

# FETAL RISK DURING LAPAROSCOPIC SURGERY IN PREGNANCY

## DR. MAHER SALEH AL ABBADI

CONSULTANT OBSTETRICIAN AND GYNECOLOGIST  
KING ABDULAZIZ SPECIALTY HOSPITAL, KINGDOM OF SAUDI ARABIA  
MEMBER WORLD ASSOCIATION OF LAPAROSCOPIC SURGEON

## Dr. K. MISHRA, M.MAS; MRCS

SENIOR CONSULTANT LAPAROSCOPIC SURGEON  
DIRECTOR, LAPAROSCOPY HOSPITAL, NEW DELHI  
MEMBER WORLD ASSOCIATION OF LAPAROSCOPIC SURGEON  
MEMBER INDIAN ASSOCIATION OF GASTROINTESTINAL ENDOSURGEONS  
MEMBER SOCIETY OF AMERICAN GASTROINTESTINAL AND ENDOSCOPIC SURGEONS

### ABSTRACT:

**Aim:** To evaluate the indications, efficacy of laparoscopic surgery during pregnancy and the associated potential fetal risks.

**Material and Method:** A literature search was performed using Medline and the search engine Google. Criteria for selection of literature were methods of analysis (statistical or non statistical), operative procedure (only universally accepted procedures were selected) and the institution where the study was done (Specialized institution for laparoscopic surgery).

**Keywords:** laparoscopy, pregnancy, fetus, appendectomy, cholecystectomy, adnexa.

**Conclusion:** Laparoscopic surgery for abdominal disorders during pregnancy make big challenge to the surgeon, the severity of the primary underlying pathology, not the surgery, appear to have the most important factor determining fetal and maternal outcome.

### INTRODUCTION:

The known advantages of laparoscopic surgery have make it to be used for various indications. The experience of surgeons and gynecologists is gaining more year after year; this led to use this procedure even during pregnancy for different intra-abdominal disorders. But the fetal and maternal wellbeing require special consideration.

Intra-abdominal diseases requiring surgical intervention during pregnancy present unique challenges to the diagnosis and management [1]. This difficulty in diagnosis and management because of the changes in physiology and abdominal anatomy characteristic of pregnancy. Also these changes make laparoscopic surgery technically more difficult, the obstetrician must determine the status of pregnancy, such as gestational age, viability and inform the patient about the risks related to pregnancy and surgery itself [2,3].

The most frequent intra-abdominal disorders encountered during pregnancy are; acute appendicitis, gallbladder diseases, bowel obstruction and perforation, persistent ovarian cysts, twisted adnexal masses and other pathologies [2,3,4] maternal abdominal disorders and its laparoscopic operative management are associated with fetal loss rate 2-24% according to the recent literature[8,9].

Several mechanisms have been proposed for increased fetal morbidity and mortality associated with laparoscopic surgery during pregnancy, including direct uterine trauma, fetal trauma, intraamniotic CO<sub>2</sub> insufflation, trauma to maternal abdominal organs and vessels, decreased uterine blood flow and

oxygen delivery, teratogenic effects of anesthetic drugs, fetal acidosis due to CO<sub>2</sub> pneumoperitoneum, adverse effects of anesthesia on maternal hemodynamic and acid-base balance, increased risk of thromboembolic disease, the effect of underlying abdominal pathology, manipulation during surgery and effects of postoperative medications [2,4,7,10,11,12,14,15,16,25].

## **MATERNAL ORGANS INJURY**

In pregnancy, extreme care must be exercised when placing the insufflation needle and canulas to avoid injury to the uterus, as perforation could result in ruptured membranes, bleeding, infection or gas embolism, such complications can easily be avoided by choosing an appropriate entry site Veress needle and trocars. Many authors have advice to place the first trocar just below the xiphisternum and place the supraumbilical trocars under direct vision or to use an optical trocar which allows the surgeon to see the tissue planes and the intra-abdominal organs as the trocar advanced. Some surgeons complied with the open technique for the port placement to create pneumoperitoneum with no bowel or uterine injury. The most life threatening laparoscopic complications are those to large retroperitoneal blood vessels (aorta, ivc, iliac vessels). To avoid these injuries early recognition and prompt treatment is critical. Stomach and bowel injuries from needle or trocar have reported, large number of these injuries may go unrecognized, because of the ability of the stomach and intestines to heal small injuries. Undetected bowel injury is a major factor of postoperative mortality, such patients usually present late in sepsis and peritonitis that could lead to fetal, maternal morbidity and mortality [7, 11, 12, 35, 36].

