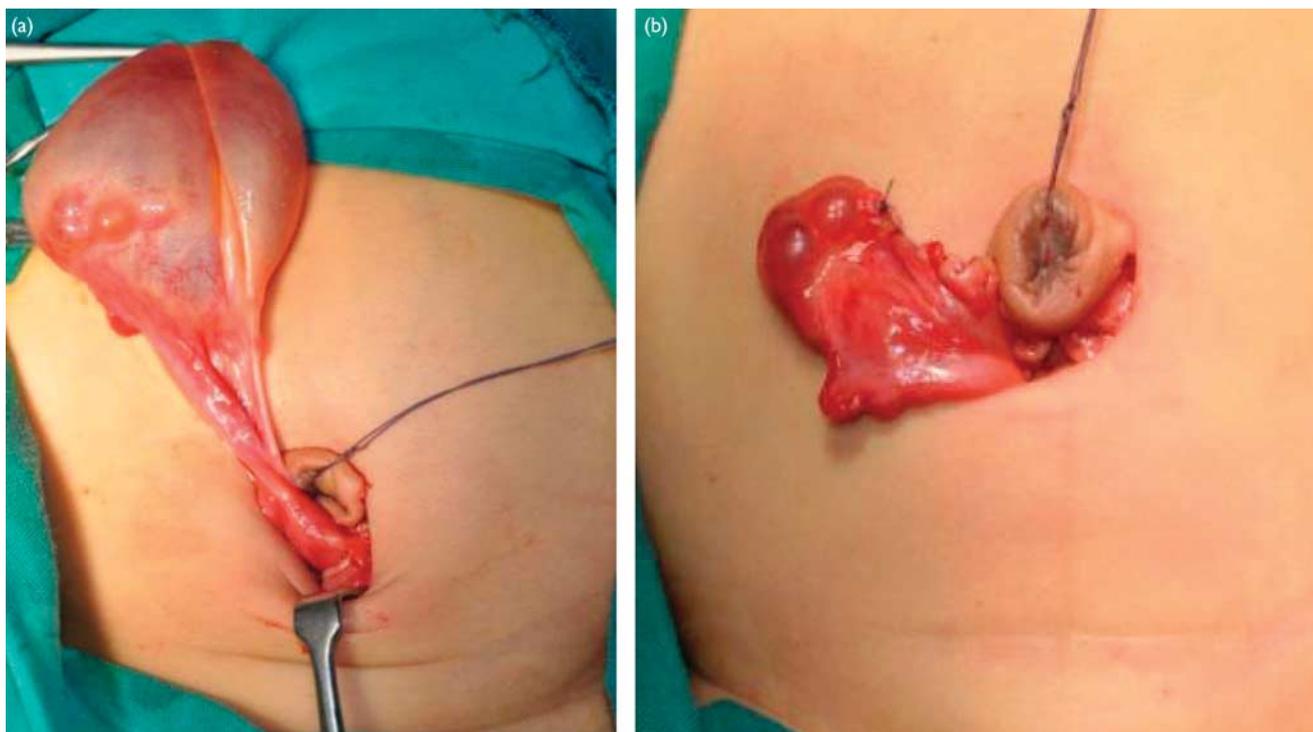
Spontaneous regression of smaller cysts could occur in 25–50% of cases [19].

The appearance of a complex cyst with debris on ultrasonography, presence of large simple cysts (> 4 cm), multiloculations, and persistent symptoms indicate surgical intervention because of the presumed risk of complications [7,20,21], such as torsion of the cyst on its own pedicle [7,22,23]. These complications usually occur in cysts with a diameter of more than 5 cm [4,24].

Many cases of ovarian cysts were traditionally treated through an open approach. The conventional surgical approach through a lower transverse abdominal approach offers considerable exposure for the pelvis and the rest of the abdomen in neonates and young children. However, this approach has been replaced by minimally invasive surgery in many centers in the past three decades.

