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Can the Risk Factors Predicting Surgical Treatment be Determined in Patients with Tubo-Ovarian Abscess?

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ABSTRACT

OBJECTIVES: In this study, we aimed to determine the risk factors in predicting the need for surgical treatment due to medical treatment failure in patients with tubo-ovarian abscess.

STUDY DESIGN: This is a retrospective cohort study performed in a university hospital between 2015 and 2020. Sixty-nine patients with tubo-ovarian abscess were treated with parenteral antibiotics. Some of them required surgery because antibiotic treatment was not successful. We compared the group in which parenteral antibiotic treatment was successful with the group that required surgical treatment. The conservative treatment group consisted of 43 (62.3%) patients who responded to antibiotic therapy alone (gentamicin-clindamycin), and the operation group consisted of 26 women (37.7%) who did not reply to antibiotic therapy and required operation. Demographic, clinical, sonographic, and laboratory results were compared between the two groups using univariate and logistic regression analyses.

RESULTS: Overall, up to 37.7% (26/69) of the patients underwent surgery after failure of antibiotic therapy. Patients who failed antibiotic therapy had higher infection parameters such as C-reactive protein (205±109 mg/dL vs. 115 ± 90 mg/dL, p=0.002), platelet count (349 ± 108 x $10^3/mm^3$ vs. 298 ± 95 x $10^3/mm^3$, p=0.042), and neutrophil-to-lymphocyte ratio (18.8 ± 35.7 vs. 8.2 ± 6.9, p=0.022). Also in the same group, larger tubo-ovarian abscess size (61.6±16.6 mm vs 45.8 ± 10.3 mm, p<0.001) and more frequent intrauterine device use (46.2% vs 16.3%, p=0.007) were observed. But none of them (C-reactive protein, neutrophil-to-lymphocyte ratio, tubo-ovarian abscess size, presence of an intrauterine device) was found to be a significant independent factor in anticipating conservative treatment failure of tubo-ovarian abscess in logistic regression analysis.

CONCLUSION: Although helpful in diagnosis, none of the demographic, sonographic, or laboratory parameters can predict surgical treatment in women with tubo-ovarian abscess.

Keywords: Conservative treatment, C-reactive protein, Neutrophil to lymphocyte ratio, Pelvic inflammatory disease, Surgery, Tubo-ovarian abscess

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Introduction

A tuba-ovarian abscess (TOA) is a complex infectious mass of the fallopian tube and ovary, and occasionally other close pelvic organs (1). TOA typically occurs as a complication of pelvic inflammatory disease (PID). It is an abscess formation, often as a result of an ascending infection either from the vaginal flora or a sexually transmitted pathogen. TOA is associated with 15% of PID) cases (2).

Most patients are between 15 and 40 years old and, are sexually active. Risk factors for TOA are similar to those for PID such as having multiple sexual partners, aging 15-25 years, the presence of intrauterine devices (IUDs), having a history of PID, sexually transmitted infection in the partner, and getting immunosuppression. Polymicrobial organisms such as aerobes, anaerobes, and facultative microorganisms are responsible for the pathogenesis of TOA (3). Treatment

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methods include parenteral antibiotics, drainage, surgical intervention, or combinations thereof (3). The first choice in the treatment of TOA is parenteral antibiotics. However, approximately 25% to 30% of patients do not respond to antibiotic treatment alone (3). Surgery is required when antibiotic therapy is insufficient or when the mass ruptures in patients with suspected TOA (4,5).

Before the introduction of antibiotics and modern surgery, the TOA-related mortality was about 50% or higher (6). Although TOA-related mortality is rarer today, it can still be fatal if TOA ruptures or causes sepsis. Delaying treatment in TOA patients can lead to long-term consequences such as ectopic pregnancy, infertility, chronic pelvic pain, recurrent PID, and ovarian vein thrombosis (7-9). The factors that cause the failure of antibiotic therapy have not yet been identified. There is no consensus on the risk factors predicting surgical treatment in patients with TOA.

