

Relationship between admission neutrophil/lymphocyte, thrombocyte/lymphocyte, and monocyte/lymphocyte ratios and 1-year mortality in geriatric hip fractures: Triple comparison

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ABSTRACT

BACKGROUND: Elderly patients with hip fractures have a high post-operative 1-year mortality rate. The aim of this study was to investigate the relationship of the neutrophil/lymphocyte ratio (NLR), thrombocyte/lymphocyte ratio (TLR), and monocyte/lymphocyte ratio (MLR) with mortality.

METHODS: The data of 350 patients who suffered femoral intertrochanteric fractures between January 2015 and January 2020 were examined, and the demographic data of 124 patients who met the study criteria were evaluated. During the 1-year follow-up, 92 patients (74%) who continued their lives and 32 patients (25%) who died were divided into two groups: Group 1 (survivors) and Group 2 (non-survivors). NLR, TLO, MLO, presence of comorbidities, age, sex, American Society of Anesthesiologists Physical Status Classification, length of hospital stay, fracture type, and fracture pattern values were statistically compared between the two groups.

RESULTS: NLR, TLR, and MLR are the laboratory parameters assessed within the scope of the study. Preoperatively, the mean NLR was 6.59 (1.61–26.29), mean TLR was 197.94 (86–516), and mean MLR was 0.73 (0.19–15.68). In this study, a significant relationship was found between NLR, TLR, and MLR values and the occurrence of post-operative 1-year mortality ($p=0.01$). In addition, the result was significant in the correlation between these parameters. Cutoff values were found to be 7.53 for NLR, 192 for TLR, and 0.54 for MLR in receiver operator characteristic curve analysis ($p<0.01$).

CONCLUSION: NLR, TLR, and PLR are significant predictors of 1-year mortality in patients aged over 60 years with hip fractures.

Keywords: Fracture; hip; lymphocyte; mortality; neutrophil; platelet.

INTRODUCTION

Increased average life expectancy is associated with an increase in hip fracture rates in the elderly population. In the 1990s, the annual incidence of hip fractures was 1.2 million worldwide,^[1] and this figure is expected to reach 6.3 million in 2050.^[2] Hip fractures are among the major causes of mortality in the elderly population. The rate of mortality observed in patients within the 1-year period after hip fracture surgery

can reach up to 36%.^[3] These high mortality rates highlight the importance of investigating the predictive causes of this condition.

Various studies have been conducted on biochemical parameters that may be correlated with morbidity and mortality in patients who develop hip fractures. These studies have demonstrated that laboratory findings such as low albumin and high potassium levels may be correlated with mortality

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ty.^[4] Some studies have stressed the relationship between the neutrophil/lymphocyte ratio (NLR) and mortality in hip fractures among elderly patients.^[5,6] Moreover, studies have suggested that the thrombocyte/lymphocyte ratio (TLR) can be an evaluation parameter for the development of mortality.^[7] It has also been shown that the monocyte/lymphocyte ratio (MLR) may be correlated with mortality after hip fractures in the elderly population.^[8] However, there are no data on the correlation and relationships among these three parameters.

Therefore, this study aimed to determine whether NLR, TLR, and MLR can be used as predictive factors for mortality following femoral intertrochanteric fracture and to evaluate the correlation among these parameters.

MATERIALS AND METHODS

Study Population

In this study, the medical data of patients who presented with a diagnosis of hip fracture between January 2015 and January 2020 were retrospectively analyzed. Our research was conducted in accordance with the Declaration of Helsinki, and approval was obtained from the Ethics Committee.

The criteria for inclusion in the study were as follows: diagnosis of a femoral intertrochanteric fracture, age ≥ 60 years, 1-year follow-up data available, the fracture being fixed within 48 h, use of a dual lag screw-based proximal femur nail, and fracture reduction in the good reduction group according to the Fogagnolo criteria.^[9] Patients with additional injuries due to pathological fractures, multi-trauma, and multiple fractures, body mass indices of ≥ 35 , those for whom a method other than proximal femoral nailing was used as the fracture fixation method, and those for whom chronic immunosuppressive medication was used were excluded from the study.

