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Original Article

Comparison of packing-free treatment with and without Kirschner wire splinting for nasal bone fracture: a retrospective analysis in Korea

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Background: Nasal bone fractures are among the most common facial injuries. This study aimed to compare the clinical outcomes of a no-packing approach with and without Kirschner wire (K-wire) splinting in the treatment of less severe nasal bone fractures.

Methods: We conducted a retrospective study comparing cases of simple fractures classified as type II-III according to Higuera's classification that were treated surgically with closed reduction. Patients were divided into two groups: the control group (no packing, no K-wire splint) and the experimental group (no packing with K-wire splint). We calculated the difference in the distance (mm) between the centerline of the triangle and the apex on facial bone on computed tomography scans immediately after surgery and at a mean of 3.6 months after surgery, assessing postoperative symptoms at 3 days after surgery.

Results: The experimental group (no packing with K-wire splint) showed no statistically significant difference in radiological outcomes compared to the control group. The distance from the apex to the centerline of the triangle was 0.009±0.012 mm in the control group and 0.008±0.009 mm in the experimental group. However, the control group reported fewer postoperative symptoms, including nasal obstruction and dry mouth.

Conclusion: The packing-free approach without K-wire splinting may reduce postoperative discomfort without compromising surgical outcomes compared to K-wire splinting without packing.

Abbreviations: CT, computed tomography; K-wire, Kirschner wire

Keywords: Closed fracture reduction / Facial bones / Fracture healing / Nose

INTRODUCTION

Nasal bone fractures are among the most common facial injuries encountered in both traumatic and nontraumatic settings, representing a significant portion of maxillofacial traumas worldwide [1-3]. While nasal bone fractures are often considered nonlife-threatening, they can lead to significant functional and cosmetic concerns if not managed appropriately.

The management of nasal bone fractures has evolved over the years, with numerous techniques and approaches advocated by surgeons worldwide. Various surgical techniques exist for the treatment of nasal bone fractures, with closed reduction being commonly used for most less severe cases [4]. Following surgery, nasal splints are often utilized along with diverse packing materials for optimal postoperative management [4]. Kirschner wire (K-wire) splinting involves the placement of wires to stabilize the fractured nasal bones, while some practitioners opt for a minimal packing approach [5]. According to previous studies

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comparing the use of K-wire splinting without additional packing versus intranasal gauze packing after nasal bone fracture surgery, both methods maintain a comparable reduction effect up to 6 months after surgery. Additionally, the use of a K-wire splint resulted in fewer complaints of symptoms such as nasal obstruction and dry mouth.

The aim of this study was to compare the outcomes of a no-packing approach with K-wire splinting to those of a no-packing approach without K-wire splinting in the treatment of nasal bone fractures. By evaluating factors such as efficacy, complication rates, postoperative symptoms and patient satisfaction, we seek to contribute to the ongoing discourse surrounding optimal management strategies for this common facial injury. Understanding the advantages and limitations of each approach is crucial for clinicians making informed decisions tailored to individual patient needs, ultimately optimizing treatment outcomes and patient satisfaction.

METHODS

We conducted a retrospective review of 65 cases of nasal bone fractures from 2019 to 2024. This study focused exclusively on cases not accompanied by other facial fractures. We analyzed computed tomography (CT) scans and patient photographs immediately after surgery and at a mean of 3.6 months (range, 2.9–4.6 months) after surgery. Through this analysis, we compared changes in nasal reduction and investigated patient discomfort during packing. We conducted our study exclusively on patients classified as Higuera IIa-III based on CT scans (Table 1) [6]. Postoperative symptoms were assessed 7 days after surgery.

One surgeon performed all closed reduction procedures on all the patients under general anesthesia. Patients were divided into two groups: the control group received no intranasal packing and no K-wire (external splint only), while the experimental group received no intranasal packing and K-wire splinting with external splint. Among them, 32 patients were assigned to the experimental group (no packing with K-wire splint), whereas 35 patients comprised the control group (no packing without K-wire splint).

