Original Article

Effect of platelet indices on postoperative pain and edema in bimaxillary surgery

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ABSTRACT

الأهداف: هدفت هذه الدراسة إِلى التحقيق في تأثير مؤشرات حجم الصفائح الدموية (PVI) على الألم والوذمة بعد العملية في المرضى الذين يخضعون لجراحة الفكين وتقييم العلاقات بين معلمات PVI والعوامل السريرية الأخرى.

المنهجية: قمنا بفحص السجلات الطبية لـ 50 مريضًا تتراوح أعمارهم بين 18-40 عامًا ، تم علاجهم بين عامي 2019 و 2020. تم تحليل مؤشرات الصفائح الدموية (عدد الصفائح الدموية (PLT) ، حجم الصفائح الدموية المتوسطة ، عرض توزيع الصفائح الدموية ، الصفائح الدموية (PCT)، ونسبة الخلايا الكبيرة للصفائح الدموية). تم تقييم الألم والوذمة بعد العملية بناءً على تواتر إِعطاء الأدوية المسكنة عبر الوريد (IV) والتصوير ثلاثي الأبعاد على التوالي. تم استخدام الانحدار المعاقب باللوحة للتحليل.

النتائج: تمت ملاحظة ارتباطات إِيجابية كبيرة بين PLT والوذمة بعد العملية في اليوم الأول (T1-0) والثالث (T3-0) بعد العملية. علاوة على ذلك ، كان PLT مرتبطا بشكل إِيجابي بعدد إِدارات الأدوية المسكنة عبر الوريد من 24 إِلى 72 ساعة بعد الجراحة. بالإِضافة إِلى ذلك ، تم تحديد ارتباط إِيجابي ملحوظ بين مستويات PCT وكمية الأدوية المسكنة عبر الوريد التي تم إِعطاؤها خلال الـ 24 ساعة الأولى بعد الجراحة
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الخلاصة: كانت مؤشرات الصفائح الدموية ، وبشكل خاص مستويات PLT و PCT، مرتبطة بالألم والوذمة بعد العملية في المرضى الذين يخضعون لجراحة الفكين. تمتلك هذه المؤشرات القدرة على العمل كعلامات حيوية للتنبؤ وإِدارة مضاعفات الجراحة بعد العملية. هناك حاجة لمزيد من الدراسات لاستكشاف الفائدة السريرية والآثار الناجمة عن هذه النتائج.

Objectives: To investigate the influence of platelet volume indices (PVI) on postoperative pain and edema in patients undergoing bimaxillary surgery and assessed the associations between PVI parameters and other clinical factors.

Methods: We examined the medical records of 50 patients aged 18-40, treated between 2019 and 2020. Platelet indices (platelet count [PLT]), mean platelet volume, platelet distribution width, plateletcrit (PCT), and platelet large cell ratio) were analyzed. Postoperative pain and edema were assessed based on the frequency of intravenous (IV) analgesic administration and 3D imaging. A lasso-penalized regression was used for the analysis.

Results: Significant positive correlations were observed between PLT and postoperative edema on the first (T1-0) and third (T3-0) postoperative days. Furthermore, PLT was positively associated with the number of IV analgesic drug administrations from 24 to 72 hours after surgery. Additionally, a discernible positive correlation was identified between PCT levels and the quantity of IV analgesic drugs administered within the first 24 hours after surgery.

Conclusion: Platelet indices, particularly PLT and PCT levels, were associated with postoperative pain and edema in patients undergoing bimaxillary surgery. These indices have the potential to serve as biomarkers for predicting and managing postoperative complications of orthognathic surgery. Further studies are required to explore the clinical utility and implications of these findings.

Keywords: orthognathic surgical procedures, platelets, postoperative complications, edema, pain, postoperative

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Platelets are nuclearless, discoid-shaped blood elements produced by megakaryocytes in the bone marrow. They are mainly responsible for initiating the repair of damage to the vascular endothelium through processes called primary and secondary haemostasis. Molecular-level studies have revealed that platelets play essential roles not only in haemostasis but also in inflammatory, anti-inflammatory, wound healing, angiogenesis, tumour growth, metastasis, bacterial defence, and tissue reconstruction processes.[1-3]

Latest studies have suggested that platelets have a substantial impact on both acute and chronic inflammation, including the release of pro-inflammatory substances and their interaction with inflammatory surface molecules, leukocytes, and endothelial cells. Platelets have also been found to potentially influence inflammatory diseases.[4]

Platelet volume indices (PVI), a set of measurements, including platelet count (PLT), mean platelet volume (MPV), platelet distribution width (PDW), plateletcrit (PCT), and platelet large cell ratio (P-LCR), have emerged as leading indicators of platelet function and activation, reflecting platelet size distribution. These parameters, derived from routine blood counts, are innovative biomarkers for acute and chronic diseases owing to their easy accessibility and cost-effectiveness.[5,6]

However, despite reports of a correlation between platelet index parameters and inflammatory conditions such as rheumatoid arthritis, ankylosing spondylitis, and diabetes mellitus, the relationship between PVI and postoperative outcomes in orthognathic surgery remains largely unexplored.[7-9]

Orthognathic surgery is performed to correct dentofacial deformities, temporomandibular joint problems, and facial asymmetry, often resulting in various preoperative, intraoperative, and postoperative sequelae such as edema, pain, swelling, and blood loss.[10-12]

Provided the essential role of platelets in inflammation, we hypothesized that platelets influence postoperative edema and pain. Thus, this study aimed to fill this knowledge gap by assessing the influence of platelet indices on postoperative pain and edema after bimaxillary surgery. This study contributes to the literature by examining the potential of PVI parameters as predictive indicators of postoperative outcomes in orthognathic surgery.