Of the 350 patients evaluated within the scope of the study, 226 were excluded from the study because they did not meet the study criteria. As a result, 124 patients were evaluated within the scope of this study. Further, age, sex, fracture side, femoral intertrochanteric fracture type according to the Evans-Jensen classification^[10] and stability or instability of the fracture pattern, American Society of Anesthesiology (ASA) score, length of stay, duration of post-operative stay in the intensive care unit, and demographic data were evaluated. Furthermore, the patients who survived and those who lost their lives at the end of the 1-year period were identified and divided into Group 1 (survivors) and Group 2 (non-survivors). According to the Evans-Jensen classification, fracture Types 1a, 1b, and 2a were considered stable and Types 2b and 3 were considered reversely unstable. In addition, in the evaluation of comorbidities, patients were assessed as not having comorbidities, having three or fewer comorbidities, and having more than three comorbidities.

Patients and Care

Pre-operative anticoagulant heparin prophylaxis was initiated in patients whose preparations were completed within 48 h after hospitalization. In addition, cefazolin prophylaxis was administered 30 min preoperatively. Proximal femoral nailing with dual lag screws was performed in all patients with good fracture reduction. In the post-operative period, cefazolin sodium prophylaxis was continued for 1 day. In addition, low-molecular-weight heparin prophylaxis was administered to all patients for 1 month postoperatively. In addition, heparin doses were arranged in line with the relevant branch recommendations for the patient group with additional cardiovascular disease or a high risk of venous thromboembolism. All patients were mobilized in the post-operative period by providing as much load as they could tolerate.

Hematologic Evaluation

Venous blood samples and complete blood cell counts (CBCs) taken from each patient during admission to the hospital were examined. Regarding the neutrophil, lymphocyte, monocyte, and thrombocyte values in routinely measured CBC, the first number was divided by the second number, and NLR, TLR, and MLR were obtained. Furthermore, the NLR, TLR, and MLR of the survivors were compared with those of the non-survivors, and the correlation between them was statistically examined.

Statistical Analysis

Descriptive statistics of the data obtained from the study are presented as mean and standard deviation for numerical variables and frequency and as percentage for categorical variables. Normal distribution tests of pre-operative and post-operative NLR, TLO, and MLO variables were performed using the Kolmogorov-Smirnov and Shapiro-Wilk tests. The variables were not normally distributed ($p < 0.05$). In comparing these variables according to categorical variables, the Mann-Whitney U-test was performed for categorical variables containing two groups and the Kruskal-Wallis test was performed for categorical variables containing three or more groups. The Dunn test, one of the post hoc (multiple comparison) tests, was performed to determine which group caused the difference as a result of the Kruskal-Wallis analysis. In addition, the differences between categorical variables were tested using the Chi-square test, and the relationships between the numerical variables were analyzed using Spearman's correlation analysis. The differences between pre-operative and post-operative NLR, TLO, and MLO variables were evaluated using the Wilcoxon test. Analyses were performed using SPSS 22.0. Statistical significance (P) was set at < 0.05 .

RESULTS

Regarding the demographic data of 124 patients evaluated as part of the study out of 350 patients who were admitted and treated for hip fractures, 65 were female (52.42%), 59 were

male (47.58%), and the overall mean age was 79.70 (60–97) years. The fracture side was right in 56 patients (45.18%) and left in 68 patients (54.84%). During follow-ups, it was found that 32 patients (25.81%) died within 1 year and 92 patients (74%) survived after 1 year. The mean length of stay of the patients was 6.43 days (2–19). In the post-operative period, 91 patients (73%) did not require follow-up in intensive care conditions, whereas 33 patients (26%) required intensive care follow-up; the average intensive care unit length of stay in the patient group was 0.71 days (0–5).

