

## The Nasal Septum in Facial Injuries

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### Abstract

There are more than 50,000 nasal fractures per year in the United States, making the nose the most commonly fractured bone of the face. Facial injuries are often associated with multiple traumas and many are not promptly diagnosed and treated. Decisions regarding the treatment of nasal trauma should be based on clinical findings and nasal bone radiography.

Optimal management of nasal trauma in the acute setting is critical in minimizing secondary nasal deformities. The open rhinoplasty technique provides excellent exposure of the nose and improves surgical control of the maneuvers employed, leading to better surgical results. Good exposure is the main indication for open reduction.

The cartilaginous septum is considered to be the most important anatomical structure because it provides support of the distal nose and maintains the bilateral nasal airway. Prompt identification and management of septal fractures are imperative to avoid the potential complications related to nasal airway obstruction. Open repair of nasal fractures may allow better outcomes than closed fracture manipulation and may also minimize the need for difficult subsequent operations.

**Keywords:** *Nasal Septum; Facial Injuries; Nasal Bone Radiography*

### Introduction

An estimated 39% of all facial injuries involve the nasal bones [4]. Inaccurate treatment of a fracture of the nasal pyramid can often lead to secondary nasal deformities and chronic nasal obstructions [5].

Closed reduction has been the treatment paradigm for nasal fractures for more than 5,000 years [6]. Patient satisfaction rates with this closed reduction range from 62% to 91%, while surgeon satisfaction rates are typically much lower (21% to 65%) [4]. Patients undergoing repair for nasal fractures have lower postoperative expectations than patients undergoing cosmetic rhinoplasty [7]. Traditional practices have emphasized an approach that allows minimal intervention and produces a functional and aesthetic result [1,8,9]. Many less invasive techniques have led to high rates of revision. Posttraumatic nasal deformity requiring subsequent rhinoplasty or septorhinoplasty remains in as many as 50% of patients [10-14]. Tension and pressure stress vectors caused by hidden cartilage fractures behind intact septal mucosa may lead to poor outcomes. Restoration of functional and aesthetic facial and nasal anatomy has led individual surgeons to consider taking a more aggressive initial approach [5,15-19].

In 1984, Murray and colleagues [15] performed ground-breaking work in understanding the integral relationship of septal anatomy in nasal fracture repair. They advocated open repair of the nasal septum in conjunction with nasal fracture reduction. Other studies [5,16]

draw similar conclusions. The open approach allows a surgeon to better diagnose the deformity and to better execute certain maneuvers. Revision rates for primary open septorhinoplasty are less than those for closed rhinoplasty [20-23]. Rhee and associates reported that 78.8% of patients with simple nasal bone fractures required primary septoplasty [5].

### Clinical assessment

Decisions regarding the treatment of nasal trauma should be based on clinical findings and nasal bone radiography. Patient history provides the most clinically pertinent understanding of a given nasal fracture. Essential factors include the mechanism of injury, time since injury, patient age, and differentiation between acute vs chronic/preexisting deformities. The initial diagnosis of the fracture is the most difficult aspect of treating a nasal fracture. Important factors are the cause of the trauma, history of previous facial injuries, any prior nasal deformity, and history of nasal obstruction (Figure 1).



**Figure 1:** A 17-year-old man with a facial injury presented 4 hours after a ski collision. The patient's medical history includes no previous nasal trauma, airway obstruction, or nasal surgery. In the initial physical examination bilateral epistaxis, a mildly depressed nasal dorsum, severe swelling, periorbital and nasal ecchymosis, and significant dorsal asymmetry (nasal pyramid deviation exceeding one half the width of the nasal bridge), crepitation, visible septal hematoma, a nasal septum deviated to the left side, and open nasal laceration were observed. Images courtesy of Alexander Kutubidze, MD, PhD.

A computed tomography (CT) image will reveal the nature of the fractured nasal bone. The CT is essential for an exact diagnosis of the nasal fracture and to classify the nature of all injuries. Many different and complex methods have been proposed for classifying nasal-septal fractures [5,9,24-27]. A CT analysis of the nature of the fractures of nasal bone and associated injuries will determine the plan and prognosis [28-33].

