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The relationship between preoperative neutrophil-to-lymphocyte ratio and early postoperative clinical outcomes following laparoscopic inguinal hernia repair: A retrospective analysis

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ABSTRACT

Introduction: This study aimed to evaluate the impact of preoperative neutrophil-to-lymphocyte ratio (NLR) levels on early postoperative clinical outcomes in patients undergoing laparoscopic inguinal hernia repair using the Transabdominal Preperitoneal (TAPP) technique.

Materials and Methods: In this single-center retrospective study, data from 93 patients who underwent surgery using the TAPP technique between June 2022 and December 2024 were analyzed. The patients were divided into two groups based on their preoperative NLR: ≤2 (Low NLR, n=51) and >2 (High NLR, n=42). The primary endpoint of the study was to compare the postoperative 6th-hour Visual Analog Scale (VAS) scores between the groups. Secondary endpoints included postoperative VAS scores at 24 h, 10 days, and 3 months, rescue analgesic consumption, the time to return to daily life/work.

Results: The mean postoperative 6th-hour VAS score was significantly lower in the Low NLR group than in the High NLR group (p=0.006). Similarly, the mean 24th-hour VAS scores were significantly lower in the Low NLR group (p=0.022). However, the mean VAS scores on the 10th postoperative day and at 3 months were comparable between the groups (p=0.274 and p=0.104, respectively). Mean rescue analgesic consumption was significantly lower in the Low NLR group than in the High NLR group (p=0.005). The median time to return to daily life/work was shorter in the Low NLR group (p<0.001).

Conclusions: A higher preoperative NLR is associated with greater early postoperative pain, higher analgesic consumption and delayed return to daily life/work after laparoscopic inguinal hernia repair. NLR may serve as a biomarker for predicting postoperative pain and recovery, although larger prospective studies are needed for validation.

Keywords: Inguinal Hernia, laparoscopy, preoperative, neutrophil-to-lymphocyte ratio

Introduction

Inguinal hernia is one of the most common pathologies requiring surgical intervention worldwide.[1] Approximately 20 million inguinal hernia repairs are performed annually, underscoring the widespread use of this procedure in surgical practice. Inguinal hernia surgery can be performed using open, laparoscopic, or robotic approach.[2,3] Among these techniques, the Transabdominal Preperitoneal (TAPP) approach, first described by Arregui, involves

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entering the peritoneal cavity to place a mesh within the preperitoneal space and is widely utilized in current surgical practice.[4]

Postoperative pain following inguinal hernia repair is a significant clinical issue that directly affects patient comfort and recovery.[5] The intensity of postoperative pain is closely associated with the time required for patients to resume daily activities. In addition to the surgical technique and the materials used, patient-specific biochemical and inflammatory parameters are thought to influence the perception of pain. In this context, there is a growing interest in the use of systemic inflammatory markers identified in the preoperative period, particularly hematologic indices such as the neutrophil-to-lymphocyte ratio (NLR), as potential biomarkers for predicting postoperative pain intensity. The NLR reflects the systemic inflammatory response and has been associated with postoperative pain and recovery in various surgical procedures.[6–8]

A review of the literature reveals that, in the context of elective laparoscopic inguinal hernia repair—where the most effective method for reducing postoperative pain remains a matter of debate—studies investigating the relationship between preoperative NLR levels and postoperative pain are quite limited. Therefore, the aim of the present study was to evaluate the impact of preoperatively measured NLR on early postoperative clinical outcomes in patients undergoing laparoscopic inguinal hernia repair using the TAPP technique.

Methods

This single-center, retrospective, observational study was approved by the Antalya Training and Research Hospital Medical Research Scientific Ethics Committee (No: 2025-122, Date: 17/04/2025), and the study was conducted in accordance with the Declaration of Helsinki and national regulations. Data of patients who underwent inguinal hernia repair using the TAPP technique at our institution between June 2022 and December 2024 were retrospectively analyzed. This study was conducted in accordance with the principles of the Declaration of Helsinki. Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines was followed for patient enrollment and allocation.

