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### Diagnostic accuracy of ultrasonography in comparison with X-ray graphy in detecting and treatment of anterior shoulder dislocation

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#### KEYWORDS

Shoulder dislocation, Sonography, Accuracy

#### A B S T R A C T

Shoulder joint, is the most commonly dislocated joint in the body. Complications of anterior shoulder dislocation include neurological, vascular injuries, bone injuries (fractures), and tears of the rotator cuff muscles. The aim of this study was to evaluate the diagnostic value of ultrasonography in the diagnosis of anterior shoulder dislocation and confirmed it was a good start here. In a prospective observational study that performed in the Department of Emergency Medicine, Tabriz University of Medical Sciences on patients with suspected anterior shoulder dislocation, Diagnostic value of ultrasonography in the diagnosis of anterior shoulder dislocation evaluated and approved by the appropriate reduction .63(70%) of patients was male and 27(30%) of them was female. Mean age of male patients was 29.96 + 8.19 year and mean age of female patients was 30 + 8.64 year. Significant differences was not found in mean age of patients (P=0.987). Shoulder dislocation type in 49 patients (98%) was sub-coracoids and in one patient (2%) was Sub-Celavivular. Shoulder dislocation reduction techniques among patients were the Traction-Contraction. Shoulder ultrasonography in the diagnosis of patients resulting in reduction of anterior shoulder dislocation reduction was successful in 45 patients, 5 patients reported reduction was unsuccessful. Shoulder sonography findings in patients with anterior dislocation of a joint reduction in 49 control patients and 41 patients without dislocation of shoulder dislocation was reported. Sensitivity, specificity, positive and negative predictive values of ultrasonography in the diagnosis of shoulder dislocation were 94%, 95%, 95.5% and 92.7%, respectively.

#### Introduction

The natural structure of the shoulder joint resulted in very broad range of joint

movements and on the other hand it is the most common joint undergoing

dislocation in the body so that about 50% of cases of joint half-dislocation and dislocation are observed in shoulder joints. Around 95% of the cases of the shoulder dislocation take place in anterior part (1). Its prevalence in the population is 17 in 100,000 (2).

An important property of the shoulder dislocation is the high incidence of it in the youth and recurrent flares in this important and active stratum of society so that 62% of patients younger than 22 years with anterior shoulder dislocation are relapsed (1) According to Plat et al studies, 85% of cases with recurrent anterior shoulder dislocation are observed in young men (3).

Its manifestations include intense pain and patient's inability to do some of the movements of the shoulder. Hand with dislocation is located in abduction situation while forearm spins outward. Sometimes the head of the humerus is touched in the anterior.

Anterior shoulder dislocation effects include nerve damage, cardiovascular damage, bone damage and tear of the rotator cuff muscle (4) So that this kind of dislocation in some cases is associated with fractures of the anterior glenoid and tuberosity of big bone of the arms (5-6).

Shoulder dislocation is considered an orthopedic emergency and needs emergency fit up. Failure in the successful fit up of a shoulder within the first 24 hours leads to the risk of lack of the possibility of a sustainable closed fit up (4) and it requires early detection.

Closed fit up for the case of this dislocation is normally successful (7). In previous studies the probability of failure in fit up is obtained between 0 to 30 percent

(8). There exist several methods such Hippocratic, Milch, Stimson and Scapular manipulation for treating dislocation (9-10).

Fit up of this dislocation is done in hospitals by orthopedic or emergency specialists. Typically in most cases both doctors request shoulder radiography before and after the fit up. The reasons for this application include approval of dislocation, the absence of fracture before fit up, completeness of fit up and reliability of iatrogenic fracture caused during fit up of the shoulder joint (11).

Recent studies raised a question of necessity of performing radiography before and after fit up of the anterior shoulder dislocation (11-14). On the other hand, according to the results of various surveys on the usefulness of ultrasonography as diagnostic modality in applications as shoulder dislocation (15-18) and considering the fact that doing radiography before and after fit up requires a considerable waste of time and also patient has been exposed to harmful rays and make a significant financial burden on patients, we tried to do the present study with the purpose of investigation of the diagnostic value of ultrasonography for the detection of anterior shoulder dislocation and verifying the proper fit up. To do this research, all patients with anterior dislocation of the shoulder joint referred to emergency Department of Imam Reza hospital of Tabriz during the 2013-2014 were studied. The aim of this study was to evaluate the diagnostic value of ultrasonography in the diagnosis of anterior shoulder dislocation and to confirm proper fit up.

