Original Article / Orijinal Araştırma

Effectiveness of Blood Urea Nitrogen to Albumin Ratio and C-reactive Protein to Albumin Ratio in Prediction of Medical Treatment Failure for Tuboovarian Abscess

Tubaovaryan Abselerin Medikal Tedavisinin Başarısızlığının Tahmininde Kan Üre Azotu/Albümin Oranı ve C-reaktif Protein/ Albümin Oranının Etkinliğinin Değerlendirilmesi

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ABSTRACT

Objective: This study aimed to compare the clinical characteristics of patients with tuboovarian abscess who responded to medical treatment (MT) and those who underwent surgical intervention (SI) because of MT failure.

Methods: Patients who were cured by MT were defined as Group 1 (n=25, 55.6%) and patients requiring SI were defined as Group 2 (n=20, 44.4%). The largest diameter of the abscess (cm) detected by ultrasound was recorded. Blood urea nitrogen to albumin (A) ratio (BAR) and C-reactive protein (CRP) to albumin (A) ratio (CAR) calculated according to laboratory tests on the first day of hospitalization.

Results: BAR and CAR were analyzed higher in Group 2 (p=0.3; p=0.5, respectively). The abscess size of Group 2 was statistically significantly higher than that of Group 1 (p=0.002). Abscess size greater than 5.8 cm was calculated as the cut-off point indicating failure of MT (p=0.003). The cut-off points of BAR 2.7 (p=0.3) and CAR 35.6 (p=0.09) were indicators of SI. According to the univariate and multivariate analyses, abscess size was an independent factor for predicting SI (p=0.01; p=0.03, respectively).

Conclusion: Our study suggested that BAR and CAR may be used to predict candidates for SI. Future prospective controlled studies are required to confirm our findings.

Keywords: Blood urea nitrogen to albumin ratio, C-reactive protein to albumin ratio, surgical intervention, tuboovarian abscess

ÖZ

Amaç: Bu çalışmanın amacı, medikal tedaviye (MT) yanıt veren tubaovaryan abse (TOA) hastaları ile MT'nin başarısızlığı nedeniyle cerrahi girişim (SI) uygulanan hastaların klinik özelliklerini karşılaştırmaktır.

Yöntem: MT ile iyileşen hastalar Grup 1 (n=25, %55,6) ve cerrahi girişim gerektiren hastalar Grup 2 (n=20, %44,4) olarak tanımlandı. Absenin ultrason ile saptanan en büyük çapı (cm) kaydedildi. Kan üre azotu/albümin (A) oranı (BAR) ve C-reaktif protein (CRP)/albümin (A) oranı (CAR) hastaneye yatışın ilk günündeki laboratuvar testlerine göre hesaplandı.

Bulgular: BAR ve CAR, Grup 2'de daha yüksek olarak analiz edildi (p=0,3; p=0,5, sırasıyla). Grup 2'nin abse boyutu Grup 1'e göre istatistiksel olarak anlamlı derecede yüksekti (p=0,002). 5,8 cm'den büyük abse boyutu, MT başarısızlığını gösteren kesme noktası olarak hesaplandı (p=0,003). BAR 2,7 (p=0,3) ve CAR 35,6 (p=0,09) kesme noktaları cerrahi girişim gerektiren grubun göstergesiydi. Tek değişkenli ve çok değişkenli analize göre abse boyutu cerrahi girişim gerektirmeyi öngörmede bağımsız faktör olarak saptandı (p=0,01; p=0,03, sırasıyla).

Sonuç: Çalışmamız, BAR ve CAR'nin SI gerektiren TOA hastalarını tahmin etmede kullanılabileceğini düşündürmektedir. Bulgularımızı doğrulamak için prospektif kontrollü çalışmalara ihtiyaç vardır.

