Nasal Bone Fracture Reduction

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Abstract

This prospective study of 68 patients was performed to analyze the clinical features, diagnosis, treatment and classification of nasal bone fractures. All patients underwent a complete history, physical examination, and plain radiographic evaluation. The most common age group was 11-30 years which comprised 67.64% of the patients. Male preponderance was 5:1. Violence was the most common cause accounting for 42.65% of the cases. Violence accounted for 35% of fractures in males and 82% of the fractures in females. Displacement is the most common type of nasal bone fracture (33.82%). The mean duration for fracture reduction after sustaining injury in our study was approximately 30 hours after the injury. All adult patients with a displaced fracture underwent closed reduction under local anesthesia. In children, mandatory general anesthesia was given. All patients were satisfied with their aesthetic outcome.

Introduction

The nose being is one of the most projected parts of the body and, thus, is highly susceptible to injury. Nasal fractures may cause both cosmetic disfigurement and functional problems. A timely intervention within two weeks brings the nasal structures back into its original position/ Delayed intervention may necessitate Rhinoplasty (osteotomy) to correct the external deformities either during the primary procedure or during a staged reconstruction. The nasal pyramid's main structures are two thin plates of nasal bones. Hence it is highly vulnerable to external injuries, especially vehicular accidents, sports injuries, and violence. Though
such injuries are not life threatening they can cause external nasal deformities, cosmetic disfigurement of the face and breathing difficulty through the nose.\textsuperscript{2}

**Nasal Bone Anatomy:**

The paired nasal bones form the upper portion of the nasal pyramid while the lower part consists primarily of the upper lateral cartilage. The nasal bones articulate superiorly with the frontal bone and laterally with the frontal process of the maxilla. Inferiorly, they articulate with the upper lateral cartilage in a cantilever fashion (Figure 1). Nasal bones are thick in the upper portion and thin in the lower portion hence most of the fractures occur in the lower portion. The septum is divided into a posterior bony portion and an anterior cartilaginous portion. The bony posterior portion is comprised superiorly by the perpendicular plate of the ethmoid bone and inferiorly by the vomer bone. The septal cartilage forms the anterior portion of the nasal septum. The most superior portion of the bony septum is sandwiched between the two nasal bones, hence a tripod is formed. Understanding the anatomy of this structure is essential for the surgeon who treats nasal fractures.

**Aims and Objectives:**

- To analyze nasal bone fractures with regards to its clinical features, diagnosis and treatment.
- To classify nasal bone fractures and their pattern.

**Methods**

This prospective study of 68 cases of nasal bone fractures was conducted over a two year period at the Department of Otolaryngology-Head and Neck Surgery, M.P. Shah Medical College, Jamnagar, India. Only those patients having a simple nasal bone fracture free of any other life-threatening injuries and with a stable neurological condition were included in the study. Undisplaced fractures were also included in the study.

Patients were evaluated according to the following criteria: Complete history was taken for estimation of location, magnitude, and direction of the blow(s), the nature of the applied force with respect to force per unit of area. The appearance and function of the nose before the injury was ascertained whenever possible. Knowledge of previous injuries to the nose may offer insight into preexisting deformities which may require an open surgical approach. Information pertaining to loss of consciousness, a history of change in visual acuity, gaze restriction, diplopia, regional anesthesia/hypoesthesia, or epiphora, anosmia or hyposmia, complaints of malocclusion and sensory deficits in the cheek and anterior dentition was obtained to rule out injuries to the surrounding structures.

Photographs of the patient taken before the injury, if available, can be of help in providing a gross baseline of nasal contour and midline relationships and particularly for medico-legal purpose. Unfortunately, we were unable to procure preoperative photographs in any of our cases as reduction was carried out as an emergency procedure.

A thorough external assessment of the nose under adequate lighting was done with the patient seated in a slightly reclined position. The external nose was examined from the frontal view and from both sides with oblique and lateral views. Nasal bones were palpated to detect crepitation which confirms the presence of a nasal bone fracture. Although the examination is a painful procedure for the patient, it is very important
in those cases where x-ray of the nasal bone is inconclusive regarding fracture or displacement. Anterior rhinoscopy was done to evaluate the position of the septum.

