IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 18, Issue 1 Ser. 18 (January. 2019), PP 14-19
www.iosrjournals.org

Angle of Mandible Fracture: Ultrasonography or Plain Film Radiography?

Dr. Mohammad Danish, MDS[1], Dr. Syed S Ahmed, PHD, MDS[2], Dr.Gulam S Hashmi, MDS[3], Dr.Sajjad A Rahman, MDS[4]

1,2,3,4 - Department of Oral and maxillofacial surgery; Dr.Ziauddin Ahmed dental college and hospital Aligarh Muslim university, Aligarh, Uttar Pradesh 202002 India.
Corresponding Author:Dr. Mohammad Danish, MDS

Abstract:*Mandibular fracture is the second most common facial fracture and angle of the mandible is the most common mandibular fracture. For the diagnosis of angle fracture conventionally two radiograph perpendicular to one another are required. Ultrasonography was used in the diagnosis of superficially placed facial bone fracture. In this study we compared the conventional radiography with ultrasonography for the diagnosis of mandibular angle fracture.The purpose of this study is to evaluate the effectiveness of USG as an alternative method for conventional radiography in the diagnosis of mandibular angle fracture.Cohort study conducted during December 2014 to December 2016. Total 24 patients were selected for this study. Sensitivity and positive predictive values for ultrasonography was calculated compared to Conventional radiography using SPSS version 16. The sensitivity and positive predictive value of ultrasonography as compare to OPG and posteroanterior view of skull were 100% and 100% respectively.*
Hence forth the above study showed that ultrasonography is a simple, reliable, cost effective, radiation free technique and can be used for detection of fracture of mandibular angle with high sensitivity
Keywords*: Angle of mandible, conventional radiography, fracture, Ultrasonography.*

Date of Submission: 16-01-2019 Date of acceptance: 31-01-2019

I. Introduction

Mandibular fracture is the second most common fracture of facial skeleton, which is subsequent to its unique characteristics such as the mobility and limited bone support[1]. This is interesting to note that whenever mandible is fractured, angle is the most common site, accounting for 27.7% of all mandibular fracture in developing countries[2]. The angle fractures have been reported to have highest rate of post-surgical complication among all the mandibular fractures[3,4,5,6,7].

For provisional diagnosis of fracture of angle, proper history and clinical examination is necessary. However, for confirmatory diagnosis at least two radiographic views at right angle to each other are necessary (panoramic radiograph and postero-anterior view of skull).

Panoramic radiograph is the single most informative radiologic study that allows satisfactory visualization of all regions of the mandible (condyle, ramus, body and symphysis)[8], but fails to exhibit the variation in displacement of fractured segments. CT scan can overcome this limitation but there are some limitation of CT scan in relation to high cost, limited availability and high ionic radiation exposure[9] and interference of metal implant[10].

There have been considerable advancement in computing hardware and microelectronic technology in ultrasonography, which not only making it applicable for soft-tissues, but also to hard tissue lesions of the head and neck[11,12]. These advancements provide an alternative method for the diagnosis of maxillofacial fractures to conventional radiography and computed tomography. High resolution ultrasonography has been compared with other radiographic modalities for the diagnosis of nasal bone fracture[13,14,15,16]. Ultrasonography was used in detection of the fracture of orbit, nasal bone, zygomatic bone and mandible and their sensitivity and specificity was compared. The sensitivity and specificity of ultrasound in detecting orbital fractures were 56–100% and 85–100%, respectively, whilst that of nasal fractures were 90–100% and 98–100%, respectively. Sensitivity and specificity of ultrasonography in detecting zygomatic fractures were >90%. For mandibular fractures, the sensitivity and specificity was 66–100% and 52–100%, respectively[17].

Ultrasonography is a rapid, cost-effective, and radiation free imaging technique for detection of superficially situated bone fracture such as zygomatic arch and mandibular fractures.

Overall sensitivity, specificity, positive predictive value and negative predictive value of USG against CT in diagnosing zygomatic arch and mandibular fractures were found out to be 97.4% , 100%, 100%, and 66.7%, respectively[18].

