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Original Research

Obstetric Outcomes and Postoperative Complications in Pregnant Women Undergoing Non-Obstetric Abdominal Surgery: A Prospective Observational Study.

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Abstract

Background: Non-obstetric abdominal surgery during pregnancy requires timely treatment of maternal disease while protecting fetal well-being. Evidence from single-centre prospective cohorts remains limited, particularly in resource-constrained tertiary-care settings. **Objectives:** To describe the surgical spectrum, obstetric outcomes, neonatal outcomes, and postoperative complications among pregnant women undergoing non-obstetric abdominal surgery and to identify factors associated with adverse outcomes. **Methods:** This prospective observational study included 80 pregnant women who underwent non-obstetric abdominal surgery at Mamata Academy of Medical Sciences, Bachupally, Telangana, India. Participants were enrolled from May to December 2023 and followed until pregnancy completion. Maternal characteristics, surgical diagnosis, urgency, operative approach, anaesthesia, obstetric events, neonatal outcomes, and postoperative complications were recorded. Categorical variables were compared using Fisher's exact test. **Results:** The mean maternal age was 27.4 ± 4.6 years, and the mean gestational age at surgery was 22.8 ± 8.1 weeks. Appendicitis and gallstone-related disease accounted for 38.8% and 30.0% of procedures, respectively. Emergency surgery was performed in 81.3%, laparoscopy in 57.5%, and laparotomy in 42.5%. Term and preterm live births occurred in 72.5% and 17.5%, respectively; the overall live-birth rate was 90.0%. Composite adverse obstetric outcomes occurred in 27.5%, and postoperative complications in 22.5%. Adverse obstetric outcomes were more frequent after laparotomy, with complicated intra-abdominal pathology, and when operative duration exceeded 90 minutes. The same factors were associated with increased postoperative morbidity. No maternal deaths occurred. **Conclusion:** Most women achieved a live birth, but adverse obstetric and postoperative outcomes were clinically important. Complicated pathology, open surgery, and prolonged procedures identified higher-risk patients requiring coordinated surgical, anaesthetic, and obstetric care.

Keywords: abdominal surgery; pregnancy; laparoscopy; obstetric outcome; postoperative complications; preterm birth.

Introduction

Non-obstetric surgery during pregnancy presents a distinctive clinical challenge because diagnostic and therapeutic decisions must protect maternal health without compromising fetal viability. Approximately 1-2% of pregnant women require an operation unrelated to delivery, although reported rates vary according to the population studied and the procedures included.[1] Acute appendicitis, symptomatic gallstone disease, intestinal obstruction, adnexal torsion, trauma, and abdominal sepsis are among the principal indications. Delayed treatment can permit disease progression, perforation, sepsis, haemodynamic instability, and preterm uterine activity; therefore, medically necessary surgery should not be postponed solely because of pregnancy.[1-3]

Pregnancy produces substantial cardiovascular, respiratory, gastrointestinal, and haematological adaptations that influence perioperative care. Reduced functional residual capacity, increased oxygen consumption, airway oedema, aspiration risk, aortocaval compression, and a hypercoagulable state require careful anaesthetic planning.[2,4] Maintenance of maternal oxygenation, normocapnia, blood pressure, temperature, and uteroplacental perfusion is central to fetal protection. Current clinical evidence has not demonstrated teratogenicity from standard anaesthetic agents used at usual concentrations, but the underlying surgical disorder, maternal physiological disturbance, and timing of intervention can influence miscarriage, preterm birth, fetal growth, and neonatal condition.[2-5] Multidisciplinary coordination among surgeons, obstetricians, anaesthesiologists, neonatologists, and critical-care teams is therefore essential.

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Large population studies have reported higher risks of prematurity, low birth weight, low Apgar scores, and fetal or neonatal loss after non-obstetric surgery than among pregnancies without surgical exposure.[6, 7] Interpretation remains difficult because disease severity, emergency presentation, infection, and operative complexity frequently coexist. The second trimester has traditionally been considered technically favourable for non-urgent procedures, yet urgent surgery is undertaken in any trimester when clinically indicated.[3,8] Minimally invasive surgery is increasingly used because it can reduce postoperative pain, wound complications, immobility, and length of stay. Nevertheless, gestational age, uterine size, trocar placement, pneumoperitoneum pressure, surgical expertise, and fetal monitoring require individual consideration.[8]

Available evidence is dominated by retrospective databases, administrative coding studies, and condition-specific series. Prospective data describing the complete pathway from surgical presentation to pregnancy completion are comparatively scarce in Indian tertiary-care settings. Local evaluation is important because referral patterns, timing of presentation, access to laparoscopy, disease severity, and postoperative surveillance differ across institutions.