All patients underwent radiographic evaluation with right and left lateral views of the nose. Radiological examination is very important for the medico-legal documentation as once the fracture is reduced; the evidence of the fracture can no longer be detected. Fractures were classified according to the following simple classification: Displacement type, depressed type, mixed type, non-deformation type, and unclassified type (because of facial swelling).

Preoperative and postoperative photographs were taken in 4 views (frontal, basal, right and left lateral and oblique lateral.) All the adult patients which had nasal bone or septum displacement underwent closed reduction under local anesthesia. In children, reduction was done with general anesthesia. If there was no edema at the time of presentation, the reduction was carried out immediately. If edema was present at the time of presentation, the reduction was deferred till edema subsided which was an average of 3-7 days in our study. For those patients who had an undisplaced fracture of the nasal bone, reduction was not carried out, and micropore tape was applied on the skin overlying the nasal bones to prevent splaying.

**Technique of Local Anesthesia:** Both nasal cavities were packed with 4% Xylocaine, approximately 30-45 minutes before reduction. The infratrochlear nerve, near the medial canthus area, and the external-nasalis nerve, over the dorsum, is blocked by injecting 2% Xylocaine through the intercartilagenous area. The infraorbital nerve is blocked either through the intercartilagenous area or by injecting directly through the cheek skin. The naso-palatine nerve is blocked by injecting at the philtrum area (Figure 2). A few milliliters of 2% Xylocaine are injected on either side of the septum. **Enlarged Pictures At End Of Manuscript**

![Figure 1: Nasal Anatomy](image1.png)  ![Figure 2: Nasal Anesthesia](image2.png)

**Reduction steps:** It is very important to assess the direction of force of injury. Commonly, the trauma produces an outward fracture of the nasal bone on one side. (Convexity of the nasal bone on one side and concavity of the nasal bone on the other side- Figures 3, 4 and 5).

**Enlarged Pictures At End Of Manuscript**
Walsham’s Forceps (Figures 6 and 7) are first introduced with guarded force, without any jerky movement, on the convex side of the nasal cavity. Next, the fracture is first disimpacted by the outward (lateral) movement with Walsham’s Forceps, then impacted back by the inward or medial movement. Usually there is a click sound when the fracture is reduced. **Enlarged Pictures At End Of Manuscript**

Thus, first the fracture is increased and then decreased. A similar procedure is done on the other side (Displacement and realignment of nasal process of maxilla). It is important to put rubber tubing on the outer blade of the Walsham’s Forceps to prevent tissue damage. We used a red rubber catheter. Since the nasal skeleton is a tripod structure with delicate balance of the two nasal bones with the septal bone sandwiched in between, it is important to bring alignment of the septum back to its original position. Thus, in all cases, the nasal septum is lifted by pulling forward using an Asch’s Forceps (Figures 8 and 9) (Disimpaction of the nasal bone). This straightens the anterior portion of the nasal septum.
This step is repeated again and the Asch’s Forceps is inserted further posteriorly and forward. Upward traction is then applied. This step also brings back the posterior portion of the septum into proper alignment with the premaxillary crest (Septum manipulation). The nasal bones are always supported by the surgeon’s fingers while maneuvering with the Asch’s Forceps. Usually brisk bleeding is encountered at this stage which can be controlled by a temporary nasal pack and suctioning the throat. Using medial digital pressure the nasal skeleton is molded (see Figure 10 - molding the nasal pyramid and skeleton). This maneuver should bring the nasal pyramid and external nose into proper alignment (Figure 11 and 12). If it is not in the proper position and alignment, these steps are repeated again. Anterior rhinoscopy is performed to evaluate the final position of the septum and also nasal patency.

If there is a depressed fracture, the lifting of the septum with Asch’s Forceps (Figures 8 and 9) is initially carried out. The advantage of using the Ashe’s Forceps is that it prevents the crushing of the septum and the columella.

If there is an open wound, it is closed with appropriate sutures in a routine fashion. Before leaving the operating suite, all patients who underwent a local anesthetic procedure were shown the final result with a mirror and asked to reconfirm the original shape of the nose. Since the patients are always conscious, they are able to tell the surgeon whether the nose is back to its normal position or not. A light anterior nasal pack is inserted. Micropore tape (Figure 13) in strips is applied over the dorsum of the nose overlapping 1/3 of the previous tape to prevent displacement of the nasal bones. POP cast (Figure 14) is applied for three weeks.
Results

84% were male while 16% were female with male preponderance of 5:1. The majority of the patients were between the ages of eleven to thirty years (67.64%) (Table 1).