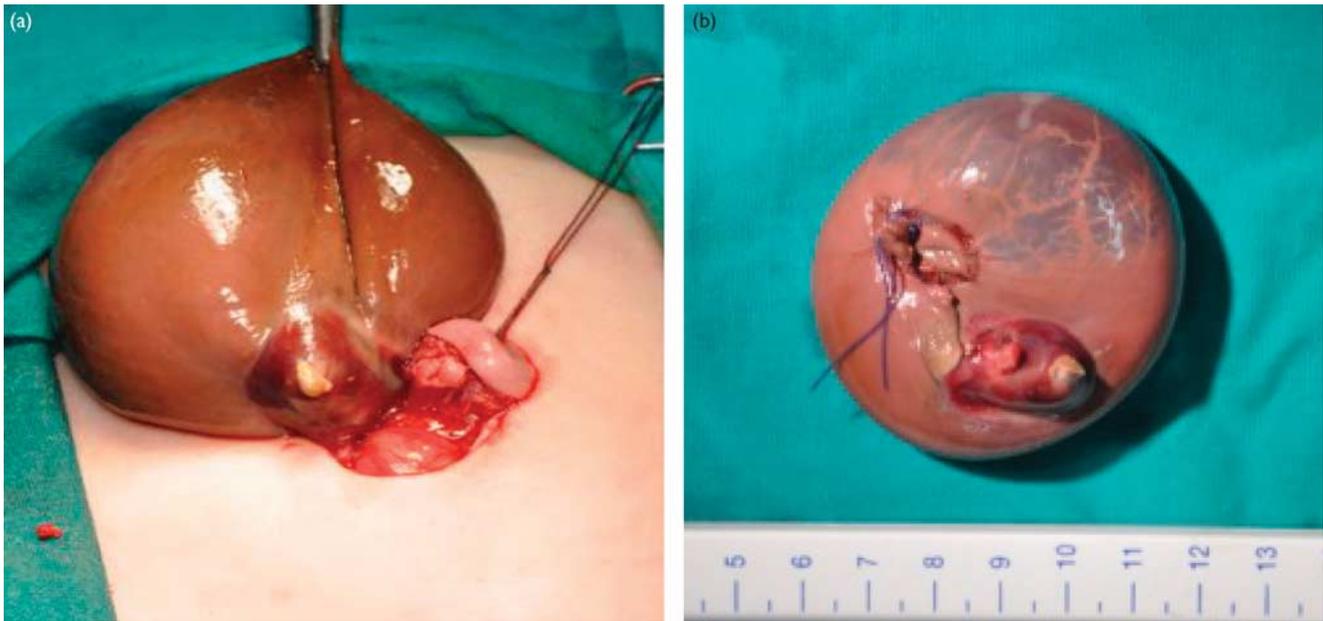
The recent advances in laparoscopic techniques markedly improve the cosmetic results [25]. The laparoscopic approach allows visualization of the other ovary and the whole abdominal cavity and pelvic area for coexistence of associated pathologies. In addition, laparoscopy allows the surgeon to perform a therapeutic maneuver, to untwist a gonad in case of torsion, to resect the cyst wall in cases of well-preserved ovarian parenchyma, or to perform an ovariectomy or an adnexectomy if the parenchyma is damaged [4,21,26]. The laparoscopic approach for ovarian cysts in newborns was reported to be easy to learn and is a safe and reliable method [27,28]. Eltabbakh *et al.* [11] reported a 94% success rate with laparoscopic management of benign ovarian cysts. These results are consistent with our results and with other published series [12].

Fig. 4



(a) Extraction of the cyst. (b) Preservation of ovarian tissue at the base of the excised cyst.

Fig. 5



(a) Excision of an ovarian cyst complicated by torsion. (b) Ovary was not salvageable.

Exploration of the entire abdominal cavity is an advantage of the laparoscopic approach, especially if the preoperative diagnosis is not definite. Likewise, the excellent visualization of the surgical anatomy allows better preservation of important anatomic structures especially when operating on a smaller-sized child.

Despite several potential advantages of the laparoscopic approach, certain limitations of this approach include the need for specialized equipment [29], associated higher cost, and longer operating time [30]. Furthermore, large cysts may limit the working space and hinder the insertion of the trocar. Poor tolerance to pneumoperitoneum in some newborns is another concern. A longer operative time was needed in patients treated by the laparoscopic approach compared with the transumbilical approach in the current series.

Circumumbilical incision was adopted by many pediatric surgeons for a number of other procedures including management of ovarian cysts [17,18]. Ovarian cysts in neonates and young children can be easily accessible through the transumbilical approach because they are freely mobile as a result of a long pedicle and they are frequently located intra-abdominally because of a shallow pelvis. In the current series, no difficulties were noted during the extraction of large ovarian simple cysts by means of the transumbilical approach after decompression.

