Is the stripping technique a tissue-sparing procedure in large simple ovarian cysts in children?

Francesco Arena\textsuperscript{a}, Carmelo Romeo\textsuperscript{a,⁎}, Marco Castagnetti\textsuperscript{b}, GianFranco Scalfari\textsuperscript{a}, Marcello Cimador\textsuperscript{b}, Pietro Impellizzeri\textsuperscript{a}, Daniela Villari\textsuperscript{c}, Fabrizio Zimbaro\textsuperscript{d}, Enrico DeGrazia\textsuperscript{b}

\textsuperscript{a}Department of Medical and Surgical Pediatric Sciences–Unit of Minimally Invasive Pediatric Surgery, University of Messina, 98125 Messina, Italy
\textsuperscript{b}Department of Pediatric Surgery–Istituto Materno Infantile, University of Palermo, Palermo, Italy
\textsuperscript{c}Department of Human Pathology–Unit of Histopathological Diagnosis, University of Messina, 98125 Messina, Italy
\textsuperscript{d}Department of Radiological Sciences University of Messina, 98125 Messina, Italy

Key words: Ovary; Conservative surgery; Stripping technique

Abstract

Background: Stripping of the cystic wall is performed by gynecologists to treat large ovarian cysts. Information in the pediatric population is poor. We prospectively evaluated the pathologic specimens of large ovarian cyst to determine whether the stripping technique is a tissue-sparing procedure even in this age.

Methods: We evaluated 5 patients. Samples were taken from the intermediate part of the cystic wall and from the layer covering the cyst during excision. The presence of ovarian tissue adjacent to the cyst wall, and the morphological features of the surrounding tissue were both evaluated. Pelvic ultrasound follow-up was also performed.

Results: Patients’ mean age was 4.5 years (7 days to 12 years). All cysts were removed because all were symptomatic. The mean diameter was 86.6 mm (74-100 mm). Cysts were follicular in 2 cases, serous in other two, and endometriotic in 1 case. Adjacent ovarian tissue was present in 1 of 5 specimens and was approximately 1 to 2 mm in thickness. The layer adjacent to the cystic wall always appeared as normal ovarian tissue. Ultrasound scans at follow-up revealed presence of ovarian tissue.

Conclusion: The stripping procedure for large ovarian cyst excision allows to spare the adjacent normal ovarian tissue even in pediatric age because ovarian tissue is rarely excised with the cyst wall during the procedure.

© 2008 Elsevier Inc. All rights reserved.

Management of large ovarian cysts in children is controversial and complicated by a poorly understood natural history [1,2]. Surgery should be undertaken in the presence of symptoms, of tendency of the cyst to increase in size, or of failure of the cyst to resolve or shrink off spontaneously [3].
Operative treatment has also been suggested to be appropriate in asymptomatic patients with ovarian cysts larger than 5 cm in diameter or greater than 13 mL in volume [4] to reduce the risk for serious complication and rescue ovarian tissue [5].

Ovarian cysts selected for treatment can be aspirated percutaneously or laparoscopically, unroofed or resected laparoscopically, aspirated, and then resected via a minimally invasive laparotomy or treated with an open procedure [6]. In any case, aim of the procedure should be to spare as much ovarian tissue as possible while minimizing the risk for cyst recurrence.

Stripping of the cystic wall is a technique used by gynecologists for the treatment of large benign ovarian cysts [7]. The procedure can be performed via either an open [8] or laparoscopic approach [7] and even if ovarian tissue is not macroscopically evident. Evidence shows that this is a tissue-sparing procedure.

To our knowledge, such a technique has not been reported in children yet.

We report our experience with surgical stripping of large benign ovarian cysts in 5 patients. The study also includes a histologic analysis of the excised cystic tissue to investigate its morphology and verify whether ovarian tissue is inadvertently excised together with the cystic wall. We finally report the ultrasound scan (US) follow-up of the residual ovarian tissue left behind after the stripping of the cyst.

### 1. Materials and methods

Between January 2004 and December 2005, 5 patients, 7 days to 12 years old, underwent excision of large ovarian simple cysts (Table 1). Preoperatively, all patients underwent a plain abdominal x-ray, US, computed tomographic scan, and evaluation of β human chorionic gonadotropin (β-HCG) and α fetoprotein (α-FP) levels.

In all cases, a laparotomy was performed via a Pfannenstiel incision. The cyst wall was stripped off the remaining ovarian parenchyma through traction exerted in opposite directions by using 2 atraumatic grasping forceps. When necessary, hemostasis was achieved applying the bipolar forceps on the ovarian parenchyma after excision of the cystic wall. A 2 × 2-mm biopsy specimen was harvested from the ovarian cortex for histologic examination. The cortex was then reconstructed with absorbable sutures.

