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COMPARATIVE STUDY BETWEEN CONVENTIONAL RADIOGRAPHY AND ULTRASONOGRAPHY IN DETECTION OF BONY FRACTURE

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Abstract

Aim: Rapid advances in computing hardware and microelectronic technology have facilitated technological advances in ultrasonography (USG) over the past three decades, making it applicable not only to soft tissues but also to bone lesions. This has led to increased interest in examining ultrasound imaging as an alternative to traditional radiography. Therefore, based on the above-mentioned findings, the present study was planned to compare conventional radiography and ultrasonography in detecting bone fractures in patients.

Method: The study was planned on 25 patients who were identified as fracture cases. Patients were examined with ultrasonographic as well as conventional radiographic techniques.

Result: This study shows that Ultrasound technique is a very fast, cost effective, and radiation-free imaging technique for detecting superficial bone fractures.

Conclusion: The present analysis, the characteristic of ultrasonography screening performance in bony fracture finding was found to be more effective than radiography. In the case of isolated uncomplicated fractures, USG can replace conventional radiography.

Keywords: Ultrasonography, Conventional Radiography, Bony Fracture

Introduction

Injury shows a major cause of death and disability worldwide [1]. Bone fractures are common injuries. A bone fracture is a surgical condition in which there is a break in bone continuity. They occur when a large force causes a bone to break. Falling, collisions while walking and severe blows are painful causes of broken bones. Diseases that weaken bones and overuse can lead to fractures [2]. There are four major types of bones based on shape - long, short, flat, sesamoid and irregular [3].

Adjacent structures such as nerve, muscle or blood vessels, spinal cord, and damage to nerve roots (for spinal cord rupture) or cranial material (for skull rupture) cause other specific signs and symptoms. Some fractures can cause serious complications, including a condition called compartment syndrome. If left untreated, compartment syndrome can eventually lead to dehydration. Other complications may include nonunions where the fractured bone does not heal, or nonunions where the fractured bone heals properly. One form of meronin is bone loss, which is especially common after fractures of the femur and table [4]. Fractures can be diagnosed based on a specific medical history and physical examination. X-ray images are often used to confirm the diagnosis. In some cases, an x-ray of nearby joints may be needed to rule out degeneration or rupture. Computed tomography (CT) or magnetic resonance imaging (MRI) may be indicated if simple radiography is not enough. Both high-intensity and low-intensity trauma can lead to fractures. Road accident prevention efforts, which are the most common cause of impact trauma, include reducing obstacles while driving. Driving both with driving and texting, and under the influence of normal interference, leads to an almost six-fold increase in accidents. Wearing a seatbelt can also reduce the risk of injury in the event of a collision [5]. A common cause of low power trauma is falling home. When considering preventive efforts, the National Institutes of Health (NIH) will consider ways to reduce the likelihood of falls, the strength of falls, and the weakness of bones. It's a good idea to keep the cord away from busy areas, install railings to brighten the stairs, and install an auxiliary bar near the washroom tub to keep you from falling into your house. To minimize the effects of a fall, NIH recommends a straight fall on your hips and hands. Finally, taking calcium vitamin D supplements can help strengthen bones [6].

Vitamin D supplements, in combination with excess calcium, significantly reduce the risk of hip fractures and other types of fractures in the elderly. However, vitamin D supplementation alone did not reduce the risk of fractures [7].

High-Special-Resolution Ultrasonography (USG), however, may be an alternative method of imaging in patients with occult scaphoid fractures. Technological improvements in sonography have led to higher local resolution of this diagnostic tool, and thus, higher local resolution can reveal subtle post-traumatic changes of the

US cortex and / or periosteum, immediately after injury. May be present but is not shown on traditional radiographs. Furthermore, higher local resolution US is more easily accessible, less time consuming, and significantly less expensive than MR imaging [8]. X-rays are the use of x-rays to observe the internal structure of a patient. It is a one type of electromagnetic radiation produced by X-ray tubes. X-rays pass through the body and are caught behind the patient by a detector. High sensitivity film for X-ray or digital detectors. There are differences in the absorption of X-rays by different tissues in the body, the denser the bones, the more radiation they absorb, and the soft tissues allow more passage. This variation creates contrast in the image to represent the 2D of all structures within the patient [9]. This study was designed for comparative diagnosis of conventional radiography and ultrasonography to detect fractures in patients.

Method

The study group consists of 25 patients of all ages and is sexually involved in the study either outdoors or indoors in the emergency ward or orthopedics, and in any of the other departments of our hospital where medically suspected fractures are suspected. Each patient underwent conventional radiography with a detailed medical history, local examination, and appropriate feedback.

