Available online at www.sciencedirect.com

SciVerse ScienceDirect

Taiwanese Journal of Obstetrics & Gynecology 50 (2011) 458–462

www.tjog-online.com

Original Article

Surgical intervention for maternal ovarian torsion in pregnancy

Shuenn-Dhy Chang [a,b], Chih-Feng Yen [a,b], Liang-Ming Lo [a,b], Chyi-Long Lee [a,b], Ching-Chung Liang [a,b,*]

[a] *Department of Obstetrics and Gynecology, Chang Gung Memorial Hospital at Linkou, Linkou, Taiwan*
[b] *Department of Obstetrics and Gynecology, Chang Gung University College of Medicine, Taoyuan, Taiwan*

Accepted 5 October 2011

Abstract

Objective: Maternal ovarian torsion in pregnancy is a rare complication. This study was conducted to review the clinical manifestations, and to compare the outcome between laparoscopy and laparotomy in women undergoing surgery for ovarian torsion (OT) during pregnancy.
Materials and Methods: Using the International Classification of Disease, Ninth Revision, and Clinical Modification, we reviewed the clinical records of patients with OT during pregnancy between 1997 and 2008 at a university hospital.
Results: Twenty pregnant women were identified with surgically proven OT, 10 in the first trimester, eight in the second, and two in the third. Thirteen (65%) cases were suspected before operation to be adnexal torsion. The most common symptom and sign were pelvic pain (95%) and an adnexal or pelvic mass (95%), followed by nausea and vomiting (65%), elevated white blood cell count $>12 \times 10^9$/L (45%), and fever (10%). Most patients in the first trimester (75%) and a minority in the second and third trimesters (37.5%) received management via laparoscopy. Patients undergoing laparoscopy treatment had smaller ovarian masses and a shorter postoperative hospital stay than those receiving laparotomy. None of these patients had significant complications during or after surgery. However, the outcomes of pregnancy varied: 12 (60%) term deliveries, three (15%) preterm deliveries at over 31 gestational weeks, one missed abortion and four elective abortions in the first trimester.
Conclusion: The diagnosis of OT during pregnancy is often missed due to nonspecific clinical features and uncommon objective findings. Detorsion only or detorsion plus ancillary procedures via laparoscopy is recommended to treat pregnant women suffering from OT, owing to the advantages of a shorter hospital stay and favorable surgical and pregnancy outcomes.

Keywords: Adnexa; Emergency; Laparoscopy; Ovary; Torsion

Introduction

Torsion of the adnexa accounted for 2.7% of all surgical emergencies in one series of acute gynecologic complaints [1]. However, maternal ovarian torsion (OT) during pregnancy is a rare event, with a reported incidence of 1–10 per 10,000 spontaneous pregnancies [2]. Because OT in pregnancy more commonly occurs in the first half of gestation, early diagnosis and treatment is very important to salvage the adnexa in women desiring to continue their pregnancy and preserve ovarian future function. The correct diagnosis of maternal OT in pregnancy may be delayed due to nonspecific clinical features and difficulties encountered in performing a physical examination, particularly in the second half of pregnancy. Most of the clinical data on OT in pregnancy have been presented in some small series and several case reports [1–14], whose pregnancy outcome was always not clearly identified. Hence, the aims of this study were to describe clinical symptom presentations, objective findings, and surgical and pregnancy outcomes of maternal OT in pregnancy over a 12-year period at our institute, and to compare the surgical results of laparoscopy and laparotomy.

* Corresponding author. Department of Obstetrics and Gynecology, Chang Gung Memorial Hospital, Linkou Medical Center, 5 Fu-Shin Street, Kweishan, Taoyuan 333, Taiwan.
E-mail address: ccjoliang@cgmh.org.tw (C.-C. Liang).

