Antenatal Surgical Management for Ovarian Cysts: 13 Years' Experience

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Objective: To evaluate the outcome of surgically treated ovarian cysts during the antenatal period in 51 women.
Methods: The outcome of pregnant women who underwent surgery during the antenatal period for ovarian cyst from January 2003 to December 2015 at a university hospital in Hong Kong was retrospectively reviewed. Operative details, histopathology of the ovarian cyst, pregnancy complications, and neonatal outcome were assessed.
Results: Of 51 women surgically treated for ovarian cyst during pregnancy, 29 were operated electively in the late first or early second trimester (mean [range] gestational age, 14 [8-22] weeks) and 22 were emergency operations (mean [range] gestational age, 13 [4-32] weeks). There were no intra-operative complications or adverse neonatal outcome. The most common pathology was mature cystic teratoma (22/54, 40.7%). Most ovarian cyst complications occurred between 7 and 13 weeks of gestation (72.7%) and when the size of the cyst was >6 cm (81.8%).
Conclusion: Elective surgery for ovarian cyst in the late first or second trimester can be achieved safely with a laparoscopic approach. Ovarian cysts >6 cm are at risk of complications and warrant elective surgery. Accurate diagnosis of ovarian cyst complications during pregnancy can be made clinically based on symptoms and ultrasonographic findings.
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Introduction

Detection of an adnexal mass during pregnancy has increased with the use of routine ultrasound scans to assess fetal viability, growth and morphology. The prevalence of adnexal mass in pregnancy ranges from 1/76 to 1/2328 deliveries[1]. Most of the ovarian cysts detected in early pregnancy are functional cysts that resolve with increasing gestation and can be managed conservatively[2]. Nonetheless, some may persist and become clinically significant with a risk of cyst complications. Malignancy is rare; the incidence of ovarian malignancy in pregnancy ranges from 0.073 to 0.11 case per 1000 deliveries[1].

Although antepartum surgery is generally safe, adverse maternal and fetal outcomes such as miscarriage, intrauterine fetal death, and preterm delivery have been reported[3]. The optimal treatment for a growing adnexal mass during pregnancy remains controversial.

This study aimed to review the maternal and fetal outcomes in 51 pregnant women who underwent surgical treatment for ovarian cysts.

Methods

We retrospectively reviewed records of all pregnant women who underwent elective or emergency surgery for removal of an ovarian mass from January 2003 to December 2015 in our university hospital. Patients' baseline characteristics, ultrasound findings, histological findings, presenting symptoms, indications for surgery, operative details, pregnancy complications and neonatal outcome were retrived. The mean diameter of the ovarian mass was calculated as the sum of three dimensions of the mass divided by three. Term delivery was defined as delivery after 37 weeks of gestation.

The decision to proceed to elective surgery was based on the department protocol and patient choice (Table 1). The decision to proceed to emergency surgery was based on the attending surgeon's clinical and ultrasound suspicion of complications arising from the ovarian mass.

Statistical analysis was performed using the Statistical Package for the Social Sciences version 22.0 (SPSS Inc., Chicago [IL], US). Chi square test was used to analyse categorical variables and *t* test was used for continuous variables. The significance level was set at p<0.05.

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Results

A total of 51 pregnant women who underwent elective (n=29) or emergency (n=22) ovarian cystectomy were identified (Table 2). The mean maternal age and parity was 30.1 years and 0.98, respectively. The mean body mass index was 21.6 kg/m².

Ultrasonography was performed before the operation in all patients. Suspicious features were detected in 6 patients, one of whom had ovarian malignancy. All patients with benign features on ultrasonography were confirmed to be benign on final pathology.

The mean gestational age at initial diagnosis was 10 (range, 4-26) weeks. The mean gestational age at the time of operation was 13.7 (range, 4-32) weeks; 14.1 weeks for

Table 1. Management protocol for ovarian cysts complicating pregnancy

Ovarian cyst	Management protocol
Simple unilocular cyst	
Before 16 weeks and size ≤6 cm	Conservative management unless complications develop
Before 16 weeks and size >6 cm, or cyst persisting beyond 16 weeks (before 20 weeks)	Counsel patients about pros and cons of surgery during pregnancy and arrange surgery in the second trimester if patient agrees
After 20 weeks	Conservative management unless patient is symptomatic
Suspicious ovarian cyst	Consult gynaeoncologist for opinion

