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Laparoscopic management of adnexal masses with the open entry technique in second-trimester pregnancy

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Abstract *Background and Objectives:* To describe laparoscopic management of adnexal mass during pregnancy between January 1994 and November 2003 and give an overview of existing literature on this subject (1992–2003). *Design:* Observational (descriptive) study with prospectively collected database supplemented by retrospective chart review. *Setting:* Tertiary-care referral centre. *Subjects:* Eleven consecutive pregnant patients with an adnexal mass. *Interventions:* Ten patients had laparoscopy with the open entry technique and one with the closed entry technique. *Main outcome measures:* Blood loss, operating time, number of conversions to laparotomy, complications and pregnancy outcome. *Results:* The incidence of laparoscopic management of adnexal pathology during pregnancy in our institution was 1:1,206 pregnancies (0.1%). One patient was suspected to have an ovarian malignancy, which appeared to be a large malignant tumour originating from the intestine. Ovarian malignancy was not found. In seven cases, surgery was postponed until the 16th week of gestation; however, four patients required surgery earlier in pregnancy due to suspicion of ovarian malignancy ($n=1$) or adnexal torsion ($n=3$). No entry-related or intra-operative complications occurred. Two procedures were converted to laparotomy but were not due to laparoscopic complications. One intra-uterine foetal death occurred at 24 weeks of gestation (12 weeks after adnexal detorsion). No postoperative maternal complications occurred, and nine healthy infants were born. One patient continues to have an uncomplicated pregnancy. *Conclusions:* Adnexal masses requiring surgical intervention can be explored laparoscopically.

We advise the open entry technique in order to avoid entry-related complications, e.g. to the pregnant woman's uterus and the adnexal mass.

Keywords Laparoscopy · Adnexal mass · Pregnancy · Open entry technique

Introduction

Reported incidence of adnexal masses during pregnancy ranges from 1:81 to 1 in 2,500, with an overall rate of malignancy of 2–5% [1]. Management of these masses during pregnancy presents a clinical dilemma. Abdominal surgery during gestation brings risk to both mother and foetus. However, conservative management may result in torsion, rupture of the mass, obstruction during delivery [2] or metastases in cases of malignancy [1]. Therefore, in some cases surgical intervention is necessary.

Small cysts early in pregnancy are most likely to be functional, and conservative management is preferable. However, some masses persist or even grow during pregnancy without any complaints. In order for the potential risks of a surgical emergency to be avoided, elective removal is recommended in the case of an adnexal mass larger than 6 cm that persists after 16 weeks of gestation [2, 3]. Elective removal is suggested to result in less morbidity than in an emergency setting [3]. Also, in the case of malignant features at ultrasound, surgical intervention is required [1].

It has been suggested that the laparoscopic approach can safely be performed during pregnancy [1, 4, 5]. However, one study of seven patients in a general surgical emergency setting reported a high rate of foetal death (57%) [6]. The advantages of a laparoscopic approach compared with laparotomy include lower prevalence of operating complications, less postoperative pain, quicker resumption of normal bowel function, short hospital stay and less adhesion formation [1, 7, 8]. Above all, a rapid recovery reduces surgery-related complications such as thromboembolism, the leading cause of maternal death [9,

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10]. Incisional herniation as a late complication is rarely seen [11]. On the other hand, the pneumoperitoneum may cause potential risk to the foetus. Increased abdominal pressure may lead to decreased uterine blood flow, premature contractility or premature labour [12]. Also, the effect of carbon dioxide on the foetus during laparoscopy is not well understood. However, animal studies suggest that there are no deleterious effects of the latter [13].

