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ACCORDANCE BETWEEN CLINICAL AND RADIOLOGIC FINDINGS OF NASAL BONE FRACTURE

NAZAL KEMİK KIRIĞININ KLİNİK VE RADYOLOJİK BULGULARI ARASINDAKİ UYUMU

Mehmet ÇELİK*, Said SÖNMEZ*, Mehmet Melih ÇİÇEK*, Levent AYDEMİR*, Mehmet Serkan ALPASLAN*, Şenol ÇOMOĞLU*

ABSTRACT

Objective: The goal of our study was to compare physical examination with plain X-ray findings in patients with a suspected nasal bone fracture (NBF).

Methods: The study included 403 patients who received a suspected NBF between 2014 and 2016; the files of these patients were retrospectively reviewed. In our tertiary hospital, patients with nasal bone trauma are principally admitted to the trauma and emergency department. Patients are first examined by a general surgeon for suspected NBF. Afterwards, lateral nasal radiography and otorhinolaryngology (ORL) consultations are requested. Presence of crepitation, radiologic findings, swelling, deviation of nasal axis, septal hematoma/fracture, and cause of trauma are all documented.

Results: The 403 patients who presented to the trauma and emergency department for suspected NBF included 274 males and 129 females, the median age was 25±18.7 years (range, 2-106 years). When the correlation between positive clinical and radiologic findings was analyzed, crepitation was correlated with radiologic data in 155/156 (99.3%) cases, deviation of nasal axis in 135/142 (95%), septal hematoma 4/5 (80%), swelling in 103/134 (76.8%), laceration in 60/93 (64.5%), and epistaxis in 7/14 (50%). The correlation of crepitation, deviation of nasal axis, and swelling with radiologic evaluation were found statistically significant.

Conclusion: Crepitation of nasal bone, deviation of nasal axis and swelling of the nasal dorsum were significantly correlated with plain X-ray imaging that had a positive finding of fracture. We believe that these results might have practical potential for diagnostic management and save time especially in crowded emergency departments.

Keywords: Crepitation; epistaxis; nasal; nasal bone fracture; plain X-ray; septal hematoma; trauma.

ÖZET

Amaç: Çalışmamızın amacı nazal kemik kırığı (NKK) olan hastalarda fizik muayene ile düz grafi bulgularını karşılaştırmaktı.

Yöntem: Çalışmada, 2014-2016 yılları arasında şüpheli nazal kemik fraktürü tanısı alan 403 hastanın dosyaları retrospektif olarak incelendi. Üçüncü basamak hastanemizde, burun kemiği travması olan hastalar Travmatoloji ve Acil Cerrahi başvurusunun ardından, NKK şüphesiyle lateral burun radyografisi ile Kulak Burun Boğaz Servisi'ne konsülte edilmektedir. Hastaların bulguları krepitasyon, şişlik, aks devisyonu ve septal hematom/kırık varlığına; radyolojik bulgulara ve travmanın nedenine göre kategorize edildi.

Bulgular: Nazal kemik kırığı şüphesi nedeniyle değerlendirilen 403 hastanın 274 ü erkek ve 129 u kadın olup; medyan yaş 25 ± 18.7 idi. (aralık; 2-106 yaş) Pozitif klinik ve radyolojik bulgular arasındaki korelasyonu analiz ettiğimizde radyolojik verilerde; krepitasyon 155/156 (% 99.3), aks deviasyonu 135/142 (%95), septal hematom 4/5 (% 80), şişlik 103/134 (% 76.8), laserasyon 60/93 (%64.5) ve burun kanaması 7/14(% 50) oranında tespit edildi.

Krepitasyon, aks deviasyonu ve şişlik ile radyolojik değerlendirme arasındaki korelasyon istatistiksel olarak anlamlı bulundu.

