Original Research Article

Ultrasound - An imaging tool for mandibular fracture

Rupesh Mandava[1*], Sreeram M P[2], Elengkumaran[3], C Ravindran[4], Venkata Sai[5]

[1]Associate professor, Department of Radiology , Great Eastern Medical School and Hospital, Srikakulam, Andhra Pradesh, INDIA.
[2]Surgical Registrar, Department of Surgical Oncology, Sri Shankara Cancer Hospital and Research Centre Basavanagudi, Shankarapuram, Banglore, Karnataka, INDIA.
[3]Reader, [4]Professor and Head, Department of Oral and Maxillofacial Surgery, Sri Ramachandra University, Chennai, Tamil Nadu, INDIA.
[5]Professor and Head, Department of Radiology and Imaging Sciences, Sri Ramachandra University, Chennai, Tamil Nadu, INDIA.
Email: rupeshmandava@gmail.com, drsreeram111@gmail.com, drkumaranomfs@gmail.com, ravindran642@yahoo.com, venkatasai_25@yahoo.com

Abstract

Mandible is one of the most commonly fractured bone in facial skeleton. Diagnosis can be confirmed with various imaging techniques. Use of ultrasonography in imaging facial fractures is not yet established. We assessed the efficiency of ultrasound in screening mandibular fracture in 17 patients. USG showed 100 % sensitivity in locating fracture lines.
Key Word: Ultrasound, mandibular fracture.

***Address for Correspondence:**
Dr. Rupesh Mandava, Plot No 244, Road No 78, Jubilee Hills, Hyderabad-500033, Telangana, INDIA.
Email: rupeshmandava@gmail.com
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INTRODUCTION

Mandibular fractures are one of the most commonly reported fractures in the maxillofacial skeleton. The main causes of mandibular fracture include motor vehicle accidents, interpersonal violence, falls, and sports-related injuries. The most frequently fractured anatomical locations in mandible are angle of mandible (12%), condyle (22%), symphysis (10%), body (6%), ramus (3%), and coronoid process (1%) [1]. When the fracture is ruled out clinically or in dilemma of presence of fracture, then it is surgeon's choice to confirm the diagnosis with an ideal imaging tool. Before directly relying on CT scans, the physician usually confirm the presence of fracture with radiographs. Panoramic radiograph, Lateral oblique radiograph, Posteroanterior radiograph are the usual choice of imaging mandibular fracture[2]. All of these investigations has it cons like patient positioning, radiation etc. The use of ultrasound in diagnosis of head and neck pathologies has been previously reported[3]. Ultrasound has been used in diagnosis of facial fractures, but the literature is limited and still evolving. W. L. Adeyemo *et al* reviewed the use of USG in diagnosing facial fractures[4]. We have assessed the efficiency of ultrasound imaging in the screening of mandibular fractures secondary to trauma.

MATERIALS AND METHODS

A total of 17 patients were assessed with USG, who reported to accident and emergency department with objective and subjective signs of mandible fracture. After obtaining consent from the patient and their relatives, ultrasonography of mandible was done in an uniform pattern with a linear probe with a frequency of 7 – 10 MHz[5]. The anatomic location in the mandible with suspected fracture was scanned. The sonographic findings were compared with the clinical findings which were later compared with CT scan (Table 1). This was studied by primary investigator and also by the radiologist to compare the presence of fracture and degree of displacement.

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RESULT

Table 1: CT findings of each patient

1	Fracture of Bilateral parasymphysis
2	Fracture of Left parasymphysis
3	Fracture of Symphysis and right condyle
4	Fracture of Right parasymphysis and left angle
5	Fracture of Symphysis
6	Fracture of Symphysis
7	Fracture of Symphysis and left condyle
8	Fracture of Right parasymphysis
9	Fracture of Left parasymphysis and bilateral condyle
10	Fracture of Symphysis and left coronoid
11	Fracture of Right angle
12	Fracture of Left body
13	Fracture of Right parasymphysis and left condyle
14	Fracture of Right parasymphysis and left condyle
15	Fracture of Right parasymphysis
16	Fracture of Left high condyle
17	Fracture of Symphysis and left condyle

The CT result was correlating with USG finding in all the 17 cases. USG showed 100% sensitivity in imaging mandibular fractures. On sonography, fracture was identified by the presence of a discontinuity in the bone which was seen as a discontinuity in the hyper echoic line[6]. The degree and direction of displacement of the fracture segment was also studied. Ultrasound has high sensitivity in imaging even undisplaced fracture lines[7] (Figure 1a, Figure 1b).