Considering pre-operative NLR, TLR, and MLR, which are the laboratory parameters assessed within the scope of the study, the mean NLR was 6.59 (1.61–26.29), mean TLR was 197.94 (86–516), and mean MLR was 0.73 (0.19–15.68).

When the correlation between NLR, TLR, MLR, and fracture type was evaluated, it was observed that fracture type had a significant relationship with NLR only (Table 1).

When the entire patient group was examined, the correlations between total length of stay and NLR ($p=0.01$), TLR ($p=0.029$), and MLR ($p=0.04$) were statistically significant. The requirement of intensive care was significantly correlated with MLR only ($p=0.05$). The correlations between sex and age and NLR, TLR, and MLR were not significant ($p>0.05$). The difference between pre-operative NLR, TLR, and MLR and 1st post-operative day NLR, TLR, and MLR was significant ($p=0.001$) (Table 2).

Table 2. NLR, TLR, NLR changes between admission and postoperative day 1

| | Median | Minimum | Maximum | p |
|-------------------|--------|---------|---------|-------|
| Admission NLR | 5.13 | 2.85 | 9.44 | 0.001 |
| Postoperative NLR | 9.37 | 5.62 | 13.82 | |
| admission TLR | 175 | 153 | 241 | 0.001 |
| Postoperative TLR | 249.31 | 182.49 | 328.42 | |
| admission MLR | .51 | .34 | .73 | 0.001 |
| Postoperative MLR | .88 | .47 | 1.19 | |

NLR: Neutrophil/lymphocyte ratio; TLR: Thrombocyte/lymphocyte ratio; MLR: Monocyte/lymphocyte ratio.

When the 1-year follow-up data of the patients were evaluated and the data of survivors and non-survivors at the end of 1 year were compared, there was a significant difference among NLR, TLR, and MLR ($p=0.001$). In addition, when the correlation between the groups in terms of the length of stay was assessed, the outcome was statistically significant. The relationship between age, fracture side, sex, comorbidity grouping, fracture pattern, requirement of post-operative stay in the intensive care unit and its mean duration, and ASA values between the two groups was not significant (Table 3).

It was observed that the correlation among pre-operative NLR, TLR, and MLR in 92 survivors was statistically significant

Table 1. Relationship between fracture type and NLR, TLR, MLR

| Variable | Fracture type | Number | Median | Q1 | Q3 | p |
|---------------|---------------|--------|--------|------|-------|-------|
| Admission NLR | 1a | 23 | 4.92 | 2.76 | 8.66 | 0.030 |
| | 1b | 46 | 4.58 | 2.74 | 5.96 | |
| | 2a | 7 | 4.35 | 1.66 | 4.74 | |
| | 2b | 36 | 7.50 | 4.60 | 10.95 | |
| | 3 | 8 | 7.37 | 2.92 | 13.24 | |
| | Reverse | 4 | 4.84 | 3.32 | 10.77 | |
| Admission TLR | 1a | 23 | 175 | 156 | 186 | 0.747 |
| | 1b | 46 | 168 | 153 | 238 | |
| | 2a | 7 | 173 | 130 | 176 | |
| | 2b | 36 | 187 | 145 | 278 | |
| | 3 | 8 | 175 | 133 | 274 | |
| | Reverse | 4 | 145 | 95 | 270 | |
| Admission MLR | 1a | 23 | 0.43 | 0.33 | 0.76 | 0.142 |
| | 1b | 46 | 0.48 | 0.33 | 0.71 | |
| | 2a | 7 | 0.34 | 0.33 | 0.71 | |
| | 2b | 36 | 0.70 | 0.43 | 0.87 | |
| | 3 | 8 | 0.64 | 0.43 | 1.18 | |
| | Reverse | 4 | 0.55 | 0.49 | 0.63 | |

NLR: Neutrophil/lymphocyte ratio; TLR: Thrombocyte/lymphocyte ratio; MLR: Monocyte/lymphocyte ratio.