<table>
<thead>
<tr>
<th>Age in Years</th>
<th>Male</th>
<th>Female</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 10</td>
<td>6 (9%)</td>
<td>1 (1%)</td>
<td>7 (9%)</td>
</tr>
<tr>
<td>11 to 20</td>
<td>15 (22%)</td>
<td>3 (4%)</td>
<td>18 (26%)</td>
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<tr>
<td>21 to 30</td>
<td>24 (35%)</td>
<td>4 (6%)</td>
<td>28 (41%)</td>
</tr>
<tr>
<td>31 to 40</td>
<td>6 (9%)</td>
<td>0 (0%)</td>
<td>6 (9%)</td>
</tr>
<tr>
<td>41 to 50</td>
<td>4 (6%)</td>
<td>0 (0%)</td>
<td>4 (6%)</td>
</tr>
<tr>
<td>51 to 60</td>
<td>1 (1%)</td>
<td>0 (0%)</td>
<td>1 (1%)</td>
</tr>
<tr>
<td>&gt; 60</td>
<td>1 (1%)</td>
<td>0 (0%)</td>
<td>1 (1%)</td>
</tr>
<tr>
<td>Total</td>
<td>57 (84%)</td>
<td>11 (16%)</td>
<td>68 (100%)</td>
</tr>
</tbody>
</table>

Traffic accidents were the most common cause in males (35.29%) while violence was the most common cause in females (13.24%). Overall violence was more common (42.65%) than traffic accidents (35.29%). Accidental fall including sports injury was the least common cause (8.82%) and were mostly found in children. All of the six cases of accidental falls in our study were found in children below ten years of age. (Table 2).

<table>
<thead>
<tr>
<th>Type of Injury</th>
<th>Male</th>
<th>Female</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Violence</td>
<td>20 (29.41%)</td>
<td>9 (13.24%)</td>
<td>29 (42.65%)</td>
</tr>
<tr>
<td>Traffic Accidents</td>
<td>24 (35.29%)</td>
<td>0 (0%)</td>
<td>24 (35.29%)</td>
</tr>
<tr>
<td>Accidental Fall and Sports</td>
<td>5 (7.35%)</td>
<td>1 (1.47%)</td>
<td>6 (8.82%)</td>
</tr>
<tr>
<td>Work related</td>
<td>8 (11.76%)</td>
<td>1 (1.47%)</td>
<td>9 (13.24%)</td>
</tr>
<tr>
<td>Total</td>
<td>57 (83.82%)</td>
<td>11 (16.18%)</td>
<td>68 (100%)</td>
</tr>
</tbody>
</table>

The most common type of nasal bone fracture was the displacement type accounting for 33.82 % of the cases, followed in order by Non-deformation type (25%), mixed and unclassified type (14.71% each) and depressed type (11.76%). The common clinical features were nasal deformity (70 %), edema (30%), tenderness (100%), nasal bleeding (76%), and external abrasions/lacerations (32%).
Chart 1: Type of Nasal Bone Fracture

<table>
<thead>
<tr>
<th>Type</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Displacement</td>
<td>33.82%</td>
</tr>
<tr>
<td>Depressed</td>
<td>11.76%</td>
</tr>
<tr>
<td>Mixed</td>
<td>14.71%</td>
</tr>
<tr>
<td>Nondeformed</td>
<td>17.25%</td>
</tr>
<tr>
<td>Unclassified</td>
<td>14.71%</td>
</tr>
</tbody>
</table>

- **Displacement** - Displacement of the Nasal Bones or Septum
- **Depressed** - Depressed Dorsum
- **Mixed** - Displacement and depressed combined
- **Nondeformed** - Undisplaced Fracture
- **Unclassified** - Edema at the time of presentation

In all cases, the diagnosis was made based on clinical examination and x-ray of the lateral nasal bone, bilaterally. Fifty-eight patients (85.29%) presented within twelve hours of the injury before development of significant edema out of which 25% had non-deformation (undisplaced) fracture which did not require reduction. All others underwent immediate closed reduction with a mean time-to-reduction of 20.5 hours. The remaining ten patients (14.71%) presented after twelve hours to five days after injury with significant post traumatic edema. Closed reduction had to be deferred till edema subsided completely (the period of which ranged from three to seven days with a mean time-to-reduction of 3.2 days). Overall, the mean time-to-reduction was thirty hours. All patients were satisfied with the aesthetic outcome of closed reduction with none requesting or requiring a revision.

