

Laparoscopic surgery in pregnancy: precautions and complications

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Abstract:

During pregnancy due to the physiological changes that take place in the mother and considering the presence of a living foetus in utero, surgical conditions are handled with a lot of care and cautions. Pregnancy was considered to be absolutely contraindicated for laparoscopic intervention, but with better understanding of physiology of pregnancy and improved anaesthetic and laparoscopic techniques, emergency laparoscopic procedures such as, diagnostic laparoscopy for pain abdomen, appendicectomy, splenectomy, pheochromocytoma, cholecystectomy, are feasible in pregnancy. Lachman et al, have already reported 300 laparoscopic procedures during pregnancy.[1] Here we review physiological changes in pregnancy, indications of minimal axis surgery, effects of pneumoperitonium in pregnant patient, and precautions and complications of laparoscopic surgery during pregnancy.

Key words:

Pregnancy, laparoscopy, foetus, pneumoperitonium, complications, cholecystectomy

Introduction:

During pregnancy usually all the surgical procedures are avoided to minimize various risks of anaesthesia and procedure to mother and foetus. At times emergency surgical conditions makes it absolutely necessary for intervention. With increasing progress in minimal axis surgery more and more surgeons have found the skill and interest to perform the emergency procedures laparoscopically. Laparoscopy was first done in pregnancy for diagnosis and evaluation. The first laparoscopic appendicectomy in pregnancy was performed by Scheiber in 1990.[3]. The first laparoscopic cholecystectomy in pregnancy was first done in pregnancy for diagnosis and evaluation of acute abdominal pain in 1980.[2]. The first laparoscopic appendicectomy in pregnancy was done by Weber in 1991.[2].

How ever surgical intervention in pregnant ladies needs special consideration of well being of mother and foetus both, if intrauterine viable foetus is present, and in cases of ectopic pregnancy or heterotrophic pregnancy the pathophysiological changes brought about during pregnancy should be considered for the safety of patient. Further more with advancement of pregnancy laparoscopic diagnosis and procedures becomes more challengingly difficult as the gravid uterus displaces the organs and becomes completely an abdominal organ.

Up to this date the data on laparoscopic procedures during pregnancy are still limited, but with growing ability of minimal axis surgeons the recent accumulating data shows that laparoscopic procedures such as diagnostic laparoscopy, adnexal surgery, appendicectomy, splenectomy, cholecystectomy and management of ectopic and heterotrophic pregnancies are relatively safe and effective during pregnancy, if certain precautions are taken. But of course like all surgical procedures in pregnancy there is an increase risk of certain complications with laparoscopic intervention in pregnancy.

Aim:

Aim of this review article is to study the precautions and complications of laparoscopy in pregnancy. The following parameters were evaluated:

1. Physiological changes during pregnancy
2. Foetal consideration
3. Effects of pneumoperitonium in pregnancy during laparoscopic procedures
4. Criteria for patient selection
5. Advantages of laparoscopy in pregnancy
6. Risks of laparoscopy in pregnancy
7. Strategies for safe laparoscopic surgery in pregnancy

Materials and methods:

A literature search was performed using search engine Google, Highwire, Springer link and library facilities.

Physiological changes in pregnancy:

Almost all the organ systems undergo physiological changes in pregnancy [11, 4]. These changes should be considered during operative procedures in pregnancy.

Gastrointestinal system:

Due to enlarged gravid uterus, stomach is pushed towards diaphragm and assumes a more horizontal position. The viscera like transverse, ascending and descending colon are displaced so location of abdominal pain and tenderness especially in condition like appendicitis is altered. The hormonally induced decrease lower oesophageal sphincter tone causes gastroesophageal regurgitation which places the pregnant lady at higher risk of aspiration, so nasogastric tube suction and careful airway management is necessary for all pregnant patients undergoing laparoscopy.

Cardiovascular and hematological changes:

Cardiac output and blood volume increase by 30-40%.[5], but as RBC volume does not expand by same ratio this result in physiological anaemia specially noticed in second trimester.

After 20 weeks gestation, the gravid uterus compresses aorta and inferior vena cava and may cause supine hypotension syndrome, so during surgery the patient should be positioned in lateral recumbent position to avoid venacaval compression during surgery.[6]. A vasomotor block caused by spinal anaesthesia produces more severe hypotension than in non pregnant individuals.