The physical examination can be divided into external and internal examinations. The goal of the external examination is to evaluate nasal deformities. The nose should be palpated gently to detect step-offs and areas of tenderness. The most certain signs of fracture are

a tender, palpable, or visible deformity. Any significant drainage from the nose should lead to concern for cerebrospinal fluid rhinorrhea. Fractures within the cribriform plate secondary to septal injury may cause cerebrospinal fluid rhinorrhea and the fluid should be tested for glucose or  $\beta$ -transferrin [27].

The following instruments are recommended for a proper internal examination of the nose [30]:

- Headlight
- Nasal specula
- Decongestant spray
- Cotton-tipped applicators
- Frazier-tipped suction
- Nasal packing material

A rigid or flexed endoscope can be used for the internal examination. The internal examination should begin with suctioning out any blood. A topical anesthetic with vasoconstrictive effects should be used to control bleeding during the examination. Attention should be paid to the status of the septum and any mucosal disruptions indicative of the trauma should be noted. Septal deviations, chronic or acute, will be apparent during the internal examination. If a rigid or flexible endoscope is being used, then the scope should be placed in the nasal vestibule and advanced posteriorly under direct vision. Once the endoscope is advanced along the floor of the nose and beneath the inferior turbinate, then the inferior meatus, turbinates, septum, and the posteroinferior septal junction with the perpendicular plate of the ethmoid should be examined [9].

The time that has passed since the injury should be considered as patients may present hours, days, or weeks later. Within the first few hours of the injury, before substantial swelling, there is an opportunity to fully visualize the deformity. The surgeon should obtain a medical history to rule out previous nasal trauma and deformities. A history of previous nasal surgeries and their subsequent outcomes are significant. Management of an acute nasal fracture in the presence of an untreated or undertreated prior nasal injury is difficult because the nose may return to the previously deformed state. To achieve a better understanding of how the patient's nose appeared before the acute injury, a review of old photographs may be helpful. The patient should be questioned to determine any history of breathing difficulties, nasal congestion, snoring, sleep apnea, and/or nasal drainage. Use of inhalers or allergy medications should also be noted. The patient's expectations regarding surgery for the current injury must take into account any previous conditions.

In the author's opinion, the importance of recognizing and optimally treating septal deformity cannot be overemphasized. An unrecognized septal deformity is one of the major causes of unfavorable outcomes. Correcting a nasal fracture while neglecting septal injury is futile because the unrepaired septum will only serve as a pivot point for future nasal bone deviation [6,25].

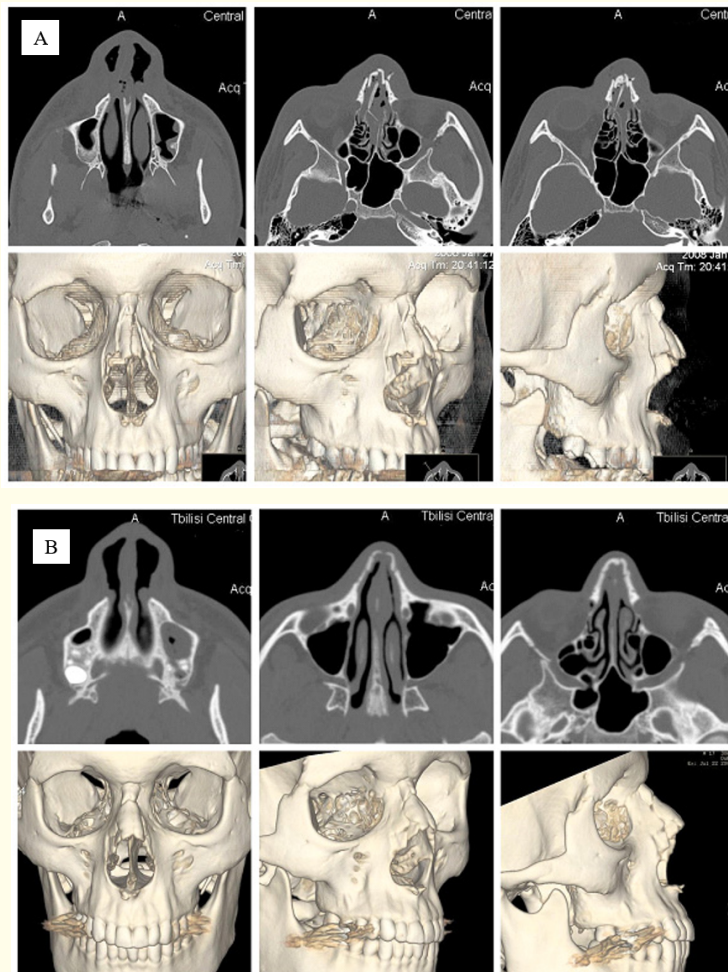
### Treatment

Optimal management of nasal trauma in the acute setting is critical in minimizing secondary nasal deformities. The open rhinoplasty technique provides excellent exposure of the nose and improves surgical control of the maneuvers employed, leading to better surgical results. Good exposure is the main indication for open reduction [31-34].