In contrast to general surgery [12], in gynaecology no guidelines concerning the laparoscopic approach during pregnancy are available. General surgeons' published data suggest that the open laparoscopic entry technique is preferred in pregnancy so that entry-related complications can be avoided [12]. This possibly reduces the risk of penetrating injury to the uterus by either by Veress needle or first trocar. Adnexal masses during pregnancy, which require surgery, are relatively rare, which makes randomisation for either entry technique hardly feasible. Until the results of a randomised study are published, we will continue to be confronted with the clinical dilemma of pregnant patients with adnexal masses, which makes case series valuable [14]. For this reason we describe our laparoscopic experience of adnexal masses during pregnancy, with special attention to the laparoscopic approach.

Material and methods

All pregnant women with an adnexal mass requiring surgery at the Leiden University Medical Centre (LUMC) between January 1994 and November 2003 were included in the study. If no additional malignant features (e.g. ascites or omental cake) were found at ultrasound and clinical examination, the adnexal masses were explored laparoscopically. Depending on the intra-operative findings we decided whether to proceed laparoscopically or to convert to laparotomy. Patients were preferably operated upon after 16 weeks of gestation. Figure 1 shows our pre-operative and intra-operative management technique in cases where an adnexal mass was found that required surgical intervention. Criteria for cystectomy or adnexectomy were the same as for non-pregnant women of reproductive age. Cystectomy was performed whenever possible so that ovarian tissue would be preserved.

All women had a documented intra-uterine pregnancy. All laparoscopic procedures were preferably performed with the open laparoscopic entry technique as first described by Hasson [15]. We modified this technique by introducing the Origin balloon trocar (Autosuture) with blunt tip, after the abdomen had been opened, via a 2 to 3-cm transverse incision beneath the umbilicus. Pneumoperitoneum was established under direct vision of the laparoscope. Data on patients were collected by a prospectively kept database supplemented by a retrospective chart review. Age, gestational age, gravity, parity, symptoms, size of the mass, operating time and technique, estimated blood loss, complications, use of tocolysis, histopathology, length of hospital stay and postoperative course, including pregnancy outcome, were recorded. Serum CA-125 determination was not routinely performed.

We routinely performed gastric and bladder decompression with a nasogastric tube and a Foley catheter prior to gaining access to the abdominal cavity. All laparoscopic procedures were performed under endotracheal anaesthesia. The intra-abdominal CO₂ insufflation pressure was automatically regulated and maintained at 12–14 mmHg. All masses were extracted with an Endo-bag (Storz, Tuttlingen, Germany). No cervical devices were used for manip-

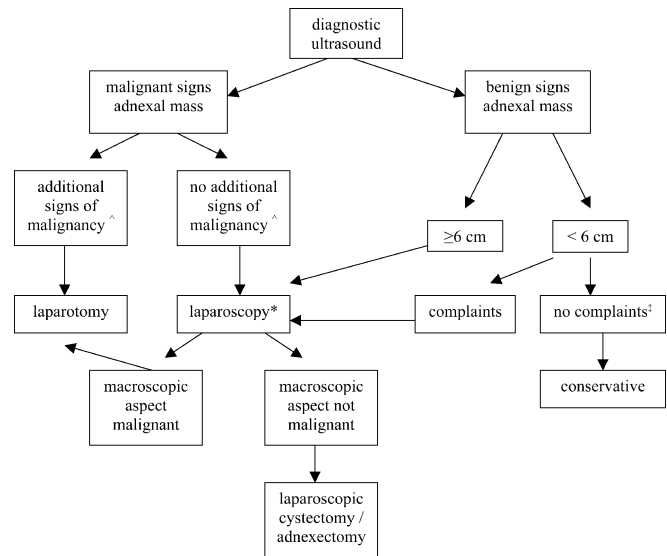


Fig. 1 Pre-operative and intra-operative management of adnexal masses during pregnancy (^ ascites, omental cake, * preferably after 16 weeks of gestation, ‡ mass <6 cm; diagnosed after at least two ultrasound examinations)

ulation of the uterus during the procedure. Postoperatively, the foetal heart tones and uterine contractility were checked. Prophylactic tocolysis was not routinely given. Recently, the protocol in our clinic has been adjusted, since the use of prophylactic tocolysis is shown to be ineffective [1, 16]. Gynaecologists experienced in laparoscopic surgery performed the procedure.

