

Examination of the Clinic, Radiologic, and Demographic Characteristics of 436 Patients with Nasal Fracture

ABSTRACT

Background: The aim of this study is to retrospectively investigate the demographic characteristics, mechanism of injury, physical examination and radiological findings, types of fractures, accompanying injuries, and treatment methods of adult patients who presented with nasal fracture.

Methods: The data of 436 adult patients diagnosed with nasal fracture within a period of 2 years in a tertiary hospital were used for this study. Along with demographic characteristics of the cases, mechanism of injury, time interval between admission and injury, radiological methods applied, type of nasal fracture, accompanying injuries, presence of septal hematoma, whether reduction was performed or not, and whether it was a medico-legal case were investigated.

Results: Nasal fractures were more common in men, with a total of 301 (69%) male patients and a mean age of 36.2. Type I and II nasal fractures were the most common in both genders. Computed tomography was used in 198 (45.4%) patients, while direct radiography was used in 180 (41.3%) patients. The most common accompanying injury was maxillary bone fracture. Reduction was applied to 183 (42%) patients with nasal fractures. Septal hematoma was present in 4.8% of cases.

Conclusion: Nasal fracture is more commonly seen in men. Falling is the most common cause of nasal fracture in all age groups. Although it is no longer recommended as much for fracture investigation, direct radiography is still frequently used. The presence of septal hematoma should always be investigated in nasal fracture cases, and early intervention should be performed if septal hematoma is detected in order to prevent complications.

Keywords: Nasal bone, nasal fracture, maxillofacial trauma

INTRODUCTION

Due to its prominent location in the middle of the face, the nose is often subject to trauma. Nasal fractures (NF) make up more than 50% of all maxillofacial fractures. Nasal fractures can occur as a result of high-energy trauma, such as motor vehicle accidents, sports injuries, domestic accidents, and physical violence.^{1,2} The nose is one of the most important aesthetic and functional units of the face. Because it contains structures with different characteristics, such as bone, cartilage, mucosa, and skin, managing injuries in the nasal region can be challenging. Knowledge of the anatomy of this region is the most fundamental factor in selecting an appropriate treatment approach.

Patients who have suffered trauma to the maxillofacial region often present to the emergency department due to symptoms such as nasal bleeding, edema, ecchymosis, deformity, and laceration. Following initial evaluation in the emergency department, patients with suspected nasal bone fracture are referred to either Otorhinolaryngology (ENT) or Plastic and Reconstructive Surgery (PRC) clinics.^{1,3} Although direct radiography has some limitations for the clinical diagnosis of nasal bone fracture, it is still the most commonly used procedure for imaging suspected cases. Direct radiography has a high sensitivity (88%) and specificity (95%) for nasal bone fractures, but its sensitivity (75%) and specificity (28%) for lateral nasal wall fractures are lower.⁴ However, in pediatric patients, the diagnostic value is lower due to the fact that nasal bones are not completely ossified and fused.⁵



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The diagnosis of both nasal bone and lateral wall fractures can be made more accurately with computerized tomography imaging that includes the maxillofacial region. However, both the cost and radiation exposure to the patient are major disadvantages of tomography. Based on the physical examination and radiological evaluations (lateral nasal radiography or maxillofacial computerized tomography), a diagnosis of nasal bone fracture can be made, and appropriate interventions can be performed in the outpatient clinic or operating room setting.^{1,6} Although there are various classification systems for NF types, there is no widely accepted classification system. Clinicians often consider the presence, location, fragmentation, and nasal height loss of the fracture when planning treatment.⁷

The aim of this study is to investigate, through retrospective analysis of patient records, the type of fracture, etiological factors, physical examination and radiological findings (including computed tomography (CT) and direct radiography), treatment interventions, and sociodemographic characteristics of patients with NFs, and to compare the results with similar studies in the literature. The study seeks to provide insights into the management and diagnosis of NFs, as well as the various factors that may influence the clinical outcomes of patients with this condition.