Methods. The medical records of 58 patients (21 males and 37 females) aged 18-40 years who underwent bimaxillary surgery at the Department of Oral and Maxillofacial Surgery, Erciyes University, Melikgazi, Kayseri, Turkey between 2019 and 2020 were included in the study. The study adhered to the principles of the Declaration of Helsinki on Medical Protocols and Ethics. All the surgeries were performed by the same surgeon (A.E.D.). The ethical approval for this retrospective study was obtained from the local Ethics Committee of Erciyes University Faculty of Medicine (2019/901).

The inclusion criteria for the study were as follows: American Society of Anaesthesiologists (ASA) physical status I; patients whose demand for analgesic medication in the postoperative period was met only with intravenous (IV) opioid medication, specifically 50 mg of tramadol (Contramal, Istanbul, Turkey); patients who received Le Fort I and bilateral sagittal split ramus osteotomy (BSSO) procedures due to dentoskeletal anomalies; as well as those without prior medical conditions or drugs that might impact their post-surgical wound recovery. The exclusion criteria were as follows: patients whose preoperative blood tests were performed more than 3 days preoperatively, patients with a history of allergic reactions to any drug used for general anaesthesia, patients who had a history of prolonged utilisation of non-steroidal anti-inflammatory drugs (NSAIDs) or opioid-derived drugs before surgery, patients whose analgesic demand was met with NSAIDs, and patients who had an incomplete follow-up. In addition, patients scheduled for genioplasty were excluded from the study for standardization.

The patient records were scanned retrospectively, and 8 patients did not meet the inclusion criteria. The study was carried out using data obtained from the medical files of the remaining 50 patients, which were recorded for detailed statistical analysis. All the patients underwent conventional Le Fort I osteotomies. Following the administration of local anaesthesia, the mucoperiosteal flap was fully lifted. Exposure of the zygomatic buttress and piriformis aperture was achieved, and the pterygomaxillary junction was bilaterally pinpointed. Subsequent to the disconnection of the nasal mucosa, the osteotomy lines were demarcated in accordance with the typical Le Fort I procedure. Completion of the down-fracture was followed by repositioning of the maxilla using a splint, with rigid fixation achieved using a miniplate and monocortical screws (KLS Martin, Tuttlingen, Germany) for all patients. Bilateral sagittal split ramus osteotomy was performed under local anaesthesia with a mucoperiosteal flap elevated from the external oblique line to the region of the first molar, and a horizontal osteotomy line was made with the Hunsuck modification. After the osteotomy, the split spreader was controlled to avoid reaching the mandibular canal. After completion of the splitting, the occlusion was moved and fixed with the splints in the final position. All the patients underwent rigid fixation using miniplates and monocortical screws (KLS Martin, Tuttlingen, Germany).

Patient demographic data were collected, including age, gender (male/female), and body mass index (BMI). Platelet indices, including PLT, MPV, PDW, PCT, and P-LCR, were obtained from routine preoperative haemogram tests. Pain severity was evaluated based on the number of analgesic drugs administered according to each patient's demand during the postoperative period. Pain intensity is generally assessed using the visual analogue scale (VAS); however, the number of analgesic administrations administered according to each patient's postoperative demand was used in this study. The patients' analgesic drug demand was met if their scores were 40. In this study, tramadol (50 mg) was used as the primary analgesic. The number of IV analgesic drug administrations was recorded separately for each patient within the first 24 hours (h) postoperatively and from the 24th to 72nd hours postoperatively.

Swelling measurements were performed by the same researcher (S. C.) to assess the increase in edema. The anatomic landmarks were determined as the bilateral medial and lateral canthi, nasion, tragus, bilateral gonion, and gnathion. The degree of postoperative swelling was assessed using a 3dMD imaging system and 3dMD Vultus software (3dMD, Atlanta, GA, USA) (**Figure 1**). All swelling measurements were articulated as the cumulative 3-dimensional area of the landmarks (cm2) captured at T0 (preoperatively), T1 (one day post-surgery), and T3 (3 days post-surgery). The increase in swelling between T1 and T0 (T1-0) and between T3 and T0 (T3-0) was determined and recorded. In the study, T1-0 served as the metric for assessing postoperative edema on the first day, while T3-0 was used for the third day.

Intraoperative blood loss, measured in millilitres (mL), was calculated from the blood collected using the same suction and sponge during and at the end of the Le Fort I and BSSO procedures. Other variables included surgical time and the amount of maxillomandibular movement for each patient.

For the study, each patient's platelet indices were compared with the number of IV analgesic drugs administered separately for 2 periods (first postoperative 24 h and the 24th–72nd h postoperatively). Associations between platelet indices and T1-0 and T3-0 were also evaluated. The effects of T1-0 and T3-0 on pain severity were investigated by considering the number of postoperative analgesic drug administrations during the first 24 hours and 24-72 h. However, the effect of T3-0 on pain intensity on the first day was ignored. The maxillomandibular movements of each patient in the T1-0 and T3-0 groups were compared. Among other variables, the amount of intraoperative blood loss and the duration of surgery were compared using PVI.