DISCUSSION

USG was mainly used in the field of gynecology, thyroid diseases, abdominal evaluation like peritoneal fluid collection, breast evaluations and also by the anesthesiologist to give regional local anesthesia like brachial plexus block etc. During its introduction to head and neck region, USG was restricted to superficial structures especially for lymph node, neck vessels etc and was initially thought to have limited use in bone structure. Following improvements in ultrasound technology like high resolution USG, it is now being routinely used in the examination and diagnosis of bone pathology[5].

This study evaluated the efficiency of USG in the screening of mandible fractures. It was found that ultrasound has 100% sensitivity in screening facial fractures. In this study of 17 mandibular fracture cases, USG could identify all the fractures even displaced high condyle fracture (Figure 2 a; Figure 2b). This was not in agreement with the study done by R. E. Friedrich *et al*[9].

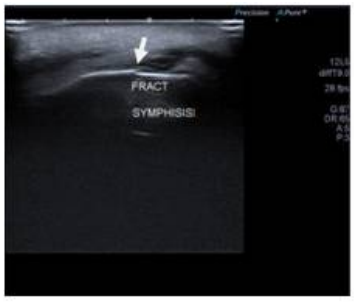

Figure 1A

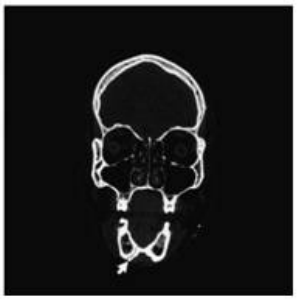

Figure 1B

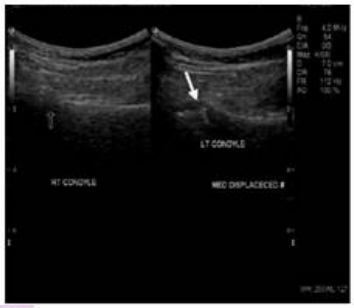

Figure 2A

Figure 2B

Figure 3A

Figure 3B

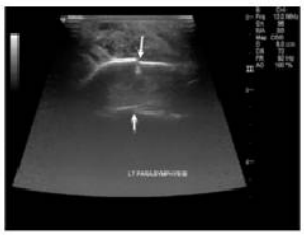

Figure 3C

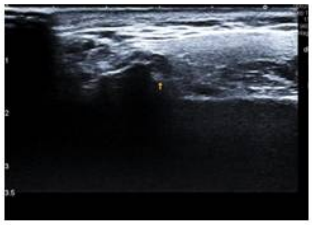

Figure 4A

Figure 4B

Figure 1: Ultrasound(Figure 1a) and CT(Figure 1b) image comparing undisplaced symphysis fracture as a hyperechoic discontinuity in the symphysis region ; suggestive of fracture.

Figure 2: Ultrasound(Figure 2a) showing medially displaced condylar fracture as a hyperechoic discontinuity with displacement of the fragments and Coronal CT(Figure 2b) showing medially displaced left high condylar fracture.

Figure 3: Ultrasound(Figure 3a) and CT (Figure 3b)image showing oblique fracture in the parasymphysis region Ultrasound image(Figure 3c) showing bicortical fracture in the the left parasymphysis region

Figure 4: Ultrasound (Figure 4 a) and Coronal CT(Figure 4 b) showing fracture of the left condyle with displacement.

None of the previous studies have documented about the evidence to visualize bicortical displacement of fracture segments in USG. However, in this study, especially mandibular symphysis, parasymphysis and body showed bicortical disruption (Figure 3).

W. L. Adeyemo*et al* reviewed the use of USG in diagnosing facial fractures. He documented the limitation of USG to locate undisplaced fractures. This was not in concurrence with the present study. It was possible to diagnose even linear undisplaced fractures with USG (Figure 1a, Figure 1b). Misinterpretation of some anatomical areas as fractures was a limitation documented by previous authors[9]. Dentoalveolar segment and teeth in this study was initially misdiagnosed as fracture. However, correlating the clinical examination and CT scan, it was identified to be normal USG finding. In this study we encountered seven patients with mandibular condyle fracture (figure 4a, figure 4b), USG located all condylar fractures and even intracapsular fracture[8]. Probability of not locating undisplaced linear intracapsular fracture could be a probability, but we did not encounter any during our study period.

CONCLUSION

Ultrasound can be used as an initial primary imaging tool in an emergency department to identify mandibular fracture with limitations being inability in identifying undisplaced linear intracapsular condyle fractures. However if the patient has a confirmed fracture in USG , then CT scan which is the gold standard have to be done for treatment planning.

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