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## SUSPECTED APPENDICITIS DURING PREGNANCY: PREVALENCE AND MANAGEMENT

### SUMNJA NA APENDICITIS U TRUDNOĆI: POJAVNOST I POSTUPAK

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*Original paper*

*Key words:* pregnancy, appendicitis

**SUMMARY. Objective.** An evaluation of the the clinical picture, diagnostic procedures and outcome of appendicitis in pregnant women. **Method.** Retrospective analytic study of 28 appendectomies performed during pregnancy for suspected appendicitis in our hospital at period April 2004 to September 2006. All files and medical records of these patients were analyzed and studied. The including variables (demographic, clinical, laboratory and surgical outcomes data) were collected retrospectively. The number of correct and wrong diagnosis were reported and comparison of perinatal outcome, maternal morbidity and different variables in negative and positive laparotomy performed. **Results.** The prevalence of suspected appendicitis in pregnancy is 0.29%. Incidence of negative laparotomies was 36%. The most correct diagnostic findings for acute appendicitis were history of periumbilical pain, anorexia and iliac fossa findings. Delayed surgical intervention significantly increased maternal morbidity ( $p=0.003$ ), rate of premature labor ( $p=0.031$ ) and rate of abortion but not significantly ( $p=0.28$ ). **Conclusion.** The prevalence of suspected appendicitis during pregnancy in our environment during this period was higher than the reported incidence; the rate of wrong diagnosis is still high. Good clinical assessment with adjunct ultrasonic examination could reduce the incidence of negative laparotomies and prevent late complications. Delay in operation is leading to higher rate of maternal morbidity and adversely affect the obstetric outcome.

*Izvorni članak*

*Ključne riječi:* trudnoća, appendicitis

**SAŽETAK. Cilj rada.** Vrednovanje kliničke slike, dijagnostičkih postupaka i ishoda apendicitisa u trudnica. **Metode.** Retrospektivno je analizirano 28 trudnica s apendektomijom tijekom trudnoće zbog sumnje na appendicitis. U bolnici u Zarqa-i u Jordanu u razoblju od travnja 2004. do rujna 2006. učinjeno je 28 apendektomija tijekom trudnoće. Analizirane su povijesti bolesti tih 28 trudnica. Istraživane su razne varijable: demografske karakteristike pacijentica, kliničke, laboratorijske i kirurški ishod. Ustanovljen je broj točnih i pogrešnih dijagnoza te uspoređen perinatalni ishod i maternalni morbiditet u pacijentica s pozitivnim i negativnim laparotomijskim nalazom. **Rezultati.** Pojavnost sumnje na apendicitis u trudnoći je bila 0,29% svih registriranih trudnoća. U 36% sumnji je laparotomijom nađen normalni apendiks. Najtočniji dijagnostički nalaz za akutni apendicitis je bio periumbilikalni bol, anoreksija i osjetljivost ilijačnih šupljina. Odgađanje kirurške intervencije je znakovito povisilo majčin morbiditet ( $p=0,003$ ), stopu preranog poroda ( $p=0,031$ ) te neznakovito stopu pobačaja ( $p=0,28$ ). **Zaključak.** Pojavnost sumnje na apendicitis u trudnoći je u našim prostorima bila viša nego se uobičajeno spominje; stopa krivih dijagnoza je još visoka. Dobra klinička psudba uz dodatak ultrazvučnog pregleda mogla bi smanjiti učestalost negativnih laparotomija i spriječiti kasnije komplikacije. Odgoda operacije povećava maternalni morbiditet i obrnuto pridonosi opstetričkom ishodu.