The inclusion criteria were patients aged between 18 and 65 years who underwent the TAPP technique-based inguinal hernia repair at our institution between June 2022 and December 2024. Only patients who had completed the 3-month postoperative follow-up period after the date of approval by the ethics committee were included. Eligible patients had unilateral elective primary inguinal hernia repairs performed by a hernia-specialized surgeon at our clinic, with preoperative day 1 complete blood count and C-reactive protein (CRP) levels, as well as postoperative 24-hour complete blood count values available. In addition, postoperative Visual Analog Scale (VAS) pain scores had to be recorded at the 6th hour, 24th hour, 10th day, and 3rd month. The exclusion criteria were as follows: Patients with bilateral inguinal hernia, patients with a hernia defect larger than 3 cm, those with a history of previous open hernia repair, those older than 65 years, those requiring postoperative intensive care, those with incomplete data, smokers, and those on anticoagulant therapy.

Data of patients who underwent inguinal hernia repair using the TAPP technique were retrospectively analyzed. In accordance with previous surgical studies evaluating the association between preoperative NLR and postoperative pain-related outcomes, patients were categorized into two groups using a literature-based NLR threshold of 2 (NLR ≤2 and NLR >2). This threshold was adopted to maintain methodological consistency and facilitate direct comparison with earlier reports, rather than being derived post hoc from the present dataset.[9–13] The patients were categorized into two groups based on their preoperative NLR values: Those with NLR ≤2 were classified as the Low NLR Group, and those with NLR >2 as the High NLR Group. Demographic data of the included patients [age, sex, body mass index (BMI), comorbidities, American Society of Anesthesiologists (ASA) score, history of previous abdominal surgery, presenting symptoms, surgical site and operation duration], VAS scores, preoperative CRP, preoperative and postoperative complete blood count parameters [hemoglobin (Hb), white blood cell (WBC) count, and NLR], length of hospital stay, time to return to Daily Life/Work, rescue analgesic consumption and presence of surgical complications within the 3-month follow-up period were retrospectively obtained from a prestructured clinical form routinely used in our department, as well as from the hospital database, operative records, and nursing notes. Operative time was defined as the duration from the initiation to the completion of surgery, whereas the time to return to daily life/work was defined as the period from the date of surgery to the resumption of daily activities or return to work. Postoperative complications were assessed and classified according to the Clavien-Dindo classification system (Grade I: Minor deviation without

need for specific treatment; Grade II: Requires pharmacologic treatment; Grade III: Requires surgical, endoscopic, or radiological intervention; Grade IV: Life-threatening complication requiring ICU care; Grade V: Death of the patient).[14] All complications were retrospectively documented during the routine outpatient follow-up visits.

Visual Analog Scale (VAS) is a subjective measurement tool used to assess pain levels in patients. This scale rates pain on a scale from 0 to 10, where a score of "0" indicates no pain and "10" represents unbearable pain.[15] Postoperative VAS scores (at 6 and 24 h, day 10, and month 3) were retrospectively recorded using a prestructured clinical form routinely completed in our clinic, as well as from nursing observations and the hospital database. All data were collected as part of the standard follow-up protocol routinely performed for patients undergoing hernia surgery by the hernia surgeon at our institution.

This study aimed to evaluate the impact of preoperatively measured systemic inflammatory markers on postoperative clinical outcomes in patients undergoing inguinal hernia repair using the TAPP technique. In particular, this study aimed to compare postoperative pain levels between patients with low (≤2) and high (>2) preoperative NLR. Accordingly, the primary endpoint of the study was to assess the effect of different preoperative NLR levels on the 6th-hour postoperative VAS score in patients undergoing laparoscopic inguinal hernia repair using the TAPP technique. The 6th postoperative hour was chosen as the primary time point for evaluation, as it aligns with previous studies that investigated early pain dynamics following hernia surgery.[16,17] The comparison of VAS scores at additional postoperative time points, occurrence of early postoperative complications, and the time to return to daily life/work were defined as the secondary endpoints of the study.

Standard Transabdominal Preperitoneal Procedure

In the TAPP technique, the optical trocar was inserted through the supraumbilical region using the Hasson technique. Lateral trocars were placed on both sides of the transverse line to ensure the preservation of the inferior epigastric vessels. A wide peritoneal flap was prepared to allow adequate evaluation of the hernia defect. Dissection was initiated from the Bogros space in accordance with the International Endohernia Society (IEHS) guidelines[18-20], considering anatomical structures, and was extended to include the Cooper's ligament, iliac fascia, and iliopubic tract. The hernia sac was carefully dissected to achieve adequate parietalization. Following dissection, a polypropylene mesh was placed in the appropriate anatomical plane and the peritoneal flap was closed.

