

MASTER CLASS

Laparoscopic Surgery During Pregnancy



BY CHARLES E. MILLER, M.D.

In a large multisurgeon survey published by the Society of Laparoendoscopic Surgeons, 1.2% of the 16,329 surgeon members

said they performed laparoscopic procedures in pregnancy. The most common of the 413 laparoscopic procedures performed in pregnancy by these 192 surgeons appeared to be cholecystectomies, adnexal procedures, and appendectomies (*J. Reprod. Med.* 1997; 42:33-8).

In an excellent review article (*Obstet.*

Gynecol. Surv. 2001;56:50-9), Dr. Mohammad Fatum and Dr. Nathan Rojansky from Hadassah Ein-Kerem Medical Center and the Hebrew University Medical School, Jerusalem, noted the following major advantages of laparoscopic surgery during pregnancy:

- ▶ Small abdominal incisions resulting in rapid postoperative recovery and early mobilization, thus minimizing the increased risk of thromboembolism associated with pregnancy.

- ▶ Early return of gastrointestinal activity because of less manipulation of the bowel during surgery, which may result in fewer postoperative adhesions and intestinal obstruction.

- ▶ Smaller scars.

- ▶ Fewer incisional hernias.

- ▶ A reduced rate of fetal depression because of decreased pain and less narcotic use.

- ▶ Shorter hospitalization time and a prompt return to regular life.

I am pleased that Dr. Joseph S. Sanfilippo agreed to author this edition of the Master Class in Gynecologic Surgery on laparoscopic surgery during pregnancy.

A 1973 Chicago Medical School graduate, Dr. Sanfilippo was honored with a Distinguished Alumnus Award in 1990. He completed his fellowship in reproductive endocrinology and infertility at the University of Louisville (Ky.) School of Medicine and later gained his MBA degree at Chatham College in Pittsburgh.

Currently, Dr. Sanfilippo is professor of obstetrics, gynecology, and reproductive

sciences; vice chairman of reproductive sciences; and director of reproductive endocrinology and infertility at Magee-Womens Hospital, Pittsburgh.

He has been a prolific researcher and author, particularly in the areas of surgery, reproductive medicine, and adolescent gynecology.

He also is considered an expert in laparoscopic surgery in pregnancy and has contributed to literature in this area as well. ■

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Potential Pitfalls in Pregnant Patients

Operative laparoscopy during pregnancy has been part of the growing field of minimally invasive surgery for more than 2 decades. As efforts during the 1980s to develop laparoscopic techniques unfolded, pregnant women were on the radar screen; one of the first textbooks of minimally invasive surgery, published in the 1980s, for instance, featured a chapter on laparoscopy in pregnancy.

A report on more than 150 patients undergoing laparoscopic appendectomy, including 6 pregnant patients, was published in 1990 (*Surg. Endosc.* 1990;4:100-2). The first laparoscopic cholecystectomy during pregnancy was reported in 1991 (*Obstet. Gynecol.* 1991;78[pt. 2]:958-9).

Through the 1990s, as technology improved and laparoscopy assumed a prominent place in gynecologic practice, and as general surgeons acquired more skill in laparoscopy, it became increasingly apparent that pregnant patients with appendicitis, cholecystitis, and other complications—both nonobstetric problems and problems of a more obstetric and gynecologic nature—were among the patients for whom laparoscopic surgery is often the treatment of choice.

Experience with the laparoscopic approach in pregnant patients increased, and anesthesiologists, surgeons, and obstetricians learned more about the effects of excessive intraabdominal pressure, other anesthesia-related problems, and the importance of prophylaxis for deep vein thromboses, among other issues.

Today, we can tell pregnant patients that laparoscopic surgery is a safe option. Data have shown that the second trimester is generally the safest time to intervene, and that most complications—when they do occur—seem to be related to the underlying disorder rather than the surgery per se. Overall, the complication rate for laparoscopic surgery during pregnancy is similar to that in the nonpregnant state.

It is important that we are aware of and knowledgeable about the unique presentation of certain problems during pregnancy, such as acute appendicitis and cholecystitis, and that we are ready to call upon a general surgeon with advanced minimally invasive skills.