Table 1. Nasal bone fracture classification

Fracture type	Description
I	Soft tissue injury
IIa	Simple unilateral
IIb	Simple bilateral
III	Simple displaced
IV	Closed comminuted
V	Open comminuted or complicated

Classification according to Higuera et al. [6].

Surgical technique

Closed reduction under general anesthesia was conducted by manually reducing the nasal bone fracture via intranasal placement of a Boies elevator and/or Asch forceps, with external stabilization provided by the surgeon's thumb and index finger on the nasal dorsum to detect subtle osseous movements. When necessary, the nasal septum was aligned to the midline using Walsham forceps.

For the insertion of the K-wire, following fracture reduction, a nasal speculum was used to widen the nostril openings to facilitate visualization of the alar cartilage. Two 0.9-mm threaded K-wires were then gently inserted through the mucosa near the caudal border of the lateral cartilage on the fractured side, passing posteriorly along the nasal bone (Fig. 1). The insertion depth of the wires was verified by comparing external lengths, with wire ends cut just below the alar rim and bent using wire bending pliers. Confirmation via sagittal CT revealed distal tips

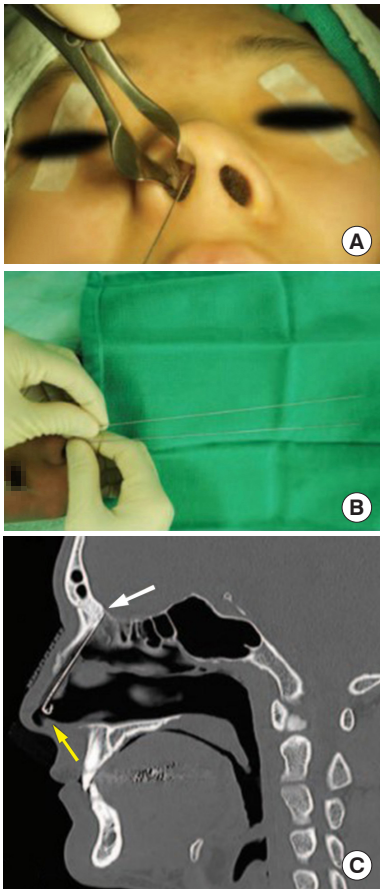

Fig. 1. Surgical method for closed reduction using K-wire nasal splinting. (A) Insertion of the Kirschner wire into the mucosa above the lateral cartilage. (B) Verification of K-wire placement by comparison with an additional K-wire. (C) A sagittal CT scan revealed the distal end beneath the frontal sinus floor (indicated by a white arrow) and the bent proximal end at the insertion point (marked by a yellow arrow), which is not externally visible.

positioned below the frontal sinus floor, with proximal tips bent at the mucosal insertion site. Similar procedures were employed if contralateral fracture reduction was needed. An external thermoplastic dorsal splint remained in place for 7 days. K-wire splinting was removed after 7 days during outpatient follow-up. In all groups, gauze packing was applied to control postoperative nasal bleeding and was removed as early as possible, typically within 1 day after achieving hemostasis. An external nasal splint was applied for 7 days in both the experimental and control groups.

Comparisons of the maintenance of support

We conducted CT scans on the operation day and at a mean of 3.6 months (range, 2.9–4.6 months) after surgery. To facilitate an unbiased comparison of the support provided to the reduced nasal bones among the groups, we marked a triangle on the axial view at both time points (Fig. 2A for operation day, Fig. 2B for 3 months). This triangle was delineated by points at the intersections of lines formed by the anterior walls of both the maxillae and the bilateral nasal bones, as well as by lines formed by the lateral surfaces of the nasal bone. We subsequently measured the distance from the apex to the triangle's centerline (Fig. 3).

