Eurasian J. Chem. Med. Pet. Res., **(2027),** Volume 6, Issue 1, 72-80

Eurasian Journal of Chemical, Medicinal and Petroleum Research

Journal homepage: https://www.ejcmpr.com/

DOI: https://doi.org/10.5281/zenodo.21923574

Association Between Nasal Bone Fracture Severity and Short-Term Postoperative Complications

Ladan Nouri Bayat[1], Ali Reza Lotfi[2*]

[1]Assistant Professor of Otorhinolaryngology, Head and Neck Surgery, School of Medicine, Tabriz University of Medical Sciences, Tabriz, Iran

[2]Associate Professor of Otorhinolaryngology, Head and Neck Surgery, Department of Otorhinolaryngology, School of Medicine, Tabriz University of Medical Sciences, Tabriz, Iran

Article info
Received: 20.04.2026
Accepted: 13.08.2026
Available Online: 13.08.2026
Checked for Plagiarism: Yes

Keywords:
Nasal fracture; Fracture severity; Postoperative complications; Inflammatory response

ABSTRACT

Introduction: Nasal bone fracture is a common facial injury with potential early postoperative consequences, including pain, bleeding, edema, airway symptoms, and residual deformity. Fracture severity may influence these outcomes by reflecting the extent of structural and soft-tissue damage. This study aimed to determine short-term postoperative complications according to nasal bone fracture severity.

Material and methods: This descriptive cross-sectional study of 75 patients at Tabriz University of Medical Sciences in 2024 investigated the association between nasal bone fracture severity and early outcomes. Measured variables included demographics, fracture characteristics, surgical parameters, and short-term complications, including VAS pain score, epistaxis, edema, ecchymosis, and septal hematoma. Data were analyzed using normality testing, t-tests, Mann-Whitney U, and chi-square tests.

Results: Among 75 patients, severe/complex nasal fractures (n=34) were associated with worse short-term postoperative outcomes than mild/moderate injuries (n=41). Severe fracture patients experienced longer operations (41.53 ± 11.47 vs. 28.64 ± 8.12 minutes, $p<0.001$), higher 24-hour VAS pain (4.85 ± 1.56 vs. 3.42 ± 1.18, $p<0.001$), increased moderate/severe edema (61.76% vs. 26.83%, $p=0.002$), and more unplanned visits (26.47% vs. 7.32%, $p=0.027$). Severe fracture independently predicted early complications (adjusted OR=3.86, $p=0.020$).

Conclusion: Severe nasal bone fractures are independently associated with an increased risk of short-term postoperative complications. Patients with complex fracture patterns experience higher pain levels, more pronounced soft-tissue edema, and greater rates of early residual deformity, leading to more frequent unplanned clinical evaluations. Preoperative severity stratification can identify high-risk cases requiring closer early postoperative surveillance.

Introduction

Nasal bone fracture is the most common type of facial fracture because of the prominent and exposed position of the nose within the midface. It occurs across a wide range of age groups and is frequently encountered in emergency departments, trauma clinics, and otolaryngology or maxillofacial surgical practice. Although many cases are considered minor injuries, the functional and cosmetic consequences can be substantial, particularly when fracture

Corresponding Author: **Ali Reza Lotfi (AR_Lotfi@gmail.com - ORCID: 0000-0002-3050-5937)*
1 Email: ladan_bayat@gmail.com - ORCID: 0009-0007-3699-1116)

displacement, comminution, septal involvement, or associated soft-tissue trauma are present [1].

The clinical significance of nasal bone fracture extends beyond the initial traumatic event because even seemingly limited injuries may result in pain, edema, epistaxis, nasal obstruction, septal deviation, deformity, and patient dissatisfaction. The short-term postoperative period is particularly important, as this interval reflects the immediate consequences of both trauma severity and surgical intervention. Complications arising during this phase can influence recovery, need for revision, healthcare utilization, and overall treatment success [2].

Management of nasal bone fracture generally depends on the degree of displacement, fracture pattern, septal injury, timing of presentation, and surgeon preference. While closed reduction remains the standard approach for many uncomplicated fractures, more severe injuries may require more extensive manipulation, splinting, septal correction, or open intervention. As fracture severity increases, tissue trauma often becomes more pronounced, and this may create a biological and technical context that predisposes patients to adverse short-term outcomes after surgery [3].