MATERIAL AND METHODS

In this study, patients aged 18 and over who were diagnosed with suspected NF between January 2018 and December 2020 in Muğla Training and Research Hospital were retrospectively examined through hospital records. The study was approved by the Muğla Sıtkı Koçman University Human Research Ethics Committee on June 13, 2021, with decision number 123. Then, records of patients who received at least one of the diagnoses "nasal bone fracture, maxillofacial injury, nasal surface injury" in the emergency department, ENT, and PRC clinics were accessed from the hospital automation system and the ENT and PRC clinic archives, and patients with complete information who were over 18 years old were included in the study. Patients who were diagnosed with nasal bone fracture but had no fracture detected on radiological examination and examination records, patients with old fractures unrelated to trauma, patients whose records could not be accessed, and patients under 18 years old were excluded from the study.

In the data collection form created for the study, age, gender, admission date, department of admission, mechanism of injury,

MAIN POINTS

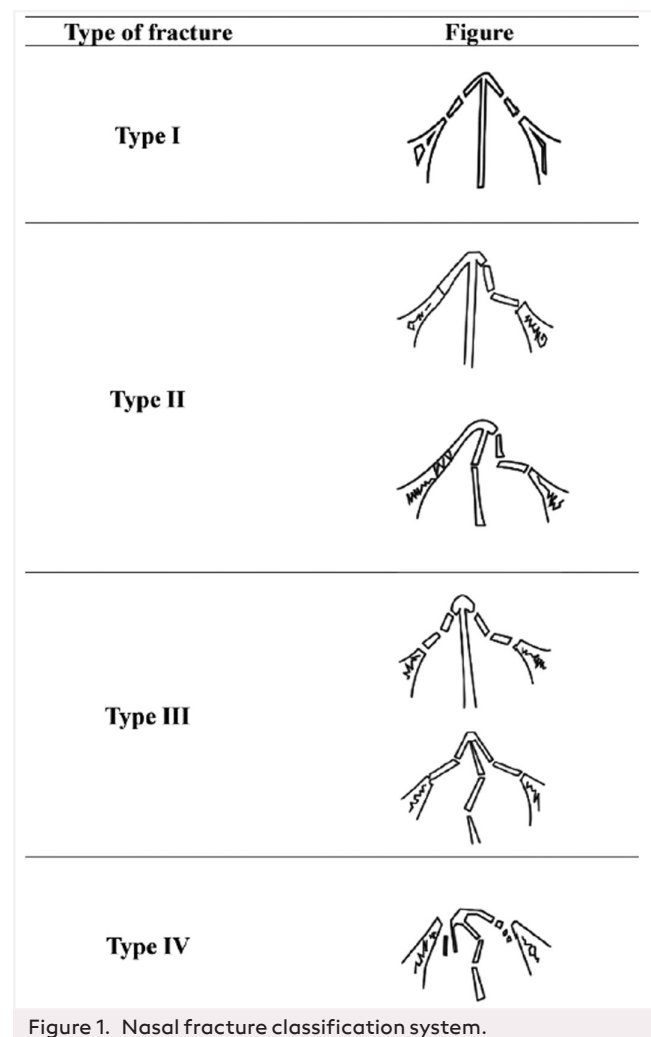
- The nasal bone is the most commonly broken bone in maxillofacial trauma.
- The most common etiological cause of nasal bone fractures is falling.
- Nasal fracture is most commonly accompanied by maxillary fracture.
- Septal hematoma is seen in 4% after nasal fracture.
- Type III NFs were most commonly caused by physical violence, and type IV NFs were most commonly caused by traffic accidents.

time elapsed between admission date and trauma, radiological methods applied to the patient, type of NF, associated injuries, presence of septal hematoma, and whether there was a forensic case were investigated. In addition, information on the treatment method applied to the patient, presence of follow-up imaging, and whether a late-stage operation was performed due to deformity was examined. The classification system described by Kim et al was used to determine the type of NF.⁸ According to this classification system, NFs are classified as follows:

- Type I, non-depressed linear fracture;
- Type II, unilateral depressed fracture with or without septal fracture;
- Type III, bilateral depressed fracture with or without septal fracture;
- Type IV, comminuted fracture, divided into 4 groups (Figure 1).