During pregnancy WBC count increases to 12,000 -14,900 per mm.[4, 7]

A hypercoagulable state is physiologically developed in pregnancy due to increase in fibrinogen and other coagulation factors such as factor VII, factor VIII, factor IX, and factor X.[8]. Thus the risk of thromboembolism increases in pregnancy.

Respiratory system:

Due to enlarging gravid uterus gradually the chest movements are restricted. There is an increase in minute ventilation and oxygen consumption and decrease in residual volume, also mixed venous oxygen content and functional reserve capacity also decreases so patient is prone to hypoxemia and hypocapnia.[9] Pa CO₂ of 28-32 mm Hg, Ph of 7.44 and decrease bicarbonate levels are detected due to chronic respiratory alkalosis which has to be maintained during pregnancy. The patient gain more weight during pregnancy and there is more oedema in soft tissue of neck so anaesthetist may face more difficulty in airway management.

Urinary system:

Hydronephrosis, decreased urethral peristalsis and bladder expansion increase incidence of urinary tract infection. There is an increased retention of water and electrolytes.[10].

Foetal consideration:

Foetus is a hidden patient in the womb of the pregnant mother and its health should be considered by surgeon and anaesthetist both. It is important to:

1. Maintain uteroplacental blood flow and oxygenation. Decreased uteroplacental blood flow may be due to maternal hypotension or increase in uterine artery resistance.
2. Maternal hypoxia causes foetal hypoxia and metabolic acidosis and in long term it may be fatal to infant so it should be prevented.
3. Avoid teratogenic drugs during anaesthesia. Cocaine is known to have teratogenic effect so products containing cocaine should be avoided. Diazepam and Nitrous oxide are considered safe during anaesthesia as no teratogenicity was detected clinically.[11, 12].
4. Avoid preterm labour. Try to manipulate uterus the minimum possible. Although there is an increased incidence of spontaneous abortion, premature delivery and low birth weight following anaesthesia but in emergency situations operation is unavoidable.

3. Effects of pneumoperitoneum in pregnancy during laparoscopic procedure:

In pregnant patient the pneumoperitonium increases the intra abdominal pressure and this causes decreased inferior venacaval return to the heart, hence decreased cardiac output. With reverse Trendelenburg position decreased cardiac output is even worsened, Cardiac index decreases, and when this is combined with mothers hypoxia can cause foetal death.[13]. Increase intra abdominal pressure also leads to decreased uterine blood flow and increase intrauterine pressure, these may in turn cause foetal hypoxia and may lead to foetal death.[14]. Pneumoperitonium decreases the diaphragmatic movement, in pregnant lady already the movement of diaphragm is decreased due to bulky uterus, this further decrease movement due to pneumoperitonium causes increase peak airway pressure, decrease functional reserve capacity, increased ventilation perfusion mismatch, decreased thoracic cavity compliance and increase pleural pressure .[15].

Use of CO₂ for causing pneumoperitonim leads to hypercarbia and further hypoxemia .The CO₂ absorbs across the peritoneum and leads to respiratory acidosis in patient and her foetus.[16]. If PCO₂ increases above 40 mm ,decreased removal of CO₂ occurs leading to foetal acidosis. Foetal tachycardia and hypotension may develop as a result of foetal hypocarbia .This can be corrected by maintaining mild maternal respiratory alkalosis, by hyperventilating the mother during surgery. Monitoring maternal arterial blood gases is better than monitoring Pa CO₂ during laparoscopic procedures.[17].

N₂O as the gas for pneumoperitonization will not cause foetal respiratory acidosis, but it is highly combustible.[18].

4. Criteria for patient selection:

A safe laparoscopic procedure can be performed in all the three trimesters of pregnancy from 2-31 weeks.[16]. During the first trimester there is increase risk of abortion up to 12%.[16, 17, 19]. Also risk of teratogenesis increases in first trimester.

In the third trimester, there is a 40% risk of preterm labour and 30% risk of premature birth.[20]. Also the visualization in laparoscopic procedure is decreased due to enlarged uterus.[1].

Therefore second trimester is considered the safest time for laparoscopic surgery in pregnancy. The risk of abortion is not increased, no risk of teratogenesis, and risk of preterm labour is only 5% in second trimester.

