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ORIGINAL ARTICLE

Refinement treatment of nasal bone fracture: A 6-year study of 329 patients

Chieh Chou [a], Chao-Wen Chen [b], Yi-Chia Wu [a], Ko-Kang Chen [a], Su-Shin Lee [a,c,*]

[a] *Division of Plastic Surgery, Department of Surgery, Kaohsiung Medical University Hospital, Kaohsiung, Taiwan*
[b] *Division of Trauma, Department of Surgery, Kaohsiung Medical University Hospital, Kaohsiung, Taiwan*
[c] *Department of Surgery, Faculty of Medicine, College of Medicine, Kaohsiung Medical University, Kaohsiung, Taiwan*

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Summary *Background:* The reliability of X-ray radiography for diagnosing nasal bone fractures (NBFs) remains controversial. Recent studies show that, for determining the orientation and location of the displaced/depressed fracture, nasal sonography is as accurate as facial computed tomography. This retrospective study compared conductor-assisted nasal sonography (CANS) to conventional diagnostic tools and reported subjective patient satisfaction and discomfort after closed reduction combined with tube technique.
Methods: This retrospective study reports the results of 329 refinement treatments for nasal bone fracture (including 199 men and 130 women) performed from 2005 to 2011. All patients were assessed with CANS and completed a survey immediately prior to removing the packing. Questionnaires were adapted from the nasal obstruction symptom evaluation (NOSE) scale.
Results: The study found that CANS has a 97.2% rate of accuracy in diagnosing NBF. The visual analog scale scores of nasal obstruction, nasal congestion, sleep disturbance, trouble breathing, and inability to move air through the nose were analyzed. The experimental group scores were significantly different from the control group for all scores ($p < 0.001$).
Conclusion: Compared to conventional methods, CANS is more accurate for detecting NBF. We recommend its use as an alternative tool for diagnosing a nasal fracture. Because the

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* Corresponding author. Division of Plastic Surgery, Kaohsiung Medical University Hospital, 19th Floor, Number 100, Tzyou First Road, Kaohsiung 807, Taiwan.
E-mail addresses: sushin@kmu.edu.tw, k831702000@gmail.com (S.-S. Lee).

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tube technique balances pressure between the nasopharynx and middle ear during swallowing, patient comfort is enhanced. Application of these modifications can improve accuracy in diagnosing NBF and can improve the quality of NBF treatment.

1. Introduction

The prominence of the nose on the human face makes it prone to injury.[1] Blunt injuries sustained in traffic accidents, slip-and-fall accidents, batteries, and sports activities are the leading causes of nasal fractures. Properly treating nasal bone fracture (NBF) requires accurate diagnosis and evaluation. In addition to physical examination used to assess nasal deviation or depression, the tool most commonly used to detect NBFs is the radiograph. Although the radiograph is the initial step in assessing NBF, its reliability for diagnosing nasal fractures remains controversial.[2] However, many studies have reported that X-ray examinations have poor sensitivity and specificity for diagnosing NBFs.[3–5] Therefore, nasal sonography has garnered much interest in recent years because it provides detailed information about superficial areas in various imaging planes. Additionally, it does not require radiation exposure. Recent studies have concluded that, for delineating the orientation and location of the displaced/depressed fracture, nasal sonography is as accurate as facial computed tomography (CT).[6–10] Since 2007, the authors have used conductor-assisted nasal sonography (CANS) as the primary tool for diagnosing NBF in the emergency department of a medical university hospital. By using an innovative probe conductor design and a water-filled glove, the CANS technique effectively avoids the discomfort of applying ultrasound gel on the face while providing images that are just as clear as CT images. Sonography is ideal for rapid and accurate diagnosis in preliminary assessment of a patient with suspected NBF.

Untreated NBFs can cause both cosmetic and functional complications. However, recommended management may vary from no intervention, to closed reduction, to extensive open reduction.[11] Compared to open reduction, closed reduction is less invasive and procedurally simpler but achieves comparable outcomes. Thus, closed reduction of the nasal bone is the preferred treatment for most nasal trauma patients in the emergency department.

After closed reduction, the newly repositioned nasal bone and nasal septum can be fixed with intranasal packing. Various methods have been reported for packing and supporting the reduced nasal bone. A Doyle Combo Splint (DCS; Boston Medical Products Inc. Westborough, MA, USA) was commonly used in many medical facilities. It was combined with the airway tube and a Silastic sheet. Using the same concept, we inserted silicone catheters along the floor of the inferior nasal meatus prior to packing to minimize discomfort. This simple technique not only relieves nasal obstructive symptoms but also secures the position of the nasal septum, which otherwise tends to be easily displaced after reduction surgery.

This retrospective study compared CANS to conventional diagnostic tools and reported subjective patient satisfaction and discomfort after closed reduction combined with tube technique.

2. Materials and methods

This study enrolled 329 consecutive patients (199 male, 130 female) who were treated for NBFs at our plastic surgery department by two surgeons between January 1, 2005 and September 1, 2011. Fifty-five patients randomly selected as the control group who had nasal packing using Gelfoam® (Pfizer, NY, USA) and polyvinyl alcohol (PVA) sponge packing Invotec® (Invotec Inc, FL,USA) only. The remaining 274 patients (experimental group) had nasal packing with Gelfoam and PVA sponge packing with the tube technique. Age, sex, injury etiology, concurrent injuries, surgical time, and treatment technique were retrospectively identified and analyzed.

2.1. Diagnostic methods and application of CT and radiographs

Conventionally, diagnoses of nasal fractures require a detailed patient history and physical examination. Plain X-ray images were obtained first. However, CT examinations were performed when more severe facial bone injuries or intracranial lesions were suspected. In our hospital, facial CT scans are performed using 16-channel multidetector-row CT (Light-speed, General Electric Medical Systems, Milwaukee, WI, USA) at a slice thickness of 1–3 mm. Images are then viewed with a picture archiving and communications system. We classified all patients based on the nasal trauma classification proposed by Rohrich and Adams.[12] Type I is simple and unilateral, Type II is simple and bilateral, Type III is comminuted, Type IV is complex (nasal and septal disruption), and Type V is associated with nasoorbitoethmoid fracture and midface fracture.

2.2. Conductor-assisted nasal sonography

CANS was introduced in our emergency department in 2007. Since then, physicians have routinely used sonography to evaluate patients with acute nasal trauma except in cases of open wounds to the nose. During the study period, all CANS surveys were performed with a Philips Envisor HD ultrasound machine (Philips Medical Systems, Bothell, WA, USA) with a linear transducer (12 to 3 MHz; Fig. 1A–D). Transverse and longitudinal scans are both executed for the examiner's panoramic evaluation. A water-filled surgical glove was used as a probe conductor to ensure full contact with the surface of the nose[13] (Fig. 1C). In the study, any