In this study, we compared the clinical and laboratory values of patients with TOA as predictors for invasive surgery. The purpose of the study is to contribute to identifying risk factors to predict women requiring surgical treatment due to antibiotic treatment failure.

Material and Method

Medical records of patients diagnosed with TOA were retrospectively reviewed in the Department of Obstetrics and Gynecology, University of Health Sciences Tepecik Training and Research Hospital, Turkey between January 1, 2015, and December 31, 2020. The study was carried out in accordance with the Declaration of Helsinki. Approval was obtained from the Hospital Local Ethics Committee (approval number: 2021/06-31, date: 15.06.2021). Informed consent for data use was routinely obtained from all participants at admission.

The diagnosis of TOA was made in the presence of an ultrasonographic complex cystic adnexal mass and clinical signs and symptoms (pelvic pain with uterine or adnexal tenderness or cervical motion tenderness, or cervical mucopurulent discharge with or without fever) as reported by the Centers for Disease Control and Prevention (CDC) guidelines (10). The presence of an intrauterine device (IUD) was confirmed through ultrasonography and removed at the beginning of the treatment. The largest diameter was recorded ultrasonographically as the TOA size. If the abscess was bilateral, the sum of the largest diameters was recorded as the TOA size. An ultrasonography examination was performed on all patients (except one) using a 6-10 MHz transvaginal probe (Toshiba AplioTM 500; Toshiba Medical Systems Inc., USA). Suprapubic ultrasonography was performed with the abdominal probe of the same device on only one patient who was a virgin.

The primary purpose of this study is to identify risk factors to predict patients requiring surgical treatment due to antibiotic treatment failure. Therefore, women who received antibiotics before hospitalization, who were operated on immediately, and whose medical records were insufficient were excluded from the study. Other exclusion criteria are; women who were not hospitalized or did not accept treatment, who received treatment other than antibiotic therapy, and patients with a different diagnosis or with malignancy.

Between 2015 and 2020, 112 women were diagnosed with TOA and/or PID. 43 of them were excluded according to the determined criteria, of which 33 were diagnosed with only PID, 3 with endometrioma, 3 with ovarian cyst rupture, 2 with an ovarian cyst, and 2 with hydrosalpinx. The remaining 69 patients formed the study group. These patients with TOA were divided into 2 groups: those who responded well to antibiotic therapy and were treated only with parenteral antibiotics (conservative management group) and those who eventually required surgical intervention after antibiotic therapy failed (surgical management group). While 43 (62.3%) of these patients were treated with antibiotics only (conservative management group), 26 (37.7%) of them eventually underwent surgery (surgical management group). Both groups were compared in terms of demographic characteristics, medical conditions, presence of an IUD, previous pelvic surgery, fever, TOA size, neutrophil count, lymphocyte count, platelet count, neutrophil-lymphocyte ratio (NLR), platelet-lymphocyte ratio (PLR), inflammatory markers [C-reactive protein (CRP), white blood cell (WBC)], length of hospital stay (LOS), and readmissions. Readmission was considered as rehospitalization within 6 months of discharge.

Demographic characteristics, initial clinical symptoms, obstetric and gynecological history, gynecological examination findings (uterine or adnexal tenderness, cervical motion tenderness, cervical/vaginal discharge), imaging and laboratory findings, treatment modalities (conservative or surgical), and LOS were obtained from patient files and electronic database of the hospital as study parameters. All of these parameters were evaluated for each case. A routine bimanual examination was performed for each woman (except for one who was a virgin). The increased fever was accepted as a body temperature $\geq$38˚C. The size of the TOA was measured by pelvic ultrasonography at admission or magnetic resonance imaging (MRI) was used when sonographic imaging was insufficient, such as clearly distinguishing the lesion and not performing an optimal measurement. Venous blood samples were taken at admission for analysis of serum complete blood cell (CBC) count, CRP level, and biochemical values. CBC count was assessed with an automated cell counter (Beckman Coulter UniCel DxH 800; Beckman Coulter Inc., USA). Serum CRP concentrations were evaluated with standard methodology (Beckman Coulter AU680; Beckman Coulter Inc., USA). Hemoglobin (g/dL), WBC count (x10^3/mm^3), neutrophil (x10^3/mm^3) count, lymphocyte (x10^3/mm^3) count, platelet (x10^3/mm^3) count and CRP (mg/L) values were recorded on the first day of hospitalization. NLR and PLR of the patients were calculated according to the CBC parameters and recorded.

