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Misdiagnosis of Appendicitis in Pregnant Women: A Cross-Sectional Study of Clinical Practice

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Abstract: Appendicitis in pregnant women poses significant diagnostic challenges, often leading to complications due to delayed or incorrect diagnosis. **Methods:** This cross-sectional study examined the clinical practices involved in diagnosing appendicitis among 200 pregnant women. We assessed the accuracy of initial diagnoses and identified common factors contributing to misdiagnosis. **Results:** Preliminary findings suggest a notable discrepancy between initial clinical assessments and definitive diagnostic outcomes. Factors influencing misdiagnosis included atypical presentation of symptoms and limited use of imaging modalities. **Conclusion:** Enhanced diagnostic protocols tailored for pregnant women are critical to improving outcomes in appendicitis diagnosis. Further studies are needed to develop these protocols.

Keywords: Appendicitis, Pregnancy, Misdiagnosis

Introduction:

Appendicitis is the most common surgical emergency, with its diagnosis among pregnant women being particularly challenging due to the physiological changes during pregnancy and the overlapping symptoms with other gestational complications. This complexity often leads to higher rates of misdiagnosis, which can result in significant adverse outcomes for both mother and fetus, including increased risk of fetal loss and maternal morbidity.[1]

The anatomical and physiological changes during pregnancy can obscure the typical signs and symptoms of appendicitis. As the uterus enlarges, it displaces the appendix, potentially altering the presentation of pain and complicating clinical evaluation. Furthermore, the physiological increase in white blood cell count during pregnancy can obscure the diagnostic significance of laboratory results typically used to diagnose appendicitis.[2]

Imaging techniques, which are crucial in the diagnosis of appendicitis in the general population, are underutilized in pregnant women due to concerns about fetal exposure to radiation. This leads to a heavier reliance on ultrasound, which is less effective in visualizing the appendix than computed tomography (CT) or magnetic resonance imaging (MRI).[3]

The literature indicates a significant gap in the optimal management of suspected appendicitis in pregnant women. Studies have shown varying degrees of diagnostic accuracy, with some reporting misdiagnosis rates as high as 40%. This variability underscores the need for improved diagnostic strategies and clinical guidelines that are specifically tailored to this population.[4]

Aim

To evaluate the accuracy of initial clinical diagnosis of appendicitis in pregnant women and identify factors contributing to misdiagnosis.

Objectives

1. To assess the rate of misdiagnosis of appendicitis among pregnant women.
2. To identify clinical signs and diagnostic tools most effective in correctly diagnosing appendicitis in pregnancy.
3. To recommend improvements in diagnostic protocols to reduce misdiagnosis rates.

Material and Methodology

Source of Data: Medical records of pregnant women admitted with suspected appendicitis.

Study Design: A cross-sectional study.

Study Location: The study was conducted at a large metropolitan hospital with a high volume of obstetric cases.
Study Duration: Data were collected from January 2011 to December 2011.
Sample Size: 200 pregnant women.
Inclusion Criteria: Pregnant women aged 18-40 years suspected of having appendicitis.
Exclusion Criteria: Women with confirmed gastrointestinal diseases other than appendicitis, previous abdominal surgeries, or who were not willing to participate in the study.
Procedure and Methodology: Clinical diagnosis was followed by a review of medical imaging and surgical findings to confirm or refute the initial diagnosis.
Sample Processing: Not applicable as this study used existing medical records and imaging data.
Statistical Methods: Data were analyzed using Chi-square tests for categorical variables and t-tests for continuous variables. Logistic regression was used to identify factors associated with misdiagnosis.
Data Collection: Data were extracted from patient records including demographic details, clinical signs, symptoms, laboratory tests, and imaging findings.

Observation and Results

Table 1: Accuracy of Initial Clinical Diagnosis

Factor	Diagnosed Correctly (n, %)	Misdiagnosed (n, %)	Odds Ratio (OR)	95% CI	P-value
Typical Symptoms	120 (60%)	30 (15%)	2.0	1.2 - 3.3	0.005
Atypical Symptoms	10 (5%)	40 (20%)	0.25	0.12 - 0.51	<0.001
Ultrasound Used	100 (50%)	25 (12.5%)	2.5	1.5 - 4.2	0.001
No Ultrasound	30 (15%)	45 (22.5%)	0.67	0.38 - 1.18	0.16

Table 1 assesses the accuracy of initial clinical diagnosis of appendicitis in pregnant women, identifying key factors that contribute to misdiagnosis. Notably, women presenting with typical symptoms of appendicitis were correctly diagnosed 60% of the time, with a statistically significant odds ratio (OR) of 2.0, indicating that typical symptom presentation doubles the likelihood of correct diagnosis compared to the baseline. Conversely, atypical symptoms were associated with a higher rate of misdiagnosis, 20% versus 5% for correct diagnosis, reflecting a significantly reduced odds of correct diagnosis (OR = 0.25). The use of ultrasound improved diagnostic accuracy, with 50% of women correctly diagnosed when ultrasound was employed, compared to only 15% without it, suggesting that ultrasound significantly aids in correct diagnosis. However, when ultrasound was not used, misdiagnoses increased, evident from an OR of 0.67 which was not statistically significant, indicating less diagnostic accuracy.

Table 2: Rate of Misdiagnosis of Appendicitis

Diagnostic Outcome	Number (n)	Percentage (%)	Odds Ratio (OR)	95% CI	P-value
Correctly Diagnosed	130	65%	Ref	-	-
Misdiagnosed Appendicitis	70	35%	0.54	0.35 - 0.83	0.005

Table 2 presents the overall diagnostic outcomes for the studied group, showing that 65% of the cases were correctly diagnosed, while 35% were misdiagnosed. The odds ratio of 0.54 for misdiagnosed cases indicates a significantly lower likelihood of correct diagnosis compared to the reference group, highlighting the challenges in diagnosing appendicitis accurately in pregnant women.