## Introduction

Acute appendicitis is the most common nonobstetrical operative procedure during pregnancy with an incidence of 1 in 500–10000 pregnancies.<sup>1–4</sup> It represents a dilemma because its symptoms resemble to usual normal symptoms of pregnancy, and laparotomy in pregnancy has a risk of miscarriage and preterm labor. Incorrect diagnosis has been reported in 25% to 50% of patients<sup>5–7</sup> and rates of fetal loss and early delivery in negative laparotomy were 4% and 10% respectively.<sup>7</sup> Conversely, the delay in diagnosis and surgical intervention carries a risk of appendicular perforation, which increases significantly the risk to the mother and fetus.<sup>7,8</sup> The risk of perforation increases during the later stages of pregnancy; it is 8.7% of all perforations occurring during the first trimester, 12.5% in the second one, and 26.1% in the third trimester.<sup>9</sup>

In our environment the true rate of acute appendicitis in pregnant women is not known and its management is unclear. The purpose of our study is to estimate this incidence, to analyze the clinical presentation and assess the early surgical intervention in relationship to maternal health and fetal outcome.

## Subjects and method

This is a retrospective study of 28 cases of suspected appendicitis in pregnancy from April 2004 to September 2006 at Prince Hashem Hospital (Zarqa, Jordan).

Twenty eight cases of appendectomy during pregnancy were included in the study. All files and medical records of these patients were analyzed and studied. Demographic, clinical, laboratory and surgical outcomes data were collected retrospectively. The primary outcome variable was the histopathology report (normal

**Table 1.** Demographic data and presentation of pregnant women with suspected appendicitis.**Tablica 1.** Demografski podatci i prikaz trudnica sa sumnjom na apendicitis

Age (year) (mean ± SD)	26.7 ± 5.8
Parity (mean ± SD)	2.8 ± 2.1
Body mass index (kg/m <sup>2</sup> ) (mean ± SD)	25.1 ± 4.0
Gestational age (week) (mean ± SD)	23.6 ± 8.9
<b>Symptoms (N) (%)</b>	
Abdominal pain	
Epigastric	9 (32%)
Periumbilical	9 (32%)
Rt iliac Fossa	8 (28.6%)
RT upper quadrant	2 (7.1%)
Nausea	25 (89.3%)
Vomiting	21 (75%)
Anorexia	16 (57.1%)
<b>Signs (N) (%)</b>	
Fever	17 (60.7%)
Tachycardia	16 (57.1%)
Tenderness	20 (71.4%)
Rebound positive	17 (60.7%)
Equivocal	7 (25%)
Muscular rigidity	7 (25%)
Felt Mass	2 (7.1%)
<b>Lab Result</b>	
Negative ultrasonic findings	6 (21.4%)
Normal histopathological findings	9 (32.1%)
Leukocytosis	17 (60.7%)

or inflamed appendix). Prevalence were calculated from the total number of deliveries and abortions that occurred during this period. Demographic variables included age, body mass index (BMI) and parity. Clinical data included abdominal pain (epigastric, iliac fossa, periumbilical or upper quadrant), nausea, vomiting, anorexia, fever, tachycardia, abdominal tenderness (iliac fossa or upper quadrant), positive or negative rebound (iliac fossa or upper quadrant), rigidity and palpable mass. Laboratory data included WBC count and ultrasonic findings. Surgical outcomes data included maternal morbidity and fetal outcome. Maternal morbidity was assessed by recurrent hospital admissions, duration of hospital stay, postoperative fever, presence of labor pain and wound infection. Fetal outcome was assessed from the reported abortion or prematurity.

### Statistical methods

Differences in baseline characteristics were evaluated using Fisher's exact test (2-tailed) for categorical variables and the Wilcoxon rank sum test for continuous or ordinal data. Continuous data were presented as means with standard deviations (Mean ± SD). Significance was determined at the p<0.05 level (2-tailed). Using a set of demographical, clinical and laboratory outcomes data as independent variables and suspected appendicitis as a dependent variable and the primary outcomes defined as histopathologically confirmed appendicitis.

**Table 2.** Comparison between pregnant women with confirmed appendicitis and those with normal appendix.**Tablica 2.** Usporedba između trudnica s potvrđenim apendicitisom i onih s normalnim apendiksom.