Treatment protocol: Antibiotic treatment protocols were in accordance with CDC guidelines (10). Initially, all patients received medical treatment including Clindamycin (900 mg IV every 8 hours) plus gentamicin (2 mg/kg loading dose, followed by 1.5 mg/kg IV every 8 hours). Parenteral antibiotics were continued for 72 hours for each patient. Patients whose clinical conditions improved were discharged with outpatient antibiotic therapy (450 mg oral clindamycin four times a day for 14 days or doxycycline 100 mg twice a day plus 500 mg metronidazole twice a day for 14 days). Surgery was performed in patients whose clinical conditions did not improve after antibiotic therapy. Among the invasive surgery criteria; the persistent fever, abdominopelvic pain or tenderness, no reduction in abscess diameter, and any signs of sepsis. Postoperative antibiotic therapy was continued until the patient recovered.

Statistical analysis

Statistical Package for the Social Sciences (SPSS) v27.0 software (IBM® SPSS® Statistics, Armonk, New York, USA) was used for statistical analysis. Descriptive data were given as n, %, mean±SD, and median (min, max). The normality of the distributions was evaluated with the Shapiro-Wilk test and histogram plots. The student's t-test was used to compare normally distributed data and data were presented as mean±SD. Mann Whitney U test was used in the analysis of data that did not show normal distribution, and the data were presented as median (min, max). Categorical variables were compared with the chi-square test. The area under the receiver operating characteristic (ROC) curve was used for cut-off values, sensitivity, and specificity. Multivariate regression analysis was used to calculate the effective factors in predicting surgery. Results with p<0.05 were accepted significantly.

Results

Demographic, clinical, and laboratory characteristics of patients with TOA are presented in table I. The mean age was not statistically different for the conservatively and surgically treated groups (p=0.145). The gravidity, parity, and the number of living children were significantly higher in the surgically treated group than in the conservatively treated group (p=0.008, p=0.046, and p=0.009, respectively). There was no statistical difference between the two groups in terms of previous pelvic surgery, previous cesarean section, history of ectopic pregnancy, history of curettage, and history of tubal ligation. Furthermore, TOA size and LOS were significantly greater in the surgically treated group. The mean TOA size was 45.8±10.3 mm for the conservative treatment group and 61.6±16.6 mm for the surgical intervention group (p<0.001). The mean LOS was 10±5 days in the surgical intervention group and 6±3 days in the conservative treatment group (p=0.002).

There was no statistical difference between the two groups in terms of menopausal status, marital status, comorbidity, and vaginal and/or cervical discharge. Contrary to expectations, cervical motion tenderness was significantly more frequent in the conservatively treated group (p=0.021) and re-admission was significantly more frequent in the surgically treated group (p<0.001). However, TOA recurrence was not observed in either group. Abdominal/pelvic pain was the most common reason for re-admission in both groups. There was no difference between the two groups in terms of fever at admission (p=0.098).

There were no significant differences between the groups in terms of WBC count, hemoglobin level, neutrophil count, lymphocyte count, and PLR. Platelet counts and the presence of an IUD were statistically significantly higher in the surgically treated group than in the conservatively treated group (p=0.042 and p=0.007, respectively). The mean CRP value was 205±109 mg/L in the surgical intervention group and 115±90 mg/L in the conservative treatment group (p=0.002). We found the mean NLR value to be 18.8±35.7 for the surgical intervention group and 8.2±6.9 for the conservative treatment group (p=0.022) (Table I).

