

# Comparison of Closed Reduction Alone versus Primary Open Repair of Acute Nasoseptal Fractures

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## ABSTRACT

**Objective:** Nasoseptal injuries have traditionally been treated via closed reduction. Historically, the high incidence of postreduction deformities has led some surgeons to consider alternative approaches to obtain superior results. Here we compare simple closed reduction versus primary open repair of the nasoseptal fracture.

**Study Design:** This was a prospective study of 40 consecutive patients treated with simple closed reduction of their combined nasal bone and septal fracture versus 40 patients treated with closed reduction of their nasal bone fracture and open treatment of the septum. Group outcomes were then compared.

**Results:** In the closed reduction group, 60% had significant postoperative septal deviation, whereas only 12.5% suffered from residual septal deformity in the open group. This resulted in a statistically significant reduction ( $p < .01$ ) of patients requiring a second operation to formally address the septum.

**Conclusion:** By addressing the septum through an open approach, a statistically significant reduction in the number of patients requiring revision rhinoplasty was achieved.

## SOMMAIRE

Les fractures septonasaales ont traditionnellement été traitées par réduction fermée. La haute incidence de déformités suivant ces réductions a encouragé certains chirurgiens à trouver une approche alternative pour obtenir de meilleurs résultats. Nous comparons ici la réduction fermée simple versus la réparation ouverte primaire des fractures nasoseptales.

**Devis:** Ceci est une étude prospective sur 40 patients consécutifs traités par réduction fermée simple de leurs fractures septonasaales combinées versus 40 patients dont la fracture nasale a été traitée par réduction fermée mais le septum par approche ouverte. Nous avons ensuite comparé les résultats des groupes.

**Résultats:** Dans le groupe avec réduction fermée, 60% des patients avaient une déviation septale significative en postopératoire, mais seulement 12.5% dans le groupe avec réduction ouverte. Cela a mené à une réduction statistiquement significative ( $p < .01$ ) du nombre de patients nécessitant une seconde opération pour prendre soin du septum.

**Conclusion:** Nous avons obtenu une réduction statistiquement significative du nombre de patients nécessitant une rhinoplastie de révision en utilisant une approche ouverte sur le septum.

**Key words:** nasal fracture, rhinoplasty, septoplasty

Owing to its central location, prominence, and anterior projection, it is not surprising that the nose represents the most commonly fractured facial bone.<sup>1</sup> In addition, the nasal pyramid requires less force to sustain a fracture than any other facial bone.<sup>2</sup> In fact, the nose is the

third most commonly fractured bone in the human body.<sup>3</sup> The nose, a symbol of dignity and respect in many societies throughout antiquity, is a landmark subject in the evolution of facial plastic and reconstructive surgery.

The first description of nasal trauma management dates to the seventh century BC. In the *Surgical Papyrus*, Edwin Smith described the repositioning of displaced nasal bones by inserting a linen wrap saturated with grease and honey into each nostril and manipulating the fractured bones into their premorbid alignment.<sup>4</sup> He further explained how stiff linen rolls were placed on each side of the nose and bound to reinforce the internal packing and reduced nasal bones.

In the fifth century BC, Hippocrates took the description of nasal injuries a step further. While recommending

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early repositioning of the nasal bones, he found that he was unable to satisfactorily realign the bones in the midline if the septum was deviated.<sup>5</sup> In the first century AD, Soranus of Ephesus applied the Hippocratic methods by recommending the insertion of a mylotis (a special probe) to facilitate the repositioning of the nasal bones following a fracture.<sup>6</sup> The Hippocratic teachings continued to influence physicians and remained almost unchanged until the nineteenth century. In 1947, Maliniac published his classic description of the management of acute nasal injuries,<sup>7</sup> after which, only minor modifications of the optimal timing, approach, and postoperative management of acute nasoseptal fractures have been described in the literature.