Table 3. Relationship with demographic data and hematological parameters of patients who died within 1 year and lived more than 1 year

| | | Survivor (group 1) | Non-survivor (group 2) | p-value |
|--------------------------------|----------------------|--------------------|------------------------|---------|
| Number, n (%) | | 92 (75) | 32 (25) | |
| Age | | 79.39 (60–97) | 80.59 (68–94) | 0.75 |
| Side | Right | 45 | 11 | 0.79 |
| | Left | 47 | 21 | |
| Gender, n (%) | Female | 47 (51) | 18 (56) | 0.89 |
| | Male | 45 (49) | 14 (44) | |
| Comorbid disease group, n (%) | No comorbid diseases | 22 (23) | 9 (29) | 0.875 |
| | ≤3 comorbid disease | 62 (68) | 20 (62) | |
| | >3 comorbid disease | 8 (9) | 3 (9) | |
| Fracture pattern, n (%) | Stable | 61 (66) | 15 (46) | 0.75 |
| | Unstable | 31 (34) | 17 (54) | |
| Length of stay in the hospital | | | | |
| Average length of stay | | 6.04 (2–18) | 7.53 (4–19) | 0.01 |
| Average intensive care stay | | 0.63 | 0.93 | 0.23 |
| ASA, n (%) | ASA 2 | 9 (9) | 1 (3) | 0.249 |
| | ASA 3 | 13 (15) | 3 (9) | |
| | ASA 3 intensive care | 61 (67) | 27 (85) | |
| | ASA 4 | 9 (9) | 1 (3) | |
| Hematological parameters | NLR | 4.44 (1.61–17.07) | 12.75 (7.4–26.29) | 0.01 |
| | TLR | 170.35 (86–484) | 262.53 (128–516) | 0.01 |
| | MLR | 0.49 (0.19–1.43) | 1.36 (0.43–15.68) | 0.01 |

ASA: American Society of Anesthesiology; NLR: Neutrophil/lymphocyte ratio; TLR: Thrombocyte/lymphocyte ratio; MLR: Monocyte/lymphocyte ratio.

($p=0.00$). In addition, when the correlation between NLR and TLR, NLR and MLR, and TLR and MLR in 32 non-survivors was considered, the outcome was considered significant ($p=0.025$, $p=0.054$, $p=0.003$).

In the ROC analysis conducted on the 1-year mortality assessment of patients in this study group, the cutoff values were 7.53 for NLR, 1.92 for TLR, and 0.54 for MLR (Figs. 1–3, respectively).

DISCUSSION

In this study, we investigated the correlation between post-operative 1-year mortality and pre-operative NLR, TLR, and MLR in patients aged over 60 with hip fractures. Our study results showed that the values measured in the pre-operative period were closely correlated with 1-year mortality.

In their study on mortality rates after hip fractures in the geriatric population, Cenzer et al.^[11] found the 1-year mortality rate to be 27%. Johnston et al.^[12] found a rate of 30.7% in their study on a series of 27,475 individuals. In our study, we found the rate to be 25.81%, which is consistent with the literature.

Some believe that the inflammatory processes associated with hip fracture and surgery affect survival.^[13] It has been

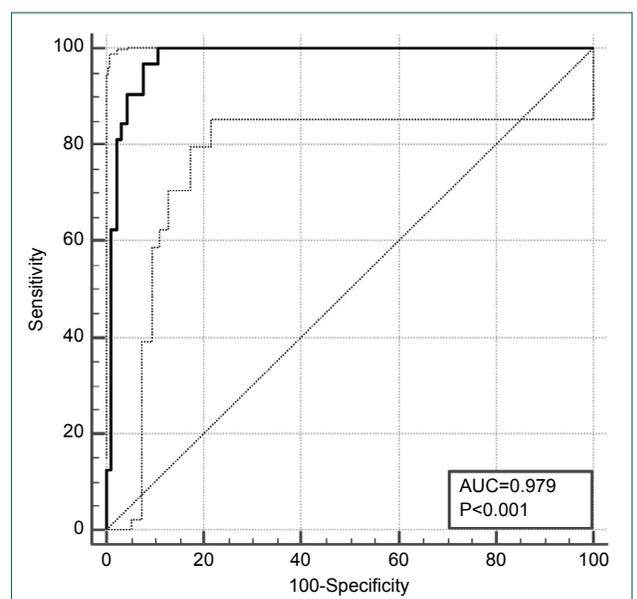


Figure 1. NLR $p<0.001$; AUC = 0.979; Sensitivity = 96.87% (95% CI 83.8–99.9); Specificity = 92.39% (95% CI 84.9–96.9).