A receiver operating characteristic (ROC) curve was drawn to show the predictive role of CRP, NLR, platelet count, TOA size, and the largest diameter of TOA for surgical treatment. Cut-off values of CRP, NLR, platelet count, TOA size, and the largest diameter of TOA were given to determine eligibility for surgical treatment (Table II). According to the ROC analysis, the area under the curve (AUC) for CRP was 0.733 (cut-off 161.5 mg/L, 95% CI: 0.608-0.857, p=0.002, sensitivity 66.7% , specificity 65.9%), for TOA size it was 0.797 (cut-off 49.5 mm, 95% CI: 0.715-0.927, p<0.001, sensitivity 73.1%, specificity 72.1%), for largest TOA diameter it was 0.825 (cut-off 56 mm, 95% CI: 0.747-0.951, p<0.001, sensitivity 80.8, specificity 76.7%), for NLR it was 0.665 (cut-off 6.9, 95% CI: 0.534-0.814, p=0.022, sensitivity 65.4%, specificity 65.1%), for platelet count it was 0.647 (cut-off 327.5 x10^3/mm^3, 95% CI: 0.511-0.790, p=0.042, sensitivity 65.4%, specificity 65.1%) (Figure 1).

In the multivariate regression analysis, no significant correlation was identified between NLR, CRP, platelet count, TOA size, largest TOA diameter, and the presence of an IUD with medical treatment failure (Table III).

Common clinical symptoms at presentation were abdominal pain and abnormal tenderness (63.8%), increased vaginal and/or cervical discharge (49.3%), cervical motion tenderness (48.5%), and fever (17.4%) (Table IV).

Table I: *Demographic, clinical, and laboratory characteristics of patients with tubo-ovarian abscesses*

	Conservative treatment n=43	Surgical management n=26	*p*
Maternal age (year) (mean±SD)	36±8.4	39±6.3	0.145
Gravidity median (min,max)	3 (1-8)	3 (1-8)	0.008
Parity (n,%)			0.046
Nulliparous	6 (14%)	0	
Multiparous	37 (86%)	26 (100%)	
Living children median (min, max)	1 (0-3)	2 (1-7)	0.009
History of ectopic pregnancy (n,%)	0	2 (7.7%)	0.064
History of tubal ligation (n,%)	0	2 (7.7%)	0.064
History of curettage (n,%)	14 (32.6%)	14 (53.8%)	0.080
Previous cesarean section (n,%)	13 (30.2%)	8 (30.8%)	0.962
Previous pelvic surgery (n,%)	5 (11.6%)	4 (15.4%)	0.653
TOA size (mm) (mean±SD)	45.8±10.3	61.6±16.6	<0.001
Largest TOA diameter (mm) (mean±SD)	51.8±18.1	75±24	<0.001
LOS (days) (mean±SD)	6±3	10±5	0.002
WBC at admission (*10^3/mm^3) (mean±SD)	14.1±5.8	16±5.4	0.117
CRP at admission (mg/L) (mean±SD)	115±90	205±109	0.002
Hemoglobin at admission (g/dL) (mean±SD)	11.4±2	11.5±1.5	0.872
Neutrophil at admission (*10^3/mm^3) (mean±SD)	11.3±5.7	13.5±5.2	0.086
Lymphocyte at admission (*10^3/mm^3) (mean±SD)	1.7±0.7	1.6±1	0.331
Platelet count at admission (*10^3/mm^3) (mean±SD)	298±95	349±108	0.042
Neutrophil-to-lymphocyte ratio (mean±SD)	8.2±6.9	18.8±35.7	0.022
Platelet-to-lymphocyte ratio (mean±SD)	196.1±90.9	440.4±586.1	0.062
Presence of an IUD (n,%)	7 (16.3%)	12 (46.2%)	0.007
Marital status (n,%)			0.431
Single	6 (14%)	2 (7.7%)	
Married	37 (86%)	24 (92.3%)	
Menopausal status (n,%)			0.818
Premenopausal	39 (90.7%)	24 (92.3%)	
Postmenopausal	4 (9.3%)	2 (7.7%)	
Comorbidity (n,%)			
Diabetes	1 (2.3%)	1 (3.8%)	0.715
Hypertension	1 (2.3%)	1 (3.8%)	0.715
Asthma	2 (4.7%)	2 (7.7%)	0.600
Congenital single kidney	1 (2.3%)	0 0.433	
Hypothyroidism	1 (2.3%)	2 (7.7%)	0.289
Immune thrombocytopenic purpura (ITP)	0	1 (3.8%)	0.195
Sjogren's syndrome	0	1 (3.8%)	0.195
Vaginal and/or cervical discharge (n,%)	24 (55.8%)	11 (42.3%)	0.276
Cervical motion tenderness (n,%)	25 (59.5%)[a]	8 (30.7%)	0.021
Fever at admission (n,%)	10 (23.3%)	2 (7.7%)	0.098
Abscess location (n,%)			
Right	28 (65.1%)	14 (53.8%)	0.352
Left	14 (32.6%)	10 (38.5%)	0.617
Bilateral	1 (2.3%)	2 (7.7%)	0.289
Readmission (n,%)	2 (4.7%)	9 (34.6%)	<0.001