Statistical analysis. The analysis of data was carried out utilizing SPSS Statistical Package for the Social Sciences, version 26 (IBM Corp., Armonk, New York, USA) and JASP 0.14.1 (JASP Team, 2020) statistical software. Descriptive statistics were displayed as the

Figure 1 - The anatomic landmarks are selected and the area is calculated on Vultus 3-dimensional program.

number of units (n), percentage (%), median (M), and interquartile range (IQR). The Shapiro-Wilk test was employed to investigate the normality of the numerical variables' distribution. Numerical variables were compared based on gender using the Mann-Whitney U test. Spearman and partial correlation analyses were performed to compare the numerical variables. Owing to the high correlation between MPV, PDW, PCT, and PLCR, the effect of independent variables on the dependent (outcome) variables was evaluated using least absolute shrinkage and selection operator (Lasso) penalized regression analysis, which is a regularised linear regression analysis. Lasso-penalized regression analysis is preferred because feature selection is automatically performed using machine learning. Statistical significance was set at $p<0.05$ significant.

An analysis of statistical power was carried out in line with the effect sizes proposed by Cohen, using estimates from similar parameters in the existing literature.[13] The sample size was calculated according to the LASSO regression parameters, and the effect size was determined to be 0.219. Post hoc power analysis revealed that 42 individuals had 80.3% power and 5% type 1 error. According to a simulation study, the power of the test was sufficient, with a 5% type 1 error.

Results. The demographic characteristics, platelet volume indices, specifics regarding the number of analgesic drug administrations in the first 24 h and 24–72 h postoperatively, and edema levels on the first and third postoperative days (T1-0, T3-0) for the included 50 patients were statistically compared and separated according to gender, as presented in Table 1.

Edema levels at T1-0 and T3-0 were statistically evaluated alongside platelet indices as well as the quantity of IV analgesic drugs administered within the first 24 h and between 24–72 hours postoperatively. When assessing the correlations between the amount of edema and platelet indices, different trends were observed. For postoperative T1-0 and PLT, there was a distinct positive correlation with a p-value of <0.001 and r=0.540. In contrast, T1-0 and P-LCR showed a negative correlation with a p-value of 0.032 and r=-0.314. Similarly, T3-0 and PLT exhibited a significant positive correlation with a p-value of <0.001 and r=0.596 (Table 2).

Furthermore, when comparing the amount of edema and the number of IV analgesic drugs administered postoperatively, a significant positive correlation was found. For the first postoperative day edema levels and the number of IV analgesic drugs administered between 24 hours and 72 hours postoperatively, the correlation had a p-value of <0.001 and r=0.518. For the third postoperative day edema levels and the number of IV analgesic drugs administered between 24 hours and 72 hours postoperatively, the correlation had a p-value of <0.001 and r=0.541 (Figure 2 & 3).

Additionally, a statistical comparison of the number of IV analgesic drug administrations and platelet indices was carried out. Positive correlations were observed between the number of IV analgesic drug administrations in the first 24 hours and PCT (p=0.045 and r=0.297), and between the number of such administrations in the 24th-72nd hours and PLT (p<0.001 and r=0.495; Table 2).

Lastly, T1-0 edema, T3-0 edema, and IV analgesic drug administration were compared with variables considered confounding factors, such as the amount of maxilla-mandibular movement, blood loss, body mass index (BMI), and surgery duration. Of these, only the

Table 1 - Comparison of platelet volume indices, the number of analgesic drug administrations in the first 24 hours and 24-72 hours postoperatively, and the amount of edema on the first and third days according to gender.

Characteristics	Gender		Test statistics	
	Male M (IQR)	Female M (IQR)	z	*P*-value
The amount of edema on the first day postoperatively (cm^2) (T1-0)	21.29 (11.11)	21.71 (15.66)	0.498	0.619
The amount of edema on the third day postoperatively (cm^2) (T3-0)	17.32 (8.67)	21.26 (13.11)	1.051	0.293
Number of IV analgesic drug applications for the first 24 hours postoperatively	4.0 (2.0)	4.0 (2.0)	0.193	0.847
Number of IV analgesic drug applications in the 24-72 hours postoperatively	2.0 (0.5)	3.0 (1.0)	1.886	0.059
PLT	257.0 (67.0)	292.0 (81.5)	1.991	0.047
MPV	10.00 (0.30)	10.00 (0.00)	1.769	0.077
PDW	11.00 (3.00)	12.00 (2.00)	0.970	0.332
PCT	0.20 (0.05)	0.30 (0.10)	1.961	0.049
PLCR	25.90 (8.05)	28.50 (6.55)	1.703	0.089

M: median value, IQR: inter-quartile ranges, z: Mann-Whitney U test standardized test statistic, PLT: platelet count, MPV: mean platelet volume, PDW: platelet distribution width, PCT: plateletcrit, PLCR: platelet large cell ratio, IV: intravenous line

Table 2 - Correlation coefficients between dependent variables and independent variables adjusted for confounders.*