Anahtar Kelimeler: Kan üre azotu/albümin oranı, C-reaktif protein/albumin oranı, cerrahi müdahale, tubaovaryan abse

INTRODUCTION

Tuboovarian abscess (TOA) is a complication of pelvic inflammatory disease (PID) that affects adnexal structures and adjacent pelvic organs.[1] Approximately one-third of women diagnosed with PID become complicated by TOA.[2] The pathogenesis of TOA is polymicrobial.[3] Sexually transmitted genital infections such as Neisseria gonorrhoeae and Chlamydia trachomatis facilitate the occurrence of TOA.[3] Broad-spectrum antibiotic therapy, drainage procedures, invasive surgery, or various combinations of these are treatment options.[4] Broad-spectrum intravenous antibiotics targeting anaerobes and gram-negative aerobes have become the first-line therapy for TOA.[5,6] Antibiotic therapy provides cure in 70% of patients.[5,6] Demographic, clinical, and laboratory findings affect the failure of medical treatment (MT).[7,8] Detection of cases with low probability of responding to MT in the early period will prevent unnecessary antibiotic therapy and unnecessary hospitalization. In addition, early surgical intervention (SI) can accelerate the recovery of patients. On the other hand, the difficulties of surgical operation of tubaovarian abscesses are known by gynecologists. Clinical experience and data in the literature draw attention to the fact that there is a fine line in the management of the disease.

Clinical and laboratory evaluations such as white blood cell (WBC) count, C-reactive protein (CRP), neutrophil-to-lymphocyte ratio (NLR), platelet-to-lymphocyte ratio (PLR), abscess size, age, and fever have been reported in the literature to predict MT MT.[9-14] CRP is an acute phase reactant that increases during the inflammatory process.[10] Blood urea nitrogen (BUN) is a biomarker that provides valuable information about the clinical status of patients.[11-13] Therefore, it has been reported that high BUN levels are a significant laboratory parameter for predicting mortality.[11,13] Albumin is a protein that clinically affects the physiology and function of organs.[14,15] Low albumin levels are associated with mortality and unsuccessful treatment in pneumonia and intensive care patients.[16-18] The importance of BUN to albumin ratio (BAR) and CRP to albumin ratio (CAR) parameters has been reported in emergency and intensive care patients to predict mortality from sepsis.[19-21] In these studies, BAR and CAR values of patients with systemic infection and sepsis were found to be statistically higher. There is no study in the literature evaluating the relationship between TOA and these markers. We hypothesized that CRP and BUN values would increase, whereas albumin values would decrease in TOA patients unresponsive to MT. Therefore, in our study, we aimed to predict the outcome of TOA cases with BAR and CAR.

METHODS

Ethical approval for this retrospective observational study was received from Dokuz Eylül University of Ethics Committee (decision no: 2022/34-22, date: 26.10.2022). This study was conducted in accordance with the Helsinki Declaration principles. During the prehospitalization period, patients who received MT were excluded from the study. Between June 2014 and August 2022, 72 patients diagnosed with TOA were treated in our clinic. Twenty-seven patients were excluded from the study because of missing data. It was found from the records that percutaneous abscess drainage under radiological guidance was performed in 2 of these patients. In our study, 45 cases were analyzed. Two groups were compared as patients cured with MT [Group 1 (n=25, 55.6%)] and patients requiring SI [Group 2 (n=20, 44.4%)] in the study (Figure 1).

TOA was diagnosed with clinical symptoms of pelvic pain, vaginal discharge, diarrhea, and fever (>38). In addition, the diagnosis was strengthened by high WBC and CRP levels. The presence of a complex adnexal mass was imaged using ultrasound. All patients were hospitalized. They were treated empirically with an antibiotic regimen that included cephalosporin plus metronidazole or clindamycin plus gentamicin. MT was continued for 72 h unless there was deterioration in clinical or inflammatory laboratory markers. SI was considered if the patient's symptoms (hypotension, fever >38, progression in CRP and WBC values, sepsis, ruptured abscess, or peritonitis) did not improve after 72 h of antibiotic administration. Surgical procedures included salpingectomy, salpingoophorectomy, or total hysterectomy, depending on the patient's individual characteristics and findings during surgical exploration. Postoperative antibiotic treatment was continued until the clinical findings were stable.
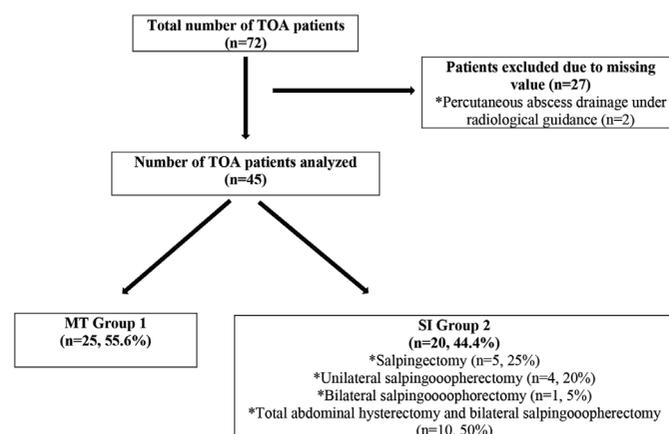

