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## Nasal Bone Fractures: Differences Amongst Sub-Specialty Consultants

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# Nasal Bone Fractures: Differences Amongst Sub-Specialty Consultants

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## Abstract

**Background:** Nasal fractures constitute the largest proportion of facial trauma each year, however, there is no consensus management. In this study, we investigated the role of the consultant and the functional and aesthetic outcomes of procedures performed to address nasal bone fractures.

**Methods:** A retrospective chart review of patients who sustained nasal bone fractures was conducted from 8/1/14 through 1/23/18. Categorical variables were analyzed using chi-squared testing and Fisher's exact test, where appropriate, while continuous variables were compared using Mann–Whitney U testing.

**Results:** During the study period, 136 patients met inclusion criteria for full analysis. The mean age of this cohort was  $47.6 \pm 20.2$  years with the majority identifying as African–American (53.7%) and male (67.2%). Otolaryngologists were significantly more likely to assess pre-operative nasal obstruction (100%) compared to plastic surgeons (24.1%) ( $P < .001$ ). Otolaryngology elected operative management (53.3%) at a significantly higher rate than plastic surgery (24.1%) ( $P = .005$ ). Additionally, otolaryngology was significantly more likely to manage patients in an outpatient setting (91.2%), whereas plastic surgery more commonly performed inpatient management (57.1%) ( $P = .006$ ). Plastic surgery averaged a significantly shorter amount of time from presentation to operative management ( $7.3 \pm 10.7$  days) compared to otolaryngology ( $20 \pm 27.7$ ) ( $P = .019$ ). Consulting service was not associated with a need for revision surgery.

**Conclusions:** Consultants across subspecialties differ in the management of nasal bone trauma. A more standardized approach is warranted by all individuals involved in the care of maxillofacial trauma patients.

## Keywords

nasal fracture, Miscellaneous, Facial trauma, Reconstruction, Facial Plastic and Reconstructive Surgery, Nose

## Introduction

Nasal fractures constitute the largest proportion of facial trauma each year in the United States due to the fragility of both the cartilaginous and bony structures, as well as its prominence on the face, often making it the first point of impact in facial injuries.<sup>1–2</sup> Nasal bone fractures are commonly a result of motor vehicle accidents, falls, sports-related trauma, and interpersonal violence.<sup>2–14</sup> Males are affected approximately twice as often as females, with a peak incidence occurring in the second and third decades of life.<sup>3,9–10,12–17</sup> Common presentations include nasal deformity, swelling, epistaxis, and periorbital ecchymosis, while bony crepitus and nasal segment mobility can also be diagnostic.<sup>3</sup> Nasal bone fractures often require reduction within 2 weeks of injury to achieve an optimum outcome. Unfortunately, a delay in diagnosis or treatment beyond this window can lead to a persistent functional and/or cosmetic deformity requiring further surgical intervention.<sup>18</sup>

There is no consensus regarding operative techniques, timing of repair, and post-operative management for nasal

bone fractures in the literature.<sup>19</sup> With the high incidence of nasal fractures and the demands for cost-effectiveness, there is a need for more research on this topic.<sup>15</sup> In this study, we investigated the role of the consultant and the

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**Table 1.** Patient Demographics Compared by Consulting Service.

	Plastic Surgery (n = 29)	Otolaryngology (n = 107)	P-Value
	N (%)	N (%)	
Age (mean $\pm$ standard deviation in years)	47.1 $\pm$ 23	47.7 $\pm$ 19.6	.742
Sex (male)	15 (51.7%)	77 (72%)	<b>.039</b>
Race/Ethnicity			.122
Caucasian	6 (20.7%)	32 (29.9%)	
African-American	17 (58.6%)	56 (76.7%)	
Hispanic	3 (10.3%)	17 (15.9%)	
Asian	3 (10.3%)	2 (1.9%)	

functional and aesthetic outcomes of procedures performed to address nasal bone fractures. We assessed whether consulting otolaryngologists differ from plastic surgeons in their evaluation and treatment of a nasal trauma patient, and hypothesize that otolaryngologists may be more likely to assess functional nasal parameters.