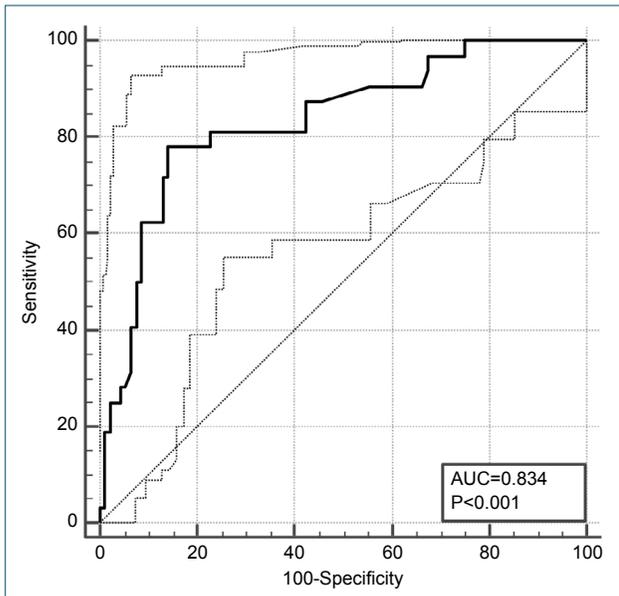


Figure 2. TLR $p<0.001$; AUC = 0.834; Sensitivity = 78.12% (95% CI 60.0–90.7); Specificity = 85.87% (95% CI 77.0–92.3).

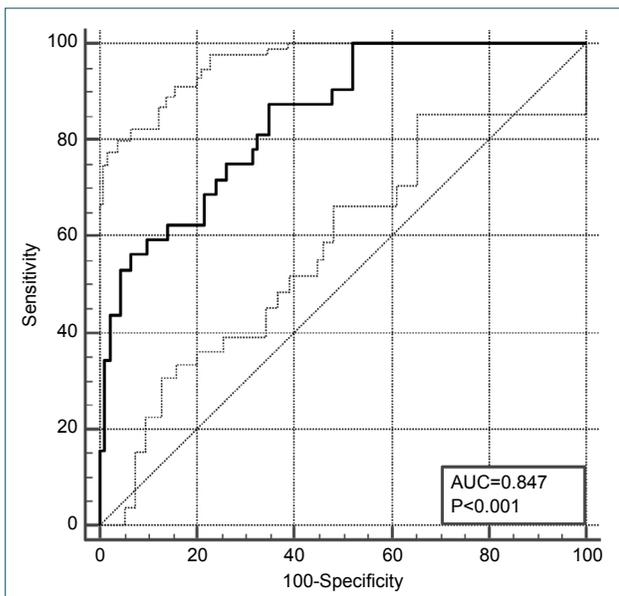


Figure 3. MLR $p<0.001$; AUC=0.847; Sensitivity = 87.5% (95% CI 71.0–96.5); Specificity=65.22% (95% CI 54.6–74.9).