Outcome measures		PLT	MPV	PDW	PCT	PLCR
The amount of edema on the first day postoperatively (cm^2) (T1-0)	*r*	0.540†	0.096	0.206	0.007	-0.314†
	p	<0.001†	0.515	0.166	0.963	0.032†
The amount of edema on the the third day postoperatively (cm^2) (T3- 0)	*r*	0.596†	0.052	0.118	0.050	-0.170
	p	<0.001†	0.730	0.433	0.744	0.259
Number of IV analgesic drug applications for the first 24 hours postoperatively	*r*	0.195	0.127	0.151	0.297†	-0.200
	p	0.257	0.395	0.318	0.045†	0.182
Number of IV analgesic drug applications in the 24-72 hours postoperatively	*r*	0.495†	0.058	-0.180	0.228	0.086
	p	<0.001†	0.696	0.225	0.124	0.566

*All paired comparisons have been adjusted according to the factors to which the compared variables are related. †Indicates statistically significant correlations. For example, when evaluating the relationship between the amount of edema on the third day postoperative day and platelet, corrections were carried out according to BMI, gender, MPV, PDW, PCT, and PLCR. PLT: platelet count, MPV: mean platelet volume, PDW: platelet distribution width, PCT: plateletcrit, PLCR: platelet large cell ratio, IV: intravenous line, r: Pearson correlation coefficient

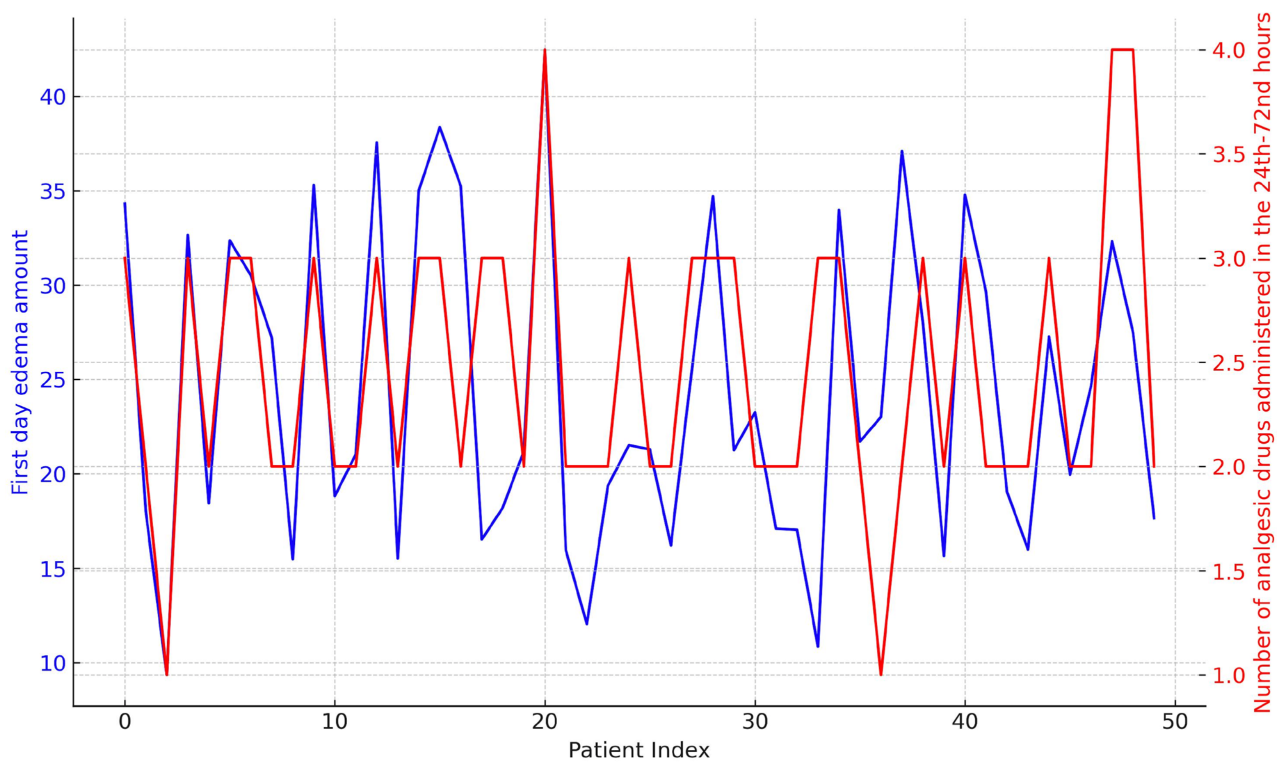

Figure 2 - Correlation between first-day postoperative edema amount and number of analgesic drugs administered in the 24th-72nd hours.

number of IV analgesic drug administrations within the first 24 h was positively correlated with the amount of maxillary impaction (*p*=0.023; Table 3).