Statistical Analysis

Statistical analysis was performed using the SPSS v. 22 (IBM SPSS Corp.; Armonk, NY, USA) software program. Descriptive statistics were presented as number, percentage, mean, and SD.



RESULTS

Records of 436 patients with NFs who met the inclusion and exclusion criteria for the study within the determined time period were accessed. Of all patients, 301 (69%) were male and 135 (31%) were female, and the mean age was 36.2 ± 17.41 (age range; 18-94 years). The male-to-female ratio was found to be 2.22. It was found that 223 of all patients applied to the emergency department, 171 to the ENT Department, and 42 to the PRC clinics.

It was determined that 167 (38.3%) of the patients with NFs were due to falls, 86 (19.7%) were due to physical violence, 68 (15.6%) were due to traffic accidents, 54 (12.4%) were due to home accidents, 27 (6.2%) were due to sports injuries, and 34 (7.8%) were due to other reasons. It was observed that NFs most commonly occurred after falls. The distribution of patients according to the type of trauma is given in Table 1.

When considering age groups, the most common cause of NF was found to be falls in both the 18-65 age group and those over 65 years old. However, in the over 65 age group, over half of all fractures were caused by falls, while in the 18-65 age group, this ratio was approximately 1 in 3. The distribution of trauma types according to age groups is shown in Table 1.

Trauma types that lead to NFs according to gender are presented in Table 1. The most common etiological reasons in male patients were falls and physical violence, while in female cases, the most common reasons were falls and household accidents.

When evaluating the types of fractures in patients, type I fracture was the most common (50.9%), followed by type II in 24.5% of cases, type III in 14.7% of cases, and type IV fracture in 9.9% of cases. The distribution of fracture types by gender is presented in Table 2.

When comparing nasal bone fracture types according to the cause of trauma, NFs due to falls and household accidents were most commonly seen as type I NFs. Type III NFs were most commonly caused by physical violence, and type IV NFs were most commonly caused by traffic accidents (Table 3).

When analyzed in terms of radiological imaging methods applied for fracture detection in patients, it was found that CT was applied to 198 (45.4%) cases, direct radiography was applied to 180 (41.3%) cases, and no imaging method was applied to 57 cases. It was understood that at least 1 radiological imaging method was applied to 86.9% of all patients.

Among the 436 patients who presented to our hospital due to facial trauma and had nasal bone fractures, it was observed that

Table 1. Distribution of Patients with Nasal Fracture by Trauma Type

Trauma Type	Age Between 18 and 65 years		Over 65 Years		All Cases		Male		Female	
	n	%	n	%	n	%	n	%	n	%
Fall	145	36.6	22	55	167	38.3	109	36.2	58	43
Traffic accident	60	15.2	8	20	68	15.6	48	15.9	20	14.8
Physical violence	83	21	3	7.5	87	19.7	73	24.3	13	9.6
Home accident	50	12.6	4	10	54	12.4	22	7.3	32	23.7
Sport injury	27	6.8	0	0	27	12.4	26	8.6	1	0.7
Other	31	7.6	3	7.5	34	12.4	23	7.6	11	8.1
Total	396	100	40	100	436	100	301	100	135	100

Table 2. Distribution of Fracture Types by Gender

	Type I		Type II		Type III		Type IV		Total	
	n	%	n	%	n	%	n	%	n	%
Male	146	48.5	68	22.6	51	16.9	36	12	301	100
Female	76	56.3	39	28.9	13	9.6	7	5.2	135	100
Total	222	50.9	107	24.5	64	14.6	43	9.8	436	100

Table 3. Distribution of Trauma Types by Nasal Fracture Types

Trauma type	Type I		Type II		Type III		Type IV		Total	
	n	%	n	%	n	%	n	%	n	%
Fall	102	61.1	34	20.4	21	12.6	10	6	167	100
Traffic accident	26	38.2	20	29.4	8	11.8	14	20.6	68	100
Physical violence	27	31.4	28	32.6	21	24.4	10	11.6	86	100
Home accident	36	66.7	11	20.4	6	11.1	1	1.9	54	100
Sport injury	13	48.1	8	29.6	6	22.2	0	0	27	100
Other	18	52.9	6	17.6	2	5.9	8	23.5	34	100
Total	222	50.8	107	24.6	64	14.7	43	9.9	436	100

