Section: Miscellaneous

Original Research Article

MANAGEMENT OF ACUTE APPENDICITIS IN PREGNANCY-LAPAROSCOPY VS OPEN APPROACH IN A TERTIARY CARE HOSPITAL

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ABSTRACT

Background: The objective of this study was to critically assess and compare the maternal and fetal outcomes between laparoscopic and open appendectomy in the management of acute appendicitis during pregnancy, conducted at a tertiary care hospital. **Materials and Methods:** This retrospective cohort study included 100 pregnant patients diagnosed with acute appendicitis who underwent either laparoscopic or open appendectomy. The patients' ages ranged from 18 to 40 years, and data were systematically gathered through an extensive review of medical records. The primary goal was to evaluate the surgical outcomes, including maternal complications, fetal health, and recovery times. A combination of descriptive and inferential statistical analyses was employed to compare the two surgical approaches across several critical parameters, such as postoperative complications, recovery duration, and length of hospital stay. **Result:** The findings revealed that laparoscopic appendectomy was associated with significantly reduced operative times (85 minutes) compared to open appendectomy (112 minutes). Additionally, the laparoscopic group exhibited lower rates of postoperative infections (4% versus 10%) and no instances of wound dehiscence, whereas the open surgery group presented a higher incidence of such complications. The average hospital stay was notably shorter for the laparoscopic group (3.5 days) compared to the open surgery group (5.0 days), highlighting the expedited recovery associated with the minimally invasive approach. Regarding fetal outcomes, the laparoscopic group demonstrated a lower incidence of preterm births (6% versus 12%) and no fetal loss, in contrast to the open surgery group, which experienced a 4% fetal loss rate. Furthermore, patients in the laparoscopic group returned to normal activities more quickly, with a mean of 7.5 days, compared to 10.3 days in the open surgery group. **Conclusion:** This study demonstrated that laparoscopic appendectomy offers distinct advantages over open appendectomy in the management of acute appendicitis during pregnancy. Laparoscopic surgery was associated with shorter operative durations, fewer postoperative complications, faster recovery, and comparable maternal and fetal outcomes. These findings reinforce the increasing body of evidence suggesting that laparoscopic appendectomy should be regarded as the preferred surgical approach for pregnant patients with acute appendicitis, offering enhanced maternal safety and better fetal outcomes.

INTRODUCTION

Acute appendicitis represents one of the most prevalent and critical surgical emergencies encountered in the general population. However, its occurrence during pregnancy introduces distinct challenges for both diagnosis and management. Acute appendicitis, characterized by the rapid inflammation of the appendix, necessitates urgent surgical intervention to prevent catastrophic complications such as perforation, peritonitis, or sepsis.[1] In pregnant women, the management of appendicitis is further complicated by physiological changes that influence the presentation of the condition, as well as by concerns for the well-being of both the mother and the fetus. As such, it is

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imperative to promptly identify the condition and choose the most appropriate surgical approach to optimize maternal and fetal outcomes.[2]

The incidence of appendicitis in pregnancy is relatively rare, with estimates suggesting a frequency of 1 in 1,000 to 1 in 1,500 pregnancies, with peak occurrence during the second trimester. In the pregnant population, the clinical presentation of appendicitis often diverges from that seen in non-pregnant individuals due to the anatomical and physiological alterations caused by the enlarging uterus.[3] As the uterus expands, it displaces the abdominal organs, which can obscure the classic symptoms of appendicitis, such as right lower quadrant pain, fever, and nausea. Consequently, the clinical features may be less obvious, and differential diagnosis becomes more challenging. Symptoms commonly associated with pregnancy, such as morning sickness and gastrointestinal discomfort, may mimic those of appendicitis, leading to diagnostic ambiguity.[4]

Despite the challenges in diagnosing acute appendicitis in pregnancy, early intervention remains critical. Delayed treatment can lead to significant maternal morbidity, including the risk of appendiceal rupture, which significantly elevates the likelihood of life-threatening peritonitis, sepsis, and the potential for fetal loss. Perforation of the appendix can also lead to the formation of intra-abdominal abscesses, which complicate the clinical course and may result in preterm labor or fetal distress. Thus, timely surgical intervention is essential to minimize these risks and prevent adverse outcomes for both the mother and her unborn child.[5-7]

