LAPAROSCOPY IN PREGNANCY - GENERAL SURGEON'S ROLE

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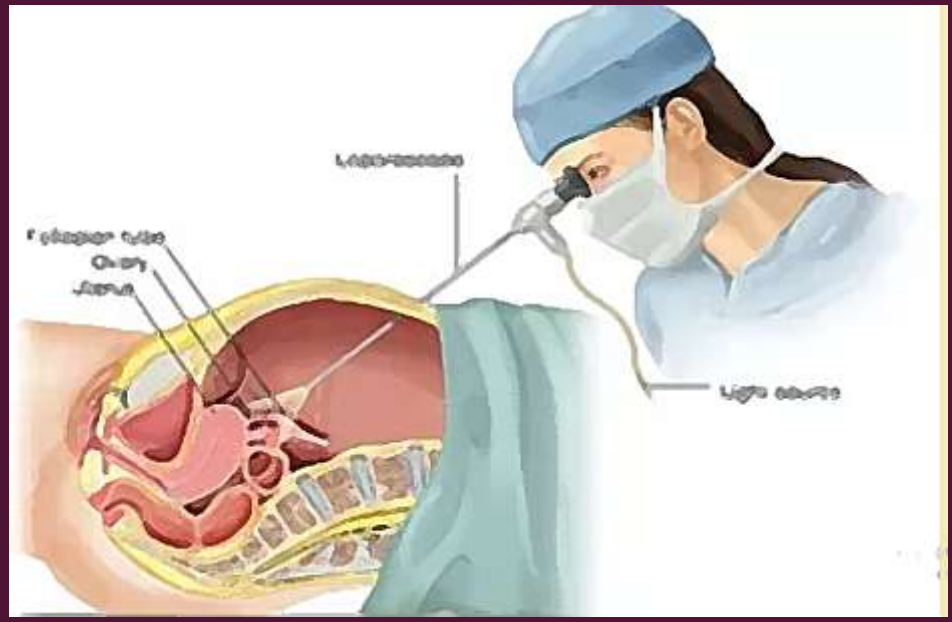


- INTRODUCTION
- ANATOMICAL & PHYSIOLOGICAL CHANGES IN PREGNANCY AFFECTING LAPAROSCOPY/ ANAESTHESIA
- INDICATIONS FOR SURGERY IN PREGNANCY
- ADVANTAGES
- DISADVANTAGES
- GUIDELINES
- COMMON PROCEDURES PERFORMED DURING PREGNANCY

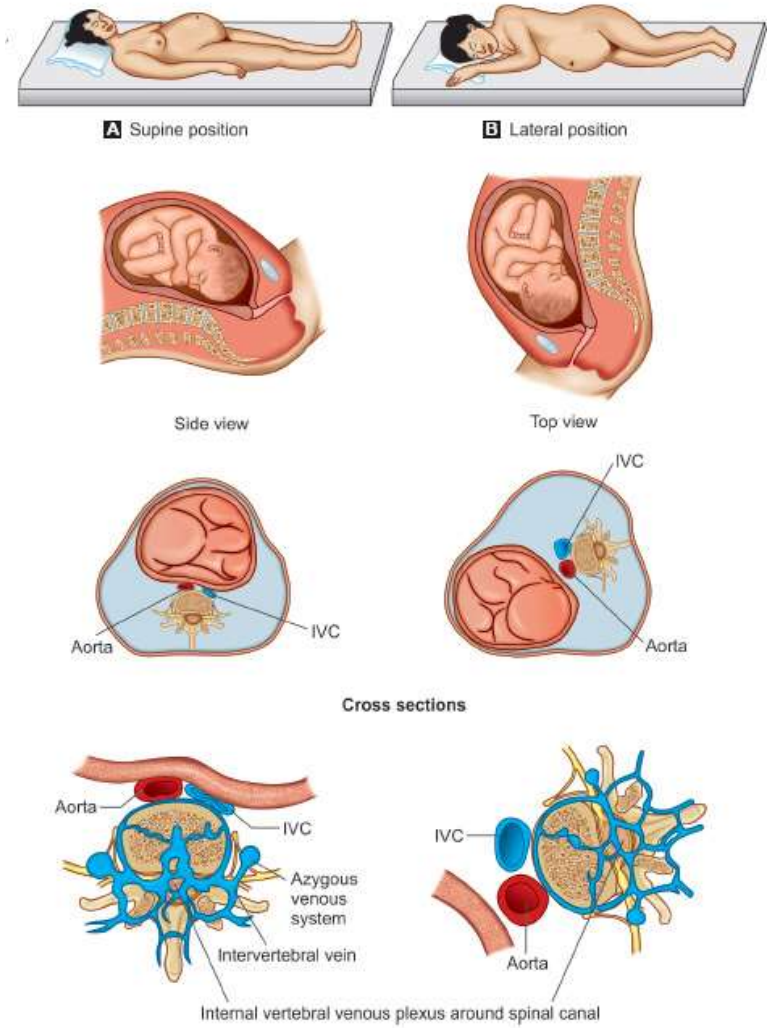
INTRODUCTION

- Each year, roughly 2% of pregnant women will undergo non-obstetrical abdominal surgery.
- The indications for surgery are similar to non-pregnant patients in the same age population.Appendicitis, symptomatic cholelithiasis and adnexal masses are some of the common diagnoses encountered.
- Pregnancy poses challenges in the diagnosis and surgical management of these conditions for several reasons.

