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ORIGINAL ARTICLE

Preoperative inflammatory markers in the prediction of adnexal torsion

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ABSTRACT

Objective: To investigate the role of preoperative inflammatory markers in the diagnosis of adnexal torsion (AT).

Material and Methods: A retrospective case-control study was carried out, comparing 110 patients who had undergone surgery for AT with a control group of 102 patients. Demographic characteristics and preoperative hematological parameters were compared between those with and without adnexal torsion.

Results: Patients diagnosed with AT had significantly lower age, gravidity, and parity compared to the control group. The AT group had elevated levels of WBC, neutrophils, platelets, and NLR, and lower levels of MPV. Multivariate analysis revealed that NLR, WBC, and MPV were independently predictive of AT. The NLR cut-off value was determined to be 2.64. Based on this value, the sensitivity, specificity, positive predictive value, and negative predictive value were 84.3%, 78.2%, 78.2%, and 84.3%, respectively.

Conclusion: This study suggests that preoperative inflammatory markers, particularly NLR, may be valuable tools for improving the early diagnosis of AT. In addition, NLR demonstrated superior diagnostic accuracy over WBC count.

Keywords: Adnexal torsion, neutrophil/lymphocyte ratio, NLR.

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INTRODUCTION

Adnexal torsion (AT) is a rare and emergent condition characterized by the twisting of the adnexal peduncle around its axis.[1] While AT can occur at any age, it is most prevalent during the reproductive years. Hence, prompt management of AT is crucial for the reproductive health of affected women.[2]

Unfortunately, early detection of adnexal torsion poses challenges. Various laboratory markers have been used for early diagnosis, yet a specific marker remains elusive. Despite the availability of imaging techniques like ultrasonography (USG) and Doppler USG, the diagnosis of AT is difficult due to the low diagnostic accuracy of imaging modalities.[3] Consequently, a reliable method for preoperative confirmation of the diagnosis is lacking, with diagnosis often being made during surgery.[4]

Recent studies suggest that inflammatory markers and their ratios could aid in the early diagnosis of AT. Therefore, the purpose of this study is to examine the role of inflammatory parameters in the preoperative diagnosis of adnexal torsion.

MATERIAL AND METHODS

A retrospective case-control study was carried out in the obstetrics and gynaecology department of a tertiary hospital from January 2018 to December 2023. The study received approval from the ethics committee (No: 2023/514/260/27) and adheres to the tenets of the Declaration of Helsinki. Data were extracted from the hospital database system. A comparison was made between 110 patients who underwent surgery for AT and a control group of 102 patients of similar age who underwent routine gynecologic examination and had no malignancy, systemic illness, or infection. Demographic characteristics and preoperative hemogram parameters were compared.

Statistical Analysis

Descriptive statistics were used to analyze the data. The normal distribution of the variables was tested using the Kolmogorov-Smirnov test. Differences between groups were analyzed with the Mann-Whitney U test and Chi-square test, as appropriate. The ROC curve was constructed to determine the optimal cut-off values, and the effect level was examined by univariate and multivariate logistic regression. The analysis was carried out using the SPSS 28.0 (Armonk, New York: IBM Corp.) program.

RESULTS

The adnexal torsion group had significantly lower age, gravidity, and parity than the group without adnexal torsion. Additionally, the group with AT had significantly higher white blood cell (WBC), neutrophil, platelet, neutrophil-to-lymphocyte ratio (NLR), platelet-to-leukocyte ratio (PLR), neutrophil-to-eosinophil ratio (NER), and lymphocyte-to-eosinophil ratio (LER) values than the group without adnexal torsion. Monocyte levels were not significantly different between the two groups (p>0.05) (Table 1).

Through a univariate analysis of adnexal torsion, a number of factors were deemed significant (p<0.05), including age, gravidity,

Table 1: Demographic data and laboratory results of the groups

	Adnexal torsion (-) (n=102)		Adnexal torsion (+) (n=110)		p
	Mean±SD/n-%	Median	Mean±SD/n-%	Median	
Age (years)	42.4±5.3	42.0	29.1±11.4	27.0	**0.000***
Gravidity	3.2±1.3	3.0	2.5±1.7	2.0	**0.000***
Parity	2.7±1.2	2.0	1.9±1.4	2.0	**0.000***
WBC (x10^3/µL)	7.7±2.4	7.2	11.8±3.9	11.5	**0.000***
Neutrophil (%)	4.7±1.9	4.4	8.8±3.4	8.5	**0.000***
Eosinophil (%)	0.17±0.14	0.14	0.07±0.09	0.02	**0.000***
Lymphocyte (%)	2.3±0.7	2.2	1.8±1.0	1.6	**0.000***
Platelet (x10^3/µL)	277.4±71.4	265.5	277.7±810.7	193.1	**0.000***
Monosit	0.54±0.18	0.53	0.65±0.35	0.60	0.114*
MPV	10.8±0.9	10.7	9.7±1.4	9.9	**0.000***
NLR	2.2±1.2	2.0	8.2±17.8	5.1	**0.000***
PLR	130.3±45.2	123.1	256.3±811.8	168.0	**0.000***
NER	58.0±84.0	28.3	361.6±447.3	127.4	**0.000***
LER	23.5±21.6	15.2	62.8±70.6	34.1	**0.000***