## Methods

Following IRB approval, a retrospective chart review was conducted through the Einstein Healthcare Network (Philadelphia, PA) from 8/1/14 through 1/23/18. Patients >18 years of age who sustained an acute, isolated nasal bone fracture confirmed on computed tomography (CT) scan whom were evaluated by a consultant with at least 1 follow-up visit were included. Patients were excluded if they were <18 years of age, sustained other maxillofacial fracture(s), sustained a concomitant septal fracture, and if no consultation was performed by a maxillofacial trauma service. Furthermore, patients who were evaluated by the oral maxillofacial surgery (OMFS) service were excluded due an unavailability in follow-up documentation.

Patients with nasal bone fractures were identified using ICD-10 and CPT codes, using a sample size of convenience. Information abstracted included patient age, sex, and race/ethnicity. Furthermore, the consulting team, fracture management, and if surgically managed, the type of surgery, setting and time interval to treatment were recorded. Practice patterns of the two consulting teams (otolaryngology and plastic surgery) were compared to determine if they differed in the evaluation (nasal obstruction, cosmetic deformity) and operative management (type of surgery, time interval to treatment, splint usage, and revision surgery) of patients. Types of surgeries included closed reduction, open reduction, and septorhinoplasty.

Descriptive statistics were used to present incidence of variables. Categorical variables were analyzed using chi-squared testing and Fisher's exact test, while continuous variables were compared using Mann-Whitney U testing. Statistical significance was set as  $P \leq .05$ . Statistical analysis was performed using IBM SPSS® (Armonk, NY).

## Results

During the study period, a total of 690 patients incurred an acute, isolated nasal bone fracture. The average age of this cohort was  $45.6 \pm 18.4$  years, with the majority being African-American (64.6%) and male (69.1%). A formal consultation was conducted for 176 patients (25.5%)—107 with otolaryngology (60.8%), 29 with plastic surgery (16.5%), and 40 with OMFS (22.7%; excluded from analysis). As a result of the study parameters and inclusion criteria, 136 patients were identified as appropriate for analysis—107 patients with otolaryngology (78.7%) and 29 patients with plastic surgery (21.3%). The mean age of this sub-cohort was  $47.6 \pm 20.2$  years with the majority of patients identifying as African-American (53.7%) and male (67.6%). Neither age nor race/ethnicity differed by consulting service, however, otolaryngology evaluated a greater proportion of male patients (72%) compared to plastic surgery (51.7%) ( $P = .039$ ) (Table 1).

Upon presentation, the majority of patients had a degree of nasal obstruction (83.8%) and cosmetic deformity (97.1%) documented by the consulting physician. Nearly half of the patients underwent operative management (47.1%), with a mean of  $18.7 \pm 26.4$  days from the time of presentation to operative intervention. Otolaryngology operated on 57 (53.3%) patients, which included 44 (77.2%) closed reduction, 11 (19.3%) open reduction, and two (3.5%) septorhinoplasty. Seven patients (12.3%) required revision surgery, which included five (71.4%) secondary open reduction and two (28.6%) secondary septorhinoplasty. In contrast, plastic surgery operated on seven (24.1%) patients, which included six (85.7%) closed reduction and one (14.3%) septorhinoplasty. No patients managed by plastic surgery required revision surgery.

