

Appendicitis in pregnancy: a novel approach for diagnostic dilemma

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Abstract

Background: The preoperative diagnosis of acute appendicitis is often inaccurate in pregnant women, and complicated appendicitis is associated with a high rate of fetal loss.

Objective: Our purpose was to elicit a better understanding of the presentation of acute appendicitis in pregnancy and to clarify diagnostic dilemmas reported in the literature.

Study design: We retrospectively reviewed 15216 deliveries from June 2009 to December 2011. Selected records were reviewed for gestational age, signs and symptoms at presentation, complications and, histologic diagnosis of appendicitis.

Results: Of 15216 deliveries, 15 (0.1%) were complicated by a preoperative diagnosis of probable appendicitis. Acute appendicitis was confirmed histologically in 12 (80%) of the 15 cases. Right-lower-quadrant pain was the most common presenting symptom regardless of gestational age (first trimester [100%]; second trimester, [80%]; and third trimester, [60%]). The mean maximal temperature for proven appendicitis was 37.6°C, in comparison with 37.8°C (not significant) for those with normal histologic findings. The mean leukocyte count in patients with proven appendicitis was $16.4 \times 10^9/L$ ($8.2-27.0 \times 10^9/L$), in comparison with $14.0 \times 10^9/L$ ($5.9-25.0 \times 10^9/L$) for patients with normal histologic findings. At the time of surgery, appendiceal perforation was found in 2 cases.

Conclusion: Pain in the right lower quadrant of the abdomen is the most common presenting symptom of appendicitis in pregnancy

regardless of gestational age. Fever and leucocytosis are not clear indicators of appendicitis in pregnancy.

Key words: appendicitis in pregnancy, pain location, leukocytosis.

Introduction

Appendectomy for presumed acute appendicitis is the most common non-obstetric surgical emergency during pregnancy, occurring in 1 in 766 births. This represents an overall incidence of 0.05% to 0.07% and does not appear to be any different in the nongravid population^{1,2}. One report of a reduced incidence of appendicitis during pregnancy suggested a possible protective effect and the mean age is 28 years³. Remarkably, the preoperative diagnosis is incorrect in 25% to 50% of patients for several reasons^{4,5}. Although it can occur in any trimester, there appears to be a slight predominance in the second trimester, with incidences of approximately 30%, 45%, and 25% in the first, second, and third trimesters, respectively⁶. Diagnosing appendicitis is an emergency because it is a potentially life-threatening process for both the mother and may also affect the fetus with preterm labour and delivery. Diagnostic criteria in non-pregnant women cannot be applied in pregnant women because of the changes in anatomy and physiology. Signs and symptoms which are common to both normal pregnancy and appendicitis include anorexia, nausea and vomiting, mild to moderate leucocytosis, and pain. These ultimately lead to diagnostic dilemma for appendicitis in pregnancy.

Uncertainty in making the diagnosis can contribute to delay in surgical intervention with increased maternal and fetal morbidity and mortality rates. The low diagnostic accuracy rate for appendicitis in pregnancy has been accepted as a consequence of an aggressive surgical strategy to minimise the risk of maternal mortality and fetal loss associated with ruptured appendicitis resulting from delayed diagnosis^{7,8}.

Objective

The objective of the study was to elicit a better understanding of the presentation of acute

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appendicitis in pregnancy and to clarify diagnostic dilemmas reported in the literature.

Material and method

All pregnant patients delivered at J K Lone Hospital Kota (India) and in private nursing home and hospitals in the Kota city from June 2009 to December 2011 were reviewed. Records that were coded as "rule out appendicitis" or "appendicitis" were selected. In addition, all patients who had an exploratory laparotomy performed were screened to ensure the greatest possible data accuracy. Data gathered from these records included the presenting complaints, gestational age at presentation, history, physical examination, laboratory evaluation, temperature and operative findings and histopathological examination. Outcome variables included preterm labour, preterm delivery, abruptio placentae, sepsis, appendiceal rupture, and neonatal death.

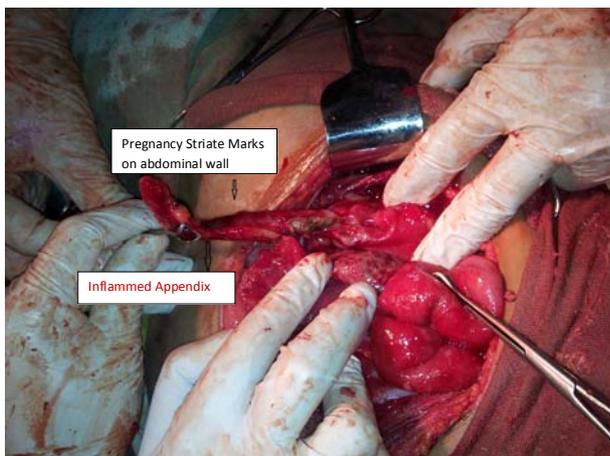


Figure 1. Inflamed appendix in a pregnant woman.