Figure 1. Flowchart of tuboovarian abscess cases

SI: Surgical intervention, TOA: Tuboovarian abscess, MT: Medical treatment

The demographic characteristics, clinical findings, and laboratory results of the groups were compared. Age, menopausal status, gravity, parity, presence of intrauterine device (IUD), and immunosuppressive comorbidity were the demographic data. Clinical findings included pelvic pain, vaginal discharge, diarrhea, and fever (>38). The largest diameter of the abscess (cm) detected by ultrasound and the hospitalization time (day) were recorded. Hemoglobin, hematocrit, platelet count, WBC count, neutrophil count, lymphocyte count, BUN, albumin (A), and CRP levels were recorded on the first day of hospitalization. NLR, PLR, BAR, and CAR were calculated according to laboratory tests.

Statistical Analysis

Analyses were performed using Statistical Package for the Social Sciences version 25.0 (IBM Inc., Chicago, IL, USA). Normality analysis was performed according to the Kolmogorov-Smirnov test. Not normally distributed parameters were analyzed using the Mann-Whitney U test. Results were expressed as median (minimum-maximum) values. The chi-square test and Fisher's precision test were used in the analysis of categorical data. Categorical variables are expressed as frequency (percentage). The specificity and sensitivity analysis of each marker was performed using the receiver operating characteristic (ROC). ROC analysis was performed to calculate the area under the curve (AUC), which indicates the average sensitivity of a marker. The results are 95% confidence intervals (CI). Univariate and multivariate logistic regression analyses were used to evaluate the predictors of surgery. The p value considered statistically significant was <0.05.

RESULTS

Seventy-two patients with a diagnosis of TOA were treated in our clinic. Twenty-seven patients were excluded from the study for the stated reasons. 45 patients were analyzed in the study. The patients who received MT were defined as Group 1 (n=25, 55.6%) and the patients requiring SI were defined as Group 2 (n=20, 44.4%). All patients in the SI group underwent laparotomy [salpingectomy 5 cases (25%); unilateral salpingoooophorectomy, 4 cases (20%); bilateral salpingophorectomy, 1 case (5%); total abdominal hysterectomy and bilateral salpingoooophorectomy, 10 cases (50%)]. No complications were observed during the surgery. No malignancy was detected in the final pathology results.

The demographic and clinical findings of the groups are listed in Table 1. The overall median age was 39 years (20-65 years) in the MT group and 42 years (22-50 years) in the SI group; the difference was not significant (p=0.2). One patient (4%) in the MT group and 2 patients (10%) in the SI group were in the postmenopausal period. There was no difference between the groups in terms of menapulsal status (p=0.4). Groups were compared according to gravida and parity, and no difference was found (2 vs 2, p=0.2; 2 vs 2, p=0.2, respectively).

There were no significant differences between the groups in the presence of IUD (28% vs 30%, p=0.8). Clinical findings included pelvic pai, vaginal discharge, diarrhea, and fever. These symptoms were similar between groups (92% vs 85%, p=0.4; 4% vs 5%, p=0.8; 4% vs 10%, p=0.4, respectively). The size of the abscess was imaged on the day of hospitalization using ultrasound. The abscess size

