

Role of Laparoscopy in the Management of Acute Abdomen in Pregnancy

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Abstract

Background: Acute abdomens during the pregnancy due to both non-obstetric and obstetric conditions are though rare often results in late diagnosis and complications. Laparoscopic surgery in pregnancy was felt to be more dangerous and, in fact, was contraindicated due to the fear of injuring the pregnant uterus, hypercapnea and impaired fetal outcome. This prospective study is carried out with the objective that with the surgical skills improved in laparoscopy and the availability of high-tech smart instrumentations the laparoscopy shall be a feasible and safe approach for the early diagnosis and management of acute abdomen.

Materials and Methods: All the patients admitted with the non-obstetric acute abdomen are evaluated and subjected to appropriate laparoscopy management. The surgical complications, difficulties, progress of labor and the fetal outcome were studied. Out of 10 patients presented with acute abdomen nine patients were managed by laparoscopy and the outcomes are studied.

Results: Out of 9 patients underwent surgical treatments there were no rate of conversion and difficulty in the procedure encountered. Laparoscopic surgery in pregnant women significantly reduce abdominal scars, days of hospitalization, infectious complications, post-operative pain, use of analgesics, and an early return to the normal life. Early ambulation results in the reduction of the risk of thromboembolic events and atelectasis. Fetal outcome in 8 patients were uneventful except one case with appendicular perforation went for early abortion.

Conclusion: Based on the various published studies and the present study the author recommend that laparoscopy in pregnancy for the management of acute abdomen is a safe procedure, in all trimesters.

Key words: Acute abdomen, Fetal outcome, Hassan technique, Insufflation pressure, Laparoscopy

INTRODUCTION

Non-obstetrical abdominal surgeries during pregnancy for the acute abdomen are carried out approximately 1 in 500 - 1 in 635 women.^{1,2} Appendicitis is the most common non obstetrical acute abdomen occurring during pregnancy. Other conditions are acute cholecystitis, small bowel obstruction, ovarian cyst with or without torsion, obstructed hernias, abdominal pregnancy, splenic disorders

etc. Laparoscopy has become increasingly popular in the treatment and evaluation of acute abdomen.

When surgical management carried out through laparoscopy during pregnancy it helps the women to get cosmetic scar, lesser days of hospitalization, much reduced surgical site infection (SSI), reduced post-operative pain resulting in reduced usage of analgesics and enable the patient to get back to normal life early. Laparoscopy minimizes adhesions and possible intestinal obstruction. Early ambulation results in the reduction of the risk of events and atelectasis.

In acute abdomen during pregnancy, it is much difficult to make correct diagnosis. The symptoms and signs of acute abdomen can present physiologically in normal pregnant women. The nausea and vomiting are frequent.

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Leukocytosis, low grade pyrexia, hypotension, anorexia can occur in normal pregnancy and will not arouse the suspicion of acute abdomen. The site of pain will not correspond to the normal anatomical site as the pregnancy progresses the uterus enlarges and moves cephaloid, hence push and alter the anatomical position of the viscera. Clearly, these changes can alter the clinical picture.³

The potential possibility of trocar induced injury to the enlarged gravid uterus can be prevented by Hasson technique, an open approach to enter the peritoneum. CO₂ pneumoperitoneum can produce hypercapnia and it is a potential hazard to the fetus. Keeping the insufflations pressure lower than 12 mmHg, monitoring the end tidal CO₂ to be below 35 mmHg by hyperventilation of the mother and continuous PO₂ saturation measurement can avoid the potential hazards of hypercapnia.^{4,5}

In the past, pregnancy was considered a contraindication for laparoscopy. However, in this modern era multiple reports recommend the successful use of diagnostic and therapeutic laparoscopy during pregnancy. Though the procedure is performed as late as at 34 weeks of gestation, the optimal time is the early second trimester.

In this study, pregnant women with various acute abdomen conditions were managed by laparoscopy. The post-operative period progression of labor and fetal outcome is correlated. The study also postulates the various precautionary measures and modifications for each condition.