Methodology

Each patient's informed consents were taken. Transverse and longitudinal planes of bony fractures was examined in the suspected patients. Care was taken to scan very lightly over the site. In ultrasonography, breech in the continuity of the cortex of the bone was used as the criterion to suggest a fracture as it is the most definitive and reliable factor in diagnosing a bony fracture. A clear disruption of cortical bone as small as 1-2 mm was detected. Fractured displacements ends was also appreciated with the USG probe as step off deformity or avulsion of a bony segment. Limit of about 2 mm was taken as a criterion for deciding displacement to be absent and present. The results of radiography and ultrasonography were compared to confirm their relative effectiveness in detecting fractures.

Results and Discussion

Ultrasound is a rapid, non-invasive diagnostic imaging method that uses only sound waves and therefore poses no risk of radiation exposure. Basically it is used for the diagnostic purpose in soft tissue. Severe swelling and softening of the fracture can be painful for the patient and can make scanning bone sketches difficult, reducing the accuracy of the procedure. In this current study, it was not difficult to examine patients with swelling and overall tenderness. The analgesic effect of the drug taken by the patient may be reduced. The aim of this study was to determine if ultrasound could be used as a diagnostic tool for the study of fractures. Ultrasound has been shown to be very accurate as a diagnostic method for diagnosing suspicious fractures when performed and interpreted by an experienced ultrasound technician. There was no systematic difference between the results of the ultrasound examination and the results of the conventional radiographic examination, and the sensitivity and specificity of the ultrasound were high. This result indicates that ultrasound can be used as a diagnostic tool to rule out fractures, as shown in Tables 1 and 2.

Table 1: Result of Radiography and USG on different bones

Type of bone	Result of radiography	Result of USG: Negative	Result of USG: Positive	Total
Long bone	Negative	6	0	6
	Positive	0	11	11
	Total	6	11	17
Flat bone	Negative	1	2	3
	Positive	0	2	5
	Total	1	4	5
Short bone	Negative	0	1	1
	Positive	0	2	2
	Total	0	3	3

Table 2: General Sensitivity, Specificity, PPV, NPV and Accuracy of radiography against USG.

Sensitivity (%)	Specificity (%)	Positive Predictive Value (%)	Negative Predictive Value (%)	Accuracy (%)
82.35	100.00	100.00	72.73	88.00

Ultrasonography was used to identify fractures based on observation of cortical bone disruption. For small fractures, ultrasound detection of this mark and its distinction from other findings depends largely on the skill of the operator. The role of operator skill in ultrasound injury detection was also corrected in this study [10-12]. An ultrasound performed by a radiologist is more sensitive than an emergency doctor. In this study, we found that the characteristic of this method increases at frequencies above 10 MHz. This may be due to the high resolution obtained at high frequencies [13]. Facilitates the detection of fracture symptoms. Numerous narrative review articles and qualitative systematic reviews highlight the potential benefits of ultrasound in detecting chest wall fractures. In this regard, Chan announced in a systematic review of the Medline Indexed Study that ultrasound is more sensitive to detecting chest fractures than x-ray. Finding that the diagnostic accuracy of ultrasound is double the capacity of x-ray examination in diagnosing fractures, Dietrich et al. Ultrasound is also considered a useful diagnostic tool for detecting rib fractures [15].

Ultrasound is a rapid, non-invasive diagnostic imaging method that uses only sound waves and, therefore, there is no risk of radiation exposure. Originally used to assess soft tissue. Success has been obtained thanks to Ord et al [16]. Imaging of maxillofacial fractures when USG is used to estimate orbital fracture. Swelling and softening throughout the fracture can make the procedure uncomfortable for the patient, make it difficult to scan the shape of the bone, and reduce the precision of the procedure [17]. In this study, it was not difficult to diagnose patients with swelling and overall tenderness. The decreased sensitivity may be due to the analgesic effect of the drug taken by the patient. Additionally, an isolated zygomatic arch or mandibular fracture has also been found to be associated with minimal swelling and tenderness. Unlike conventional CT scans and X-rays, the downside of USG is that the fracture cannot be attached to the surrounding physical marks. Patients were examined based on subjective and objective evidence of the results of medical history studies. The doctor should select the relevant diagnostic imaging method to confirm the diagnosis based on the signs and symptoms of the presence of a facial fracture. Though there are conventional imaging techniques for assessing the fracture but each has its own drawbacks which make it difficult to interpret. Conventional radiography requires special patient positioning and repeated exposures which may be challenging in a trauma room. CT on the other hand is invasive, not easily accessible and high cost which makes it usage option limited. Ultrasound is a high frequency sound wave that is transmitted in to the human body by a transducer and the echoes from tissue surface are detected and displayed on a screen. Initially USG Was limited only to soft tissues.