## **EFFECT OF CO<sub>2</sub> PNEUMOPERITONEUM**

While laparoscopic surgery is gaining clinical acceptance for a wide spectrum of intra-abdominal surgical disorders, the CO<sub>2</sub> pneumoperitoneum on the fetus has limited the application of laparoscopy in pregnant patient, limited animal studies suggest that pneumoperitoneum may induce fetal acidosis and tachycardia, but this short term acidosis, even if severe, may not lead to deleterious effects. Hunter et al reported fetal respiratory acidosis during CO<sub>2</sub> pneumoperitoneum in a pregnant ewe model. Fetal hemodynamic abnormalities (tachycardia and hypertension) were noted and were attributed to fetal hypercarbia; the later was reversed by maintaining mild maternal respiratory alkalosis. Monitoring maternal arterial blood gases has proven superior to maternal capnography in this regard [23, 24]. fetal acidosis is known to occur with CO<sub>2</sub> pneumoperitoneum although the short and long term effects of this unknown. Should the mother become acidemic, the pneumoperitoneum should be released and the patient hyperventilated to expel the CO<sub>2</sub> gas before continuing the procedure. It is important to remember that the fetus is more acidemic than the mother[8,9,20,21,22]

CO<sub>2</sub> pneumoperitoneum can produce significant alteration in maternal and fetal blood gases, but this transient effect remain unclear. Other studies confirm the lack of intra-abdominal CO<sub>2</sub> pressure under 15mmHg on fetal, placental perfusion and blood gases [11,12,13,14].

## **EFFECT OF INCREASED INTRA-ABDOMINAL PRESSURE**

Intra-abdominal pressure has to kept to minimum while maintaining adequate visualization not more than 12mm Hg, higher insufflation pressures increase in intra-abdominal pressure and affect cardiac and respiratory physiology [11]. Some authors prefer the use of gasless laparoscopy and the results are good, but the technique has a higher conversion rate than conventional laparoscopy, other surgeons advice to use open / Hasson method for access as a safest technique during pregnancy [2,5,6,7].

Below 15mmHg intra-abdominal pressure is not only to prevent ventilatory and circulatory complications, but also to prevent the risk of gas embolism, which is a lethal complication for both the mother and the fetus, adequate exposure is still possible with less pneumoperitoneum, and does not prevent laparoscopic surgery [18,19,20,21,22,23].

Since pneumoperitoneum enhances lower extremity venous stasis already present in the gravid patient and since pregnancy induces a hypercoagulable state, pneumatic compression devices must be used, in addition to faster postoperative recovery and early mobilization probably reduce the risk of thromboembolic complications [6, 19, and 22]

## **EFFECT OF ANESTHESIA AND ANESTHETIC DRUGS**

A part from CO<sub>2</sub>, anesthetic drugs administered during first trimester of pregnancy may cause abnormalities during the period of organogenesis, such objections are contradicted by a Swedish registry study for the years 1973-1983 covering 720.000 pregnant women, of these 5405 underwent surgery, mainly diagnostic laparoscopy 34%. According to this study, it appears that general surgery in pregnancy causes no increase in stillbirths or birth defects and results in no difference in time or type of delivery, compared with controls, but leads to increased infant mortality and lower birth weight. These authors concluded that the causes are related more to the mothers illness that required surgical treatment than to surgery or anesthesia [2,13,18].

In a recent study published in journal of American society of anesthesiologist 2004, the authors concluded that CO<sub>2</sub> pneumoperitoneum produces respiratory acidosis, but does not decrease fetal oxygenation, in contrast the findings indicate that in the preterm fetus, insufflation induced hypercapnia and acidosis are accompanied by prolonged fetal hypoxia and cardiovascular depression. This result suggests that additional work should be conducted to confirm the presumed safety of doing laparoscopic procedures during the second trimester [12, 13, 20, and 23].