Based on the various published studies and this study the author recommends that laparoscopy during pregnancy is a safe procedure, in all trimesters.

MATERIALS AND METHODS

This prospective study of laparoscopic surgery for non-obstetric causes during pregnancy presenting as acute abdomen are carried out in Annammal Hospital from January 2013 to January 2015.

Inclusion Criteria

All the pregnant women with normal viable gestation attending the hospital with acute pain abdomen are evaluated with basic diagnostic criteria protocol and patient requiring surgical intervention irrespective of gestational age are included in this study.

Ethical Aspects

The study proposal was approved by the Ethical Committee of our institution. All participants were provided and obtained written informed consent after explaining all the features of the study.

Procedure

Totally 10 cases of the acute abdomen during pregnancy underwent operative management. Nine were by laparoscopy and one by an open method. Nine cases were in second-trimester gestation and one in the first trimester. The results of the study were studied using simple statistical analysis.

The etiology for the acute abdomen, gestational age of occurrence, the modality of management, the progression of labor, mode of delivery and fetal outcome are measured and tabulated in Table 1.

RESULTS

Nine out of ten patients had laparoscopic management and one by the open method. No surgical complications were encountered. One case with appendicular perforation and local peritonitis at the first-trimester pregnancy operated by laparoscopy resulted with abortion in the following week.

All the other nine cases were followed up till term and normally delivered. All the babies delivered by both caesarean and assisted labor had good Apgar and no adverse events in the neonatal period. In the post-operative period, the entire patient treated with laparoscopy had shown significant early ambulation, lesser pain, and good wound healing with no SSI. All patients had a smooth recovery and uneventful post-operative period.

Table 1: Case details and management outcome

Pathology	Number of patients	Mean gestational age	Nature of treatment	Mode of delivery	Baby outcome
Acute appendicitis	4	18 weeks	Laparoscopic appendectomy	Caesarian	Normal
Appendicular perforation	1	8 weeks	Laparoscopic appendectomy	Abortion	Applicable
Ovarian cyst torsion	3	21 weeks	Laparoscopic cystectomy	Caesarian 2 full term normal delivery - 1	Normal
Acute cholecystitis	1	20 weeks	Laparoscopic cholecystectomy	Full term normal delivery	Normal
Umbilical hernia/obstructed	1	23 weeks	Hernioplasty	Caesarian	Normal
Total	10				

DISCUSSION

Acute Abdomen

The acute abdomen is defined by Stedman's medical dictionary, 27th edition, as "any serious acute intra-abdominal condition presenting with pain, tenderness, vomiting and muscular rigidity, and requiring emergency surgical intervention." Though all the known causes of the acute abdomen can occur with pregnancy, certain clinical conditions are more likely to occur in pregnancy.

The approach to pregnant patients with severe abdominal pain is very similar to that for non-pregnant patients with acute abdomen. However, the physiological symptoms and signs of pregnancy can mimic like symptoms and signs pertinent to acute abdomen such as nausea, vomiting, leukocytosis, mild pyrexia, hypotension, and anorexia. A structured approach in history taking and meticulous clinical examination are mandatory.

The acute abdomen can be due to non-pregnancy related and also pregnancy related. The causes are tabulated in Tables 2 and 3.

Incidence

During pregnancy incidence of non-obstetric surgeries varies from 1.5% to 2%. The common presentations can be seen in Table 4.

Safety

After 1990, the laparoscopic modality for surgical management became much popular in Gynecology. However, the safety and feasibility of laparoscopy during pregnancy often evolved much debate and controversy. Though elective surgeries are preferred for laparoscopy for an emergency, it is used with caution.