Historically, the management of appendicitis in pregnant patients has favored the open appendectomy technique, particularly when the diagnosis is clear and there are no complicating factors. Open appendectomy allows for direct access to the appendix and provides the opportunity for broader exploration of the abdominal cavity, which may be necessary in cases of complicated appendicitis.[8] However, this approach involves larger incisions, increased postoperative pain, a longer recovery period, and a heightened risk of complications such as wound infection, deep vein thrombosis, and pulmonary embolism. These factors underscore the need for a more refined and less invasive approach, especially in the context of a pregnant patient.[9]

In recent years, laparoscopic appendectomy has gained prominence as a minimally invasive alternative to open surgery, even during pregnancy. This approach offers significant advantages, including smaller incisions, reduced postoperative discomfort, shorter hospitalization, and faster recovery times.[10] Additionally, laparoscopic surgery allows for enhanced visualization of the appendix and surrounding structures, providing the surgeon with the ability to more accurately identify the appendix, even in the context of altered anatomy due to pregnancy. These factors contribute to the growing preference for laparoscopic surgery, particularly in the early stages of pregnancy when the uterus may obscure the appendix, making visualization through an open approach more challenging.[11]

Despite the clear benefits of laparoscopic surgery, concerns regarding its safety during pregnancy persist. The use of carbon dioxide (CO2) insufflation, a common feature of laparoscopic procedures, can increase intra-abdominal pressure, which in turn may reduce uteroplacental blood flow, potentially leading to fetal hypoxia or other adverse outcomes. These risks have raised questions about the safety of laparoscopy, particularly in the first and second trimesters. However, accumulating evidence suggests that, when performed with meticulous technique and appropriate precautions, laparoscopic appendectomy can be safely executed with minimal risk to both mother and fetus. As a result, laparoscopic surgery is increasingly recognized as a viable and effective option for managing acute appendicitis in pregnant patients.[12]

When deciding between a laparoscopic or open approach, several critical factors must be considered. These include the patient's gestational age, the severity of the appendicitis, the presence of complications such as perforation or abscess formation, and the surgeon's expertise in laparoscopic procedures in the pregnant patient. In some cases, an open approach may be necessary if the patient's condition is deteriorating rapidly or if laparoscopic access is deemed technically challenging.[13] Ultimately, the choice of surgical method must be tailored to the individual patient's clinical scenario to ensure the best possible outcomes. The overarching aim is to ensure timely and effective surgical intervention to minimize the risk of complications and safeguard the health of both mother and child.

Aim of the study

The aim of this study was to evaluate and compare the outcomes of laparoscopic versus open appendectomy in the management of acute appendicitis during pregnancy at a tertiary care hospital.

Objective: The objective of this study was to compare the maternal and fetal outcomes between laparoscopic and open appendectomy in the management of acute appendicitis during pregnancy.

MATERIALS AND METHODS

This investigation employed a retrospective cohort design conducted at a tertiary care hospital, with a sample size of 100 pregnant patients diagnosed with acute appendicitis, who underwent either laparoscopic or open appendectomy. The patients' ages ranged from 18 to 40 years. The primary aim was to critically compare the maternal and fetal outcomes associated with each surgical approach. The study involved a thorough review of medical records spanning a predefined period to ensure

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comprehensive data collection, focusing on both short-term and long-term outcomes.

Inclusion Criteria

The study included pregnant women who were diagnosed with acute appendicitis during any trimester of pregnancy and subsequently underwent either laparoscopic or open appendectomy. Only patients with a definitive diagnosis of appendicitis, confirmed through clinical evaluation, laboratory tests, and imaging modalities, were considered eligible for inclusion, provided they underwent surgical intervention at the study institution.

Exclusion Criteria

- Patients with a history of prior abdominal surgeries that complicated the approach to appendectomy
- Individuals with significant contraindications to either laparoscopic or open surgery
- Patients presenting with comorbid conditions that could severely affect surgical outcomes, such as:
  - Uncontrolled diabetes mellitus
  - Severe preeclampsia
  - Other high-risk pathologies that could interfere with surgical safety and efficacy

Data Collection

Data were meticulously gathered through a retrospective review of the hospital's medical records, encompassing comprehensive patient profiles, surgical documentation, intraoperative observations, and detailed postoperative outcomes. Information collected included the surgical approach (laparoscopic or open), gestational age at the time of surgery, operative duration, postoperative recovery trajectories, and any immediate or delayed complications, both maternal and fetal.

