Original Article

Ultrasonography as a Diagnostic Aid in Mandibular Fractures – An Original Study

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Abstract

Background: Ultrasound is an in expensive, non-invasive readily available imaging technique that can be used as a primary investigating image technique. Proper application of this imaging can be of use in detecting various normal, pathological lesions and fractures in the maxillofacial regions. We present our experience with application and utilization of ultrasonography (USG) as a diagnostic aid in mandibular fractures. **Materials and Methods:** This study consists of 15 patients with mandibular fractures in a mean age of 25–50 years without any medical complications. Patients had undergone ultrasonographic examination of the mandible preoperatively. **Results:** Ultrasound was accurate in assuming the fracture site and ultrasound imaging was concordant with other radiological investigations. Sonography is the suitable tool in case of emergency. **Conclusion:** We conclude that USG is safe, rapid, and in expensive investigation method in diagnosing mandibular fractures.

Keywords: Diagnosis, Mandibular fractures, Ultrasonography.

Introduction

Ultrasonography (USG) is an imaging modality which uses energy generated by sound waves of 20,000 or more vibrations per second. Sonography was introduced in a medical field in early 1950s with study development and its use in diagnosis has proved helpful in medical field and now in dentistry.[1] Diagnostic ultrasound imaging relies on high-frequency mechanical vibrations which are transmitted through tissues these are produced by a transducer constructed of a piezoelectric material, such a lead zirconate titanate, which converts electrical signals into sound waves which are transmitted into the tissues as a series of pulses. The aim of any imaging examination for maxillofacial injuries is to evaluate the positions of the anatomic elements, both hard and soft tissues, in 3D dimensions.

Ultrasound sonography has already been described in the region of the orbit, zygomatic arch, mandibular condyle, and ramus.[2] In this study, investigation of mandibular fracture (symphyseal, Para symphyseal, and body) is done using ultrasonography in patients reported to casualty.

Materials and Methods

The study was conducted in division of oral and maxillofacial surgery, Rajah Muthiah Dental College and Hospital. This study consists of 15 patients with mandibular fractures in a mean age of 25–50 years without any medical complications. Patients had undergone ultrasonographic examination of the mandible preoperatively. The fractures were classified as typically displaced and undisplaced fractures.

Technique

The patient had undergone ultrasonographic examination of mandibular fractures. A Philips ultrasound system with 7.5 MHz small linear transducer was used. The patient head was turned to opposite side while he or she was being examined in the supine position. After application of sterile gel, the probe was placed over the traumatized area (Figure 1) to locate the fracture and its whole length was evaluated. Any interruption in the continuity of the white line of the contour, including displacement, was considered as fracture (Figure 2), same procedure was carried for the opposite side (Figure 3).

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Figure 1: Position of patient and probe during ultrasonography

