Original Research Article

Role of ultrasonography in the evaluation of cause of shoulder pain

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ABSTRACT

Background: Painful shoulder is one of the more common patient problems. Most of the time patients, complaining of chronic or even acute pain at shoulder area, are found normal with x-ray. Aim of this study was to evaluation of cause of shoulder pain using ultrasonography of shoulder joint.
Methods: This cross sectional observational study was carried out in the department of Radiology and Imaging, BIRDEM for the period of 1st June 2008 to 30th May 2009. Total 37 patients were included in the study. Accidental case, referred shoulder pain and shoulder pain due to systemic causes were excluded. Every patient underwent physical examination, x-ray and ultrasonography for further evaluation. Ethical approval was taken from institutional review board. Statistical analysis was done for validation of x-ray and USG in the diagnosis of shoulder pain.
Results: The mean±SD age was 46.14±10.85 years and all patients were within 28 to 70 years age range. Sensitivity of USG to diagnose different type of shoulder pathology was 93.3%, specificity 54.5%, positive predictive value 58.3%, negative predictive value 92.3% and accuracy 70.3 whereas Sensitivity of x-ray to diagnose different type of shoulder pathology was 13.3%, specificity 90.9%, positive predictive value 50.0%, negative predictive value 60.6% and accuracy 59.5%.
Conclusions: USG is a sensitive and accurate imaging modality for evaluating the cause of shoulder pain.

Keywords: Shoulder pain, Ultrasonography, X-ray

INTRODUCTION

Shoulder pain is a common patient problem. Excluding traumatic lesions main causes of painful shoulder are due to adhesive capsulitis, acute or chronic calcific tendinitis, bursitis, bicipital tendinitis and lesions of the musculotendinous cuff.[1] Arthritis is a less frequent cause of painful shoulder.[1] Most of the time patients complaining of chronic or even acute pain at shoulder area, are found normal with x-ray and x-ray does not give us idea about muscles, tendons, bursa, ligaments and even cartilages.[2] Some of the causes of shoulder pain may be hidden where a plain x-ray gives us almost no knowledge and sometimes physical examination cannot be done due to severe pain. In those cases we can do ultrasound examination- which is cheap, available and

has no known adverse effect. Ultrasonography is regarded throughout the world as a good modality for evaluation of non-skeletal structures. It is fast becoming the leading investigation of choice for rotator cuff and long head of biceps pathology.[3] Real time nature of ultrasound gives us dynamic assessment for muscles, tendons bursas, ligaments, synovial fluid and may be helpful for assessing cause of painful shoulder.[4]

Computed tomography is thought to be a useful technique to diagnose musculo-skeletal pathologies. But as it is limited to transverse scans of extremities in routine practice, it has rarely been used in tendon imaging. It has also the disadvantages of high cost and hazards of radiation. MRI is thought to be most accurate modality for imaging most of the lesions of soft tissues, muscles

and tendons.[5] But the method is not so much used for tendon imaging due to its high cost and less availability in low-income country like Bangladesh. Again, according to some research workers, the results of ultrasound are more sensitive and accurate than MRI in detection of some injuries of tendons.[5,6] Although a number of clinical tests used for diagnosis of painful shoulder are considered accurate in determining the location of the periarticular lesions, in these entities may be difficult to differentiate by physical examination. Given the great improvement in musculoskeletal imaging achieved by high frequency USG and its present availability in rheumatologic practice, it can be used to evaluate the accuracy of clinical diagnosis of painful shoulder. The recent advance in high frequency ultrasonography has markedly improved the rate of correct diagnosis of musculo-skeletal pathologies. The arthroscopic findings of rotator cuff integrity are compared with the diagnosis made from ultrasonography by some research workers.[7] According to them the diagnostic ultrasound is effective for screening of suspected rotator cuff tear, acromial sub deltoid bursitis, greater tuberosity fracture and adhesive capsulitis.[2] So, USG may be the investigation of choice for detecting the pathology of tendon, for its availability and low cost. So aim of this study was to evaluate USG as a diagnostic tool for accurate diagnosis of shoulder pathology and to help the physician for early management.

METHODS

This cross sectional observational study was carried out in the department of Radiology and Imaging, BIRDEM General Hospital, Dhaka, Bangladesh from the period of June 2008 to May 2009. The objective of this study was to establish diagnostic usefulness of ultrasonography in the assessment of shoulder joint pathology.

Inclusion criteria

A total 37 patients having shoulder pain were included in this study.

Exclusion criteria

Accidental case, referred shoulder pain and shoulder pain due to systemic causes were excluded.