In cases of doubtful fracture, combination of USG and conventional plain films may be considered to avoid unnecessary exposures from higher imaging like CT scan. It can be considered as the imaging of choice when CT or conventional radiography are not advised as in pregnant women.
The purpose of this study is to evaluate the effectiveness of USG as an alternative method for conventional radiography in the diagnosis of mandibular angle fracture.

II. Materials & Methods

Sample of the study: This was a cohort study conducted on consecutive patients reporting/referred to the outpatient department of Oral and Maxillofacial Surgery, Dr. Z A Dental College, Aligarh Muslim University, Aligarh or admitted in the indoor after sustaining injuries during December 2014 to October 2016. A total 24 patients of fractured mandibular angle were selected.

Inclusion criteria
The patient's sample of this study was selected based on the following criteria:-
1. Adult patients
2. Angle fracture of mandible (already diagnosed with OPG)

Exclusion criteria
The following cases were excluded in the study:-
1. Panfacial fracture
2. Pregnant patient
3. Medically compromise patients.

Preoperative evaluation of the patient: All the patients were examined according to standard protocol after evaluation of maxillofacial trauma patients and noted on specially designed case sheets.The preoperative OPG (Fig. 1), postero-anterior view of the skull (Fig. 2) and preoperative ultrasonography (Fig. 3) were taken in the Department of Oral Medicine and Radiology, DR. Z. A. Dental College and Department of Radiodiagnosis, Jawaharlal Nehru Medical College and hospital Aligarh Muslim University, Aligarh. Postoperative ultrasonography (Fig. 4) was also done to find out the reduction or orientation of fractured segment after open reduction and internal fixation.

Fig 1. Preoperative OPG showing fracture of right angle of mandible (black arrow).

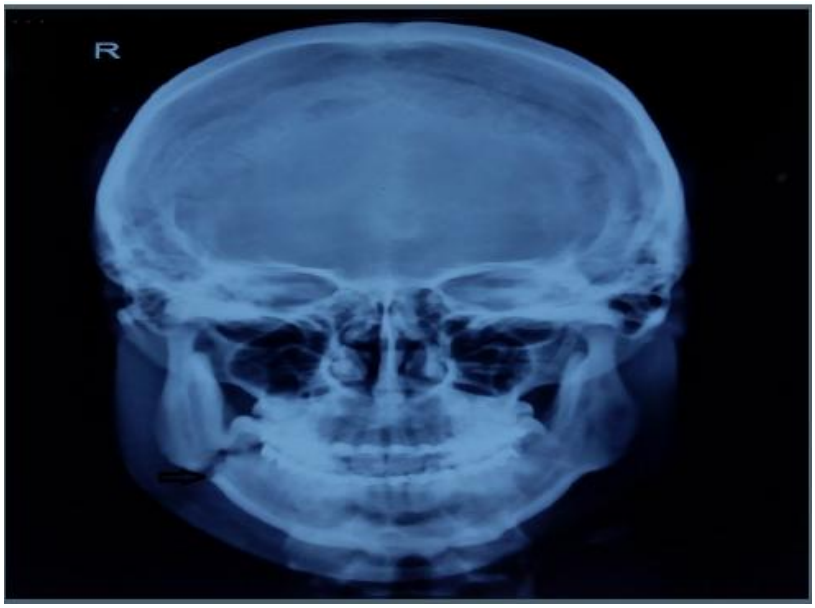

Fig 2. Preoperative postero-anterior view of the skull showing fracture of right angle of mandible (black arrow).

Ultrasonography of the mandibular fracture was performed with a 10MHz linear transducer (Sonoline G 40, Siemens Medical Solutions Germany).
Patients were asked to sign a consent for their willingness to participate in the study, if conscious and adult, or by his/her attendant/ guardian, if unconscious or a minor.

Fig 3. Preoperative ultrasonography showing displacement in fractured segments.