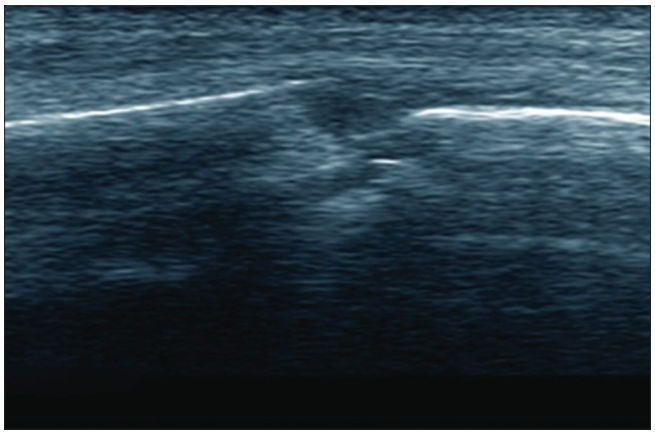

Figure 2: Fractured site

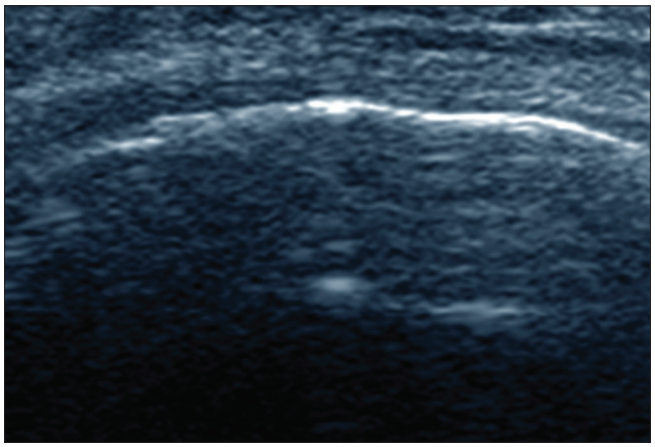

Figure 3: Normal site

Fractures of mandible were identified as interruption in white line. The patients had undergone open reduction and internal fixation of mandibular fractures.

All of the sonograms were taken and interpreted by the sonologists who not aware of the radiographic findings.

Usual ultrasound scan examination for mandibular fractures took <10 min and none of the patients found the procedure painful or uncomfortable. Nine mandibular fractures were treated with open reduction and internal fixation under GA and six cases under LA.

Results

Out of 15 cases, the patients were between the age group of 25 and 50. The nature of injury was RTA in nine cases and self-falls in six cases. In other radiological investigations, the fracture showed displacement in two cases and one case with bone loss. Ultrasound was accurate in assuming the fracture site and ultrasound imaging was concordant with other radiological investigations. Sonography is the suitable tool in case of emergency. In patients with the suspicion of a lower mid-third fracture, sonography offers alternative to conventional radiographs as first-line imaging to low economic status patients. In this way, it is possible to make a reliable diagnosis while at the same time avoiding X-ray exposure.

Discussion

Ultrasound in midface is used for the detection of fractures of the maxillofacial region, that is, nasal bone fractures, orbital rim fractures, maxillary fractures, mandibular fractures, zygomatic arch fractures, and for locating the position of mandibular condyles.[3] Modern medical use of CT is increasing resulting in cancer associated with CT scan which is about 1:4000 or even more severe radiation from single CT scan which is equivalent to a dent 100–250 plan chest films. In patients with metallic implants, there can be blurring of images due to artifacts generated by metal. CT requires a special patient positioning, which may not be possible in uncooperative patients and who have cervical spine injuries and pregnant women.[4] Ultrasounds with aid of high-resolution transducer can demonstrate the internal muscle structures more clearly than CT. In diagnostic ultrasound, high-frequency sound waves are transmitted into the body by transducer and echoes from tissue interface are detected and displayed on screen. The transducer is designed to produce longitudinal waves, hence, only those waves can pass through tissues get reflected, audio frequency of a sound wave is 20 KHz. Anything below this is called infrasonic and above this is ultrasound. Ultrasound uses frequency of 1–15 MHz (2.5, 3.5, 7.5, and 10 MHz). The transducer has a special property called piezoelectric effect, that is, they can convert sound waves into electrical waves and vice versa.[5]

As like X-ray, sound beam from ultrasound is waves transmitting energy ray passes readily in vacuum, whereas sound requires medium for its transmission. Sound waves travel slowest in gases, and intermediate velocity in liquids and most rapidly in solids. All body tissues except bone behave like liquids, and therefore, they all transmit sound at above some velocity. The velocity of 1540 m/s is used as an average for body tissues. USG is one method of imaging which lacks radiation hazards, this imaging technique can be used for bone and soft-tissue examination, either normal or pathological lesions, detection of calculi in major salivary glands, TMJ

imaging, detection of fractures, and vascular lesions.[4-7] Hence, proper application of this method can be a great importance in maxillofacial trauma.[4]

Conclusion

Based on our study, we conclude that USG is safe, rapid, and in expensive investigation method in diagnosing mandibular fractures. USG is an alternative modality of investigation method to reduce the radiation exposure as in case of radiographs and CT. USG is an easier method of investigation in case of not able to position the patient.

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