demonstrated that cytokines such as TNF- α , IL-6, and IL-10 are independent predictors of post-operative mortality and complications.^[14] Furthermore, NLR, MLR, and TLR have been accepted as new inflammation parameters in the literature.^[15–17] In a study conducted in 2015, Forget et al.^[6] described NLR as a new risk factor in the evaluation of mortality after hip fractures. In their study, they reported that advanced age, male sex, and comorbid diseases, as well as an NLR of >5 on the 5th post-operative day, were correlated with post-operative mortality, but pre-operative NLR value was not correlated with mortality. In their study of a geriatric group, Fisher et al.^[18] highlighted the correlation be-

tween hip fracture and high NLR at admission and increased inflammatory response with in-hospital deaths and post-operative myocardial damage. Temiz et al.^[5] demonstrated in their study that pre-operative NLR was closely correlated with post-operative mortality rates. While the correlation between increased platelet activity and the clinical picture of atherosclerosis and thromboembolism is known, it is thought to be a parameter associated with chronic inflammation. Recent studies indicate that TLR is closely correlated with cardiological patient follow-up data and complications as well as patient surveillance in oncological patient groups.^[19–21] In their study involving post-operative follow-up of patients with hip fractures, Emektar et al.^[7] emphasized that TLR at admission was closely related to 1-year mortality. Moreover, MLR is closely related to surveillance in cancer patients during follow-ups.^[22,23] In their studies on 1-year mortality rates of patients operated for hip fractures in the geriatric population, Bingol et al.^[8] reported that MLR could be a predictive factor. Based on our study findings, we believe that TLR and MLR are closely related to 1-year mortality.

The fact that the patient group consisted of elderly individuals highlights the prevalence of an increased rate of comorbidities. In their study, Forget et al.^[6] stated that a diagnosis of three or more comorbidities was closely correlated with 1-year mortality ($p=0.043$). In a study on 1-year mortality assessment after hip fractures, Emektar et al.^[7] did not find a correlation between comorbidities and mortality. In our study, we observed that comorbidities were correlated with length of stay but were not significantly correlated with 1-year mortality.

When we reviewed the literature, we did not encounter any studies that evaluated the correlation between hip fracture classification and NLR, TLR, and MLR. In our study, using the Evans-Jensen classification,^[10] we observed a significant correlation between NLR, MLR, and stable-unstable fracture evaluation. Based on the significance of these ratios in unstable fractures, we suggest that these parameters are correlated with bone density and quality. In addition, NLR was directly correlated with fracture subgroups. Further, there was no correlation between PLR and fracture pattern evaluation.

We believe that rehabilitation and return to normal life after hip fractures in the elderly population are associated with length of stay. In our study, we found a significant correlation between length of stay and NLR, TLR, and MLR. Our study also showed that MLR is related to the requirement for intensive care. Considering the treatment costs to the patients and the time required for them to return to daily life, we believe that this parameter is important. In our study, the changes from pre-operative NLR, TLR, and MLR values to the 1st post-operative day values were found to be significant. We assume that this change is related to the inflammatory process that occurs in the body due to fracture and surgery.

Being a monocentric and retrospective study was a limitation of this study. No repeated blood tests were performed, and no other parameters related to inflammation were studied. This hypothesis may need to be supported by prospective studies in future.

Conclusion

There are many factors associated with mortality rates after hip fractures in the geriatric population. NLR, TLR, and MLR, which are the three parameters assessed during admission, can be used as predictive parameters to predict 1-year mortality in patients aged over 60 years with hip fractures.

Ethics Committee Approval: This study was approved by the Gaziantep University Clinical Research Ethics Committee (Date: 10.02.2021, Decision No: 2021/54).

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Authorship Contributions: Concept: S.B.T.; Design: S.B.T.; Supervision: S.B.T.; Resource: S.B.T.; Materials: S.B.T., B.B.; Data: S.B.T., B.B.; Analysis: S.B.T., A.M.; Literature search: A.M.; Writing: S.B.T.; Critical revision: S.B.T.