Table 1. Demographic characteristics and clinical findings of the cases			
	Group 1 (n=25)	Group 2 (n=20)	p value
Age (year)	39 (20-62)	42 (22-50)	0.2
Postmenopausal status	**1/25 (4%)**	**2/20 (10%)**	0.4
Gravida	2 (0-5)	2 (0-6)	0.2
Parity	2 (0-3)	2 (0-4)	0.2
IUD	7/25 (28%)	6/20 (30%)	0.8
Immunosuppressive comorbidity	4/25 (16%)	3/20 (15%)	0.9
Clinical findings			
Pelvic pain and vaginal discharge	23/25 (92%)	17/20 (85%)	0.4
Diarrhea	1/25 (4%)	1/20 (5%)	0.8
Fever (>38)	1/25 (4%)	2/20 (10%)	0.4
Abscess size (cm)	4 (2-12)	6 (3-10)	0.002
Hospitalization (days)	8 (3-15)	9.5 (4-24)	0.2
*Not normally distributed parameters were analyzed with the Mann-Whitney U test. Results were expressed as median (minimum-maximum) values. **Chi-square test and Fisher's precision test were used in the analysis of categorical data. Categorical variables were expressed as frequency (percentage). IUD: Intrauterine device			

of the SI group was significantly different (4 cm vs 6 cm, p=0.002). Hospitalization time was longer in the SI group (8 vs 9.5). However, this difference was not statistically significant (p=0.2).

Table 2 shows the laboratory values of the groups. Hemoglobin and WBC were lower in Group 2 (11.9 vs 11.1, p=0.07; 12.7 vs 12.2, p=0.3, respectively). NLR was higher in Group 1 (6.3 vs 5.1, p=0.4). PLR was higher in Group 2 (213.7 vs 217.5, p=0.9). CRP value was higher in Group 2 (115 vs 129.5, p=0.7). Albumin was found to be lower in Group 2 (3.5 vs 3.3, p=0.1). The BUN value of both groups was found to be 9.4 (p=0.9). BAR and CAR were analyzed higher in Group 2 (2.6 vs 2.8, p=0.3; 34.9 vs 36.4, p=0.5, respectively).

All independent parameters were evaluated with the ROC curve to predict failure of MT and requirement of SI (Figure 2, Table 3). Abscess size greater than 5.8 cm was calculated as the cut-off point indicating failure of medical therapy (sensitivity 65%; specificity 80%; p=0.003). NLR below 5.5 (AUC 0.56; sensitivity 55%; specificity 64%) and PLR above 177.5 (AUC 0.506, sensitivity 65%, specificity 36%) were indicators of failure to MT (p=0.4; p=0.9; respectively). The cut-off point of BAR 2.7 (AUC 0.586, sensitivity 55%, specificity 60%; p=0.3) and CAR 35.6 (AUC 0.550, sensitivity 55%, specificity 52%; p=0.09) were indicators of surgical treatment.

According to the univariate and multivariate analysis, abscess size was an independent predictor of surgical treatment [Odds ratio (OR): 1.5; 95% CI: 1.084-2.207; p=0.01, OR: 1.4; 95% CI: 1.036-2.129; p=0.03, respectively] (Tables 4, 5).

DISCUSSION

In the current study, we evaluated the factors affecting the failure of MT and predicting SI. We found that abscess size was an independent and important factor for SI. BAR and CAR levels were higher in the SI group, although they did not reach statistical significance.

Hwang et al.[22] found that TOA patients who required SI although antibiotic therapy were at an older age. In
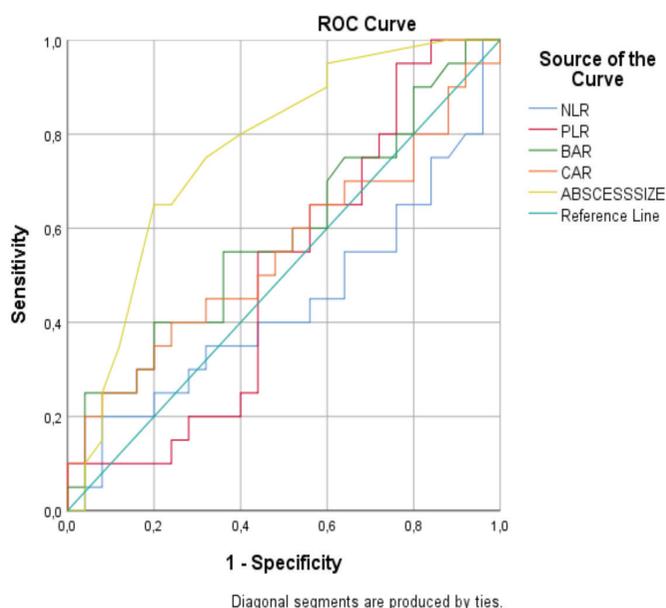