The present study aimed to describe the maternal and pregnancy characteristics, indications, urgency, operative approaches, obstetric and neonatal outcomes, and postoperative complications among pregnant women undergoing non-obstetric abdominal surgery. A secondary objective was to examine the unadjusted associations of surgical urgency, operative approach, complicated intra-abdominal pathology, and prolonged operative duration with composite adverse obstetric outcomes and postoperative maternal complications.

METHODOLOGY

Study design and setting: This prospective observational study was conducted at Mamata Academy of Medical Sciences and its attached teaching hospital, Bachupally, Telangana, India. The institution is a tertiary-care teaching centre providing multidisciplinary emergency, surgical, anaesthetic, obstetric, neonatal, laboratory, imaging, intensive-care, and inpatient services. Recruitment was undertaken from May 2023 to December 2023. Women were followed beyond the recruitment period, when required, until delivery, miscarriage, intrauterine fetal death, or stillbirth so that final pregnancy outcomes could be documented.

Study participants and sampling: Pregnant women aged 18 years or older with a confirmed intrauterine pregnancy who underwent an abdominal surgical procedure for a condition unrelated to delivery were eligible. Consecutive eligible patients were approached after the decision for surgery had been made by the treating team. Women managed without surgery, those undergoing an obstetric operation as the index procedure, those declining participation, and those without adequate postoperative or pregnancy follow-up were excluded. Of 86 women assessed, 80 fulfilled the criteria and were analysed.

Clinical management and data collection: Management was determined by the responsible surgical, obstetric, and anaesthetic teams according to the clinical indication, gestational age, maternal condition, fetal viability, and available expertise.[3,4,8] Emergency procedures were not delayed because of pregnancy. Preoperative assessment included obstetric review, gestational-age confirmation, relevant laboratory testing, imaging, anaesthetic evaluation, and fetal assessment when technically feasible. Operative approach and anaesthetic technique were selected by the treating clinicians. Standard measures included avoidance of maternal hypoxaemia and hypotension, appropriate positioning after mid-pregnancy, thromboprophylaxis based on individual risk, and postoperative obstetric surveillance.

Variables and outcome definitions: Data were recorded prospectively using a structured case-record form. Variables included maternal age, gravidity, gestational age, previous miscarriage and caesarean delivery, anaemia, hypertension, diabetes, surgical diagnosis, urgency, operative approach, anaesthetic technique, operative duration, transfusion, postoperative complications, intensive-care admission, reoperation, hospital stay, pregnancy complications, final pregnancy outcome, birth weight, 5-minute Apgar score, neonatal intensive care unit admission, and neonatal death. A composite adverse obstetric outcome was defined as miscarriage, intrauterine fetal death or stillbirth, or preterm delivery before 37 completed weeks. Complicated intra-abdominal pathology comprised intestinal obstruction, gastrointestinal perforation, or peritonitis.

Statistical analysis: Continuous variables were summarised as mean $\pm$ standard deviation or median with interquartile range. Categorical variables were expressed as frequencies and percentages. Two-by-two comparisons were performed using Fisher's exact test because several cells contained small expected counts. A two-sided p-value below 0.05 was considered statistically significant. Associations were unadjusted and were interpreted as exploratory.

Ethical considerations: Necessary Permissions were obtained before starting the study. Written informed consent was obtained from enrolled participants, and clinical care was not altered for research purposes.

Results

Participant recruitment

During the study period, 86 pregnant women presenting with acute or elective non-obstetric abdominal surgical conditions were assessed for eligibility. Six women were excluded: three were managed conservatively without surgery, two declined participation, and one had incomplete follow-up information. The remaining 80 women underwent non-obstetric abdominal surgery and were included in the final analysis. Complete maternal postoperative and pregnancy outcome data were available for all participants.