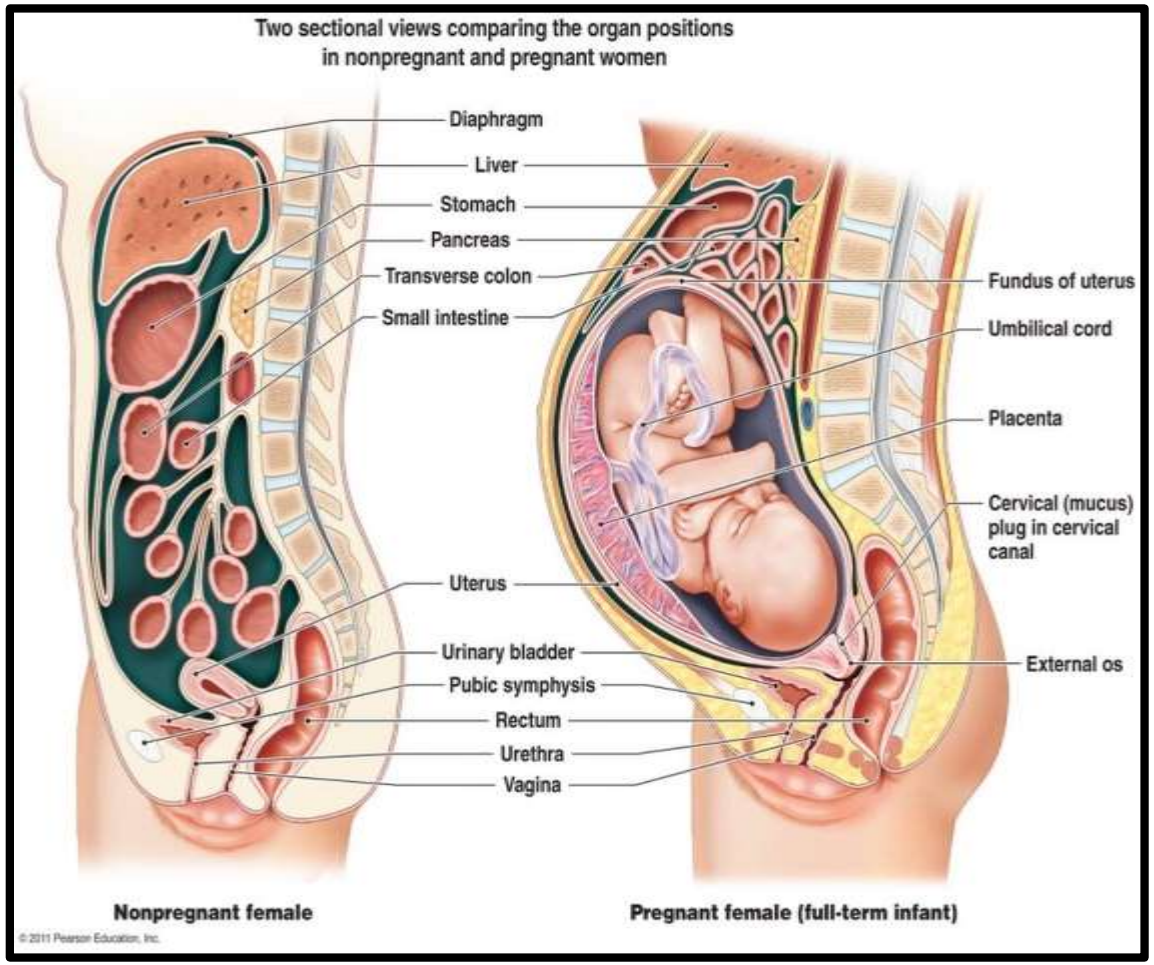
- For many years, pregnancy was considered a relative contraindication for laparoscopic surgery,
- With better understanding of physiology of pregnancy ,improved anaesthetic and laparoscopic techniques, and with the availability of experienced surgeons emergency laparoscopic procedures are feasible in pregnancy.
- Laparoscopic appendecectomy in a pregnant patient was first performed by Scheiber in 1990.
- Since the 1990's laparoscopic surgery has gained popularity and in the past few years has become the standard of care for pregnant women with surgical pathologies.

ANATOMICAL AND PHYSIOLOGICAL CHANGES

- CARDIOVASCULAR
- Cardiac output increases by up to 50% during pregnancy because of increases in heart rate and stroke volume.
- SUPINE HYPOTENSION SYNDROME – compression of IVC by the gravid uterus reduces venous return and cardiac output resulting in hypotension and associated vagal symptoms and signs.
- These changes can be reduced by turning the patient from supine to lateral decubitus position.
- Compression of IVC by the gravid uterus can result in distension of the epidural venous plexus. This results in reduced capacity of epidural space, enhanced spread of anaesthetic solution and chances of intra vascular injection of local anaesthetic agent.



IVC, inferior vena cava.



ANATOMICAL AND PHYSIOLOGICAL CHANGES

- RESPIRATORY SYSTEM / ACID BASE BALANCE
- ↑Alveolar ventilation due to the stimulatory effect of progesterone & estrogen on respiratory centre results in chronic respiratory alkalosis with PaCo2 levels of 28 - 32 mm Hg, ↓levels of bicarbonate & buffer base.
- The expanding uterus causes a decrease in the FRC of lungs. Further decrease in the FRC by induction of pneumoperitoneum can cause hypoxemia.
- ↓FRC, ↑O2 consumption and↓ buffering capacity result in the rapid development of hypoxia and acidosis during periods of hypoventilation or apnoea.

- Alveolar hyperventilation & reduced FRC can allow faster distribution of inhaled agents resulting in faster induction and reduced MAC.
- Hence, care should be taken to prevent hypoxia in a pregnant patient as lower dosages of analgesic and anaesthetic agents can induce unconsciousness quickly and unexpectedly.