In routine clinical care, postoperative evaluation after nasal fracture repair often focuses on the correction of alignment and the relief of obstruction. However, early complications such as persistent bleeding, infection, worsening edema, ecchymosis, residual deformity, airway compromise, pain, septal hematoma, and the need for unplanned clinical reassessment can substantially affect the quality of recovery. These outcomes may also increase emotional distress, delay return to normal activities, and reduce patient confidence in treatment [4].

Fracture severity is a clinically meaningful concept, yet its relationship with postoperative complications has not been sufficiently characterized in a consistent and outcome-oriented manner. Severity may include the extent of displacement, the presence of bilateral fractures, comminution, depression, instability, deviation of the nasal pyramid, and concomitant septal disruption. These characteristics are likely to reflect not only greater mechanical damage but also more extensive mucosal, vascular, and cartilaginous injury, all of which may influence postoperative healing [5].

The biological basis for expecting a link between greater fracture severity and worse short-term outcomes is plausible. More severe fractures generally involve broader soft-tissue injury, increased local inflammation, greater vascular disruption, and more extensive manipulation during reduction. This may contribute to amplified edema, persistent tenderness, impaired mucosal integrity, and a higher risk of hematoma or secondary deformity. In addition, technically difficult reductions may be more likely to leave residual instability or require repeated intervention, thereby increasing the burden of early postoperative morbidity [6].

From a surgical perspective, preoperative stratification according to fracture severity could improve planning, counseling, and postoperative surveillance. Patients with more severe injury patterns may benefit from closer monitoring for bleeding, airway compromise, or aesthetic dissatisfaction in the early postoperative period. They may also require more detailed informed consent regarding the possibility of persistent asymmetry, nasal obstruction, or further corrective procedures. Despite this practical relevance, the literature still lacks sufficient data linking severity categories directly to immediate postoperative complications in a structured manner [7].

A further challenge is that nasal bone fractures are often treated as homogeneous injuries in retrospective series, even though substantial heterogeneity exists in mechanism and anatomical disruption. Trauma due to interpersonal violence, falls, sports injuries, and road traffic accidents can generate markedly different force vectors and injury patterns. Patients may also differ in age, comorbidities, timing of presentation, and previous nasal deformity, all of which can influence postoperative recovery. Without accounting for fracture severity, interpretation of short-term outcomes remains incomplete [8].

Previous studies on nasal trauma have primarily emphasized epidemiology, timing of reduction, aesthetic outcomes, radiologic classification, or long-term functional sequelae. Although these domains are important, less attention has been directed toward the early postoperative phase as a discrete and clinically meaningful period of assessment. Short-term complications deserve focused investigation because they reflect the combined effects of trauma burden, perioperative management, and immediate wound-healing responses, and they may serve as early indicators of later dissatisfaction or revision needs [9].

Another reason to study this topic is the increasing emphasis on quality metrics in surgical care. Even in relatively brief procedures such as nasal fracture reduction, outcomes such as pain intensity, bleeding, unscheduled visits, infection, septal complications, and early residual deformity can meaningfully affect patient-centered care. Identifying severity-related risk patterns may help optimize discharge instructions, follow-up timing, analgesic strategies, and criteria for early intervention. Such evidence would support more tailored postoperative management rather than uniform care for all fracture types [10].

The relationship between fracture severity and early complications may also have implications for resource allocation in emergency and surgical settings. Patients with severe fractures may require more detailed imaging, longer procedural time, greater perioperative support, and more frequent postoperative assessment. In systems with limited resources, objective knowledge about which patients are at greater short-term risk could improve triage and allow clinicians to focus surveillance on those most likely to experience clinically significant postoperative events [11].

Importantly, the assessment of short-term postoperative complications should include both clinician-observed and patient-reported outcomes. Objective findings such as bleeding, infection, septal hematoma, or residual displacement are essential, but they do not fully capture the patient's postoperative experience. Pain severity, breathing difficulty, dissatisfaction with nasal appearance, and the perceived need for urgent reassessment are equally relevant in determining the real-world burden of surgery after nasal trauma. A severity-based framework may therefore improve both surgical and patient-centered outcome evaluation [12].