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REFERENCES

- Choi H, Seo K, Hyung S, Shim Y, Lim SC. Compact hip-force sensor for a gait-assistance exoskeleton system. *Sensors (Basel)* 2018;18:566. [CrossRef]
- Cooper C, Campion G, Melton LJ 3rd. Hip fractures in the elderly: A world-wide projection. *Osteoporos Int* 1992;2:285–9. [CrossRef]
- Abrahamsen B, van Staa T, Ariely R, Olson M, Cooper C. Excess mortality following hip fracture: A systematic epidemiological review. *Osteoporos Int* 2009;20:1633–50. [CrossRef]
- Mosfeldt M, Pedersen OB, Riis T, Worm HO, van der Mark S, Jørgensen HL, et al. Value of routine blood tests for prediction of mortality risk in hip fracture patients. *Acta Orthop* 2012;83:31–5. [CrossRef]
- Temiz A, Ersözülü S. Admission neutrophil-to-lymphocyte ratio and postoperative mortality in elderly patients with hip fracture. *Ulus Travma Acil Cerrahi Derg* 2019;25:71–4. [CrossRef]
- Forget P, Moreau N, Engel H, Cornu O, Boland B, De Kock M, et al. The neutrophil-to-lymphocyte ratio (NLR) after surgery for hip fracture (HF). *Arch Gerontol Geriatr* 2015;60:366–71. [CrossRef]
- Emektar E, Corbacioglu SK, Dagar S, Uzunosmanoglu H, Safak T, Cevik Y. Prognostic value of the neutrophil-lymphocyte and platelet lymphocyte ratios in predicting one-year mortality in patients with hip fractures and aged over 60 years. *Eur J Emerg Med* 2017;16:165. [CrossRef]
- Bingol O, Ozdemir G, Kulakoglu B, Keskin OH, Korkmaz I, Kilic E. Admission neutrophil-to-lymphocyte ratio and monocyte-to-lymphocyte ratio to predict 30-day and 1-year mortality in geriatric hip fractures. *Injury* 2020;51:2663–7. [CrossRef]
- Fogagnolo F, Kfuri M Jr, Paccola CA. Intramedullary fixation of pertrochanteric hip fractures with the short AO-ASIF proximal femoral nail. *Arch Orthop Trauma Surg* 2004;124:31–7. [CrossRef]
- Jensen JS. Classification of trochanteric fractures. *J Acta Orthop Scand* 1980;51:803–10. [CrossRef]
- Cezer IS, Tang V, Boscardin WJ, Smith AK, Ritchie C, Wallhagen MI, et al. One-year mortality after hip fracture: development and validation of a prognostic index. *J Am Geriatr Soc* 2016;64:1863–8. [CrossRef]
- Johnston AT, Barnsdale L, Smith R, Duncan K, Hutchison JD. Change in long-term mortality associated with fractures of the hip: Evidence from the scottish hip fracture audit. *J Bone Joint Surg Br* 2010;92:989–93.
- Sedlář M, Kvasnička J, Krška Z, Tománková T, Linhart A. Early and sub-acute inflammatory response and long-term survival after hip trauma and surgery. *Arch Gerontol Geriatr* 2015;60:431–6. [CrossRef]
- Sun T, Wang X, Liu Z, Chen X, Zhang J. Plasma concentrations of pro- and anti-inflammatory cytokines and outcome prediction in elderly hip fracture patients. *Injury* 2011;42:707–13. [CrossRef]
- Balta S, Ozturk C, Balta I, Demirkol S, Demir M, Celik T, et al. The neutrophil-lymphocyte ratio and inflammation. *Angiology* 2016;67:298–9.
- Uslu AU, Küçük A, Şahin A, Ugan Y, Yılmaz R, Güngör T, et al. Two new inflammatory markers associated with disease activity score-28 in patients with rheumatoid arthritis: Neutrophil-lymphocyte ratio and platelet-lymphocyte ratio. *Int J Rheum Dis* 2015;18:731–5. [CrossRef]
- Yang T, Zhu J, Zhao L, Mai K, Ye J, Huang S, et al. Lymphocyte to monocyte ratio and neutrophil to lymphocyte ratio are superior inflammation-based predictors of recurrence in patients with hepatocellular carcinoma after hepatic resection. *J Surg Oncol* 2017;115:718–28. [CrossRef]
- Fisher A, Srikusalanukul W, Fisher L, Smith P. The neutrophil to lymphocyte ratio on admission and short-term outcomes in orthogeriatric patients. *Int J Med Sci* 2016;13:588–602. [CrossRef]
- Bhatti I, Peacock O, Lloyd G, Larvin M, Hall RI. Preoperative hematologic markers as independent predictors of prognosis in resected pancreatic ductal adenocarcinoma: Neutrophil-lymphocyte versus platelet-lymphocyte ratio. *Am J Surg* 2010;200:197–203. [CrossRef]
- Alexandrakis MG, Passam FH, Moschandreia IA, Christophoridou AV, Pappa CA, Coulocheri SA, et al. Levels of serum cytokines and acute phase proteins in patients with essential and cancer-related thrombocytosis. *Am J Clin Oncol* 2003;26:135–40. [CrossRef]
- Sierko E, Wojtukiewicz MZ. Platelets and angiogenesis in malignancy. *Semin Thromb Hemost* 2004;30:95–108. [CrossRef]
- Hu P, Shen H, Wang G, Zhang P, Liu Q, Du J. Prognostic significance of systemic inflammation-based lymphocyte- monocyte ratio in patients with lung cancer: Based on a large cohort study. *PLoS One* 2014;9:e108062. [CrossRef]
- Jia W, Wu J, Jia H, Yang Y, Zhang X, Chen K, et al. The peripheral blood neutrophil-to-lymphocyte ratio is superior to the lymphocyte-to-monocyte ratio for predicting the long-term survival of triple-negative breast cancer patients. *PLoS One* 2015;10:e0143061. [CrossRef]