ANATOMICAL AND PHYSIOLOGICAL CHANGES

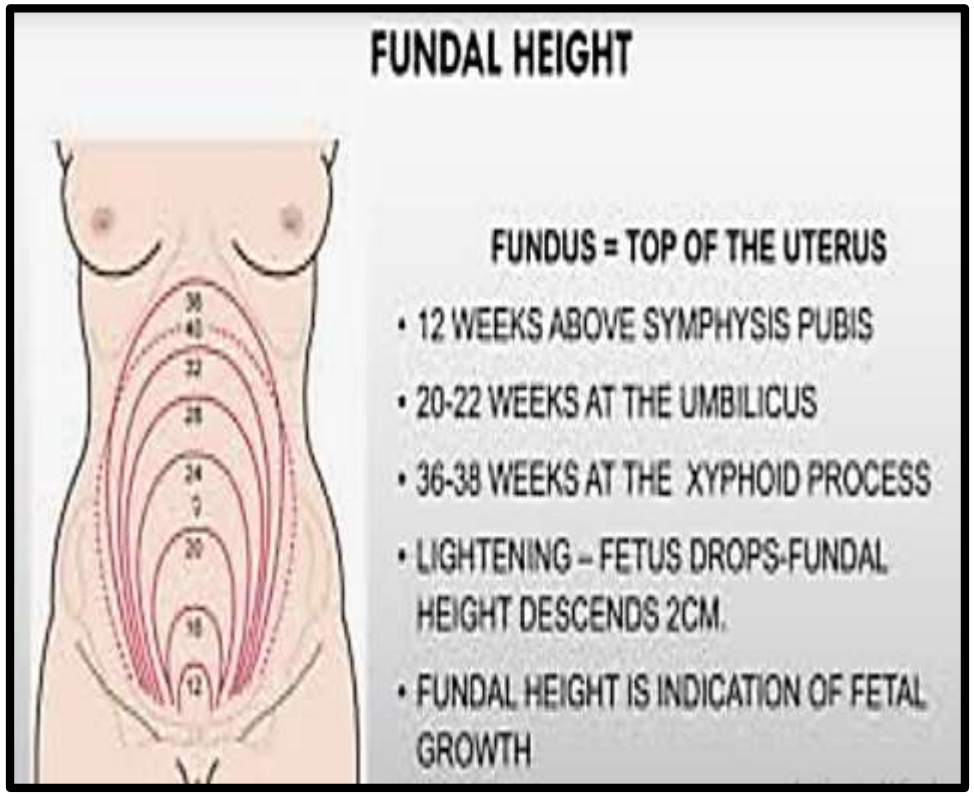
- GASTROINTESTINAL
- There is a decrease in gastrointestinal motility caused by mechanical changes in the abdomen from an enlarging uterus as well as from smooth muscle relaxation caused by the increased production of progesterone.
- Furthermore, the decrease in lower esophageal sphincter competence caused by mechanical shifting from the gravid uterus combined with increased intra-abdominal pressure leads to an increase in reflux and dyspepsia.
- These changes have led to a recommendation of rapid induction anesthesia and aspiration prophylaxis in pregnant women undergoing surgery.

ANATOMICAL AND PHYSIOLOGICAL CHANGES

- HEMATOLOGICAL CHANGES
- Blood volume expansion begins in the 1st trimester & because of smaller increase in RBC volume than plasma, mild to moderate blood loss can be well tolerated.
- There are changes in the coagulation factors during pregnancy which include an increase in fibrinogen, factors VII, VIII, X & XII, and a decrease in antithrombin III.
- All of these changes result in an increased risk of venous thromboembolism. Hence, thromboprophylaxis management should be applied to pregnant surgical patients.
- Pregnancy is associated with benign leukocytosis, hence WBC count is not a reliable indicator of infection.

ANATOMICAL AND PHYSIOLOGICAL CHANGES

- It is important to know the level of fundus of the gravid uterus as it is helpful in deciding the position for trocar placement.
- The primary port location – umbilical/ supra umbilical/ sub xiphoid/ palmer's point is chosen by the surgeon according to uterine size, location of pathology and experience.



SURGICAL INDICATIONS

1. Acute appendicitis
2. Acute cholecystitis and it’s complications
3. Acute pancreatitis and it’s complications
4. Intestinal obstruction
5. Trauma with visceral injury or hemorrhage
6. Vascular accidents – ruptured abdominal aneurysm

ADVANTAGES OF LAPAROSCOPY IN PREGNANCY

- Small abdominal incision
- Rapid post operative recovery
- Early mobilisation
- Decreased risk of thrombo embolism associated with pregnancy
- Reduced incidence of incisional hernia

ADVANTAGES OF LAPAROSCOPY IN PREGNANCY

- Early return of gastro intestinal activity due to less manipulation of the bowel during surgery which may result in fewer post operative adhesions and intestinal obstruction
- Decreased rate of fetal depression due to decreased pain and less narcotic use.
- Shorter hospitalisation time and prompt return to regular life.

DISADVANTAGES OF LAPAROSCOPIC SURGERY IN PREGNANCY

- Concerns about laparoscopic surgery in the pregnant patient center on three areas:

1. Increased intra-abdominal pressure can lead to decreased inferior vena caval return resulting in decreased cardiac output. The fetus is dependent on maternal hemodynamic stability.

The primary cause of fetal demise is maternal hypotension or hypoxia, so a fall in maternal cardiac output could result in fetal distress.

2. Increased intra-abdominal pressure seen with a pneumoperitoneum could lead to decreased uterine blood flow and increased intrauterine pressure, both of which could result in fetal hypoxia.

DISADVANTAGES OF LAPAROSCOPIC SURGERY IN PREGNANCY

3. Carbon dioxide is absorbed across the peritoneum and can lead to respiratory acidosis in both mother and fetus.

Fetal acidosis could be potentiated by the decreased vena caval return.

Other disadvantages include:

- Hemorrhage and herniation at the port site.
- Increased risk of vascular and organ trauma, in particular uterine perforation due to enlargement of the uterus and limitations to visual field and surgical access.
- Consequences of uterine perforation - uterine rupture, infections, preterm delivery, and laceration of the fetus or placenta.

- Increased risk of bleeding due to increased vascularity of uterus and adnexae.
- Risk of teratogenecity due to anaesthetic agents - modern anaesthetic agents are thought not to be teratogenic in therapeutic doses.