The dissection of mixed cystic and solid ovarian masses can be carried out through the transumbilical approach after extension of the skin incision and generous caudal extension of the underlying midline fascial incision. This was needed in one patient. On the basis of the difficulties in extraction of such mixed solid and cystic lesions, it might be more appropriate to choose conventional open

surgery through lower transverse abdominal incision in nonovarian masses with considerable solid components.

Ovarian tissue preservation is recommended whenever feasible. This can be achieved by the enucleation of the cyst with ovarian reconstruction so as to preserve the reproductive function of the ovary. A part of the ovarian tissue was preserved in 12 cases (57%) in this series. Successful salvage of the ovary was noted in a larger percentage of patients treated by the transumbilical approach compared with laparoscopic surgery (72 vs. 40%). However, this difference can be explained by the larger percentage of complicated cysts in the laparoscopic group rather being attributed to the approach itself. In case of large or complicated lesions it may be impossible to preserve ovarian tissue, and oophorectomy then becomes necessary. Oophorectomy is considered the procedure of choice in cases of ovarian torsions or in cases of uncertain pathology [31,32].

Conclusion

When indicated, ovarian cysts in children can be managed effectively by either the transumbilical or the laparoscopic approach. Both approaches proved to be effective and safe with comparable results. The laparoscopic approach is advised when preoperative diagnosis is not defined. The transumbilical approach proved to be versatile and offers adequate surgical exposure. It can be a good alternative to laparoscopy for management of ovarian cysts in children when proper laparoscopic setup is absent.

Acknowledgements

Conflicts of interest

There are no conflicts of interest.

