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Original Research

Clinical Profile, Surgical Management, and Maternal-Fetal Outcomes of Acute Surgical Abdomen During Pregnancy: A Prospective Observational Study.

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Abstract

Background: Acute surgical abdomen during pregnancy creates diagnostic and therapeutic difficulty because physiological changes alter clinical findings, while delayed intervention can increase maternal and fetal morbidity. **Objectives:** To describe the clinical profile, surgical management, and maternal-fetal outcomes of pregnant women undergoing surgery for acute abdominal conditions and to identify factors associated with adverse outcomes. **Methods:** This prospective observational study included 80 pregnant women who underwent surgery for acute surgical abdomen at Mamata Academy of Medical Sciences, Bachupally, Telangana, India, from April to November 2023. Maternal characteristics, presenting features, diagnosis, operative approach, postoperative complications, pregnancy outcomes, and neonatal outcomes were recorded. Associations with a composite adverse maternal-fetal outcome were assessed using odds ratios with 95% confidence intervals. **Results:** The mean maternal age was 27.8 ± 4.7 years, and the mean gestational age at surgery was 23.1 ± 8.2 weeks. Acute appendicitis was the leading diagnosis (40.0%), followed by acute cholecystitis or complicated gallstone disease (22.5%). Surgery was performed within 24 hours in 82.5% of women; 46.3% underwent completed laparoscopic procedures. Postoperative complications occurred in 22.5%, intensive care was required in 10.0%, and no maternal deaths occurred. Five pregnancies ended in fetal loss. Among 75 live births, 22.7% were preterm, 24.0% had low birth weight, and 18.7% required neonatal intensive care. Delayed surgery, advanced intra-abdominal pathology, and open surgery were associated with adverse outcomes. **Conclusion:** Prompt diagnosis and coordinated surgical-obstetric care produced favorable maternal survival. Delayed intervention and severe intra-abdominal disease were the principal markers of poorer maternal-fetal outcomes.

Keywords: Acute abdomen; pregnancy; non-obstetric surgery; laparoscopy; maternal outcome; fetal outcome.

Introduction

Acute abdominal pain during pregnancy presents a distinctive clinical challenge because normal gestational changes can obscure classical symptoms and signs. Displacement of abdominal viscera by the enlarging uterus, physiological leukocytosis, altered gastrointestinal motility, and pregnancy-related nausea can reduce the diagnostic specificity of history, examination, and laboratory findings. At the same time, clinicians must evaluate two interdependent patients and balance the consequences of diagnostic imaging, anaesthesia, and surgery against the risks of untreated maternal disease. Professional guidance emphasizes that medically necessary surgery should not be postponed solely because of pregnancy and recommends multidisciplinary assessment involving surgical, obstetric, anaesthetic, and neonatal teams.¹

Non-obstetric surgery is required in approximately 1%-2% of pregnancies, although estimates vary according to the population and procedures considered. A systematic review reported that maternal mortality following such interventions is uncommon, but miscarriage, preterm labour, and fetal loss remain important concerns, particularly when the underlying disease is advanced.² Large population-based studies have also shown higher relative risks of preterm delivery, low birth weight, caesarean delivery, and prolonged hospitalization after non-obstetric surgery, while emphasizing that the attributable risk for an individual operation is generally low.³ These outcomes reflect the combined influence of the primary surgical condition, systemic inflammation, gestational age, urgency of intervention, anaesthetic exposure, and perioperative complications.

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Maintenance of maternal oxygenation, haemodynamic stability, and uteroplacental perfusion forms the basis of perioperative fetal protection. Contemporary anaesthetic reviews indicate that no currently used anaesthetic agent has been established as a human teratogen at standard clinical concentrations; however, hypotension, hypoxaemia, hypercarbia, and prolonged operative exposure require careful prevention.^{4,5} Laparoscopy has become an accepted option during pregnancy when performed by experienced teams with gestation-appropriate port placement, controlled insufflation pressure, maternal positioning, and fetal assessment. Surgical guidelines support ultrasonography as the initial imaging method and magnetic resonance imaging when ultrasonography is inconclusive, while ionizing imaging should be used only when its diagnostic benefit outweighs potential risk.^{6,7}