Table 2: Non-pregnancy-associated causes of acute abdominal pain

Non-pregnancy-associated causes of acute abdominal pain	
Intra-abdominal	Extra-abdominal
• Appendicitis	• Sickle-cell crises
• Cholecystitis	• Cardiac pain
• Pancreatitis	• Lower lobe pneumonia
• Adnexal masses	• Referred pleuritic pain from pulmonary embolism
• Intestinal obstruction	• Psychological disturbance
• Inflammatory bowel disease	
• Urinal tract infections	
• Renal calculi	
• Trauma	
• Splenic artery aneurysms	
• Hernia	
• Meckel diverticulum	

Potential concerns include:

- Pneumoperitoneum induced rise in intra-abdominal pressure may induce fetal hypoxia by decreasing uteroplacental blood circulation.
- Absorption of carbon dioxide can lead to fetal acidosis.
- Premature rupture of membrane and preterm delivery can happen during uterine manipulations or iatrogenic uterine perforation.
- Using trocar or veress needle can directly injure the fetus inside the uterus.

Corneille *et al.* concluded with their study carried out with 94 patients and reported there is no difference between laparoscopic or open approach for appendicitis and cholecystitis in terms of safety during pregnancy. However, both laparoscopy and open surgeries during pregnancy will have perinatal complications.⁶

Reedy *et al.* in their retrospective study on the safety of laparoscopy surgeries on pregnant women, concluded after comparing 2181 laparoscopy procedures done on pregnant women (<20 weeks gestation) with 1552 open procedures on pregnant women (<20 weeks) there is no difference among two group on birth weight, gestational duration, congenital malformation or growth potential.⁷

Table 3: Pregnancy related acute abdomen

Pregnancy related acute abdomen	
1 st trimester of pregnancy	Late 2 nd and 3 rd trimester of pregnancy
<ul style="list-style-type: none"> • Abortion • Trophoblastic disease • Ectopic pregnancy • Ovarian cysts • Fibroid degeneration • Amniocentesis complications • Acute fatty liver of pregnancy • Rupture of rectus abdominis • Torsion of uterus • Septic abortion with peritonitis 	<ul style="list-style-type: none"> • Abruptio placentaee • Uterus rupture • Fibroid degeneration • Liver pain due to Glinsson's membrane • Distension (HELLP syndrome) • Symphysiolysis • Lumbar pain • Placenta percreta

Table 4: The rate of incidence of non-obstetric surgeries during pregnancy

Indications	Incidence
Appendicitis	1:1500 pregnancies
Cholecystitis	1:1500-1:10,000 pregnancies
Bowel obstruction	1:1500-1:3500 pregnancies
Adnexal torsion	1:3000-1:4000 pregnancies
Cervical disease	1:3000-1:5000 pregnancies
Trauma	Variable (trauma complicates 4-8% of all pregnancies, but the incidence of severe, life-threatening trauma possibly requiring surgery is 0.3-0.4%)

Jung *et al.* recommended in obese pregnant women appendicitis laparoscopy approach is much preferred. He also suggested using direct approach using Hassan technique or optical trocar and choosing the port site according to fundal height safety is ensured.

In pregnancy, diaphragm is displaced upwardly by the growing fetus, which results in decreased residual lung volume and functional residual capacity. Pneumoperitoneum cause upward displacement of the diaphragm resulting in restrictive pulmonary physiology. Intra-abdominal insufflation pressure is maintained at <12 mmHg to avoid worsening pulmonary physiology in gravid women.

Indications

The indications for the laparoscopic management of acute abdomen during pregnancy are same as non-pregnant women. Whenever, the clinical presentations warrants acute interventions laparoscopy can be performed depending upon the skills and optimum training of the surgeon and the team.

Timing

During pregnancy in all trimesters, the laparoscopy procedures can be carried out. However, due to the fear of teratogenicity, due to drugs in the first trimester and difficult ergonomics, due to an enlarged uterus, the optimal time to operate shall be early second trimester. In the event of a direct threat to the mother or the fetus, surgical intervention should be conducted regardless of gestational age.