In addition, there is value in examining this issue within a defined institutional setting where treatment protocols, operative techniques, and postoperative care pathways are relatively consistent. Such an approach reduces some of the variation that often obscures associations in multicenter or highly heterogeneous datasets. By evaluating patients managed under similar clinical conditions, it becomes more feasible to isolate the contribution of fracture severity to early postoperative outcomes and to generate findings that may inform future comparative or multicenter studies [13].

Understanding whether severity predicts short-term complications is also important for communication with patients and families. Nasal fracture is frequently perceived as a straightforward injury with simple treatment, yet the expected recovery trajectory may vary considerably depending on the extent of structural damage. A more evidence-based explanation of risk can improve patient expectations, encourage adherence to postoperative instructions, and facilitate timely recognition of warning signs such as persistent bleeding, progressive obstruction, or worsening deformity after intervention [14].

Accordingly, the present study was designed to determine short-term postoperative complications in patients with nasal bone fracture according to fracture severity. By comparing early clinical outcomes across different levels of injury severity, this research seeks to clarify whether more severe fractures are associated with a greater burden of immediate postoperative morbidity. The findings may contribute to improved perioperative risk stratification, individualized follow-up planning, and more informed management of patients undergoing treatment for nasal bone fracture.

Material and methods

Study Design:

This descriptive cross-sectional study was conducted at Tabriz University of Medical Sciences in 2024 to evaluate short-term postoperative complications among patients with nasal bone fracture according to fracture severity.

Sampling

The required sample size was calculated using the Cochran formula for a single-population proportion in a descriptive cross-sectional study, and 75 patients were enrolled. Participants were selected using convenience sampling among eligible patients who presented to the study setting during the data collection period.

Inclusion/Exclusion Criteria

The study included patients with confirmed nasal bone fracture who underwent surgical management and had complete clinical records and postoperative follow-up data available for analysis. Patients were excluded if they had major facial trauma involving other bones, associated cranial or maxillofacial injuries requiring additional operative procedures, a history of previous nasal surgery or preexisting nasal deformity, congenital nasal abnormalities, active systemic infection, coagulation disorders, or incomplete medical records. Patients who declined participation or were lost to short-term follow-up were also excluded.

Procedure

After enrollment, demographic and clinical data were collected using a structured checklist. The severity of nasal bone fracture was determined based on preoperative clinical assessment and available imaging findings, and patients were categorized accordingly. The measured variables included age, sex, mechanism of injury, time elapsed from trauma to surgery, fracture laterality, degree of displacement, septal involvement, and the method of surgical treatment. Short-term postoperative outcomes were then recorded during the immediate recovery period and early follow-up. In addition, postoperative clinical variables were assessed, including pain intensity using the visual analogue scale (VAS), epistaxis, edema, ecchymosis, nasal obstruction, infection, septal hematoma, residual deformity, need for unplanned medical visit, and any requirement for additional intervention. Operative variables such as anesthesia type, procedure

duration, and intraoperative bleeding were also documented. All assessments were performed by the research team using a uniform data collection form to ensure consistency across participants.

Data Analysis

Data were analyzed using SPSS software. The normality of quantitative variables was assessed with the Shapiro-Wilk test. Normally distributed variables were reported as mean and standard deviation and compared using the independent samples t-test, whereas non-normally distributed variables were presented as median and interquartile range and analyzed using the Mann-Whitney U test. Categorical variables were summarized as frequencies and percentages and compared using the Ethics Committee of T Fisher's exact test, as appropriate. A p value of less than 0.05 was considered statistically significant.

Ethical Considerations

This study was approved by the Ethics Committee of Tabriz University of Medical Sciences with the ethics code IR.TBZMED.FMD.REC.1404.420. Written informed consent was obtained from all participants before enrollment, and confidentiality of patient information was strictly maintained throughout the study.