TOA: Tubo-ovarian abscess, WBC: White blood cell, CRP: C-reactive protein, IUD: Intrauterine devices, LOS: Length of hospital stay. a One patient was excluded because she was a virgin.

Table II: *A receiver operating characteristic curves to assess the usefulness of platelet count, C-reactive protein, tubo-ovarian abscess size and the largest size of tubo-ovarian abscess, neutrophil-to-lymphocyte ratio*

	Cut-off	Sensitivity	Specificity	AUC	95% CI	*p*
Platelet count at admission (*10^3/mm^3) (mean±SD)	327.5	65.4%	65.1%	0.647	0.511-0.790	0.042
CRP at admission (mg/L) (mean±SD)	161.5	66.7%	65.9%	0.733	0.608-0.857	0.002
TOA size (mm) (mean±SD)	49.5	73.1%	72.1%	0.797	0.715-0.927	<0.001
Largest TOA diameter (mm) (mean±SD)	56	80.8%	76.7%	0.825	0.747-0.951	<0.001
Neutrophil-to-lymphocyte ratio (mean±SD)	6.9	65.4%	65.1%	0.665	0.534-0.814	0.022

CRP: C-reactive protein, TOA: Tubo-ovarian abscess, AUC: Area under the curve, CI: Confidence interval

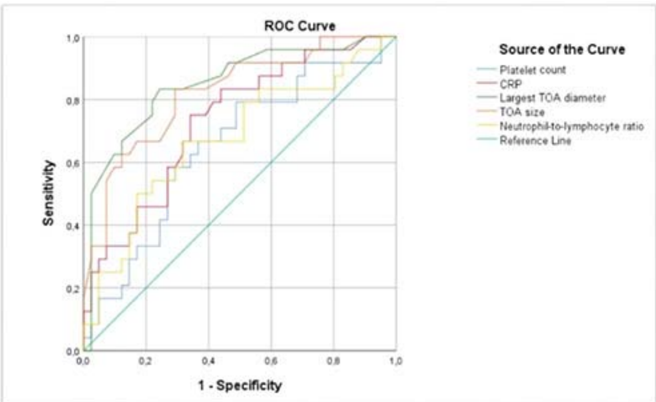

Figure 1: *A receiver operating characteristic curve was drawn to show the predictive roles of C-reactive protein, tubo-ovarian abscess size, the largest diameter of tubo-ovarian abscess, neutrophil-lymphocyte ratio, and platelet count for surgical treatment*