Problems Requiring Surgery

Up to 2% of pregnancies are complicated by a surgical problem.

By far the most common surgical condition during pregnancy is acute appendicitis; its incidence is 0.5-1

per 1,000 pregnancies. Other surgical emergencies in pregnancy include acute cholecystitis (with an incidence of 5 per 10,000 pregnancies), intestinal obstruction, persistent ovarian cysts larger than 6 cm, and ovarian torsion and other adnexal problems. (The incidence of adnexal torsion is 1 in 5,000, and the incidence of any adnexal problem complicating pregnancy is 1 per 500-600 pregnancies.)



BY JOSEPH S. SANFILIPPO, M.D., M.B.A.

With the advent of assisted reproductive technologies, the incidence of heterotopic pregnancies is increasing, and growing numbers of successful laparoscopic surgeries for these pregnancies in hemodynamically unstable patients also are being reported. The extrauterine pregnancy can be addressed via salpingostomy or salpingectomy depending on

the intraoperative findings. Minimal disturbance of the uterus and intrauterine gestation is the goal of intraoperative management.

The approach to laparoscopic surgery for these patients must take into account the physiological changes of pregnancy, including a 45% increase in plasma volume and a 10%-20% increase in cardiac volume, as well as increased oxygen consumption, decreased functional residual volume, and a theoretical predisposition to thromboembolic complications.

We must also be aware that the Trendelenburg position increases intrathoracic pressure, impairing venous return and accentuating the change in functional residual capacity. We may not, therefore, be able to achieve as steep a Trendelenburg position in pregnancy as in the nonpregnant state.

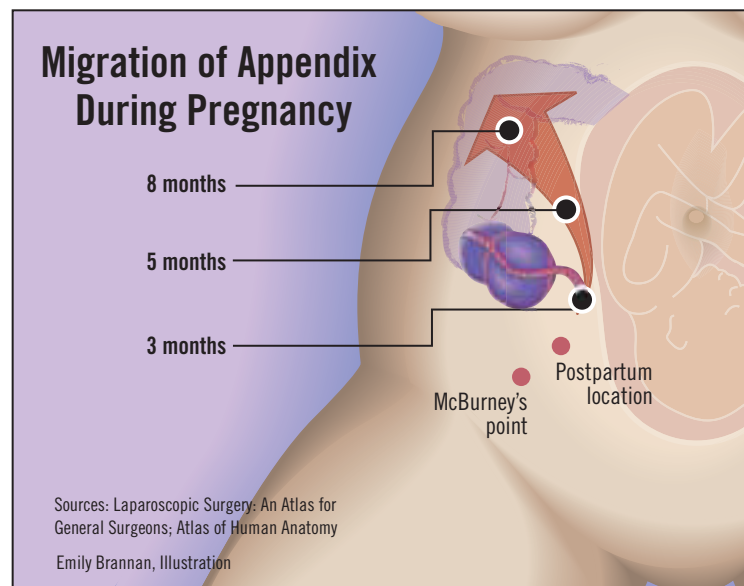
Because we are dealing with two passengers on these surgical journeys, we also must ensure that we not disturb the uteroplacental blood flow and oxygenation—that is, we must prevent fetal asphyxia and preterm labor—and that we are cognizant of the potential teratogenic effects of analgesics and other medications.

Medications and Assessment

Medications that have been recommended related to surgical intervention during pregnancy include indomethacin supplementation 25-50 mg preoperatively

and a second dose 12 hours later. Unfortunately, however, there is a paucity of prospective data to support any one specific recommendation.

Progesterone supplementation—through a vaginal supplement of 25-100 mg postop for up to 7 days—has



Sources: *Laparoscopic Surgery: An Atlas for General Surgeons*; *Atlas of Human Anatomy*
Emily Brannan, Illustration

also been advocated after the procedure. Again, there are no well-designed studies to provide a firm basis for medication support.

Data from studies in ovariectomized rats supports the subcutaneous use of 3 mg of progesterone plus 200 ng of estradiol benzoate for 10-19 days with monitoring of serum progesterone levels (*J. Reprod. Fertil.* 1990;90:63-70).

