

# **Acute appendicitis during pregnancy**

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Saudi Journal of Obstetrics and *Gynecology*.

# SAUDI JOURNAL OF OBSTETRICS AND GYNECOLOGY

OFFICIAL PUBLICATION OF THE SAUDI OBSTETRICS AND  
GYNECOLOGICAL SOCIETY

3 January, 2006

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## **ACUTE APPENDICITIS DURING PREGNANCY**

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**BACKGROUND:** Acute appendicitis is the most common cause of an acute abdomen in pregnancy, but there is a wide differential diagnosis which should be considered. Appendicitis is estimated to occur in 1 in 1500 pregnancies. The goal of this study is to evaluate clinical presentation and factors associated with complications of appendicitis during pregnancy.

**METHODS:** Records of patients with the clinical diagnosis of appendicitis in pregnancy, over a period of 5 years between 1<sup>st</sup> of January 2000 and 31<sup>st</sup> December 2004, were reviewed. Demographic, clinical, and paraclinical data were collected. Multivariate analysis was carried out by logistical regression.

**RESULTS:** Twenty eight consecutive cases were reviewed Eleven (39%) in first, 6 (22%) in second and 11(39%) in third trimester. The mean age was thirty years old. Fifteen (54%) had noncomplicated appendicitis, 4 (14%) had complicated appendicitis, and 9 (32%) had negative exploration. The obstetric morbidity following appendectomy included 2 (18%) spontaneous abortion in the patients operated upon in the 1<sup>st</sup> trimester but none in the second trimester. Furthermore, 27% of the cases operated upon in the third trimester went in labor before discharge.

**CONCLUSIONS:** In pregnancy a high clinical suspicion is necessary to make the diagnosis. Ultra-sound is not reliable beyond the 2<sup>nd</sup> trimester. If appendicitis is strongly suspected there should be no delay in surgical interference.

**Keywords:** appendicitis, pregnancy, fetal outcome.

**Introduction:**

The lifetime risk of developing appendicitis has been estimated to be 6-9%. In 1849, the first case of appendicitis during pregnancy was reported in the medical literature<sup>2</sup>. Acute appendicitis has traditionally been a clinical diagnosis and remains so to this day.<sup>3-5</sup> Acute appendicitis is the most common non gynecological cause of an acute abdomen in pregnancy, but there is a wide differential diagnosis which should be considered.<sup>6-11</sup> Appendicitis is estimated to occur in 1 in 1500 pregnancies<sup>7,8</sup>. Early diagnosis is difficult as features, such as nausea, vomiting and leucocytosis are present in many normal pregnancies. Delay in diagnosis of acute appendicitis increases the risk of morbidity and mortality for the patient and the fetus. Surgical exploration itself is not without risk<sup>8</sup>.

**METHODS:**

The operating room registry was examined for all cases of appendicitis with pregnancy that had been performed during 3 years period between 1<sup>st</sup> of January,2000 and 31<sup>st</sup> of December 2004. A total of 28 patients were identified. The files were retrieved and examined for the following data: patient's age, gestational stage at presentation, gastro-intestinal symptoms, clinical signs (temperature, pulse, abdominal wall rigidity, right iliac fossa rebound tenderness and rectal pain) and white blood cell count. The result of ultrasonography, if done, was obtained. According to the operative finding and pathology report the status of the appendix was divided into noncomplicated (inflamed, gangrenous without perforation), complicated (perforation, abscess, peritonitis), and normal. The rate of fetal loss in the 1<sup>st</sup> trimester and early second trimester (miscarriage) was examined in relation to the histo-pathology finding whether inflamed or normal appendix. The gestational age was defined as follows: first trimester, upto and including the 12<sup>th</sup> week of pregnancy, second trimester, between the 13<sup>th</sup> and 28<sup>th</sup> week inclusive, and third trimester (beyond the 29th week).

**RESULTS:**

The mean age was thirty years old with standard deviation of 7.2. The gestational age distribution was as follow: 11(39%) 1<sup>st</sup> trimester 6(22%) 2<sup>nd</sup> trimester and 11(39%) 3<sup>rd</sup> trimester. Fifteen (54%) had noncomplicated appendicitis, 4 (14%) had complicated appendicitis, and 9 (32%) had negative exploration (normal appendix). The commonest site for abdominal pain was right iliac fossa in all the three trimesters. The relation between clinical factors and ultrasound in each of the three trimesters is shown in table 1. As regard the clinical symptoms and signs, the commonest site for abdominal pain was in the right iliac fossa. The relation between clinical factors and histopathology is shown in table 2.