Acute appendicitis is consistently reported as the most frequent non-obstetric abdominal surgical emergency in pregnancy, followed by symptomatic biliary disease, intestinal obstruction, and adnexal torsion.⁸ Diagnostic delay in appendicitis can permit perforation and peritonitis, which worsen obstetric outcomes. For gallstone-related disease, laparoscopic cholecystectomy has been associated with fewer maternal, fetal, and surgical complications than open surgery in comparative evidence.⁹ Observational studies further suggest that laparoscopic management is feasible across all trimesters in appropriately selected women.¹⁰

The present study was undertaken to describe the demographic and obstetric characteristics, clinical presentation, diagnostic profile, operative management, maternal postoperative complications, and fetal and neonatal outcomes of women presenting with acute surgical abdomen during pregnancy. It also aimed to examine whether delayed surgery, advanced intra-abdominal pathology, operative approach, and trimester at surgery were associated with a composite adverse maternal-fetal outcome.

METHODOLOGY

Study design and setting: This prospective observational study was conducted in the Departments of General Surgery and Obstetrics and Gynaecology at Mamata Academy of Medical Sciences and Hospital, Bachupally, Telangana, India, from April to November 2023. The institution is a tertiary teaching hospital providing emergency surgery, obstetric care, anaesthesia, intensive care, radiology, and neonatal services.

Study participants: Pregnant women of any gestational age who presented with acute surgical abdomen, required operative treatment after multidisciplinary evaluation, and provided informed consent were enrolled consecutively. Acute surgical abdomen was defined as an acute intra-abdominal condition requiring urgent or emergency surgical assessment and operative management. Women with pain attributable solely to obstetric causes, those managed without surgery, those declining participation, and those without adequate maternal or pregnancy follow-up were excluded. Gestational age was determined from the last menstrual period and confirmed by available ultrasonographic records.

Clinical and diagnostic assessment: Each participant underwent structured history-taking and examination, including maternal age, parity, trimester, obstetric history, comorbidities, symptoms, vital signs, abdominal findings, and relevant laboratory investigations. Obstetric assessment documented fetal viability and gestational status. Ultrasonography was the first-line imaging investigation. Magnetic resonance imaging was used when ultrasonography was inconclusive. Additional limited radiological imaging was undertaken only after multidisciplinary risk-benefit assessment, consistent with published surgical guidance.^{6,7}

Surgical and perioperative management: The decision and timing of surgery were determined jointly by the surgeon, obstetrician, and anaesthesiologist. Procedures were classified as emergency surgery or urgent surgery following stabilization. Operative approach, conversion, anaesthetic technique, operative duration, estimated blood loss, intraoperative pathology, transfusion, and postoperative intensive-care requirement were recorded. Laparoscopic access, trocar position, pneumoperitoneum, maternal positioning, and fetal evaluation were adapted to gestational age and clinical condition. Standard perioperative antibiotics, thromboprophylaxis, analgesia, and obstetric surveillance were provided according to institutional practice.

Outcome assessment: Maternal outcomes included postoperative complications, reoperation, intensive-care admission, hospital stay, and mortality. Obstetric and neonatal outcomes included uterine contractions, tocolysis, miscarriage, intrauterine fetal death, gestational age and mode of delivery, birth weight, Apgar score, neonatal intensive-care admission, neonatal death, and major congenital anomaly. Participants were followed through delivery and neonatal hospital discharge. A composite adverse maternal-fetal outcome comprised a major maternal postoperative complication, pregnancy loss, preterm birth, or neonatal death.

Statistical analysis: Continuous variables were summarized as mean $\pm$ standard deviation or median with interquartile range. Categorical variables were expressed as frequencies and percentages. Associations with the composite outcome were estimated using odds ratios and 95% confidence intervals. The chi-square test or Fisher's exact test was used for categorical comparisons. A two-sided p value <0.05 indicated statistical significance. [Insert the statistical software and version used in the original analysis.]

Ethical considerations: Necessary Permissions were obtained before starting the study. Written informed consent was obtained from every participant, and confidentiality was maintained.

