

Original Article

Adnexal Masses in Pregnancy: Fetomaternal Blood Flow Indices During Laparoscopic Surgery

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ABSTRACT **Study Objective:** To assess changes in uterine and umbilical arteries during laparoscopy in human pregnancy.
Design: Case series (Canadian Task Force classification III).
Setting: University tertiary care referral center for high-risk pregnancy and minimally invasive surgery.
Patients: Nine pregnant women who underwent first- and second-trimester laparoscopic surgery because of an adnexal mass.
Intervention: Laparoscopic cyst enucleation or annessiectomy.
Measurements and Main Results: No maternal complications and no miscarriages or adverse pregnancy outcome occurred. Mean (SD) gestational age at delivery was 39.1 (0.7) weeks, birth weight was 3390 (298) g, and Apgar score at 5 minutes was 9.6 (0.5). Mean uterine resistance index, umbilical artery pulsatility index, and fetal heart rate were measured using transvaginal ultrasonography at various times during surgery. Mean uterine resistance index and umbilical artery pulsatility index values remained constant during laparoscopy. Fetal heart rate was maintained in the normal range (120–160 bpm) but progressively decreased during the surgical procedure.
Conclusion: In human pregnancy, laparoscopic techniques do not seem to modify uteroplacental perfusion evaluated using noninvasive ultrasonography. Journal of Minimally Invasive Gynecology (2012) 19, 443–447 © 2012 AAGL. All rights reserved.

Keywords: Laparoscopy; Pregnancy; Adnexal mass; Fetomaternal doppler velocimetry

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The occurrence of an adnexal mass in pregnancy has been detected more commonly with routine use of ultrasonography in prenatal care. The incidence of an adnexal mass in pregnancy varies between 2% and 10% based on study population, use of sonography, and gestational age at presentation [1]. Expectant management is the first-choice treatment of adnexal masses smaller than 6 cm in greatest diameter, based on an increased rate of spontaneous resolution [2,3]. However, surgical

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management may be indicated in the presence of a persistent adnexal mass larger than 6 cm because of the risk of malignancy (2.15%) [4] or the possibility of emergency surgery because of mass rupture or torsion, or pain [5]. When surgery is indicated, laparoscopy is currently accepted as the most efficient method to manage adnexal masses in pregnancy, taking into account specific recommendations of the SAGES (Society of American Gastrointestinal and Endoscopic Surgeons) Guidelines Committee [6,7]. Laparoscopy provides the same clinical outcomes as with open surgery [8], plus the well-documented advantages of shorter hospital stay, less postoperative ileus, earlier mobilization with an associated decreased risk of thromboembolic events, reduced postoperative pain, decreased fetal depression due to lessened postoperative narcotic requirements, lower risk of wound complications, and less need for uterine manipulation [9].

Concerns have been raised about the possibility that pneumoperitoneum during laparoscopy may compromise uterine blood flow, resulting in fetal hypoxia and acidemia. Studies in animals have demonstrated opposite results in detecting fetal acidosis associated with CO₂ insufflation, and no long-term adverse effects have been identified [10–15]. In humans, fetal acidosis and intraoperative fetal heart rate abnormality with insufflation have not yet been documented. Doppler ultrasound has been demonstrated to be a reliable non-invasive method of examining uteroplacental perfusion. Uterine artery Doppler measurement in the second trimester and earlier at 11 to 14 weeks of gestation could be a good method for identification of women at risk of pre-eclampsia and fetal growth restriction [16]. A number of clinical studies have reported the efficacy of umbilical antenatal Doppler measurement to detect fetal hypoxia and acidemia [17,18]. The present study assessed, for the first time in human pregnancy and with a non invasive method, maternal and fetal hemodynamic changes during laparoscopic treatment of adnexal masses measured using Doppler ultrasound velocimetry of the uterine and umbilical arteries.