Multivariate analysis was carried out by logistical regression and we found that there is statistically significant relationship between both W.B.C > 15 (p value= 0.004) , fever (p value= 0.008) and positive histo-pathology of the appendix. The relation between ultra-sound in all the three trimesters and the histo-pathology is shown in table 3.

The sensitivity of the ultra-sound was 79% while specificity 44% and the positive likelihood ratio was 1.42 and the negative likelihood ratio was 0.47. The ultra-sound sensitivity in the 1<sup>st</sup> trimester is 87% while specificity is 33% and in the 3<sup>rd</sup> trimester the sensitivity dropped to 57% while specificity increased up to 75%. There was 2 Cases of miscarriage following appendectomy. Of those one had inflamed appendix and the other the appendix was normal.

No statistically significant relationship between obstetric complication (miscarriage and premature labour) and positive histo-pathology of the appendix as p value= 0.528 so the complications might be related to operative trauma rather than the inflammatory process.

**Discussion:**

The pregnant patient with appendicitis presents a unique challenge to both surgeon and gynecologist. Appendicitis during pregnancy is associated with significant morbidity and mortality if not promptly identified and treated.<sup>9,10</sup>

The clinical accuracy of diagnosing acute appendicitis ranges from 70% to 87%<sup>12</sup>. Published negative appendectomy rates range from 9% to 40%<sup>4</sup>, with the highest rates in women of childbearing age. Adolescents have a higher risk of appendicitis in pregnancy than other age groups<sup>13</sup>. Acute appendicitis developing in pregnancy produces significant diagnostic and therapeutic dilemmas.<sup>14,15</sup> Symptoms may mimic those of normal or abnormal pregnancy. Signs are often altered, obscured or absent. Investigations are complicated by the normal changes during pregnancy that resemble disease or produce changes in reference ranges. The risks to the fetus of ionising radiation, analgesics, antibiotics and anaesthetics must all be borne in mind. Treatment may be limited by the need to avoid or minimise surgery. All of these factors can lead to delays in diagnosis and treatment for some severe intra-abdominal emergencies, which can pose significant threat to both mother and fetus<sup>11,15</sup>. The gravid uterus, stretching the anterior abdominal wall, prevents direct peritoneal irritation, thus concealing the classical signs of localized peritonitis as well as preventing the greater omentum from reaching, and perhaps containing, areas of inflammation.<sup>8,16</sup> Classical teaching holds that the appendix migrates toward the right upper quadrant during pregnancy as it is displaced by the enlarging uterus. This was based on Baer's series of barium enemas in pregnant women reported in 1932<sup>17</sup> which proved to be false<sup>5,16</sup>. Right lower quadrant pain was the most commonly presenting symptom in 22(78.6%) regardless of gestational age, and the condition occurred in all trimesters of pregnancy as in other studies.<sup>9,13,16,18,19</sup> Clinical examination has limitations in confirming the diagnosis; fever and rebound tenderness are variable features in our study fever was in 25(89%) while rebound tenderness in 26(93%). In some studies less than half of patients with proven appendicitis in pregnancy had rebound or tenderness on rectal examination. The white cell count is thought to be unhelpful due to the relative leucocytosis of pregnancy<sup>7</sup> but in our study there is statistically significant relationship between W.B.C > 15 (p value= 0.004) and positive histopathology of the appendix. Urinalysis may also be misleading as haematuria and leucocytosis are present in many conditions. Even proof of bacteriuria is often nondiagnostic due to the rate of asymptomatic bacteriuria in the pregnant and non-pregnant population being around 5–10%<sup>7</sup>. These diagnostic difficulties can lead to delay and progression of the underlying disease. Ultrasound has been shown to be very sensitive in the diagnosis of appendicitis, up to 86% in the nonpregnant population<sup>7</sup>. This combined with its safety in obstetric practice make it the



modality of choice in the investigation of possible appendicitis in pregnancy. Series have shown that graded compression ultrasound has a high sensitivity and specificity for appendicitis in the first and second trimesters but is technically difficult in later gestation<sup>20,21</sup>. The sensitivity of ultra-sound in our study was 79%. The value of using helical computed tomography is questionable.<sup>8,12</sup> The difficulty in diagnosis and the reluctance to operate in pregnancy can lead to a significant delay in treatment. Traditional surgical teaching suggests that any abdominal surgery during the first trimester of pregnancy is fraught with fetal loss while intervention in the third trimester is associated with preterm deliver<sup>22</sup>.