Results

Participant recruitment and baseline characteristics

During the study period, 86 pregnant women presenting with acute surgical abdomen were assessed for eligibility. Six women were excluded: three improved with conservative management and did not require surgery, two declined participation, and one was lost to follow-up. The remaining 80 women underwent surgical intervention and were included in the final analysis. Complete maternal, obstetric, and neonatal outcome data were available for all participants.

The mean maternal age was 27.8 ± 4.7 years, and the mean gestational age at surgery was 23.1 ± 8.2 weeks. Most procedures were performed during the second trimester. Abdominal pain was present in all participants, followed by vomiting, guarding or rebound tenderness, and fever. The baseline maternal, obstetric, and clinical characteristics are presented in Table 1.

Table 1. Maternal, obstetric, and clinical characteristics of the study population

Characteristic	Value
Total participants	80
Maternal age, years, mean $\pm$ SD	27.8 ± 4.7
Gestational age at surgery, weeks, mean $\pm$ SD	23.1 ± 8.2
Primigravidae	35 (43.8%)
Multigravidae	45 (56.3%)
First-trimester surgery	15 (18.8%)
Second-trimester surgery	41 (51.3%)
Third-trimester surgery	24 (30.0%)
Previous miscarriage	11 (13.8%)
Previous caesarean delivery	16 (20.0%)
Anaemia	22 (27.5%)
Hypertensive disorder of pregnancy	7 (8.8%)

Gestational or pre-existing diabetes	5 (6.3%)
Abdominal pain	80 (100.0%)
Vomiting	52 (65.0%)
Fever	25 (31.3%)
Guarding or rebound tenderness	26 (32.5%)
Tachycardia	19 (23.8%)
Abdominal distension	15 (18.8%)
Constipation or obstipation	12 (15.0%)
Leukocytosis	51 (63.8%)

Diagnostic profile and surgical management

Ultrasonography established or strongly suggested the diagnosis in 61 women (76.3%). Magnetic resonance imaging was required in 13 cases (16.3%), while six women (7.5%) underwent additional limited radiological evaluation after multidisciplinary assessment. Acute appendicitis was the most frequent diagnosis, accounting for 32 cases (40.0%), followed by acute cholecystitis or complicated gallstone disease in 18 cases (22.5%). Emergency surgery was undertaken in 72 women (90.0%), and 66 participants (82.5%) underwent surgery within 24 hours of hospital admission. Laparoscopic surgery was successfully completed in 37 women (46.3%), whereas 43 (53.8%) underwent an open procedure. Diagnostic and perioperative details are summarized in Table 2.

Table 2. Final diagnosis and surgical management

Variable	Value
Final diagnosis	
Acute appendicitis	32 (40.0%)
Acute cholecystitis or complicated gallstone disease	18 (22.5%)
Intestinal obstruction	10 (12.5%)
Adnexal torsion	8 (10.0%)
Hollow-viscus perforation	5 (6.3%)
Obstructed or incarcerated hernia	4 (5.0%)
Other surgical emergencies	3 (3.8%)
Surgical and perioperative characteristics	
Emergency surgery	72 (90.0%)
Urgent surgery after stabilization	8 (10.0%)
Surgery within 24 hours of admission	66 (82.5%)
Surgery after more than 24 hours	14 (17.5%)
Laparoscopic procedure completed	37 (46.3%)
Open surgical procedure	43 (53.8%)
Conversion from laparoscopy to open surgery	3 (3.8%)
General anaesthesia	75 (93.8%)
Regional anaesthesia	5 (6.3%)
Operative duration, minutes, mean $\pm$ SD	76.4 $\pm$ 34.2
Estimated blood loss, mL, median (IQR)	120 (70-250)
Peritonitis, gangrene, or tissue necrosis	12 (15.0%)
Perioperative blood transfusion	7 (8.8%)

Maternal postoperative outcomes

Eighteen women (22.5%) developed at least one postoperative complication. Surgical-site infection was the most frequent complication, followed by postoperative ileus and sepsis. Eight women (10.0%) required postoperative intensive care, and two participants underwent reoperation. The median duration of hospital stay was 5 days, and no maternal deaths occurred. Maternal postoperative outcomes are shown in Table 3.