	Women with confirmed appendicitis N=19	Women with normal appendix N=9	Significance of differences (p value)	Logistic Regression (p value)
Age	24 ± 4.9	27.9 ± 6	.09	.10
Parity	1.8 ± 1.5	3.2 ± 2.3	.08	.12
BMI	23.4 ± 3.3	25.9 ± 4.2	.11	.13
Gestational age	21.7 ± 9.4	24.5 ± 8.7	.46	.42
<b>Abdominal pain</b>				
Epigastric	4 (44.4%)	4 (21.1%)	.89	.06
Periumbilical	6 (31.6%)	3 (33.3%)	.04	.03
Rt iliac Fossa	7 (36.8%)	1 (11.1%)	.13	.01
RT upper quadrant	2 (10.5%)	1 (11.1%)	.11	.62
Nausea	17 (89.5)	8 (88.9%)	.96	.76
Vomiting	16 (84.2%)	5 (55.6%)	.02	.77
Anorexia	14 (73.7)	2 (22.2%)	.01	.01
Fever	12 (63.2%)	5 (55.6%)	.70	.83
Tachycardia	14 (73.3%)	2 (22.2%)	.01	.01
<b>Tenderness</b>				
Rt iliac Fossa	16 (84.2%)	2 (22.2%)	.008	<.001
Between Rt iliac Fossa and Rt U Q	3 (15.8%)	2 (22%)	.11	.001
<b>Rebound</b>				
Negative	1 (5.3%)	6 (66.7%)	.04	.02
Positive	15 (78.9%)	2 (22.2%)	.01	.001
Equivocal	3 (15.8%)	1 (11.1%)	.08	.60
Muscular rigidity	6 (85.7%)	1 (11.1%)	.24	.24
Absence of felt mass	17 (89.5%)	9 (100%)	.31	.31
Positive ultrasonic findings	15 (78.9%)	3 (33.3%)	.02	.02
Leukocytosis	14 (73.3%)	3 (33.3%)	.04	.19

Each factor found to be significant on univariate analysis were included in the multivariate model. Multivariate analysis was performed with binary logistic regression. Statistical analysis was performed using the Statistical Package for the Social Sciences (SPSS) for Windows version 17.0 (SPSS Inc, Chicago, Illinois).

### Results

During the period of the study there were 9783 deliveries and abortions. Twenty eight (0.29%) cases were provisionally diagnosed and admitted as having acute appendicitis with pregnancy. The frequency of histopathology confirmed appendicitis to all deliveries and abortions was 0.18%.

Demographic data of women, the frequency of the symptoms and signs of appendicitis, ultrasonic and laboratory findings are presented in the *Table 1*. The mean gestational age at admission was 23.6±8.9 weeks with the higher frequency in third trimester (46%) but not significant in relation to other trimesters.

The study factors were compared between the two groups: (women with confirmed appendicitis versus

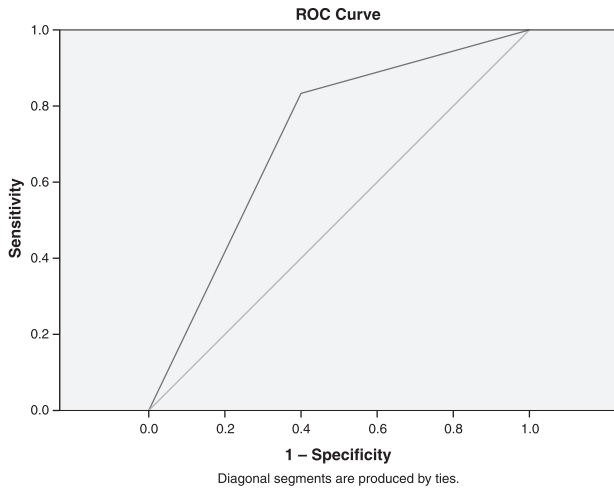


Figure 1. Sensitivity and specificity of leukocytosis in prediction of acute appendicitis in pregnant woman

Slika 1. Osjetljivost i specifičnost leukocitoze krvi u predikciji akutnog apendicitisa trudnica.