1028-4559/$ - see front matter
doi:10.1016/j.tjog.2011.10.010

Materials and methods

A retrospective study was undertaken of a consecutive series of OT in pregnancy presenting at our institute, a tertiary hospital. Medical records from 1997 to 2008 that contained adnexal torsion in pregnancy were extracted. Furthermore, patients were picked out by applying the International Classification of Disease, Ninth Revision, and Clinical Modification (ICD-9-CM; codes 654.4 and 620.5). If OT in pregnancy was confirmed by chart documentation, data regarding demographic information, symptoms and signs, surgical outcome and pathological findings were collected. In addition, data from imaging studies and tocolysis records were also reviewed. Patients with a diagnosis of OT in pregnancy who did not have surgical confirmation of OT were not included in this study. Imaging studies included gynecological ultrasound performed by on-duty gynecologists. Color Doppler flow for an adnexal lesion was evaluated at the level of the ovary and tube through the vaginal route using the Acuson Sequoia 512 ultrasound system (Acuson, Mountain View, CA, USA; vaginal transducer 4-9 MHz).

Prophylactic tocolysis was not routinely given but was administered if the patient experienced uterine contraction after surgery. The tocolytic protocol included oral or intramuscular administration of progesterone in the first trimester, and oral or intravenous administration of ritodrine in the second and third trimesters. The gestational trimesters were classified as follows: (1) first trimester, before 12 weeks; (2) second trimester, 13–27 weeks; and (3) third trimester, 28 weeks and above.

Finally, we compared the various clinical manifestations, intra- and postoperative complications, and length of hospital stay between patients undergoing laparoscopy and those receiving laparotomy. The ethics committee of our university hospital approved the study protocol (No. 96-0556B). For analyses of factors associated with OT in pregnancy and the choice of operating methods, discriminant analysis was used. A p value <0.05 was considered statistically significant.

Results

A total of 20 pregnant women were identified with surgically proven OT: 10 in the first trimester, eight in the second, and two in the third. Two (10%) pregnancies were achieved by ovulation induction, and one (5%) was complicated by ovarian hyperstimulation. The mean age of the patients was 29.4 ± 5.1 years (range 22–40 years), with a mean parity of 0.5 ± 0.8 (range 0–3), and a mean body mass index of 21.1 ± 2.6 kg/m^2 (range 17.5–28.5 kg/m^2). The mean duration of lower abdominal pain until operation was 11.7 ± 40.1 days (range 0.4–180 days). Five patients (25%) had had prior pelvic surgery, including two who had undergone cesarean section, two ovarian cystectomy, and one surgery for an ectopic pregnancy.

Table 1 shows that the most common symptom and sign were pelvic pain (95%) and an adnexal mass (95%), followed by nausea and vomiting (65%), elevated white blood cell count $>12 \times 10^9$/L (45%), and fever (10%). The characteristics of the pain were variable: its onset was sudden in 12 (60%) women, almost all patients complained of lower abdominal pain, but peritoneal signs were encountered in only seven (35%). In all patients except one, an adnexal or pelvic mass could be detected on gynecological ultrasound; the mean size of the ovarian cystic mass at surgery was 7.9 cm (range 4–20 cm, median 6.6 cm). Doppler flow studies were carried out in two cases, both showing normal adnexal vascular flow.

Table 1
Clinical manifestations and surgical results associated with ovarian torsion in pregnancy.[a]

Adnexal mass	19	95
Pelvic pain	19	95
Sudden onset	13	65
Not sudden onset	7	35
Nausea and vomiting	13	65
WBC count $>12 \times 10^9$/L	9	45
Peritoneal sign	7	35
Fever	2	10
Operative methods		
Laparoscopy	12	60
Laparotomy	8	40
Mass size (cm)[b]	7.9±3.6	4–20
Operative time (min)	90.7±40.9	40–200
Blood loss (mL)	56.5±44.3	10–200
Hospital stay (d)	4.8±5.5	1–27

[a] Data are presented as n (%) or mean ± standard deviation, range.
[b] Median of mass size = 6.6 cm.