Otolaryngologists were significantly more likely to assess pre-operative nasal obstruction (100%) compared to plastic surgeons (24.1%) ( $P < .001$ ). Both services assessed cosmetic deformity to a similar extent. Otolaryngology elected operative management (53.3%) at a significantly higher rate than plastic surgery (24.1%) ( $P = .005$ ). Additionally, otolaryngologists were more likely to manage

**Table 2.** Practice Patterns by Consulting Service.

	Plastic Surgery (n = 29)	Otolaryngology (n = 107)	P-Value
	N (%)	N (%)	
Management characteristics			
Assessed nasal obstruction	7 (24.1%)	107 (100%)	<.001
Assessed cosmetic deformity	28 (96.6%)	104 (99%)	.326
Operative Management	7 (24.1%)	57 (53.3%)	.005
Management setting			.006
Outpatient	3 (42.9%)	52 (91.2%)	
Inpatient	4 (57.1%)	5 (8.8%)	
Time from Presentation to Surgery (mean/ standard deviation in days)	7.3 ± 10.7	20 ± 27.7	.019

**Table 3.** Demographics and Characteristics of Patients Receiving a Nasal Splint.

	Received Splint (n = 47)	No Splint (n = 17)	P-Value
	N (%)	N (%)	
Age (mean ± standard deviation in years)	39.6 ± 16.6	40.1 ± 16.1	.885
Sex (male)	32 (68.1%)	10 (58.8%)	.491
Race/Ethnicity			.578
Caucasian	10 (21.3%)	4 (23.5%)	
African-American	29 (61.7%)	8 (47.1%)	
Hispanic	5 (10.6%)	4 (23.5%)	
Asian	3 (6.4%)	1 (5.9%)	
Consultant type			<.001
Plastic surgery	1 (2.1%)	6 (35.3%)	
Otolaryngology	46 (97.9%)	11 (64.7%)	
Management Characteristics			
Assessed nasal obstruction	46 (97.9%)	13 (76.5%)	.005
Nasal obstruction present	40 (87%)	10 (76.9%)	.398
Improved nasal obstruction	39 (90.7%)	10 (76.9%)	.335
Assessed cosmetic deformity	47 (100%)	15 (100%)	1.00
Cosmetic deformity present	0 (0%)	2 (11.8%)	.067
Improved cosmetic appearance	44 (95.7%)	14 (82.4%)	.117
Management setting			.048
Outpatient	43 (91.5%)	12 (70.6%)	
Inpatient	4 (8.5%)	5 (29.4%)	
Time interval from presentation to surgery (mean/standard deviation in days)	22.4 ± 29.9	8.4 ± 7.9	.012

patients surgically in an outpatient setting (91.2%), whereas plastic surgery more commonly performed inpatient management (57.1%) ( $P = .006$ ). Finally, plastic surgery averaged a significantly shorter amount of time from presentation to operative management ( $7.3 \pm 10.7$  days) compared to otolaryngology ( $20 \pm 27.7$ ) ( $P = .019$ ) (Table 2).

Of the 64 patients who underwent operative management, 73.4% received a splint. No demographic variables were associated with splint usage ( $P > .05$ , for all). Otolaryngologists were significantly more likely to use a splint (97.9%) after operative intervention compared to

plastic surgeons (2.1%) ( $P < .001$ ). Additionally, patients who received a splint were significantly more likely to be evaluated for nasal obstruction on the initial examination (97.9%) compared to those who did not (76.5%) ( $P = .005$ ) (Table 3).

Most patients managed with an operative intervention had some form of nasal obstruction (78.1%) and cosmetic deformity (81.3%). Following surgery, most patients experienced a reduction in nasal obstruction (76.6%) and an improved cosmetic appearance (90.1%). These factors were not associated with splint usage ( $P > .05$ , for all). However,