Standard Perioperative and Postoperative Patient Management

All patients underwent surgery under general anesthesia. Standard anesthesia monitoring, including 3-lead electrocardiography, heart rate, noninvasive blood pressure, peripheral oxygen saturation, and end-tidal carbon dioxide, was applied to all patients in the operating room. For postoperative analgesia, all patients received a standard administration of 1 g of intravenous paracetamol and 100 mg of intravenous tramadol by the anesthesia team, 20 min before the end of surgery. All patients were managed postoperatively with a standard pain protocol consisting of intravenous paracetamol administered every 8 hours. During the first 24 postoperative hours, patients with a VAS score greater than 4 routinely received 100 mg of intravenous tramadol as rescue analgesia.

Statistical Analysis

A pilot study including 10 patients in each group was conducted to determine the power analysis of the study. The 6th-hour VAS score was designated as the primary outcome variable, and based on the data obtained, a power analysis was performed using G*Power 3.1 statistical software. The mean (standard deviation; SD) 6th-hour VAS score was calculated as 3.5 (0.972) in the Low NLR Group and 4.40 (1.51) in the High NLR Group. Assuming equal group sizes, 33 patients per group were required (α=0.05, β=0.95, effect size=0.93). To account for potential patient dropout during the study period, a 10% attrition rate was added, resulting in a minimum required sample size of 37 patients per group for a total of at least 74 patients to be included in the study.

All statistical analyses were performed using IBM SPSS Statistics version 24 (Statistical Package for the Social Sciences). Continuous variables were presented as mean ± SD or median (interquartile range; IQR), while categorical variables were expressed as frequencies (percentage; %). The Shapiro–Wilk test was used to assess the normality of distribution for continuous variables. Parametric variables were compared using Student's t-test, while non-parametric variables were analyzed using the Mann–Whitney U test. Categorical variables were evaluated us-

ing the Chi-square test or Fisher's exact test, as appropriate. Statistical significance was set at P<0.05.

Results

The medical records of 122 patients who underwent laparoscopic inguinal hernia repair using the TAPP technique between June 2022 and December 2024 were reviewed and analyzed. Oving to protocol violations, 16 patients from the Low NLR Group and 13 patients from the High NLR Group were excluded from the analysis. Consequently, data from 51 patients in the Low NLR Group and 42 patients in the High NLR Group were included in the final statistical analysis (Fig. 1).

Demographic Data

There were no statistically significant differences between the groups in terms of age, sex, BMI, comorbidities, ASA score, or history of abdominal surgery (p>0.05). No statistically significant differences were observed between the groups in terms of preoperative symptoms. In the Low NLR Group, 5 patients (9.8%) presented with preoperative pain and 15 patients (29.4%) with swelling, whereas in the High NLR Group, preoperative pain was observed in 4 patients (9.5%) and swelling in 11 patients (26.2%) (p=0.936). No statistically significant differences were found between the groups in terms of hernia localization (p=0.170). The demographic characteristics of the patients are summarized in Table 1.

Intraoperative Data

Evaluation of hernia types in the Low NLR Group revealed indirect hernia in 30 patients (58.8%), direct hernias in 16 patients (31.4%), pantaloon hernias in 4 patients (7.8%), and femoral hernias in 1 patient (2%). In the High NLR Group, 24 patients (57.1%) had indirect hernia, 14 patients (33.3%) had direct hernia, and 4 patients (9.5%) had pantaloon hernia; no femoral hernia was observed (p=0.816). Intraoperative bleeding rates were similar between the groups (p=0.899). The median operative time was 35 minutes (IQR 30–35) in the Low NLR Group and 34.5 minutes (IQR 30–36.75) in the High NLR Group, with no statistically significant difference between the groups (p=0.542) (Table 2).

