Considerations for nasal bone fractures:
Preoperative, perioperative, and postoperative

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INTRODUCTION
In recent years, the incidence of nasal bone fractures has increased concomitantly with increasing social complexity and a greater frequency of sports activities. Although fracture reduction is relatively simple, and most fractures can be corrected in a short surgical procedure, the postoperative results of the surgical correction of nasal bone fractures tend to be relatively unsatisfactory, with complication rates that are higher than desired [1-4].

These problems result from several issues, including inaccurate recognition and interpretation of various aspects of fractures; inaccurate surgical planning, which results in undercorrection or overcorrection; failure to perform proper management of the septum; complications related to nasal packing and its removal; postoperative management; and patients’ level of satisfaction in light of potential complications. In this review, we discuss preoperative, perioperative, and postoperative considerations that surgeons should keep in mind to optimize the outcomes of nasal bone fracture correction.

Keywords: Bone / Closed fracture reduction / Fractures / Nasal bone

PREOPERATIVE CONSIDERATIONS
Preoperatively, clinicians should meticulously interpret both two-dimensional and three-dimensional imaging in order to properly recognize and interpret clinically relevant aspects of the fracture. According to Park et al. [5], it is sometimes difficult to diagnose nasal bone fractures through simple X-rays, which showed a sensitivity of 62% for diagnosing nasal bone fractures. In the report of Min et al. [6], the sensitivity of simple X-rays was 71.9% in children and 80.9% in adults. Kim and Hwang [7] reported that the sensitivity and specificity of computed tomography (CT) readings were 95.0% and 92.9%, respectively. The positive predictive value of CT readings was 99.3%. In 17.1% of cases, a reading of “nasal bone fracture” did not clinically correspond to a nasal bone fracture, while readings of “no nasal bone fracture” or “old nasal bone fracture” clinically corresponded to a nasal bone fracture in 3.3% of cases.

In addition, three-dimensional imaging may be inferior to simple radiography or CT in determining the presence of a fracture, but if a clear and sharp fracture line is present, three-dimensional imaging has been reported to be useful for determining the extent of the fracture, the extent of the depression, and the degree of deviation or displacement [8]. Additionally, Han et al. [9] reported that fracture patterns predicted by resi-
dents and plastic surgeons based on simple radiography and
two-dimensional CT images were very different from the actual
characteristics of nasal bone fractures according to three-di-
-dimensional CT scans. Therefore, it is necessary to obtain more
accurate information on fracture status, including the range of
the fracture, the degree of deflection or displacement, and the
overall characteristics of the fracture through three-dimen-
sional imaging.

PERIOPERATIVE CONSIDERATIONS

Precise surgical plan and optimal reduction
When operating on a fracture, even if the case appears to be
routine, it is necessary to create a precise surgical plan to avoid
undercorrection or overcorrection, to minimize iatrogenic
damage, and to reduce the operating time by minimizing the
information that must be obtained from three-dimensional im-
ageing. It is preferable to perform dorsal pyramidal reduction
first, in order to secure space for restoring fractured segments
of the lateral nasal wall and the frontal process of the maxilla to
their anatomical positions. Then, reduction of depressed lateral
nasal walls, the frontal process, and/or outward-deviated lateral
nasal walls can be done.

Nasal septum management
After completing bony reduction, it may be easy to overlook
management of the septum; however, it is difficult to obtain ex-
cellent results without addressing septal problems.

The author usually manipulates areas of septal deviation with
a long nasal speculum and a No. 3 knife handle wrapped with a
Vaseline gauze, by pushing the septum from the convex side to
the concave side and ensuring that the septal line is as straight
as possible.

Retouching areas of bony reduction
After manipulating areas of septal deviation and confirming the
alignment of the bony reduction with its the anatomical posi-
tion, it is preferable to perform additional bony reduction fol-
lowing the initial sequence of reduction, because when insert-
ing a long nasal speculum and spreading it out in the nasal cav-
ity, manipulation of the septum with a knife handle may disturb
the alignment of the nasal pyramid, which contains fractured
segments that have already been reduced.

Nasal packing and securing the nasal airway
After reduction, a roll of Vaseline gauze is packed in the dorsal
nasal cavity (only on the side that was depressed preoperatively)
to support the reduced bone fragments. Merocel packs can be
placed in both nasal airways. Before finishing the operation, it
is necessary to ensure the absence of an excessive amount of
blood clots in the throat or ongoing posterior nasal bleeding. In
most cases, many blood clots are present in the throat after re-
duction of a nasal bone fracture, so the author removes them
using a mouth gag and suction immediately, and then checks
whether there is ongoing posterior nasal bleeding. If nasal
bleeding is present, wet gauze is packed in the posterior nasal
airway and nasal tip compression is performed repeatedly until
the bleeding stops, as confirmed visually. After verifying that
nasal bleeding has stopped, the author finishes the operation
after applying an external nasal thermo-splint.