Traditional treatment of nasoseptal injuries has centred around closed reduction; however, persistent deformities following closed reduction alone have encouraged surgeons to consider alternative approaches. In fact, the postreduction incidence of nasal deformities has been shown to be as high as 40 to 62%, independent of the surgeon's experience, when simple closed manipulation is employed.<sup>8,9</sup>

This high rate of persistent deformity following closed reduction of nasal fractures prompted our prospective study. In this study, 40 consecutive patients were treated with simple closed reduction of their combined nasal bone and septal fracture, whereas the next 40 patients were treated with closed reduction of their nasal bone fracture and open treatment of the septum. Patient outcomes between the two groups were then compared.

## Patients and Methods

Institutional Review Board approval was obtained. The study was performed from August 1997 through March 2005. All patients were those of the senior author (Y.D.). Any patient who suffered a naso-orbital ethmoid fracture or a fracture of the ascending process of the maxilla was excluded from this study. Finally, any patient who was noted not to have any significant septal deformity following reduction of the nasal bones was also excluded from this study. All patients were required to be followed up for a minimum of at least 3 months. Any patient who could not meet this criterion was omitted from the final count.

The first 40 consecutive patients comprised the closed reduction group. All patients within this group had a nasal bone fracture, as well as an associated septal deformity, including significant fracture or dislocation. Simple closed reduction was performed using a flat elevator. Once this was done, Doyle splints were placed in all patients, whereas a dissolvable bolster (Ethicon, Inc., Somerville, NJ) was placed to support the nasal bones only if they were felt to

be unstable following reduction.<sup>10</sup> An Aquaplast cast (WFR/Aquaplast Thermoplastics, Wyckoff, NJ) was applied in every case.

In the second cohort of 40 consecutive patients, the nasal bones were again reduced using a flat elevator, whereas the septum was addressed in an open manner. Fractured and displaced segments were either resected or relocated back into proper central alignment. Dorsal and caudal struts measuring at least 10 mm were preserved in every patient to maintain proper nasal support. Generally, our goal was to relocate rather than remove deviated fragments of nasal septum whenever possible. Again, Doyle splints were placed in all patients once the mucoperichondrial flap was closed. The same criterion was used to determine if a Surgicel bolster was to be placed for support of the nasal bones, and an Aquaplast cast was placed at the conclusion of every case. It is important to note that no patient underwent an open septorhinoplasty in this group.

At follow-up, patients were evaluated for both subjective and objective nasal airway obstruction and persistent deviation. Any septal deviation of more than 20% from the midline was considered significant in the postoperative period. Those who continued to suffer from significant nasal obstruction or deviation were offered a secondary surgery.

Estimates of statistical significance between treatment groups were determined using the two-tailed Student *t*-test. Data were considered statistically significant at the  $p \leq .05$  level. The two study groups were felt to have equal variance.

## Results

The first group of patients consisted of 31 men and 9 women who underwent fracture repair by simple closed reduction under general anesthesia following oral endotracheal intubation. The mean age of this group was 27.2 years of age, and the average follow-up was 6.3 months. Of the 40 people, 24 (60%) had persistent postoperative septal deviation that was deemed significant. This was relatively arbitrarily classified as greater than 50% obstruction along the floor of the nose, and surgery was recommended for all 24 of these patients. Patients with significant (more than 50%) obstruction of the internal nasal valve were excluded from study. This subgroup was treated with grafting of the valve either primarily or secondarily. Although all 24 patients complained of significant nasal airway obstruction compared with their prefracture state, only 7 of these patients (29.2%) elected to undergo secondary formal repair of the septum. Six of the seven patients subsequently

underwent open septorhinoplasty, whereas the final patient underwent a simple septoplasty. All seven patients had significant objective improvement in their nasal airway obstruction, and no patient complained of breathing difficulty following the second procedure. It is important to note that of the 17 patients who elected to forgo a second surgery to formally address the septum, the most common reason was due to financial constraints (64.8%). Concurrent turbino-plasty was performed for enlarged turbinates. This was simple cauterization and outfracture for mild cases of hypertrophy and formal submucous resection for severely hypertrophic turbinates.