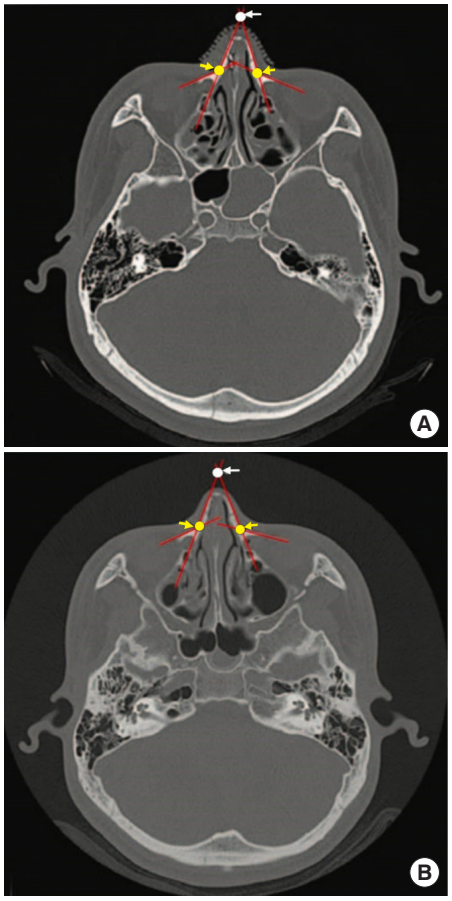

Fig. 2. Computed tomography axial views showing a triangle drawn. (A) On the day of surgery (B) a mean of 3.6 months post-surgery. The yellow arrows point to the intersections of the lines formed by the anterior walls of both maxillae and the bilateral nasal bones (yellow dots). The white arrow indicates the intersection (white dot) of the lines formed by the lateral surfaces of the nasal bone. The triangles formed by these three points were analyzed.

Postoperative symptoms and asymmetry

We assessed symptoms following surgery, including nasal pain, nasal obstruction, headache, dry mouth, decreased appetite, sleep disturbance, and discomfort, and assigned scores ranging from 1 to 5 points (1 = least severe to 5 = most severe). These symptoms were evaluated 3 days after surgery. Asymmetry was assessed postoperatively using both the surgeon's visual evaluation and the patient's assessment, each scored on a 5-point scale. Asymmetry was assessed at a mean of 3.6 months (range, 2.9–4.6 months) after surgery, during which postoperative CT scans were also performed.

Statistical analysis

The data were analyzed using PASW Statistics for Windows, version 18.0 (SPSS Inc.). We used the paired-sample *t*-test to compute the mean ± standard deviation and 95% confidence interval for preoperative and postoperative comparisons.

RESULTS

Patient characteristics

Among a total of 65 patients, 34 underwent nasal bone reduction surgery in the experimental group (no packing with K-wire splint), while the remaining 31 underwent reduction surgery in the control group (no packing and no K-wire splint). The mean ages of the patients in these groups were 35.5 years (range, 13–58 years) for the experimental group and 37.0 years (range, 17–57 years) for the control group. The mean number

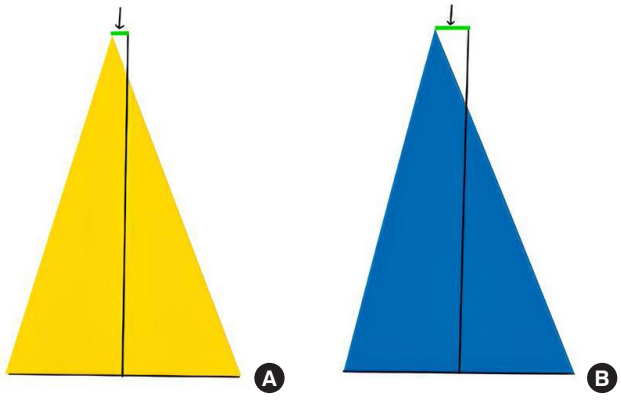

Fig. 3. Distance (green line) from the apex to the centerline of the triangle. (A) The day of surgery. (B) Mean 3.6 months after surgery.