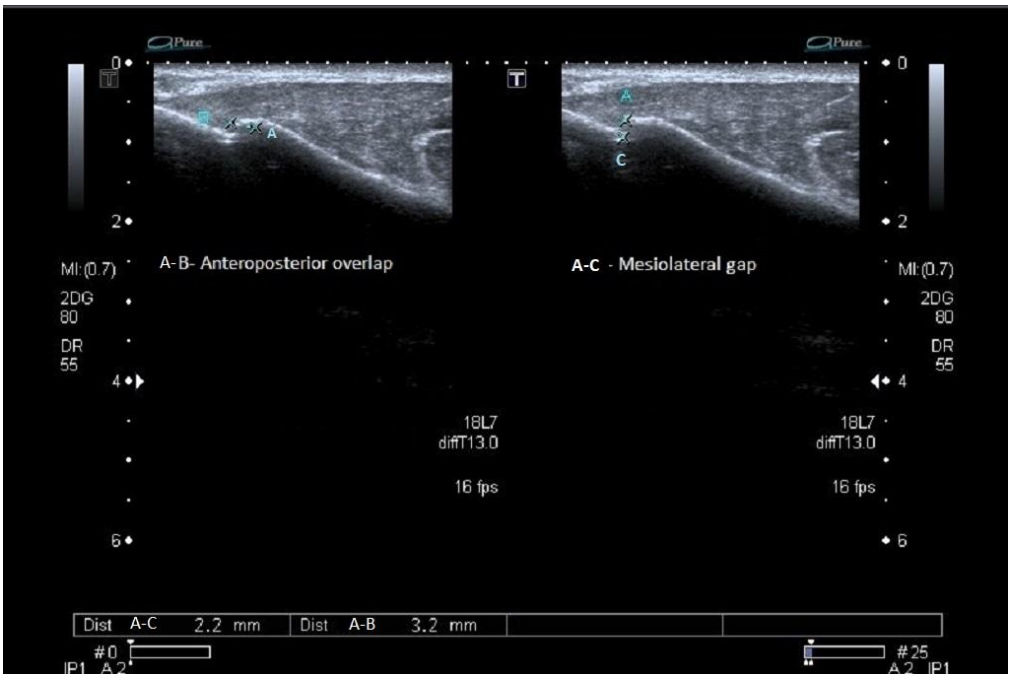

Fig 4. Postoperative ultrasonography showing displacement in fractured segments.

Operative techniques: All the procedures were performed under general anesthesia. Intraoral open reduction and internal fixation with single 2 mm titanium miniplates was done in all the patients.

Data analysis: All data were placed on to a designed database and with the help of the Statistical Package for the Social Sciences (SPSS Version 16. Chicago, Illinois), sensitivity and positive predictive value of fracture diagnosis was calculated.

III. Results

Out of the 24 patients 18 were male and 6 were females. The mean age of the patients was 29.71 years. Most common cause of trauma was road traffic accident (14) followed by fall from height (7) and assault (3). Right angle of fracture was present in 13 patients and left angle of fracture was present in 11 patients. The sensitivity and positive predictive value of ultrasonography as compare to OPG and posteroanterior view of skull were 100% and 100% respectively. This implies that all the patients who were diagnosed with OPG and posteroanterior view of skull were also diagnosed with ultrasonography as fracture of angle of mandible. Postoperative ultrasonography was done to detect the reduction after ORIF. In Fig.3 preoperatively there was an anteroposterioroverlap of 3.7 mm (Distance A-B) and mediolateral gap of 4.0 mm (Distance A-C). After ORIF anteroposterior overlap and mediolateral gap were reduced to 3.2 mm (DistanceA-B) and 2.2 mm (Distance A-C) respectively (Fig. 4).

IV. Discussion

Maxillofacial trauma may occur in isolation or may be associated with other injuries 19-21].Improvement in lifestyle and introduction of safety norms considerably changes the pattern and cause of mandibular fractures. Vehicular accidents account for 43%, assaults for 34%, work-related for 7%, fall account for 7%, sporting accidents for 4% and the remainder had miscellaneous causes for mandibular fracture [22].