Of 26 patients who did not respond to antibiotic treatment, laparoscopy and abscess drainage were applied to 1 (3.9%), laparotomy and cystectomy were applied to 1 (3.9%), laparotomy and abscess drainage was applied to 5 (19.2%), laparotomy and single/bilateral salpingectomy were performed in 5 (19.2%), laparotomy and salpingo-oophorectomy were performed in 9 (34.6%), total abdominal hysterectomy and bilateral salpingectomy/bilateral salpingo-oophorectomy were performed in 5 (19.2%). We observed complications in two patients in the surgical intervention group. One had a bowel injury and the other had a wound infection (Figure 2).

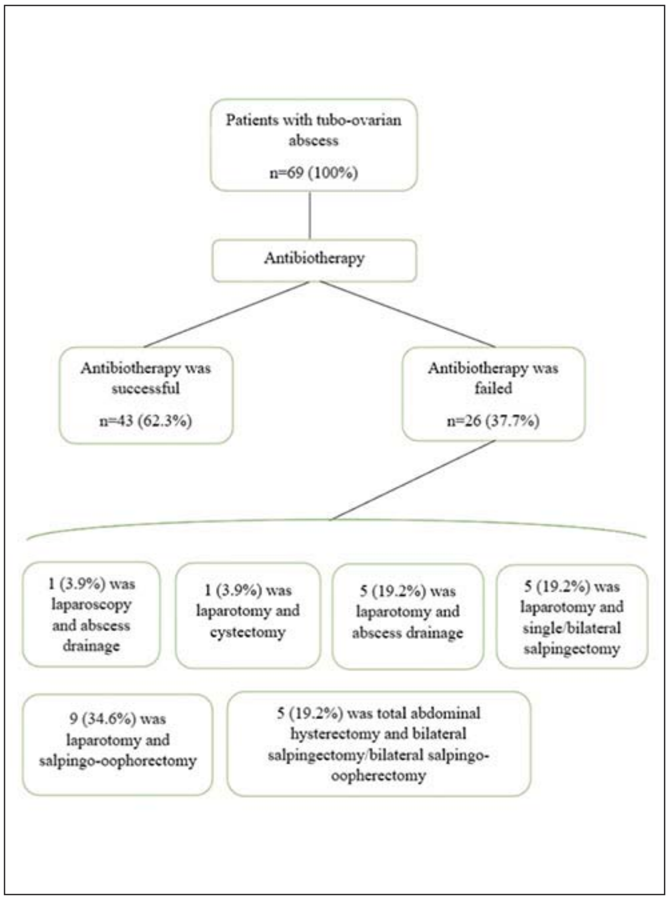

Figure 2: *The flowchart showing the treatment modalities of patients with tubo-ovarian abscesses*

Table III: *Multivariate regression analysis of factors associated with conservative treatment failure**

	Adjusted OR	95% CI	*p*
CRP at admission (mg/L)	1.004	0.996-1.013	0.325
TOA size (mm)	1.097	0.993-1.213	0.068
Largest TOA diameter (mm)	1.020	0.966-1.078	0.468
Neutrophil-to-lymphocyte ratio	1.018	0.938-1.104	0.675
Platelet count at admission (*10^3/mm^3)	1.005	0.997-1.013	0.200
Presence of an IUD	3.598	0.667-19.412	0.136
Cervical motion tenderness	0.704	0.146-3.387	0.661

*CRP: C-reactive protein, TOA: Tubo-ovarian abscess, IUD: Intrauterine devices, OR: Odds ratio, CI: Confidence interval. *Analysis was performed for all significant variables in the initial univariate analysis, except for living children, hospitalization duration, and readmission.*