Table 2. Demographic data for patients with nasal bone fractures

Variable	Packing-free	K-wire
No. of patients	34	31
Age (yr), mean (range)	35.5 (13–58)	37.0 (17–57)
Time to reduction (day), mean (range)	8 (3–13)	9 (3–12)
Sex, No. (%)		
Male	19 (55.9)	20 (64.5)
Female	15 (44.1)	11 (35.5)
Nasal fracture type, No. (%)		
Type IIa	8 (23.5)	9 (22.6)
Type IIb	19 (55.9)	17 (54.8)
Type III	7 (20.6)	5 (16.1)
Cause of injury, No (%)		
Slip	5 (14.7)	6 (19.4)
Violence	7 (20.6)	4 (12.9)
Sport	9 (26.5)	10 (32.3)
Collision	6 (17.6)	5 (16.1)
Traffic accident	3 (8.8)	3 (9.7)
Bicycle	4 (11.8)	3 (9.7)

of days from injury to reduction surgery was 8 days (range, 3–13 days) for the experimental group and 9 days (range, 3–12 days) for the control group. Type IIb nasal fractures constituted the majority, accounting for 55.9% in the experimental group and 54.8% in the control group. The most common cause of injury was sports in both groups (26.5% in the experimental group, 32.3% in the control group) (Table 2).

Comparison of accuracy and support

We compared the measurements of the length from the centerline to the apex of the triangle between the two groups, as assessed by CT imaging, immediately after surgery and at a mean of 3.6 months after surgery (Table 3). When the measurements at 3.6 months postoperatively were compared between the experimental group (no packing with K-wire splint) and the control group (no packing and no K-wire splint), no statistically significant difference was observed. Similarly, there was no statistically significant difference in the distribution of distance between the two groups immediately after surgery and at a mean of 3.6 months after surgery.

Comparison of complication rates and postoperative symptoms

Postoperative complications were investigated among patients, and no complications requiring separate intervention were found in both group (Table 4). Additionally, to assess patient satisfaction with the packing method, postoperative symptoms were examined. The items included nasal obstruction, nasal

Table 3. Distance between the center line of triangle and apex

Variable	Packing-free group (n = 34)	K-wire splinting group (n = 31)	*p*-value
Operation day (mm)	0.11 ± 0.05	0.10 ± 0.06	0.229
Mean 3.6 months after surgery (mm)	0.12 ± 0.05	0.11 ± 0.06	0.221
Change in distance (mm)	0.009 ± 0.012	0.008 ± 0.009	0.966

Values are presented as mean ± standard deviation.
Measured on the operation day and a mean of 3.6 months (range, 2.9–4.6 months) after surgery.

Table 4. Demographic data for patients with nasal bone fractures

Variable	Packing-free group (n = 34)	K-wire splinting group (n = 31)	*p*-value
Complication (number)	0	0	
Postoperative symptoms (score)[a]			
Nasal obstruction	1.12 ± 0.33	1.45 ± 0.57	0.006
Nasal pain	2.08 ± 0.62	2.42 ± 0.76	0.061
Headache	1.47 ± 0.66	1.48 ± 0.68	0.937
Dry mouth	2.02 ± 0.52	2.52 ± 0.63	0.001
Loss of appetite	1.24 ± 0.50	1.55 ± 0.57	0.021
Sleep disturbance	1.17 ± 0.46	1.32 ± 0.48	0.212
Swallowing difficulty	1.82 ± 0.52	2.32 ± 0.83	0.006
Asymmetry rating	2.11 ± 0.64	2.03 ± 0.55	0.564

Values are presented as mean ± standard deviation.
[a]Score: 1 (least severe) to 5 (most severe).

pain, headache, dry mouth, loss of appetite, sleep disturbance, swallowing difficulty, and asymmetry rating. Except for the asymmetry rating, the mean scores for all items were lower in the control group than in the experimental group, with nasal obstruction, dry mouth, loss of appetite, and swallowing difficulty showing statistically significant lower scores ($p < 0.005$). Moreover, there was no statistically significant difference in asymmetry rating complaints reported by patients between the two groups.