GUIDELINES

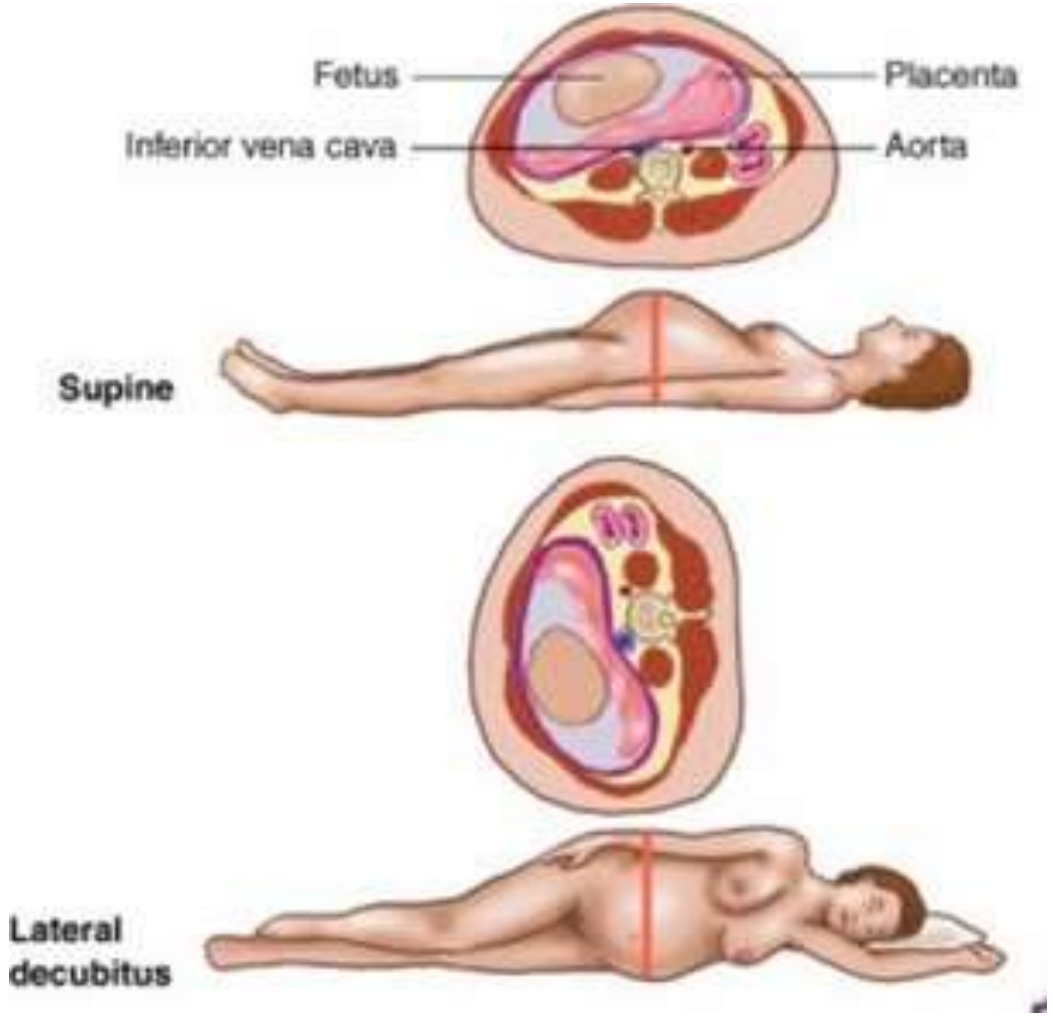
- SAGES – South American Association of Gastro intestinal and Endoscopic Surgeons
- SAGES recommends the guidelines for safe usage of laparoscopic surgery in pregnancy regarding assessment and management.

- PATIENT SELECTION
- When a pregnant patient suffering with pain abdomen is diagnosed to have a pathology and requires surgical intervention, decision has to be made whether the approach is open or laparoscopic depending upon the skills of the surgeon, experience and availability of equipment.
- When possible, surgical intervention should be delayed until the 2nd trimester when the risk of foetal death is least.
- In case of emergency, surgery can be performed in any trimester of pregnancy.

- Obstetrical consultation should be obtained pre operatively and the surgery should be ideally performed in a setting with multidisciplinary support – obstetrician, anaesthetist, paediatrician etc.
- Emergency condition in any trimester of pregnancy can be treated via laparoscopy and pregnancy should not be considered as a contra indication.

- ANAESTHESIA
- The preoperative anaesthetic review should include details related to the pregnancy such as gestational age and pregnancy related comorbidities and routine history taking and airway examination.
- General anaesthesia and endotracheal intubation are essential for a secure airway.
- Aspiration prophylaxis should be administered and a strategy for airway management should be made as the risk of aspiration in pregnancy is high.
- A rapid sequence induction should be considered to minimise the risk of aspiration.

- PATIENT POSITIONING
- Uterus becomes an intra abdominal organ from 18 weeks of gestation.
- Pregnant patients in the first trimester can be placed in the dorsal lithotomy position because of the small size of the uterus.
- Supine position → compression of IVC → ↓ venous return to the heart & cardiac output.
- Reduced cardiac output can cause maternal hypotension and reduced placental perfusion during surgery. Hence, patients are placed in a left lateral decubitus position to relieve the compression on IVC


Fetus
Placenta
Inferior vena cava
Aorta
Supine
Lateral decubitus

- DIAGNOSIS AND IMAGING
- Early diagnosis and intervention in pregnancy is associated with a better prognosis. In pregnant women with abdominal pain, fetal outcome depends on the outcome of the mother.
- The imaging modalities available include usg, CT and MRI.
- Ultrasound imaging is associated with no ionizing radiation exposure and should be the initial imaging test of choice. It is highly sensitive and specific for diagnosis of abdominal pathologies.
- Ionizing radiation exposure to the fetus increases the risk of teratogenesis and childhood leukemia.

- Cumulative radiation dosage should be limited to 50- 100 mGy during pregnancy and a onetime exposure of not more than 50 mGy.
- CT scan is associated with high ionizing radiation exposure and should not be the initial imaging modality except in emergency such as trauma or acute abdominal pain or when MRI is unavailable.
- MR imaging is preferred over CT scan in the diagnosis of pain abdomen in a gravid patient because of it's non ionizing nature.

- Administration of radionucleotides is safe for mother and fetus to apply for diagnostic studies.
- When considered necessary to treat an urgent medical condition, radiopharmaceuticals can be administered at doses providing fetal exposure of <5 mGy and after consultation with a nuclear medicine radiologist.

- ENTRY TECHNIQUES
- 2 methods – open (HASSON) and closed (optical & VERESS)
- Both open and closed techniques can be used for access to abdominal cavity in pregnancy when used appropriately.
- Closed techniques are usually associated with a higher risk of injury to the uterus or intra abdominal organs.
- The chances of injury are reduced if the site of initial access is adjusted according to fundal height and by elevation of abdominal wall during insertion.
- Ultrasound guided placement of trocar can reduce the chances of uterine injury.

