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Original Article

Accuracy of point-of-care ultrasound using low frequency curvilinear transducer in the diagnosis of shoulder dislocation and confirmation of appropriate reduction

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ABSTRACT

Background: Ultrasound (US) is an effective modality in the evaluation of shoulder dislocation and reduction. In most studies, high frequency US probes have been used.

Objective: To determine the sensitivity and specificity of low frequency US in the diagnosis of shoulder dislocation and its proper reduction in the emergency department (ED).

Methods: In a prospective observational study 84 patients, suspicious of shoulder dislocation, were enrolled in our study. In ED, they all underwent low frequency (curve) probe US examination by the emergency physician at the time of admission. Standard radiographies of their shoulder joints were taken later and then reported by the attending radiologist. As soon as the shoulder dislocation was confirmed, reduction of the joint was done under procedural sedation and analgesia. US and radiography of the relocated joint were taken for the second time. The sensitivity and specificity of low frequency US were compared with radiography by the appropriate statistical analysis.

Results: In comparison to radiography, US had a sensitivity of 100.0%, specificity of 80.0%, positive predictive value of 98.7%, and negative predictive value of 100.0% in diagnosis of shoulder dislocation. The specificity of US in diagnosis of proper reduction of the joint, was estimated to be 98.7% with a negative predictive value of 100.0%. US took a significantly less time than radiography to be performed ($p < 0.001$).

Conclusions: Low frequency US is highly accurate in diagnosing shoulder dislocation and its proper reduction. Thus it might be a good substitute for radiography in these situations.

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1. Introduction

The glenohumeral joint is the most commonly dislocate major joint in the body. Most shoulder dislocations are anterior.^{1,2} The incidence of shoulder dislocation is estimated to be 17 per 100000 annually and two distinct age and gender peaks have been reported to be affected the most, first in men 20–30 years of age and the second in older women.³

Shoulder dislocation is a true emergency. In most emergency departments (EDs), its diagnosis is initially confirmed by radiography. In almost all cases pre-reduction X-rays are necessary. Ultrasound (US) can save time in this procedure, because it is ready and accessible. US does not have the risk of exposing to radiation induced by other imaging modalities.

Physicians usually require X-rays of the joint before and after the reduction.⁴ There are some reasons behind this order: dislocation confirmation, concomitant fracture diagnosis, appropriate reduction and finding new fractures after reduction.⁵ Recent evidence about taking radiography of the dislocated shoulder joint seems controversial.^{5–8} Some of these studies have recommended that physicians could omit unnecessary pre and post-reduction X-rays, which cause extra expense, radiation and prolong ED stay.⁹

Most previous studies have used high frequency linear probe in shoulder US. In this study, we decided to use low frequency US in

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the diagnosis of shoulder dislocation and its proper reduction. Low frequency US probe seems to be especially more helpful in shoulder dislocation and in muscular patients. If US has a good sensitivity and specificity comparing to radiography, we could substitute this rapid and easy modality with X-rays.

2. Materials and methods

2.1. Participants and study design

This was a prospective observational and diagnostic accuracy study. All patients with the history and clinical suspicion of shoulder dislocation, who were admitted to the EDs of 2 university hospitals, were enrolled in our study. This study was performed during one year, from April 2014 to April 2015. The study was approved by the ethics committee of university. All patients were required to read informed consent letter and signed it if they accepted to participate in our study.

Our inclusion criteria were: patients older than 16 years old, with clinical suspicion of shoulder dislocation of any kind, induced by any reason (trauma or spontaneously), who were admitted to the EDs of two tertiary referral hospitals. The exclusion criteria were: pregnant patients, patients with depressed level of consciousness or ones who needed emergent surgical operation like laparotomy.

Patients who met the inclusion criteria, underwent US

examination by an emergency medicine (EM) faculty or a chief resident who passed a 6-h training course of US examination in shoulder dislocation by the chief investigator (EM attending physician). They passed a 2-month-pilot course on real patients in order to gain enough experience and skill in normal and abnormal shoulder US.

We used the low frequency (curve) US probe (Sonosite M-Turbo, C 3–5 MHz probe) and put it horizontally on the posterior rim of shoulder joint with its marker pointing towards patient's lateral. The method we used for joint US and the results are shown in Fig. 1.