Ultrasound shows promise as a detection tool in identification of bony fractures. The development of handheld ultrasound systems may therefore enable a means of more quickly identifying clinically significant fractures, through more rapid image acquisition and simultaneous interpretation at the bed side. As there is a small size these are useful in locations where traditional radiography and experienced physicians are not available [18].

Conclusion

The current study we found that the performance of ultrasound screening in detecting fractures is more characteristic than radiography. Ultrasound can be used as an alternative to X-rays to detect a fracture, thus protecting the patient from radiation exposure. Further research should be directed to the study of systematic use of ultrasound in the detection of fractures.

References

1. Katherine Abel. Official CPC Certification Study Guide. American Medical Association, 2013, p. 108.
2. Witmer Daniel K, Marshall Silas T, Browner Bruce D. "Emergency Care of Musculoskeletal Injuries". In Townsend, Courtney M.; Beauchamp, R. Daniel; Evers, B. Mark; Mattox, Kenneth L. (eds.). Sabiston Textbook of Surgery (20th ed.). Elsevier, 2016, pp. 462-504. ISBN 978-0-323-40163-0.
3. Balaban NE, Bobick J (2008) Skeletal system. In: The handy anatomy answer book. Visible Ink Press Publishers, pp. 376.
4. Zebouni SH, Khalil SA, Roukos S, Moussa ML, Smayra T, et al. (2008) Musculoskeletal imaging limb fractures: ultrasound imaging features. J Radiol 89: 557-563
5. Sidwell Richard, Matar Maher M., Sakran Joseph V. "Trauma Education and Prevention". Surgical Clinics of North America. 2017; 97(5):1185-119.
6. "Preventing Falls and Related Fractures | NIH Osteoporosis and Related Bone Diseases National Resource Center". www. bones. nih. gov. Retrieved 2018-12-03.
7. Avenell Alison, Mak Jenson CS, O'Connell Dianne. "Vitamin D and vitamin D analogues for preventing fractures in post-menopausal women and older men". The Cochrane Database of Systematic Reviews. 2014; (4):+CD000227.
8. https://www.who.int/diagnostic_imaging/imaging_mod alities/dim_plain-radiography/en/
9. Herneth AM, Siegmeth A, Bader TR, Ba-Ssalamah A, Lechner G, et al. (2001) scaphoid fractures: evaluation with high-spatial-resolution us-initial results. Radiology 220: 231-235.
10. Abbasi S, Farsi D, Hafezimoghadam P, Fathi M, Zare MA. Accuracy of emergency physician-performed ultrasound in detecting traumatic pneumothorax after

a 2-h training course. Eur J Emerg Med. 2013; 20(3):173- 7.
11. Bui-Mansfield LT, Chen DC, O'Brien SD. Accuracy of ultrasound of musculoskeletal soft-tissue tumors. Am J Roentgenol. 2015; 204(2):W218.
12. Fine D, Perring S, Herbetko J, Hacking C, Fleming J, Dewbury K. Three-dimensional (3D) ultrasound imaging of the gallbladder and dilated biliary tree: reconstruction from real-time B-scans. Br J Radiol. 1991; 64(767):1056-7.
13. Lee JH, Jeong YK, Park KB, Park JK, Jeong AK, Hwang JC. Operator-dependent techniques for graded compression sonography to detect the appendix and diagnose acute appendicitis. Am J Roentgenol. 2005; 184(1):91-7.
14. Majumdar S, Kumar PS, Pandit A. Effect of liquidphase properties on ultrasound intensity and cavitational activity. Ultrason Sonochem. 1998; 5(3):113-8.
15. Chan SS. Emergency bedside ultrasound for the diagnosis of rib fractures. Am J Emerg Med. 2009; 27(5):617-20.
16. Dietrich CF, Mathis G, Cui XW, Ignee A, Hocke M, Hirche TO. Ultrasound of the pleurae and lungs. Ultrasound Med Biol. 2015; 41(2):351-65.
17. Ord RA, Le May M, Duncan JG, Moos KF. Computerized tomography and B-scan ultrasonography in the diagnosis of fractures of the medial orbital wall. Plast Reconstr Surg. 1981; 67:281-8.
18. Hubner U, Schlicht W, Outzen S, Barthel M, Halsband H. Ultrasound in the diagnosis of fractures in children. J Bone Joint Surg Br. 2000; 82:1170-3.