Results

The baseline demographic and clinical features of the study cohort, grouped by nasal fracture severity, are presented in Table 1. The study evaluated 75 patients, divided into a mild/moderate severity group (n=41) and a severe/complex group (n=34). There were no statistically significant differences between the two groups regarding mean age (31.46 ± 10.37 vs. 34.82 ± 12.19 years, p=0.203) or sex distribution (p=0.448). However, trauma etiology differed significantly (p=0.031), with interpersonal violence and motor vehicle accidents accounting for the majority of cases in the severe group, whereas falls were more common in the mild/moderate cohort. Notably, structural injury parameters showed high statistical significance, as bilateral fractures (82.35% vs. 34.15%, p<0.001) and concomitant septal involvement (73.53% vs. 21.95%, p<0.001) were substantially more prevalent in the severe fracture group. The average time elapsed from initial trauma to surgical intervention was slightly longer in the severe group, though this difference did not reach statistical significance (5.09 ± 2.43 vs. 4.27 ± 2.11 days, p=0.124).

Table 1. Baseline Demographic and Clinical Characteristics of Patients with Nasal Bone Fractures Stratified by Injury Severity

Parameter	Mild/Moderate Severity (n=41)	Severe/Complex Severity (n=34)	p-value
Age (years), Mean ± SD	31.46 ± 10.37	34.82 ± 12.19	0.203
Sex, n (%)	-	-	0.448
Male	29 (70.73%)	27 (79.41%)	-
Female	12 (29.27%)	7 (20.59%)	-
Etiology of Trauma, n (%)	-	-	0.031
Interpersonal Violence	11 (26.83%)	15 (44.12%)	-
Motor Vehicle Accidents	8 (19.51%)	12 (35.29%)	-
Falls	14 (34.15%)	4 (11.76%)	-
Sports/Other Injuries	8 (19.51%)	3 (8.82%)	-
Fracture Laterality, n (%)	-	-	< 0.001
Unilateral	27 (65.85%)	6 (17.65%)	-
Bilateral	14 (34.15%)	28 (82.35%)	-
Septal Involvement, n (%)	9 (21.95%)	25 (73.53%)	< 0.001
Time to Surgery (days), Mean ± SD	4.27 ± 2.11	5.09 ± 2.43	0.124

The surgical characteristics and short-term postoperative outcomes of the study population are summarized in Table 2. Patients with severe/complex nasal fractures required general anesthesia significantly more often than those with mild/moderate injuries (70.59% vs. 39.02%, p=0.008) and experienced significantly longer operative times (41.53 ± 11.47 vs. 28.64 ± 8.12 minutes, p<0.001). In the early postoperative phase, the severe fracture group reported significantly higher pain scores on the visual analogue scale at 24 hours (4.85 ± 1.56 vs. 3.42 ± 1.18, p<0.001).

Regarding early soft-tissue sequelae, the rates of moderate-to-severe edema (61.76% vs. 26.83%, p=0.002) and moderate-to-severe ecchymosis (52.94% vs. 21.95%, p=0.006) were significantly higher in the severe group. Although early postoperative epistaxis (26.47% vs. 9.76%, p=0.061) and septal hematoma (14.71% vs. 2.44%, p=0.076) were more frequent in the severe group, these differences did not reach statistical significance. Crucially, patients with severe fractures suffered from significantly higher rates of early residual deformity (23.53% vs. 4.88%, p=0.023) and required more unplanned clinical evaluations during the immediate follow-up period (26.47% vs. 7.32%, p=0.027).

Table 2. Surgical Parameters and Short-Term Postoperative Complications Stratified by Nasal Bone Fracture Severity

Parameter	Mild/Moderate Severity (n=41)	Severe/Complex Severity (n=34)	p-value
Anesthesia Type, n (%)	-	-	0.008
Local Anesthesia / Sedation	25 (60.98%)	10 (29.41%)	-
General Anesthesia	16 (39.02%)	24 (70.59%)	-
Operative Duration (minutes), Mean ± SD	28.64 ± 8.12	41.53 ± 11.47	< 0.001
Postoperative Pain (VAS at 24h), Mean ± SD	3.42 ± 1.18	4.85 ± 1.56	< 0.001
Postoperative Epistaxis, n (%)	4 (9.76%)	9 (26.47%)	0.061
Moderate/Severe Edema, n (%)	11 (26.83%)	21 (61.76%)	0.002
Moderate/Severe Ecchymosis, n (%)	9 (21.95%)	18 (52.94%)	0.006
Septal Hematoma, n (%)	1 (2.44%)	5 (14.71%)	0.076
Early Residual Deformity, n (%)	2 (4.88%)	8 (23.53%)	0.023
Unplanned Postoperative Visit, n (%)	3 (7.32%)	9 (26.47%)	0.027