Several series have shown that early intervention avoids morbidity and mortality<sup>7</sup>. Complications from appendicitis that occur during pregnancy include preterm labor, increased maternal morbidity, and early fetal delivery or fetal loss. A perforated appendix often leads to uterine contractions and premature labor. However, the use of tocolytics prior to surgery is not recommended for prophylactic use primarily due to the potential risk of fluid overload that can result in pulmonary edema and adult respiratory distress syndrome with use of tocolytics<sup>13</sup>. The fetal loss rate in perforated appendicitis rises sharply from 1.5% to as high as 36%<sup>13</sup>. Acute appendicitis can cause premature labor pains, especially if the appendix is perforated, which occurs in 14% in our study but was up to 80% in other studies<sup>9-16</sup>. Appendiceal rupture has been reported to occur twice as often in the third trimester (69%) as it does in the first and second trimesters (31%)<sup>23</sup>.

There is an increased risk of delivery the week following surgery when performed after 23 weeks; gestation<sup>13</sup>. Spontaneous abortion rate in the first trimester was 18% compared with none in the second. Furthermore, 27% of the cases reported in the third trimester resulted in premature labor which is similar to other studies<sup>9,13,16,24</sup>.

In a related study of nonobstetric operations, preterm delivery was noted to be higher with third trimester surgical manipulation. Within 2 weeks of the operation, the rate was 25% in the third trimester compared with 8% in the second trimester<sup>22</sup>.

The management of appendicitis during pregnancy is a surgical emergency, and perforated appendicitis is the number one surgical cause of fetal loss during pregnancy<sup>25</sup>. For this reason, pregnancy should not delay the surgical treatment of appendicitis. Time has not changed the adage that the mortality of appendicitis complicating pregnancy is the mortality of delay.

The decision to operate in suspected appendicitis in pregnancy must be made bearing in mind the consequences of delayed treatment. Close consultation should take place between the involved specialities (surgery, obstetrics, anaesthetics and neonatology). Surgical exploration

itself is not without risk as pre-term labour occurs in 9% of negative laparotomy while in other series upto 15%<sup>8</sup>. Intra-operative considerations must include slight left positioning of the patient and minimal uterine manipulation. Operative approach depends on surgical preference. Both open (68%) and laparoscopic (32%) appendectomy have been utilized with success<sup>5,22</sup>.

Despite new adjuncts in the evaluation the patients with a suspected diagnosis of appendicitis (ultrasonography, computerized tomography, laparoscopy), there was no difference in perforation or negative appendectomy rates<sup>4</sup>.

Most of the larger series of appendectomies during pregnancy have a negative laparotomy rate between 14 and 43%.<sup>23,26</sup> and it was 32% in our series.

**Conclusions:**

It is very important to diagnose appendicitis in pregnant women because this life-threatening condition for the mother may also affect the fetus by causing preterm labor and delivery. It can be concluded that a high clinical suspicion is necessary to make the best diagnosis. The management of appendicitis during pregnancy is a surgical emergency, and perforated appendicitis is the number-one surgical cause of fetal loss during pregnancy. For this reason, pregnancy should not delay the surgical treatment of appendicitis.

