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# Acute appendicitis in pregnancy — risk factors associated with principal outcomes: A case control study

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**KEYWORDS**
Acute appendicitis;
Pregnancy;
Perforation;
Fetal loss;
Tocolytics

**Abstract** *Background:* The aim of this study was to determine the risk factors associated with the principal outcomes in acute appendicitis during pregnancy: appendix-perforation, and maternal and fetal mortality and maternal morbidity.
*Methods:* Fifty-two pregnant women who were diagnosed and operated upon acute appendicitis in Dicle University Hospital, Diyarbakir, Turkey were presented.
*Results:* The frequency of appendicitis was higher in second trimester. On laparotomy 21 patients had perforated, 29 patients had non-perforated and 2 patients had normal appendix. Interval between symptom onset and operation was found as the only predictive variable, which was independently associated with the presence of appendiceal perforation. There was a significant difference between perforated and non-perforated patients about the rate of complications (52% vs. 17%). Gestational age ($p = 0.036$), interval between symptom onset and operation ($p = 0.018$) and white blood cell count ($p = 0.025$) were the variables related with preterm labor. Tocolytic treatment after the onset of contractions could not prevent preterm labor. The rate of fetal mortality was 8%.
*Conclusions:* Presence of perforation is the only predictive factor for maternal morbidity. The aim of the surgeon should be operating the patient before perforation. An observation period may be essential in equivocal patients, but should be individualized according to duration of symptoms and findings of physical examination. The interval between the symptom onset and operation should never exceed 20 hours. Tocolytics should be ordered for the patients with delayed presentation and advanced gestational age in order to prevent preterm labor and fetal loss.


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## Introduction

A variety of non-obstetric conditions requiring operation may arise in women during pregnancy. Appendicitis is reported to be the most common non-obstetric surgical emergency during this period.[1–8] In spite of its frequency, there has been no serious improvement in the success of accurate diagnosis of acute appendicitis especially when close to term.[3–5,9] There are many studies describing the greater diagnostic difficulty, higher complication rate, and increased rates of fetal and maternal mortality.[3,4,6,9] The outcome may be improved if prompt diagnosis is made, and surgical intervention combined with obstetrical care is performed in the early period of the disease. Operating too quickly reduces the amount of perforations at the cost of a number of unnecessary operations whereas delaying too much reduces the latter at the cost of increasing the number of perforations. So it is important to estimate the best cut-off point of those elapsed times.

The aim of this study was to determine the risk factors associated with the principal outcomes in acute appendicitis during pregnancy: appendix-perforation, and maternal and fetal mortality and maternal morbidity.

## Methods

The study population consisted of 52 pregnant women who underwent operation with the diagnosis of appendicitis at the General Surgery Department of Dicle University Hospital between January 1990 and January 2005. The following data were analyzed: age, gestational age, signs and symptoms on presentation, duration of symptoms, physical findings, diagnostic modalities, length of time to operation from admission, surgical findings, histological diagnosis, maternal morbidity and maternal and fetal mortality.

The SPSS 12.0 for Windows (SPSS, Inc., Chicago, IL, USA) was used for the analysis of data. Quantitative data were expressed as means $\pm$ SD. Differences in continuous variables were analyzed by the Mann–Whitney *U*-test or Student's *t*-test. Differences in categorical variables were assessed with the Fisher's exact test and the chi-square test with Yate's correction; as appropriate, $p < 0.05$ was considered statistically significant. To estimate the independent contribution of each variable to the development of perforation and preterm labor, we applied a stepwise binary logistic regression analysis model. All the variables that were significant at $p < 0.05$ in the univariate analysis were considered for the model and odds ratio were calculated for each variable. The cut-off value of interval between the symptom onset and operation was calculated by Receiver Operating Curve (ROC) analysis.

## Results

Over a period of 15 years, 52 pregnant and 695 non-pregnant women underwent appendectomy. The mean age of the pregnant women was $26.92 \pm 6.11$ years (range, 16–43 years). Gestational stage at the diagnosis was first trimester in 11 (21%) patients, second trimester in 27 (52%) patients and third trimester in 14 (27%) patients. In relation to frequency of appendicitis, there was a statistically significant difference between trimesters ($p = 0.012$). Its frequency was higher in the second trimester.

The most common symptoms on presentation were right lower quadrant pain (69%), and nausea and vomiting (58%) (Table 1). The duration of symptoms ranged from 6 hours to 7 days, with a mean duration of $47.67 \pm 45.62$ hours. On physical examination, abdominal tenderness (100%) and rebound (65%) were the most common findings. Eighteen patients had tenderness at right lower quadrant of the abdomen alone. Mean white blood cell count (WBC) was $13\,784 \pm 5506/mm^3$. Leukocyturia was encountered in 58%, bacteriuria in 38% of the patients. Of 5 patients who were referred for observation more than 24 hours, 4 had leukocyturia and bacteriuria. Abdominal ultrasound revealed a non-compressible tubular structure in the right lower quadrant consistent with acute appendicitis in 10 patients. Other ultrasonographic findings are shown at Table 1. The sensitivity of ultrasound was 48% and specificity was 100%. Its positive predictive value was 100% and negative predictive value was 8%. The rate of accuracy was 50%.

Forty-seven patients underwent operation within 24 hours after admission, while 3 patients, all of whom were in second trimester, underwent within 24–48 hours. Two patients were taken to the operating room after 48 hours: one 4 and the other 10 days after presentation. Both of the patients had urinary infections and non-specific ultrasound findings. The second patient having additional symptoms such as vaginal hemorrhage and back pain had been hospitalized in gynecology department with the diagnosis of threatened abortion.

Perforated appendicitis, either with peritonitis or periappendicular abscess, was observed in 21