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* Istanbul University, Istanbul Faculty of Medicine, Department of Otorhinolaryngology-Head and Neck Surgery, Istanbul, TURKEY

(Corresponding author/İletişim kurulacak yazar: mehmetcelik@istanbul.edu.tr)

Sonuç: Fizik muayene ile burun kemiğinin krepitasyonu, aks deviasyonu ve burun dorsumunun şişmesi ile kırık bulgusu pozitif olan düz X-ray görüntüleme arasında anlamlı korelasyon göstermiştir. Bu sonuçların, özellikle kalabalık acil servislerde tanı yöntemleri için pratik bir potansiyele sahip olabileceğine ve zaman kazandıracağına inanıyoruz.
Anahtar kelimeler: Burun; krepitasyon; epistaksis; nazal; nazal kemik kırığı; direk grafi; septal hematom; travma.

INTRODUCTION

Nasal bone fracture (NBF) is the most common type of facial fracture, and the third most common fracture of the human skeleton (1, 2). Interpersonal violence and motor vehicle crashes are the main causes, and alcohol consumption is often another factor (3).

Identifying NBFs is dependent on a thorough history and physical examination (4). Patients usually present with some combination of epistaxis, edema, laceration, instability, crepitation, ecchymosis, and deformity; however, these physical findings may not always be present and are often fading (5). Although radiographic assessment (plain X-ray) is highly controversial for the clinical decision of nasal fracture in the emergency department, it is a common procedure for imaging of suspected cases. Plain X-ray has high sensitivity (88%) and specificity (95%) for NBF; however, both sensitivity and specificity is lower for fractures of the lateral nasal wall than for those of nasal bones, although the specificity is higher (75%) than the sensitivity (28%) (6). On the other hand, nasal bones are not totally ossified and fused in the pediatric population in whom X-ray has even less value (7).

Newer computed tomography (CT) scans have greater sensitivity and specificity for NBF. However, radiation exposure, high price, and lack of impact on management do not justify their use in diagnosing isolated NBFs, however, CT scans can be a valuable tool if the patient has extensive maxillofacial trauma (8).

Untreated NBFs, delayed time to treatment, traumatic edema, and occult septal injury may cause functional and cosmetic defects. Therefore, timely accurate diagnosis and appropriate intervention are important steps for the management of NBFs (4).

The goal of this study was to compare physical examinations with plain X-ray findings in patients with a suspected NBF, and also to demonstrate descriptive results in the emergency department.

MATERIALS AND METHODS

The study is a retrospective review of 403 patients who received suspected NBF between 2014 and 2016.

In our tertiary hospital, patients with nasal bone trauma are principally admitted to the trauma and emergency department. Patients are first examined by a general surgeon for suspected NBF. Afterwards, plain X-ray for lateral nasal radiography and otorhinolaryngology (ORL) consultations are requested.

Clinical and radiologic evaluation of the patient is performed by an ORL subspecialist and expert radiologist. The final diagnosis is immediately reported in case of any similarity between radiologic findings and physical examination. If there is no physical and historical clue of NBF, doubtful radiologic findings are concluded as negative.

Clinical assessment of patient by ORL subspecialists start with an inspection of the face, paying attention to the presence of any swelling and/or deviation of the nasal axis (Fig. 1). Then nasal cavity is examined with anterior rhino-endoscopy for septal hematoma and/or fracture, and presence and/or location of epistaxis. Moreover, the nasal dorsum is palpated in order to detect any sign of crepitation. Presence of crepitation, radiologic findings, swelling, deviation of the nasal axis, septal hematoma/fracture, and causes of trauma are all documented.

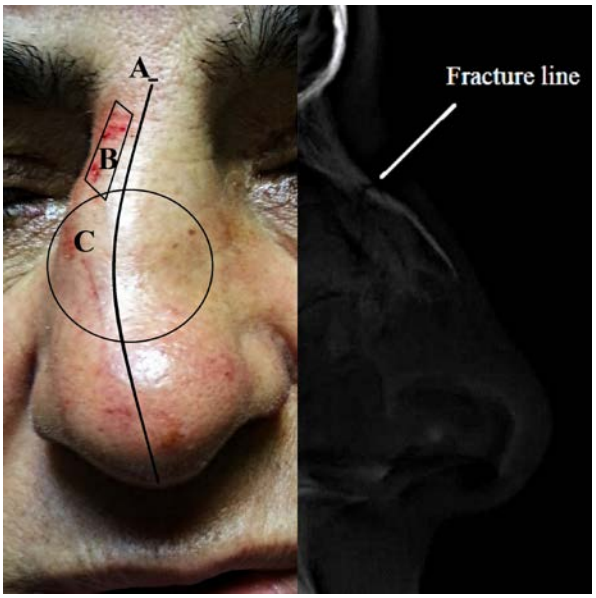

Figure 1. (Left) Clinical findings of nasal fracture. (A). Deviation ("C" shape) of the nasal axis (B). Laceration of the nasal skin (C). Swelling of the nasal dorsum. (Right) Plain X-ray showing nasal fracture line.