Thromboprophylaxis

Pregnancy promotes hyper-coagulable state and hence warrants thromboprophylaxis. Laparoscopy surgery takes more operating time resulting in prolonged duration of immobilization and hence will promote thrombosis. The use of pneumoperitoneum and reverse trendelenberg position will also promote venous stasis inducing thrombosis. Hence, thromboprophylaxis is useful in all surgeries during pregnancy. Pneumatic compression devices indicated for all women undergoing surgery during pregnancy. Pharmacologic thrombo-prophylaxis should be individualized based on additional risk factors for venous thromboembolism length of procedure and scope of the procedure.⁸

Prophylactic Tocolysis

Tocolytics should not be used prophylactically in pregnant women undergoing surgery. However, peri operatively when signs of preterm labor are present, better to use tocolytics. The use of monopolar electrocautery must be avoided in order to minimize the uterine contractility. The glucocorticoids are also not indicated for surgery during pregnancy.

The specific agent and indications for the use of tocolytics should be individualized and based on the recommendation of an obstetrician.⁹

Patient Position

Both lithotomy and supine positions can be used. However, it is preferred to have left ward to avoid potential compression to abdominal vessels.

Appendicitis in Pregnancy

Acute appendicitis occurs at the frequency of 1/600-1/1000 pregnancies and it is the most common acute abdomen during pregnancy. Physiological leukocytosis, anatomic changes due to enlarged uterus associated nausea and vomiting results in the delay for the diagnosis of appendicitis.¹⁰

Abbasi *et al.* in their study in 2014 have proved appendiceal rupture occurs more frequently during third-trimester pregnancy due to delay in diagnosis and treatment.¹¹

Andersen and Nielsen in their epidemiological study in 2001 with 53,000 women undergoing appendectomy stated in the age-matched study pregnant women are less likely to develop appendicitis than the non-pregnant women and in pregnancy it is more common in second trimester.¹² The incidence of appendicitis was slightly higher in the second trimester.

Zingone *et al.* through their cohort study of over 350,000 pregnancies reported during antepartum period incidence of appendicitis is lowered by 35% and it is least common during the third trimester of antepartum period and in elderly patients.¹³

Pregnancy does not affect the overall incidence of appendicitis, but the severity may be increased in pregnancy. During pregnancy, appendicitis may present with perforation in 25% of patient. If surgery delay occurs more than 24 h the incidence of perforation increases to 66%. Appendicitis seems to be more common in the second trimester. The perforation results in high incidence of a fetal loss and maternal morbidity. Even if on surgery appendix is found to be normal, it is better to remove appendix as:

1. Though the appendix is grossly normal early disease may still present
2. Right iliac fossa pain will produce diagnostic dilemma.

The various symptoms and signs with which appendicitis can present are tabulated Table 5.

Right lower quadrant pain close to McBurney's point is the most common symptom of appendicitis, irrespective of the

gestational age.¹⁴ During third trimester, due to the enlarged uterus the pain may shift upwards in the hypochondrium.¹⁵

Laboratory: Leukocytosis (white cells >10,000 cells/ μ L) and left shift in the differential count is the feature of appendicitis. Mild leukocytosis can normally present in pregnant women: Mourad *et al.* in their retrospective study on 66993 deliveries, including 67 pregnancy with appendicitis, analyzed the leukocyte count in both pregnant women with and without appendicitis stated mean leucocyte count on patient with appendicitis were 16400 cells/ml and women having normal appendix 14000 cells/ml.¹⁶

Microscopic hematuria and pyuria may occur when the inflamed appendix is close to the bladder or ureter. Mild elevations in serum bilirubin (total bilirubin >1.0 mg/dL) have been described as a marker for appendiceal perforation (sensitivity 70% and specificity 86%). An elevated C - reactive protein level occurs in appendicitis, but is a nonspecific sign of inflammation.