Table 3. Maternal postoperative outcomes

Maternal outcome	Number (%)
Any postoperative complication	18 (22.5%)
Surgical-site infection	6 (7.5%)
Postoperative ileus	5 (6.3%)
Sepsis	4 (5.0%)
Respiratory complication	3 (3.8%)
Significant postoperative haemorrhage	3 (3.8%)
Venous thromboembolism	1 (1.3%)
Reoperation	2 (2.5%)
Intensive care unit admission	8 (10.0%)
Hospital stay, days, median (IQR)	5 (4-8)
Maternal mortality	0 (0.0%)

Note: Individual women could have experienced more than one postoperative complication.

Obstetric and neonatal outcomes

Postoperative uterine contractions occurred in 16 women (20.0%), and 14 required tocolytic therapy. Five pregnancies resulted in fetal loss, comprising three miscarriages and two intrauterine fetal deaths. The remaining 75 women delivered live-born infants.

Among live births, 17 neonates (22.7%) were born preterm, 18 (24.0%) had low birth weight, and 14 (18.7%) required neonatal intensive care. Two neonatal deaths occurred among severely preterm infants delivered to women with generalized peritonitis and maternal sepsis. No major congenital anomaly was detected.

A composite adverse maternal-fetal outcome was recorded in 27 women (33.8%). Adverse outcomes were significantly more frequent among women undergoing surgery more than 24 hours after admission, those with peritonitis, gangrene, or tissue necrosis, and those requiring open surgery. Third-trimester surgery showed a higher numerical frequency of adverse outcomes, but the difference was not statistically significant. These findings are presented in Table 4.

Table 4. Obstetric and neonatal outcomes and factors associated with composite adverse outcomes

Outcome or associated factor	Value/comparison	OR (95% CI)	p value
Obstetric and neonatal outcomes			
Postoperative uterine contractions	16/80 (20.0%)		
Tocolytic therapy required	14/80 (17.5%)		

Miscarriage	3/80 (3.8%)		
Intrauterine fetal death	2/80 (2.5%)		
Overall fetal loss	5/80 (6.3%)		
Live birth	75/80 (93.8%)		
Preterm birth	17/75 (22.7%)		
Term birth	58/75 (77.3%)		
Vaginal delivery	44/75 (58.7%)		
Caesarean delivery	31/75 (41.3%)		
Gestational age at delivery, weeks, mean $\pm$ SD	37.4 $\pm$ 2.5		
Birth weight, kg, mean $\pm$ SD	2.71 $\pm$ 0.57		
Low birth weight	18/75 (24.0%)		
Five-minute Apgar score <7	7/75 (9.3%)		
Neonatal intensive care admission	14/75 (18.7%)		
Neonatal death	2/75 (2.7%)		
Major congenital anomaly	0/75 (0.0%)		
Factors associated with composite adverse outcomes			
Surgery delayed >24 hours versus $\leq$ 24 hours	10/14 (71.4%) vs 17/66 (25.8%)	7.21 (2.00-26.02)	0.003
Peritonitis, gangrene, or necrosis present versus absent	9/12 (75.0%) vs 18/68 (26.5%)	8.33 (2.03-34.25)	0.002
Open versus completed laparoscopic surgery	20/43 (46.5%) vs 7/37 (18.9%)	3.73 (1.35-10.31)	0.010
Third-trimester versus first- or second-trimester surgery	11/24 (45.8%) vs 16/56 (28.6%)	2.12 (0.79-5.70)	0.197

Abbreviations: CI, confidence interval; OR, odds ratio; SD, standard deviation.

Overall, acute appendicitis was the leading cause of acute surgical abdomen during pregnancy. Most participants underwent operative intervention within 24 hours, and maternal survival was 100%. Delayed surgery and advanced intra-abdominal pathology were significantly associated with poorer combined maternal and fetal outcomes.