Figure 2. ROC curve for independent variables

ROC: Receiver operating characteristic, NLR: Neutrophil-to-lypmhocyte ratio, PLR: Platelet to lymphocyte ratio, BAR: Blood urea nitrogen to albumin ratio, CAR: C-reactive protein to albumin ratio

Table 2. Laboratory results			
	Group 1 (n=25)	**Group 2 (n=20)**	**p value**
Hemoglobin (g/dL)	11.9 (10.3-13.8)	11.1 (8.3-13.2)	0.07
Hematocrit (%)	35.2 (31.8-40.9)	33.4 (25.7-39.5)	0.09
Platelet (10^3/μL)	334 (196-768)	328 (190-602)	0.9
Leukocyte (white blood cell) (10^3/μL)	12.7 (6.6-35.3)	12.2 (5-21.1)	0.3
Neutrophil (10^3/μL)	11.2 (5.1-32.9)	9.9 (3.3-19.1)	0.2
Lymphocyte (10^3/μL)	1.6 (0.8-4.1)	1.7 (0.3-2.6)	0.5
Blood urea nitrogen (mg/dL)	9.4 (4.7-21.8)	9.4 (3.4-21.2)	0.9
Albumin (g/dL)	3.5 (0.6-4.6)	3.3 (2.2-4.2)	0.1
C-reactive protein (mg/L)	115 (1-323)	129.5 (1-541)	0.7
Neutrophil to lymphocyte ratio	6.3 (1.1-27.4)	5.1 (1.5-27.2)	0.4
Platelet to lymphocyte ratio	213.7 (54.4-586.3)	217.5 (115-675)	0.9
Blood urea nitrogen to albumin ratio	2.6 (1.1-5.1)	2.8 (1.4-5.6)	0.3
C-reactive protein to albumin ratio	34.9 (0.2-106)	36.4 (0.2-226)	0.5
*Not normally distributed parameters were analyzed with the Mann-Whitney U test. Results were expressed as median (minimum-maximum) values			

addition, the cut-off age requiring SI was reported to be 34.3 years. Similarly, Alay et al.[23] also found that the group requiring SI was at an older age. In another study, no difference was found between the ages of the MT and SI groups.[24] In our study, patients in the SI group were older. However, the groups were similar in terms of age.

MT is the first line in hemodynamically stable TOA cases. Percutaneous abscess drainage can be applied if necessary.[9] If SI is required (hypotension, fever >38, progression in CRP and WBC levels, sepsis, ruptured abscess, or peritonitis), the currently recommended approach is endoscopic surgery.[25]

Because of the lack of well-controlled prospective studies comparing laparoscopy and laparotomy options, there is no definite consensus in the literature.[26] The surgical method (laparatomy/laparoscopy) and type of operation (from drainage to hysterectomy) should be evaluated according to the characteristics of the patient surgeon, and clinic. Abscess drainage, salpingectomy, salpingooophorectomy, and hysterectomy can be performed with surgery. Hsiao et al.[27] compared TOA cases according to menopausal status in terms of peroperative observation and pathology reports. They reported that gynecological/non-

Table 3. AUC values and cut-off points for NLR, PLR, BAR, CAR and abscess size to determine surgical group

	Cut value	p value	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	LR +	LR -	AUC (%95 CI)
NLR	5.5	0.4	55	64	55	64	1.2	1.7	0.565 (0.389-0.741)
PLR	177.5	0.9	65	36	45	69	1.85	0.56	0.506 (0.334-0.678)
BAR	2.7	0.3	55	60	56	68	1.85	1.5	0.586 (0.415-0.757)
CAR	35.6	0.09	55	52	52	65	1.85	1.1	0.550 (0.374-0.726)
Abscess size (cm)	5.8	0.003	65	80	72	74	1.85	4	0.764 (0.623-0.905)

*P<0.05.