In the second group, the nasal bones were again addressed by simple closed reduction, whereas the septum was addressed in an open manner. This group was composed of 27 men and 13 women, whose mean age was 29.4 years, and the average follow-up was 6.3 months. Using the same criteria as for the previous group, only five patients (12.5%) suffered from residual septal deformity causing nasal airway obstruction, resulting in a statistically significant reduction ( $p < .01$ ) in the number of patients requiring a second operation to formally address the septum. Of the five patients, only three elected to undergo a second surgery to repair the septum, all of which were performed through an open septorhinoplasty. No objective septal deviation or subjective obstructive complaints occurred in this group following the second procedure.

It is important to note that in both the first and second groups, all of the primary surgeries occurred within 1 week of their injury.

It is important to note that four participants (10%) in this group were noted to have a fracture of their septal L-strut on elevation of the mucoperichondrial flap during the initial operation. The fractures in all four of these patients were repaired through percutaneous Kirschner wire fixation.<sup>11</sup> Of the five patients with residual deformity following the first operation, two of the individuals (40%) were known to have had an L-strut fracture at their initial injury. Only one of these patients underwent formal secondary open septorhinoplasty, resulting in an excellent outcome.

It is important to note that no septal perforation or septal hematoma occurred in either treatment arm.

## **Discussion**

Immediate treatment of a nasal injury can be difficult owing to the significant soft tissue swelling that is frequently associated with it. Other than the treatment of lacerations and septal hematomas, definitive treatment can

be postponed for 3 to 4 days, at which time, the patient can be reevaluated. During this interval, ice packs can be very effective in reducing swelling. Instructing the patient to maintain the head at a slight elevation above the heart can further aid in reduction of edema. If substantial swelling is still encountered when the patient returns in 3 to 4 days, the patient can be scheduled for reexamination in another 3 to 4 days before definitive treatment is planned. Unlike children who should undergo definitive treatment as soon as possible to prevent secondary complications such as scar contracture, adults can have definitive treatment delayed as far as 12 days following an injury without increasing the risk of sequelae. After this time, the nasal bones have generally begun to firmly heal, which can require a significantly greater effort, and possibly the use of osteotomies, at the time of reduction.

When discussing radiographic imaging, it is generally accepted that decisions regarding the management of nasal trauma are based solely on clinical findings; therefore, plain radiographs have no place in the decision-making process regarding acute nasal trauma.<sup>12</sup> The same holds true of computed tomography. Although it has been shown to be helpful in diagnosing septal fractures, it has not been able to predict its severity and therefore is a costly and unnecessary study.<sup>1,13</sup>

Much controversy exists as to the ideal treatment to properly address acute nasal fractures. The time-honored tradition has been through closed reduction; however, deformities persisting following what was felt to be a good reduction have caused this approach to be questioned. The high incidence of postreduction nasal deformities (40–62%) with the use of simple closed reduction, independent of surgeon experience, led us to pursue the present study.<sup>8,9</sup>

The high incidence of poor cosmetic and functional results has caused clinicians to search for alternative methods of addressing acute nasal fractures to prevent this significant level of residual deformity. Adamson and colleagues were the first to combine submucosal septal resection with the manipulation of the nasal bones and, via this technique, found that the need for revision rhinoplasty was nearly obviated.<sup>14</sup> Nearly 20 years later, Murray and colleagues gave us our first insight into the mechanics and pathophysiology of why performing isolated simple closed reduction on a nasal fracture was leading to the high revision rate.<sup>15</sup> Their cadaveric study led to the understanding that a nasal bone deviation greater than half of the nasal bridge width had a concomitant C-shaped fracture of at least the ethmoid plate of the septum. Applying this knowledge in a prospective study, they showed that by addressing the septal fracture through a hemitransfixion incision, a statistically significant

long-term cosmetic and functional outcome could be obtained. This was felt to be due to the alleviation of overlapped, interlocked fragments of the septum that would ultimately result in a secondary nasal deformity when only the nasal bones were addressed through a closed reduction technique.