Data Analysis

The collected data were analyzed using both descriptive and inferential statistical methods. Comparative analyses were conducted to evaluate maternal and fetal outcomes, as well as key indicators such as length of hospital stay, postoperative recovery times, and incidence of surgical complications between the laparoscopic and open surgery groups. Statistical tests, including chi-square tests for categorical variables and t-tests for continuous data, were employed to identify significant differences between the two groups, with a significance threshold set at $p < 0.05$.

RESULTS

Table 1: Demographic Characteristics of Study Participants

Characteristic	Laparoscopic Group (n = 50)	Open Appendectomy Group (n = 50)	Total (n = 100)
Age (mean ± SD)	28.5 ± 5.2	29.3 ± 4.7	28.9 ± 5.0
Gestational Age (weeks) (mean ± SD)	16.2 ± 5.0	17.0 ± 5.2	16.6 ± 5.1
Parity			
- Nulliparous	28 (56%)	30 (60%)	58 (58%)
- Multiparous	22 (44%)	20 (40%)	42 (42%)
Age Group			
- 18-25 years	20 (40%)	18 (36%)	38 (38%)
- 26-35 years	23 (46%)	25 (50%)	48 (48%)

Table 1 presented a comprehensive overview of the demographic characteristics of the participants. The mean age of the patients was comparable between both groups, with the laparoscopic group averaging 28.5 years and the open appendectomy group at 29.3 years. Similarly, the mean gestational age at the time of surgery was slightly lower in the laparoscopic group (16.2 weeks) compared to the open surgery group (17.0 weeks). In terms of parity, the laparoscopic group had a higher proportion of nulliparous patients (56%) compared to the open surgery group (60%). The distribution of age groups revealed a predominance of patients aged 26-35 years, with no significant differences between the two surgical approaches.

Table 2: Surgical Characteristics

Characteristic	Laparoscopic Group (n = 50)	Open Appendectomy Group (n = 50)	Total (n = 100)
Duration of Surgery (minutes) (mean ± SD)	85 ± 22	112 ± 28	98.5 ± 25
Type of Appendicitis			
- Simple Appendicitis	37 (74%)	30 (60%)	67 (67%)
- Perforated Appendicitis	13 (26%)	20 (40%)	33 (33%)
Incision Type			
- Single incision (laparoscopic)	50 (100%)	0	50 (50%)
- Traditional incision	0	50 (100%)	50 (50%)

Table 2 provided a detailed breakdown of the surgical characteristics of both groups. The duration of surgery was notably shorter for patients in the laparoscopic group, with an average of 85 minutes,

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compared to 112 minutes for those undergoing open appendectomy. Notably, all laparoscopic procedures were performed with a single incision, whereas open appendectomy required traditional incisions. When examining the type of appendicitis, the laparoscopic group had a higher percentage of simple appendicitis cases (74%) compared to the open surgery group (60%). Conversely, a greater proportion of patients with perforated appendicitis underwent open appendectomy (40% versus 26%).

Table 3: Maternal Outcomes

Outcome	Laparoscopic Group (n = 50)	Open Appendectomy Group (n = 50)	Total (n = 100)
Postoperative Infection	2 (4%)	5 (10%)	7 (7%)
Wound Dehiscence	0	3 (6%)	3 (3%)
Hemorrhage	1 (2%)	2 (4%)	3 (3%)
Length of Hospital Stay (days) (mean ± SD)	3.5 ± 1.2	5.0 ± 1.7	4.25 ± 1.5
Maternal Mortality	0	0	0

Table 3 focused on maternal outcomes, illustrating the benefits of laparoscopic surgery in terms of postoperative recovery. The incidence of postoperative infection was lower in the laparoscopic group (4%) compared to the open surgery group (10%). Remarkably, no cases of wound dehiscence were reported in the laparoscopic group, while 6% of the open appendectomy patients experienced this complication. The mean length of hospital stay was significantly reduced for the laparoscopic group, with a mean of 3.5 days compared to 5.0 days for the open surgery group, highlighting the faster recovery associated with the minimally invasive approach. Importantly, maternal mortality was absent in both groups, indicating that both surgical approaches were equally safe for the mother.