Table 2. Maternal demographics*

Maternal demographic	Elective (n=29)	Emergency (n=22)	All cases (n=51)
Maternal age (years)	29.5 (20-39)	30.9 (24-40)	30.1 (20-40)
Gravity	0.97 (0-4)	0.45 (0-2)	0.98 (0-4)
Parity	0.31 (0-2)	0.54 (0-2)	0.37 (0-2)
Multiple pregnancy	0	2 (9)	2 (3.8)
Body mass index (kg/m²)	22.1 (16.9-39.6)	21.0 (16.7-27.5)	21.6 (16.7-39.6)
Gestation at diagnosis (weeks)	10 (5-14)	10.0 (4-26)	10.0 (4-26)
Gestation at operation (weeks)	14.1 (8-20)	13.1 (4-32)	13.7 (4-32)
Time from diagnosis to operation (weeks)	4.1 (0-15)	3.2 (0-20)	3.7 (0-20)

* Data are shown as mean (range) or No. (%) of subjects

Table 3. Histological diagnosis of adnexal masses

	Elective (n=33)*	Emergency (n=21)†	Total
Mature cystic teratoma	17	5	22
Corpus luteal cyst	1	6	7
Serous cystadenoma	4	3	7
Endometrioma	5	1	6
Mucinous cystadenoma	5	1	6
Struma ovarii	0	2	2
Fimbrial cyst	0	1	1
Fibrothecoma	1	0	1
Dysgerminoma	0	1	1
Serous adenocarcinoma	0	1	1

* Four out of 29 cases had bilateral ovarian cysts
† Histology not available in 1 case as only de-torsion was performed

elective cases and 13.1 weeks for emergency cases) The mean time from initial diagnosis to operation was 3.7 weeks.

A total of 54 ovarian cysts were excised because four patients had bilateral involvement (Table 3). One patient underwent de-torsion of the ovary only. The most common histology was mature cystic teratoma (n=22, 40.7%). Two

(3.8%) were ovarian malignancy (one high-grade serous adenocarcinoma and one dysgerminoma).

All elective surgeries were performed via a laparoscopic approach during the first or second trimester, except that elective laparotomy was performed for one patient suspected of ovarian malignancy (Table 5). The patient presented at 8 weeks of gestation with right-side abdominal pain; preoperative ultrasonography revealed a 9-cm right unilocular ovarian cyst with irregular border and multiple papillary projections. Owing to suspected ovarian malignancy, laparotomy with right salpingo-ophorectomy and peritoneal and omental biopsy were performed. The operation lasted for 60 minutes. No tocolysis was required. The final pathology was endometrioma. For the 28 elective laparoscopies, the primary entry was made using the Hasson technique via an intraumbilical incision. Ovarian cystectomy was performed in 26 cases and salpingo-ophorectomy in two. The cyst ruptured during the operation in 23 cases.

For the 22 emergency surgeries, 13 were laparoscopy and nine were laparotomy (Table 5). All were performed for patients suspected of ovarian cyst complications. For the 13 emergency laparoscopy, the primary entry was made using the Veress needle at 4 weeks and 9 weeks of gestation in two cases, and using the Hasson technique through an intraumbilical incision in 11 cases. Ovarian cystectomy was performed in 10 cases, and haemostasis of bleeding ovarian cyst, salpingo-ophorectomy and de-torsion and drainage of the ovary in three cases. Only one patient had postoperative urinary tract infection.

For the nine cases of emergency laparotomy, three cases with large cyst size (10-20 cm) were performed in the first trimester, and 6 in the late second or third trimester (17-

Table 4. Cyst types by ultrasonographic appearance

Type	No. of cysts (n=54)
Benign	
Simple	
Corpus luteum	7
Serous cystadenoma	5
Mucinous cystadenoma	4
Struma ovarii	2
Fimbrial cyst	1
Teratoma	
Mature cystic teratoma	22
Endometrioma	2
Mucinous cystadenoma	1
Endometrioma	
Endometrioma	2
Serous cystadenoma	1
Mucinous cystadenoma	1
Suspicious	
Endometrioma	2
Serous adenocarcinoma	1
Dysgerminoma	1
Fibrothecoma	1
Serous cystadenoma	1

Table 5. Operative and postoperative details of elective and emergency operations*

	Elective laparoscopy (n=28)	Elective laparotomy (n=1)	Emergency laparoscopy (n=13)	Emergency laparotomy (n=9)
Operating time (mins)	90.25 (33-166)	60	69.8 (20-170)	68.8 (30-175)
Blood loss (ml)	50 (5-200)	50	19.2 (0-50)	60 (5-400)
Intra-operative complications	0	0	0	0
Postoperative complications	0	0	1 Urinary tract infection	1 Fever, 1 wound gaping
Hospital stay (days)	3.7 (2-7)	13	3.6 (2-6)	5.6 (4-6)
Tocolysis in peri-operative period	0	0	0	Tocolysis in 3 third trimester case
Conversion to laparotomy	0	-	0	-

* Data are shown as mean (range), unless otherwise specified

32 weeks). Salpingo-ophorectomy was performed in five cases and ovarian cystectomy in four (Table 5). One patient developed fever postoperatively and another had a gaping wound. Tocolytics were given in three cases with surgery in the third trimester; one received Adalat prophylactically for 3 days, and the other two developed preterm labour and received nifedipine and atosiban.

