

## Comparison of Physical Examination and Conventional Radiography in Diagnosis of Nasal Fracture

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**Abstract** Nasal bone fracture is the most common fracture which would result from facial trauma. So, the present study performed to select the most reliable way to diagnose new fractures considering CT scan results as a gold standard in this matter. All the people refer to a forensic medicine center were, at first, physically examined by general practitioners. Plain lateral radiography and ENT consult were requested afterwards. CT scan was requested to get trusty results in case of any imbalance between Radiographic finding and physical examination. The results finally were evaluated and compared. CT scan was tried for 61 (6%) patients with positive clinical findings for new fracture which were not supported by radiologic studies. New fracture was identified in 55 participants out of the above number. Trusting physical examination and its preference to the radiologic findings has special value in cases where fracture is not detectable by radiography and there is no access to CT scan.

**Key Message** Trusting physical examination and its preference to the radiologic findings has special value in cases where fracture is not detectable by radiography and there is no access to CT scan.

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### Introduction

Facial fractures are the major cases referring to the forensic medicine centers, as a matter of fact, and nasal bone fracture is the most common fracture in the face [1–4] which its diagnosis would probably face some difficulties despite its simplicity [1, 5].

Therefore, a reliable diagnosis of a new fracture absolutely is very vital to prevent injustice for the complainant and the culprit.

After physical examination, radiography is the main diagnostic method for nasal bone fracture; including lateral-view imaging for nasal dorsum and occipitomental view focusing on lateral nasal walls.

In a study by Kwon et al. it was detected that ultrasonography had a positive linear correlation with computed tomography in diagnosing nasal bone fractures [1, 6]. On the contrary, in comparison with ultrasonography (83% sensitivity and 50% specificity), plain radiography was more effective in a study in 2005 conducted by Thiede (94% sensitivity and 83% specificity) in nasal bone fracture diagnosis [1].

Computed tomography (CT) scan as a gold standard could segregate old and new fractures which make confusion in diagnosis only based on physical examination and plain radiography. But, in some situations, this standard diagnostic imaging method would be limited because of high price or lack of access and facilities. So, finding a diagnostic power between the two mentioned conventional methods can help us get enough identification for new fractures without using CT scan.

This study was planned and conducted to compare the efficacy of physical examination and plain radiography in discriminating new nasal bone fractures from old ones considering CT scan results as a gold standard method.

**Materials and Methods**

Through an analytical cross-sectional study, 1019 patients with nasal trauma enrolled the study in a 16-month period.

Nasal trauma was defined as any discomfort in nasal area along with the expression of trauma by the patients. They were, at first, physically examined by general practitioners. Plain lateral radiography and ENT consult were requested afterwards.

All the radiographies were interpreted by a single expert radiologist and, similarly all the patients were visited by an ENT subspecialist during the study.

The final diagnosis was immediately reported in case of any similarity between physical examination and radiologic findings, but CT scan was requested in order to get trustworthy findings if there was any imbalance between their results.

Considering that the price of CT scan was guaranteed by the authors, CT scan was requested only if necessary, the procedure was described for all the participants and all the private information were kept as secrets, all the ethical aspects of this study were respected.

The study protocol was approved in the ethics committee of legal Medicine Organization of East Azerbaijan

and informed consent was obtained from all participants before enrollment.

**Results**

Out of 1,019 participants, 126 (12.4%) were female and 893 (87.6%) were male. The mean age was 29.67 years with the mode of 27. There was a range of 4–81 years old for 992 patients whose ages were recorded.

The period of time between the traumas and the referrals was clear in 996 cases with a range of 0–40 days. The mean and mode were 3.15 and 2 days, respectively.

The mechanism of trauma was battling in 79.6%, while accidents and family violence made up 18.7% of causes.

The most frequent signs were swelling, tenderness and crepitation in physical examination. On the contrary, septal hematoma along with bone prominence due to dislocated fracture was the least common one. Table 1 illustrates the symptoms and signs.