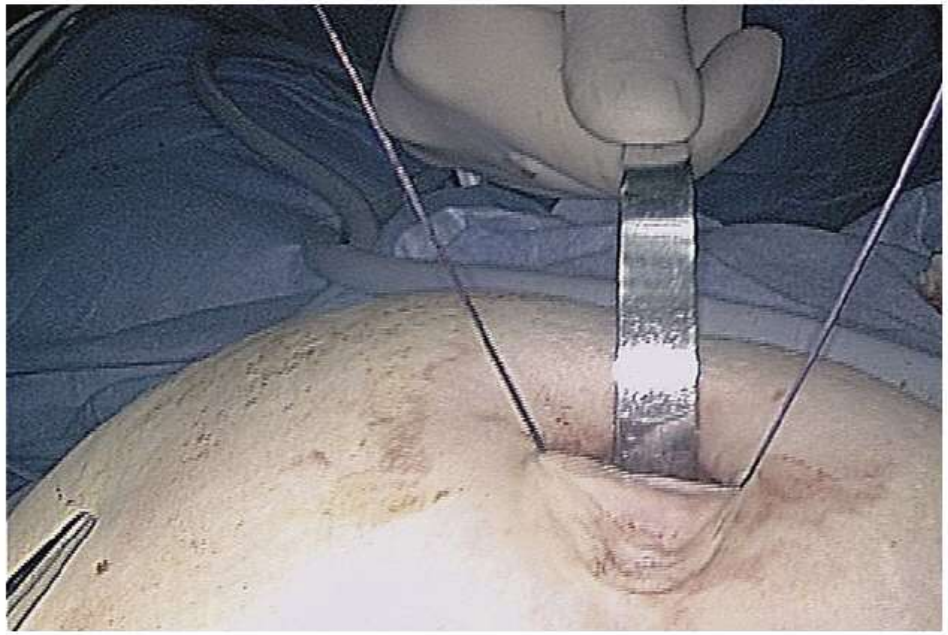


FIG. 112.4 Open laparoscopy technique: The skin and fat can be retracted with small S retractors. The fascia is incised, and a suture is placed at each angle.

FIG. 112.5 The peritoneum is incised, and the peritoneal cavity entered. A blunt-tipped trocar is inserted. The suture is then wrapped around the special grooves of the trocar.

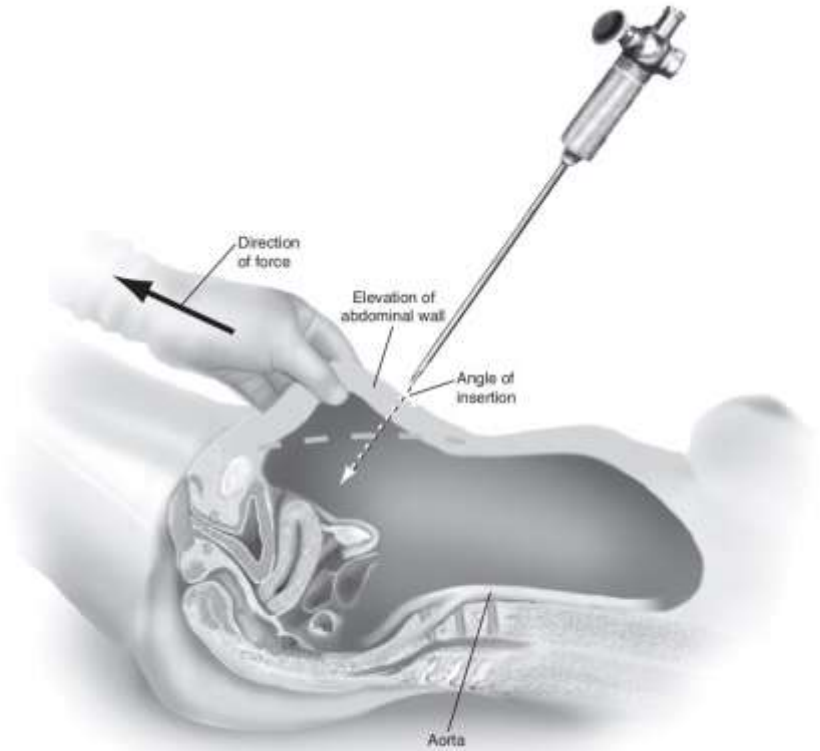


FIG. 112.2 Insertion of the Veress needle should be performed with elevation of the anterior abdominal wall. The angle should be at 45 degrees and in the midline.

- EFECTS OF PNEUMOPERITONEUM
- The respiratory system in pregnancy has a restrictive physiology and pneumoperitoneum created during laparoscopy further exacerbates this condition.
- Intra operative management of pressure in a level of 10 – 15 mm hg can be used safely in pregnancy.

- TROCAR PLACEMENT
- The location of the primary port depends on the level of uterine fundus. The level of fundus and size of uterus is determined by palpation clinically or by ultrasound.
- The primary port location – umbilical/ supra umbilical/ subxiphoid/ palmer's point is chosen by the surgeon according to uterine size, location of pathology and experience.
- Palmer's point – 1-2 cms below the subcostal margin in the left midclavicular line.

- In the late 2nd and 3rd trimesters, palmer's point or a point 3 – 6 cms above the umbilicus in midline is suggested for initial port placement.
- Insertion of orogastric tube for gastric decompression is useful when palmer's point is used for access.

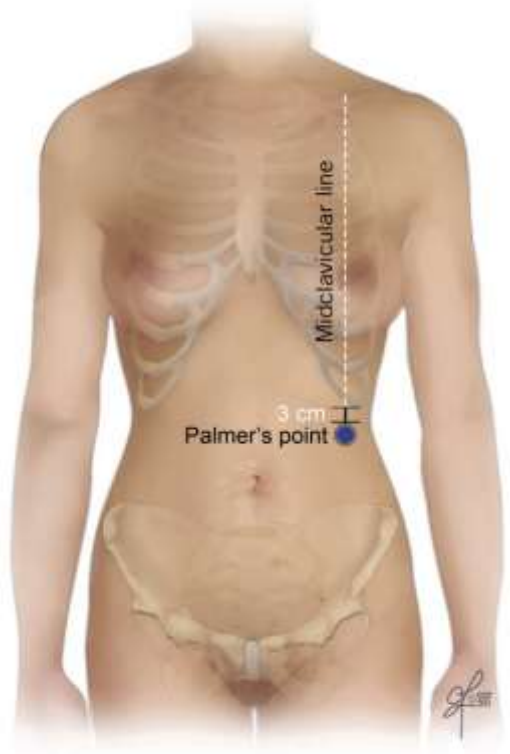


FIG. 112.1 Palmer's point is located 3 cm below the left costal margin at the left midclavicular line. (*Courtesy The Cleveland Clinic.*)

- Secondary port placement depends upon the gestational age of the patient.
- In late pregnancy, secondary port placement should be considered on the same side of pathology as this technique prevents the surgeon from placing and handling the instrument across the pregnant uterus.