RESULTS

The 403 patients who presented to the trauma and emergency department for suspected NBF included 274 males and 129 females, the median age was 25±18.7 years (range, 2-106 years). No statistically significant differences were observed in terms of sex. Moreover, NBF was found more common in patients in their second and third decades.

The causes of trauma were associated with accidents in 12 (3%) cases, falls in 134 (33.3%), violence in 75 (18.6%), and bump in 182 (45.2%) (Table 1).

Radiologic findings were positively correlated with nasal bone fracture in 240 cases. CT scans were

obtained for only one case because of suspicious findings in plain X-ray.

Table 1: This table demonstrates the descriptive results of the patients

Median Age (years)	25 ± 18.7
Male, n (%)	274 (68%)
Female, n (%)	129 (32%)
Cause of Trauma, n (%)	
• Accident	12 (3%)
• Violence	75 (18.6%)
• Fall	134 (33.3%)
• Bump	182 (45.2%)

Clinical findings included crepitation of the nasal bone in 166 patients, nasal axis deviation in 142, swelling of the nasal dorsum in 134, laceration of nasal skin in 93, epistaxis in 14, and septal hematoma in 5 patients.

When we analyzed the correlation between positive clinical and radiologic findings, we found that crepitation was correlated with radiologic data in 155/156 (99.3%) cases, deviation of nasal axis in 135/142 (95%), septal hematoma 4/5 (80%), swelling in 103/134 (76.8%), laceration in 60/93 (64.5%), and epistaxis in 7/14 (50%). The correlation of crepitation, deviation of nasal axis, and swelling with radiologic evaluation was found statistically significant (Table 2) ($p<0.05$).

Table 2. Correlation between clinical and radiologic findings of nasal bone fracture

Clinical Findings, n (%)	**Plain X-Ray Findings**		***p*-Value**: test for significant relationship between clinical and radiologic findings
	Negative n: 163	Positive n: 240	
Crepitation of Nasal Bone	1	155 (99.3%)	***p***<0.05
Swelling of Nasal Dorsum	31	103 (76.8%)	***p***<0.05
Nasal Septal Hematoma	1	4 (80%)	***p***>0.05
Laceration of Nasal Skin	33	60 (64.5%)	***p***>0.05
Epistaxis	7	7 (50%)	***p***>0.05
Deviation of Nasal Axis	7	135 (95%)	***p***<0.05
Cause of Trauma, n (%)			
• Accident	4 (33.3%)	8 (66.7%)	
• Violence	9 (12%)	66 (88%)	***p***<0.05
• Fall	58 (43.3%)	76 (56.7%)	
• Bump	92 (56.4%)	90 (37.6%)	

DISCUSSION

Diagnosis of NBF is primarily clinical. Patients with acute nasal trauma may report epistaxis, nasal deformity, subconjuctival hemorrhage, pain, edema, ecchymosis or nasal obstruction. Highly suspicious signs of nasal fracture are crepitation, mucosal lacerations, septal fracture and/or dislocation, obvious concavity, and depressions of the nasal bone (8).

Radiographic assessment (plain X-ray) of nasal fracture is highly controversial for clinical decisions in the emergency department. Besides, the anatomy of the nose with cartilaginous and boney structures can cause confusion for the management of this injury (Fig. 2). For instance, plain X-Ray is usually not useful for diagnosis of NBF in the pediatric population whose nasal bones are not ossified (7). There are some more limitations of X-ray imaging. It is not capable of detecting cartilaginous fracture and there are several situations with false positive results such as soft tissue swelling, previous fracture, the presence of suture lines, developmental defects, and vascular marking.[9] Nevertheless, some studies suggest that radiography of the nose should be obtained for showing fractures and for medicolegal purposes (10, 11).