References

- 1 Zampieri N, Borruoto F, Zamboni C, Camoglio FS. Foetal and neonatal ovarian cysts: a 5-year experience. *Arch Gynecol Obstet* 2008; **277**:303–306.
- 2 Schultz KAP, Ness KK, Nagarajan R, Steiner ME. Adnexal masses in infancy and childhood. *Clin Obstet Gynecol* 2006; **49**:464–479.
- 3 Cass DL, Hawkins E, Brandt ML, Chintagumpala M, Bloss RS, Milewicz AL, et al. Surgery for ovarian masses in infants, children and adolescents: 102 consecutive patients treated in a 15-year period. *J Pediatr Surg* 2001; **36**:693–699.
- 4 Esposito C, Garipoli V, Di Matteo G, De Pasquale M. Laparoscopic management of ovarian cysts in newborns. *Surg Endosc* 1998; **12**:1152–1154.
- 5 Brown MF, Hebra A, McGeehin K, Ross AJ III. Ovarian masses in children: a review of 91 cases of malignant and benign masses. *J Pediatr Surg* 1993; **28**:930–932.
- 6 Pomeranz AJ, Sabnis S. Misdiagnoses of ovarian masses in children and adolescents. *Pediatr Emerg Care* 2004; **20**:172–174.
- 7 Hengster P, Menardi G. Ovarian cysts in the newborn. *Pediatr Surg Int* 1992; **7**:372–375.
- 8 Spigland N, Ducharme JC, Yazbeck S. Adnexal torsion in children. *J Pediatr Surg* 1989; **24**:974–976.
- 9 Brandt ML, Luks FI, Filiatrault D, Garel L, Desjardins JG, Youssef S. Surgical indications in antenatally diagnosed ovarian cysts. *J Pediatr Surg* 1991; **26**:276–282.
- 10 Heling KS, Chaoui R, Kirchmair F, Stadie S, Bollmann R. Fetal ovarian cysts: prenatal diagnosis, management and postnatal outcome. *Ultrasound Obstet Gynecol* 2002; **20**:47–50.
- 11 Eltabbakh GH, Charboneau AM, Eltabbakh NG. Laparoscopic surgery for large benign ovarian cysts. *GynecolOncol* 2008; **108**:72–76.
- 12 Mittal S, Gupta N, Sharma AK, Dadhwal V. Laparoscopic management of a large recurrent benign mucinous cystadenoma of the ovary. *Arch Gynecol Obstet* 2008; **277**:379–380.
- 13 Celik A, Ergun O, Aldemir H, Ozcan C, Ozok G, Erdener A, et al. Long-term results of conservative management of adnexal torsion in children. *J Pediatr Surg* 2005; **40**:704–708.
- 14 Goh SM, Yam J, Loh SF, Wong A. Minimal access approach to the management of large ovarian cysts. *Surg Endosc Other Intervent Tech* 2007; **21**:80–83.
- 15 Myers ER, Bastian LA, Havrilesky LJ, Kulasingam SL, Terplan MS, Cline KE, et al. Management of adnexal mass. *Evid Rep Technol Assess* 2006; **130**:1–145.
- 16 Tan KC, Bianchi A. Circumbilical incision for pyloromyotomy. *Br J Surg* 1986; **73**:399.
- 17 Soutter AD, Askew AA, Teitelbaum D, Wulkan M. Transumbilical laparotomy in infants: a novel approach for a wide variety of surgical disease. *J Pediatr Surg* 2003; **38**:950–952.
- 18 Lin JY, Lee ZF, Chang YT. Transumbilical management for neonatal ovarian cysts. *J Pediatr Surg* 2007; **42**:2136–2139.
- 19 Van der Zee DC, Van Seumeren IGC, Bax KMA, Rovekamp MH, Pull ter Gunne AJ. Laparoscopic approach to surgical management of ovarian cysts in the newborn. *J Pediatr Surg* 1995; **30**:42–43.
- 20 Shapiro EY, Kaye JD, Palmer LS. Laparoscopic ovarian cystectomy in children. *Urology* 2009; **73**:526–528.
- 21 Aslam A, Wong C, Haworth JM, Noblett HR. Autoamputation of ovarian cyst in an infant. *J Pediatr Surg* 1995; **30**:1609–1610.
- 22 Adelman S, Benson CD, Hertzler JH. Surgical lesions of the ovary in infancy and childhood. *Surg Gynecol Obstet* 1975; **141**:219–222.
- 23 Heloury Y, Guiberteau V, Sagot P, Plattner V, Baron M, Rogez JM. Laparoscopy in adnexal pathology in the child: a study of 28 cases. *Eur J Pediatr Surg* 1993; **3**:75–78.
- 24 Bagolan P, Rivosecchi M, Giorlandino C, Bilancioni E, Nahom A, Zaccara A, et al. Prenatal diagnosis and clinical outcome of ovarian cysts. *J Pediatr Surg* 1992; **27**:879–881.
- 25 Fujimoto T, Segawa O, Lane GJ, Esaki S, Miyano T. Laparoscopic surgery in newborn infants. *Surg Endosc* 1999; **13**:773–777.
- 26 Kanno S, Emil S, Takeuchi L, Atkinson JB. Laparoscopic approach to ovarian pathology in children and adolescents. *Pediatr Surg Int* 1995; **10**:221–225.
- 27 Jawad AJ, Al Meshari A. Laparoscopy for ovarian pathology in infancy and childhood. *Pediatr Surg Int* 1998; **14**:62–65.
- 28 Dobremez E, Moro A, Bondonny JM, Vergnes P. Laparoscopic treatment of ovarian cyst in the newborn: a series of nine cases. *Surg Endosc Other Intervent Tech* 2003; **17**:328–332.
- 29 Chen MK, Schropp KP, Lobe TE, Wiener E. Complications of minimal-access surgery in children. *J Pediatr Surg* 1996; **31**:1161–1165.
- 30 Esposito C, Mattioli G, Monguzzi GL, Montinaro L, Riccipiettoni G, Aceti R, et al. Complications and conversions of pediatric videosurgery: the Italian multicentric experience on 1689 procedures. *Surg Endosc Other Intervent Tech* 2002; **16**:795–798.
- 31 Creighton S. Pediatric and adolescent gynaecology. In: Burge DM, Griffiths MD, Steinbrecher HA, Wheeler RA, editors. *Paediatric surgery*. 2005 2nd ed. Oxford, UK: Oxford University Press, Hodder Arnold. pp. 555–559.
- 32 Wood PL. Pelvic pain, ovarian cysts and endometriosis in adolescent girls. In: Balen AH, editor. *Pediatric and adolescent gynaecology*. 2004 Cambridge: Cambridge University Press. pp. 359–372.