Pregnancy and neonatal outcomes were reviewed. For patients with elective surgery, no information was available in four patients who returned to their referring obstetrician for subsequent care. Two patients had termination of pregnancy at the same operation: one at 10 weeks of gestation because of maternal anxiety and another at 20 weeks of gestation because of intrauterine growth restriction secondary to chronic hypertension with superimposed severe pre-eclampsia. In the remaining 23 patients, two developed gestational diabetes and one placenta praevia type 1. All delivered a live fetus at term with a mean gestational age of 39.0 (range, 37-41) weeks. Four patients delivered by Caesarean section, two by vacuum extraction, and 17 were a normal vaginal delivery. The mean birth weight was 3161 (range, 2310-4080) g. Only one baby developed neonatal jaundice. No other neonatal complications were reported.

For patients with emergency surgery, one underwent termination of pregnancy (because of dysgerminoma) and three returned to their referring obstetrician so no information was available. One patient had severe pre-eclampsia and one had oligohydramnios. All patients delivered at term, except for the patient with severe pre-eclampsia who delivered at 30 weeks of gestation. The mean gestation at delivery was 38.7 (range, 30-41) weeks. Among the 22 patients, 10 had a normal vaginal delivery, three required vacuum extraction, and five required Caesarean section. The mean birth weight was 2627 (range, 1425-3515) g. No neonatal complications were reported.

Surgery at first or second trimester was comparable in terms of length of hospital stay, blood loss, operating time, gestational age at time of delivery, and birth weight (Table 6).

The most common histological diagnosis that caused complications in the first trimester was corpus luteal cyst (6/15, 40%), and in the second trimester was mature cystic teratoma (3/7, 42.9%). The most common ovarian cyst complication was torsion (20/22, 90.9%). Preoperative clinical diagnosis of ovarian torsion was made in 16 patients. The type of ovarian cyst complication remained unspecified in four. The remaining two patients were diagnosed with ovarian cyst rupture (both were confirmed intra-operatively). Most complications occurred between 7 and 13 weeks of gestation (72.7%) and when the cyst size was $\geq$6 cm (81.8%). All patients with acute complication presented with pain and 40.9% presented with nausea or vomiting (Figure).

Discussion

Detection of ovarian mass during pregnancy has increased with the routine use of ultrasonography. In a local study, ovarian cysts are found in 6% of pregnancies with routine ultrasound scaning performed before 16 weeks of gestation[4]. Most ovarian masses detected during pregnancy are benign, and up to 70% resolve spontaneously, with only a few developing complications[1]. Most obstetricians now adopt a more conservative approach when managing this condition. The advance of laparoscopic techniques enable laparoscopic surgery for most cases.

Whether to proceed to operative management

Table 6. Comparison of operative, pregnancy, and neonatal outcomes in the first and second trimester*

	First trimester	Second trimester	p Value
Route of operation (laparoscopy)	16/20	25/28	0.429
Emergency case	15/20	4/28	0.001
Length of stay (days)	4.25 ± 2.27	3.71 ± 1.27	0.348
Blood loss (ml)	30 ± 29.33	43.49 ± 60.65	0.316
Operation time (mins)	77.25 ± 44.65	81.25 ± 35.03	0.73
Need of tocolysis	0	0	-
Birth weight (g)	3182.14 ± 407.42	3142.33 ± 397.15	0.775
Gestation at delivery (weeks)	37.125 ± 7.35	38.435 ± 4.21	0.484

* Data are shown as No. of subjects or mean ± standard deviation, unless otherwise specified
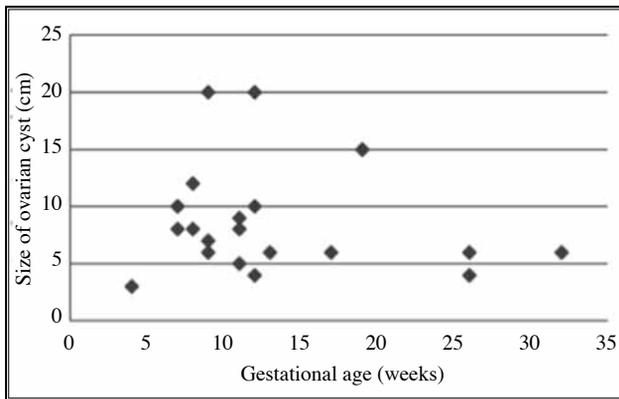
Figure. Scatter plot of ovarian cyst diameter and gestational age of ovarian cyst complication (n=22)