**Table 4.** Demographics and Characteristics of Patients Requiring Revision Surgery.

	Revision Surgery (n = 7)	No Revision (n = 57)	P-Value
	N (%)	N (%)	
Age (mean $\pm$ standard deviation in years)	54.7 $\pm$ 9.1	37.8 $\pm$ 16.1	<b>.004</b>
Sex (male)	6 (85.7%)	36 (63.2%)	.236
Race/Ethnicity			.813
Caucasian	1 (14.3%)	13 (22.8%)	
African-American	5 (71.4%)	32 (56.1%)	
Hispanic	1 (14.3%)	8 (14%)	
Asian	0 (0%)	4 (7%)	
Consultant type			1.00
Plastic surgery	0 (0%)	7 (12.3%)	
Otolaryngology	7 (100%)	50 (87.7%)	
Management characteristics			
Assessed nasal obstruction	7 (100%)	52 (91.2%)	1.00
Nasal obstruction present	7 (100%)	43 (86%)	.232
Improved nasal obstruction	4 (57.1%)	43 (75.4%)	.370
Assessed cosmetic deformity	1 (14.3%)	48 (98%)	<b>&lt;.001</b>
Cosmetic deformity present	7 (100%)	55 (100%)	1.00
Improved cosmetic appearance	2 (28.6%)	56 (100%)	<b>&lt;.001</b>
Management setting			.580
Outpatient	7 (100%)	48 (84.2%)	
Inpatient	0 (0%)	9 (15.8%)	
Time interval from presentation to surgery (mean/standard deviation in days)	15.4 $\pm$ 4.9	19.1 $\pm$ 28.1	.060

splint usage was associated with outpatient management (91.5%,  $P=.048$ ) and a significantly longer time interval from presentation to surgery (22.4 days) compared to those who did not receive a splint (8.4 days) ( $P=.012$ ) (Table 3).

Patients requiring revision surgery demonstrated a more advanced age (54.7 years) compared to those who did not (37.8 years) ( $P=.004$ ). Sex and race/ethnicity were not associated with revision surgery ( $P>.05$ , for both). Consulting service was also not associated with a need for revision surgery. However, patients assessed for cosmetic deformity prior to surgical intervention were significantly less likely to require revision surgery (2%), compared to those not assessed for a deformity (14.3%) ( $P<.001$ ). Additionally, all patients (100%) with improved post-operative cosmetic appearance did not require revision surgery. However, of the patients who required revision surgery, 28.6% of patients did not experience cosmetic improvement ( $P<.001$ ) (Table 4). Management setting (inpatient versus outpatient) and time interval from presentation to treatment were not shown to predict revision surgery.