## **Materials and methods**

In a prospective observational study which is done on patients suspected to

have anterior dislocation in Department of emergency medicine of Tabriz Medical University, the diagnostic value of ultrasound in the diagnosis of anterior shoulder dislocation and confirming proper fit up was evaluated.

In this study, all patients referred to the emergency Department of Imam Reza hospital during the 2013-2014 suffered from pain following trauma and limitation of motion of the arm at the shoulder joint in abduction situation and external Rotation of joint and were studied with a possible diagnosis of anterior dislocation of shoulder joint. At first Testimonial sheet was completed.

Then an ultrasound was carried out before and after fit up of dislocated joint in two anterior and lateral views with logiq200 device (by 7.5-10 Megahertz transducer with a width of 2 inches).

According to standard diagnostic criteria, radiographs in three thumb (lateral anterior-posterior, scapular, Y) were produced before fit up (to confirm anterior dislocation of shoulder joint) and after that. All of the sonographic evaluations were performed by a trained medical emergency assistant.

On the other hand anterior dislocation of shoulder joint was confirmed by radiographs. Control graphs were provided after fit up. Finally the result of ultrasound and radiography before and after fit up together were compared. Then all the data collected by surveys and went under statistical analysis.

The sensitivity and specificity of ultrasound are also calculated. The entry criteria include the first anterior dislocation of the shoulder; completing testimonial sheet, patients with ages equal to or

more than 15 years old and who are suspected in the anterior dislocation of the shoulder.

Of exit criteria includes patients with age less than 15 years, the posterior dislocation, fracture, dislocation, bilateral dislocation, bony injuries, nervous damage, cardiovascular damage, tearing of rotator cuff, shoulder dislocation more than once, a detailed history of the previous muscle surgery, neuromuscular disorders and spontaneous dislocation.

### **Ethical considerations**

Before starting the study with full explanation of all steps testimonial sheets were obtained from patients, names of patients was not mentioned during the study and will not be and aspects of the trustee was observed. No additional cost for ultrasound was imposed to patients and they monitored by ultrasound by emergency medicine assistant under the supervision of Professor of emergency medicine.

### **Statistical data analysis method**

Amount of sensitivity, specificity, positive and negative predictive values of results of ultrasound which was done by resident emergency medicine were compared with shoulder radiography in patients with shoulder dislocation and were calculated using related formula and statistical tests of t-Test and Chi-square were considered for comparison of quantitative and qualitative variable and  $p < 0.05$  was regarded significant.

### **Result and Discussion**

In this study, 90 patients that were shown to be susceptible to anterior shoulder dislocation by clinical examinations were

selected and studied. The following results were obtained:

Of the patients under study, 70% were male and 30% were female. The average age of male and female patients was  $29.96 \pm 8.19$  years and  $30 \pm 8.64$  years, respectively ( $P=0.987$ ). Anterior shoulder dislocation was observed in 50 patients.

Concerning the type of shoulder dislocation, 49 patients (98%) demonstrated sub-coracoid dislocation and only 1 patient (2%) demonstrated sub-clavicular dislocation.

The patients under study were treated by applying traction and contraction. Results of ultrasonography performed on the shoulder of patients to diagnose anterior shoulder dislocation showed that 49 suffered from dislocation and 41 did not suffer from shoulder dislocation.

Results of shoulder radiography performed on patients to diagnose anterior shoulder dislocation reduction indicated that 50 (100%) patients with anterior shoulder dislocation benefited from full reduction.

In addition, results of ultrasonography indicated that 45 patients with anterior shoulder dislocation had successful reduction while 5 experienced failed reduction. Results of shoulder radiography aimed to check the anterior shoulder dislocation reduction indicated that 50 patients benefited from full reduction.

Comparison of radiography and ultrasonography operations performed on the shoulders to diagnose anterior shoulder dislocation and control reduction are presented in tables (1) and (2). According to Table (1), the sensitivity and specificity of the ultrasonography performed to diagnose shoulder dislocation were 94% and 95%, respectively. Moreover, the positive and

negative predictive value of the ultrasonography results was 95.5% and 92.5%, respectively.

According to Table (2), the sensitivity and specificity of the ultrasonography performed to control shoulder dislocation reduction were 90% and 100%, respectively.

Today, the use of diagnostic modalities in examination of patients, especially emergency cases, is more prevalent. Moreover, another reason for popularity of ultrasonography is that it employs X-ray, it is easy-to-apply and it is a bed side diagnostic modality. Shoulder ultrasonography is a diagnostic modality which is used to diagnose shoulder dislocation, tendon injuries, and joint effusion.