Although it was not significant in the univariate correlation analysis (Table 3), a suitable model was created by planning a multivariate regression analysis in accordance with the literature. Consequently, 4 regularized linear regression models were created for the 4 dependent (outcome) variables. Disclosure rates were reached for all 4 dependent variables when secondary outcomes were excluded. The regularized linear regression models and disclosure rates are as follows: i) T1-0(cm^2) = −0.067 + 0.630 * PLT + 0.001 * MPV + 0.001* PWD + 0.173* PCT − 0.130*PLCR + 0.320 * Mand Set Back − 0.074 * mand advancement. The rate of disclosure of T1-0 with this equation was 91.3%.

ii) T3-0 (cm^2) = −0.077 + 0.736 * PLT + 0.001 * MPV + 0.001 * PDW + 0.001* PCT − 0.119 * PLCR +

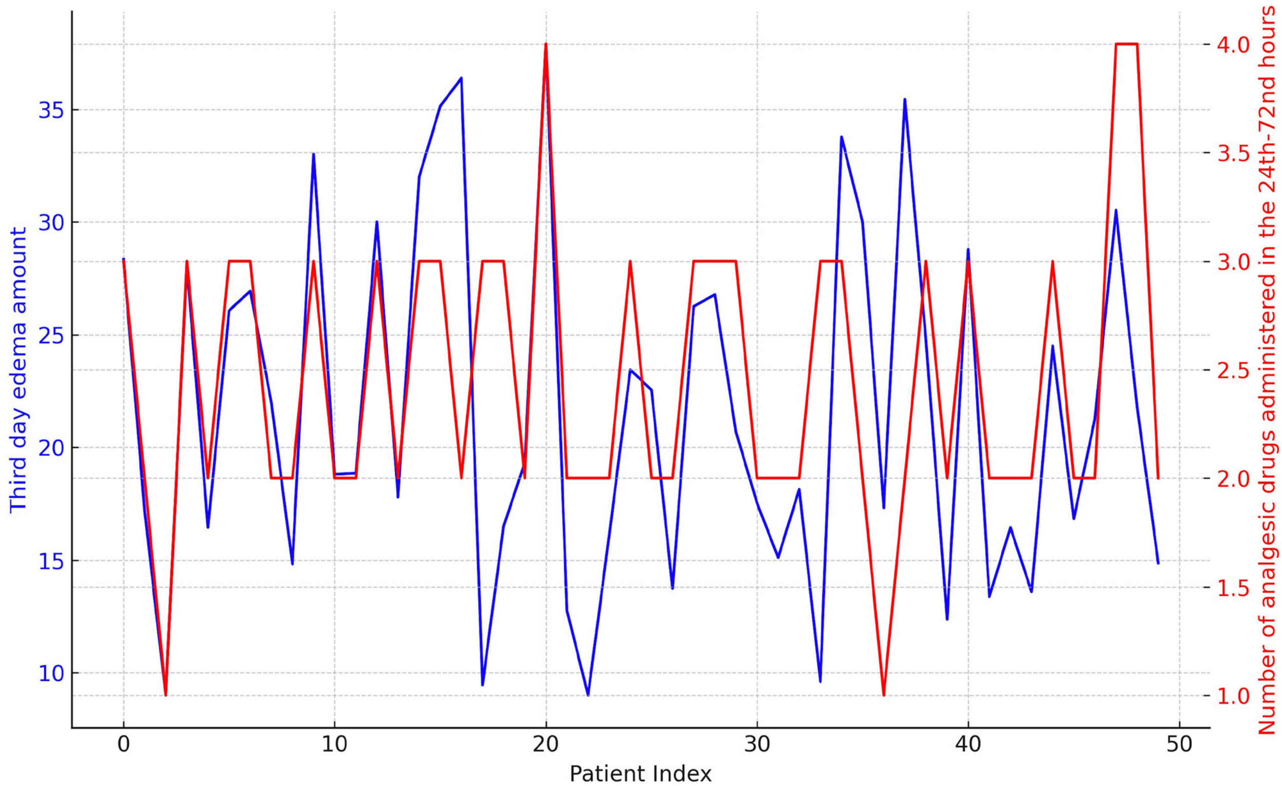

Figure 3 - Correlation between third-day postoperative edema amount and number of analgesic drugs administered in the 24th-72nd hours.

Table 3 - Correlation of dependent and independent variables with variables considered to be confounding factors.

Variables		Age	BMI	Amount of bleeding	Duration of surgery	Maxillary advancement	Maxillary impaction	Mandibular setback	Mandibular advacement
The amount of edema on the first day postoperatively (cm^2) (T1-0)	*rho*	-0.131	-0.150	-0.003	0.196	-0.178	0.054	0.230	-0.196
	p	0.366	0.298	0.981	0.173	0.216	0.708	0.107	0.172
The amount of edema on the third day postoperatively (cm^2) (T3-0)	*rho*	-0.079	-0.107	-0.076	0.183	-0.182	0.013	0.118	-0.272
	p	0.587	0.460	0.602	0.147	0.207	0.926	0.415	0.056
Number of IV analgesic drug applications for the first 24 hours postoperatively	*rho*	-0.216	-0.186	-0.053	0.223	0.062	0.320*	0.039	-0.147
	p	0.131	0.196	0.713	0.120	0.671	0.023*	0.789	0.310
Number of IV analgesic drug applications in the 24-72 hours postoperatively	*rho*	-0.141	-0.054	0.014	0.049	-0.054	0.228	-0.059	-0.245
	p	0.330	0.710	0.926	0.733	0.711	0.111	0.682	0.086
PLT	*rho*	-0.181	-0.133	0.010	0.124	-0.223	0.099	-0.090	-0.155
	p	0.208	0.118	0.945	0.391	0.119	0.496	0.534	0.283
MPV	*rho*	0.138	0.046	0.049	-0.040	-0.183	0.090	0.077	0.153
	p	0.339	0.752	0.733	0.785	0.202	0.536	0.593	0.289
PDW	*rho*	0.008	-0.072	0.110	0.037	-0.072	0.010	0.132	0.024
	p	0.957	0.620	0.445	0.797	0.621	0.946	0.362	0.871
PCT	*rho*	-0.159	-0.164	0.028	0.082	-0.237	0.069	-0.012	-0.080
	p	0.270	0.121	0.848	0.571	0.098	0.635	0.934	0.582
PLCR	*rho*	0.089	-0.054	0.063	-0.028	-0.135	0.016	0.090	0.111
	p	0.539	0.710	0.666	0.847	0.351	0.911	0.534	0.444