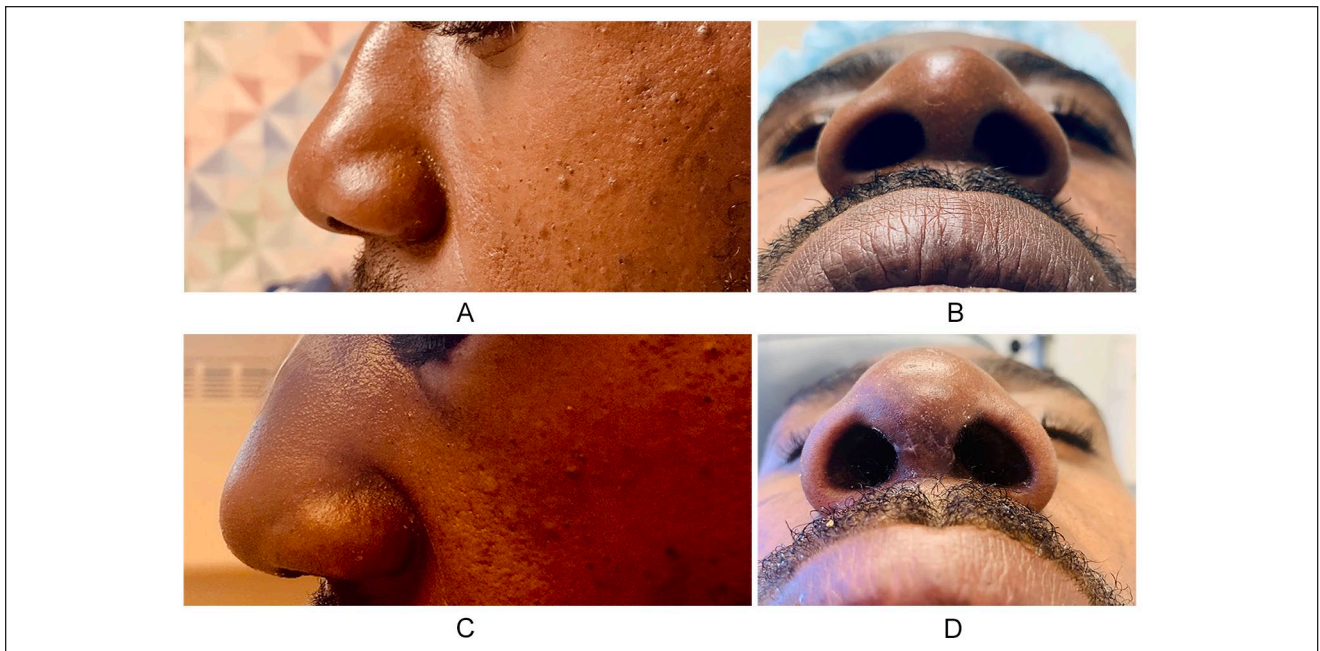
## Discussion

Nasal bone fractures are often overlooked and undertreated often leading to undesirable sequelae. The diagnosis and treatment of delay operative management on an outpatient basis compared to plastic surgery colleagues.

Nasal bone fractures are the third most common fracture of the human skeleton, comprising 39% of patients with maxillofacial trauma.<sup>15,20-22</sup> Many studies clearly define the importance of a thorough history and physical exam when approaching patients with a possible nasal fracture,<sup>3-4,8,12-13,16,19</sup> although our study demonstrates that management may differ by sub-specialty, as otolaryngologists are significantly more likely to assess nasal obstruction and utilize splints after surgical intervention. In addition, demographic data, patient age, chief complaint, history of injury, direction of blow, and differentiating acute versus chronic deformity/obstruction may all play a role in patient management.<sup>4,8,13,15,19</sup> Higuera et al. went on to delineate the signs and symptoms of nasal fractures, which include cerebrospinal fluid rhinorrhea, epistaxis, periorbital ecchymosis, tenderness to palpation and a palpable deformity.<sup>8</sup> An external evaluation, including palpation to detect step-offs and areas of tenderness as well as observation of nasal deviation, should be performed on all patients presenting with nasal trauma. This should be followed by an internal examination with proper lighting, a nasal speculum and suction.<sup>6,8,16,19</sup> A rigid or flexible endoscope can facilitate this examination, but is not a necessity. The most indicative sign of fracture is a tender, palpable or visible deformity.<sup>8</sup>

The demographics of this study cohort were somewhat consistent with the existing literature.<sup>9-10,13,15-17,23-24</sup> Most of the patients were male and otolaryngologists evaluated a





**Figure 1.** (A) 28-year-old male who underwent open septorhinoplasty following nasal trauma. Note significant dorsal hump (B) and poor columellar height on base view. (C) Following open septorhinoplasty, the patient exhibited improved dorsal contour (D) and columellar height.

Note. These changes can be more subtle in an African-American patient with thick skin, as seen in these photos.

greater proportion (72%) compared to plastic surgeons (51.7%), which we believe is incidental. Although the age profile of our cohort was slightly more advanced (mean  $47.6 \pm 20.2$  years) compared to previous studies, patients undergoing operative management were younger (mean  $39.7 \pm 6.2$  years). The majority of patients were identified as African-American, which varies in the literature depending on study location. Our institution draws patients from an urban, underserved neighborhood with a higher proportion of minority populations. While treating this patient population, it is important to remember that African-American features can be markedly different from other ethnic groups. African-Americans, on average, have wider and shorter nose than a typical European American and have an acute columella and nasolabial angle. They also tend to have thicker nasal skin with a thick fibro-fatty sublayer and a bulbous fatty nasal tip, weak lower lateral cartilage, and large nostrils in the vertical and horizontal dimensions. This features can be appreciated in Figure 1, which displays an African-American patient from our series who underwent open septorhinoplasty following nasal trauma<sup>25</sup> (Figure 1).