Diagnostic procedures utilizing radiation should be limited to 5-10 rad during the first 25 weeks of gestation. Beyond that dosage, chromosomal mutations and neurologic abnormalities become concerns, as does the theoretical increased risk of childhood leukemia and other hematologic cancers.

Assessment CT scans generally are an appropriate test during pregnancy because the amount of radiation is relatively low—from 2 to 4 rad for a single study. MR imaging is appropriate, of course, as it does not involve ionizing radiation. Potentially concerning is the use of a contrast agent with CT or MR imaging. Gadolinium is commonly used in pregnancy; the use of this or other contrast agents should be discussed by the obstetrician and radiologist.

The second trimester is generally the safest time to

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intervene because there is a higher incidence of preterm labor in the third trimester and spontaneous abortion during the first trimester. The incidence of miscarriage after surgery in the second trimester is 5.6%, compared with 12% in the first trimester.

Ideally, pre-, intra-, and postoperative management should be planned through multispecialty discussion involving anesthesiologists, general surgeons, and gynecologic surgeons.

Preanesthetic medications include benzodiazepines (for example, midazolam) and/or opioids (such as Fentanyl administered intravenously). Intravenous induction agents include propofol, barbiturates, ketamine, and etomidate (Arch. Gynecol. Obstet. 2007;276:201-9). Neuromuscular blocking medications include succinylcholine, vecuronium, or atracurium complemented by the administration of nitrous oxide.

Operative Management

Patient positioning during surgery is critical. The pregnant patient should be placed in the left lateral decubitus position, with her right hip elevated, to minimize interference with venous return. She must also undergo a more gradual, careful change to the Trendelenburg position than a nonpregnant patient would, and even more gradual reverse Trendelenburg positional changes.

Intraoperative monitoring should include measurement of vital signs, oxygen saturation, and end-tidal CO₂ level, and observation of uterine activity. Intraabdominal pressure generally should be in the range of 12-15 mm Hg. Ideally, lower-extremity pneumatic compression devices should be utilized.

Careful monitoring for signs of preterm labor is also important. Fetal heart rate monitoring can provide useful data, both preoperatively and postoperatively. The use of tocolytic agents is certainly indicated when there are signs of preterm labor, but there is minimal support among experts for routine prophylactic tocolysis in the second trimester. Depending on the clinical circumstance, at 24 weeks' gestation, tocolysis can be considered.

Experts have debated for years the gestational age at which the uterus limits laparoscopic access to the abdominal cavity, and there still is no consensus.

Controversy continues over the use of the open laparoscopic technique versus the use of the Veress needle traditional technique (closed), especially in the left upper quadrant. Researchers are also investigating the use of gasless laparoscopy during pregnancy.

The vast majority of gynecologic and general surgeons who perform laparoscopic surgery in pregnant patients lean toward an open laparoscopic technique, but the closed and gasless techniques are also acceptable. I favor the primary use of an open approach with the Hasson cannula. This often provides better overall control with regard to entrance into the peritoneal cavity.

Clinicians who opt to use a Veress needle are certainly focused on an acceptable alternative to introduction of CO₂ into the peritoneal cavity. The decision-making process is primarily a reflection of the gynecologic surgeon's training and level of comfort.

We should strive to avoid placing any instruments near the cervix. A sponge on a stick can provide an element of uterine manipulation in an atraumatic manner.

Secondary trocar placement must take into account the size of the uterus, with secondary trocar sleeves placed above the umbilicus and away from the uterus. Careful planning of where ports should be placed is a wise idea prior to making the skin incision. Inferior epigastric vessels should be identified to include superficial branches.

Direct visualization of trocar entrance into the abdominal cavity is of paramount importance and should be documented in the record accordingly.

Prompt Diagnosis

Associated morbidity makes a prompt diagnosis of

acute appendicitis or cholecystitis critical. As obstetricians we should be well versed in the various symptoms and clinical presentation of these problems in pregnant patients. We must have a high index of suspicion and be ready to engage a general surgeon colleague early on.

A diagnosis of appendicitis can all too easily be delayed because of the displacement of the appendix by the gravid uterus and the normal physiological leukocytosis of pregnancy. The consequences of delay, however, are significant: The incidence of fetal loss is as high as 35% when the appendix ruptures, compared with 1.5% with uncomplicated appendicitis.