Maternal and pregnancy characteristics

The mean maternal age was 27.4 $\pm$ 4.6 years, with a range of 19-38 years. Thirty-four women (42.5%) were primigravidae, while 46 (57.5%) were multigravidae. The mean gestational age at surgery was 22.8 $\pm$ 8.1 weeks. Surgery was performed during the first trimester in 16 women (20.0%), the second trimester in 42 (52.5%), and the third trimester in 22 (27.5%). Ten women (12.5%) had a history of previous miscarriage, and 18 (22.5%) had undergone a previous caesarean delivery. Anaemia was present in 24 participants (30.0%), hypertensive disorders in six (7.5%), and diabetes mellitus in four (5.0%). The baseline characteristics are presented in Table 1.

Table 1. Baseline maternal and pregnancy characteristics

Characteristic	Value
Maternal age, years, mean $\pm$ SD	27.4 $\pm$ 4.6
Age <25 years	24 (30.0%)
Age 25-29 years	31 (38.8%)
Age $\geq$ 30 years	25 (31.3%)
Primigravida	34 (42.5%)
Multigravida	46 (57.5%)
Gestational age at surgery, weeks, mean $\pm$ SD	22.8 $\pm$ 8.1
First trimester	16 (20.0%)
Second trimester	42 (52.5%)
Third trimester	22 (27.5%)
Previous miscarriage	10 (12.5%)
Previous caesarean delivery	18 (22.5%)

Anaemia	24 (30.0%)
Hypertensive disorder	6 (7.5%)
Diabetes mellitus	4 (5.0%)

Values are presented as number and percentage unless otherwise specified. SD: standard deviation.

Surgical indications and operative characteristics

Acute appendicitis was the most frequent indication for surgery, accounting for 31 cases (38.8%), followed by symptomatic gallstone disease or acute cholecystitis in 24 cases (30.0%). Intestinal obstruction was diagnosed in 10 women (12.5%), adnexal torsion or a symptomatic ovarian cyst in seven (8.8%), and gastrointestinal perforation with peritonitis in five (6.3%). Three women (3.8%) underwent surgery for other abdominal conditions, including incarcerated hernia and splenic pathology. Emergency surgery was required in 65 women (81.3%), whereas 15 (18.8%) underwent planned or semi-elective procedures. A laparoscopic approach was used in 46 cases (57.5%), while open laparotomy was performed in 34 (42.5%). General anaesthesia was administered to 72 women (90.0%). The mean operative duration was 86.4 ± 34.2 minutes, and 29 procedures (36.3%) lasted longer than 90 minutes (Table 2).

Table 2. Indications and operative characteristics

Variable	Number (%)
Primary surgical diagnosis	
Acute appendicitis	31 (38.8%)
Gallstone disease/acute cholecystitis	24 (30.0%)
Intestinal obstruction	10 (12.5%)
Adnexal torsion/ovarian cyst	7 (8.8%)
Gastrointestinal perforation/peritonitis	5 (6.3%)
Other abdominal conditions	3 (3.8%)
Urgency of surgery	
Emergency	65 (81.3%)
Elective/semi-elective	15 (18.8%)
Operative approach	
Laparoscopic surgery	46 (57.5%)
Open laparotomy	34 (42.5%)
Anaesthetic technique	
General anaesthesia	72 (90.0%)
Regional anaesthesia	8 (10.0%)
Operative duration >90 minutes	29 (36.3%)
Intraoperative blood transfusion	6 (7.5%)

Obstetric and neonatal outcomes

Term live birth occurred in 58 women (72.5%), while 14 women (17.5%) delivered preterm but had a live-born infant. Four women (5.0%) experienced miscarriage, and four (5.0%) had an intrauterine fetal death or stillbirth. Thus, the overall live-birth rate was 90.0%. Preterm uterine contractions during the perioperative or postoperative period were documented in 14 women (17.5%). Threatened miscarriage occurred in six women (7.5%), premature rupture of membranes in five (6.3%), and placental abruption in two (2.5%). Tocolytic therapy was administered to 11 women (13.8%) based on obstetric indications.

Among the 72 live-born neonates, 15 (20.8%) had a birth weight below 2.5 kg, six (8.3%) had a 5-minute Apgar score below 7, and 10 (13.9%) required neonatal intensive care unit admission. One neonatal death occurred, producing a neonatal mortality rate of 1.4% among live births. Obstetric and neonatal outcomes are summarised in Table 3.