*Indicates statistically significant correlations. PLT: platelet count, MPV: mean platelet volume, PDW: platelet distribution width, PCT: plateletcrit, PLCR: platelet large cell ratio, IV: intravenous line, rho: Spearmen correlation coefficient

0.155 * mand set back – 0.083 &* mand advancement. The rate of disclosure of T3-0 with this equation was 67.8%.

iii) IV analgesic drug application number in the first 24 h postoperatively = –0.072 + 0.001 * PLT + 0.001 * MVP + 0.001 * PDW+ 0.185 * PCT – 0.001 * PLCR + 0.001 * mand set back + 0.001 * mand advancement. The rate of disclosure of the number of IV analgesic drug administrations in the first 24 hours postoperatively with this equation was 12.2%.

iv) IV analgesic drug application number in the 24–72 hours postoperatively = –0.009 + 0.442 * PLT + 0.001 * MPV + 0.001 * PDW + 0.127 * PCT + 0.001 * PLCR + 0.001 * mand set back – 0.174 * mand advancement. With this equation, the disclosure rate of IV analgesic drug administration in the 24th–72nd hours postoperatively was 50.2%.

Discussion. Many studies have shown various relationships between hemogram test parameters and surgical diagnosis, follow-up, and survival rates. For example, it has been reported that the ratio of neutrophil-lymphocyte parameters obtained from hemogram tests is associated with postoperative pain and pain perception in chronic diseases.[14–16] In another study, Turgut et al[17] found that a higher neutrophil-lymphocyte ratio (NLR) was associated with greater postoperative analgesic consumption in orthognathic surgery. Also, they suggested that adequate postoperative pain control could be achieved with various preventive treatments while considering the preoperative NLR. The current study demonstrated a correlation between PVI and postoperative edema and pain, particularly in relation to PLT and PCT levels.

Among the platelet indices, the authors noticed that the most studied parameter is MPV. Some studies have shown a relationship between MPV, inflammatory and cardiovascular diseases, and postoperative nausea and vomiting. A meta-analysis evaluated the associations between MPV and cardiovascular disease risk, and the authors provided evidence supporting an increased association of MPV with myocardial infarction and mortality.[18-20] However, statistical significance was not found between MPV values and the main variables investigated in this study: pain and edema.

Notably, many studies have investigated the relationship between platelet-rich plasma (PRP) administration and postoperative pain and swelling.[21,22] Platelet-rich plasma is a platelet-rich concentrate manufactured from whole blood by centrifugation and contains platelet levels greater than the baseline in whole blood. Because of the growth factors and cytokines found in the granules of platelets, PRP may assist in wound healing and possible complications such as postoperative pain and edema.[23] However, in studies conducted with PRP, its effect on pain and edema was very diverse. Although various publications have disagreed on whether PRP increases or decreases edema and postoperative pain.[24-26] The present study found positive correlations between PLT and the amount of edema on the first and third days, and between IV analgesic drug administration numbers in the 24th-72nd h. There was a significant correlation between the amount of edema on the first and third days and the number of IV analgesic drug administrations on the 24th–72nd h postoperatively.

A recently published review has stated that the role of platelets in inflammation is crucial for hemostasis. Therefore, possible therapeutic interventions targeting platelet activation and reduction of surface receptors have been reevaluated with respect to inflammatory complications.[2]

A review of 48 studies that included 23,037 patients underscored preoperative pain, anxiety, age, and the nature of the surgery as crucial factors affecting postoperative pain. The same research inferred that early identification of patients susceptible to postoperative pain could facilitate more successful interventions and improved management of pain.[27] In the present retrospective study, PCT and PLT values and the amount of postoperative first- and third-day edema significantly correlated with postoperative analgesic requirements, which was accepted as postoperative pain severity. In a study by Shetty et al,[28] the average analgesic consumption was evaluated in bimaxillary surgery, and the mean postoperative analgesic administration was found to be 6. In our study, the number of postoperative analgesics consumed was 6, which is consistent with the results of this study.

The PCT calculates the entire platelet mass as a proportion of the volume they fill in the blood. The recognized normal range of PCT is between 0.2% and 0.2%, which facilitates the effective detection of quantitative platelet anomalies.[29-31] Tang et al[32] demonstrated the potential of PCT as a novel biomarker of active Crohn's disease in patients. In addition, this study found a significant relationship between PCT parameters and the first 24 h postoperative IV analgesic requirements.