Magnetic resonance imaging is ideal for excluding acute appendicitis during pregnancy when clinical, and ultrasound examinations are inconclusive.¹⁷ A meta-analysis evaluating magnetic resonance imaging in pregnant women with suspected appendicitis included six studies of 12-148 patients of whom 2-14 patients subsequently had confirmed acute appendicitis.¹⁸

Surgical approach: When the diagnosis is relatively certain, both open and a laparoscopic appendectomy are considered. No randomized trials have been performed to suggest that one technique is better than another, and the choice of technique should be based on the surgeon's experience level.

Laparoscopic appendectomy: Laparoscopy can be performed successfully during all trimesters but for the uterine volume in the last trimester that could interfere with the visualization and laparoscopic instrumentation.

Procedure

Preferred adoption for safe appendicectomy are:

- Using open Hassan technique or optic port

Table 5: Symptoms and signs of appendicitis

Symptoms (%)	Signs (%)
• Abdominal pain: 96	• Right lower quadrant tenderness: 85
• Right lower quadrant: 75	• Rebound tenderness: 80
• Right upper quadrant: 20	• Abdominal guarding: 50
• Nausea: 85	• Rectal tenderness: 45
• Vomiting: 70	• Right upper quadrant tenderness: 20
• Anorexia: 65	• Temperature >37.8°C (100°F): 20
• Dysuria: 8	

- Left lateral positioning of the patient to avoid abdominal vessel compression
- Not to use any cervical instruments,
- Insufflation pressures not more than 10-12 mm Hg
- Port position as per fundal height as depicted in Figure 1.

Wilasrusmee *et al.* in 2012 stated the risk of fetal loss was greater for laparoscopic appendicectomy versus open appendicectomy in pregnant women.¹⁹ In 2014 Walker *et al.* stated laparoscopic appendectomy during pregnancy may be associated with higher rates of fetal loss. However, it is a low-grade evidence and not strong enough to determine the modality of appendectomy in pregnant women.²⁰

In our study, use of laparoscopy is safe, provided adequate monitoring done and no overt signs of preterm labor present. Laparoscopy offers optimal visualization and early recovery. We use slightly lower intra-abdominal pressures of 10-12 mmHg (which provides excellent visualization), an open entry technique, and directly visualized trocar insertion.

Cholecystitis in Pregnancy

Gallstones are more common during pregnancy due to decreased gallbladder motility and increased cholesterol saturation of bile. Cholecystitis can occur due to gallstones (up to 90% of the cases of cholecystitis in pregnancy).²¹

The major independent risk factor for gallstones is pre-pregnancy obesity. Gallstones are prevalent more in multiparous women than nulliparous and in fatty women of more than 40 years old.

Acute cholecystitis: Definitive, prompt surgical therapy is required for any patient with cholecystitis and signs of sepsis, suspected gangrene, or perforation. Even in the

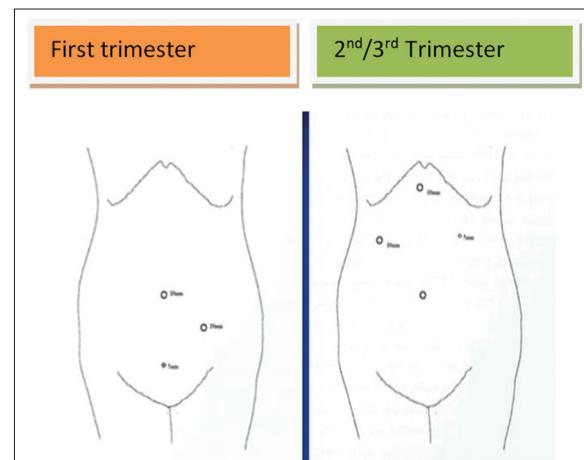


Figure 1: Port positioning in the 1st and 2nd - 3rd trimester

absence of indications for urgent or emergent surgery, pregnant women with acute cholecystitis should undergo cholecystectomy. Although symptoms of cholecystitis may abate within 7-10 days of initiating supportive care, there is a high risk of recurrence or serious complications.