Twelve patients (60%) underwent laparoscopy and eight patients (40%) laparotomy. Most of the women in the first trimester (9/12, 75%), but only a minority in the second and third trimesters (3/8, 37.5%), received laparoscopy. The operative procedures were as follows: detorsion followed by cystectomy in 16 patients (80%), oophorectomy in two (10%) with masses larger than 12 cm, and simple detorsion in two (10%). Patients were more commonly diagnosed with a lesion on the right side (60%), and more patients (70%) presented themselves at the emergency department and underwent laparoscopy (60%). Thirteen (65%) cases were suspected to be adnexal torsion before operation; other preoperative diagnoses were appendicitis in three and ovarian cyst in four women. Ten patients (50%) had surgery within 24 hours, and 17 patients (85%) received surgery within 72 hours.

Table 2 demonstrates that the patients who underwent laparoscopy had a significantly smaller ovarian mass and a shorter hospital stay than those undergoing laparotomy. No patient suffered significant complications during surgery. In terms of pregnancy outcome, there were 12 (60%) term deliveries, three (15%) preterm deliveries at 31, 32, and 34 gestational weeks, respectively, one (5%) missed abortion, and four (20%) elective abortions in the first trimester, with patients citing fear of surgical and anesthetic risk inflicted on the fetus. There was no significant difference in pregnancy results between laparoscopy and laparotomy. Four women (4/15, 27%) delivered by cesarean section for common obstetric indications, and 11 women (11/15, 73%) underwent vaginal deliveries. Table 3 shows that teratoma, corpus luteum cyst, and follicular cyst were the three most common masses.

Table 2
Laparoscopy versus laparotomy on ovarian torsion in pregnant women.[a]

	Laparoscopy ($n = 12$)	Laparotomy ($n = 8$)	p
Age (y)	29.1 ± 4.8	29.8 ± 5.8	0.552
Parity	0.5 ± 0.7	0.5 ± 1.1	0.473
Body mass index (kg/m^2)	20.7 ± 3.1	21.8 ± 1.9	0.167
Mass size (cm)	7.0 ± 2.3	8.7 ± 5.1	0.001
Operative time (min)	87.9 ± 39.9	94.8 ± 44.6	0.568
Blood loss (mL)	58.8 ± 32.1	53.8 ± 60.9	0.251
Hospital stay (d)	2.9 ± 1.1	7.6 ± 7.9	< 0.001
Baby delivered alive	7 (58.3%)	5 (62.5%)	0.667
Pregnancy outcome			
Live term baby	7 (58.3%)	5 (62.5%)	0.667
Live preterm baby	2 (16.7%)	1 (12.5%)	0.579
Cesarean section	2 (16.7%)	2 (25%)	0.443
Vaginal delivery	7 (58.3%)	4 (50%)	0.599
Abortion	3 (25%)[b]	2 (25%)	1

[a] Data are presented as n (%) or mean ± SD.
[b] One case of missed abortion.

Discussion

In our series, 50% of cases of maternal OT occurred in first trimester and only 10% in the second half of pregnancy. Our findings were in accordance with other reports in showing that OT mainly occurs during the first trimester of pregnancy [1–5]. We observed that the common symptoms and signs of maternal OT in pregnancy include a sudden onset of lower abdominal pain with nausea/vomiting, an adnexal mass, and an increased white blood cell count. However, the diagnosis of maternal OT was missed in 35% ($n = 7$) of our patients because of nonspecific clinical features and uncommon objective findings. Previous studies have also addressed similar problems with diagnosis [1,4]; the reported rates of incorrect preoperative diagnosis of OT in pregnancy have range from 15% to 30%. Our erroneous preoperative diagnoses were ovarian cyst and appendicitis. Other preoperative diagnoses in previous reports included ovarian hyperstimulation, round ligament pain, preterm contractions, and pyelonephritis [4].

Some investigators have suggested that the correct diagnosis of maternal OT might be delayed in the second half of gestation because the increased dimensions of the uterus cause difficulties in abdominal palpation and inefficient sonographic examination [3]. However, our results and those of previous studies demonstrate that maternal OT usually occurs in the first trimester [1,3], allowing clinicians to carry out a satisfactory physical and ultrasound examination. Keeping a high index of suspicion of ovarian mass torsion in pregnant women with a relevant clinical presentation is the clinician's best tool in diagnosing this condition [3].