*: Mann-Whitney u test; WBC: White blood cells; MCV: Mean corpuscular volume; MPV: Mean platelet volume; PDW: Platelet distribution width; NLR: Neutrophil–lymphocyte ratio; PLR: Platelet–lymphocyte ratio; NER: Neutrophil– eosinophil ratio; LER: Lymphocyte – eosinophil ratio.

Table 2: Logistic regression model of demographic and laboratory parameters

	Univariate			Multivariate		
	OR	95% CI	p	OR	95% CI	p
Age (years)	0.842	0.803–0.883	**0.000**			
Gravidity	0.672	0.507–0.892	**0.006**			
Parity	0.568	0.388–0.831	**0.004**			
WBC (x10^3/µL)	1.582	1.388–1.805	**0.000**	1.258	1.085–1.459	**0.002**
Neutrophil (%)	1.811	1.542–2.127	**0.000**			
Eosinophil (%)	0.000	0.000–0.002	**0.000**			
Lymphocyte (%)	0.537	0.382–0.757	**0.000**			
Platelet (x10^3/µL)	1.000	1.000–1.000	0.997			
MPV	0.456	0.344–0.606	**0.000**	0.491	0.332–0.727	**0.000**
NLR	2.404	1.815–3.184	**0.000**	1.862	1.412–2.455	**0.000**
PLR	1.010	1.005–1.015	**0.000**			
NER	1.007	1.003–1.010	**0.000**			
LER	1.025	1.012–1.037	**0.000**			

Logistic Regression (Forward LR). WBC: White blood cells; MCV: Mean corpuscular volume; MPV: Mean platelet volume; NLR: Neutrophil–lymphocyte ratio; PLR: Platelet–lymphocyte ratio; NER: Neutrophil– eosinophil ratio; LER: Lymphocyte – eosinophil ratio; CI: Confidence interval; OR: Odds ratio.

Table 3: Prediction of adnexal torsion according to the cut-off values of WBC, NLR and MPV

	AT (-)	AT (+)	Sensivity	PPV	Specificity	NPV	Accuracy	+Likelihood	p
WBC									
<8.8	84	24	76.5%	75.0%	76.4%	77.8%	76.4%	3.24	**0.000**
≥8.8	26	78							
NLR									
<2.64	86	16	84.3%	78.2%	78.2%	84.3%	81.1%	3.86	**0.000**
≥2.64	24	86							
MPV									
<11	64	86	84.3%	57.3%	41.8%	74.2%	37.7%	1.45	**0.000**
≥11	46	16							
≥20	37	35							

WBC: White blood cells; MPV: Mean platelet volume; NLR: Neutrophil–lymphocyte ratio; PPV: Positive predictive value; NPV: Negative Predictive value; CI: Confidence interval; AUC: Area under the curve; AT: Adnexal torsion.

parity, WBC, neutrophils, eosinophils, lymphocytes, platelets, mean platelet volume (MPV), NLR, PLR, NER, and LER. However, a multivariate analysis showed that only WBC, MPV, and NLR values were independently effective in distinguishing patients with and without adnexal torsion (p<0.05) (Table 2).

Cut-off values were determined for NLR, MPV, and WBC levels as presented in Table 3. The cut-off point determined for WBC in the diagnosis of torsion was >8.8, and the sensitivity was 76.5%, the specificity was 76.4%, the positive predictive value (PPV) was 75.0%, and the negative predictive value (NPV) was 77.8% for this value.

The NLR cut-off value was set at 2.64, with sensitivity, specificity, PPV, and NPV of 84.3%, 78.2%, 78.2%, and 84.3%, respectively.

The cut-off value for MPV was determined as 11.0, with sensitivity, specificity, PPV, and NPV of 84.3%, 41.8%, 57.3%, and 74.2%, respectively.