The appendix changes location during gestation, rising progressively above the McBurney point. At 8 or 9 months, the appendix can essentially be as high as the top of the uterine fundus. As an inflamed appendix drifts away from the abdominal wall, the signs of peritoneal irritation are often minimized; fewer than half of pregnant patients, in fact, have peritoneal signs.

During the first trimester, the pain is primarily in the area of the McBurney point, and sometimes in the pelvic area. In the second trimester, the pain is associated with the displacement of the appendix, with the point of maximal tenderness frequently above the iliac crest. In the third trimester, pain and tenderness may be localized to the right costal margin. Irrespective of the trimester, patients often have right lateral rectal tenderness.

The pain of appendicitis must be differentiated from the pain of uterine origin. The latter often can be alleviated by providing adequate hydration and placing the patient in the decubitus position. Both Alder's sign (fixed tenderness) and Bryan's sign (tenderness in the right lateral position) can help with this differentiation.

Acute cholecystitis often presents initially with biliary colic associated with nausea and vomiting. When the common bile duct is obstructed by a stone, pain persists and often radiates to the subscapular area, right flank, or shoulder. Patients typically have right subcostal tenderness associated with fever.

Ultrasonography is usually effective for diagnosing

Laparoscopic Cholecystectomy

- ▶ The overall complication rate for this procedure has been reported to be 0.75% in the literature.
- ▶ The highest incidence of fetal loss associated with laparoscopic cholecystectomy is in the first trimester, and the highest incidence of premature labor is in the third trimester.
- ▶ Elective abortion is not recommended, even with an intraoperative cholangiogram.
- ▶ Extrahepatic biliary obstruction due to gallstones can be managed laparoscopically.

Source: Dr. Sanfilippo

the presence of stones or dilatation of the common bile duct. Technetium-99m-iminodiacetic acid scans of the gallbladder can be used in pregnancy with minimal risk of radiation exposure.

Whenever possible, first-trimester patients with cholecystitis should be treated conservatively until the second trimester. Any patient who does not improve with medical management, however, should undergo laparoscopic surgery regardless of the gestational age of the fetus.

With adnexal cysts, it is generally acceptable to provide expectant management if the enlargement is less than 6 cm. There is evidence that 80%-90% of these enlargements will resolve spontaneously.

Again, it is of paramount importance that the obstetrician/gynecologist is cognizant of the anatomic and physiological changes associated with pregnancy. The option of a minimally invasive approach is often appropriate and timely in the management of nonobstetric emergencies during pregnancy. ■

DR. SANFILIPPO said he had no conflicts of interest relevant to the content of this article.

Managing Anesthesia Risks

By System

Gastrointestinal

- Empty stomach contents.
- Be aware that gastric content results in increased risk for aspiration/regurgitation.
- Consider prescribing antacids preoperatively.

Cardiovascular

- Minimize inferior vena cava and aortic compression.
- Be aware of decreased peripheral vascular resistance, increased cardiac output, and vasodilatation.

Respiratory

- Be aware that oxygen consumption increases, as well as tidal volume (40%), respiratory rate (15%), and alveolar ventilation (70%).
- Encourage compensatory hyperventilation during surgery.
- Be prepared for challenges with intubation due to nasopharyngeal swelling.

Source: Dr. Sanfilippo

By Anesthetic

Inhalation Agents

- Nitrous oxide
 - Potential for increased incidence of spontaneous abortion
- Halothane
 - Congenital deformities in operating room personnel have been reported.
- Enflurane
 - Teratogenesis
- Isoflurane
 - Effects on fetus unknown

Intravenous Agents

- Diazepam
 - Cleft palate
- Thiopental sodium
 - Overall no increase in congenital anomalies.

Muscle Relaxants

- Succinylcholine
 - No apparent adverse effects on fetus.

Local/Regional Anesthesia

- Bupivacaine (Marcaine) 0.75%
 - May cause cardiac arrhythmias.
- Lidocaine
 - Potential adverse effects on fetal central nervous system and myocardium