Original Research

Assessment Of The Ultrasonography Vs. Conventional Radiography For The Diagnosis Of Nasal bone fractures

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ABSTRACT
Aim: To determine if ultrasonography may serve as the primary diagnostic technique for nasal bone fracture, we compared the diagnostic efficacy of ultrasonography and conventional radiography to clinical examination as the gold-standard methodology.**Materials &Methods**: There was cross-sectional study done in the Radiology Department. 100 people who had a clinical or forensic basis for the investigation of a nasal bone fracture underwent routine Waters and lateral nasal bone view radiography as well as high resolution ultrasonography. The negative likelihood ratio (LR-), positive likelihood ratio (LR+), specificity (Sp), and sensitivity (Se) were used to calculate the diagnostic accuracy. Additionally, the negative predictive value (NPV) and the positive predictive value (PPV) were computed. **Results**: Physical testing revealed that 81 of the 100 patients had broken nasal bones, while 19 others were found to be OK but were under scrutiny due to legal issues. In this study, 71 of the 91 patients with clinically diagnosed nasal bone fractures had a fracture line visible on conventional radiography. All 100 people were evaluated using ultrasonography. In 77 of the 81 clinically verified fractures of the nasal bone, the fracture line was apparent. Compared to radiography, ultrasound has a lower LR. The LR+ of sonography for the diagnosis of a fractured nasal bone was 65.81 [95% CI: [9.28-390.10], showing a considerable and persuasive increase in the likelihood of fracture in the presence of positive data. In addition, the sonography's LR was 0.21 [95% CI: 0.10-0.21], indicating a considerable to moderate reduction in the risk of fracture in the event of negative results. The LR of x-ray was 0.41 [95% CI: 0.21-0.42], indicating a slight decrease in the likelihood of fracture in negative results, compared to the LR+ of radiography, which was 5.81 [95% CI: 2.87-6.27], indicating a modest rise in the possibility of fracture in positive data. **Conclusion:** High-resolution ultrasonography may be a useful diagnostic tool for a fractured nasal bone. In many situations, high-resolution ultrasound imaging may be employed instead of conventional radiography.
Keywords:NasalBone,Fracture, Ultrasonography,Radiography

INTRODUCTION

Injuries account for a large part of mortality and permanent disability worldwide. One of the most common injuries among them is a broken bone. A fracture develops when the bone's continuity is broken, necessitating surgical intervention. They develop when a powerful force breaks the bone. Traumatic bone fractures can be brought on by a variety of events, including falls, car accidents, and major impacts. Pathological bone fractures can also be the result of bone-weakening diseases or overuse.The nasal pyramid is the face bone that fractures most commonly, despite the nose being the most noticeable feature (1,2).3 The nasal pyramid is made up of the two nasal bones and the maxillary frontal processes. Despite the fact that a nasal pyramid fracture can happen anywhere, it's important to give special attention to the lateral nasal walls, nasal dorsum, and nasal septum.4 The most accurate way to diagnose nasal fractures is by clinical tests, however adjacent tissue oedema and hemotatoma can complicate the diagnosis. For forensic purposes, imaging studies for midface fractures are also necessary.The primary method for identifying nasal injuries is traditional radiography, albeit these are not always reliable and it can be difficult to tell which side is broken. 6,7 When it comes to detecting challenging facial fractures, especially mid-facial fractures, CT has long been considered the gold standard and is the preferred method.8-10 However, the expense, accessibility, and radiation exposure to patients of CT procedures make them expensive. Due to their proximity, the thyroid gland and eyes are particularly vulnerable to the harmful effects of X-ray

radiation in the form of thyroid cancer and cataracts. Additionally, individuals with cervical vertebral injuries or those who are uncooperative cannot receive a coronal CT section, nor may pregnant women freely employ CT procedures.11,12 This necessitates investigating alternatives to CT imaging. The non-invasive, inexpensive technology of ultrasonography has been used to find several fractures of the face, including those of the zygomatic bone, nasal bone, orbital floor, anterior wall of the frontal sinus, and orbital floor.10,14 It has been studied if ultrasound may detect nasal bone fractures that have already been established.4, 5 Ultrasonography has been used to diagnose nasal bone fractures, although its sensitivity and specificity have not been examined. The purpose of this single-blind study was to assess the diagnostic efficacy of CT and ultrasonography in identifying nasal bone fractures.

MATERIALANDMETHODS

A cross-sectional study was conducted at the Department of Radiology after gaining approval from the protocol review committee and the institutional ethics committee. After receiving informed consent, a thorough history was taken from the patient or, in the case of a sick patient, the patient's family. The procedure's strategy, risks, benefits, outcomes, and associated complications were all explained to every patient. 100 patients with nasal bone fractures who underwent physical examination by an otolaryngologist for a medical or legal reason made up the research group. Following that, these patients had sonography and routine radiography. Physical examination was the gold standard for determining whether a nasal bone fracture had occurred. All patients underwent a first lateral and Waters view radiography examination. The results were examined by a radiologist. Depending on whether there was a nasal bone fracture, the reports were then categorized as "yes" or "negative". After that, the patients were sonographically inspected. On an ESAOTE MYLAB 50 ultrasound machine with a 10 MHz linear probe, sonographies were carried out. All sonographic examinations were performed by a radiologist with expertise in soft tissue and musculoskeletal imaging. The primary diagnosis was communicated to the radiologists, but they were not informed of the outcomes of the physical examination or each other's diagnostic evaluations. To examine the right and left sides, lateral wall, and dorsum of the nose, patients were examined while lying on their backs in the right, left, and longitudinal perspectives. The nasal pyramide's cortical rupture provided ideal sonographic viewing conditions. In addition, subperiosteal hemorrhage and soft tissue edema were looked into as potential indicators of acute vs chronic fracture. To assess diagnostic accuracy, specificity, sensitivity, NPV, and PPV were computed and used, along with the negative and positive likelihood ratios (LR- and LR+), specificity (Sp), and sensitivity (Se).

