# Correction of Nasal Fractures

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**KEYWORDS**

• Nasal fracture management • Open reduction internal fixation nasal fracture
• Nasomaxillary fracture • Facial trauma • Nasal bone

**KEY POINTS**

- Nasal fracture is the most common bony injury resulting from blunt facial trauma.
- Optimal management of nasal trauma in the acute setting is critical to restoring pretraumatic form and function and minimizing secondary nasal deformities.
- Evaluation of nasal fractures should include careful examination of the nasal septum because unsuccessful fracture management is often due to inadequate treatment of concurrent septal fracture.
- Complex traumatic nasal deformities, especially with significant septal involvement, may require more aggressive acute surgical management and an initial open surgical approach.
- The open treatment of isolated nasal fractures is a controversial subject without widely accepted indications for timing, patient selection, and surgical technique.

## INTRODUCTION

Nasal fractures most commonly result from blunt facial trauma in events, such as motor vehicle accidents, sports-related injuries, assaults, and falls.[1] The nasal bones are the most frequently fractured facial bone, with a peak incidence during the second and third decades of life with boys and men more commonly affected than girls and women.[1–4] Isolated nasal fractures are defined as fractures involving the nasal bones with or without concomitant involvement of the nasal cartilages and nasal septum. Nasal septal fractures are associated with 39% to 96% of nasal fracture cases, with increasing severity associated with more frequent septal fractures.[5–7] In more severe cases, they can coincide with fractures of the nasomaxillary buttress, naso-orbitoethmoid (NOE) complex, and frontal sinus. For the purposes of this article, discussion is focused on the treatment of isolated nasal fractures.

## ANATOMIC CONSIDERATIONS

The structural framework of the nose includes the nasal bones, the nasal septum, the nasal process of the frontal bone, the frontal process of the maxilla, the ethmoid bone, the vomer, and cartilaginous structures. The nasal bones are thicker above the intercanthal line as they meet the nasofrontal suture. Inferiorly, the thinner nasal bone serves as a cantilever point for the attached upper lateral cartilages (ULCs) and corresponds externally to the rhinion. The transition between the thicker and thinner nasal bone is a common fracture site.[8] Within the nasal cavity, the perpendicular plate of the ethmoid fuses with the nasal bones along the dorsum. External impact to the

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nasal bones is transmitted to the septum through this connection leading to concomitant septal injury during nasal trauma.

The paired ULCs attach to the caudal aspect of the nasal bone and dorsal aspect of the quadrangular (septal) cartilage. Cephalically, the ULCs attach via fibrous union to the nasal bones and can overlap the undersurface of the nasal bones by as much as 11 mm.[9] Laterally, the ULCs are only loosely attached to the maxilla by a fibrous aponeurosis. Thus, the nasal bone and septal attachments of the ULCs are the main contributions to their stability and support of the middle vault. Internally, the ULCs help form the internal nasal valve and contribute to the midline support of the cartilaginous septum. The paired lower lateral cartilages (LLCs) provide little septal support but are essential in the aesthetics and contour of the nasal tip. In general, significant force is required to cause cartilaginous injury due to the soft and malleable quality of cartilage that allows the dissipation of force.

The nasal septum plays a crucial role in the nasal structure and understanding its anatomy is paramount in the management of nasal fractures. The quadrangular cartilage comprises the majority of the septum with bony contributions from the vomer inferiorly and perpendicular plate of the ethmoid posteriorly and superiorly. Inferiorly, the quadrangular cartilage thickens and lies within the bony groove of the maxillary nasal crest. The dorsal and posterior septal cartilage provides the primary support for the nasal dorsum and the caudal septum provides the primary support for the nasal tip. Correction of septal deformities secondary to trauma is crucial in re-establishing premorbid form and function. In children the septum remains as a major growth center for the face until approximately 12 to 13 years of age. Significant septal trauma can adversely affect midface development.[10]

The external and internal carotid arteries supply a rich vascular network in the nasal region. Branches of the maxillary artery (sphenopalatine, greater palatine, and infraorbital arteries), facial artery (superior labial and angular arteries), and ethmoid arteries (anterior and posterior) anastomose in a redundant fashion, predisposing nasal fracture patients to epistaxis. Anterior or posterior epistaxis may arise depending on the location of vessel injury, with anterior bleeds more commonly seen than posterior. In most cases, nasal hemorrhage is either self-limited or readily controlled with direct manual pressure, blood pressure management, and/or topical medications. Rare persistent cases can require nasal packing, operative intervention, or angiography with embolization.

## FRACTURE PATTERNS

No universally accepted classification of nasal fracture pattern exists although many clinical, anatomic, and radiographic classifications have been proposed.[5,7,8,11,12] Nasal fractures can be classified in 2 broad categories based on impact force: lateral-type versus frontal-type injuries. Lateral-type injuries tend to be more common, have fewer residual anatomic and functional defects compared with frontal injuries, and are more amenable to closed reduction.[12,13] Frontal injuries classically produce a posteriorly depressed fracture where the nasal septum is always involved. They are more severe, have a higher risk of residual deformity postsurgery, and are often associated with NOE fractures.

Stranc and Robertson[12] proposed a classification of lateral and frontal injuries based on anterior-posterior depth of injury in relation to the nasal tip and concluded that deeper levels of injury portended worse prognosis. In 1989, Murray and colleagues[8] proposed a pathologic classification system with 7 types of nasal fractures based on a cadaver study. They illustrated that septal fractures occur if the nose is deviated more than one-half a nose breadth from its original position and emphasized the importance of septal management for successful reduction. The variety of injury patterns and complexity of classification have precluded universal practical clinical application of any of these schemes.

Most isolated nasal fractures can be evaluated with several major characteristics in mind:

1. Unilateral versus bilateral involvement and degree of comminution
2. Lateral-type versus frontal-type injury
   - Degree of bony deviation relative to nasal width
   - Degree of depression of nasal dorsum
3. Status of nasal septum
4. Presence of middle vault/cartilaginous dislocations

Nasal fractures vary along a continuum between a unilateral, nondisplaced, greenstick fracture to bilateral, severely comminuted, and depressed nasal bone fractures with significant septal involvement and concomitant adjacent fractures. More aggressive surgical management is necessary with increased severity. Closed and open treatments may have similar outcomes with appropriate patient selection for each operative treatment.[14] In general, closed fracture reduction techniques are still considered first line for mild nasal fractures.[15] Treatment outcomes from closed reduction, however, are often