The logistic regression analysis identifying predictors of short-term postoperative complications is presented in Table 3. In univariable analysis, severe/complex fracture pattern was significantly associated with a higher likelihood of postoperative complications (OR=4.92, 95% CI:1.78-13.61, p=0.002). Septal involvement, general anesthesia, and longer operative duration were also significantly related to increased postoperative morbidity. After adjustment for age, sex, time to surgery, septal involvement, anesthesia type, and operative duration, severe/complex fracture remained an independent predictor of short-term complications (adjusted OR=3.86, 95% CI:1.24-12.04, p=0.020). In contrast, septal involvement showed only a borderline association after adjustment (adjusted OR=2.68, 95% CI:0.84-8.56, p=0.096), while general anesthesia and operative duration were no longer statistically significant. These findings suggest that fracture severity has an independent contribution to early postoperative risk beyond procedural and anatomical factors, as shown in Table 3.

Table 3. Univariable and Multivariable Logistic Regression Analysis of Factors Associated with Short-Term Postoperative Complications

Variable	Univariable OR	95% CI	p-value	Multivariable Adjusted OR	95% CI	p-value
Severe/Complex Fracture	4.92	1.78-13.61	0.002	3.86	1.24-12.04	0.020
Age	1.03	0.99-1.07	0.118	1.02	0.97-1.06	0.402
Male Sex	1.41	0.46-4.33	0.548	1.18	0.34-4.13	0.793
Time to Surgery	1.17	0.95-1.44	0.138	1.09	0.86-1.39	0.479
Septal Involvement	3.74	1.35-10.39	0.011	2.68	0.84-8.56	0.096
General Anesthesia	2.95	1.08-8.09	0.035	1.72	0.51-5.79	0.383

Operative Duration	1.07	1.02-1.12	0.006	1.04	0.99-1.10	0.121

Discussion

The present study was designed to examine whether the severity of nasal bone fracture is associated with the incidence of short-term postoperative complications, with particular emphasis on the inflammatory burden that accompanies more extensive structural injury. Rather than viewing nasal trauma solely as a mechanical disruption requiring alignment correction, this study approached fracture severity as a potential determinant of early postoperative recovery through its relationship with tissue damage, mucosal edema, vascular congestion, and secondary inflammatory responses. In this context, the central aim was to clarify whether patients with severe or complex nasal fractures experience a greater burden of immediate postoperative morbidity than those with mild or moderate injuries, and whether fracture severity remains an independent predictor after adjustment for relevant clinical and operative factors [15].

The findings of this study showed a consistent pattern linking greater fracture severity with worse early postoperative outcomes. Although the two severity groups were broadly similar in age, sex distribution, and time to surgery, severe or complex fractures were significantly more often associated with bilateral injury and septal involvement. These patients also required general anesthesia more frequently, had longer operative duration, and demonstrated a higher frequency of several early postoperative complications, including more pronounced edema, greater ecchymosis, higher rates of residual deformity, and more unplanned postoperative visits. In regression analysis, severe or complex fracture remained an independent predictor of short-term complications, even after accounting for demographic and procedural variables. Taken together, these results suggest that fracture severity is not simply a descriptive anatomical category but a clinically meaningful predictor of postoperative risk [16].

One important explanation for these findings is the biological relationship between fracture severity and the magnitude of local inflammation. Severe nasal fractures generally involve greater disruption of periosteum, mucosa, subcutaneous tissue, and the osseocartilaginous framework, which leads to a more extensive inflammatory cascade in the early post-traumatic and postoperative periods. This process is characterized by vasodilation, increased vascular permeability, leukocyte recruitment, and interstitial fluid accumulation, all of which clinically manifest as edema, tenderness, congestion, and ecchymosis. The significantly higher rates of moderate to severe edema and ecchymosis observed in the severe fracture group are therefore biologically plausible and reflect the expected consequences of a stronger inflammatory response following greater tissue injury. These findings support the concept that postoperative morbidity after nasal fracture reduction is shaped not only by surgical technique but also by the inflammatory burden inherent to the initial trauma pattern [17].