Table IV: *Presenting symptoms and signs of patients*

	Yes	No
Symptoms (n,%)		
Abdominal pain	44 (63.8%)	25 (36.2%)
Abnormal vaginal bleeding	8 (11.6%)	61 (88.4%)
Vaginal and/or cervical discharge	34 (49.3%)	35 (50.7%)
Signs on admission (n,%)		
Fever (>37.5 °C)	12 (17.4%)	57 (82.6%)
Tachycardia (>100 bpm)	0	69 (100%)
Hypotension (<90/60 mmHg)	2 (2.9%)	67 (97.1%)
Abnormal tenderness	44 (63.8%)	25 (36.2%)
Defense and/or rebound	7 (10.1%)	62 (89.9%)
Cervical motion tenderness	33 (48.5%)[a]	35 (51.5%)

a: One patient was excluded because she was a virgin

Discussion

The mortality rate in patients with TOA has decreased significantly in the last decades, particularly with the use of broad-spectrum antibiotics, imaging modalities, image-guided drainage techniques, and laparoscopy. However, there is still a risk of mortality from abscess rupture or sepsis. Also, the optimal treatment of TOA remains unclear. It is controversial whether conservative treatment or surgical intervention is the priority in patients with TOA. It is important to recognize patients who are less likely to reply to antibiotic therapy, as early operation can reduce morbidity and mortality. In our study, the presence of an IUD, increased TOA size, high CRP level, high platelet count, and high NLR were found to be risk factors related to surgical treatment in TOA cases in univariate analysis. However, these parameters did not remain significant in the multivariate model.

Since patients with TOA are more common during the reproductive period, a broad-spectrum antibiotic regimen should be chosen as the first-line treatment (10). The success rate of broad-spectrum antibiotics in the treatment of TOA ranges from 16% to 95%. Most studies have reported a success rate of 70% or more (11,12). Our antibiotic success rate is 62.3 %, and our surgical management rate was 37.7% in cases where antibiotics were insufficient.

In the literature, the relationship between inflammatory markers such as CRP, WBC, and erythrocyte sedimentation rate (ESR) and treatment outcomes in women with TOA has not yet been established, and there is no consensus on this issue. Of these, CRP is particularly useful in detecting bacterial infection. CRP is an acute phase protein produced in the liver that opsonizes pathogens and facilitates phagocytosis (13). Previous studies have attempted to predict various parameters for the need for surgical intervention in patients with TOA. These studies have reported higher levels of inflammatory markers at admission in patients who failed antibiotic therapy and eventually required surgery (14-17). Kuo et al. reported that a high CRP level is an important signal for operation (18). However, several studies in the literature found no significant difference in CRP levels between groups that had successful antibiotic therapy and those that did not. Topcu et al. reported that no significant difference was observed between the groups with favorable or poor prognoses in terms of CRP levels (19). Tugrul Ersak et al. also reported that they could not find any laboratory parameter (CRP, WBC, and CA 125) as a factor that could affect the treatment outcome (20). Karaca et al. reported that none of the variables such as age, parity, mass diameter, serum CRP, ESR, and procalcitonin level had significant value in predicting cases of TOA requiring invasive surgery (21). Also, Levin et al. reported that CRP levels, WBC, and platelet counts at admission were significantly higher in the antibiotic treatment failure group, but they did not remain significant in the multivariate model (22). Fouks et al. also found no added value for mean CRP values at admission, even after multivariate analysis (15). Hwang et al. reported that although WBC, CRP, and ESR levels were statistically significantly higher in the surgical intervention group than in the conservative treatment group in the univariate analysis, only ESR was significant in multivariate analysis (23). Similarly, in our study, the mean CRP level in univariate analysis was significantly higher in the surgical intervention group (205±109 mg/L) than in the conservative treatment group (115±90 mg/L). Based on ROC curve analysis, the CRP cut-off value of 161.5 mg/L had 66.7% sensitivity and 65.9% specificity for predicting surgical intervention; however, these associations remained insignificant in the multivariate model.