Outcome measures were: blood loss during the procedure, operating time, number of conversions to laparotomy, intra-operative and postoperative complications and pregnancy outcome.

Results

Eleven consecutive pregnant patients had a laparoscopic procedure during this period. No primary laparotomies were performed for adnexal masses in pregnancy during this time. The incidence of surgery for adnexal masses during pregnancy in our institution was 1:1,206 pregnancies (0.1%). Table 1 shows the demographic and clinical characteristics. Mean age was 29 years (range 21–37 years). In five patients the adnexal mass was found at routine ultrasound for estimation of gestational age, three patients had an ultrasound examination for vaginal blood loss, and three patients presented with an acute abdomen suspicious of a tordated adnex.

Seven patients underwent cystectomy, two patients adnexectomy, one patient unwinding of a twisted adnex combined with drainage of the cyst and one patient underwent debulking of a large gastrointestinal tumour. Two procedures were converted to laparotomy (case nos. 7 and 8). In case no. 7 the diameter of the ovarian cyst, with a macroscopic benign aspect, was too large for an Endo-bag to be used. A small laparotomy by median incision was performed so that possible spillage of cystic content could be prevented. Based on this laparoscopic finding the incision of the laparotomy was smaller than it

Table 1 Clinical features and pregnancy outcome after laparoscopic surgery for adnexal masses during pregnancy (1994–2003) (GIST gastrointestinal stroma-cell tumour)

Case no.	Age	Indication ultrasound	Gest. age diagnosis	Gest. age surgery	Size (cm)	Laparoscopic approach	Procedure	Histopathology	Postoperative stay (days)	
1	31	Blood loss	11+0	16+6	12	Open	Cystectomy	Endometriosis	2	Uncomplicated
2	26	GA	6+0	16+0	15	Open	Cystectomy	Mucinous cystadenoma	2	Uncomplicated
3	30	Blood loss	9+0	17+0	8	Open	Cystectomy	Dermoid cyst	2	Uncomplicated
4	31	Acute abdomen, IUF	12+3	12+3	4	Closed	Aspiration	Functional cyst	5	Uncomplicated
5	37	GA	13+0	16+6	8	Open	Cystectomy	Mucinous cystadenoma	2d	Uncomplicated
6	28	GA	8+0	16+0	7.5	Open	Adnexectomy	Dermoid cyst	2	Uncomplicated
7	25	GA	11+5	12+0	11	Open ^a	Adnexectomy	Functional cyst	6	Uncomplicated
8	25	GA	16+3	17+0	11	Open ^a	Debulking	GIST	22	Uncomplicated
9	31	Blood loss	10+0	16+0	8	Open	Cystectomy	Functional cyst	1	Uncomplicated
10	21	Acute abdomen	14+1	14+1	9	Open	Cystectomy	Mucinous cystadenoma	1	Uncomplicated
11	36	Acute abdomen	7+0	7+0	8	Open	Cystectomy	Serious cystadenoma	2	Pregnant

^a Converted to laparotomy

would have been in a primary laparotomy. In case 8 the pelvic mass was difficult for us to interpret at ultrasound. Ultrasonic aspects were of a benign ovarian cyst. Laparoscopy revealed normal ovaries and a large tumour originating from the intestine. The procedure was converted to a median laparotomy, and general surgeons performed a debulking of the tumour. A histopathological specimen revealed a gastrointestinal stroma-cell tumour.

Four of the 11 patients had surgery before the 16th week of gestation (case nos. 4, 7, 10 and 11). Indication in three patients was acute abdomen (case nos. 4, 10 and 11); in the fourth patient the adnexal mass was suspected of being malignant, on ultrasound (case no. 7). However, in this case no additional malignant features were seen on ultrasound. To decide where and how to place the incision of the laparotomy, we performed a diagnostic laparoscopy. Of these four patients, two had functional cysts (case nos. 4 and 7).