Postoperative pain is the most important factor that negatively affects postoperative comfort. The importance of platelets in inflammation has been highlighted in recent studies. Estimating pain severity and the need for analgesia will provide more effective pain intervention and better pain management in patients with high postoperative pain expectancy. The authors suggest that this approach could prevent complications arising from postoperative pain. The PVI, which can be easily obtained during preoperative examination, was investigated in this study. These factors might be essential predictors of postoperative pain and edema severity. Accordingly, the use of analgesic drugs that improve platelet function may be more effective for postoperative pain management. Therefore, analgesic drugs may be more effective than opioids in reducing the severity of postoperative pain and edema. In a study conducted by Tüzüner et al,[33] the preoperative use of a non-selective cyclooxygenase-1 enzyme (COX) and COX-2 inhibitor (diclofenac sodium), an opioid drug (tramadol), and a placebo was compared in terms of postoperative analgesic consumption. Upon concluding the study, it was noted that the group given a placebo demonstrated the greatest use of analgesics. Among the tramadol and diclofenac groups, the diclofenac group had the lowest analgesic consumption, although this difference was not statistically significant. At our centre, 50 mg IV tramadol, an opioid drug, is the preferred first-choice analgesic for bimaxillary surgery, with dexketoprofen as a rescue drug. Patients who did not require rescue analgesics were selected for this study during a retrospective review of patient files, as the investigation focused on the impact of PVI on postoperative pain and edema. Opioid drugs do not affect platelet function; however, drugs that are effective against COX-1 do. We believe that the use of analgesics that partially affect COX-1 and have a stronger effect on COX-2 could be a more effective strategy for reducing the severity of postoperative pain and edema. However, further studies on this topic are warranted.

There is a lack of studies exploring the association between platelet indices and postoperative pain and edema. Thus, this study is unique and contributes valuable information to the literature.

Study limitation. This study carried out retrospectively. However, our study also considered potential confounding variables, such as age, BMI, and extent of bleeding. Therefore, prospective studies in this field are warranted.

In conclusion, the present study showed that PLT, MPV, PDW, PCT, and P-LCR may lead to the highest degree of postoperative first-day edema. A significant relationship was demonstrated between PLT and the amount of edema seen on the first and third days after surgery and analgesic consumption between the 24th–72nd hours postoperatively. Edema on the first and 3rd days was also found to be effective for analgesic consumption between 24-72 hours postoperatively. This relationship suggests that PLT count may be the most effective predictor of postoperative pain. In addition, there was a significant association between PCT level and the number of analgesic drugs consumed in the first 24 h postoperatively. The authors concluded that the PLT and PCT levels may significantly indicate the severity of postoperative pain and edema.

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References

1. Jackson SP. The growing complexity of platelet aggregation. *Blood* 2007;109:5087-5095.
2. Margraf A, Zarbock A. Platelets in inflammation and resolution. *J Immunol* 2019; 203: 2357-2367.
3. Bekő K, Koványi B, Gölöncsér F, Horváth G, Dénes Á, Környei Z, et al. Contribution of platelet P2Y12 receptors to chronic Complete Freund's adjuvant-induced inflammatory pain. *J Thromb Haemost* 2017; 15: 1223-1235.
4. Weyrich AS, Lindemann S, Zimmerman GA. The evolving role of platelets in inflammation. *J Thromb Haemost* 2003; 1: 1897–1905.
5. Chen H, Wu Q, Zhang Y, Li Q, Ma J, Kong F, et al. Nomograms based on the novel platelet index score predict postoperative prognosis in endometrial cancer. *Gynecol Oncol* 2020; 158: 689-697.
6. Lembeck AL, Posch F, Klocker EV, Szkandera J, Schlick K, Stojakovic T, et al. Large platelet size is associated with poor outcome in patients with metastatic pancreatic cancer. *Clin Chem Lab Med* 2019; 57: 740-744.
7. Jurcuț C, Jurcuț R, Caraiola S, Nițescu D, Mihai C, Baicuş A, et al. Platelet histogram indices and cardiovascular disease in patients with rheumatoid arthritis. *Rom J Intern Med* 2010;48:51-55.
8. 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. *Jt Bone Spine* 2008; 75: 291-294.
9. Kaur R, Kaur M, Singh J. Endothelial dysfunction and platelet hyperactivity in type 2 diabetes mellitus: molecular insights and therapeutic strategies. *Cardiovasc Diabetol* 2018; 17: 121.
10. Panula K, Finne K, Oikarinen K. Incidence of complications and problems related to orthognathic surgery: a review of 655 patients. *J Oral Maxillofac Surg* 2001; 59: 1128-1137.
11. Kim SG, Park SS. Incidence of complications and problems related to orthognathic surgery. *J Oral Maxillofac Surg* 2007; 65: 2438-2444.
12. Piñeiro-Aguilar A, Somoza-Martín M, Gandara-Rey JM, García-García A. Blood loss in orthognathic surgery: a systematic review. *J Oral Maxillofac Surg* 2011; 69: 885-892.
13. Cohen J. A power primer. *Psychol Bull* 1992; 112: 155-159.
14. Fang YN, Tong MS, Sung PH, Chen YL, Chen CH, Tsai NW, et al. Higher neutrophil counts and neutrophil-to-lymphocyte ratio predict prognostic outcomes in patients after non-atrial fibrillation-caused ischemic stroke. *Biomed J* 2017; 40: 154-162.