**References:**

1. Addis DG, Sheffer N, Fowler BS, et al. The epidemiology of appendicitis and appendectomy in the United States. *Am J Epidemiology*. November. 1990; 132:910.
2. Hancock H. Disease of appendix caeci cured by operation. *Lancet*. 1942; 2:380-382.
3. Emil, S, Peter M, Labergem, J. Clinical versus sonographic evaluation of acute appendicitis in children: a comparison of patient characteristics and outcomes. *JPed Surg*. 2001; 36: 780-783.
4. Bergeron E, Richer B, Gharib R, et al. Appendicitis is a place for clinical judgement. *Am J Surg*. 2000; 179: 460-462.
5. Popkin C, Lopez P, Cohn S, et al. The incision of choice for pregnant women with appendicitis is through McBurney point. *Am J of Surg*. 2002; 183: 20-22.
6. Schwartz SI, Tomshires G, Spencer FC. Principle of Surgery. 1999:1383-1394.
7. Martindale A, Paisley A. Surgical and urological problems in pregnancy. *Elsevier Obstet & Gynecol*. 2004; 14: 350-355.
8. Castro MA, Shipp T, Castro E. The use of helical computed tomography in pregnancy for the diagnosis of acute appendicitis. *Am J Obstet Gynecol*. 2001; 184: 954-957.
9. Al Qasabi Q, Tyagi A, Al Dohayan A, et al. Acute appendicitis complicating pregnancy. *Annals Saudi Medicine*. 1991; 11: 58-61.
10. Ali M, Al Shehri, M, Zaki Z, et al. Acute abdomen in pregnancy. *International J Gynecol & Obstet*. 1998; 62: 31-36.
11. Tamir IL, Bongard FS, Klein SR. Acute appendicitis in the pregnant patient. *Am J Surg*. 1990; 160: 571-576.
12. Weyant M, Eachempati S, Maluccio M, et al. Interpretation of computed tomography does not correlate with laboratory or pathologic findings in surgically confirmed acute appendicitis. *Surgery*. 2000:145-152.
13. Angelini, D. Obstetric triage revisited: update on non-obstetric surgical conditions in pregnancy. *J Midwifery & Women's Health*. 2003; 48:111-118.
14. Guss D, Richards C. Comparison of men and women presenting to an ED with acute appendicitis. *Am J of Emergency Medicine*. 2000;18:372-375.
15. Auguste T, Murphy B, Oyelese Y. Appendicitis in pregnancy masquerading as

- recurrent preterm labor. *International Gynecol & Obstet.* 2002; 76: 181-182.
16. Hodjati H, Kazerooni T. Location of the appendix in the gravid patient: a re-evaluation of the established concept. *International J Gynecol & Obstet.* 2003; 245-247.
  17. Baer JL, Reis RS, Arens RA. Appendicitis in pregnancy with changes in position and ascis of the normal appendix in pregnancy. *J Am Med Assoc.* 1932; 16: 1359-1364.
  18. Hee P, Viktrup L. The diagnosis of appendicitis during pregnancy and maternal and fetal outcome after appendectomy. *International J Gynecol & Obstet.* 1999; 65: 129- 135.
  19. Hoshino T, Ihara Y, Suzuki T. Appendicitis during pregnancy. *International J Gynecol & Obstet.* 2000; 69: 271-273.
  20. Lim H, Bae S, Seo G. Diagnosis of acute appendicitis in pregnant women: value of sonography. *Am J Radiol.* 1992; 159(3): 539-42.
  21. Berloon Tj, Brown BP, Abu-Yousef MM, Wamock N, Berhaum KS. Sonography of acute appendicitis in pregnancy. *Abdom Imag.* 1995; 20 (2): 49-51.
  22. Affleck D, Handrahan D, Egger M, et al. The laparoscopic management of appendicitis and cholelithiasis during pregnancy. *Am J Surg.* 1999; 178:523-528.
  23. Sharp H. The acute abdomen during pregnancy. *Clin Obstet and Gynecol.*2002; 45: 405-413.
  24. Devore GR. Acute abdominal pain in the pregnant patient. *Clin Perinatal.* 1980; 7: 349-369.
  25. Squines RA. Surgical considerations in pregnancy. *Audio Dig Serg* 1998; 45-6.

Table 1 Relation between the three trimesters and clinical findings and ultra-sound.

clinical findings and ultra-sound	1 <sup>st</sup> trimester	2 <sup>nd</sup> trimester	3 <sup>rd</sup> trimester
Right iliac fossa pain	11	3	8
rigidity	3	3	6
Rebound tenderness	10	6	10
Ultra-sound	9	6	5

Table2 Relation between clinical factors and histopathology

Histopathology	Fever	Pain in the right iliac fossa	Duration of pain>8h	Rebound tenderness	W.B.C >15
Inflamed appendix 19 (68%)	19 (76%)	15 (68%)	15 (75%)	17 (65%)	15 (88%)
Normal appendix 9 (32%)	6 (24%)	7 (32%)	5 (25%)	9 (35%)	2 (12%)
Total 28 (100%)	25 (100%)	22 (100%)	20 (100%)	26 (100%)	17 (100%)

Table 3 Relation between ultra-sound in all the three trimesters and the histo-pathology

Ultra-sound	Histo-pathology inflamed appendix	Histo-pathology normal appendix	Total
Positive	15	5	20
negative	4	4	8
Total	19	9	28