In one patient (case no. 9) surgery could be postponed until the 16th week of gestation, and a functional cyst was removed.

Four of 11 patients received prophylactic tocolysis. Mean blood loss during laparoscopic surgery was 100 ml (25–300 ml) and for laparotomy was 100 and 6,000 ml. In this study laparoscopic cystectomy took an average time of 76 min, laparoscopic adnexectomy lasted for 70 min. Postoperative hospital stay varied from 1 to 22 days, with a mean stay after laparoscopic surgery of 2.1 days and, for laparotomy, 6 and 22 days.

One adverse foetal outcome occurred (case no. 4). An intra-uterine foetal death (IUF) was diagnosed at 24 weeks of gestation, 12 weeks after laparoscopy in an emergency setting. Autopsy gave no explanation for the death. Nine women delivered healthy babies at term. No intra-operative complications occurred. One patient (case no. 11) has an ongoing uncomplicated pregnancy.

In Table 2 an overview of gynaecological laparoscopy (approximately 210 cases) during pregnancy is given.

Discussion

Conservative management of a symptom-free adnexal mass with a benign aspect on ultrasound examination can be justified until the 16th week of gestation for two reasons. First, it is stated that an adnexal mass before the 16th week of gestation is often a functional cyst and the incidence of these cysts after 16 weeks is minimal [1, 3]. However, in our series one patient still had a persistent functional cyst after this period (case no. 9). Second, we have to consider the direct risk of surgery to the foetus early in pregnancy. Surgery is thought to be related to an increased risk of spontaneous abortion. Although laparoscopy in the third trimester has been described by some authors, it causes technical difficulties due to the enlarged uterus (Table 2) [17, 18]. Therefore, in our opinion, if laparoscopy is necessary, the second trimester seems to be the optimum period for surgery to be performed.

In our opinion, even in cases with suspicion of a malignant adnexal mass without additional features of malignancy on ultrasound (e.g. ascites, omental cake), a primary diagnostic laparoscopy is mandatory (Fig. 1) [19]. The peritoneal cavity and pelvic mass can be inspected for macroscopic malignant features. The advantage of this sequence is that origin, location and size of the pelvic mass can be determined. If the surgeon decides to convert to laparotomy, the location and size of the incision can be adjusted to the laparoscopic findings (case no. 7) [20]. However, in this context, we have to consider that, even in experienced hands, for macroscopic qualification of an adnexal mass the false-positive findings for malignancy were as high as 53% [21]. Additional to

Table 2 Laparoscopic management of adnexal masses during pregnancy (1992–2003)

Author [reference no.]	Year	<i>n</i>	Gestational age	Complications (<i>n</i>)	Conversion
Guerrieri et al. [27]	1994	1	?	None	None
Howard and Vill [28]	1994	2	2nd trimester	None	None
Levy et al. [29]	1995	3	2nd trimester	Pre-term labour (1)	1
Parker and Childers [4]	1996	12	9–17 weeks	None	None
Tazuke et al. [30]	1996	9	2nd trimester	PROM at 31 weeks (1)	?
Neiswender and Toub [31]	1997	2	15–18 weeks	None	None
Morice et al. [32]	1997	6	6–13 weeks	Recurrence torsion (1)	None
Nezhat et al. [33]	1997	9	16 weeks	None	None
Yuen and Chang [34]	1997	16	13–15 weeks	None	None
Soriano et al. [9]	1999	39	1st trimester	Congenital malformations (2) First trimester miscarriages (5)	?
Andreoli et al. [10]	1999	7	6–27 weeks	Tocolytic agents for contractions (1) Pre-term delivery 35 weeks (1)	2
Moore and Smith [35]	1999	14	11–21 weeks	Mild peritonitis (1) IUFD 31 weeks (1)	None
Mattei [36]	1999	2	9–11 weeks	None	None
Bassil et al. [18]	1999	1	25 weeks	Premature labour 33-Week twins (1)	None None
Kim et al. [17]	2000	1	3rd trimester	None	None
Abu-Musa et al. [37]	2001	1	16 weeks	None	None
Stepp et al. [38]	2003	11	13–22 weeks	Tocolysis for contractions (2)	None
Mathevet et al. [5]	2003	47	6–33 weeks	Second trimester miscarriage (1) Tocolytic agents for contractions (3) Pre-term delivery 35–36 weeks (3) Gastroschisis (1)	2
Oelsner et al. [7]	2003	192 ^a	?	Fever (3) Asthma and vomiting (1) PPROM at 21 weeks (1) Threatened abortion 13 weeks (1) Pre-term delivery <35 weeks (5) Intra-uterine growth restriction (6) Abortions (15) Anomaly (6)	?
Present study	2003	11	7–17 weeks	IUFD 24 weeks (1)	2