- INTRA OPERATIVE MONITORING
- Pneumoperitoneum created in laparoscopy due to co2 is associated with a risk of fetal acidosis with fetal tachycardia, hypertension and hypercapnia.
- EtCo2 monitoring is shown to reflect maternal acid base status adequately and is preferred over the more invasive arterial line monitoring.
- It is adviseable to maintain Etco2 at a level of 28 – 32 mm Hg to prevent respiratory acidosis during laparoscopy.
- Pre operative and post operative fetal heart rate monitoring is necessary to know the status of viable foetus.

- PROPHYLAXIS
- Aspiration prophylaxis – preoperative fasting, antacid administration and airway protection are strategies employed to decrease the risk for aspiration.
- In some situations, administration of a h2 blocker or a gastric motility agent such as metoclopramide should be considered as well.
- Pneumoperitoneum increases the lower extremity venous stasis already present in the gravid patient and pregnancy being a hypercoagulable state increases the chances of DVT.

- Use of pneumatic compression devices both intra operatively and post operatively beyond the first trimester and early ambulation reduce the chances of thromboembolism.
- Unfractionated heparin can be used in patients who require anti coagulation.
- Routine administration of tocolytics is not adviseable and should be considered only when signs of preterm labor are present intra operatively.
- Use of mono polar cautery should be kept to minimum to avoid stimulation of uterus.

COMMON PROCEDURES PERFORMED IN PREGNANCY

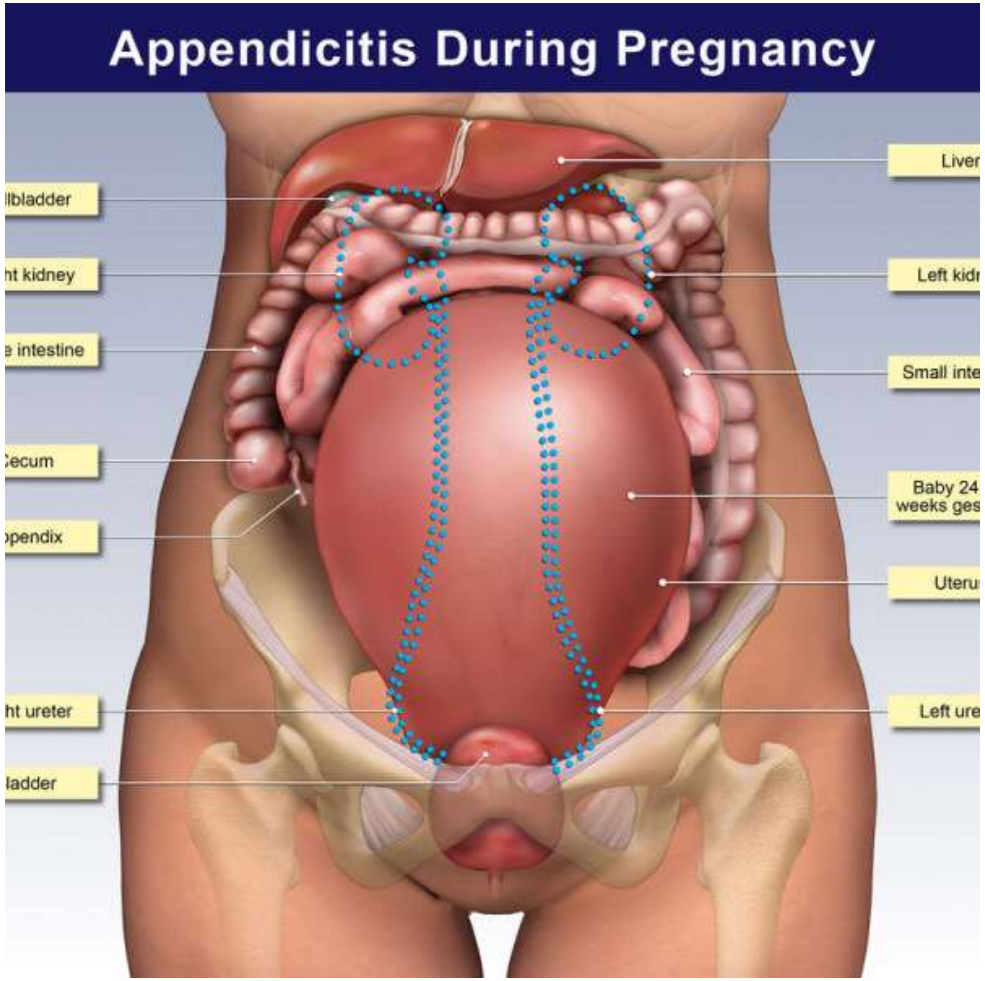
LAPAROSCOPIC APPENDICECTOMY

- Acute appendicitis is the most common cause of nonobstetric acute abdomen during pregnancy, with a reported incidence of 0.05% to 0.1% & lower incidence in third trimester
- However, it has been noted that perforation of the appendix occurs twice as often in the third trimester (69%) compared with the first and second trimester.
- A 66% perforation incidence has been reported where surgery is delayed by more than 24 hours compared with 0% incidence when surgical management is initiated prior to 24 hours after presentation.

Advantages:

1. Laparoscopy can result in less manipulation of the uterus while obtaining optimum exposure of the surgical field and could reduce delays in diagnosis and treatment.
2. It affords easier visualization and treatment of ectopically located appendix or helps in detecting other unexpected sources of pain .

- Position – dorsal lithotomy position in 1st half of pregnancy and left lateral decubitus position in 2nd half of pregnancy.
- Trocar placement – subxiphoid region.