15. Chandrashekara S, Rajendran A, Jaganath AB, Krishnamurthy R. Neutrophil-lymphocyte ratio, pain perception, and disease activity score may serve as important predictive markers for sustained remission in rheumatoid arthritis. ***Reumatismo*** 2015; 67: 109-115.
16. Daoudia M, Decruynaere C, Le Polain de Waroux B, Thonnard JL, Plaghki L, Forget P. Biological inflammatory markers mediate the effect of preoperative pain-related behaviours on postoperative analgesics requirements. ***BMC Anesthesiol*** 2015; 15: 183.
17. Turgut HC, Alkan M, Ataç MS, Altundağ SK, Bozkaya S, Şimşek B, et al. Neutrophil lymphocyte ratio predicts postoperative pain after orthognathic surgery. ***Niger J Clin Pract*** 2017;20:1242-1245.
18. Chu SG, Becker RC, Berger PB, Bhatt DL, Eikelboom JW, Konkle B, et al. Mean platelet volume as a predictor of cardiovascular risk: a systematic review and meta-analysis. ***J Thromb Haemost*** 2010; 8: 148-156.
19. Gasparyan AY, Stavropoulos-Kalinoglou A, Mikhailidis DP, Douglas KM, Kitas GD. Platelet function in rheumatoid arthritis: arthritic and cardiovascular implications. ***Rheumatol Int*** 2011; 31: 153-164.
20. Canpolat DG, Dogruel F, Gönen ZB, Yılmaz C, Zararsız G, Alkan A. The role of platelet count, mean platelet volume, and the mean platelet volume/platelet count ratio in predicting postoperative vomiting in children after deep sedation. ***Saudi Med J*** 2016; 37: 1082-1088.
21. Hartlev J, Nørholt SE, Schou S, Isidor F. Pain after mandibular ramus block harvesting and lateral ridge augmentation with and without involvement of platelet-rich fibrin: a randomized controlled trial. ***Int J Oral Maxillofac Surg*** 2021; 50: 384-390.
22. Zhu J, Zhang S, Yuan X, He T, Liu H, Wang J, et al. Effect of platelet-rich fibrin on the control of alveolar osteitis, pain, trismus, soft tissue healing, and swelling following mandibular third molar surgery: an updated systematic review and meta-analysis. ***Int J Oral Maxillofac Surg*** 2021; 50: 398-406.
23. Setayesh K, Villarreal A, Gottschalk A, Tokish JM, Choate WS. Treatment of muscle injuries with platelet-rich plasma: a review of the literature. ***Curr Rev Musculoskelet Med*** 2018; 11: 635-642.
24. Filardo G, Di Matteo B, Di Martino A, Merli ML, Cenacchi A, Fornasari P, et al. Platelet-rich plasma intra-articular knee injections show no superiority versus viscosupplementation: a randomized controlled trial. ***Am J Sports Med*** 2015;43:1575-1582.
25. Gandevivala A, Sangle A, Shah D, Tejnani A, Sayyed A, Khutwad G, et al. Autologous platelet-rich plasma after third molar surgery. ***Ann Maxillofac Surg*** 2017;7:245-249.
26. Kumar A, Singh G, Gaur A, Kumar S, Numan M, Jacob G, Kiran K, et al. Role of platelet-rich plasma in the healing of impacted third molar socket: a comparative study on Central India population. ***J Contemp Dent Pract*** 2020; 21: 986-991.
27. Ip HY, Abrishami A, Peng PW, Wong J, Chung F. Predictors of postoperative pain and analgesic consumption: a qualitative systematic review. ***J Am Soc Anesthesiol*** 2009;111:657-677.
28. Shetty V, BhanuPrakash B, Yadav A, Menon A. Do regional nerve blocks before bimaxillary surgery reduce postoperative pain? ***J Oral Maxillofac Surg*** 2020; 78: 724-730.
29. Budak YU, Polat M, Huysal K. The use of platelet indices, plateletcrit, mean platelet volume and platelet distribution width in emergency non-traumatic abdominal surgery: a systematic review. ***Biochem Medica*** 2016; 26: 178-193.
30. Gao Y, Li Y, Yu X, Guo S, Ji X, Sun T, et al. The impact of various platelet indices as prognostic markers of septic shock. ***PLoS One*** 2014; 9: e103761.
31. Baig MA. Platelet indices-evaluation of their diagnostic role in pediatric thrombocytopenias (one-year study). ***Int J Res Med Sci*** 2015; 3: 2284- 2289.
32. Tang J, Gao X, Zhi M, Zhou HM, Zhang M, Chen HW, et al. Plateletcrit: A sensitive biomarker for evaluating disease activity in Crohn's disease with low hs-CRP. ***J Dig Dis*** 2015;16:118-124.
33. Tuzuner AM, Ucok C, Kucukyavuz Z, Alkis N, Alanoglu Z. Preoperative diclofenac sodium and tramadol for pain relief after bimaxillary osteotomy. ***J Oral Maxillofac Surg*** 2007;65:2453-2458.