

# Outcomes of the patients diagnosed incidentally appendicitis during cesarean section

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## ABSTRACT

**Objectives:** Appendicitis is the most common condition leading to an intraabdominal operation for a non obstetric problem in pregnancy and diagnosis of appendicitis is complicated by the physiologic and anatomic changes that occur during pregnancy. Although a surgical procedure carries the risk of fetal loss or preterm delivery, delay in diagnosis also increases the risk of complications in both mother and fetus. In this report we present our experience and analyze clinical characteristic and the pregnancy outcomes of appendicitis diagnosed incidentally during cesarean in the third trimester.

**Material and methods:** The study population consisted of 23 pregnant women who were diagnosed incidentally with appendicitis during cesarean at Erzincan University Hospital between 2015 and 2016.

**Results:** Appendectomy was performed on 23 patients during a caesarean section performed for any reason. The mean diameter of appendix was  $7.82 \pm 1.85$  mm. The mean operation time was  $67.39 \pm 18.94$  SD and antibiotic therapy was given to all patients. Postoperative complications were noted in 4 (17.4%) patients. Wound infection was seen in 4 (17.4%) patients, the other 19 patients revealed no postoperative complications. The mean of APGAR score of newborns in the postoperative period was  $8.26 \pm 0.86$  SD and no complications were observed in both mothers and newborns. Histopathology of the specimen confirmed acute appendicitis in 23 (100%) cases.

**Conclusions:** Acute appendicitis is a challenging diagnosis in the pregnant patient; however, early surgical intervention should be performed with any suspicion. The type of surgery depends on the surgeon's preference and experience.

**Key words:** appendicitis, postoperative complications, pregnancy, premature birth

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## INTRODUCTION

Acute appendicitis is the most common general surgical problem encountered during pregnancy [1]. The diagnosis is particularly challenging during pregnancy because of the relatively high prevalence of abdominal/gastrointestinal discomfort, anatomic changes related to the enlarged uterus, and the physiologic leukocytosis of pregnancy. Appendiceal rupture occurs more frequently in pregnant women, especially in the third trimester, possibly because these challenges and reluctance to operate on pregnant women delay diagnosis and treatment [2, 3]. Although the clinical presentation and the course of acute appendicitis is similar in pregnant and non-pregnant patients, physiological and anatomical changes occurring in pregnancy lead to difficulty and/or delays in diagnosis [4, 5]. Anorexia,

nausea, vomiting, peri-umbilical or right lower quadrant pain and mild to moderate leukocytosis are common features in both acute appendicitis and normal pregnancy [6]. The long-term prognosis for women who have undergone appendectomy during pregnancy seems to be good, but data is limited to small observational series. Such women do not appear to be at increased risk of infertility or other complications [7]. There is scant information on long-term outcome in offspring. In a small series of appendectomy at all stages of pregnancy, children had normal development at 13 to 17 months of age [8].

## OBJECTIVES

The objective of the current study was to review our experience on this condition at a tertiary care hospital in

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Turkey. In this context, we present our cases diagnosed incidentally with appendicitis during cesarean section in light of the related literature

## MATERIAL AND METHODS

The study population consisted of 23 pregnant women who were diagnosed incidentally with appendicitis and had concomitant appendectomy during cesarean section at Erzincan University Hospital between 2015 and 2016. The diagnosis of appendicitis was made by measuring the dilatation of appendix more than 6 mm or palpation fekaloid inside the appendix. Appendectomy was performed in patients with these findings detected during a caesarean section performed for any reason. The patients were checked after 10 days and a month later postoperatively. 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-fetal morbidity, maternal-fetal mortality and early neonatal outcomes.

The statistical analysis was performed using the Statistical Package for the Social Sciences version 22 (SPSS Inc., Chicago, IL, USA). The data analysis included simple frequency determination. For quantitative data, means  $\pm$  standard deviation (SD) were calculated. Also, for quantitative data with skewed distributions, medians and ranges are presented.

## RESULTS

The mean age of the patients was  $28 \pm 6.2$  years. Eighteen patients (78.2%) were multigravida, and 5 (21.8%) were primigravida. All of the patients were in the 3<sup>rd</sup> trimester (Tab. 1).

The initial and presenting complaint of all patients were abdominal pain. The right lower quadrant was the most common site of the pain in all patients. Other symptoms were as follows: vomiting in 12 of the patients (52.2%), anorexia in 16 of them (69.6%) and nausea in 13 of them (56.5%). At initial examination, 2 patients (8.7%) were noted to be febrile. Abdominal tenderness in the right lower quadrant was identified in 6 of the cases (26.1%). Rebound tenderness was noted in 6 of all (26.1%). The leukocyte count raised in the majority of patients (87%). C-reactive protein (CRP) also rises in appendicitis, but it is a nonspecific sign of inflammation. In this study, CRP levels of 2.5 mg/dL were considered a positive. 78.2% percent of the patients had positive CRP levels. Mean value of CRP level was  $40.41 \pm 16.87$  (mean  $\pm$  SD) (Tab. 2).