Patients and Methods

Nine women with singleton pregnancies with an ultrasound diagnosis of an adnexal mass that required surgical treatment were recruited between 2004 and 2008. The local institutional review board approved the study protocol, and all patients provided written informed consent. Laparoscopy was performed between 11 and 15 weeks of gestation. In all cases, endotracheal general anesthesia was administered with propofol, fentanyl and vecuronium, and maintained with sevoflurane and fentanyl. Patients were placed in the left lateral recumbent position to minimize compression of the intraabdominal vessels. No instrument was applied to the cervix or inserted into the uterine cavity. Pneumoperitoneum was obtained using the open technique, maintaining intraabdominal CO₂ pressure at less than 12 mm Hg and minimizing the duration of operative time. No tocolytic drug was administered during surgery. The surgical procedure was performed according to SAGES guidelines [7]. Histologic diagnosis was performed in all cases. After surgery, the women were observed until delivery to detect any possible complications of the pregnancy. Data obtained at delivery included gestational age, birth weight, and Apgar score at 5 minutes. Normal outcome was defined as delivery at term of an appropriately grown fetus and no evidence of pregnancy complications. Fetal heart rate (FHR), mean uterine arterial resistance index, and umbilical arterial pulsatility index were evaluated via ultrasound on the day before surgery (T₀); at various times during the procedure including at the induction of anesthesia (T₁), during CO₂ insufflation (T₂), during the surgical procedure (T₃), and at CO₂ desufflation (T₄); and on the day after surgery (T₅).

Ultrasonographic measurements were performed using a 7.5-MHz transvaginal phased-array transducer (Hitachi Corp., Tokyo, Japan). After the cervix was identified, the probe was moved laterally until the paracervical vascular plexus was identified. Color Doppler ultrasound was performed to identify the uterine artery as it ascended to the uterine body. Pulsed-wave Doppler was then used to obtain uterine artery waveforms. The pulsed Doppler gate was placed over the entire width of the vessel, in the fragment before the uterine artery branched into the arcuate arteries. When 3 similar consecutive waveforms were obtained, the resistance index [(peak systolic velocity – end diastolic velocity)/peak systolic velocity] was automatically calculated by positioning the caliper on the systolic and diastolic values. The procedure was then repeated on the opposite uterine artery, and the mean resistance index of the 2 vessels was calculated. The umbilical artery Doppler waveform was obtained from a free loop of cord, and measurements were made when a clear consistent waveform was obtained in the absence of fetal movement. The pulsatility index was measured according to the simplified Gosling formula (systolic velocity – diastolic velocity/mean velocity). Concurrently, fetal cardiac frequency was calculated from 2 consecutive cardiac cycles [19].

Statistical Analysis

Data are presented as mean (SD). The paired *t* test was used when the mean values of uterine artery resistance index, umbilical artery pulsatility index, and FHR were compared at different times during the surgical procedure. A value of *p* < .05 was considered statistically significant.

Results

Mean (SD) gestational age at the time of the surgical procedure was 14 (1) weeks, and diameter of the cyst was 8.0 (2.3) cm. Histologic diagnosis in the 9 patients was mature teratoma in 5, and corpus luteum cysts, ovarian fibroma, immature teratoma, and borderline serous tumors in 1 each (Table 1).

Surgical indications were the presence of abdominal pain in 2 patients (22.2%), diagnostic suspicion of torsion in 2 (22.2%), and presence of ultrasound features suggestive of malignancy in 5 (55.6%). Enucleation of the cysts was performed in 6 cases (66.7%), and salpingo-oophorectomy in 3 (33.3%) (Table 1). No operative or postoperative maternal complications occurred.

Obstetric Outcome

No miscarriages or fetal malformations occurred, and no adverse pregnancy outcome was registered. Seven women delivered vaginally, and cesarean section was performed in the other 2 women, because of obstetric indications and for a surgical second look, respectively. Mean (SD) gestational age at delivery was 39.1 (0.7) weeks, birth weight was 3390 (298) g, and Apgar score at 5 minutes was 9.6 (0.5).

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