Studies comparing conservative and surgical management of cholecystitis revealed the incidence of preterm delivery (3.5 vs. 6.0%) and fetal mortality (2.2% vs. 1.2%). It is ironical to note medical treatment not only fails often, but also it will reoccur in 92% of patients in the first trimester, 64% at the second trimester and 44% in the third trimester. Surgery is best. A study reports when cholecystitis is managed by surgery incidence of fatal mortality is only 2.6%. However, on conservative management it is 8.0%.²²

Cholecystectomy during pregnancy: With appropriate attention to the altered anatomy and physiology of pregnancy, laparoscopic cholecystectomy can be done safely.²³

Silvestri *et al.* in a review of data from the American College of Surgeons database from 2005 to 2009, stated pregnancy do not increase post-operative morbidity for cholecystectomy. Composite 30 days major morbidity was similar after cholecystectomy between pregnant and non-pregnant women at 1.8%.²⁴

Enlarged uterus and relatively smaller abdominal cavity result in difficulties in doing lap cholecystectomy during advanced gestation. Insertion of the trocar under vision or sonographic guidance is preferred. As high intra-abdominal pressure will decrease venous return and cardiac output, resulting in the reduction of uteroplacental blood perfusion the insufflations pressure must be kept 10-12 mm of Hg. Trendelberg position and operating table left tilt to avoid caval compression can minimize the risk of this complication. The first port entry is adjusted according to the fundal height as per Figure 2.

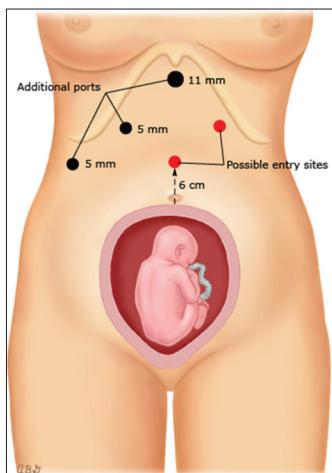


Figure 2: Port sites as per fundal height

Adnexal Masses Complications in Pregnancy

Adnexal masses are common but asymptomatic in most of the time²⁵ and may occur from 1 in 81 to 1 in 1000.²⁵ Cystic masses detected during early pregnancy disappear within the first trimester.

Common causes for adnexal mass are persistent corpus luteal functional cysts, benign dermoid cysts, and serous or mucinous cystadenomas. If the mass is more than 6 cm and or torsion happen laparoscopy cystectomy is done. If the mass is solid, has surface excrescences, is associated with ascites, or has other features suggesting malignancy, then bilateral salpingo-oophorectomy is appropriate. Contra lateral ovary should not be resected unless bilateral disease is identified.²⁶

Pregnancy predisposes to adnexal torsion. 20% of adnexal torsions occur during pregnancy. The adnexal torsion is a serious condition.²⁷ Dermoid ovary often ends in torsion, more so on the right side especially in the third trimester. The surgery must be performed as soon as possible having in mind the necessity to save as much more ovarian tissue as possible, however, in cases of ovarian necrosis the only option is salpingo-oophorectomy.

Mathevet *et al.* in their review of 47 patients who had laparoscopic ovarian cystectomy one pregnancy loss occurred 4 days after the procedure, suggesting that the laparoscopic approach remains a safe option even in pregnancy.²⁸

In our study, three patients with ovarian cyst underwent laparoscopy surgery. Two of them are dermoid and one mucinous cyst. All in the second trimester and post-surgical period were uneventful.

CONCLUSION

Based on our experience and the literature review we conclude that laparoscopy is both, a safe and a better outcome promising procedure in pregnancy. Laparoscopy is the surgical method of the future, and it is a feasible, safe and advantageous surgery in pregnancy provided that we follow long established and proven principals of good surgery. These include early diagnosis and treatment, a multidisciplinary assessment and approach, avoidance of unnecessary trauma, strict asepsis, and hemostasis.

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