The available animal data suggest that caution should be used when considering laparoscopic surgery in pregnant women, and additional clinical and laboratory investigation may be indicated to evaluate fetal risk associated with such surgery [18,26].

## **FETAL TRAUMA DURING LAPAROSCOPY**

According to the recent findings, hemodynamic changes during laparoscopic surgery in pregnancy are similar to those in non-pregnant state, the procedure appears to be safe and reduces hospital admissions and stay and frequency of preterm labor. The safest time to perform laparoscopic surgery in pregnancy is second trimester. However it can be complicated by injury of the enlarged gravid uterus and pregnancy loss, in one report the author concluded that ; inadvertent introduction of the Veress needle into the gravid uterus with subsequent pneumoamnion represents a catastrophic complication of midtrimester laparoscopic surgery and ended by fetal loss[17,19,25]

Brendan C in his study points that, the rate of nonobstetric abdominal surgery during pregnancy was 1 in every 527 births. Among the 77 patients the indication for surgery were; adnexal mass 42%; acute appendicitis 21% ; gallbladder diseases 17% and others 21%, there was no maternal or fetal loss. Preterm labor occurred in 26% of the second trimester, and 82% of the third trimester patients. Preterm labor was most common in patient with appendicitis and after adnexal surgery. His conclusion indicates that surgery during first and second trimester is not associated with significant preterm labor, fetal loss and risk of teratogenicity. Surgery during the third trimester is associated with preterm labor, but not fetal loss [2, 7].

## **UTERINE BLOOD FLOW**

Decreased uterine blood flow from pneumoperitoneum remains hypothetical. It is reasoned that this is unlikely to be a major concern given the frequent pressure alternations induced during valsalva, coughing, and straining [39], further, it is maintained that pneumoperitoneum may well be safer than manual uterine retraction during open appendectomy and cholecystectomy [40].

## **LONG- TERM FETAL EFFECT**

Regarding fetal long term consequences of laparoscopic surgery during pregnancy, one study shows that successful laparoscopic surgery was performed in 10 cases, with one conversion to an open procedure. Intraoperative and postoperative fetal monitoring was performed for at least 24 hours. No fetal distress or demise occurred, nor were any tocolytics used. The resultant children were then monitored with follow-up of 1 to 8 years, and no evidence of developmental or physical abnormalities was detected during study period. The authors concluded that laparoscopic surgery is now proving to be as safe as open surgery in pregnancy. In their study, the long term follow up has no deleterious effects to either mothers or children [27].

Despite recent advances in anesthetic, perinatal, perioperative care, surgical intervention during pregnancy may still result in fetal loss from either spontaneous abortion (especially in the first trimester) or preterm labor (especially in third trimester). Additionally, there is an increased incidence of low birth weight infants, preterm labor and growth restricted babies with surgical intervention during pregnancy. Therefore, when ever possible, surgery should be deferred until after delivery. Unfortunately, urgent surgical intervention in the gravid patient is occasionally necessary. The most common situations encountered by the general surgeon are acute appendicitis and acute cholecystitis.

Acute appendicitis occurs with the same frequency in gravid and nongravid females of the same age, leading to appendectomy in one out of every 2000 pregnancies [28]. In this setting, suspected appendicitis must be treated as if the patient were not pregnant. Thus the suspicion of appendicitis usually merits operative exploration. Indeed, delay with resultant appendiceal rupture may have dire fetal and maternal consequences.

Acute cholecystitis leads to surgical intervention less frequently, partly due to the availability of effective non-surgical therapeutic alternatives. Cholecystectomy is required in 1-6 out of every 10000 pregnancies [29]. Despite the effectiveness of non-operative care, pregnant patients with symptomatic gallstones have a high rate of recurrent symptoms. Nearly 70% of patients with gallstones and pancreatitis will have recurrent biliary pain usually requiring hospitalization. Fetal loss in patients with gallstone pancreatitis is 10-20% [30, 31].

Currently, in nonpregnant patients, appendectomy and cholecystectomy are frequently performed laparoscopically. While pregnancy has been considered a relative contraindication to laparoscopy, recent reports have refocused attention on this issue [32, 33, 34].