**Discussion**

Nasal bone fracture is an injury commonly caused by accidents. Males are more commonly involved in accidents and violence, thus, nasal bone fractures show a male predilection. In our study, we found a male preponderance of 5:1 which is consistent with the findings of other studies Özgür A., et al, (5:1)¹ and Ogava T. et al.⁴ The majority of our patients were found in the age group of 11 to 30 years (67.64%) similar to the study done by Ogava T et al.⁴

In our study, the most common causes in descending order of nasal fractures were violence (42.65%), traffic accidents (35.29%), work related (13.24%), and accidental fall including sports (8.82%). Ogava T., et al,⁴ in their series noted the most common causes being violence (24.48. %), traffic accidents (27.58%), accidental fall including sports (24.13%) and work related (19.82%) in that order. Özgür A., et al,¹ noted in their series that violence was the most common cause.

Fractured nasal bones have been classified differently by different authors. Hwang K., et al,⁵ in their study, have classified nasal bone fractures into the following six types:
- Type I: Simple without displacement
- Type II: Simple with displacement/without telescoping
  - IIA: Unilateral
  - IIA: Unilateral with septal fracture
  - IIB: Bilateral
  - IIB: Bilateral with septal fracture
- Type III: Comminuted with telescoping or depression.

Stranc and Robertson (1979) classified nasal bone fractures into frontal and lateral types which were further subdivided into seven types. We have followed the more simple classification as used by Ogava T., et al.\(^4\) In our study, the most common type of fracture in descending order are (Chart I) displacement type (33.82%), non-deformation type (25%), mixed type(14.71%), unclassified type (14.71%), and depressed type (11.76%). Ogava T., et al, in their study found the incidence of these types to be 36.64%, 24.14%, 13.79%, 13.79% & 11.64%, respectively.

Nasal fracture reduction should be carried out immediately before soft tissue edema sets in and masks fracture deviation. Once the soft tissue edema occurs, it is difficult to assess the irregularity and more important, difficult to assess proper fracture reduction and return the nose in its original position. Thus, once edema sets in, it is always better to wait till the edema subsides completely by using anti-inflammatory drugs. Usually soft tissue edema subsides within 5-7 days and closed reduction can optimally be performed. Any delay beyond 7-10 days may result in significant bone healing which make reduction more difficult or even may require Rhinoplasty (osteotomy) at later stages.

In our study, the mean time-to-reduction was thirty hours as opposed to Özgür A., et al, who had a mean time to reduction of 2.3 days. This is because in our study 70% of the patients presented within twelve hours of injury. Physical examination and radiological studies are the two modalities used to diagnosis a nasal fracture. We always relied on our physical examination for the diagnosis. Many times crepitus is felt by digital examination but it is a painful procedure for the patient. Radiological examination of the nasal bones is important for medical legal documentation since once the fracture is reduced; all evidence of the fracture disappears. In all of our patients, their nasal fractures was diagnosed by the external appearance of the nose and physical examination. The nasal radiograph was primarily done for medico-legal purposes. We do not agree with the insignificance of nasal radiograms. This is contrary to the literature which only looks at their utility in making a medical diagnosis.\(^6,7,8\) At times, nasal radiogram shows a fracture line at the nasal bone, but without any displacement. Such cases were labeled as an “undisplaced fracture.” These patients also do not complain of any deformity or deviation. Thus, the only treatment needed is to apply tape across the nasal bone to prevent further splaying of the nasal bones. To further delineate the extent of the nasal fracture and to rule out any other facial injury computerized tomography (CT) scan may be obtained.\(^5\) However, it is more for academic purposes rather then diagnostic purposes and does not replace a good physical exam. We did not obtain a CT Scan on any of our patients.

**Conclusion**

Successful management of a nasal fracture is not so complicated. It is concluded that plain radiography for evaluation and closed reduction for treatment is sufficient for nasal bone fracture that is not associated with other facial bone fractures.

**References**

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