Most practitioners treating facial trauma will undoubtedly encounter nasal bone trauma.<sup>6,26</sup> In our series, both the otolaryngology and plastic surgery services performed consultations. They evaluated patients for cosmetic deformity in a similar manner, however, otolaryngologists were significantly more likely to assess nasal obstruction. This distinction led to

differences in patient management. Most of the patients had some form of nasal obstruction (78.1%) and cosmetic deformity (81.3%) prior to their procedure. Following surgery, most patients experienced a reduction in nasal obstruction (76.6%) and an improved cosmetic appearance (90.1%). Additionally, all patients with improved post-operative cosmetic appearance did not require revision surgery.

A systematic review conducted by Hwang et al. demonstrated an overall nasal deformity rate of 10.4%,<sup>27</sup> while Fernandes observed 100% cosmetic deformity and 73% nasal obstruction in his cohort.<sup>7</sup> Two otolaryngologists, Crowther and O'Donoghue, surveyed nasal fracture patients following reduction. In this series, 72% of patients reported that their nose appeared similar to what it was before injury while 28% felt they had a residual external deformity. In addition, 36% reported nasal obstruction. However, >50% did not feel they required revision surgery.<sup>23</sup> A study by another otolaryngologist Hung reported that 13% of patients were dissatisfied with their nasal deformity, 11% with their aesthetic appearance and 21% with their nasal patency following reduction. In addition, 29% requested revision surgery<sup>9</sup> which mirrored a similar study.<sup>21</sup> Although, others have reported higher satisfaction rates.<sup>21-22,28</sup> In one review of 13 studies, patients were happy following closed reduction with an average satisfaction rate of 79%, while surgeon satisfaction only averaged 37%.<sup>29</sup> A study by Yoon et al. observed no differences in post-reduction satisfaction between patients who had and did not have rhinoplasty.

Although, rhinoplasty patients were more likely to want a secondary procedure.<sup>30</sup>

Treatment of nasal bone trauma is not always required. If deformity or nasal obstruction is not present, observation alone is adequate.<sup>31</sup> In our cohort, nearly half of the patients underwent operative management. A larger proportion of these patients were managed surgically by the otolaryngology service (53.3%) compared to plastic surgery (24.1%). Both services initially treated patients with closed reduction (>70%), while open reduction and septorhinoplasty were utilized less often or in revision cases. This is similar to rates reported in the literature.<sup>23,26</sup> There are two principal methods in treating nasal bone fractures—closed reduction or open reduction.<sup>14,21,28,30</sup> Some of the advantages of closed reduction are that its simple, safe, fast, easy to perform, cost-effective and has minimal associated morbidity.<sup>4,17,20,28</sup> In previous studies, closed reduction alone had a success rate of 89% to 94.5%.<sup>16,26</sup> Open reduction or septorhinoplasty has classically been reserved for closed reduction failures.<sup>4,23,26</sup> Factors associated with undergoing a subsequent septorhinoplasty include young age, female gender, living in an urban setting and in the Western part of the United States, history of anxiety and a history of a preexisting nasal obstruction or defect.<sup>32</sup> Many recommend waiting 3 to 12 months for secondary repair.<sup>4,12-13,24,33-34</sup> However, others have advocated for concomitant septorhinoplasty with closed reduction to achieve a better cosmetic result.<sup>22,24,31,33</sup>

In this study, otolaryngologists were more likely to manage patients at a later date in an outpatient setting, whereas plastic surgery intervened earlier in an inpatient setting. Nasal bone fractures can be repaired within the first few hours of injury before swelling ensues. However, this is rare and most patients are managed 2 to 14 days following trauma to allow for swelling to subside.<sup>8,12,15-16,21</sup> It has been suggested that repair within the first 14 days of injury will decrease the likelihood of a patient needing a septorhinoplasty.<sup>26</sup> However, others have identified that delaying repair 2 to 5 weeks is acceptable.<sup>34</sup> As stated above, most patients in this cohort were successfully managed with closed reduction with very few patients requiring secondary open reduction or septorhinoplasty. Although otolaryngologists managed patients 20 days post-injury on average in this study, the large standard deviation (27.7) indicates there were outliers. A similar study reported that patients presented 15.6 (range 4-30) days post-injury on average.<sup>7</sup> The best explanation for this at a Level 1 trauma center are other serious injuries precluding the patients from early operative repair.<sup>26</sup> After all life-threatening and major organ injuries are dealt with, a secondary evaluation can be performed.<sup>6</sup>