After excision of the entire cyst wall, a 2 × 2-cm sample was taken from the intermediate part of the specimen. This was midway between the point where the stripping was started and finished, usually at the site of ovarian adhesion to the ovarian fossa and the ovarian hilus, respectively. The latter portions were excluded because these are the points where the cyst wall and the ovarian parenchyma are most tightly adherent, possibly yielding noncomparable specimens.

The institutional review board approved the study, and all biopsies were undertaken always after informed consent was obtained.

The same pathologist blinded to the clinical and surgical history of the patient evaluated both ovarian and cyst samples. The remaining part of the cyst wall was sent for routine histologic examination. Presence of ovarian tissue adjacent to the cyst wall was evaluated, and if present, the morphologic characteristics of the tissue were graded on a semiquantitative scale from 0 to 4 (0, complete absence of follicles; 1, primordial follicles only; 2, primordial and primary follicles; 3, some secondary follicles; 4, pattern of primary and secondary follicles as seen in normal ovary) [9].

All patients underwent a follow-up pelvic US 6, 12, and 18 months after surgery.

---

**Table 1.** Age at operation of the patients studied, cyst size and location, indications for surgery, and histological classification.

<table>
<thead>
<tr>
<th>Case</th>
<th>Age at surgery</th>
<th>Cyst size (mm)</th>
<th>Side</th>
<th>Symptoms</th>
<th>Histology</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>7 d</td>
<td>84 × 80</td>
<td>R</td>
<td>Respiratory distress</td>
<td>Follicular cyst</td>
</tr>
<tr>
<td>2</td>
<td>3 y</td>
<td>74 × 68</td>
<td>R</td>
<td>Abdominal pain</td>
<td>Follicular cyst</td>
</tr>
<tr>
<td>3</td>
<td>3 y 6 mo</td>
<td>85 × 56</td>
<td>L</td>
<td>Abdominal pain</td>
<td>Serous cyst</td>
</tr>
<tr>
<td>4</td>
<td>4 y</td>
<td>100 × 80</td>
<td>R</td>
<td>Abdominal pain</td>
<td>Serous cyst</td>
</tr>
<tr>
<td>5</td>
<td>12 y</td>
<td>90 × 80</td>
<td>R</td>
<td>Persistent after 1 year F-U</td>
<td>Endometriotic cyst</td>
</tr>
</tbody>
</table>

R indicates right; L, left, F-U, follow-up.

---

**Fig. 1.** Full thickness specimen from a serous cyst wall. Section of a surface epithelial cyst wall, consisting of a single layered cuboidal epithelium. Follicular structures are absent in the pericystic stroma (Hematoxylin and eosin, original magnification × 80).
2. Results

Abdominal US revealed in all cases a simple anechoic cyst, with an imperceptible wall, no solid components, and no fluid debris levels; computed tomographic scan confirmed the US findings.

In case 1, the ovarian cyst was diagnosed at the 34th week of gestation. The initial diameter was 46 mm but increased progressively during pregnancy. After birth, the cyst measured 84 mm appearing as simple cyst without calcifications but symptomatic with respiratory distress. Cases 2, 3, and 4 were admitted for severe abdominal pain with episodes of bilious vomiting. On examination, an abdominal mass arising from the pelvic fossa and reaching the transverse umbilical line was evident. Case 5 underwent surgical resection of a large ovarian cyst on the right side because the asymptomatic cyst increased in size during follow-up (Table 1).

In all the cases, tumor markers were within normal ranges.

At laparotomy, no ovarian tissue was macroscopically evident in 4 of 5 cases. A thin rim of ovarian tissue rich in small follicles was identified in case 4.

All procedures were accomplished successfully without any intraoperative or postoperative complication.

Histologic classification of the cysts was as follows: follicular cyst in 2 cases (cases 1 and 2, 40%), serous cyst in 2 cases (cases 3 and 4, 40%), and endometriotic cyst in one case (case 5, 20%). Routine histologic examinations of the entire specimen confirmed the blinded histologic diagnosis in all cases.

Adjacent ovarian tissue was present in 1 of 5 specimens (case 2). This ovarian tissue was approximately 1 to 2 mm in thickness. No ovarian tissue was found in 4 specimens (Figs. 1 and 2). With regard to morphologic characteristics, the ovarian tissue excised with the cyst wall was graded as 0 in 4 of 5 specimens and 1 in the remaining specimen (case 2) (Fig. 3).

The small biopsy specimens from the ovarian tissue cortex always highlighted ovarian parenchyma with regular features for age.