Table 3
Pathological findings of ovarian torsion in pregnant women.

	Pathological finding ($n = 18$)[a]	Percentage (%)
Teratoma	6	30
Corpus luteum cyst	4	20
Follicular cyst	3	15
Serous cystadenoma	2	15
Endometrioma	2	10
Mucinous cystadenoma	1	5

[a] Two cases undergoing detorsion were without pathological results.

The probable explanation for the tendency of most cases of maternal OT to occur in the first half of pregnancy is related to a higher incidence of functional cysts in the first trimester [4], which increases the risk of OT in these women. Our data provided evidence for this hypothesis, with 35% ($n = 7$) of patients having a functional cyst identified in the first trimester. Bider et al. [4] reported that 17 (85%) of 20 pregnant women who experienced adnexal torsion during pregnancy had functional cysts: 11 follicular and six corpus luteum cysts. Another common ovarian mass in our patients was a teratoma, agreeing with what has been previously reported on adnexal torsion [15]: a review article summarizing the findings from several published reports reported that corpus luteum cysts and benign cystic teratomas contributed to two-thirds of adnexal torsion during pregnancy [16].

Some studies have reported that assisted reproductive technologies are a major risk factor for maternal OT in pregnancy [2–4,6]. After ovarian stimulation, the incidence of OT in pregnancy rises to 6%, reaching up to 16% in cases of ovarian hyperstimulation syndrome [6,17]. Three retrospective case-control studies demonstrated that 48–73% of maternal OT in pregnancies achieved by ovulation induction or *in vitro* fertilization were complicated by ovarian hyperstimulation [2–4]. By contrast, our results showed that only two patients (10%) had received ovulation induction, and one of them was complicated by ovarian hyperstimulation (5%).

In our study, right-side ovarian torsion happened more frequently than left-sided torsion, a finding that has been noted in other reports [3,4,18]. This may be because surgeons are more likely to perform surgical exploration on right-sided abdominal pain to rule out acute appendicitis [19]. Another possible explanation is that the sigmoid colon helps prevent torsion of the left-sided adnexa [20].

Ultrasound scanning is usually the first imaging tool used in evaluating pelvic pain during pregnancy. In our series, the adnexal mass could be identified by ultrasound in almost all patients (95%). An enlarged ovary (>5 cm) was found in 95% of our patients at surgery. Our data indicated that ovarian cysts smaller than 5 cm rarely caused OT during pregnancy, in agreement with other reports on adnexal torsion during pregnancy [21]. In a cohort study from Taiwan, Yen et al followed 174 patients with an adnexal mass through pregnancy, 15% of whom went on to develop torsion of tumor [21]. In their study, adnexal masses between 6 cm and 8 cm in size were associated with a significantly higher risk of torsion than masses of other sizes. In line with this, the median size of adnexal masses in our data was 6.6 cm.

Doppler flow imaging with morphological assessment has been shown to improve the accuracy of diagnosing OT outside pregnancy [22], while during pregnancy this imaging technique had higher false-negative rates: Smorgick et al [3] found normal Doppler blood flow findings in 60% of cases of adnexal torsion preoperatively. Using Doppler flow examination,

Hasson et al [2] evaluated 18 pregnant women with OT and found that 11 (61%) patients presented with normal blood flow before the operation. Our study, too, missed the two cases with OT that were aided by Doppler flow imaging.

Some surgeons have been reluctant to untwist the pedicle for fear of releasing an embolus from a thrombotic vessel. In 1989, Bider et al [13] were the first to untwist adnexal torsion in six pregnant women, with no complications arising. More recently, adnexa-sparing procedures have been suggested by several investigators for pregnant women with OT [24]. Smorgick et al [3] performed detorsion in all their cases in their series of 33 pregnant women with OT, followed by cystectomy in four cases, and oophorectomy in one case with a 10 cm cystic teratoma. Of 20 patients who had OT in pregnancy in Bider et al.'s series [4], 17 (85%) patients received detorsion, followed by biopsy, aspiration, and cystectomy in nine (45%) patients. In Hasson et al.'s study [2], all 49 women received detorsion, 27 of them also undergoing an additional procedure(s). In our series of 20 patients, 16 (80%) underwent detorsion followed by cystectomy, two (10%) were treated by simply unwinding the torsion, and two (10%) with larger masses received oophorectomy.