Table 4. Distribution of Concomitant Injury

Concomitant Injury	n	%
No	338	77.5
Maxilla	24	5.5
Zygoma	20	4.6
Orbital wall	14	3.2
Other	13	3.0
Multiple bone fractures	27	6.2
Septal hematoma	21	4.8

there was accompanying facial bone injury in 98 (22.5%) cases. The distribution of accompanying injuries is shown in Table 4. The presence of septal hematoma, which is one of the most important findings we pay attention to in NF cases in otorhinolaryngology practice, was detected in 21 (4.8%) patients.

It was found that reduction was applied to 183 (42%) of the patients with NFs in their records, and 174 of these were closed reduction and 9 were open reduction. Among 40 NF patients aged 65 and over, reduction was applied only to 10, and no NF reduction was performed in 30 cases. It was determined that 240 (55%) of the 436 cases presented to the hospital on the same day. In addition, 131 (30%) of all cases were evaluated as forensic events, and temporary forensic reports were issued.

DISCUSSION

In our study, the clinical data, radiological findings, and sociodemographic characteristics of patients treated with a diagnosis of NF were examined among patients admitted to the ENT and PRC clinics and Emergency Department. Maxillofacial injuries are common in both ENT and PRC clinics as well as in emergency practice. Nasal bone fracture can occur as an isolated fracture or in more than 60% of patients with multiple system trauma.⁹ The facial region contains organs that perform essential functions for the body such as breathing, speaking, chewing, smelling, and seeing, as well as being an aesthetic area. Therefore, the management of patients with maxillofacial trauma requires special attention and often a multidisciplinary approach. While NF is the most common type of maxillofacial trauma, it is the third most common type of fracture among all bones in the body.^{7,9}

When the gender distribution of the cases included in the study was examined, 69% of the 436 patients were male and 31% were female. According to the literature, the male-to-female ratio of facial injuries varies greatly, ranging from 2.2:1 to 9.4:1, and NF is much more common in males.^{10,11}

In our study, the male/female ratio was similar to the literature, at 2.22/1. In a study by Demir et al that included 121 patients, 74% were male and 26% were female.¹² Men are more active in social life and are therefore more exposed to traffic accidents, assault, falls, work and sports-related accidents, and the use of hard objects such as fists and sticks during fights. On the other hand, women are more likely to experience trauma such as slapping and pushing during assaults, which may explain why men are more prone to NFs. In our study, the mean age for NFs was 36.2 ± 17.41 . However, 396 cases were between the ages of 18 and 65 and 40 cases were over 65 years old. When the literature is examined, it is seen that facial fractures in this patient group are

most common in those under 40 years old. Arslan et al reported a mean age of 40.3 ± 17.2 , while Gönüllü et al reported a mean age of 23.61 ± 16.75 .^{13,14} In a multicenter study by Boffano et al, the mean age for NF cases ranged from 29.9 to 43.9.¹⁰ Our results are consistent with the literature.

When the types of injuries were examined according to gender, many studies have reported that traffic accidents, falls, and physical assault are the most common etiologies for both genders. Kostakis et al reported that physical assault was the most common cause among men (28.9%), while falls were the most common cause among women (32%).¹⁵ In our study, unlike others, falls were the most common cause in both groups, while physical assault was the second most common cause in male patients, and home accidents were the second most common cause in female patients. This result may be due to the higher incidence of physical assault events in male patients. When trauma etiology was examined according to age groups, it was seen that over half of NFs in patients over 65 years old were caused by falls. Li et al reported in their study of 1193 NFs that falls were the most common cause.¹⁶ In a study of maxillofacial trauma patients, Boffano et al reported that falls were the most common cause in patients over 40 years old. Although different rates have been reported in some studies, falls, traffic accidents, and physical assault are the 3 most common etiologies for facial injuries.¹⁰ Arslan et al reported rates of physical assault (39.7%), falls (27.9%), and traffic accidents (27.2%).¹⁵

When the type of NF was examined according to the type of trauma, it was found that type I fracture occurred in over half of falls and home accidents. Type IV fracture, which is multiple and comminuted, with depression, was most commonly seen in traffic accidents. This result may be related to the higher energy of trauma in traffic accidents.