This finding was affirmed by Rohrich and Adams, who showed that by addressing irreducible septal injuries with limited inferior septal reconstruction during the acute phase through either a hemitransfixion or Killian incision, they were able to reduce the revision rate to only 9%.<sup>16</sup> Later, in a prospective study, Rhee and colleagues showed that 50 of 52 (96%) patients had septal fractures, and of these, 43 (83%) required a tissue-sparing septoplasty or a more aggressive submucosal resection to adequately address the septum.<sup>1</sup>

Fernandes took this a step further when he showed that treating acute nasal fractures through the endonasal technique was not only safe but also reduced the need for revision rhinoplasty to only 11.5%.<sup>9</sup> Finally, Renner advocated the treatment of significant nasal fractures with even a more aggressive open septorhinoplasty. This arose from his belief that the external technique allowed for the overriding skeletal fragments and points of significant instability to be better appreciated and treated at the time of the injury and thereby reduced the need for revision septorhinoplasty at 6 or more months from the time of injury.<sup>17</sup> This technique was later adopted by Staffel, who showed, through a graded algorithmic open approach, that he was able to effect a statistical improvement in the more aggressively managed patients when compared with those treated with a closed reduction.<sup>18</sup>

In this head-to-head, prospective study, we showed that by formally addressing the septum through a septoplasty at the time of the initial injury, one can achieve an outcome that is statistically superior ( $p < .01$ ) to the outcome with the closed reduction technique. Furthermore, our results reflect Murray and colleagues' findings, whereby addressing a nasal fracture through a closed reduction technique was incapable of reliably alleviating the overlapped, interlocked fragments of the septum and ultimately resulting in a secondary nasal deformity.<sup>15</sup> It is also important to note that we did not incur any complications through either the closed reduction technique or when the septum was directly addressed through a submucous resection.

Although the septum can be addressed through many different techniques, performing a directed septoplasty in which only a limited inferior septal reconstruction is performed, as advocated by Rohrich and Adams,<sup>16</sup> may

not adequately address the entire septum. This is supported by our finding of a significant proportion of fractures involving the dorsal aspect of the septum, which would not be properly addressed through such a limited technique. In the same regard, techniques such as the endonasal and external approach septorhinoplasty techniques may be too aggressive, based on the finding that these methods have not shown a reduction in the revision rate compared with those in which the septum is addressed through a submucosal resection.<sup>9,18</sup>

One cannot discuss nasal fractures without contemplating the possible complications. By far, the most common complication following a nasal fracture is inadequate reduction. As stated before, subsequent nasal deformities have been shown to be as high as 40 to 62%. Once the swelling has subsided following the reduction of a nasal fracture, patients will frequently complain of airway obstruction. This finding can point to either inadequate reduction of the fracture or incomplete management of a component of the fracture at the time of the injury. In either case, it is common to wait 4 to 6 months to perform a secondary septorhinoplasty in an attempt to correct the deformity.

A septal hematoma should be recognized and addressed immediately following the injury to prevent subsequent complications. When a hematoma is not treated, a variable amount of fibrosis can form between the septal cartilage and the perichondrium, which can lead to septal thickening and retraction of the distal nose and collumella.<sup>19</sup> In addition, an abscess can form from an untreated hematoma and result in necrosis of the septal cartilage and potentially the loss of dorsal support, as seen in the saddle nose deformity.

## Conclusion

In this study, we showed that by directly addressing the septum through a direct open approach, we were able to achieve a statistically significant reduction in both the percentage of patients requiring revision surgery or having a significant residual deformity and obstruction following the management of an acute nasoseptal fracture.

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