Results

There were 15216 deliveries during the 2 and half year study period; 15 (0.1%) had a preoperative diagnosis of probable appendicitis. Acute appendicitis was confirmed histologically in 12 (80%) of the 15 women. Distribution of suspected appendicitis in pregnancy was as follows: first trimester, 3 cases (20%); second trimester, 6 (40%); and third trimester, 6 (40%).

Pain in the right lower quadrant of the abdomen was the most common presenting symptom regardless of gestational age: 2 (100%) of 2 cases, 4 (80%) of 5 cases and 3 (60%) of 5 cases in the first, second, and third trimesters, respectively (Table 1), were histologically proven appendicitis amongst the suspected cases of appendicitis. The false-positive rate was 20% (3 out of 15). Other locations of pain included the left lower quadrant, mid abdomen, epigastric region, and a combination of locations. The mean maximal temperature for proven appendicitis was 37.6°C (35.5°C-39.4°C), in comparison with 37.8°C (36.7°C-38.9°C; not significant) for those with normal histologic findings (Table 2). The mean leukocyte count in patients with proven appendicitis was $16.4 \times 10^9/L$ ($8.2-27.0 \times 10^9/L$), in comparison with $14.0 \times 10^9/L$ ($5.9-25.0 \times 10^9/L$) for patients with normal histologic findings (Table 3). The mean maximal temperature did not show a statistically significant difference and therefore did not help in distinguishing true appendicitis.

At the time of surgery, appendiceal perforation was found in 2 cases (13%). One delivery occurred in the postoperative period complicated by abruptio placentae.

Table 1. Pain location by gestational age in histologically proven cases

| Estimated gestational age (wks.) | Patients (No.) | Location of pain | | |
|----------------------------------|----------------|----------------------|----------------------|-------|
| | | Right upper quadrant | Right lower quadrant | Other |
| 0-12 (1st trimester) | 2 | 0 | 2 | 0 |
| 12-24 (2nd trimester) | 5 | 1 | 4 | 0 |
| >24 (3rd trimester) | 5 | 2 | 3 | 0 |

Table 2. Mean maximal temperature

| Histological finding | Mean maximal temperature (°C) | Temperature >37.8°C | |
|----------------------|-------------------------------|---------------------|------------|
| | | Number | Percentage |
| Normal | 37.8 | 2/3 | 66 |
| Abnormal | 37.6 | 7/12 | 58.3 |

Table 3. Mean leukocytosis in all cases

| Histological finding | Mean leukocytes count ($\times 10^9/L$) | Patients with leukocyte count $>15 \times 10^9$ | |
|----------------------|---|---|------------|
| | | Number | Percentage |
| Normal | 14 | 2/3 | 67% |
| Abnormal | 16.8 | 5/12 | 42% |

Discussion

In our pregnant population the incidence of appendicitis is slightly higher than in an age-matched group of nonpregnant women described in the surgical literature. The proven incidence of acute appendicitis is similar in pregnant and nonpregnant women^{1,2}.

The most common presenting symptoms for appendicitis in pregnancy include anorexia, nausea, vomiting, and right lower quadrant pain^{5,9}. Fever and tachycardia may not be present during pregnancy⁹. It is long held belief that the appendix changes its location during pregnancy with an upward displacement toward the costal margin in the later stages of pregnancy^{10,11}. Obstetrics teaching historically for ~70 years has been that the pain of appendicitis migrates upward with the growing uterus; thus pain in the right upper quadrant of the abdomen would be expected in the third trimester. This concept was based on studies that described changes in appendiceal location as pregnancy progresses. Barium studies, performed in 78 women, showed that the growing uterus pushes the appendix upward and with a counterclockwise rotation of the tip. Theoretically, this would change the location of perceived pain toward the right upper quadrant or right flank with advancing gestational age. It is important to note that there is no one reliable sign or symptom that can aid in the diagnosis of appendicitis

in pregnancy, and the classic signs of appendicitis such as positive Rovsing's and psoas sign have not been shown to be of any clinical significance in diagnosing an acute appendicitis in pregnancy¹².

Location of pain: an important predictor: Oto A *et al* (2006) and Pates JA (2009) concluded the pain of appendicitis radiates with advancement of gestational from right lower quadrant to right upper abdomen^{13,14}.