^a Multicentre study, indications for surgery: adnexal mass, heterotopic pregnancy, appendicitis, cholecystitis and others

ultrasound, in case of uncertainty of the origin of the mass, pre-operative MRI can give additional information [22].

Determination of CA-125 as a predictor of ovarian malignancy is shown not to be useful in pregnancy [23], since its level is frequently elevated in normal pregnancy. CA-125 has a low specificity (69%), which leads to many false positive findings (22%) [23].

A major concern with regard to laparoscopic procedures during pregnancy is the initial insertion of the Veress needle and the first trocar. In contrast to general surgery [12], in gynaecology no official guidelines are available concerning the laparoscopic approach during pregnancy. General surgeons' published data suggest that the open laparoscopic entry technique is preferred in pregnancy so that entry-related complications may be avoided [12]. Although the closed entry technique in gynaecology should not be abandoned [24], in the case of pregnancy we advocate the use of the open entry technique. Although our series do not give enough evidence to support the abandoning of the closed entry

technique in pregnancy, we have to bear in mind that an ovarian cyst, when located in the pouch of Douglas, can lift the uterus and increase the chance of injury by the sharp instruments. In addition, the risk of penetration of the adnexal mass during the closed entry technique is possible, with the adverse effect of spillage of cystic content [25]. However, a closed entry technique can be considered when the size of the pelvic mass is less than 12 weeks of gestation. In our series no entry-related complications for either entry technique was experienced.

When feasible, if the patient is of reproductive age we recommend ovarian cystectomy, both in pregnant and non-pregnant women, to preserve ovarian tissue. Unfortunately, in case no. 6 cystectomy was not feasible, due to adhesions, and ovarian tissue could not be spared.

In this study the mean duration of laparoscopic cystectomy was 76 min and that of laparoscopic adnexectomy was 70 min. Neither procedure is more time consuming. Performing cystectomy in pregnant patients, we encountered no difficulties or excessive blood loss.

Four patients received prophylactic tocolytic agents. Nowadays, the routine use of prophylactic tocolysis is shown to be ineffective [1, 16], thus, in our clinic, tocolysis is given only to patients who are suffering from postoperative uterine irritability, in contrast to the practice by Mathevet et al. [5].

An adnexal mass during pregnancy that requires surgery is a relatively rare phenomenon and is still a dilemma for clinicians. Although reports of small series on this subject are published (approximately 210 cases) it is still important for more data and evidence to be collected in order for this problem to be treated optimally. We have to consider that, for many reasons, e.g. surgeons' experience and preferences, it is difficult for one to carry out randomised prospective studies for surgical evaluation [26].

Our algorithm in Fig. 1 shows how we support the guidelines of general surgeons in performing open laparoscopy in pregnant women in order to avoid entry-related complications to the uterus and adnexal mass.

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