ORİJİNAL ÇALIŞMA - ÖZ

Geriatrik kalça kırıklarında giriş nötrofil-lenfosit, trombosit-lenfosit, monosit-lenfosit oranları ile bir yıllık mortalite arasındaki ilişki: Üçlü karşılaştırma

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AMAÇ: Kalça kırığı olan yaşlı hastalarda ameliyat sonrası bir yıllık mortalite oranı yüksektir. Bu çalışmanın amacı nötrofil lenfosit oranı (NLR), trombosit lenfosit oranı (TLR) ve monosit lenfosit oranı (MLR) ile mortalite arasındaki ilişkiyi araştırmaktır.

GEREÇ VE YÖNTEM: Ocak 2015–Ocak 2020 tarihleri arasında femoral intertrokanterik kırık nedeniyle başvuran 350 hastanın verileri incelendi ve çalışma kriterlerini karşılayan 124 hastanın demografik verileri değerlendirildi. Bir yıllık takipte hayatına devam eden 92 hasta (%74) ile ölen 32 (%26) hasta, grup 1 ve grup 2 (%25) olarak ayrıldı. NLR, TLR, MLR ve yandaş hastalıklar, yaş, cinsiyet, ASA, hastanede kalış süresi, kırık tipi ve kırık paterni değerleri bu iki grup arasında istatistiksel olarak karşılaştırıldı.

BULGULAR: Çalışma kapsamında değerlendirilen laboratuvar parametreleri olan biyokimyasal parametrelerin ortalaması şöyle idi: NLR 6.59 (1.61–26.29), TLR 197.94 (86–516) ve MLR 0.73 (0.19–15.68). Bu çalışmada NLR, TLR, MLR değerleri ile ameliyat sonrası bir yıllık mortalite oluşumu arasında istatistiksel olarak anlamlı bir ilişki bulundu ($p=0.01$). Ayrıca bu parametreler arasındaki korelasyon ilişkisinde sonuç anlamlıydı. ROC (Alıcı operatör karakteristik eğrisi) analizinde kestirim değerleri NLR için 7.53, TLR için 192 ve MLR için 0.54 olarak bulundu ($p<0.01$).

TARTIŞMA: NLR, TLR, PLR değerleri 60 yaş üstü kalça kırığı olan hastalarda bir yıllık mortalite göstermede anlamlıdır.

Anahtar sözcükler: Kalça; kırık; lenfosit; mortalite; notrofil; platelet.

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