**The specificity and sensitivity analysis of each marker was performed with the ROC. ROC analysis was performed to calculate the AUC, which indicates the average sensitivity of a marker.

AUC: Area under the curve, NLR: Neutrophil-to-lypmhocyte ratio, PLR: Platelet to lymphocyte ratio, BAR: Blood urea nitrogen to albumin ratio, CAR: C-reactive protein to albumin ratio, PPV: Positive predictive value, NPV: Negative predictive value, LR: Likelihood ratio, CI: Confidence interval, ROC: Receiver operating characteristic

Table 4. Univariate logistic regression analysis of independent variables

	B	S.E.	Wald	OR (95% CI)	p value
NLR	-1.05	0.83	1.592	0.9 (0.765-1.060)	0.2
PLR	0.001	0.003	0.066	1 (0.994-1.008)	0.7
BAR	0.336	0.345	0.948	1.3 (0.712-2.749)	0.3
CAR	0.012	0.011	1.143	1 (0.990-2.207)	0.2
Abscess size (cm)	0.436	0.181	5.796	1.5 (1.084-2.207)	0.01

*P<0.05.

**Univariate logistic regression analysis were used to evaluate predictors of surgery.

NLR: Neutrophil-to-lypmhocyte ratio, PLR: Platelet to lymphocyte ratio, BAR: Blood urea nitrogen to albumin ratio, CAR: C-reactive protein to albumin ratio, CI: Confidence interval, OR: Odds ratio

Table 5. Multivariate logistic regression analysis of independent variables

	B	S.E.	Wald	OR (95% CI)	p value
NLR	-1.169	0.106	2.567	0.8 (0.686-1.039)	0.1
PLR	-0.001	0.004	0.066	0.9 (0.991-1.007)	0.7
BAR	0.114	0.381	0.090	1.1 (0.531-2.366)	0.7
CAR	0.006	0.014	0.196	1 (0.979-1.035)	0.6
Abscess size (cm)	0.396	0.184	4.640	1.4 (1.036-2.129)	0.03

*P<0.05.

**Multivariate logistic regression analysis were used to evaluate predictors of surgery.

NLR: Neutrophil-to-lypmhocyte ratio, PLR: Platelet to lymphocyte ratio, BAR: Blood urea nitrogen to albumin ratio, CAR: C-reactive protein to albumin ratio, CI: Confidence interval, OR: Odds ratio

gynecological malignancy may accompany TOA in the pelvic area in postmenopausal patients. The malignancy rate of the postmenopausal group was significantly higher than that of the premenopausal group. In the review, the rate of patients admitted with TOA and diagnosed with malignancy was reported as 2.5-47%.[25] Frozen section is recommended for suspected perioperative malignancy in postmenopausal TOA cases. In our study, there was no difference between the groups. Total abdominal hysterectomy and bilateral salpingooophorectomy were performed on these patients. In premenopausal patients who do not respond to MT, appropriate SI should be performed according to the fertility expectation of the patient. Therefore, it is recommended that fertility-sparing surgery preferences be at the forefront. In contrast, total abdominal hysterectomy and bilateral salpingooophorectomy can be planned in patients who do not expect fertility.[25]

The results of studies evaluating the effect of IUD as a risk factor for TOA are controversial in the literature.[28,29] Kapustian et al.[29] reported the presence of IUD in approximately 50% of TOA cases responding to MT and 25% in the SI group. Tugrul Ersak et al.[30] found the presence of IUD in 33.3% of the MT failed group and 32.4% of the SI group.[30] In the same study, it was investigated that the duration of IUD affects the success of MT. They reported that the IUD duration (years) was statistically longer in the SI group. The IUD duration of the MT-failed group was 1.5 times longer than that of the MT-successful group. They determined the cut-off point of IUD duration to be 5.5 years. We did not analyze the duration of IUD in our study. In our study, the presence of IUD was found to be 30% in the SU group and 28% in the MT group. The groups were statistically similar.