CT scans have greater sensitivity and specificity for NBF and should be obtained if there is a concern of multiple facial fractures (8, 12). CT scans are very important for detecting NBF, though in some depressed nasal fractures, lateral plain X-ray may be more useful than CT (13). Radiation exposure, higher cost, and the time-consuming nature of CT are counted among its disadvantages, thus plain X-Ray imaging for diagnostic study should be preferred (8, 14. 15). In our clinic, we order plain X-ray imaging for all patients with sole

suspicion of NBF both for diagnostic workup and medicolegal purposes, and high resolution maxillofacial CT for patients with extensive trauma.

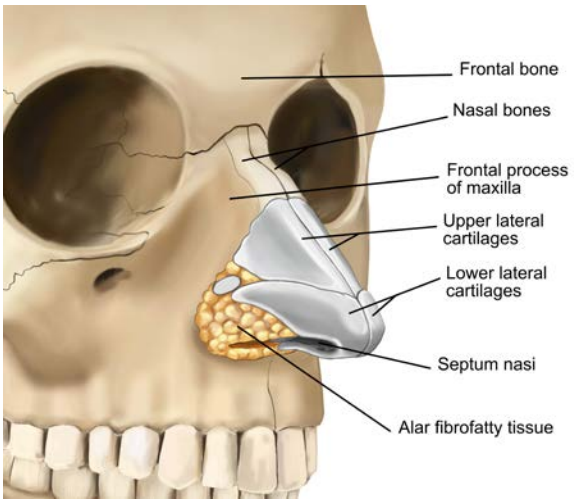

Figure 2. Anatomy of the external nose

In acute trauma, a complete physical examination is mandatory. Higuera et al. classified patients with nasal trauma clinically rather than by pathologic pattern of injury. Type I trauma can be defined as soft tissue injury without any concomitant injury of nasal structures. Type II-a trauma defines a simple unilateral nondisplaced nasal bone fracture, whereas type II-b involves simple bilateral nondisplaced fracture. Type III defines simple displaced fracture, and type IV injuries are determined as closed comminuted fractures. An open comminuted fracture or any of the above types with concomitant septal hematoma, cerebrospinal fluid rhinorrhea, airway obstruction, crush injury, severe displacement or associated naso-orbito-ethmoid midface fractures are defined as type V fractures (16). Some studies suggested that the most certain sign of fracture was a tender palpable or visible deformity. Radiographs are of no real use in this assessment (8, 16). We found crepitation of the nasal bone as the most significant sign for NBF, followed by deviation of the nasal axis and swelling, respectively.

Among the external facial bones, nasal bones are the most fragile structures with the least amount of resistance to impact force (17). We found that cause of trauma was significantly related to NBF incidence and interpersonal violence was the most frequent reason. This result can be explained as impact force is directly targeted to the nasal bones. Some studies have shown that the resultant nasal fracture is associated with lateral forces (18, 19). It has been shown that the amount of force needed to create fracture in the nasal bone was approximately 24-50 kilopascals. In this type of trauma, the nasal axis may appear deviated, the sign that has better prognosis for cosmetic and functional restoration than depressed-type fracture (20). On the other hand, some studies mentioned mission of the nasal septum during nasal trauma. When damage occurs, depending on the degree of force, the septum may dislocate, flex or fracture (8, 21). However, we found that septal hematoma, which can be an indicator for septal injury, was not significantly associated with NBF. There was a paucity of cases (n=5) with septal hematoma in our cohort and new case series are needed.

We found the peak incidence of NBF in patients in their second and third decades. In this age group, resultant fractures were frequently associated with bumping and violence, respectively. This result is in agreement with studies in the literature (11, 12).

The major limitation of this study is the lack of detailed information with regard to fracture. Hence, it is difficult to comment on the exact extent of injury and classify cohorts.

CONCLUSION

Our study revealed that clinical findings such as crepitation of nasal bone, deviation of the nasal axis, and swelling of the nasal dorsum were significantly correlated with plain X-ray imaging that had a positive finding of fracture. We believe that these results might have practical potential for diagnostic management and save time, especially in crowded emergency departments.

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Conflict of interest The authors declare that they have no conflict of interest.

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