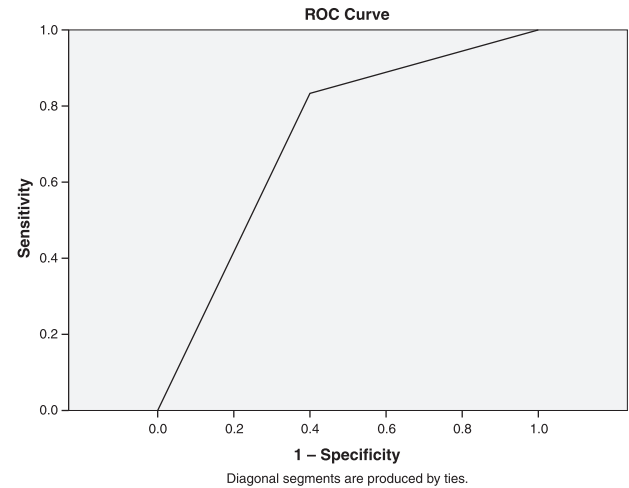


Figure 2. Sensitivity and specificity of ultrasonic findings in prediction of acute appendicitis in pregnant woman.

Slika 2. Osjetljivost i specifičnost ultrazvučnog nalaza u dijagnozi akutnog apendicitisa u trudnica.

Table 3. Comparison of perinatal outcome and maternal morbidity in relation to histopathological findings of appendix.  
 Tablica 3. Usporedba perinatalnog ishoda i morbiditeta majke u odnosu na patohistološki nalaz apendiksa.

Complications	Complex appendix (n=5)	Simple appendix (n=14)	Normal appendix (n=9)	Significance P value		
				Complex vs. Normal	Complex vs. Simple	Simple vs. Normal
Total hospital days stay (mean ± SD)	6.6 ± 1.1	5.1 ± 1	4.3 ± 0.9	.001	0.27	0.02
Postoperative fever	4 (66.7%)	2 (15.4%)	1 (14.3%)	.03	.02	.96
Readmission	2 (33.3%)	2 (15.4%)	1 (11.1%)	.54	.45	.96
Premature labor pain	2 (33.3%)	1 (7.7%)	2 (22.2%)	.81	.31	.61
Wound infection	2 (33.3%)	2 (15.4%)	1 (11.1%)	.54	.45	.96
Abortion	0	1 (7.7%)	2 (22.2%)	.82	.30	.47
Preterm delivery	2 (33.3%)	1 (7.7%)	3 (33.3%)	.34	.28	1

Table 4. Final diagnosis in the nine cases with confirmed normal appendix.

Tablica 4. Konačna dijagnoza u devet slučajeva s potvrđenom dijagnozom normalnog apendiksa.

Diagnosis	N
Threatened abortion	2
Preterm labor	2
Chorioamnionitis	2
Degenerating uterine fibroid	1
Mesenteric adenitis	2

women with normal appendix (Table 2). Nine factors found to be of significant difference within both groups: periumbilical abdominal pain ( $p=.04$ ), vomiting ( $p=.02$ ), anorexia ( $p=.01$ ), tachycardia ( $p=.01$ ), iliac fossa tenderness ( $p=.008$ ), negative rebound ( $p=.04$ ), positive rebound ( $p=.01$ ), leukocytosis ( $p=.04$ ) and positive ultrasonic findings ( $p=.02$ ). But on multivariate analysis five of nine factors mentioned above remain significant: anorexia ( $p=.01$ ), tachycardia ( $p=.01$ ), iliac fossa tenderness ( $p<.001$ ), negative rebound ( $p=.02$ ) and positive rebound ( $p<.001$ ). The other factors (age, parity, BMI,

gestational age, fever, nausea, vomiting, rigidity and absence of felt mass) were not significant.

The leukocyte count was raised in the 14 (73%) patients with confirmed appendicitis. However, the sensitivity and specificity of leukocytosis finding for diagnosis of appendicitis was 83% and 47% respectively (Figure 1). Also we found that the total diagnostic accuracy of ultrasound was (75%) (Figure 2).