5. Advantages of laparoscopy in pregnancy:

1. Short hospital stay
2. Early return to normal activities
3. Small incision, so rapid post operative recovery and less incision complications such as hernia, post operative wound infection and pain.
4. Less uterine manipulation and hence decrease uterine irritability and foetal loss.

Risk of laparoscopy in pregnancy:

1. More chance of uterine injury during port enters as uterus becomes an abdominal organ after first trimester.
2. Problems associated with pneumoperitonization as discussed already.
3. CO₂ absorption causes increase CO₂ pressure and decrease arterial PH.
4. Risk of exposure to intra abdominal smoke including carbon monoxide generated by electro surgery and laser. [21].

Strategies for safe laparoscopic surgery in pregnancy:

1. Surgery should be done in second trimester. [22].
2. If pt presents in late third trimester, surgery should be postponed if possible until after delivery. [23].
3. Nasogastric incubation is a must in all case as there is a high risk o aspiration into the lungs.
4. Patient can be placed in dorsal lithotomy position in the first half of pregnancy, but in second half to prevent inferior venacaval compression patient is ideally placed in lateral recumbent position.
5. Hypotension should be avoided; proper fluid replacement should be done.
6. Ideal method for commencing pneumoperitonium is open Hasson trocar method. Placement of trocar depends on the size of gravid uterus.
7. Tocolysis is indicated if signs of uterine irritability are present.
8. Decrease operation time by using adequate number of ports, and using most experienced surgeons.
9. Maternal hyperventilation to maintain end-tidal CO₂ Pressure at 32mmHg.
10. Lower CO₂ insufflations pressure of < 12 mm Hg should be used to avoid foetal acidosis.
11. Electrocautery should be used with care; the smokes containing carbon monoxide should be evacuated promptly to avoid toxic effect to foetus.

12. Entry of all instruments must be under direct vision; care should be taken to avoid injury to the gravid uterus.
13. All specimens should be removed with endobag to avoid spillage.
14. Manipulators should never be fixed to vagina or cervix.[24]

Society of American Gastrointestinal Endoscopic Surgery (SAGES) Recommendations [27]:

1. Obstetrical consultation should be obtained preoperatively.
2. When possible, operative intervention should be deferred until the second trimester, when foetal risk is lowest.
3. Pneumoperitonium enhances lower extremity venous stasis already present in the gravid patient and pregnancy induces a hypercoagulable state. Therefore pneumatic compression devices should be utilized whenever possible.
4. Fatal and uterine status, as maternal end tidal CO₂ and/or arterial blood gases, should be monitored.
5. The uterus should be protected with a lead shield if intraoperative cholangiography is a possibility.
6. Fluoroscopy should be utilized selectively.
7. Given the enlarged gravid uterus, abdominal access should be attained using an open technique.
8. Dependent positioning should be utilized to shift the uterus away from the inferior vena cava.
9. Pneumoperitoneum pressures should be kept at 10 mm Hg.
10. Future studies into methods that increase the safety of laparoscopy in pregnant patient should be done.

Discussion:

Advances in laparoscopic surgery have led to development of methods to perform abdominal surgery and reduce morbidity using minimal access surgery techniques.

In 1999, Lachman et al reported on a series of pregnant women undergoing 518 surgical procedures.

[1].Cholecystectomy (45%) is the most common procedures performed during pregnancy followed by adnexal surgery (34%) and appendicectomy (15%).

Operative procedures are postponed in pregnant pt until after delivery, but in acute emergency conditions even if patient is pregnant operation should be performed.

According to the recent studies done the second trimester is ideal for laparoscopic intervention.

Most cases reported and small series indicate that laparoscopy can be safely performed during pregnancy.

The incidence of prematurity and intrauterine growthrestriction was reported to be higher in the open surgical group too.

Two recent studies suggest that there is no difference in foetal outcome for patient with singleton pregnancies undergoing laparoscopy or laparotomy [1].

In one study the resultant children born after laparoscopic surgery was performed on their mother during their intrauterine life, were monitored and no evidence of developmental or physical abnormality was detected during the study period.[3].

Despite the growing clinical experience suggesting that laparoscopy is as safe as laparotomy in pregnancy, more long term clinical studies are required.

Conclusion:

A laparoscopic access to pathology in pregnancy has many benefits for the patient but it is important that the surgeon and anaesthetist both have an immense knowledge of maternal foetal physiology. The proper patient selection, experience and good surgical instruments for laparoscopic procedures are the gold standard to achieve success.

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