Regarding the relationship of surgical methods with pregnancy outcome, published data are limited at present. In our study, 15 women (75%) delivered live babies: 12 term deliveries, and three preterm deliveries after 31 gestational weeks. In a review article, Jackson et al [23] pointed out that tocolytics should not be used prophylactically in the laparoscopic treatment of surgical diseases during pregnancy, but should be considered perioperatively when signs of preterm labor are present [23]. The specific agent and indications for the use of tocolytics should be individualized. Similar good pregnancy outcomes have also been revealed in other studies [2–4]: Bider et al [4] reported that 11 of 18 (61%) patients delivered at term and one delivered prematurely at 26 gestational weeks; similarly, 83% of 36 pregnant women in Hasson et al.'s study [2] delivered healthy babies at term, and 8% had preterm delivery. Pregnancy outcome in Smorgick et al.'s study [3] of 23 pregnancies was also favorable, with 16 (70%) term deliveries and six (26%) preterm births.

In our series, 60% of patients undergoing laparoscopy had a smaller ovarian mass and a shorter hospital stay. Laparoscopy did not have an adverse impact on maternal and fetal outcomes. Previous studies have shown favorable surgical and pregnancy outcomes when treating OT in pregnancy by laparoscopy [2–4]. Our study indicated no intraoperative complications, and only one woman experienced a missed abortion after laparoscopy. We are unable to identify from the laparoscopy procedure any factor contributing to this missed abortion. However, because carbon dioxide exchange occurs with intraperitoneal insufflation, there has been concern over the effects of acidosis on the fetus [23]. Some animal studies have confirmed fetal acidosis with associated tachycardia, hypertension, and hypercapnia during carbon dioxide pneumoperitoneum [24, 25]. Until now, however, there has been no evidence to support long-term detrimental effects resulting from carbon dioxide pneumoperitoneum in humans [26]. According to published results, carbon dioxide insufflations of 10–15 mmHg can be safely used for laparoscopy in pregnant women [23].

The limitations of our study included the facts that the data were collected retrospectively and that the number of cases was small. It is, however, difficult to accumulate enough cases to conduct a larger, prospective study since maternal OT is rare in pregnant women.

In conclusion, most maternal OT occurred during the first trimester. The diagnosis of OT in pregnancy is often missed due to nonspecific clinical features and uncommon objective findings. Detorsion alone or detorsion plus ancillary procedures carried out via laparoscopy is recommended to treat pregnant women suffering from OT, owing to the advantages of a shorter hospital stay and favorable surgical and pregnancy outcomes.