Neutrophil-lymphocyte ratiois a recently used, rapid, and cheap inflammatory marker. The NLR value is easily obtained from routine blood count data by dividing the neutrophil count by the lymphocyte count. Several studies have shown that NLR correlates with inflammatory processes (24). Alay et al. compared NLR between the two study groups. It was found to be significantly higher in the surgical operation group and the cut-off value was accepted as ≥ 6.97. However, no correlation was observed between treatment type and NLR in the correlation analysis (25). Hwang et al. found that NLR had only borderline significance in the univariate analysis (23). Levin et al. reported that thrombocyte counts were significantly higher at admission in women in the surgical intervention group; however, they reported that these parameters did not remain significant in the multivariate model (22). Similarly, in the present study, NLR and platelet count were statistically significantly higher in the surgical intervention group than in the conservative treatment group in univariate analysis. But these parameters did not remain significant in the multivariate model.

It has been reported in the literature that the success of antibiotic therapy decreases as the TOA diameter increases. In large sizes, the risk of failure in antibiotic therapy has been reported (15,26,27). The increase in TOA size causes a decrease in the penetration of the antibiotic, thus adversely affecting the treatment (26,28). Some publications indicate that medical treatment fails in TOA cases with cysts larger than 6 cm (27,29-31), while others report that it fails when the cysts are larger than 5 cm (26,28,32). In another study (33), laparotomy was performed in 72% of patients with an abscess diameter of more than 10 cm and 26% of patients with an abscess diameter of less than 5 cm. Güngördük et al. reported that if the TOA size is greater than 7 cm, it is associated with an unsuccessful response to antibiotic therapy, prolonged LOS, and a higher risk of surgical complications (17). However, numerous studies, found a substantial connection between TOA size and conservative therapy failure using univariate analysis. But this association did not remain significant in the multivariate model (3,15,16,29). It may be related to the relatively small sample size of the current cohort. In the present study, TOA size and LOS were significantly higher in the surgically treated group. The mean TOA size was 45.8±10.3 mm in the conservative treatment group and 61.6±16.6 mm in the surgical intervention group. The TOA size cut-off value for surgery was 49.5 mm, with a sensitivity of 73.1% and a specificity of 72.1%. Similarly, in our study, the significant relationship between TOA size and conservative treatment failure in the univariate analysis did not remain significant in the multivariate model.

There is no unanimity about the effect of IUDs on TOA treatment outcomes. The findings of studies examining the influence of IUD use on the outcome of TOA treatment are contentious. Some studies reported that the IUD adversely affected antibiotic therapy (34,35), while others reported no effect (20,36). In this study, it was determined that IUD was not a factor affecting the treatment outcome in the multivariate model.

The limitations of this study are that it was retrospective and included a relatively small number of patients. The fact that it is a single-center study may limit the generalization of our results. Furthermore, we could not exclude the effects of other confounders (e.g., fertility desire). In addition, the current study is limited to the results of the reproductive age population. The strength of our study stems from the fact that, rather than examining the components individually, we employed multivariate analysis to establish the strength of the effect of surgical intervention.

Conclusion

In conclusion, no demographic, sonographic, or laboratory characteristic was shown to be predictive of surgical treatment in women with TOA. Clinicians need objective criteria for surgical intervention of patients with TOA before medical treatment. The optimal selection and timing of invasive treatment in patients with TOA are unclear. However, the decision on treatment modality often depends on the clinical evaluation and judgment of the primary clinician. The sample size may not be sufficient to achieve a reliable result. Prospective studies with a larger sample size should be performed to compare the outcomes of TOA treatment alternatives.

Declarations

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Availability of data and materials: The data supporting this study is available through the corresponding author upon reasonable request.

Authors' contributions: TV conducted the population study, analyzed and interpreted the data, and drafted the manuscript. BB participated in data analysis, interpretation, and draft revision. SYK and EG participated in data collection and result interpretation. MO and CET assisted with data collection and analysis. All authors read and approved the final manuscript.

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