In this study, 73.4% of patients who underwent surgical intervention received a splint. Otolaryngologists were more likely to use a splint (97.9%) compared to plastic surgeons (2.1%). This is likely a product of surgeon preference and post-graduate training which is based on anecdotal tradition

rather than randomized controlled studies.<sup>20,35</sup> It is well-reported in the literature that many surgeons use splints after reduction regardless of specialty.<sup>6,15-16</sup> Splints support and protect the nasal bones and cartilages, helps with the adherence of the skin to the underlying framework, aid in elimination of dead space and helps maintain reduction.<sup>6,8</sup> However, the benefit of splints is still debated, given their controversial stabilizing effect in complex or severely displaced fractures, patient discomfort, time-consuming application, cost, and potential for complications. In one study, splints were only used in 18.19% of repaired nasal bone fractures. They advocated splint use only for severely comminuted fractures managed by closed reduction.<sup>20</sup> Commonly used splints include aluminum Denver splints (Shippert Medical Technologies, Inc., Centennial, Colo.), Aquaplast (WFR/Aquaplast Corp; Avondale, Pa.), plaster of Paris, amongst others.<sup>15-16</sup> Our patients typically followed-up 1-week post-procedure, which is consistent with the literature for splint removal.<sup>16,20,34</sup> However, others recommend a more extensive follow-up that can extend 3 to 12 months out.<sup>7,15,17,21,36</sup>

Nasal fractures are sometimes misperceived to be insignificant, however they often need to be reevaluated,<sup>11,16,23</sup> as 9% to 62% of all closed reductions or observations can result in revision surgery to treat sequelae such as obstruction or deformity correction.<sup>4,7-9,14,19,22-23,26,28-29,34,37-38</sup> More notably, there are even higher dissatisfaction rates amongst surgeons treating nasal fractures.<sup>22,29</sup> In one study, 14 patients (15.6%) reported post-operative deformity. Of these, 71.4% were classified as functional and cosmetic, whereas the remaining 28.6% had only a functional deformity.<sup>16</sup> It has recently been shown that a preexisting nasal obstruction or defect was associated with higher rates of revision septorhinoplasty.<sup>31,34</sup> Within our cohort, 12% of patients managed by the otolaryngology service required revision surgery, which included secondary open reduction and septorhinoplasty. In contrast, no patients managed by plastic surgery required revision surgery. One explanation for this is that otolaryngologists operated on >50% patients they evaluated, while plastic surgery operated on <25%. Additionally, all otolaryngologists evaluated for nasal obstruction, both pre- and post-operatively, which could have uncovered more signs and symptoms for operative repair. Finally, otolaryngology was more likely to manage patients in an outpatient setting, therefore there may have been a greater potential for follow-up to determine whether revision surgery was indicated. Nonetheless, revision rates were not found to differ significantly between the two managing teams. Our series suggests a more advanced age and persistent cosmetic deformity may predict the need for revision surgery. In the elderly, the keystone area of the nasal bone, which is a clinically important structure for maintaining the stability of the dorsum of the nose, becomes weak due to the decrease in the volume of septal cartilage by



ossification. This may be one explanation for these patients requiring revision surgery.<sup>39</sup>

Although our study could not properly evaluate OMFS, recommend approach and guidelines have been delineated in previous literature.<sup>40-42</sup> Management begins with accurate diagnosis through both radiography and physical examination, as thorough evaluation for visible deformity and obstruction is critical to guiding the next steps, dictates management approach as well as timing. Severe deformity and obstruction most often require more immediate, and likely surgical, intervention, as these may compromise patient airway or represent greater pathology. Other findings may benefit from a delayed approach in order to assess the full extent of pathology, such as undetected deformity and late-forming edema. The closed approach is reserved for more acute, less severe injury, given that it is performed in a timely manner (ie, 10 days after injury or sooner), with generally good outcomes. Patients who require surgery will be those who have severe deformity in which closed reduction would be inadequate, requiring open reduction and/or complete septorhinoplasty. Regardless, splinting is recommended for both approaches in order to maintain patency, as is more acute treatment (10 > days).