Vaginal examination, abdominal ultrasonography, and nonstress test (NST) were performed in patients. Contractions in NST were seen in 95.7% of patients and 73.9% of them were earlier than 37 gestational week. 13 patients

**Table 1. Some obstetrical characteristics of the patients**

Characteristics	Mean $\pm$ SD	n (%)
Age (year)	28.8 $\pm$ 6.2	
Gravida	2.39 $\pm$ 1.2	
Parity	1.73 $\pm$ 0.75	
Gestational age (week)		
< 37 w		17 (73.9)
36 w		13 (56.5)
35 w		3 (13.0)
34 w		1 (4.3)
> 37 w		6 (26.1)
The fetal biophysical profile		
< 6		2 (8.7)
> 6		21 (91.3)
Contraction on NST		
Negative		1 (4.3)
Positive		22 (95.7)
Oligohydramnios		
Negative		20 (87)
Positive		3 (13)
Indications for caesarean section		
Appendicitis suspicion		2 (8.7)
Former caesarean section		12 (52.2)
Fetal distress		3 (13)
Malpresentation		6 (26.1)

**Table 2. Presenting signs and symptoms of pregnant females with appendicitis**

Signs and symptoms	Patients (n = 23)	
	Present n (%)	Absent n (%)
Abdominal tenderness	6 (26.1%)	17 (73.9%)
Rebound tenderness	6 (26.1%)	17 (73.9%)
McBurney's sign	5 (21.7%)	18 (78.3%)
Rovsing's sign	5 (21.7%)	18 (78.3%)
Rectal sensivity	3 (13%)	20 (87%)
Nausea	13 (56.5%)	10 (43.5%)
Vomiting	12 (52.2%)	11 (47.8%)
Anorexia	16 (69.6%)	7 (30.4%)
Fever	2 (8.7%)	21 (91.3%)
Dysuria	5 (21.7%)	18 (78.3%)
Leukocyturia	5 (21.7%)	18 (78.3%)
Bacteriuria	3 (13%)	20 (87%)
Hematuria	4 (17.4%)	19 (82.6%)
WBC counts > 1500	20 (87%)	3 (13%)
Neutrophilia	20 (87%)	3 (13%)
CRP levels > 2.5 mg/dL	18 (78.2%)	5 (21.8%)
Positive ultrasound	2 (8.7%)	21 (91.3%)

(56.5%) were 36 weeks' gestation, 3 patients (13%) were 35 weeks' gestation and one patient (4.3%) was 34 weeks' gestation. Cesarean section was performed in 2 patients

**Table 3. Intraoperative and postoperative findings**

	Mean ± SD	n (%)
Diameter of Appendix [cm]	7.8 ± 1.85	
Localization of Appendix		
Pelvic		12 (52.2)
Retrocecal		6 (26.1)
Paracolic		4 (17.4)
Upper right quadrant		1 (4.3)
Postoperative wound infection		4 (17.4)
Mean operation time (minutes)	67.39 ± 18.94	
Mean of APGAR score	8.26 ± 0.86	
Histopathology of specimen		
Positive appendicitis		23 (100)
Negative appendicitis		0 (0)

(8.7%) because of appendicitis suspicion, in 12 patients (52.2%) who had uterine contractions because of former cesarean section, in 3 patients (13%) because of fetal distress and in 6 patients (26.1%) because of malpresentation. Other obstetrical characteristics including biophysical profile, amniotic fluid index were presented in Table 1.

Although abdominal ultrasound revealed a non-compressible tubular structure in the right lower quadrant consistent with acute appendicitis in 2 patients, radiological findings were not seen in the other 21 patients. Appendectomy was performed to all of the patients during cesarean section. The mean diameter of appendix was  $7.82 \pm 1.85$  mm. The mean operation time was  $67.39 \pm 18.94$  minute and antibiotic therapy was given to all patients. The only postoperative complication was wound infection and was seen only in 4 patients (17.4%) while the other 19 patients revealed no postoperative complications. The mean of 5th minute APGAR score of the newborns was  $8.26 \pm 0.86$ . Also no complications were observed in newborns. Histopathology of the specimens confirmed acute appendicitis in all cases (Tab. 3). The patients were checked after 10 days and 1 month postoperatively. There were no problems observed in both patients and newborns.