Table 4: Fetal Outcomes

Outcome	Laparoscopic Group (n = 50)	Open Appendectomy Group (n = 50)	Total (n = 100)
Preterm Birth (before 37 weeks)	3 (6%)	6 (12%)	9 (9%)
Low Birth Weight (<2500g)	2 (4%)	4 (8%)	6 (6%)
Fetal Loss (miscarriage or stillbirth)	0	2 (4%)	2 (2%)
Apgar Score (mean ± SD) at 1 min	8.6 ± 0.9	8.3 ± 1.1	8.45 ± 1.0
Apgar Score (mean ± SD) at 5 min	9.4 ± 0.6	9.2 ± 0.8	9.3 ± 0.7

Table 4 provided a detailed account of fetal outcomes, revealing that fetal health was generally unaffected by the surgical approach. The incidence of preterm birth was higher in the open appendectomy group (12%) compared to the laparoscopic group (6%), although overall fetal loss rates remained low in both groups. Notably, there were no instances of miscarriage or stillbirth in the laparoscopic group, while 4% of the open surgery group experienced fetal loss. Apgar scores at both 1 and 5 minutes were comparable between the groups, indicating no significant difference in neonatal health based on the surgical method.

Table 5: Postoperative Complications

Complication	Laparoscopic Group (n = 50)	Open Appendectomy Group (n = 50)	Total (n = 100)
Postoperative Infection	2 (4%)	5 (10%)	7 (7%)
Abscess Formation	1 (2%)	3 (6%)	4 (4%)
Deep Vein Thrombosis (DVT)	0	1 (2%)	1 (1%)
Pulmonary Embolism	0	0	0
Bowel Obstruction	1 (2%)	2 (4%)	3 (3%)

Table 5 examined the postoperative complications experienced by patients in both groups. The laparoscopic approach was associated with a lower incidence of postoperative infection (4%) compared to the open appendectomy group (10%). Additionally, the open surgery group experienced a higher incidence of abscess formation (6%) compared to the laparoscopic group (2%). Deep vein thrombosis was observed in one patient from the open surgery group, while no cases were reported in the laparoscopic group. Pulmonary embolism was absent in both groups, and the incidence of bowel obstruction was slightly higher in the open surgery group (4%) compared to the laparoscopic group (2%).

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Table 6: Recovery Outcomes

Outcome	Laparoscopic Group (n = 50)	Open Appendectomy Group (n = 50)	Total (n = 100)
Postoperative Pain (mean ± SD)	3.2 ± 1.5	5.1 ± 2.0	4.1 ± 1.9
Time to Full Mobility (days)	3.2 ± 1.4	5.0 ± 1.8	4.1 ± 1.6
Return to Normal Activities (days)	7.5 ± 2.0	10.3 ± 3.1	8.9 ± 2.6
Postoperative Pain Medication (mean doses)	3.0 ± 1.1	5.2 ± 1.8	4.1 ± 1.5

Table 6 presented an analysis of recovery outcomes, highlighting the enhanced recovery associated with laparoscopic surgery. The laparoscopic group reported significantly lower postoperative pain (mean score of 3.2) compared to the open surgery group (mean score of 5.1). Recovery times were notably quicker in the laparoscopic group, with patients achieving full mobility in an average of 3.2 days, compared to 5.0 days in the open surgery group. Additionally, patients who underwent laparoscopic appendectomy returned to normal activities faster, with a mean of 7.5 days compared to 10.3 days for those who had open surgery. The laparoscopic group also required fewer doses of postoperative pain medication, further emphasizing the advantages of minimally invasive surgery in reducing postoperative discomfort and expediting recovery.

DISCUSSION

The results of this study offered a comprehensive evaluation of laparoscopic versus open appendectomy in pregnant patients diagnosed with acute appendicitis, aligning with and reinforcing findings from previous research in this field. The data revealed substantial advantages of laparoscopic surgery in terms of operative time, postoperative complications, recovery periods, and maternal and fetal outcomes, providing further evidence of its benefits in this challenging clinical scenario.

The demographic characteristics of the study participants, including age, parity, and gestational age, showed no significant differences between the two groups, which is consistent with previous studies by Chung et al., and Gilo et al.[14,15] These studies, like the present one, found that the incidence of appendicitis in pregnancy predominantly affects women in the 18–35-year age range and that nulliparous women tend to present with appendicitis more frequently, which was similarly reflected in this study's sample. The comparable distribution of these characteristics between the two surgical approaches in our study further corroborates the typical epidemiological patterns of appendicitis in pregnancy.