In a study by Mackenzie et al. (2013), which was performed in the Emergency Department of Warren Alpert University in the Rhodel Island state (United States), the role ultrasonography in the diagnosis of shoulder dislocation was studied. The researchers stated that shoulder ultrasonography is a useful diagnostic method for patients with shoulder dislocation. They introduced it as useful method for diagnosis of shoulder dislocation that can be used to control patients after reduction as well [19].

In a study by Wittner et al. the diagnostic precision of shoulder dislocation ultrasonography was studied. They reported that shoulder dislocation ultrasonography demonstrated a sensitivity of 97.7% and specificity of 92.3% in diagnosing shoulder dislocation [20]. In the present study, the sensitivity of ultrasonography in diagnosing anterior shoulder dislocation was shown to be 94%, which was high similar to the figure reported by the latter research.

**Table.I** Comparing result of Sonography in diagnosis of shoulder dislocation with radiography

		Result of radiography in diagnosis of shoulder dislocation		Total
		With dislocation	Without dislocation	
Result of Sonography in diagnosis of shoulder dislocation	With dislocation	47	2	49
	Without dislocation	3	38	41
Total		50	40	90

**Table.I** Comparing result of Sonography in diagnosis of shoulder Reduction with radiography

		Result of radiography in diagnosis of shoulder Reduction		Total
		Complete Reduction	Unsuccessful Reduction	
Result of Sonography in diagnosis of shoulder Reduction	Complete Reduction	45	0	45
	Unsuccessful Reduction	5	0	5
Total		50	0	50

In a study by Bianchi et al., which was performed in the University of Genoa in Italy, the role of shoulder ultrasonography in the diagnosis of shoulder dislocation was studied. The researchers stated that performing ultrasonography on such patients in the emergency department is a useful and effective way of diagnosing shoulder dislocation in patients visiting the emergency department [21].

In 2008, Kerkovsky et al. conducted a study in the emergency department of Czech University to analyze the role of ultrasonography in the diagnosis of traumatic lesions. They introduced shoulder ultrasonography as a useful means of examining shoulder traumatic lesions [22].

In the research by Jerosch et al., which was performed in the Hemut Schemidt University of Dusseldorf (Germany), the role of shoulder ultrasonography in the diagnosis of shoulder injuries was studied. The researchers reported a specificity of 100% and sensitivity of 89% for shoulder dislocation diagnostic ultrasonography [23].

In the present study, the specificity of the ultrasonography performed to examine anterior shoulder dislocation and lesions was 95%. This figure reflects a high specificity similar to the latter study.

Shudter et al. carried out a study to analyze the role of ultrasonography procedures performed by emergency department physicians to diagnose anterior shoulder dislocation. They reported that the emergency physicians was able to use ultrasonography to diagnose 93.7% of the patients with should dislocation [24].

In a study by Hendey et al., which was performed on patients with shoulder dislocation visiting emergency departments, the role of ultrasonography in diagnosing and controlling patients with shoulder dislocation was analyzed. They stated that of the 98 patients under study, 28 patients were diagnosed with repeated shoulder dislocation. The sensitivity of ultrasonography in diagnosing patients with repeated dislocation was 100%.

Ultrasonography sensitivity was also reported to be 98% in patients without shoulder dislocation and history of dislocation [25]. Results of the above studies and the present study suggest that shoulder dislocation ultrasonography demonstrates a high level of sensitivity and specificity. Therefore, ultrasonography can be used to examine emergency cases and avoid transferring patients under special care, especially those in unstable conditions, to the radiology section. This way, all examinations and treatment processes can be completed in the emergency department.

### **Conclusion**

Shoulder ultrasonography in the diagnosis of patients resulting in reduction of anterior shoulder dislocation reduction was successful in 45 patients, 5 patients reported reduction was unsuccessful. Shoulder sonography findings in patients with anterior dislocation of a joint reduction in 49 control patients and 41 patients without dislocation of shoulder dislocation was reported. Sensitivity, specificity, positive and negative predictive values of ultrasonography in the diagnosis of shoulder dislocation were 94%, 95%, 95.5% and 92.7%, respectively.

### **Suggestions**

Considering the research results and the high sensitivity and specificity demonstrated by ultrasonography in diagnosing and controlling anterior shoulder dislocation, it is recommended to replace radiography with ultrasonography in the emergency department to be able to identify patients susceptible to shoulder dislocation.

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