As far as our study is concerned on contrary to long held belief of migration of pain in appendicitis in pregnancy, pain remain localised to right lower abdomen in majority of patients regardless of gestational age (Table 1). As the appendix becomes obstructed by a coprolith, it distends and visceral afferent nerves are stimulated, causing constant poorly localised pain starting near the umbilicus and eventually migrating to McBurney's point, which overlies the location of the appendix in most nonpregnant patients. As the full thickness of the appendiceal wall becomes necrotic and the serosa is damaged, the somatic neurons are stimulated, which localises the pain to the right lower quadrant. This process appears to remain similar in pregnancy, contrary to the classical teaching.

Accurate diagnosis of appendicitis in pregnancy can be a diagnostic dilemma, with an accepted false-positive rate of ~15%. In pregnancy the diagnosis is

made even more difficult by the growing uterus, leading to inappropriate delay in making the correct diagnosis. The reluctance to operate in pregnancy adds to delay.

The objective of this study was to assess the classic signs and symptoms of acute appendicitis to determine their applicability in pregnancy.

Imaging studies: an aid to diagnosis: Traditionally what does this mean? has shown to be highly sensitive and specific although to a lesser degree after a gestational age of 35 weeks due to technical difficulties¹⁵. Though ultrasound is rarely helpful in making a diagnosis of acute appendicitis it helps in excluding other pathology like right ovarian or adnexal disease¹⁶. As far as imaging studies are concerned imaging of the appendix using helical computed tomography has recently shown to be a safe and potentially reliable tool to accurately identify appendiceal changes in appendicitis. Radiation exposure using this test is 300 mrad, which is below an accepted safe level of radiation exposure in pregnancy of 5 rad. Reliance on radiographic studies may not be cost-effective, and may deter from careful and timely serial physical exams¹⁷. MRI can be extremely helpful but operator dependant, expensive and time consuming¹⁶.

Mean maximal temperature: In our study there was no distinguishing temperature that separated true appendicitis from suspected cases turned out to be falsely positive. 66% of the patients with normal histology of appendix have mean maximal temperature more than 37.8°C while 58.3% patients having abnormal histology of appendix also have the same temperature (Table 2).

Leukocytosis: The incidence of leukocytosis was slightly higher in acute appendicitis, but the overlap was substantial and negates the value of this laboratory test in reducing false-positive cases and possibly avoiding laparotomy.

Our data support the concept that the majority of patients with acute appendicitis in pregnancy have pain in the right lower quadrant nearly in all trimesters. We could not demonstrate a difference between the histologically proven cases of appendicitis and the "pretenders". Early surgical intervention, with less than a 24-hour delay, has shown to be vital in minimising both maternal and fetal morbidity and mortality. Surgical delays of more than 24 hours from the time of presentation have been associated with appendiceal perforation and significant fetal loss and cases of maternal mortality^{9,18}. Use of antibiotic during or after surgery may expose

the developing fetus to potential teratogenic substances¹⁹. Pregnancy related pharmacodynamic changes result in reduced maternal plasma levels of antibiotics²⁰. If perforation, peritonitis, or gangrenous appendix has occurred, broad-spectrum antibiotics with anaerobic coverage such as the second-generation cephalosporin would be appropriate²¹.

Approach to diagnosis:

- If a pregnant patient comes with pain in right iliac fossa with clinical signs of appendicitis always have a high degree of suspicion to avoid unacceptable delay, with the possibility of increased morbidity and mortality rates.
- Laboratory investigations add little to diagnosis. There may not be leukocytosis and or elevated body temperature.
- In the first trimester or early second trimester consider pelvic ultrasound first, especially if the differential includes adnexal pathology.
- If second (especially late) or third trimester consider going straight to CT scan since this is more helpful and easier to interpret than an MRI.

Conclusion

The accurate diagnosis of appendicitis during pregnancy requires a high level of suspicion and clinical skills, and not merely relying on the classic signs and diagnostic testing. Early surgical intervention is essential. Our data demonstrate that pain in right lower abdomen is the most common symptom of appendicitis in pregnancy regardless of gestational age. Temperature is not reliably elevated in pregnant patients, and leukocytosis is present but cannot be used to rule out acute appendicitis. It remains to be determined which diagnostic test is best suited to facilitate or determine a diagnosis of acute appendicitis in pregnancy and often the correct diagnosis is determined only at surgical intervention. If in doubt after relevant investigations but have strong clinical suspicion we should go for appendicectomy preferably laparoscopically if feasible.

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