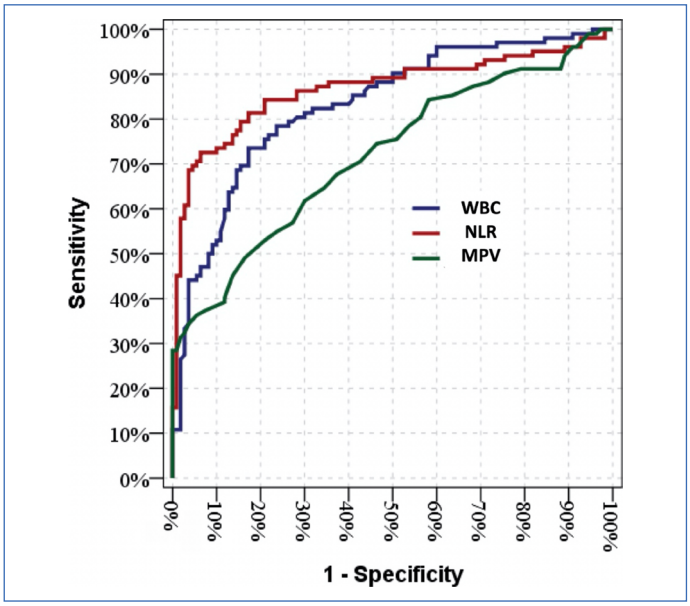

Figure 1: Receiver operating characteristic (ROC) curves analysis of neutrophil-lymphocyte ratio (NLR), white blood cells (WBC), mean platelet volume (MPV) in patients with adnexal torsion.

ROC curve analyses demonstrated that increased NLR (AUC: 0.868; 95% CI: 0.815–0.921; p<0.001), increased WBC (AUC: 0.832; 95% CI: 0.777–0.887; p<0.001), and decreased MPV (AUC: 0.720; 95% CI: 0.652–0.789; p<0.001) were statistically significant discriminative factors in predicting adnexal torsion (Fig. 1).

DISCUSSION

Adnexal torsion is a medical emergency in gynecology that can lead to infertility if not diagnosed promptly. While ultrasonography is commonly used in conjunction with clinical assessment, it is not always sufficient for accurate diagnosis. Therefore, additional tools are needed to aid clinicians in diagnosis. This study investigated the potential usefulness of inflammatory markers for diagnosing adnexal torsion. The study findings indicated that NLR, MPV, and WBC were highly successful in accurately diagnosing cases of torsion.

The median age in the AT group was found to be 27 years, supporting that AT occurs mostly in the reproductive age group.[5] This finding is consistent with the research of Ghimire et al.,[6] who found a median age of 30 years in the AT group.

NLR is a significant inflammatory indicator that has been extensively studied in relation to chronic diseases, autoimmune diseases, various gynecologic inflammatory diseases, and malignancies. The present study found that patients with AT had elevated WBC and neutrophil levels but decreased lymphocyte levels compared to the control group. Consequently, the NLR was notably higher in the AT group. This finding is in line with previously published studies,[7–9] which also found that patients with AT had higher NLR values than the non-torsion group. These findings suggest that NLR could be a useful diagnostic marker for AT.

Several studies have demonstrated the superiority of NLR over WBC in reflecting the inflammatory process in surgical procedures.[10] For instance, Lee et al.[11] reported that NLR is a more sensitive parameter than WBC in the diagnosis of AT. Similarly, Ercan et al.[8] found that NLR had higher sensitivity and specificity compared to WBC count in predicting AT. Our study confirms these previous findings, as we also found that NLR had higher sensitivity and specificity compared to WBC in the diagnosis of AT. In addition, NLR had a higher AUC value than WBC count. These results suggest that NLR may be a more sensitive indicator than WBC count for the diagnosis of AT.

Platelets are essential for hemostasis and the inflammatory response.[12] MPV reflects platelet size and activity. In cases of acute inflammation and thrombosis, platelet production and activation increase, leading to a rise in platelet count, particularly in young and large platelets, resulting in higher MPV levels. However, the majority of large reactive platelets are consumed at inflammatory sites, leading to a decrease in MPV levels.[13] Pro-inflammatory cytokines and acute phase markers secreted during the inflammatory process may also contribute to the reduction in platelet volume.[14]

There are controversies regarding the relationship between MPV and inflammation. However, previous studies suggest that an elevated MPV is associated with a higher risk of thrombosis and low-grade inflammatory conditions. Low MPV levels are often linked to high-grade inflammatory diseases, such as active rheumatoid arthritis, acute pancreatitis, and adnexal torsion.[15,16] Our study revealed that patients with AT had significantly lower MPV levels than the control group. MPV was found to be an independent predictor for adnexal torsion, with an optimal cut-off value of 11×10³/µL, 70% sensitivity, and 65.7% specificity.