The results of this study should be interpreted in the background of certain limitations. This was a retrospective, single-center experience. Plastic surgeons failing to evaluate nasal obstruction is likely a result of the failure to document a nasal examination. An explanation for this is that most patients evaluated by the plastic surgery service were initially seen by general surgery residents. However, these patients were later evaluated in the outpatient setting by an attending physician (two board-certified plastic surgeons in the practice). All otolaryngology consultations at least documented nasal obstruction on anterior rhinoscopy +/- nasal endoscopy. Patients following up at the otolaryngology outpatient office were seen by resident physicians, under the supervision of two board-certified, general otolaryngologists. Meanwhile, some patients in this study were only evaluated by the emergency medicine provider as an inpatient and were only seen by the consultant as an outpatient, which can be attributed to common curbside consults or over the phone discussions with consultants. Previous research has demonstrated that not all patients with nasal trauma require a referral to a specialist. It has been shown that patients can successfully triage themselves and decide if they need outpatient follow-up with a specialist when provided with appropriate information.<sup>18</sup> Although, nasal fracture patients are known to have poor follow-up.<sup>23</sup>

In order to standardize the results, we chose to only evaluate patients with isolated nasal bone fractures confirmed by CT scan. This unfortunately limited our sample size because there were other individuals diagnosed by physical examination and/or plain film (ie, x-ray). Patients sustaining septal

fractures were also initially included, but were then excluded because many of them subsequently underwent septoplasty which made the results more heterogeneous and difficult to analyze. This decision also limited our sample size. In this cohort, patients were more commonly evaluated by the otolaryngology team. This difference is a product of the maxillofacial call schedule at our institution—2 weeks/month otolaryngology, 1 week/month plastic surgery, and 1 week/month OMFS—which may confound follow-up times and approaches. One potential cause of the difference in time to treatment is that the plastic surgery service is covered by inhouse general surgery residents at all times, while otolaryngology residents are not inhouse while on call, causing potential delays in follow-up and as well as possibly conferring decreased patient admission due to non-urgent evaluation. As mentioned above, informal curbside consults were frequent, particularly within otolaryngology, which may also delay outpatient follow-up, formal consultation, and possibly cause decreased inpatient admission. Anecdotally, plastic surgeons operate less at our institution due to less operating room availability which may explain the smaller cohort with this group. Finally, the results of this study may be skewed due to the fact that OMFS consultations were excluded because follow-up documentation was unavailable. The study's external validity may be limited, as these are all listed factors specific to our institution, and thus different institutions with different protocols and/or patient populations may uncover different trends. Our future goals would be to design a prospective study which utilizes a more standardized consultation form to correct for heterogeneous results amongst consultation providers. Another additional measure would be to include one of the more established diagnostic and therapeutic algorithms. Finally, patient satisfaction with each procedure should be evaluated more objectively with a validated grading scale or questionnaire.

## Conclusions

Nasal bone fractures are often overlooked and undertreated often leading to undesirable sequelae. The diagnosis and treatment of nasal bone fractures can differ in many ways depending on the provider(s) involved. Otolaryngologists appear more likely to assess nasal obstruction, utilize splints after surgical intervention, and delay operative management on an outpatient basis compared to plastic surgery colleagues. Despite these findings, the decision to perform certain procedures and techniques will largely depend on the patient's needs, their anatomy and clinical presentation as well as the surgeon's preferences. As a result, a more standardized approach to certain patient types and scenarios is warranted by all individuals involved in the care of maxillofacial trauma patients.

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