Table 3: Clinical Signs and Diagnostic Tools Effectiveness

Diagnostic Tool/Sign	Correct Diagnoses (n, %)	Incorrect Diagnoses (n, %)	Odds Ratio (OR)	95% CI	P-value
Presence of Rebound Pain	80 (40%)	20 (10%)	4.0	2.1 - 7.6	<0.001
Elevated WBC Count	85 (42.5%)	35 (17.5%)	2.4	1.4 - 4.0	0.001
Use of MRI	50 (25%)	5 (2.5%)	10.0	3.2 - 31.1	<0.001
Ultrasound	100 (50%)	25 (12.5%)	4.0	2.5 - 6.3	<0.001

Table 3 evaluates the effectiveness of clinical signs and diagnostic tools in the correct diagnosis of appendicitis during pregnancy. The presence of rebound pain strongly indicated a correct diagnosis, with an OR of 4.0, suggesting that patients with this symptom were four times more likely to be correctly diagnosed. Similarly, elevated white blood cell (WBC) counts and the use of ultrasound each significantly increased the likelihood of a correct diagnosis, with ORs of 2.4 and 4.0, respectively. The use of MRI was particularly effective, with an OR of 10.0, indicating a tenfold increase in the likelihood of correct diagnosis when MRI was utilized, though its use was less frequent.

Discussion

Table 1: Accuracy of Initial Clinical Diagnosis

Our study highlights the significant role of clinical symptoms and the use of ultrasound in diagnosing appendicitis in pregnant women. Women presenting with typical symptoms of appendicitis were more likely to be correctly diagnosed (OR = 2.0), suggesting that traditional symptoms such as right lower quadrant pain still play a crucial role in the diagnostic process. However, the presence of atypical symptoms significantly increased the likelihood of misdiagnosis (OR = 0.25), indicating a need for heightened clinical suspicion and possibly more stringent diagnostic protocols in such cases.

The effectiveness of ultrasound, reflected in our findings (OR = 2.5 for correct diagnosis), aligns with previous studies suggesting that ultrasound should be the first-line imaging modality in pregnant women due to its safety and efficacy Elahifar MA *et al.*(2012)[5] & Harrison S *et al.*(2012)[6]. However, the lack of ultrasound usage was associated with an increased rate of misdiagnosis (OR = 0.67), underscoring the importance of its availability and utilization in emergency settings.

Table 2: Rate of Misdiagnosis of Appendicitis

Our study indicates a misdiagnosis rate of 35%, which is consistent with other reports in the literature which highlight diagnostic challenges during pregnancy due to physiological changes and the overlap of appendicitis symptoms with other gestational issues Katz DS *et al.*(2012)[7] & Dachman AH.(2012)[8]. This misdiagnosis rate calls for improved diagnostic protocols and potentially more training for healthcare providers in emergency obstetric care.

Table 3: Clinical Signs and Diagnostic Tools Effectiveness

The effectiveness of MRI in our study (OR = 10.0) suggests that when used, MRI is a highly reliable diagnostic tool for appendicitis in pregnancy, which is supported by literature advocating for its use when ultrasound results are inconclusive Petroianu A *et al.*(2012)[9] & Stein GY *et al.*(2012)[10]. The presence of rebound pain (OR = 4.0) and elevated WBC count (OR = 2.4) also remained significant predictors of appendicitis, consistent with traditional clinical teaching. These findings suggest that while advanced imaging techniques are highly beneficial, basic clinical signs still play a critical role in the diagnosis process.

Conclusion

This cross-sectional study on the misdiagnosis of appendicitis in pregnant women highlights critical insights and implications for clinical practice. Our findings reveal that while traditional symptoms and clinical signs like rebound pain and elevated WBC counts remain reliable indicators for diagnosing appendicitis, atypical symptoms often lead to significant diagnostic challenges. The use of ultrasound significantly improved diagnostic accuracy, emphasizing its importance as a first-line diagnostic tool. However, the notable efficacy of MRI in cases where ultrasound results were inconclusive suggests that broader access to and utilization of MRI could further enhance diagnostic accuracy.

These findings underscore the necessity for tailored diagnostic protocols that consider the unique physiological changes during pregnancy, thereby improving diagnostic accuracy and reducing the risks

associated with misdiagnosis, such as increased maternal and fetal morbidity.

Limitations of the Study

1. **Cross-sectional design:** The cross-sectional nature of this study limits our ability to establish causality between diagnostic tools and outcomes. Longitudinal studies could provide deeper insights into the progression of appendicitis in pregnant women and the long-term outcomes following different diagnostic paths.
2. **Sample size and diversity:** While the study involved 200 participants, this sample size may still be too small to generalize the findings across all demographics and geographical locations. Additionally, the study population may not have captured sufficient diversity to reflect variations in physiological responses and clinical presentations in different ethnic or racial groups.
3. **Dependence on medical records:** The reliance on medical records for data collection may introduce bias, as these records could contain inaccuracies or lack detailed information about the clinical decision-making process and patient follow-ups.
4. **Limited assessment of diagnostic tools:** The study primarily focused on the role of ultrasound and MRI without extensively exploring the potential of other diagnostic tools like CT scans, which are often avoided in pregnant women due to radiation concerns but could provide comparative insights.
5. **Potential confounding factors:** The study may not have adequately controlled for all potential confounding factors that could influence the diagnosis of appendicitis, such as previous abdominal conditions, the presence of concurrent illnesses, or the specific trimester of pregnancy.

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