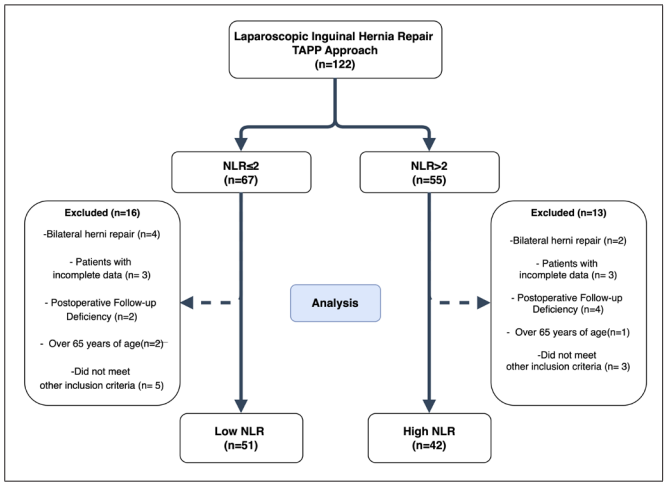


Figure 1. Flowchart.

Preoperative and Postoperative Laboratory Data

Analysis of laboratory parameters revealed that the median decrease in hemoglobin at 24 hours postoperatively was comparable between the Low NLR and High NLR groups (p=0.116). Similarly, no statistically significant difference was observed in the increase in WBC counts between the groups (p=0.204). The median absolute increase in NLR from the preoperative to postoperative measurements was also similar (p=0.290). Preoperative CRP levels did not differ significantly between the groups (p=0.364). Detailed laboratory findings are summarized in Table 3.

Postoperative Follow-up and Complication Data

Postoperative complications occurred in 7.8% of the patients (n=4) in the Low NLR Group and 7.1% of the patients (n=3) in the High NLR Group (p=0.351). In the Low NLR Group, seroma was observed in two patients (3.9%) and hematoma in two patients (3.9%), whereas in the High NLR Group, seroma was observed in three patients (7.1%) and no hematoma was detected. All complications were classified as Clavien–Dindo Grade I. The length of hospital stay was one day for all patients. Evaluation of the time to return to daily life/work revealed a median of 7 days (IQR 5–8) in the Low NLR Group and 8 days (IQR 7–9) in the High NLR Group, with a statistically significant difference between the groups (p<0.001). Mean rescue analgesic consumption was significantly lower in the Low NLR Group than in the High NLR Group (125±52.3 mg vs. 157±63.0 mg, p=0.005) (Table 4).

Postoperative Visual Analog Scale (VAS) Scores

The mean postoperative 6th-hour VAS score was 3.88 (1.17) in the Low NLR Group and 4.59 (1.14) in the High NLR Group, with a statistically significant difference between the groups (p=0.006). Similarly, a significant difference was observed in the mean postoperative 24th-hour VAS scores between the groups (p=0.022). In contrast, the mean VAS scores on postoperative day 10 and at 3 months were comparable between the groups (p=0.274 and p=0.104, respectively) (Fig. 2).

Table 1. Demographic data

		Low NLR (n=51)	High NLR (n=42)	p
Age, year		47 (38.0-56.5)	46 (39.2-53.7)	0.728
Gender	Male	46 (90.2 %)	36 (85.7%)	0.536
	Female	5 (9.8 %)	6 (14.3%)	
BMI, kg/m²		23.5 (22.9-24.2)	23.5 (23.1-24.5)	0.472
Comorbidity		3 (5.9 %)	2 (4.8%)	0.812
ASA	I	12 (23.5 %)	9 (21.4%)	
	II	37 (72.5 %)	31 (73.8%)	0.957
	III	2 (3.9 %)	2 (4.8%)	
Previous abdominal surgery		2 (3.9 %)	4 (9.5%)	0.404
Preoperative Symptom	Pain	5 (9.8 %)	4 (9.5%)	
	Swelling	15 (29.4 %)	11 (26.2%)	0.936
	Both of them	31 (60.8 %)	27 (64.3%)	
Side of the hernia	Right	35 (68.6 %)	23 (54.8%)	0.170
	Left	16 (31.4 %)	19 (45.2%)	

Values presented as median (IQR) and number (%). Chi-square test and Fisher's exact test were used for the analysis of categorical variables, while the Mann–Whitney U test was utilized for the analysis of non-parametric variables. *p<0.05 is statistically significant. ASA: American Society of Anesthesiologists; BMI: Body Mass Index; NLR: Neutrophil-to-Lymphocyte Ratio

Discussion

In our study, among patients who underwent laparoscopic inguinal hernia repair using the TAPP technique, those with a preoperative NLR ≤2 demonstrated significantly lower VAS scores at 6 and 24 hours postoperatively compared to those with NLR >2. However, the VAS scores at postoperative day 10 and month 3 were similar between the two groups. Mean rescue analgesic consumption was also significantly lower in the Low NLR group. The time to return to daily life/work after discharge were significantly lower in the Low NLR Group. In our study, the most common postoperative complications were seroma and hematoma, with complication rates being comparable between the groups.