Whatever the US result, all patients underwent an X-ray of their joint before reduction. This pre-reduction standard radiography helped the responsible physician to diagnose joint dislocation and detect any associated fractures. The results of X-rays were reported by the attending of radiology with delay. EM faculties and chief residents were blinded to the X-ray results.

After that the dislocation was confirmed, PSA was done and reduction of the joint was attempted. Both the US and radiography were repeated after the reduction.

2.2. Primary and secondary outcomes

Our primary outcome was determining the diagnostic accuracy of US using low frequency transducer in diagnosing shoulder. Our secondary outcome was comparison of the time spent in the 2 techniques.

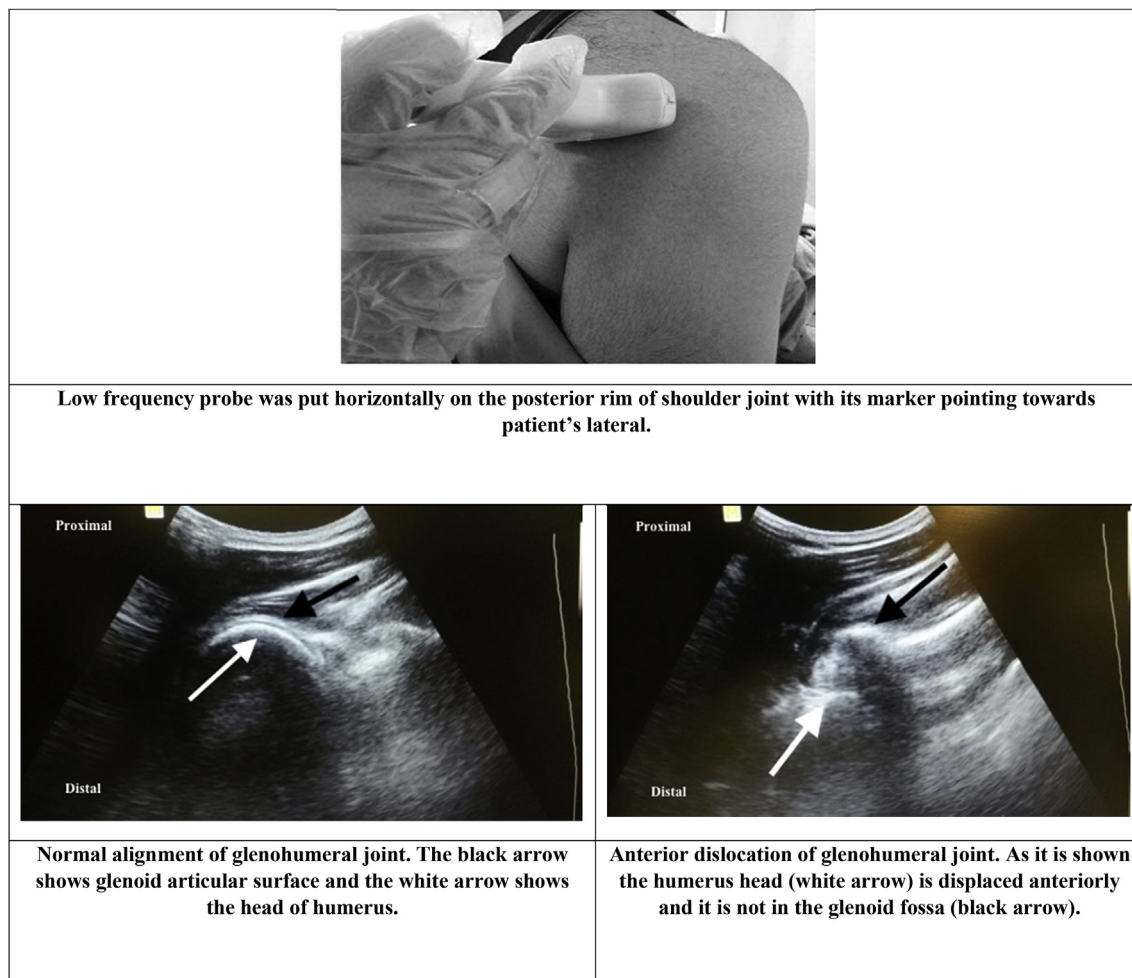


Fig. 1. Shoulder joint ultrasound exam.

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