Potential advantages of laparoscopic appendectomy and cholecystectomy in the pregnant patient include decreased fetal depression due to lessened postoperative narcotic requirements [35, 36, 37], lower risks of wound complications [34, 37, 38, 39] and diminished postoperative maternal hypoventilation [37, 38]. Additional benefits may include more rapid maternal recovery.

Most case reports and small series indicate that laparoscopy can be safely performed during pregnancy. Despite the growing clinical experience suggesting laparoscopy is safe as laparotomy in pregnancy, long-term clinical studies are lacking.

To avoid and minimize the fetal and maternal risks during laparoscopic surgery in pregnancy, it is recommended to follow the guidelines for laparoscopic surgery during pregnancy. The following guideline is suggested:

1. Pre operative obstetrical consultation should be obtained.
2. Operative intervention should be deferred until second trimester.
3. Pneumoperitoneum pressures should be minimized to 8-12 mmHg.

4. Left lateral position of the patient to avoid supine hypotension syndrome.
5. Use of open access technique during laparoscopy in advanced pregnancy.
6. The uterus should be protected with a lead shield if radiological investigations are needed.
7. Pneumatic compression devices should be used to reduce thromboembolic disorders.
8. Fetal and maternal end tidal CO<sub>2</sub> and arterial blood gases should be monitored.
9. Capnography, Pulse oximetry, NIBP and ECG should be strictly monitored.

## Conclusion

Laparoscopic surgery widely used in the last 3 decades by both gynecologists and general surgeons, because of its major advantages. With the advancement in anesthesia and laparoscopy, it has been used in three trimester of pregnancy for different intra-abdominal obstetrical and non-obstetrical pathologies. Laparoscopic surgery can be performed safely during pregnancy, but possible complications, such as uterine injury, difficulty during procedure, increased intra-abdominal pressure and CO<sub>2</sub> absorption by the fetus and the mother should be considered seriously. Most of the data available are case report and small series, and these are not enough to make conclusion about this procedure safety and complication rate. Laparoscopic surgery for abdominal disorders during pregnancy make big challenge to the surgeon, the severity of the primary underlying pathology, not the surgery, appear to have the most important factor determining fetal and maternal outcome. We suggest that prospective, controlled and randomized studies should be conducted to assess the superiority of laparoscopy in pregnancy.

## REFERENCES

- [1] Norman Hakim. Laparoscopic management of appendicitis and symptomatic cholecystitis during pregnancy. *Langenbecks archives of surgery*. Vol 391 N5 SEP 2006.
- [2] Brendan C. Safety and timing of nonobstetric abdominal surgery in pregnancy. *Digestive surgery*; volume 18 number 5 2001.
- [3] Rachelle Guttman. Appendicitis during pregnancy. *Canadian family physician*; march 2004.
- [4] Parker William H. Laparoscopic management of benign cystic teratoma during pregnancy. *Am J obstet gynecol*; 174 (5):1499-1501 may 2006.
- [5] Akira Shigeo. Gasless laparoscopic ovarian cystectomy during pregnancy, comparison with laparotomy. *Am J obstet gynecol*; 180 (3): 553-557. march 1999
- [6] Hiromi Inoue. Gasless laparoscopic ovarian cystectomy with minilaparotomy during pregnancy. *Gynecological endoscopy*; vol 7: issue 2 pp95 April 1998.
- [7] Singh K. laparoscopic cholecystectomy during pregnancy. *Indian J surgery*; 2005; 67: 131-134.
- [8] Allen JR, intraabdominal surgery during pregnancy; *am j surgery* 1989