Pain is a common postoperative complication of inguinal hernia repair, and the most effective strategy for its

Table 2. Intraoperative data

		Low NLR (n=51)	High NLR (n=42)	p
Hernia Type	Indirect	30 (58.8%)	24 (57.1%)	0.816
	Direct	16 (31.4%)	14 (33.3%)	
	Panta-loon	4 (7.8%)	4 (9.5%)	
	Femoral	1 (2%)	0	
Bleeding		1 (2%)	1 (2.4%)	0.899
Operation Duration, min		35 (30-35)	34.5 (30-36.75)	0.542

Values presented as median (IQR) and number (%). The chi-square test used for the analysis of categorical variables, while the Mann–Whitney U test was utilized for the analysis of non-parametric variables. *p<0.05 is statistically significant. NLR: Neutrophil-to-Lymphocyte Ratio

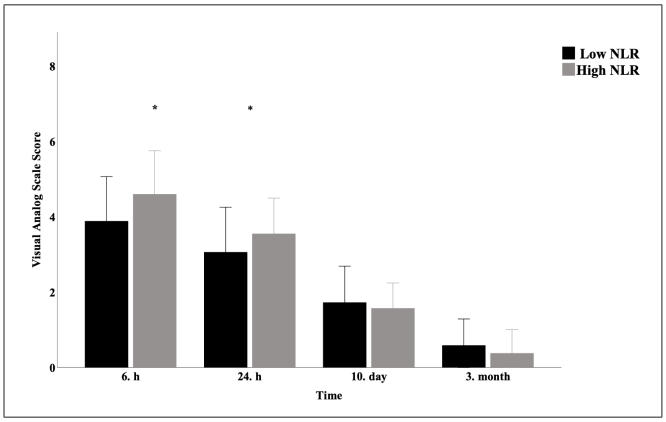


Figure 2. Postoperative visual analog scale score of the patients.

Table 3. Preoperative and Postoperative laboratory data

		Low NLR (n=51)	High NLR (n=42)	p
Hemoglobin, g/dL	Preoperative	15.2 (14.45-15.80)	15.2 (14.02-15.88)	0.991
	Postoperative	13.7 (12.95-14.35)	14.05 (13 -14.7)	0.224
	Decrease	1.6 (0.75-2.40)	1.15 (0.40-1.90)	0.116
WBC, K/μL	Preoperative	6.9 (6.15-8.00)	8.3 (6.65-10.07)	0.002*
	Postoperative	10.1 (8.2-11.25)	10.3 (8.72-11.38)	0.358
	Increase	2.3 (1.05-4.10)	2 (1.10-3.00)	0.204
NLR	Preoperative	1.5 (1.33-1.81)	2.55 (2.19-3.17)	<0.001*
	Postoperative	3.26 (2.19-4.9)	5.97 (3.22-7.96)	0.001*
	Increase	1.62 (0.68-3.23)	2.31 (0.85-5.42)	0.290
Preoperative CRP, mg/L		2.1 (0.95-3.40)	2.4 (1.10-4.90)	0.364

Values presented as median (IQR). The Mann–Whitney U test was used for the analysis of non-parametric variables. *p<0.05 is statistically significant. WBC: White Blood Cell, NLR: Neutrophil-to-Lymphocyte Ratio, CRP: C- Reactive Protein

Table 4. Postoperative Follow-up and Complication Data

	Low NLR (n=51)	High NLR (n=42)	p
Minor Complication	4 (7.8%)	3 (7.1%)	
Seroma	2 (3.9%)	3 (7.1%)	0.351
Hematoma	2 (3.9%)	0 (0%)	
Return to Daily Life/ Work, days	7 (5-8)	8 (7-9)	<0.001*
Rescue Analgesic Consumption, mg	125±52.3	157±63.0	0.005*