Table 3. Obstetric and neonatal outcomes

Outcome	Number (%)
Final pregnancy outcome, n=80	
Term live birth	58 (72.5%)
Preterm live birth	14 (17.5%)
Miscarriage	4 (5.0%)
Intrauterine fetal death/stillbirth	4 (5.0%)
Overall live birth	72 (90.0%)
Composite adverse obstetric outcome	22 (27.5%)
Pregnancy-related complications, n=80	
Preterm uterine contractions	14 (17.5%)
Threatened miscarriage	6 (7.5%)
Premature rupture of membranes	5 (6.3%)
Placental abruption	2 (2.5%)
Requirement for tocolytic therapy	11 (13.8%)
Neonatal outcomes among live births, n=72	
Low birth weight <2.5 kg	15 (20.8%)
5-minute Apgar score <7	6 (8.3%)
NICU admission	10 (13.9%)
Neonatal death	1 (1.4%)

The composite adverse obstetric outcome included miscarriage, intrauterine fetal death or stillbirth, or preterm delivery. NICU: neonatal intensive care unit.

Postoperative maternal complications

At least one postoperative complication was observed in 18 women, giving an overall complication rate of 22.5%. Surgical-site infection was the most frequent complication, occurring in five women (6.3%), followed by postoperative ileus in four (5.0%) and urinary tract infection in three (3.8%). Two women each developed postoperative haemorrhage and respiratory infection. One patient developed intra-abdominal

sepsis, and one experienced venous thromboembolism. Five women (6.3%) required postoperative intensive care, while two (2.5%) underwent reoperation. No maternal deaths were recorded. The median duration of postoperative hospital stay was 5 days, with an interquartile range of 4-8 days. Hospital stay exceeding seven days was observed in 17 women (21.3%) (Table 4).

Table 4. Postoperative maternal outcomes

Postoperative outcome	Number (%)
Any postoperative complication	18 (22.5%)
Surgical-site infection	5 (6.3%)
Postoperative ileus	4 (5.0%)
Urinary tract infection	3 (3.8%)
Postoperative haemorrhage	2 (2.5%)
Respiratory infection	2 (2.5%)
Intra-abdominal sepsis	1 (1.3%)
Venous thromboembolism	1 (1.3%)
Intensive care unit admission	5 (6.3%)
Reoperation	2 (2.5%)
Hospital stay >7 days	17 (21.3%)
Maternal mortality	0 (0.0%)

Individual complication categories represent the principal postoperative complication. Intensive care admission and reoperation could overlap with these categories.

Factors associated with adverse outcomes

The composite adverse obstetric outcome occurred in 15 of 34 women (44.1%) who underwent laparotomy, compared with seven of 46 women (15.2%) treated laparoscopically ($p=0.006$). Adverse obstetric outcomes were also more frequent among women with intestinal obstruction, perforation, or peritonitis than among those with uncomplicated abdominal pathology (66.7% versus 18.5%, $p<0.001$). Procedures lasting longer than 90 minutes were associated with a higher adverse obstetric outcome rate than shorter procedures (44.8% versus 17.6%, $p=0.018$).

Postoperative maternal complications were significantly more frequent following laparotomy than laparoscopy (38.2% versus 10.9%, $p=0.006$). Women whose operations lasted longer than 90 minutes also had a higher postoperative complication rate than those with shorter procedures (37.9% versus 13.7%, $p=0.024$). Although adverse obstetric outcomes were more common following emergency surgery than elective or semi-elective surgery, the difference did not reach statistical significance (32.3% versus 6.7%, $p=0.056$). The complete unadjusted comparisons are presented in Table 5.

Table 5. Factors associated with adverse obstetric and postoperative outcomes

Factor	Adverse obstetric outcome, n/N (%)	p-value	Postoperative complication, n/N (%)	p-value
Emergency surgery	21/65 (32.3%)	0.056	17/65 (26.2%)	0.170
Elective/semi-elective surgery	1/15 (6.7%)		1/15 (6.7%)	
Laparotomy	15/34 (44.1%)	0.006	13/34 (38.2%)	0.006
Laparoscopy	7/46 (15.2%)		5/46 (10.9%)	
Complicated intra-abdominal pathology	10/15 (66.7%)	<0.001	8/15 (53.3%)	0.003
Uncomplicated pathology	12/65 (18.5%)		10/65 (15.4%)	
Operative duration >90 minutes	13/29 (44.8%)	0.018	11/29 (37.9%)	0.024
Operative duration ≤90 minutes	9/51 (17.6%)		7/51 (13.7%)	

Categorical variables were compared using two-sided Fisher's exact test. A p-value <0.05 was considered statistically significant. Associations were unadjusted. Complicated pathology included intestinal obstruction, gastrointestinal perforation, or peritonitis.