depends on accurate diagnosis of the nature of the ovarian cyst. Ultrasonography is recommended as the first-line diagnostic tool to differentiate a benign from malignant lesion[5]. During pregnancy, diagnosis by ultrasonography can be technically difficult, especially in the third trimester. In our series, ultrasonography was utilised to classify the ovarian cyst as benign or suspicious before surgery. All cysts classified as benign were subsequently confirmed to be benign after removal. Among the six cysts that were classified as suspicious, one high-grade serous adenocarcinoma and one dysgerminoma were subsequently confirmed, whereas the remaining four were benign lesions. Our data support the usefulness of ultrasound in differentiating a benign from a malignant cyst during pregnancy. Colour Doppler findings may change during pregnancy and thus are not consistently reported in the literature[6]. Magnetic resonance imaging has been used for diagnosis of ovarian malignancy with high accuracy[7] and has been shown to be safe in the second and third trimester with avoidance of radiation exposure. During pregnancy, gadolinium-based contrast material should be avoided because of concerns about fetal safety. Magnetic resonance imaging may play a role in cases where diagnosis is in doubt to improve the diagnostic accuracy and to provide information on the extent of disease in highly suspicious cases of ovarian malignancy. Tumour markers such as CA125 or HCG are not useful as they are known to rise during pregnancy[8].

The difficulties in performing laparoscopic surgery in pregnancy include the potential risk of injuring or irritating the gravid uterus and decreased visibility of the lateral and retro-uterine surgical field due to the enlarged uterus. To avoid injury to the gravid uterus, the open Hasson technique is preferred to the Veress needle[9], as pneumoamnion with pregnancy loss has been reported due to inadvertent injury at the time of Veress needle entry[10]. Umbilical entry is considered safe in the first trimester, whereas in later pregnancy a supraumbilical entry at least 6 cm above the fundus or entry at the left upper quadrant is recommended[9]. Performing the operation in the first trimester with a smaller uterine size may potentially reduce the chance of uterine injury or irritation and allow easier operation. Previous studies have shown that up to 1/3 of all surgeries performed in the first trimester end in spontaneous miscarriage[11]. In contrast, our results showed that surgery performed in the first trimester did not result in intra-operative or pregnancy complications. This could be explained by the advancement in current anaesthetic and surgical techniques, and utilisation of laparoscopy instead of laparotomy. Nonetheless, most cysts detected in the first trimester are corpus luteum that will disappear by the end of the first trimester[1] and that elective laparoscopic ovarian surgery in the second trimester is safe with minimal complications[12]. Therefore, delaying the decision for elective surgery to the second trimester can avoid unnecessary operation.

Our findings are consistent with the existing literature that the most frequent complication of ovarian mass in pregnancy is torsion[13,14]. Adnexal masses of 6 to 8 cm are at significantly higher risk of torsion, compared with other sizes[15]. Of 49 presumed dermoid cysts detected during pregnancy, no complications developed in teratoma <6 cm[16]. In our series, most complications occurred in cysts ≥6 cm. Therefore, elective surgery during pregnancy should be considered for adnexal masses ≥6 cm.

Accurate diagnosis of complications based on ultrasonography and clinical features is important in order to avoid unnecessary surgery during pregnancy. One needs to be vigilant when a patient presents with pain and a history of known ovarian cyst, as only 40% of patients who develop torsion of ovarian cyst have classic symptoms of nausea and vomiting in addition to pain. Ultrasonographic features of ovarian torsion are highly variable and include ovarian enlargement and oedema, and features suggestive of haemorrhage and necrosis such as a solid mass with mixed echoes, and occasionally a twisted pedicle that may appear as a whirlpool, visible with both grey scale and colour Doppler[17]. Our findings showed that accurate diagnosis of ovarian cyst complications can be achieved clinically based on symptoms, physical examination and ultrasound scanning with all clinically suspected ovarian cyst complications confirmed during laparoscopy or laparotomy.

The major drawback of our series is that it was a retrospective study with a small sample size. Furthermore, pregnancy outcome and neonatal outcome was not available for all patients. Due to the rarity of ovarian cyst complications during pregnancy and the preferred conservative approach, large scale randomized controlled trials on surgical management is deemed very difficult. Nevertheless, our study showed that ovarian cyst surgery during pregnancy is safe. Our study reviewed only patients who underwent surgery, not those who was managed conservatively. Surgery is not without risk; it is important to predict the chance of ovarian cyst complications during pregnancy and in the immediate postpartum period in order to select patients for elective surgery.

Conclusion

Elective surgery for ovarian cyst in the late first and second trimester can be achieved safely with laparoscopy. Ovarian cysts of >6 cm are at risk of complications and thus warrant elective surgery. Accurate diagnosis of ovarian cyst complications during pregnancy can be made clinically based on symptoms and ultrasonographic findings.

Declaration

The authors have declared no conflicts of interest in this study.

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