**Table 2** Clinical and radiological positive and negative results

	Fracture in physical examination		Sum
	Yes	No	
<b>Fracture in radiography</b>			
Yes	465	145	610
No	61	339	400
Sum	526	484	1010

**Table 1** Symptoms and signs among the patients and their frequency

Symptoms	Nasal echymosis (%)	Nasal edema (%)	Nasal laceration (%)	Epistaxis (%)	Periorbital echymosis (%)	Right eye echymosis (%)	Left eye echymosis (%)				
Yes	17.80	45.10	34.70	3.60	13.70	11	14.40				
No	82.20	54.90	65.30	96.40	86.30	89	85.60				
Signs	Uni. dep. <sup>a</sup> (%)	Bi. dep. (%)	Right dep. (%)	Left dep. (%)	Multiple dep. (%)	R.Uni. <sup>b</sup> prom <sup>c</sup> (%)	L.Uni. prom (%)	Bi. <sup>d</sup> prom. (%)	Edema (%)	Tenderness (%)	Crip. <sup>e</sup> (%)
Yes	1.20	5.70	13.10	34.30	1.20	5.50	2.70	0.30	57	56.70	47.40
No	98.80	94.30	86.90	65.70	98.80	94.50	97.30	99.70	43	43.30	52.60

<sup>a</sup> Depression

<sup>b</sup> Unilatera

<sup>c</sup> Prominence

<sup>d</sup> Bilatera

<sup>e</sup> Crepitation

From the 1,010 performed radiographies, 60.4% had a positive clue of new nasal bone fracture and 39.6% were negative. Between the results, 239 (23.7%) were absolutely negative, while in 244 (24.2%) cases, fracture definitely existed and no more examination was needed.

In 527 (52.1%) cases more accurate examination was necessary to confirm the positive or negative diagnosis along with plain radiography.

Through physical examination, new nasal bone fracture was found in 529 (51.9%), but in 490 (48.1%) there was no clue.

Radiologic findings were reliable in 1010 cases among which 465 (47%) had accordance between positive clinical and radiologic findings. For 339 (34.2%) patients both the clinical and radiologic findings opposed nasal bone fracture. As can be seen in Table 2, 206 (20.8%) had either clinical or radiologic findings in favor of new nasal bone fracture.

CT scan was tried for 61 (6%) patients with positive clinical findings for new fracture which were not supported by radiologic studies. New fracture was identified in 55 participants out of the above number.

Using analytical tests for finding the correspondence rate between CT scan and clinical results, a statistical significant 90% linear correlation rate was detected with the range of 83–98% for a 0.95 confidence interval. Finally, an accuracy of 9 times more than radiologic study was detected for physical examination in case of positive clinical in addition to negative radiologic results among new cases of nasal fracture.

## Discussion

Of the studied nasal bone fracture cases, 87.6% were in males and 12.4% were in females which expresses a sevenfold frequency among the former group. This ratio [7, 8] and the lack of fitness of clinical and radiologic results were detected in the present study which is also seen in some other performances [1, 7–9].

Chen W, through a work published in 1999, argued that X-ray can just find bilateral fractures of nasal bone, while CT scan is effective to demonstrate most types of fractures in facial area [10]. Likewise, Rhee et al. [11] believed that CT scan, despite enough efficacies in diagnosing septal fractures, cannot find the severity of damage which would be helpful in approach and reduction of the fractures. They, in addition to confirm that septal fractures are common among simple exclusive nasal fractures, emphasize on the importance of clinical findings to diagnose the severity and repair. This point is also supported by the present study obtaining a nine-fold accuracy in comparison to plain X-ray studies.

This could be deducted that trusting physical examination and its preference to the radiologic findings has special value in cases where fracture is not detectable by radiography. It is worth mentioning that in such cases it would be better to let time goes to reduce the soft tissue inflammation and swelling in order to get more trusty results in physical examination.

Saddle nose deformity is a sequel of septal fracture and is very frequent in exclusive nasal bone fractures without hematoma drainage within the first 24 h. Limitations in CT scan access in addition to absolutely reliance on radiography could result in such sequel. Whereas, this could potentially be prevented by a few-minute accurate physical examination.

Although this study did not evaluate sensitivity, specificity and accuracy of plain radiography, some authors have considered it as a procedure with high rate of false-negative results, especially in case of single nasal bone fractures even more than 50%. As Oluwasanmi and Pinto in 2000 [12] stated that radiography is just the matter of time, money and X-ray exposure in case of demonstrating nasal fractures with no useful value.

Likewise, Smith [13] declares in 2008 that only in coexistence of other facial fractures, it would be needed to profit X-ray studies, because a single nasal bone fracture is perfectly diagnosed and managed by physical examination and clinical approach. This is exactly the same belief supported by Mayora in 2007 [14].

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**Conflict of interest** None.

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