The association between severe fracture and bilateral involvement or septal injury is also highly relevant to the interpretation of outcomes. Septal structures play a central role in both nasal support and airway patency, and injuries that extend beyond the nasal bones into the septum are more likely to produce instability, persistent mucosal swelling, and postoperative obstruction. Bilateral fractures similarly indicate a wider distribution of force across the nasal pyramid, often resulting in a more unstable osseous framework and a more challenging reduction. The high prevalence of these features in the severe group likely contributed to the increased frequency of early residual deformity and unplanned postoperative visits. In other words, the observed complications are not random postoperative events but predictable consequences of more extensive anatomical damage, which makes postoperative recovery less straightforward and more vulnerable to incomplete restoration of form and function [18].

The longer operative time and greater use of general anesthesia in the severe group also deserve consideration. More severe fractures often require more careful manipulation, repeated assessment of alignment, management of associated septal deviation, and sometimes a broader degree of intranasal intervention. These technical demands naturally prolong the procedure and may increase intraoperative tissue handling. Prolonged manipulation can intensify local swelling and microvascular disruption, thereby amplifying early postoperative inflammation and visible soft-tissue sequelae. The univariable association of general anesthesia and operative duration with complications likely reflects this relationship between case complexity and postoperative recovery. However, the loss of statistical significance after multivariable adjustment suggests that these factors may be secondary manifestations of severity rather than fully independent drivers of morbidity. This strengthens the interpretation that fracture severity itself captures a broader pathophysiological and technical burden than any single procedural variable alone [19].

The finding that severe or complex fracture remained independently associated with short-term

complications in the adjusted model is particularly important from a clinical standpoint. Even after accounting for age, sex, time to surgery, septal involvement, anesthesia type, and operative duration, the risk remained significantly elevated. This indicates that severity classification retains prognostic value beyond the obvious operative and anatomical correlates. Clinically, this means that a surgeon's early recognition of a severe fracture pattern may help anticipate which patients are more likely to develop postoperative swelling, persistent deformity, or the need for unscheduled reassessment. Such information is useful for tailoring follow-up intensity, counseling patients more realistically about recovery, and adopting preventive strategies aimed at minimizing inflammation and early morbidity. The independent effect observed in this study therefore supports severity-based postoperative planning rather than a uniform approach to all nasal fractures [20].

Another noteworthy aspect of the results is that some outcomes, such as postoperative epistaxis and septal hematoma, were more frequent in the severe group but did not reach statistical significance. This pattern should not be interpreted as evidence of no relationship. More likely, it reflects the modest sample size and the relatively low absolute frequency of these events, which can limit statistical power despite meaningful clinical differences. In practice, both postoperative bleeding and septal hematoma are complications that clinicians remain particularly concerned about because of their potential to compromise airway function, cartilage viability, and long-term structural integrity. The numerically higher rates in the severe group are consistent with the same mechanistic framework seen for edema and deformity, namely that more extensive trauma creates greater mucosal vulnerability and vascular instability. Larger future studies may clarify whether these trends become statistically robust in broader cohorts [21].

The increased rate of unplanned postoperative visits among patients with severe fractures is also highly informative because it reflects the patient-centered burden of early recovery. Unscheduled visits are often prompted by anxiety about appearance, persistent swelling, concern regarding bleeding, breathing difficulty, or dissatisfaction with initial postoperative progress. These visits therefore capture more than a binary clinical complication; they indicate that the postoperative course was sufficiently problematic to require additional healthcare contact. In this sense, the higher rate of unplanned review in the severe group reinforces the practical importance of severity stratification. Patients with severe fractures may benefit from closer scheduled follow-up, clearer discharge instructions about expected inflammatory symptoms, and more proactive communication regarding warning signs that should prompt reassessment. Such measures may improve satisfaction and potentially reduce preventable emergency presentations [22].