Six months after surgery, the US revealed presence of ovarian tissue on the operated side. The size of ovaries at 12-month follow-up is reported in Table 2. The operated ovary always appeared to increase in size with respect to the contralateral one, and in case 4, both ovaries appeared to be

<table>
<thead>
<tr>
<th>Case</th>
<th>Size of right ovary</th>
<th>Size of left ovary</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$20 \times 10 \times 6.6$</td>
<td>$10.9 \times 5.6 \times 5$</td>
</tr>
<tr>
<td>2</td>
<td>$24 \times 20 \times 18$</td>
<td>$24 \times 17 \times 5$</td>
</tr>
<tr>
<td>3</td>
<td>$20 \times 11 \times 10$</td>
<td>$25 \times 13 \times 10$</td>
</tr>
<tr>
<td>4</td>
<td>$18 \times 9 \times 16$</td>
<td>$11 \times 14 \times 8$</td>
</tr>
<tr>
<td>5</td>
<td>$28 \times 24 \times 23$</td>
<td>$24 \times 24 \times 16$</td>
</tr>
</tbody>
</table>
multifollicular. At 18 months from surgical excision, no relapse has been documented.

3. Discussion

As with neonates, most cysts in prepubertal child are follicular in origin and will resolve spontaneously [1]. The distinction between a pathologic cyst and a physiologic mature follicle is based on size alone, with cyst larger than 2 cm considered as pathologic [9]. In prepubertal age, it is also possible to observe endometriotic cyst or serous cysts, as confirmed by our experience. These types of cysts have a different behavior from simple follicular cyst because they tend to grow. The decision as to intervene has to be based on cyst size, ultrasound characteristics, and clinical symptoms [6]. Nussbaum et al [10] have developed ultrasound diagnostic criteria differentiating simple from complex ovarian cysts. A simple cyst is anechoic, with an imperceptible wall, no solid components, and no fluid debris levels. A complicated cyst contains a fluid debris level, retracting clot, septa, or is completely filled with echoes producing a solid masslike appearance [10,11]. In general, simple unilocular cysts have a very low risk for malignancy [12]. Moreover, it has been hypothesized that large simple cysts are at higher risk of torsion, and surgery is meant to reduce the potential for serious complications [5,6].

With large ovarian cysts, reported complications include compression of the ureters [13], reduction of aortocaval blood flow [14], and displacement [15] or perforation [16] of the colon. Aspiration of large ovarian cysts during the neonatal period has been reported to be successful, without recurrence of the cyst [2,17].

If surgery is chosen, the laparoscopic approach is nowadays generally favored even in infants [17]. Whether a laparoscopic technique is chosen, simple cysts should undergo fenestration [17].

When surgical treatment is performed, every attempt should be made to rescue as much gonad tissue as possible. Indeed, even if no ovary is macroscopically visible, ovarian tissue may still be present, and surgery should be limited to removal or unroofing of the cyst [1,18].

Gynecologists have introduced the stripping technique for the enucleation of benign large ovarian cysts. This procedure can be performed through an open or a laparoscopic approach and even in the absence of macroscopic evidence of any ovarian tissue. Such a technique allows to rescue at maximum the existing ovarian tissue. Our experience shows this technique to be feasible in children, too, irrespective of age. Indeed, we accomplished the procedure successfully and without intraoperative or postoperative complication in neonates, infants, and prepubertal patients.

Nature of the ovarian cysts has been suggested to be a key factor in the success of the procedure in adults. When the cyst does not have a proper capsule, such as in the case of endometriomas, the risk to remove ovarian tissue together with the cyst increases by 9 times [8].

As the primary goal of the stripping technique is to preserve ovarian tissue, we performed a histologic analysis of the cyst wall and the adjacent parenchyma. Only in one patient, a thin rim of ovarian tissue, containing few follicles, was found attached to the removed cyst. The ovarian parenchyma that was left behind, instead, always displayed a normal histologic finding and a normal appearance at follow-up USs.

Besides, many technical details may be of relevance to spare ovarian tissue. For instance, careful use of electrosurgical coagulation on the residual tissue after excision of the cyst seems to be key to avoid further damage to the ovarian tissue. However, when appropriate technique is used, small vessels may be identified and safely coagulated with bipolar forceps. Similarly, use of microsurgical technique, such as that available during the laparoscopic procedure seems to allow better results.

We do not favor instead the practice of aspirating the cyst to allow delivery via a minimally invasive approach for 2 reasons. To begin with, dissection of the cysts is easier as long as it is full. Secondly, even despite normal tumor markers, it is possible for the cysts to be malignant. Hence, we stress the importance of a proper patient selection and appropriate surgical technique consistent with the principles of ontological surgery.

In conclusion, the stripping procedure for simple large ovarian cyst excision appears to be an organ-preserving procedure even in pediatric age because the ovarian tissue was never inadvertently excised with the cyst wall.

References