References

[1] Hibbard LT. Adnexal torsion. Am J Obstet Gynecol 1985;152:456–61.
[2] Hasson J, Tsafrir Z, Azem F, Bar-On S, Almog B, Mashiach R, et al. Comparison of adnexal torsion between pregnant and nonpregnant women. Am J Obstet Gynecol 2010;202:536.e1–6.
[3] Smorgick N, Pansky M, Feingold M, Herman A, Halperin R, Maymon R. The clinical characteristics and sonographic findings of maternal ovarian torsion in pregnancy. Fertil Steril 2009;92:1983–7.
[4] Bider D, Mashiach S, Dulitzky M, Kokia E, Kipitz S, Ben-Rafael Z. Clinical, surgical and pathologic findings of adnexal torsion in pregnant and non-pregnant women. Surg Gynecol Obstet 1991;173:363–6.
[5] Rackow B, Patrizio P. Successful pregnancy complicated by early and late adnexal torsion after in vitro fertilization. Fertil Steril 2007;87:697e9–697e12.
[6] Mashiach S, Bider D, Moran O, Goldenberg M, Ben-Rafael Z. Adnexal torsion of hyperstimulated ovaries in pregnancies after gonadotropin therapy. Fertil Steril 1990;53:76–80.
[7] Shalev E, Rahav D, Romano S. Laparoscopic relief of adnexal torsion in early pregnancy. Case reports. Br J Obstet Gynecol 1990;97:853–4.
[8] Pansky M, Feingold M, Maymon R, Ben Ami I, Halperin R, Smorgick N. Maternal adnexal torsion in pregnancy is associated with significant risk of recurrence. J Minim Invasive Gynecol 2009;16:551–3.
[9] Yen ML, Chen CA, Huang SC, Hsieh CY. Laparoscopic cystectomy of a twisted, benign, ovarian teratoma in the first trimester of pregnancy. J Formos Med Assoc 2000;99:345–7.
[10] Tan KH, Chen KC, Wang TL, Chong CF, Chen CC. Ovarian cystic teratoma torsion in pregnancy. Emerg Med J 2010;27:879–80.
[11] Morice P, Louis-Sylvestre C, Chapron C, Dubuisson JB. Laparoscopy for adnexal torsion in pregnant women. J Reprod Med 1997;42:435–9.
[12] Haenggi D, Uehlinger U, Heinzl S. Adnexal torsion during pregnancy – management and literature overview. Gynakol Geburtshilfliche Rundsch 2003;43:39–42.
[13] Bider D, Ben-Rafael Z, Golderberg M, Shalev J, Mashiach S. Pregnancy outcome after unwinding of twisted ischemic-hemorrhagic adnexa. Br J Obstet Gynecol 1989;96:428–30.
[14] Smith LP, Oskowitz SP, Barrett B, Bayer SR. IVF and embryo development subsequent to ovarian torsion occurring during the resumption of meiosis. Reprod Biomed Online 2010;21:418–21.
[15] Al-Fozan H, Tulandi T. Safety and risks of laparoscopy in pregnancy. Curr Opin Obstet Gynecol 2002;14:375–9.
[16] Struyk APHB, Treffers PE. Ovarian tumors in pregnancy. Acta Obstet Gynecol Scand 1984;63:421–4.
[17] Zanetta G, Mariani E, Lissoni A, Ceruti P, Trio D, Strobelt N, et al. A prospective study of the role of ultrasound in the management of adnexal masses in pregnancy. BJOG 2003;110:578–83.
[18] Shalev E, Peleg D. Laparoscopic treatment of adnexal torsion. Surg Gynecol Obstet 1993;176:448–50.

[19] Blair CB. Torsion of the fallopian tube. Surg Gynecol Obstet 1962;114: 727–9.
[20] Vierhout ME, Wallenburg HC. Torsion of the fallopian tube: a case report of a bilateral non-simultaneous torsion and a review of the literature. Eur J Obstet Gynecol Reprod Biol 1986;23:111–5.
[21] Yen CF, Lin SL, Murk W, Wang CJ, Lee CL, Soong YK, et al. Risk analysis of torsion and malignancy for adnexal masses during pregnancy. Fertil Steril 2009;91:1895–902.
[22] Tepper R, Zalel Y, Goldberger S, Cohen I, Markow S, Beyth Y. Diagnostic value of transvaginal color Doppler flow in ovarian torsion. Eur J Obstet Gynecol Reprod Biol 1996;68:115–8.
[23] Jackson H, Granger S, Price R, Rollins M, Earle D, Richardson W, et al. Diagnosis and laparoscopic treatment of surgical diseases during pregnancy: an evidence-based review. Surg Endosc 2008;22:1917–27.
[24] Hunter JG, Swanstrom L, Thornburg K. Carbon dioxide pneumoperitoneum induces fetal acidosis in a pregnant ewe model. Surg Endosc 1995;9:272–7. discussion 277–9.
[25] Reedy MB, Galan HL, Bean-Lijewski JD, Crarnes A, Knight AB, Kuehl TJ. Maternal and fetal effects of laparoscopic insufflation in the gravid baboon. J Am Assoc Gynecol Laparosc 1995;2:399–406.
[26] Fatum M, Rojansky N. Laparoscopic surgery during pregnancy. Obstet Gynecol Surv 2001;56:50–9.