The current findings also align with a broader understanding of trauma surgery in which injury severity often predicts early postoperative outcomes through a combination of structural complexity and inflammatory stress. Although nasal bone fracture is frequently regarded as a relatively minor facial injury, the present results show that not all fractures behave similarly after intervention. Severe injuries appear to define a subgroup with a more difficult perioperative course and a more fragile early recovery profile. This has implications for both surgical decision-making and future research. Severity-based classification systems may be especially valuable if they are linked not only to radiologic description but also to recovery outcomes that matter to patients and clinicians. Integrating anatomical grading with early postoperative endpoints could improve the clinical relevance of nasal fracture research and help standardize reporting across studies [23].

Several considerations should be kept in mind when interpreting these findings. As a cross-sectional study conducted in a single institutional setting, the results provide a meaningful snapshot of early postoperative outcomes but cannot establish causality with the same strength as a prospective longitudinal design. In addition, the sample size, while appropriate for the study objectives, may have limited the ability to detect smaller between-group differences for less common complications. Nevertheless, the consistency of the main pattern across descriptive comparisons and adjusted regression analysis supports the overall validity of the findings. The use of clinically relevant outcomes and the inclusion of both anatomical and procedural variables add further strength to the study. Future investigations with larger samples, multicenter recruitment, and longer follow-up could determine whether the early inflammatory and structural disadvantages observed in severe fractures also translate into delayed functional recovery or greater revision rates [24].

Conclusion

This study demonstrates that the anatomical severity of nasal bone fractures has a significant impact on early surgical recovery and postoperative morbidity. Severe and complex fractures independently predict short-term complications, even after controlling for age, sex, septal involvement, and operative parameters. This increased risk is likely driven by greater local tissue trauma and a more intense postoperative inflammatory response.

Consequently, classifying nasal fractures by severity prior to surgery can provide valuable prognostic insights, helping clinicians optimize postoperative pain control, manage patient expectations, and implement individualized follow-up protocols.

Disclosure Statement

No potential conflict of interest reported by the authors.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Authors' Contributions

All authors contributed to data analysis, drafting, and revising of the paper and agreed to be responsible for all the aspects of this work.

References

[1] Atighechi, S., & Karimi, G. (**2009**). Serial nasal bone reduction: A new approach to the management of nasal bone fracture. *Journal of Craniofacial Surgery*, *20*(1), 49–52.

[2] Bartkiw, T. P., Pynn, B. R., & Brown, D. H. (**1995**). Diagnosis and management of nasal fractures. *International Journal of Trauma Nursing*, *1*, 11–18.

[3] Burm, J. S., & Oh, S. J. (**1998**). Indirect open reduction through osteocartilaginous incision and intranasal Kirschner wire splinting of comminuted nasal fractures. *Plastic and Reconstructive Surgery*, *102*, 342–349.

[4] Das, T. A., Aslam, A. S., Mangalath, U., Abida, R., Nair, R. B., & Soman, S. (**2018**). Evaluation of treatment outcome following closed reduction of nasal bone fractures. *Journal of Contemporary Dental Practice*, *19*(10), 1174–1180.

[5] Fertuzinhos, A., Teixeira, M. A., Ferreira, M. G., Fernandes, R., Correia, R., Malheiro, A. R., Flores, P., Zille, A., & Dourado, N. (**2020**). Thermo-mechanical behaviour of human nasal cartilage. *Polymers*, *12*(1), 177.

[6] Flint, P. W., Haughey, B. H., Robbins, K. T., Thomas, J. R., Niparko, J. K., Lund, V. J., & Lesperance, M. M. (**2014**). *Cummings otolaryngology: Head and neck surgery* (e-book). Elsevier Health Sciences.

[7] Han, D. G. (**2020**). Considerations for nasal bone fractures: Preoperative, perioperative, and postoperative. *Archives of Craniofacial Surgery*, *21*(1), 3.

[8] Han, D. S., Han, Y. S., & Park, J. H. (**2011**). A new approach to the treatment of nasal bone fracture: The clinical usefulness of closed reduction using a C-arm. *Journal of Plastic, Reconstructive & Aesthetic Surgery*, *64*(7), 937–943.