Discussion

This prospective cohort describes the clinical spectrum and short-term outcomes of 80 pregnant women undergoing non-obstetric abdominal surgery. Appendicitis and gallstone-related disease together accounted for more than two-thirds of procedures, emergency intervention was required in four-fifths, and the second trimester was the most common period of surgery. These patterns are consistent with established reviews and tertiary-centre experience identifying appendicitis and biliary disease as leading abdominal indications during pregnancy.[1,5]

The overall live-birth rate was 90.0%; however, preterm live birth occurred in 17.5%, and the composite adverse obstetric outcome reached 27.5%. Devroe et al. reported a preterm birth rate of 25% among surgically exposed pregnancies and observed lower neonatal birth weight than in matched controls.[5] Population-based analyses from Taiwan also found increased risks of prematurity, low birth weight, low Apgar scores, and neonatal death after non-obstetric surgery.[6,7] The present low-birth-weight proportion of 20.8% and neonatal intensive care admission rate of 13.9% support the need for continued obstetric and neonatal surveillance after maternal recovery. Direct numerical comparison across studies requires caution because outcome definitions, surgical case mix, gestational distribution, and reference populations differ.

Laparotomy was associated with higher composite adverse obstetric outcomes and postoperative complications than laparoscopy. Meta-analytic evidence for cholecystectomy has shown lower maternal, fetal, and surgical complication rates with laparoscopic rather than open surgery.[11] National inpatient data also demonstrated that outcomes after cholecystectomy during pregnancy vary with patient and provider characteristics.[12] Evidence for appendectomy is less uniform; updated analyses have reported heterogeneity and potential confounding from disease severity and gestational timing.[10] In the present cohort, open procedures were more likely to be selected for obstruction, perforation, peritonitis, advanced disease, or technical difficulty. Consequently, the observed association should not be interpreted as an independent harmful effect of laparotomy. It more plausibly reflects a combination of operative invasiveness and greater underlying pathology.

Complicated intra-abdominal disease showed the strongest association with adverse obstetric outcomes, while procedures exceeding 90 minutes were associated with both obstetric and postoperative morbidity. These findings align with reports identifying sepsis and severe maternal disease as important predictors of adverse obstetric events.[9] Large retrospective cohorts have likewise suggested that a substantial proportion of risk is attributable to the indication for surgery and its severity rather than anaesthetic exposure alone.[13,14] Prompt diagnosis, early source control, careful maintenance of maternal physiology, and coordinated perioperative obstetric assessment remain central.

Postoperative complications occurred in 22.5%, most commonly surgical-site infection, ileus, and urinary infection. Five women required intensive care and two underwent reoperation, but no maternal deaths occurred. The absence of maternal mortality is reassuring and supports the feasibility of surgery during pregnancy when indicated. Nevertheless, the rates of fetal loss, preterm birth, and postoperative morbidity underline the importance of risk stratification, timely referral, minimally invasive expertise where appropriate, and follow-up through pregnancy completion.

LIMITATIONS

This study was conducted at a single tertiary-care centre with a modest sample, limiting external generalisability and subgroup precision. The absence of a non-surgical comparison group prevented estimation of risk attributable to surgery beyond the underlying disease. Associations were unadjusted, leaving residual confounding by diagnosis severity, gestational age, and urgency. Long-term infant development and maternal outcomes after the puerperium were not assessed.

Conclusion

Non-obstetric abdominal surgery during pregnancy was most commonly required for appendicitis and gallstone-related disease, with most procedures performed as emergencies. Nine of every ten pregnancies resulted in live birth, although preterm delivery, fetal loss, neonatal intensive care admission, and postoperative maternal complications remained important. Complicated intra-abdominal pathology, laparotomy, and operative duration exceeding 90 minutes were associated with poorer obstetric and maternal outcomes. These findings support early diagnosis, timely surgical intervention, meticulous preservation of maternal physiology, and coordinated care involving surgery, anaesthesia, obstetrics, neonatology, and critical-care services. Laparoscopy should be considered when clinically suitable and supported by experienced personnel, while women with sepsis, obstruction, perforation, or prolonged procedures require intensified maternal-fetal surveillance.

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