Appendicitis During Pregnancy
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Small inte
Cecum
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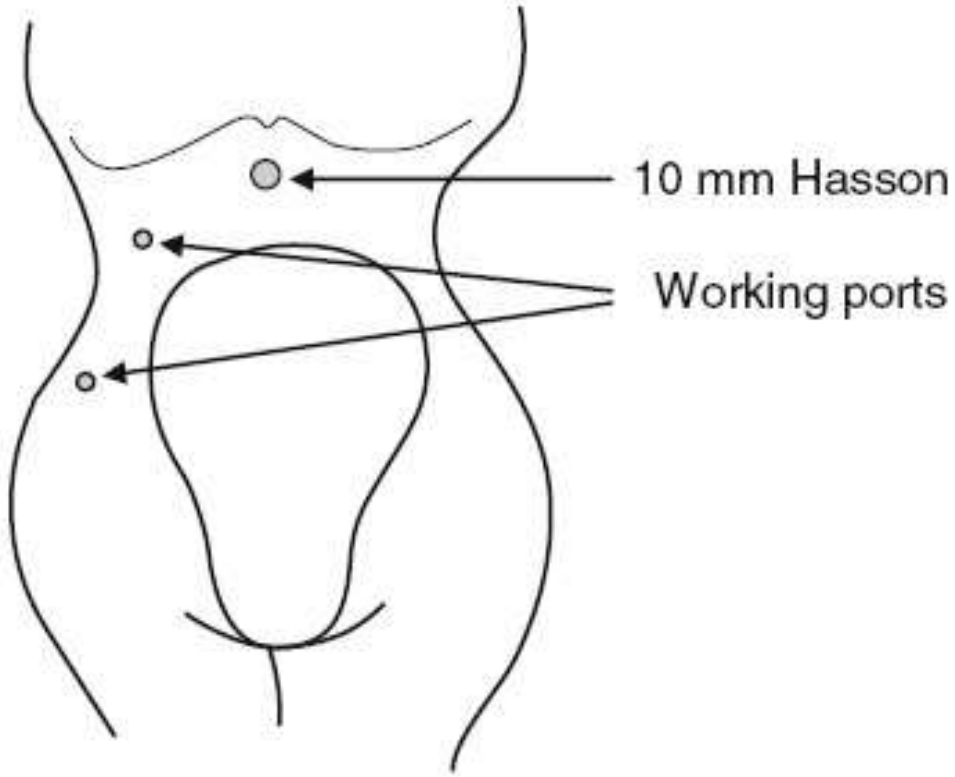
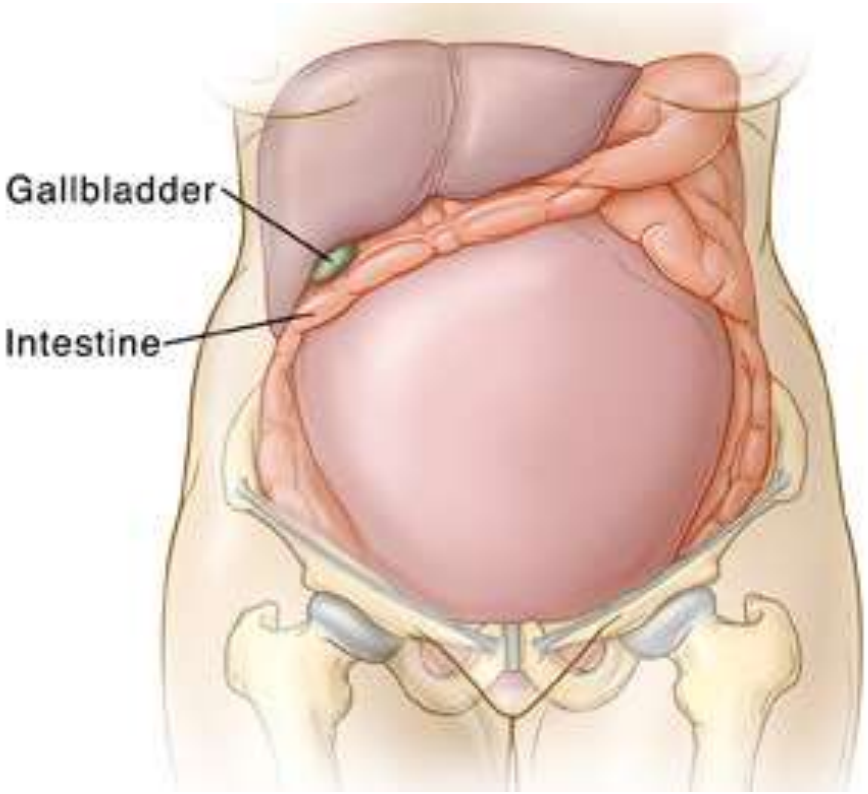

10 mm Hasson
Working ports

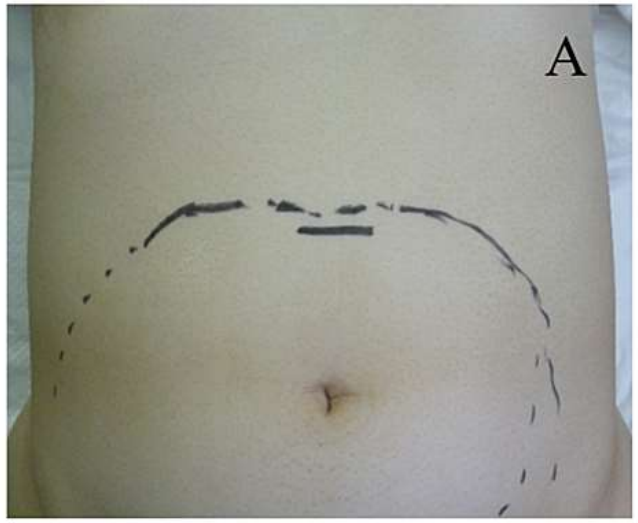
- The working ports are inserted in locations appropriate to the pathology - right upper quadrant and right lower quadrant.
- If the uterus is too large and appendecectomy cannot be performed laparoscopically, then laparoscopic visualisation of the appendix may help determine the best location for the open incision.
- 5 and 10mm laparoscopes are used for operation. Thin laparoscopes measuring 3mm can be used when possible to reduce the risk of injury to the uterus.

BILIARY TRACT DISEASES :

- Cholecystectomy for complications of cholelithiasis is the second most common operative procedure performed in pregnancy.
- Pregnant women are at increased risk for cholelithiasis, which is probably multifactorial.
- Estrogen contributes to increased cholesterol secretion and bile saturation. Progesterone causes smooth muscle relaxation of the gall bladder which leads to reduced gall bladder emptying.
- Biliary stasis along with decreased gallbladder motility can increase gallstone formation.

- Symptomatic Cholelithiasis affects 0.2 -2% of pregnant women with an increased occurence in obesity or increased parity.
- Non surgical management of symptomatic cholelithiasis poses a high risk of recurrence of symptoms.
- Laparoscopic cholecystectomy is found to have low maternal and fetal risks and is the optimal treatment for symptomatic gallbladder disease regardless of the trimester.


