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Original Article

Preoperative Platelettolymphocyte Ratio as a Prognostic Factor in Geriatric Patients with Proximal Femoral Fractures

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Abstract

Introduction: The aim of this study was to investigate whether the platelet to lymphocyte ratio is a prognostic factor in geriatric patients who underwent surgery for proximal femoral fractures. **Materials and Methods:** Clinical and laboratory data of 288 patients who underwent surgery for proximal femoral fracture were analysed. The patients were divided into six groups on the basis of sex (male and female) and survival duration after the operation (death within the first 6 months, death between the 6 and 12 months, survival for more than 12 months). Pre-operative platelet/lymphocyte ratios of these groups were compared. **Results:** Of 288 patients, 187 were female and 101 were male. There was no significant difference between the groups with regard to age (p = 0.123 female groups) (p = 0.207 male groups). Although the preoperative platelet to lymphocyte ratio was higher in patients who died within 12 months than in those who survived beyond that, this platelet/lymphocyte ratio was statistically significant in females who died in the first 6 months (p = 0.038). **Conclusion:** A high preoperative platelet to lymphocyte ratio may be associated with high risk of mortality in patients who were operated for proximal femoral fracture.

Keywords: *Platelet/lymphocyte ratio, proximal femoral fracture, mortality, risk factors*

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Introduction

Proximal femoral fractures (PFFs) tend to occur in the elderly and can sometimes be life-threatening; the main causes of PFFs include decreased balance as well as increased life expectancy and osteoporosis incidence.[1] PFFs are often accompanied by systemic diseases such as diabetes mellitus, hypertension and arrhythmia. Therefore, treatment options may vary from patient to patient. As a surgical intervention, internal fixation or arthroplasty is often performed.[2] In older patients, the aim is to mobilise the patients with the earliest method that will not threaten the patient's life. However, some factors related to the patient and the surgical treatment may also affect postoperative morbidity and mortality.[3] There are several studies in literature investigating the factors affecting morbidity and mortality after the treatment of PFF.[4] Platelet/lymphocyte ratio (PLR) and neutrophil/lymphocyte ratio (NLR) were shown to be prognostic factors in cancer patients.[5] With increase in these ratios, mortality also increases because thromboembolism, and more aggressive tumours are expected.[6] PFFs and surgical process which may lead to venous stasis, endothelial damage and high platelets cause hypercoagulability. Consequently, deep venous thrombosis (DVT) and mortal pulmonary embolism are seen. One of the major factors in the formation of thrombus is high platelets value. Since bleeding, dehydration, haematological disease affect the platelets value; PLR is preferred instead of it in recent studies. However, studies indicating whether PLR could be a prognostic factor of PFF are not available in literature.

In this study, we investigated the relationship between preoperative PLR and mortality rates in patients who underwent hemiarthroplasty for PFF

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Materials and Methods

This was a retrospective study of data from patients who underwent hemiarthroplasty for PFF in two hospitals in the black sea region. After obtaining our Ethics Committee's approval, 288 patients who underwent hemiarthroplasty above the age of 60 years for PFF, between January 2010 and December 2014, were included in this study. Exclusion criteria were age lower than 60 years, antithrombotic agents or other drugs that may interfere with platelet functions or value, treatment of cancer, treatment of anaemia. Data, such as age, sex, side and absolute platelet and lymphocyte counts, on admission (preoperative) were obtained from the patients' records, and PLRs were calculated by platelets value divided lymphocyte value. The survival duration of patients after the operation were also obtained from the hospital records.

The patients were divided into six groups based on sex and survival duration: Group IF, females who died within 6 months; Group IIF, females who died between 6 and 12 months; Group IIIF, females who survived >1 year; Group IM, male who died within 6 months; Group IIM, male who died between 6 and 12 months; and Group IIIM, male who survived >1 year. The relationships between preoperative PLR and mortality were analysed.

Data was analysed using IBM SPSS version 21 Chicago USA 2014. The normality of the data was analysed using the Shapiro–Wilk test. Independent sample tests and one-way analysis of variance were used for comparison of normally distributed parameters. The Mann–Whitney U-test was used for comparison of data that was not normally distributed. Two ratios were used for the comparison of ratios. The results are presented as means, standard deviations and medians (range). The significance level was set as $p < 0.05$.

Results

Out of a total of 288 participants were studied (mean age 79.5, range 60-98), there were 187 females and 101 male. One hundred and sixty-eight (168) patients underwent right PFF, while 120 patients had left PFF. Distribution of preoperative PLRs with respect to sex, age and groups are shown in Table 1 and Table 2. There was no significant age difference between the groups (p = 0.123 female groups) (p = 0.207 male groups). Although the preoperative PLR appeared to be higher in patients who died within 6 months and between 6-12 months compared to the patients who survive more than 1 year in all the groups, It was only statistically significant in females and in those who died in the first 6 months (p = 0.038) [Table 1].

Table 1: Preoperative PLR and age in female Groups.

Groups	n	Preoperative PLR	Age, years
Group IF	41	264.9 (69.5-618.6)[a]	82 (60-97)[b]
Group IIF	11	209.1 (125-691.7)[b]	80 (69-88)[b]
Group IIIF	135	189.6 (25.2-816.7)[b]	79 (61-98)[b]
P value		0.038	0.123

PLR: Platelet/lymphocyte ratio. [a]significant differences were seen, [b]significant differences were not seen. Values are presented as median (range)

Table 2: Preoperative PLR and age in male Groups.