[9] Higuera, S., Lee, E. I., Cole, P., Hollier, L. H., & Stal, S. (**2007**). Nasal trauma and the deviated nose. *Plastic and Reconstructive Surgery*, *120*, 64S–75S.

[10] Hwang, K., Yeom, S. H., & Hwang, S. H. (**2017**). Complications of nasal bone fractures. *Journal of Craniofacial Surgery*, *28*(3), 803–805.

[11] Hwang, K., You, S. H., Kim, S. G., & Lee, S. I. (**2006**). Analysis of nasal bone fractures: A six-year study of 503 patients. *Journal of Craniofacial Surgery*, *17*(2), 261–264.

[12] Jung, S., Yoon, S., & Kim, Y. (**2022**). Epidemiology and patterns of nasal bone fracture in elderly patients in comparison to other age groups: An 8-year single-center retrospective analysis. *Archives of Craniofacial Surgery*, *23*, 205–210.

[13] Kang, B. H., Kang, H. S., Han, J. J., Jung, S., Park, H. J., Oh, H. K., & Kook, M. S. (**2019**). A retrospective clinical investigation for the effectiveness of closed reduction on nasal bone fracture. *Maxillofacial Plastic and Reconstructive Surgery*, *41*(1), 1–6.

[14] Kang, C. M., & Han, D. G. (**2017a**). Correlation between operation result and patient satisfaction of nasal bone fracture. *Archives of Craniofacial Surgery*, *18*(1), 25.

[15] Kang, C. M., & Han, D. G. (**2017b**). Objective outcomes of closed reduction according to the type of nasal bone fracture. *Archives of Craniofacial Surgery*, *18*(1), 30.

[16] Kelley, B. P., Downey, C. R., & Stal, S. (**2010**). Evaluation and reduction of nasal trauma. *Seminars in Plastic Surgery*, *24*, 339–347.

[17] Kim, B. H., Seo, H. S., Kim, A. Y., Lee, Y. S., Lee, Y. H., Suh, S. I., et al. (**2010**). The diagnostic value of the sagittal multiplanar reconstruction CT images for nasal bone fractures. *Clinical Radiology*, *65*, 308–314.

[18] Kim, H. Y., Kim, S. R., Park, J. H., & Han, Y. S. (**2012**). The usefulness of nasal packing with Vaseline gauze and airway silicone splint after closed reduction of nasal bone fracture. *Archives of Plastic Surgery*, *39*(6), 612–617.

[19] Kim, J. W., & Han, D. G. (**2023**). Clinical characteristics of pediatric nasal bone fractures by age group. *Archives of Craniofacial Surgery*, *24*, 273–277.

[20] Kim, K. S., Yu, S. C., Han, J. W., Shim, S. M., Kwak, S., Kim, Y. M., et al. (**2019**). Effect of fentanyl nasal packing treatment on patients with acute postoperative pain after closed reduction of nasal bone fracture: A randomized double-blind controlled trial. *Journal of Plastic Surgery and Hand Surgery*, *53*, 167–172.

[21] Landeen, K. C., Kimura, K., & Stephan, S. J. (**2022**). Nasal fractures. *Facial Plastic Surgery Clinics of North America*, *30*, 23–30.

[22] Lee, K., Yoo, B. H., Yon, J. H., Kim, K. M., Kim, M. C., Lee, W. Y., Lee, S., Lim, Y. H., Nam, S. H., Choi, Y. W., & Kim, H. (**2013**). General anesthesia versus monitored anesthetic care with dexmedetomidine for closed reduction of nasal bone fracture. *Korean Journal of Anesthesiology, 65*(3), 209–214.
[23] Nishioka, H., Kondoh, S., & Yuzuriha, S. (**2018**). Convex bone deformity after closed reduction of nasal bone fracture. *Journal of Plastic, Reconstructive & Aesthetic Surgery, 71*(1), 85–89.
[24] Yu, S. S., Cho, P. D., Shin, H. W., Rhee, S. C., & Lee, S. H. (**2015**). A comparison between K-wire splinting and intranasal gauze packing in nasal bone fracture. *Journal of Craniofacial Surgery, 26*, 1624–1627.