Gallbladder
Intestine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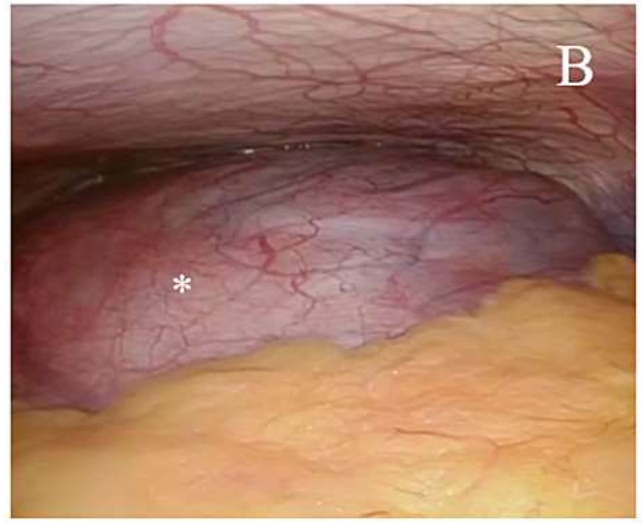
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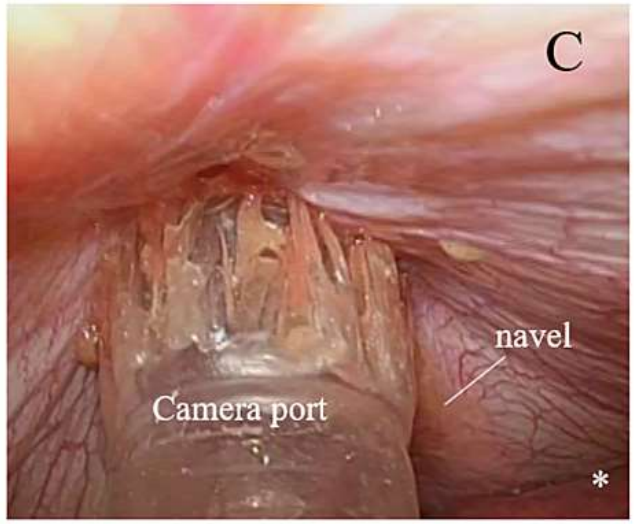
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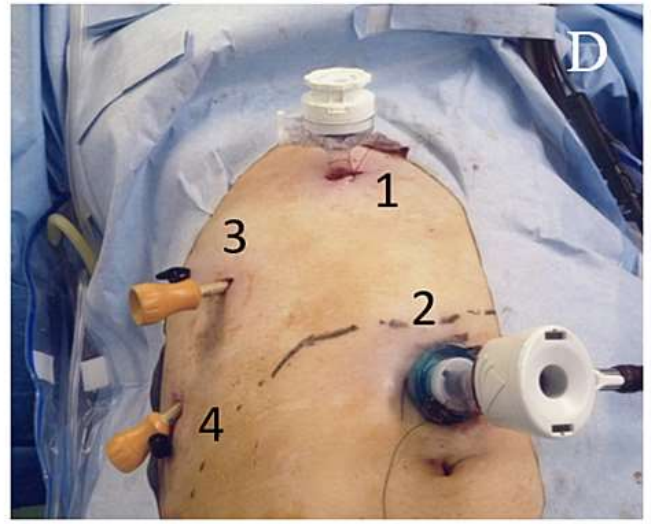
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- Complications associated with choledocholithiasis include acute cholecystitis, cholangitis and gallstone pancreatitis. They pose a significant risk of morbidity and mortality and can result in preterm labor.
- ERCP is safe and effective for choledocholithiasis and indications include complicated choledocholithiasis.
- Fetal radiation exposure during ERCP should be minimized by applying techniques such as lead shielding and minimization of radiation dosage.
- Complications such as cholangitis and pancreatitis are aimed to be treated non surgically.

ADNEXAL MASSES

- The incidence of adnexal masses during pregnancy is 2%
- Most of these adnexal masses discovered during the first trimester are functional cysts that resolve spontaneously by the second trimester .
- 80% to 95% of adnexal masses < 6cm in diameter in pregnant patients spontaneously resolve; therefore non-operative management is warranted in such cases.

ADNEXAL MASSES

- Persistent masses are most commonly functional cysts with very low rates of malignancy or mature cystic teratomas with rates of malignancy reported at 2% to 6% .
- Elective removal of masses is recomended that persist after 16 weeks and are > 6 cm in diameter due to malignant potential and risks
- Close observation in these patients when ultrasound findings are not concerning for malignancy, tumor markers (CA125, LDH) are normal, and the patient is asymptomatic .
- When surgery is indicated, use of laparoscopy in the management of adnexal masses in every trimester .

ADNEXAL TORSION

- *Laparoscopy is recommended for both diagnosis and treatment of adnexal torsion (SAGES Guidelines)*
- 10 to 15% of adnexal masses undergo torsion [207].
- Laparoscopy is the preferred method of both diagnosis and treatment in the gravid patient with adnexal torsion

ADNEXAL TORSION TREATMENT

- If diagnosed before tissue necrosis, adnexal torsion may be managed by simple laparoscopic detorsion .
- With late diagnosis of torsion,adnexal infarction may ensue, which can result in peritonitis, spontaneous abortion, preterm delivery and death .
- The gangrenous adnexa should be completely resected and progesterone therapy initiated after removal of the corpus luteum, if less than 12 weeks gestation .
- Laparotomy may be necessary as dictated by the patient’s clinical condition and operative findings .

- Laparoscopy is safe in all trimesters of pregnancy, more so in second trimester.
- One should be aware of anatomical and physiological changes before attempting laparoscopy in pregnancy.
- Early diagnosis and intervention give good results.
- Laparoscopy has the advantage of early post operative recovery, less pain, small scars and less chances of herniation.
- Hasson's method is preferrable for trocar placement.

- The disadvantages of laparoscopy include injury to intra abdominal organs and uterine perforation. The incidence of these complications are rare in experienced hands.
- Ultrasound is the preferred first line mode of investigation for abdominal pathologies. MRI has to be considered when USG is inconclusive.
- Maximum cumulative ionizing radiation exposure during pregnancy should be limited to 50 - 100mGy during pregnancy.
- Pneumoperitoneum should be limited to 10- 12 mm Hg pressure and PCo2 levels should be maintained at 28 – 32 mm Hg to avoid hypo or hypercapnia.

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THANK YOU