DISCUSSION

Nasal bone fractures are commonly observed in individuals who sustain facial trauma, often due to sports injuries, motor vehicle accidents, and assaults [1,2.7]. Nasal fractures typically present with symptoms such as nasal deformity, pain, epistaxis, and difficulty breathing through the nose [8]. Timely recognition and assessment are crucial for determining the appropriate treatment approach. Accurate diagnosis involves thorough clinical examination, nasal endoscopy, and imaging techniques such as CT scans to evaluate the severity and displacement of fractures, as well as to identify associated injuries to the nasal septum or sinuses [9]. Management options range from non-

surgical methods such as closed reduction to surgical interventions such as open reduction with internal fixation [10]. The choice of treatment depends on factors such as the complexity of the fracture, degree of displacement, and patient preferences.

After surgery, extranasal splinting and intranasal splinting and packing are commonly used, with various intranasal packing materials employed to maintain reduction postoperatively [11]. Patients often complain of discomfort, such as foreign body sensation, nasal congestion, dry mouth, headache, and other discomforts, when intranasal packing is applied [12]. To prevent these issues, methods such as nasal packing with ventilation tubes, silastic sheets or silicone splints, and intranasal K-wire splinting are utilized [11-13]. Previous studies have compared the distance (mm) between the centerline of the triangle and apex at and between 1 day and 6 months after surgery between groups treated with a K-wire splint and those treated with Vaseline gauze packing [14]. They also compared postoperative symptoms and asymmetry ratings and reported that the group treated with K-wire splinting presented fewer postoperative symptoms and less variation in the distance (mm) between the centerline of the triangle and the apex after surgery.

Therefore, we compared the outcomes between the experimental group (no packing with intranasal K-wire splint) and the control group (no packing and no K-wire splint) in patients with simple nasal bone fractures classified as type IIa to III according to Higuera's classification [6]. For accurate comparison, we quantified the length from the centerline to the apex of the triangle between the two groups immediately after surgery and at a mean of 3.6 months after surgery. Moreover, to assess potential postoperative symptoms that patients may experience following nasal bone fracture surgery, including nasal obstruction and patient-perceived asymmetry ratings, we conducted a survey comprising eight items.

When the change in distance (mm) between the centerline of the triangle and the apex at a mean of 3.6 months after surgery was compared between both groups, no statistically significant difference was observed ($p < 0.05$). Furthermore, according to previous research results, intranasal gauze packing also did not significantly differ from K-wire splinting without additional packing [14]. According to our symptom survey, the packing-free approach was associated with fewer patient-reported postoperative symptoms, such as nasal obstruction and dry mouth, compared to the K-wire splinting group. The increased symptoms observed in the K-wire group may be attributed to several factors. K-wire fixation, while commonly employed, is associated with increased irritation or discomfort at the site of wire insertion. Additionally, the presence of the wire may lead to a prolonged healing time or heightened tissue reaction, further contributing to the symptoms experienced by this group. Moreover, both groups showed no statistically significant difference in patient-reported complaints regarding asymmetry.

Through this study, it can be inferred that avoiding nasal packing after closed reduction in patients with simple nasal bone fractures may reduce the incidence of postoperative symptom complaints among patients. This approach is also unlikely to significantly affect post-surgical bone alignment compared with K-wire splinting. Therefore, the packing-free approach can be considered for managing type II and type III nasal bone fractures because it shows marginal differences in postoperative shape deformation compared with K-wire splinting while also reducing the incidence of patient-reported symptoms.

NOTES

Conflict of interest

No potential conflict of interest relevant to this article was reported.

Funding

None.

Ethical approval

The study was approved by the Institutional Review Board of Inje University Ilsan Paik Hospital (IRB No. ISPAIK 2024-08-019-001).

Patient consent

The patient provided written informed consent for the publication and use of her images.

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