Values presented as mean ± SD, median (IQR) and number (%). Fisher's exact test was used for the analysis of categorical variables, while the Mann–Whitney U test was applied for the analysis of non-parametric variables. *p<0.05 is statistically significant. NLR: Neutrophil-to-Lymphocyte Ratio

reduction remains a subject of ongoing debate.[21] NLR is an effective biomarker that reflects the ratio between neutrophils, which represent acute inflammation, and lymphocytes, which are key immunomodulatory cells in the body.[22] In the literature, several studies have demonstrated that elevated preoperative NLR levels reflect an increased systemic inflammatory response, which may in turn be associated with greater postoperative pain severity.[6,7] In a retrospective study conducted by Turgut et al.[9], high preoperative NLR levels were found to be directly associated with increased analgesic requirements following orthognathic surgery. For instance, the use of tenoxicam was significantly higher in patients with NLR ≥2. In a retrospective study by Zhu et al.[23], elevated preoperative NLR was significantly associated with both postoperative complications and mortality in patients undergoing elective surgery. Indeed, in a retrospective study conducted by Kölükçü et al.[10], postoperative analgesic consumption was significantly higher in patients undergoing rhinoplasty who had preoperative NLR>2.[10] This finding supports the potential use of NLR as a biomarker for predicting increased pain intensity in the postoperative period. Similarly, in a study by Öner et al. involving patients who underwent arthroscopic rotator cuff repair, higher postoperative pain scores and greater analgesic requirements were observed in the group with a preoperative NLR of >2.[12] When the literature is reviewed, it is evident that studies evaluating this relationship specifically in the context of elective laparoscopic inguinal hernia repair, where the most effective method to reduce postoperative pain remains controversial, are quite limited. In our current study, the finding of significantly higher VAS scores at 6 and 24 hours postoperatively in patients with a preoperative NLR >2 suggests that systemic inflammation may contribute to increased early postoperative pain levels. In addition, mean rescue analgesic consumption was significantly higher in the High NLR Group, further supporting the association between elevated preoperative NLR and greater early postoperative analgesic requirement. These findings further suggest that an increased systemic inflammatory response may affect pain intensity. One possible underlying mechanism of this relationship may be the local inflammatory response induced by the nature of

the surgical procedure performed during inguinal hernia repair. In laparoscopic repair performed using the TAPP technique, a mesh is placed in the preperitoneal space and secured with tacker fixation. Additionally, closure of the peritoneal flap may cause peritoneal irritation and indirect stimulation of nerve endings. These surgical maneuvers may activate inflammatory processes by causing direct tissue trauma and perineural inflammation. In this context, patients with elevated systemic inflammation in the preoperative period may exhibit a more pronounced physiological response to surgical trauma, which may contribute to increased pain intensity in the early postoperative period. Moreover, the use of a standardized surgical protocol for all patients in our study minimized procedure-related variability, thereby allowing a clearer assessment of the impact of preoperative NLR levels on postoperative pain. Indeed, the postoperative increase in NLR levels was similar between the groups, which supports the inference that preoperative NLR may be an marker. These findings are consistent with the hypothesis that elevated preoperative NLR elicits a stronger inflammatory response to surgical stress, thereby exacerbating postoperative pain.

The choice of an NLR threshold of 2 in the present study was based on prior literature rather than data-driven optimization within our own cohort. In particular, previous surgical studies investigating the relationship between preoperative NLR and postoperative pain-related outcomes have repeatedly used the same threshold and demonstrated clinically meaningful differences between groups.[11] Turgut et al. used NLR ≥2 as an inflammatory threshold in orthognathic surgery and reported higher postoperative analgesic requirements in the higher-NLR group.[9] Similarly, Kölükçü et al.[10] and Öner et al.[12] categorized patients using a cut-off of 2 and reported greater postoperative analgesic consumption and/or higher acute pain levels in patients with higher NLR values. In addition, the use of a threshold around 2 has also appeared in broader surgical literature as a pragmatic dichotomization point.[13] Therefore, the use of the same threshold in our study was intended to preserve comparability with the existing literature and to provide a clinically interpretable classification.

Early return to daily life and work after laparoscopic inguinal hernia repair are key parameters in determining the success of the surgical technique.[24,25] However, we did not find any studies in the literature that specifically evaluated the relationship between preoperative NLR levels and the time to return to daily life/work in the context of inguinal hernia surgery. In our study, lower early postoperative pain scores in the low preoperative NLR group may have contributed to the shorter time to return to work and daily life in these patients. This finding suggests that systemic inflammation may not only represent a biological process but also act as a direct determinant of patients' functional recovery. Therefore, the preoperative NLR may be considered a potential biomarker not only for predicting pain intensity but also for estimating the rate of postoperative recovery, as reflected by a shorter time to return to work.