POSTOPERATIVE
CONSIDERATIONS

Timing of packing removal
Closed reduction with nasal packing for 3 to 7 days is the usual
procedure for managing a nasal bone fracture. Most patients
experience severe discomfort because nasal breathing is impos-
sible [10,11]. Many reports have investigated ways to reduce
patients’ discomfort and complications, but the general consen-
sus is that the appropriate duration of nasal packing is 3 to 7
days [11-14]. However, in a previous study of the effect of early
removal of nasal packing, the author analyzed 92 cases in which
Merocel packs were removed 6 hours after the operation and
the packed rolls of Vaseline gauze were removed 1 day after the
operation to increase patients’ comfort. No significant differ-
ce in outcomes was found, and 1 day after the operation (af-
ter the nasal filling had been removed), most of the patients had
no complaints of discomfort, with the exception of five with
headache, one with nausea, and two with generalized discom-
fort (Fig. 1) [15]. Another previous study reported that reduced
nasal segments tended to undergo progressive remodeling; fur-
thermore, postoperative outcomes continued to improve over
the first month postoperatively despite the early removal of na-
sal packings, and early packing removal contributed to an in-
crease in patient satisfaction by reducing discomfort [16].

Patient satisfaction
Several studies have reported the results of nasal bone fracture
reduction in terms of patient satisfaction and/or the complica-
tion rate [1-3,17]. However, patient satisfaction is subjective and
is limited to an evaluation of the results of the operation and the
factors that influenced the results. Additionally, in some cases,
patients were not satisfied with the results of the procedure
even though there were no problems as evaluated by the clini-
cian subjectively and by CT scans objectively. Nevertheless, the
author reported that outcomes assessed on CT scans were correlated with overall patient satisfaction, and suggested that it is preferable to evaluate the correlations between subjective and objective postoperative results using both CT images and patient satisfaction [18].

Complications

Lee et al. [4] reported the complication rates of different types of fractures in the Stranc and Robertson classification, and found that fractures caused by lateral impacts resulted in more nasal deformities than those caused by frontal impacts. Sam et al. [19] investigated the association between septal deviation of the nose and external nasal deformities. Murray [20] reported that cartilaginous bending of the septum led to long-term nasal deviation after a nasal manipulation that initially appeared satisfactory.

In a previous study, the author reported that the complication rates of fractures belonging to types FI, LII, and C were statistically significantly higher than those of fractures categorized as FII and LI (FI, frontal impact group type I; FII, frontal impact group type II; LI, lateral impact group type I; LII, lateral impact group type II; C, comminuted fracture group). However, there were no statistically significant differences in the complication rates between the FII and LI groups, or between the FI, LII, and C groups (Table 1). Additionally, no statistically significant differences were found in the incidence of complications according to the presence or absence of septal fracture or deviation for each fracture type. However, the p-value for the difference in the total group was 0.046, corresponding to a statistically significant difference in the complication rate according to the presence of septal fracture or deviation in the total group of nasal bone fractures (Table 2) [18].

**CONCLUSION**

The goal of treatment of nasal bone fractures is to restore the

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**Table 2.** Comparison of the complication rate according to the presence of a septal fracture

<table>
<thead>
<tr>
<th>Fracture type</th>
<th>Septal fracture</th>
<th>p-value*</th>
</tr>
</thead>
<tbody>
<tr>
<td>-</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>FI</td>
<td>2 (5.13)</td>
<td>4 (8.89)</td>
</tr>
<tr>
<td>FII</td>
<td>0</td>
<td>1 (4.76)</td>
</tr>
<tr>
<td>LI</td>
<td>2 (3.39)</td>
<td>2 (5.56)</td>
</tr>
<tr>
<td>LII</td>
<td>1 (8.33)</td>
<td>11 (14.86)</td>
</tr>
<tr>
<td>C</td>
<td>0</td>
<td>3 (15.00)</td>
</tr>
<tr>
<td>Total</td>
<td>5 (4.27)</td>
<td>21 (10.71)</td>
</tr>
</tbody>
</table>

Values are presented as number (%).

FI, frontal impact group type I; FII, frontal impact group type II; LI, lateral impact group type I; LII, lateral impact group type II; C, comminuted fracture group.

*Chi-square test.


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**Fig. 1.** Patients’ complaints at 1 day after the operation. Reprinted from Han et al. Arch Craniofac Surg 2012;13:119-24 [15].

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**Table 1.** Complications of nasal bone fractures

<table>
<thead>
<tr>
<th>Complications</th>
<th>FI (-)</th>
<th>FII (-)</th>
<th>LI (-)</th>
<th>LII (-)</th>
<th>C (-)</th>
<th>Total</th>
<th>p-value*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hump nose</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Saddle nose</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Nasal widening</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Deviated nose</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>3</td>
<td>12</td>
</tr>
<tr>
<td>Nasal airway obstruction</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Hypoesthesia</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>2</td>
<td>4</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>26</td>
<td></td>
</tr>
<tr>
<td>Complication rate</td>
<td>6 (7.14)</td>
<td>1 (4.00)</td>
<td>4 (4.21)</td>
<td>12 (13.95)</td>
<td>3 (13.04)</td>
<td>26 (8.31)</td>
<td>&lt; 0.001*</td>
</tr>
</tbody>
</table>

Values are presented as number or number (%).

FI, frontal impact group type I; FII, frontal impact group type II; LI, lateral impact group type I; LII, lateral impact group type II; C, comminuted fracture group.

Scheppe multiple comparison result: FI, LI < FII, LII, C. *One-way analysis of variance; **Complication rate by fracture type.

nose—in terms of both appearance and function—to its pre-trauma state. Therefore, to obtain more favorable surgical results, several preoperative, perioperative, and postoperative considerations should be kept in mind.

NOTES

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

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REFERENCES