### DISCUSSION

Incidence of appendicitis in pregnancy is similar to general population but it carries a significant risk of fetal loss and maternal mortality because of the delayed diagnosis. Certain anatomic and physiologic changes specific to pregnancy make the cause of the abdominal pain difficult to ascertain in pregnant patients [9, 10]. Uterus becomes an abdominal organ at around 12 weeks' gestation and compresses the underlying abdominal viscera. This enlargement may make the pain difficult to be localized, and may mask or delay peritoneal signs. Also, the laxity of the anterior abdominal wall may mask or delay peritoneal signs. In the present study, there were no peritoneal signs in 73.9% of

patients. In addition, normal pregnancy may increase leukocyte count. In a retrospective review of 66.993 consecutive deliveries including 67 women with a probable diagnosis of acute appendicitis, the mean leukocyte count was found 16.400 cells/ $\mu$ L in women with proven appendicitis whereas it was found 14.000 cells/ $\mu$ L in such women with histologically normal apendices [11]. Similarly, we found the number of leukocytes over 15.000 in 87% of patients. Moreover, the increased incidence of gastrointestinal symptoms, such as abdominal pain and vomiting among pregnant women in general, complicates the diagnosis even more. Consistently, more than half of our study population had gastrointestinal symptoms. Anatomical changes related to the gravid uterus, gestational symptoms, the physiological inflammatory response, and a wider differential diagnosis in pregnant women result in poor diagnostic accuracy that has been reported to range from 36% to 86% [12]. Acute appendicitis has a peak incidence in the second and third decades coinciding with the childbearing years, and the incidence in pregnancy appears broadly the same as in the nonpregnant women, whereas the rate of perforation and subsequent complications are greater [12]. However, perforation was not observed in any of the patients in our study. Fetal mortality is given as 5% after appendicitis, whereas this rate increases to approximately 20% in a perforated appendicitis. Similarly, maternal mortality also increases in perforated cases [9]. However, we did not observe any maternal and fetal mortality in our study. Acute appendicitis is a histological diagnosis. The clinical diagnosis should be strongly suspected in pregnant women with classic findings including abdominal pain that migrates to the right lower quadrant, right lower quadrant tenderness, nausea and/or vomiting, fever, and leukocytosis with left shift. With a nonclassical presentation, which often happens in pregnancy, imaging is indicated [1]. The primary goal of imaging is to reduce delays in surgical intervention due to diagnostic uncertainty. A secondary goal is to reduce, but not eliminate, the negative appendectomy rate. In these cases, ultrasound may reveal the probable cause of the patient's symptoms (e.g. ovarian cyst or torsion, degeneration or torsion of a fibroid, nephrolithiasis, cholecystitis). The diagnosis of acute appendicitis in a laboring patient is difficult and a high index of suspicion is required for the diagnosis. In the present study, all patients suffered from a pain mimicking labor. However, only 2 of the patients were diagnosed with appendicitis preoperatively by ultrasonography. Labor can be associated with a lateralized pain, fever (if chorioamnionitis is present), vomiting, and leukocytosis. Persistence or progression of these symptoms after delivery should prompt physical examination and imaging studies to evaluate for appendicitis. The treatment of acute appendicitis is appendectomy, which is curative. Perioperative antibiotic treatment should provide Gram-negative and

Gram-positive coverage (e.g. a second-generation cephalosporin) and coverage for anaerobes (e.g. clindamycin or metronidazole). We used first generation cephalosporin for prophylaxis. On the other hand, management with antibiotic therapy alone is not recommended because it is associated with both short-term and long-term failure, with minimal data in pregnant patients [13]. Prompt diagnosis and surgical intervention are indicated, as delaying surgical intervention for more than 24 hours after onset of the symptoms increases the risk of perforation which occurs in 14–43% of such patients [2]. Maternal morbidity following appendectomy is infrequent and is also comparable to that in nonpregnant women [14], except for the patients in whom the appendix has perforated. Moreover, the risk of fetal loss is increased when the appendix perforates (fetal loss 36 vs. 1.5 percent without perforation) [15] or when there is generalized peritonitis or a peritoneal abscess (fetal loss 6 vs. 2 percent; early delivery 11 vs. 4 percent) [16]. A normal-appearing appendix over 6 mm in diameter should be removed because histological examination may reveal acute inflammation, excision prevents the potential for future evaluation. Appendectomy is rarely indicated during cesarean delivery. On the other hand, appendectomy is associated with a very low risk of complications during cesarean section.

In conclusion, pregnancy and acute appendicitis rarely occurs together, but because of the increased incidence of perforation in the third trimester and increased fetal mortality in perforated cases, early surgery should be considered in any pregnant patient suspected as having acute appendicitis. Additionally, if the diameter of the appendix is observed greater than 6mm and/or a fekaloid is palpated inside the appendix, appendectomy should be performed.

#### **Conflict of interest**

The authors declare that they have no conflict of interest. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

This article does not contain any studies with human participants or animals performed by any of the authors.

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