Postoperative complication rates in laparoscopic inguinal hernia repair are important criteria for assessing surgical safety and the patient's early recovery. In the literature, the complication rates for this surgical approach have been reported to range between 5% and 13%, with the vast majority being minor in nature (Clavien–Dindo Grade I–II).[26] However, we did not find any studies in the literature specifically evaluating the relationship between preoperative NLR and early postoperative complications in the context of inguinal hernia surgery. In our study, postoperative complication rates during the 3-month follow-up period were similar between the groups stratified by preoperative NLR levels, and all complications were classified as Grade I. This suggests that, in contrast to the significant predictive value of a high NLR for early postoperative pain and functional delay, NLR may not be a clinically relevant prognostic marker for early complications. Furthermore, the minimal incidence of complications in our cohort may be attributed to the standardization of the surgical protocol and the high level of surgical expertise, which aligns with existing literature supporting the safety of the TAPP technique.[27]

One of the key strengths of the present study is that it is among the few investigations to evaluate the relationship between NLR, a widely used marker of systemic inflammation, and postoperative pain levels and the recovery process in patients undergoing elective laparoscopic inguinal hernia repair. This study, which has the potential to directly contribute to clinical practice, demonstrates that preoperative assessment of NLR, a readily accessible and low-cost parameter, may allow the prediction of postoperative clinical outcomes. Moreover, the absence of statistically significant differences between the groups in key demographic variables such

as age, sex, BMI, comorbidities, and ASA score, as well as in intraoperative findings and postoperative laboratory parameters, supports the homogeneity of the sample in group comparisons. The fact that all operations were performed by the same surgeon using a standardized surgical protocol minimized the risk of procedure-related heterogeneity. In addition, we believe that assessing VAS scores at multiple time points are important factors that enhance the reliability of the results and methodological robustness of the study.

This study had several limitations. First, its retrospective and single-center design may have limited the generalizability of the findings. Unless supported by prospective multicenter studies, the applicability of these results to different patient populations and surgical teams may remain limited. Second, subjective pain assessment was restricted to the VAS score. This may not fully reflect individual variations in pain experience. Furthermore, the time to return to work was determined based on patient self-reports and clinical follow-up without evaluation using objective functional scores. Therefore, our findings should be validated in larger prospectively designed studies that incorporate objective measures. Finally, although the NLR threshold of 2 was selected in accordance with previous literature, it was not derived from ROC analysis in the present cohort. Therefore, this cut-off should be interpreted as a literature-based pragmatic threshold, and future studies with larger sample sizes may help determine the optimal threshold more precisely.

Conclusion

This study demonstrated that preoperative NLR levels in laparoscopic inguinal hernia repair may be associated with early postoperative pain intensity and functional recovery. The finding that patients with low preoperative NLR values had lower postoperative pain scores, lower analgesic consumption, and a shorter time to return to daily life/work suggests that NLR could be considered as a potential marker for pain management and patient recovery in the early postoperative period. However, given the retrospective design, limited sample size, and single-center nature of this study, the generalizability of these findings is limited. Therefore, prospective, multicenter studies with larger sample sizes are needed to validate the prognostic value of the NLR and strengthen its applicability in clinical practice.

Disclosures

Ethics Committee Approval: Ethical approval for the study was obtained from the Antalya Training and Research Hospital Medical Research Scientific Ethics Committee (No: 2025-122, Date: 17/04/2025).

Peer-review: Externally peer-reviewed.

Conflict of interest: The authors declare that they have no conflict of interest.

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Consent for publication: In accordance with the decision of the Antalya Training and Research Hospital Medical Research Scientific Ethics Committee and national guidelines for retrospective observational studies, the requirement for informed consent was waived.

Availability of data and materials: All data generated and analyzed during this study are included within the article and are available from the corresponding author upon reasonable request.

Author contributions: Concept – B.S., A.C., A.K., N.A.; Design – B.S., A.C., A.K., N.A.; Supervision – B.S., A.C., A.K., N.A.; Materials – B.S., A.C.; Data Collection – B.S., A.C., A.K.; Analysis and/or interpretation – B.S., A.C.; Literature Search – B.S.; Writing – B.S., N.A.; Critical Review – B.S., A.K.

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