Ribak et al.[24] analyzed TOA cases in two groups according to their MT success. In this study, the SI group comprised 25% of all patients. The CRP value of the SI group was higher. Hwang et al.[22] analyzed TOA cases according to the MT response. The SI group comprised 44% of the cases evaluated. They found that the CRP value was higher in the SI group. In another study, in which the SI group comprised 36% of the cohort, a similar methodologywas used. CRP values were higher in the SI group.[31] In our study, the failure rate of MT was 44%. This rate is in line with similar studies in the literature. As stated above, although CRP values were analyzed as statistically significant or insignificant, the common point of these studies is that the CRP value was higher in the SI group. Although not statistically significant, CRP was higher in Group 2 in our study.

Akkurt et al.[32] found a higher CRP value in the SI group. The difference between the groups was not statistically significant. In that study, the groups were compared in terms of WBC count. There was a statistically significant difference in the SI group. In summary, while no significant relationship was found between the medical or surgical approach and CRP levels, this relationship was significant in favor of WBC. In another study, it was reported that the WBC count was higher in the SI group, but this value did not differ between the groups.[24,31] Hwang et al.[22] found a statistically significant difference in favor of the SI group. In this study, the cut-off value of the WBC count was 10.4. Contrary to these studies, we found that WBC count was higher in the MT group. This difference was not statistically significant. We provide the reason for this contrast because of the small number of patients in our cohort group.

It has been reported that WBCs, neutrophils, and platelets are elevated in TOA patients.[23,33] Neutrophils are elevated even when the WBC count is normal. It has been determined that a relative decrease in lymphocytes causes an increase in NLR and PLR. Hwang et al.[22] reported that NLR values were higher in TOA cases that were unresponsive to MT treatment. Zhu et al.[31] found this rate to be higher in the SI group. However, they found no statistical difference between the groups. Alay et al.[23] compared NLR and PLR markers between the MT and SI groups. In this study, both markers were found to have a statistically significant difference in the SI group. However, it has been stated that these biomarkers are affected by the severity and onset time of the patient's clinical symptoms.[22] In our study, the NLR and PLR values were similar between the groups.

Fouks et al.[9] reported that an abscess size greater than 7 cm negatively affected the success of MT. They found that the abscess size of the group unresponsive to MT was 1.4 times larger. Hwang et al.[22] reported that abscesses larger than 5.9 cm required SI. The size of the abscess was larger in the SI group in our study. Abscess size greater than 5.8 cm was calculated as the cut-off point indicating failure of MT. According to the univariate and multivariate analyses, abscess size was an independent predictor of surgical treatment.

The predictivity of laboratory and clinical findings in TOA patients who underwent SI because of MT failure has different results in the literature. This situation creates dilemmas in managing TOA cases. The importance of BAR and CAR parameters has been reported in emergency and intensive care patients to predict mortality from sepsis.[19-21] In these studies, BAR and CAR values of patients with systemic infection and sepsis were found to be statistically higher. Based on the hypothesis that TOA cases unresponsive to MT may have signs of sepsis, we compared BAR and CAR values between the groups. In our study, albumin levels were found to be lower in Group 2. The BUN

value of both groups was found to be 9.4. BAR and CAR were analyzed higher in Group 2. The cut-off points of BAR 2.7 and CAR 35.6 were indicators of surgical treatment.

Study Limitations

The retrospective design and small study population from a single institution are the limitations of this study.

CONCLUSION

In conclusion, many markers and clinical findings have been evaluated in previous studies to predict the success of MT in TOA cases. However, BAR and CAR values were not evaluated with similar methodology in TOA cases. According to the results of our study, abscess size was determined to be the most predictive criterion. We believe that BAR and CAR should be considered in cases of TOA unresponsive to MT. We believe that our findings will be confirmed by prospective studies in the future.

Ethics

Ethics Committee Approval: The study was approved by the Dokuz Eylül University of Ethics Committee (decision no: 2022/34-22, date: 26.10.2022).

Informed Consent: Retrospective study.

Peer-review: Externally peer-reviewed.

Authorship Contributions

Surgical and Medical Practices: O.Y., S.K., A.A., Concept: O.Y., S.K., Design: O.Y., S.K., Data Collection or Processing: O.Y., K.A.M., O.A., Analysis or Interpretation: O.Y., Literature Search: O.Y., A.A., Writing: O.Y.

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