RESULTS

Inthisinvestigation,sonographyandradiographywereusedtoexamine100patientswho had nasalbonefracturesduringtheirphysicalexamination.Therewere26womenand74 malesamongthesepatients.Thepatients'averageagewas 22.5 years. The bulk of the cases, 91 (91%), were between theagesof10-59,with37(37%), between the ages of 20 -30, and 31 (31%), between the ages of 30 - 40. 6(6%) patients were under the age of 20, while 9(9%)were beyond the age of 50.The youngest patient inthe trial was a 10-year-old male youngster, and the oldest was a 59-year-old guy. According to physical examination, 81 of the 100 patients had nasal bone fractures, whereas 19 were judged to be normal but were scrutinisedowing to legal difficulties. In this study, conventional radiography revealed a fracture line in 71 of the 91clinically verified nasal bone fracture patients.

Table1:Demographic profile of Patients

Gender	**N=100**	**%**
Male	74	74
Female	26	26
Age		
Below20	6	6
20-30	37	37
30-40	31	31
40-50	17	17
Above50	9	9

Table2:Diagnostic Values of Conventional X-ray and Ultrasonograghy

Diagnostic Accuracy Values	**Ultrasonograghy**	**Conventional X-ray**
Sensitivity(Se)	0.95[0.86–0.97]	0.82 [0.71–0.86]
Specificity(Sp)	0.98[0.89–0.98]	0.87 [0.74–0.97]
Positive Likelihood Ratio(LR+)	65.81[9.28–390.10]	5.81 [2.87–6.27]
Negative Likelihood Ratio(LR¯)	0.21[0.10–0.21]	0.41 [0.21–0.42]

Positive Predictive Value(PPV)	0.98[0.91–0.97]	0.91 [0.82–0.95]
Negative Predictive Value(NPV)	0.92[0.81–0.94]	0.76 [0.61–0.82]

Ultrasonographywasusedtoassessall100individuals. The fracture line was visible in 77 of 81clinically confirmed nasalbonefractures.Althoughphysical examination findings for nasal bone fracturewere positive in six of the patients, the fracture linecouldnotbeidentifiedonultrasonography.Ultrason ography had greater Se, Sp, LR+, PPV, andNPV than radiography. Ultrasonography has a lowerLR than radiography. The LR+ of sonography for thediagnosis of nasal bone fracture was 65.81 [95% CI:[9.28-390.10], indicating a significant and convincingriseinthechanceoffractureinthepresenceof positive results. Furthermore, the LR of sonographywas 0.21 [95% CI: 0.10-0.21], suggesting a significantto moderate reduction in the chance of fracture in thecaseofnegativeresults.TheLR+ofradiographywas 5.81 [95% CI: 2.87-6.27], indicating a minor increasein the chance of fracture in positive results, while theLRofx-raywas0.41[95%CI:0.21-0.42],indicatingasmallreductioninthelikelihoodoffra ctureinnegativeresults.

DISCUSSION

Because radiography has a low sensitivity, physical examination is frequently employed to make the diagnosis of a broken nasal bone.15 According to prior studies, the lateral and Waters radiography views are 75% sensitive to the presence of nasal bone fractures.16 Although CT can demonstrate the anatomical aspects of the nasal bone and soft tissues, it is not always sufficient. The tiny nasal fracture line could go unnoticed as a result of the impact of CT partial volume artefacts. Sonography can detect nasal bone anomalies as minor as 0.1 mm, according to a prior study.17 Only six investigations to yet have used sonography to diagnose fractured nasal bones. In a study of 63 patients, Oliver et al. discovered that sonography is more accurate than radiography at locating the fracture line.15

In another investigation, Hyun et al. discovered that sonography is more sensitive than radiography at identifying nasal bone fractures.15 Danter found that a 20-MHz sonography probe had a sensitivity of 83% and a specificity of 50% when compared to a physical examination. He also showed that sonography had a Se and Sp of 94% and 83%, respectively, when compared to radiography.18 Kown examined 45 people who had suspected nasal bone fractures and discovered a significant association between sonography and CT.19 Beck et al. used a 5-7.5 MHz linear probe to examine 21 individuals who may have nasal bone fractures and found that all fracture lines seen on radiographs were also visible on sonograms.17 Zagolski and Strek showed that the diagnosis may be made from the sonographic test results alone in patients with nasal bone fractures.20 Our experiment used a 10-MHz linear probe, and the outcomes were equivalent to those obtained by Beck et al.17 using a 5-7.5 MHz probe and Danter's tests using an MHz probe.17 While sonography can show subperiosteal hemorrhage and soft tissue edema to help determine how acute the fracture is, radiography is unable to tell the difference between acute and chronic fracture lines. Sonography is more accurate than radiography in detecting injury to the cartilaginous part of the nose.15 Sonography is a quick, low-cost, and accurate way to identify nasal bone fractures because it may reveal anatomical aspects of the nose considerably more clearly than traditional radiography. Last but not least, sonography may be a very quick imaging technique in suspected cases of nasal bone fracture, eliminating the requirement for radiography.

CONCLUSION

High-resolution ultrasonography may be a useful diagnostic tool for a fractured nasal bone. In many situations, high-resolution ultrasound imaging may be employed instead of conventional radiography.

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