Groups	n	Preoperative PLR	Age, years
Group IM	17	226.4 (72.6-640)[b]	82 (60-95)[b]
Group IIM	8	216.3 (59-670.6)[b]	74.5 (64-94)[b]
Group IIIM	76	207 (71.1-633.3)[b]	77 (60-95)[b]
P value		0.989	0.207

PLR: Platelet/lymphocyte ratio. [b]significant differences were not seen. Values are presented as median (range)

The distribution of patients who died in and survived beyond the first postoperative year is shown in Table 1 and Table 2.

Although preoperative PLR in groups IM, IIM and IIIM were not significantly different, PLRs appeared to be higher in patients who did not survive (p = 0.989) [Table 2].

Discussion

Complete blood counts (CBCs) are easy and inexpensive examinations that show blood contents in depth. There are several studies that bring to light statistical significances between CBCs and postoperative mortality such as platelet, haemoglobin, albumin, sodium. In present study, we evaluated the relation between PLR and post-operative mortality. Advances in medicine in recent years have led to increases in average life expectancy and total number of elderly people.[7] With increase in age, loss of function and decreased bone density; there is corresponding increase in the risk of fractures caused by simple trauma.[8] Proximal femoral fracture is often seen in the elderly and has a high risk for substantial morbidity and mortality.[9] In the study, PFF was more frequent in females (80%) than in male. The mean ages of females and male with PFF are 84 and 79 years, respectively.[10]

In this study, 64% were female with a mean age of groups IF, IIF, IIIF 82, 80, 79 years respectively. In the non-homogenous patient ages (60-98 years), there were no statistically significant differences between female groups. On the other hand, male were 36%,

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with a mean age of groups IM, IIM, IIIM 82, 74.5, 77 years respectively. There were no statistically significant differences between male groups too. So, they shouldn't be divided according to age in the groups.

The mortality rate within 1 year after hip fracture has been reported to range between 24% and 45% in different studies.[11,12] These high and variable rates are associated with the preoperative condition of the patient, rather than the surgical procedure and type of anaesthesia administered.[13] For this purpose, several studies have investigated the risk factors that affect mortality after hip fracture. These studies investigated mortality rates associated with age, sex, nutritional status, smoking/alcohol use, pre-injury functional status, general health status, mental status, type of fracture, surgical procedure, operation time, type of anaesthesia, American Society of Anaesthesiologists scores, physical status and comorbid disorders (more than two poor prognoses).[12,14,15] Different results have been reported for these factors. In this respect, patients should be evaluated in terms of pre- and postoperative risk factors. We would like to state that preoperative PLR may be used as a predictive factor in PFF.

Studies considering laboratory parameters other than those mentioned above have also been reported. Implementation of routine laboratory parameters, which are also requested for patients with hip fractures, is vital because of its practicality, cost-effectiveness and usefulness in the determination of prognosis. In this regard; Miller, *et al.*,[16] Kyo, *et al*.[17] and Koval, *et al.*[18] have examined haemoglobin and albumin, total protein values and low anaemia and albumin levels as factors associated with poor prognosis. Kumar, *et al.*[10] indicated that albumin total lymphocyte count was a significant predictor of death within 12 months.

The association between laboratory parameters and mortality has also been examined in literature. Kundi, *et al.*[19] determined that high PLR was a high-risk factor for mortality in case of acute pulmonary embolism. Again, Yüksel, *et al.*[20] stated that high PLR was an additional risk factor for patients suffering from atherosclerosis. On the other hand, Akboğa, *et al*.[21] stated that high PLR was associated with cardiovascular disease and metabolic syndrome. Considering that high PLR is directly proportional to severity of coronal artery disease, its effect on mortality can be better understood.[20] Cho, *et al.* determined that high PLR and NLR, especially when combined together, posed a risk for mortality in patients with heart diseases treated with stents.[22] Barret, *et al.* show that hip fracture has repeatedly been associated with increase in the risks of death and pulmonary embolism.[23] It is well recognized that platelets play a key role in thrombotic vascular occlusion such as DVT, thromboembolism. In addition to preoperative high platelet value and PLR, venous stasis and endothelial damage may lead to increased DVT and mortal pulmonary embolism in PFFs.[24] Borges A, *et al.* show that high platelet count is a risk factor in PFF.[25]

In our study, preoperative high PLR was found to be a prognostic factor for postoperative mortality. There was significant difference in PLR only between groups IF and IIIF and not between other groups; this result can be explained by the small number of corresponding cases. High PLR may be a cause of death in these patients by triggering thromboembolic events. So, preoperative PLR may be used as predictive marker of early time mortality in females.

A limitation of our study is that the non-homogenous according to age (range 60-98 year) and other cardiovascular risk factors that may affect mortality were not included in the study design.

In conclusion, identification of new factors affecting mortality in older patients with PFF is very important. This is the first study in literature to show that PLR is associated with a high risk of mortality in patients who had undergone surgery for PFF.

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Conflicts of interest

There are no conflicts of interest

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