There are different timing options for treatment. Some injuries require immediate attention and others are better treated after time. For instance, septal hematomas require immediate evacuation and drainage because, if they are left untreated, they can lead to necrosis and perforation of the septal cartilage or they may become organized resulting in subperichondrial fibrosis and thickening with partial nasal airway obstruction. If the patient presents in the first 3 to 6 hours (before significant distorting edema sets in), then reduction of the fractured nose should be performed immediately.

The indications for open reduction of nasal trauma are [9,27]:

- Extensive fracture-dislocation of the nasal bones and septum
- Nasal pyramid deviation exceeding one half the width of the nasal bridge
- Fracture and dislocation of the caudal septum
- Open septal fracture
- Persistent deformity after closed reduction (Figure 2).



**Figure 2:** A. Preoperative computed tomography (CT) scan findings. The bony and septal fractures were classified as bilateral displacement with associated septal fracture. The nasal bone was comminuted, depressed, and telescoped. The patient was treated with primary open reduction and submucous resection was performed. B. CT scans 6 months after surgery. Functional result visualized as good. A slight irregularity remained on the CT scan, but a good shape of the arch was restored. Images courtesy of Alexander Kutubidze, MD, PhD.



In open reduction, operative techniques are dictated by the type of fracture or dislocation. Septoplasty or submucosal resection are performed if severe septal fracture is found. The septum is a bony and cartilaginous midline structure that provides structural integrity to the nose. The quadrangular cartilage is unique to the nose in that it maintains articulations to the cartilage, upper lateral cartilages, bone, vomer, and perpendicular plate of the ethmoid. Submucosal resection involves extensive resection of the cartilage and bone, including part of the vomer and part of the perpendicular plate of the ethmoid, whereas septoplasty is a tissue-sparing procedure [5].

The anterior septal angle is exposed by separating the middle crura and incising the interdomal suspensory ligament. The septal perichondrium is incised with a No. 15 blade scalpel exposing the distinctive blue-gray underlying cartilage. A Cottle septal elevator is then used to carry the dissection in a subperichondrial plane posteriorly to the perpendicular plate of the ethmoid down to the nasal floor and across the face of the septum. This subperichondrial dissection should proceed easily if performed in the correct plane. However, the dissection should proceed with caution at the junction of the cartilaginous and bony septum, as the overlying mucoperichondrium is more adherent and mucosal perforation is more likely. The same dissection is then performed on the contralateral side and the entire septum is examined using a Vienna speculum to identify deformities and to help achieve exposure for septal resection. Maintain the stability of the cartilaginous framework by preserving an L-strut with 10 mm of dorsal septum and 10 mm of caudal septum. A displaced maxillary crest often has to be completely removed. Radical cartilage or bone resection should be avoided to preserve support and limit fibrosis and contracture [35]. External splints and nasal packing are commonly used postoperatively to stabilize and protect the reduction [36].



**Figure 3:** View of the same patient at year postoperative. Reestablishment of an adequate nasal pyramid is seen as is the restoration of both functional and aesthetic facial anatomy. Images courtesy of Alexander Kutubidze, MD, PhD.

### Conclusion

The cartilaginous septum is considered to be the most important anatomical structure because it provides support of the distal nose and maintains the bilateral nasal airway. Prompt identification and management of septal fractures are imperative to avoid the potential complications related to nasal airway obstruction. The closed reduction approach does not allow direct visualization and suturing, leaving patients at risk for secondary nasal deformities or collapse. Secondary deformities may lead to suboptimal cosmetic outcomes and functional airway obstruction because precise anatomic alignment is difficult to achieve. Open repair of nasal fractures may allow better outcomes than closed fracture manipulation and may also minimize the need for difficult subsequent operations (Figure 1).

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