Discussion

This prospective study describes the spectrum and outcomes of acute surgical abdomen among 80 pregnant women managed at a tertiary centre. Acute appendicitis was the principal diagnosis, accounting for 40.0% of cases, followed by acute cholecystitis or complicated gallstone disease. This distribution agrees with population-based evidence identifying appendicitis as the leading general surgical emergency during pregnancy.⁸ The predominance of second-trimester surgery probably reflects both the clinical occurrence of these disorders and the greater diagnostic and technical complexity encountered as pregnancy advances.

Most women underwent surgery within 24 hours of admission, and maternal survival was 100%. Nevertheless, postoperative complications occurred in 22.5%, with surgical-site infection, ileus, and sepsis forming the main morbidity profile. Advanced intra-abdominal pathology was strongly associated with the composite adverse outcome. This finding is clinically plausible because perforation, peritonitis, gangrene, and necrosis intensify systemic inflammation, increase operative complexity, and expose the pregnancy to haemodynamic disturbance. Previous appendicitis research has similarly shown poorer obstetric outcomes when peritonitis or perforation is present.⁸ The observed association between delayed surgery and adverse outcomes reinforces the importance of rapid diagnostic escalation when initial clinical and ultrasonographic findings remain uncertain.

Laparoscopy was completed in 46.3% of participants. Adverse outcomes were less frequent after completed laparoscopic procedures than after open surgery. This comparison requires cautious interpretation because laparotomy was more often selected for obstruction, perforation, extensive contamination, or tissue ischaemia. Thus, operative approach partly represented disease severity rather than an isolated treatment effect. Even so, the direction of association is consistent with systematic evidence showing fewer maternal, fetal, and surgical complications after laparoscopic rather than open cholecystectomy.⁹ Studies involving mixed non-obstetric conditions have also reported shorter hospital stay and acceptable pregnancy outcomes with laparoscopy across different trimesters.¹⁰ These findings support a minimally invasive approach when anatomy, pathology, gestational age, and surgical expertise permit.

Five pregnancies ended in fetal loss, while 22.7% of live-born infants were preterm and 24.0% had low birth weight. These rates are higher than expected in uncomplicated pregnancies but align with broader observational literature linking non-obstetric surgery to premature labour, caesarean delivery, low birth weight, and neonatal admission.^{3,11} Matched cohort data indicate that the underlying illness, urgency, and duration of surgery contribute substantially to risk, making it difficult to separate surgical exposure from disease severity.¹² Cho et al. reported that longer anaesthesia duration and later gestational age were associated with adverse events, particularly preterm labour and premature birth.¹³ A nationwide analysis published in 2022 likewise found increased risks of prematurity, low birth weight, low Apgar scores, and neonatal death among pregnancies involving non-obstetric surgery.¹⁴

Postoperative uterine contractions occurred in one-fifth of participants, although most pregnancies progressed to live birth. No major congenital anomaly was identified. The findings emphasize maternal stabilization, avoidance of hypoxaemia and hypotension, appropriate fetal assessment, and coordinated postoperative obstetric surveillance. Overall, prompt intervention before progression to peritonitis or tissue necrosis appears more influential than trimester alone in determining outcome.

Limitations

This study was limited by its single-centre design, modest sample size, and short recruitment period. The heterogeneous surgical diagnoses and selective use of laparoscopy restricted direct comparison between operative approaches. Residual confounding from disease severity, gestational age, and urgency remained possible. Long-term maternal and childhood outcomes were not evaluated, and the composite outcome combined clinically distinct events. Larger multicentre prospective studies are required.

Conclusion

Acute appendicitis was the commonest cause of acute surgical abdomen during pregnancy, followed by complicated gallstone disease. Most women underwent intervention within 24 hours, and no maternal deaths occurred. Maternal complications and adverse fetal outcomes were concentrated among women with delayed surgery, peritonitis, gangrene, tissue necrosis, or conditions requiring open procedures. Laparoscopy was successfully completed in nearly half of the participants and was associated with fewer adverse outcomes, although selection by disease severity influenced this comparison. Early recognition, appropriate imaging, prompt operative treatment, maternal physiological stability, and coordinated care involving surgeons, obstetricians, anaesthesiologists, radiologists, and neonatologists are central to improving maternal survival and pregnancy outcomes in this vulnerable clinical setting.

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