In the detection and evaluation of fractures, a radiological examination method is commonly used. Although the preferred method is usually the direct radiograph, concerns have been expressed in the literature regarding its necessity and diagnostic power.¹⁷

Direct radiographs taken from a lateral view may show fractures, but they are insufficient in showing nondisplaced fractures, lateral wall fractures, and septal fractures. Therefore, some guidelines recommend against the use of direct radiographs in simple NF cases.¹⁸ Hwang and colleagues reported that the detection rate of NFs with a lateral view direct radiograph and Waters' view was 82%, while CT showed all fractures in a series of 503 cases.¹⁹

Noncontrast CT is considered a superior imaging method for the detection of small and nondisplaced fractures, septal fractures, and accompanying fractures of other facial bones. However, as many fracture cases have forensic characteristics, CT is preferred for providing objective evidence from a medico-legal perspective. The main disadvantages of paranasal sinus CT are its high cost and high radiation exposure. Nevertheless, as it meets expectations to a large extent with its speed, high benefit/cost ratio, and high accuracy rate in trauma patients, it is recommended as the imaging method of choice.¹⁹ Ultrasonography is another imaging method that is rarely used in addition to direct radiography and CT for the detection of fractures, but it has

not gained widespread use. The most significant advantage of ultrasonography is that it is cheap, has no radiation exposure, is not affected by edema, and can detect fractures at a high rate. However, the main handicaps of ultrasonography are the need for expertise in its application and limitations in documenting fractures. Nevertheless, it is preferred in pregnant and pediatric patients due to the absence of radiation exposure.²⁰

According to our study, a noteworthy finding is the frequency of septal hematoma. Septal hematoma was detected in 4.8% of all cases, which emphasizes the importance of early evaluation by an ENT physician after trauma. Septal hematoma can cause necrosis of the cartilage in a short period of time, such as 24-72 hours, by disrupting the blood supply to the septal cartilage. It should be noted that delayed treatment can lead to significant complications such as septal abscess and nasal deformities.²¹

Out of all the patients, 240 of them presented to the hospital on the same day. Early presentation to the hospital on the same day can provide an advantage for reduction. Timing is crucial in the treatment of NFs. Fracture treatment can be divided into 2 types according to timing: emergency reduction and delayed reduction. Emergency reduction is a reduction performed within the first few hours after the fracture occurs, before the development of swelling. Swelling that occurs shortly after trauma around the nose and its surroundings makes fracture reduction difficult. Delayed reduction is a more acceptable method after the development of swelling and edema. The ideal timing for delayed reduction is considered to be between 3 and 14 days.⁷ However, studies in the literature suggest that delayed reduction can be performed up to 4-5 weeks.²²

Limitations

In our study, reduction was applied to 183 of the patients (42%). This rate can be considered low. However, since this result was obtained from the records of a single hospital, the rate may be higher with patients who received treatment later in a different healthcare institution.

CONCLUSION

In conclusion, it can be stated that NFs are more common in males, with falls being the most common cause in all age groups and both genders. However, the rate of NFs due to falls is much higher in the elderly. The finding that CT scans are preferred over direct radiographs for fracture detection is noteworthy. Another important result is the incidence of septal hematoma in nearly 1 out of 20 patients, emphasizing the importance of early evaluation by an otolaryngologist in cases of NF. It should be kept in mind that when treatment is delayed, significant complications such as septal abscess and nasal deformities may occur.

Ethics Committee Approval: The study was approved by Muğla Sıtkı Koçman University Human Research Ethics Committee (Approval no: 123 Date: 13.06.2021).

Informed Consent: N/A.

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Ö.F.G.; Literature Search – Ö.F.G.; Writing Manuscript – E.Ö., Ö.F.G.; Critical Review – E.Ö., E.D.

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