Although facial injuries alone are rarely life threatening, early diagnosis of associated injuries should be ruled out to prevent mortality and morbidity. Proper diagnosis is crucial for the proper treatment and management of facial injuries. The first step in the diagnosis is proper and detailed history and extensive clinical examination. The simplest and most effective diagnostic tool is still the plain film radiograph. Panoramic radiograph is the single most informative radiologic study used in diagnosing mandibular fractures [8], but fails to exhibit the variation in displacement of fractured segments. To assess the fracture displacement at least two radiograph at right angle is needed. Orthopantomogram (or it can be substituted with right and left lateral oblique views), posterior/anterior view, and reverse Towne's view constitute a "mandible series" of radiography. Computerized tomographic (CT) scans is more superior to the plain radiograph with additional advances of 3D reconstruction of image but it possess high radiation exposure and also has the high cost.

Ultrasonography has been used extensively in the soft tissue lesions of oral and maxillofacial region, but its use in bone fracture is limited. In this study ultrasonography was used to compare the diagnosis of the mandibular angle fracture with conventional radiography.

Kleinheinz J et al. in 1997 [23] demonstrated that it was difficult to diagnosed subcondylar fracture clinically so ultrasonography can be reliably used with high sensitivity and specificity. S Nezafati et al in 2010 [24] compared the ultrasonography withsubmentovertex films and computed tomography scan in the diagnosis of zygomatic arch fractures and concluded that it is a radiation free diagnostic tool and provide a sensitivity of 88.2% in diagnosis of arch fracture. Despite the high sensitivity it was inferior to the computed tomography especially in the complex zygomatic complex fractures. W. L. Adeyemo et al in 2011 [17]published a systematic review of 17 articles and concluded that the sensitivity and specificity of ultrasound were 56–100% and 85–100%, in detecting orbital fractures respectively, whilst 90–100% and 98–100% for nasal fractures respectively, >90%in detecting zygomatic fractures and for mandibular fractures, the sensitivity and specificity was 66–100% and 52–100%, respectively.

We found that in our study the sensitivity and positive predictive value of ultrasonography was 100% and 100% respectively for the diagnosis of mandibular angle fracture. As per our knowledge not a single study is available to compare the preoperative and postoperative orientation of fracture segments and gap or overlap between them using ultrasonography.The added advantage of ultrasonography in this study was that it was used to estimate the gap or overlap between fractured segments (Fig. 3 and 4) both in anteroposterior and mediolateral direction with inferior border of the mandible was made the reference point. It may also have a benefit in the regions of the world which do not have access to CT scanning.

V. Conclusion

Ultrasonography is a simple, reliable, cost effective, radiation free technique and can be used for detection of fracture of mandibular angle with high sensitivity. The added advantage of Ultrasonography is that it can be used in the detection of orientation of fracture segment preoperatively and postoperatively so that reduction of fractured bone segments can be assessed.

VI. Conflict Of Interest

No potential conflict of interest relevant to this article was reported.

Acknowledgment

We thank the operating surgeons and the departmental nursing and clerical staff.