Histopathologically confirmed appendicitis were found in 19 patients (67.9%). Five patients had complex appendicitis and 14 patients had simple appendicitis. The mean period of hospitalization was significantly highest in patients with perforated appendicitis ( $6.6 \pm 1.1$ ,  $p=.001$ ) in relationship to those with normal appendix. However there is no significant difference in relationship to simple appendicitis ( $p=.2$ ). Overall 6 (21.4%) patients experienced unfavorable fetal outcome: 4 cases of premature deliveries (one at 27 weeks, the child died later on and three alive at 32, 34 and 31 week) and 3 cases of abortions (Table 3). The most common final diagnosis in cases of normal appendix were premature labor pain and threatened abortion (Table 4).

## Discussion

The incidence of suspected appendicitis among pregnant women in our hospital during the study period was 0.29% which is slightly higher in comparison with other studies.<sup>1–4</sup> Early marriage and repeated pregnancies till menopause make the probability of an acute appendicitis related symptoms occurring in pregnancy higher. Previous studies have reported a variety of its frequencies throughout the pregnancy; some have shown no difference,<sup>3</sup> while the others have reported that it is more frequent during the first or second trimesters.<sup>9–13</sup> In this series, the frequency of appendicitis was higher in the third trimester (38%) but not considerable.

As seen in *Table 1* the commonest symptoms of acute appendicitis during pregnancy were abdominal pain, nausea, vomiting and anorexia. The signs were tachycardia, fever, tenderness and positive rebound at iliac fossa. A few of these cardinal features occur normally in pregnancy and they are blunted by the anatomical and physiological changes of pregnancy. This clinical suspicion makes surgeons keep waiting confirmatory signs or operate and agree to the possibility of a negative laparotomy. The incidence of negative laparotomies in our study was 32.1%, which is within the range that has been reported by other studies.<sup>11,14,15</sup> In our series the most constant symptoms with confirmed appendicitis were a history of periumbilical pain and anorexia. These findings were consistent with reports in others studies.<sup>14,15</sup> Nausea, vomiting and other locations of abdominal pain were also a complaint of patients with normal findings.

Some authors have reported that physical examination on presentation is the most reliable diagnostic tool for appendicitis and may reveal fever, increased pulse rate, rebound tenderness and guarding.<sup>4,12</sup> In our study, we found that the most important signs were tachycardia, iliac fossa tenderness, negative rebound and positive rebound. However, we found that rigidity, absence of felt mass and tenderness of other locations than iliac fossa were in common with patients operated for normal appendix (*Table 2*).

The most helpful laboratory findings has been the presence of leukocytosis; it being sensitive but not specific. However, physiological leukocytosis in pregnancy makes interpretation of leukocytosis difficult.<sup>11,14,16</sup> In our study, we found that the presence of leukocytosis is of limited value for diagnosing of appendicitis (*Figure 1*).

There were conflicting reports about diagnostic accuracy of ultrasound during pregnancy for appendicitis, particularly in 3<sup>rd</sup> trimester. Some studies<sup>17</sup> confirm its of diagnostic value and others do not.<sup>18,19</sup> In our series, positive ultrasonic findings were of diagnostic value: (sensitivity 78.9% and specificity 66.7%) (*Figure 2*). However, the diagnosis cannot be ruled out if it is negative.

In general any type of laparotomy during pregnancy carries a risk of premature labor of 10–15%, and the risk is similar for both negative laparotomy and appendec-

tomy for simple appendicitis.<sup>20</sup> However, perinatal morbidity and mortality increases to 35–40% when perforation occurs.<sup>12</sup> In present study, two cases of 6 perforations (all in 3<sup>rd</sup> trimester) were complicated by premature delivery at 34 and 31 week with no fetal loss. Also, we found that maternal morbidity increased considerably in cases with perforated appendicitis (*Table 3*). The rate of abortions and premature deliveries was higher in patients with normal appendix, which it might be the primary cause of abdominal presentation (*Table 4*).

## Conclusion

From this study it is apparent that the diagnosis of acute appendicitis in pregnant women can be problematic. Diagnostic error is still high and negative laparotomy is not without complications, careful evaluation of symptoms and signs could eliminate the rate of negative laparotomies. Timely surgical intervention is recommended in cases of suspected appendicitis in pregnancy to avoid appendicular perforation.

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