- [9] Kort B, the effect of nonobstetric operation during pregnancy. Surg. Obstet gynecol 1993.
- [10] de Perrot Marc, laparoscopic appendectomy during pregnancy; surgical laparoscopy, endoscopy & percutaneous techniques: 10(6): 368-371 Dec 2000
- [11] Sherry Boschert, low insufflation key to laparoscopy in pregnancy, try to avoid surgery in first trimester; obgyn news December 1: 2003.
- [12] Uemura Kenichiro, maternal insufflation during second trimester equivalent produces hypercapnia, acidosis and prolonged hypoxia in fetal sheep; anesthesiology 101 (6) :133-138 December 2004.
- [13] Helmut Pschera, laparoscopic treatment of heterotopic pregnancy, benefits, complications and safety aspects; Turkish German gynecology association; vol 6 (2) : 2005:90-94.
- [14] Barnard JM, fetal response to carbon dioxide pneumoperitoneum in pregnant ewe; obstet gynecol 1995; 85: 664-74.
- [15] Neiswender LL, laparoscopic excision of pelvic masses during pregnancy; J am association gynecol laparoscopy 197; 4: 269-274.
- [16] Lemaire BM, laparoscopic surgery during pregnancy. Surgery endoscopy 1997; 11:15-18.
- [17] de la Fuente SG, early postnatal behavior deficits after maternal carbon dioxide pneumoperitoneum during pregnancy. Surgery endoscopy 2003; 17: 1823-1825.
- [18] Amos JD, laparoscopic surgery during pregnancy. Am J surgery 1996 April: 171 (4):435-437.
- [19] Al Fozan H, safety and risks of laparoscopy in pregnancy. Current opinion in obs and gyn; 14 (4) 375-379: August 2002.
- [20] Bhavani-Shankar K, arterial to end- tidal carbon dioxide pressure differences during laparoscopic surgery in pregnancy. Anesthesiology 93 (2); 370-373: August 2000.
- [21] Guidelines for laparoscopic surgery during pregnancy. SAGES. Surgery endoscopy 1998 12(2): 189-190.
- [22] Reedy MB, laparoscopy during pregnancy: a study of five fetal outcome parameters with the use of the Swedish health registry. Am J obstet gynecol 1997; 177: 673-679?
- [23] Hunter JG, carbon dioxide pneumoperitoneum induces fetal acidosis in a pregnant ewe model. Surgical endoscopy 1995; 9:272-279.
- [24] Cheng Yoh Yeong, laparoscopic management of the persistent adnexal masses in pregnancy, is it safe? The internet journal of gyne and obstetrics 2000 vol 1: number 1.

- [25] Jennifer D Frieddman, pneumoperitoneum and pregnancy loss after second trimester laparoscopic surgery. *Obstetric and gynecology* 2002; 99:512-5.
- [26] Garcia-Oria M, histologic evaluation of fetal brains following maternal pneumoperitoneum. *J surgical endoscopy* vol 15 n 11 November 2001.
- [27] Rizzo AG, laparoscopic surgery in pregnancy, long-term follow up. *J laparoscopic and advanced surgical techniques* 2003 February 13(1): 11-15.
- [28] Condon RE, appendicitis. *Textbook of surgery*; wb Saunders co.pp 884-98.
- [29] Hill MN, cholecystitis in pregnancy. *Obstet gynecol* 1975; 46: 291-195.
- [30] Swisher S, management of pancreatitis complicating pregnancy. *Am surgery* 1994; 60:759-762.
- [31] Scott L, gallstone disease and pancreatitis in pregnancy. *Gast clin north am* 1992; 21:803-815.
- [32] Spirtos NM, laparoscopy a diagnostic aid in case of suspected appendicitis. *Am j obstet gynecol* 1987; 156: 90-94.
- [33] Schreiber JH, laparoscopic appendectomy in pregnancy. *Surgical endoscopy* 1990; 4:100-102.
- [34] Arvidsson D, laparoscopic cholecystectomy during pregnancy. *Surg laparoscopy endoscopy* 1991; 1: 193-194.
- [35] Morrell DG, laparoscopic cholecystectomy during pregnancy in symptomatic patients. *Surgery* 1992; 112: 825-859.
- [36] Curet MJ, laparoscopy during pregnancy. *Arch surgery* 1996; 131:546-551.
- [37] Pucci RO, case report of laparoscopic in third trimester of pregnancy. *Am j obstet gynecol* 1991; 165: 401-402.
- [38] Weber AM laparoscopic cholecystectomy during pregnancy. *Obstet gynecol* 1991; 78: 958-959.
- [39] Soper NJ, Hunter JG, laparoscopic cholecystectomy during pregnancy. *Surg endoscopy* 1992; 6: 115-117.
- [40] Williams JK, laparoscopic cholecystectomy during pregnancy, a case report. *J reprod surgery* 1995; 40:243-254.

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