Surgical characteristics illustrated the notable advantages of laparoscopic surgery, particularly in terms of reduced operative time. The laparoscopic group underwent surgery in an average of 85 minutes, which is significantly shorter than the 112 minutes required for the open appendectomy group. This finding is consistent with the work of Andersen and Nielsen, who documented shorter surgical durations with laparoscopic techniques, primarily due to the reduced invasiveness and improved visualization.[16] Additionally, as noted in previous research by Peled et al., the laparoscopic approach exclusively used a single incision, which minimizes tissue disruption and enhances recovery. In contrast, the open appendectomy group required traditional larger incisions, which are associated with greater trauma and increased risk of postoperative complications, such as infection and wound dehiscence.[17] The higher proportion of simple appendicitis cases in the laparoscopic group (74%) compared to the open surgery group (60%) further supports the finding that laparoscopic surgery is particularly advantageous in uncomplicated cases of appendicitis, as seen in prior studies.

The maternal outcomes from this study demonstrated a clear benefit for the laparoscopic approach, particularly in terms of postoperative recovery. The incidence of postoperative infections was significantly lower in the laparoscopic group (4%) compared to the open surgery group (10%), aligning with findings from Tamir et al., which have consistently shown that laparoscopic appendectomy is associated with reduced infection rates.[18] The absence of wound dehiscence in the laparoscopic group is another critical advantage, reflecting the reduced incision size and faster wound healing, a conclusion that mirrors findings from Al-Mulhim et al.[19] Furthermore, the laparoscopic group had a significantly shorter average hospital stay (3.5 days) compared to 5.0 days in the open surgery group, further reinforcing the faster recovery observed with minimally invasive procedures. These outcomes corroborate a growing body of literature that demonstrates quicker recoveries and reduced hospitalization durations with laparoscopic appendectomy in pregnant patients.[19]

Fetal outcomes in this study also supported the findings from prior research, suggesting that laparoscopic appendectomy may result in better fetal health outcomes compared to open surgery. The incidence of preterm birth was lower in the laparoscopic group (6%) compared to the open surgery group (12%), which is consistent with findings from Bouyou et al.,who reported that laparoscopic surgery leads to fewer adverse fetal outcomes. The fact that there were no cases of fetal loss in the laparoscopic group, while 4% of patients in the open surgery group experienced fetal loss, further emphasizes the relative safety of the

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laparoscopic approach for both maternal and fetal health, as suggested by Caiet al.[10] Additionally, the comparable Apgar scores at both 1 and 5 minutes between the two groups indicate that neonatal health was not adversely affected by the surgical method, which is consistent with the findings of previous studies that found no significant differences in neonatal outcomes between laparoscopic and open appendectomy.

Postoperative complications were also evaluated in this study, with the laparoscopic approach demonstrating a lower incidence of complications overall. The laparoscopic group experienced a significantly lower rate of postoperative infection (4%) compared to the open appendectomy group (10%), supporting the findings of Zhanget al., who reported that laparoscopic surgery is associated with fewer postoperative infections.[12] The rate of abscess formation was higher in the open surgery group (6%) compared to the laparoscopic group (2%), which is consistent with previous studies that highlighted the advantage of laparoscopic surgery in reducing the risk of intra-abdominal abscesses and other complications. Furthermore, deep vein thrombosis (DVT) was observed in only one patient from the open surgery group, whereas no cases were reported in the laparoscopic group, reinforcing the reduced risk of thromboembolic events associated with laparoscopic surgery.

Finally, recovery outcomes demonstrated the enhanced benefits of laparoscopic surgery, particularly in terms of postoperative pain, mobility, and return to normal activities. The laparoscopic group reported significantly lower postoperative pain scores (mean score of 3.2) compared to the open surgery group (mean score of 5.1), which aligns with the results of Rountiset al, who both observed reduced postoperative pain following laparoscopic procedures.[8] Additionally, the laparoscopic group achieved full mobility significantly faster (3.2 days) compared to the open surgery group (5.0 days) and returned to normal activities more quickly (7.5 days versus 10.3 days). These findings reflect the enhanced recovery associated with laparoscopic surgery, as evidenced in prior studies that emphasized the minimal discomfort and rapid recovery afforded by minimally invasive techniques.

CONCLUSION

The results of this study align with existing literature that supports the use of laparoscopic appendectomy in pregnant patients with acute appendicitis. Laparoscopic surgery was associated with shorter operative times, fewer complications, quicker recovery, and similar maternal and fetal outcomes when compared to open appendectomy. These findings further reinforce the growing body of evidence suggesting that laparoscopic appendectomy should be the preferred approach in managing acute appendicitis during pregnancy, as it offers significant advantages in terms of both maternal safety and fetal well-being, as demonstrated in numerous studies over the past decade.

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