References

[1]. Hwang K, You SH. Analysis of facial bone fractures: An 11-year study of 2,094 patients. Indian J PlastSurg 2010;43:42.
[2]. Kirk L. Fridrich, Gustavo Pena-Velasco and Robert A.J. Olson. Changing Trends With Mandibular Fractures: A Review of 1,067 Cases. J Oral Maxillofac Surg. 1992;50:586-589.
[3]. Wagner WF, Neal DC, Alpert B: Morbidity associated with extraoral open reduction of mandibular fractures. J Oral Surg. 1979;37:97.
[4]. James RB, Fredrickson C, Kent JN: Prospective study of mandibular fractures. J Oral Surg. 1981;39:275.
[5]. Chuong R, Donoff RB, Guralnick WC: A retrospective analysis of 327 mandibular fractures. J Oral Maxillofac Surg. 1983;41:305.
[6]. Iizuka T, Lindqvist C, Hallikainen D, et al: Infection after rigid internal fixation of mandibular fractures. A clinical and radiologic study. J Oral Maxillofac Surg. 1991;49:585.
[7]. Passeri LA, Ellis E, Sinn DP: Complications of non-rigid fixation of mandibular angle fractures. J Oral Maxillofac Surg. 1993;51:382.
[8]. Chayra GA, Meador LR, Laskin OM. Comparison of panoramic and standard radiographs for the diagnosis of mandibular fractures. Journal of Oral and Maxillofacial Surgery. 1985;44:677.
[9]. Dorobisz H, Voegeli E, Hardt N. Conventional radiology and computed tomography in facial fractures. Rontgenblatter. 1983;36:428–433.
[10]. Jenkins CM, Thuau H. Ultrasound imaging assessment of the fractures of the orbital floor. ClinRadiol. 1997;52:708–711.
[11]. Koischwitz D, Gritzman N. Ultrasound of the neck. RadiolClin North Am. 2000;38:1029–1045.
[12]. Lauria L, Curi MM, Chammas MC, Pinto DS, Torloni H. Ultrasonography evaluation of bone lesions of the jaws. Oral Surg Oral Med Oral Pathol Oral RadiolEndod. 1996;82:351–357.
[13]. R Javadrashid, M Khatoonabad, N Shams,FEsmaeili, H JabbariKhamnei. Comparison of ultrasonography with computed tomography in the diagnosis of nasal bone fractures. DentomaxillofacRadiol. 2011 Dec; 40(8): 486–491.
[14]. Hong HS, Cha JG, Paik SH, et al. High-resolution sonography for nasal fracture in children. AJR Am J Roentgenol. 2007;188:86–92.
[15]. Thiede O, Krömer JH, Rudack C, Stoll W, Osada N, Schmäl F. Comparison of ultrasonography and conventional radiography in the diagnosis of nasal fractures. Arch Otolaryngol Head Neck Surg. 2005;131:434–439.
[16]. AfshinMohammadi, Mohammad Ghasemi-Rad Nasal Bone Fracture– Ultrasonography or Computed Tomography? Medical Ultrasonography.2011;13(4):292-295.
[17]. W. L. Adeyemo, O. A. Akadiri: A systematic review of the diagnostic role of ultrasonography in maxillofacial fractures. Int. J. Oral Maxillofac Surg. 2011;40:655-661.
[18]. KoijamSashikumar Singh and S. JayachandranA comparative study on the diagnostic utility of ultrasonography with conventional
[19]. radiography and computed tomography scan in detection of zygomatic arch and mandibular fractures ContempClin Dent. 2014;5(2):166–169.

[20]. Alvi A, Doherty T, Lewen G. Facial fractures and concomitant injuries in trauma patients. Laryngoscope. 2003;113(1):102-6.
[21]. Cannell H, Dyer PV, Paterson A. Maxillofacial injuries in the multiply injured. Eur J Emerg Med. 1996;3(1):43-7.
[22]. Perry M, Dancey A, Mireskandari K, Oakley P, Davies S, Cameron M. Emergency care in facial trauma e a maxillofacial and ophthalmic perspective. Injury. 2005;36(8):875-96.
[23]. Ellis E 3rd, Moos KF, el-Attar A. Ten years of mandibular fractures: an analysis of 2,137 cases. Oral Surg Oral Med Oral Pathol.1985;59(2):120-9.
[24]. Kleinheinz J, Anastassov GE, Joos U: Ultrasonographic versus conventional diagnostic procedures in dislocated subcondylarmandibular fractures; J Craniomaxillofac Trauma. 1997;3(2):40-2.
[25]. S Nezafati, R Javadrashid, S Rad and S Akrami Comparison of ultrasonography with submentovertex films and computed tomography scan in the diagnosis of zygomaticarch fractures Dentomaxillofacial Radiology. 2010;39:11–16.

Dr. Padma Badhe. "Angle of Mandible Fracture: Ultrasonography or Plain Film Radiography?." IOSR Journal of Dental and Medical Sciences (IOSR-JDMS), vol. 18, no. 1, 2019, pp14-19.