The retrospective design of this study is a limitation. Further validation of the diagnostic value of preoperative inflammatory markers in AT requires prospective studies. The study's results may be affected by the unavailability of several variables, such as the time interval between the measurement of preoperative hematologic parameters and the start of surgery or between the onset of symptoms and the commencement of treatment. Therefore, future studies that include the adnexal reserve marker and the time interval are recommended.

CONCLUSION

In conclusion, NLR, WBC, and MPV may be useful parameters in the differential diagnosis of AT. Our study suggests that NLR has a higher diagnostic value than WBC. These findings indicate that NLR could serve as a valuable tool in the preoperative diagnosis of AT.

Statement

Ethics Committee Approval: The University of Health Sciences, Kartal City Hospital Ethics Committee granted approval for this study (date: 30.10.2023, number: 2023/514/260/27).

Author Contributions: Concept – MG, İB; Design – MG, İB; Supervision – MG; Resource – MG; Materials – AG; Data Collection and/or Processing – AG; Analysis and/or Interpretation – MG, İB, EK, AG; Literature Search – MG, İB, EK, AG; Writing – MG, İB, EK, AG; Critical Reviews – MG, İB, EK, AG.

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REFERENCES

1. Sasaki KJ, Miller CE. Adnexal torsion: Review of the literature. J Minim Invasive Gynecol 2014;21:196–202.
2. Huchon C, Staraci S, Fauconnier A. Adnexal torsion: A predictive score for pre-operative diagnosis. Hum Reprod 2010;25:2276–80.
3. Rostamzadeh A, Mirfendereski S, Rezaie MJ, Rezaei S. Diagnostic efficacy of sonography for diagnosis of ovarian torsion. Pak J Med Sci 2014;30:413–6.
4. Adnexal torsion in adolescents: ACOG committee opinion no, 783. Obstet Gynecol 2019;134:e56–e63.
5. Huchon C, Fauconnier A. Adnexal torsion: A literature review. Eur J Obstet Gynecol Reprod Biol 2010;150:8–12.
6. Ghimire A, Ghimire S, Shrestha A, Pant SR, Subedi N, Pant PR. Preoperative neutrophil lymphocyte ratio in prediction of adnexal mass torsion. Obstet Gynecol Int 2023;2023:3585189.
7. Tas EE, Keskin HL, Kir EA, Kilic G, Cetinkaya G, Yavuz AF. Can preoperative complete blood count parameters be used in the diagnosis of patients with adnexal torsion: A case-control study. J Pak Med Assoc 2020;70:1319–23.
8. Ercan Ö, Köstü B, Bakacak M, Coşkun B, Tohma A, Mavigök E. Neutrophil to lymphocyte ratio in the diagnosis of adnexal torsion. Int J Clin Exp Med 2015;8:16095–100.
9. Aiob A, Lowenstein L, Borik I, Naskovica K, Mikhail SM, Odeh M. The value of clinical symptoms, the neutrophil-to-lymphocyte ratio, and ultrasonographic features in predicting adnexal torsion: A case-control study. J Obstet Gynaecol Res 2023;49:289–95.
10. Zahorec R. Ratio of neutrophil to lymphocyte counts-rapid and simple parameter of systemic inflammation and stress in critically ill. Bratisl Lek Listy 2001;102:5–14.
11. Lee J, Park J, Lee HJ, Kim MJ, Lee YH, Chong GO, et al. Original articles preoperative hematological parameters for predicting ovarian torsion in patients with mature cystic teratoma. Int J Womens Health 2021;13:317–26.
12. Batman A, Ekici M, Menekse TS, Ciftciler R, Yazici D. Predictive value of nutrition and inflammation-related indices on prognosis in type 2 diabetes mellitus patients with coronavirus disease-2019. Sisli Etfal Hastan Tip Bul 2024;58:55–61.
13. Balta S, Demirkol S, Unlu M, Celik T. Other inflammatory markers should be kept in mind when assessing the mean platelet volume. Platelets 2014;25:552–3.
14. Lei JJ, Zhou L, Liu Q, Xiong C, Xu CF. Can mean platelet volume play a role in evaluating the severity of acute pancreatitis? World J Gastroenterol 2017;23:2404–13.
15. Kisacik B, Tufan A, Kalyoncu U, Karadag O, Akdogan A, Ozturk MA, et al. Mean platelet volume (MPV) as an inflammatory marker in ankylosing spondylitis and rheumatoid arthritis. Joint Bone Spine 2008;75:291–4.
16. Öksüzoğlu A. The role of neutrophil/lymphocyte ratio and mean platelet volume in diagnosis of ovarian torsion. JGON 2021;18:867–72.