They underwent physical examination followed by x-ray and ultrasonography. Physical examination was done in the department of Physical Medicine and both x-ray and ultrasonography were done in the Department of Radiology and Imaging, BIRDEM General Hospital for further evaluation. Linear array real time transducer of frequency 7.5 MHz to 10 MHz was used for ultrasonography of shoulder joint. The tendon, muscles, bursa, synovial fluid, capsule were scanned in both sagittal and axial planes. Physical examination findings were correlated with x-ray and USG findings. Ethical approval was taken from institutional review board.

Statistical analyses of the results were obtained by using window based computer software devised with Statistical Packages for Social Sciences 14 (SPSS-14). For the validity of study outcome, sensitivity, specificity, accuracy, positive predictive value and negative predictive value of USG and x-ray in the diagnosis of shoulder pathology were calculated out after confirmation of the diagnosis.

RESULTS

This study included 37 patients having shoulder pain. The mean±SD age was 46.14±10.85 years and all patients were within 28 to 70 years age range. Approximately half of the patients were within 30-49 years age group (Table 1). 54.1% respondents were male patients and the rest 45.9% female (Figure 1).

Table 1: Distribution of the respondents by age (n=37).

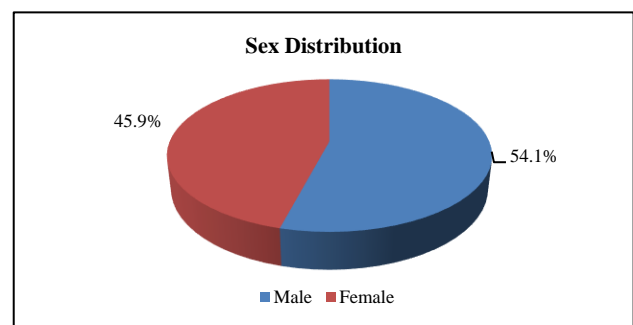| Age (years)	Frequency	Percentage
<30	1	2.7
30-39	11	29.7
40-49	11	29.7
50-59	9	24.4
>60	5	13.5
Total	37	100.0

Figure 1: Pie diagram showing sex distribution and its percentage (n=37).

Table 2: Distribution of the respondent's side of shoulder pain by sex.

Side of shoulder pain	Sex		P value
	Male	Female	
Right side	14 (70.0)	11 (64.7)	0.732
Left side	6 (30.0)	6 (35.3)	
Total	20 (100.0)	17 (100.0)	

*Chi-square test was done to measure the level of significance

Among 37 cases 10 were found normal shoulder which was 27% of total. Adhesive capsulitis and tear of supraspinatus tendon each of which was 21.6%, supraspinatus tendon calcification and biceps tendinitis each of which was found 10.8% and sub acromial bursitis was found 8.1% (Figure 2). The right shoulder pain was

found 70% in male cases whereas 64.7% in female cases. Left shoulder was found 30% in male cases and 35.3% of female cases only (Table 2).
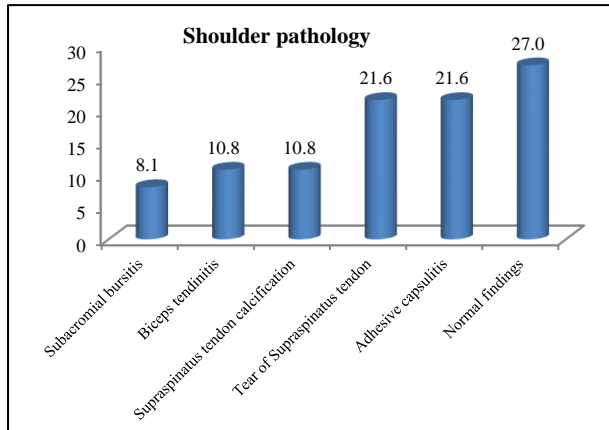

Figure 2: Different types of shoulder pathology diagnosed by USG.

Table 3: Correlation of x-ray and physical examination findings in the diagnosis of shoulder pathology.

X-ray	Physical examination		Total
	Positive	Negative	
Positive	2 (TP)	2 (FP)	4
Negative	13 (FN)	20 (TN)	33
Total	15	22	37

Table 4: Correlation of USG and physical examination findings in the diagnosis of shoulder pathology.

USG	Physical examination		Total
	Positive	Negative	
Positive	14 (TP)	10 (FP)	24
Negative	1 (FN)	12 (TN)	13
Total	15	22	37

Two cases were diagnosed as having shoulder pathology by x-ray but not confirmed by physical examination. They were false positive. Of 33 cases of negative findings, which were confirmed by x-ray, 13 were confirmed as having shoulder pathology and 20 were not by physical examination. They were false negative and true negative respectively (Table 3). Out of all patients fourteen cases were diagnosed as having shoulder pathology by USG and confirmed by physical examination. They were true positive. Ten cases were diagnosed as having shoulder pathology by USG but not confirmed by physical examination. They were false positive. Of 13 cases of negative findings, which were confirmed by USG, one was confirmed as having shoulder pathology and 12 were not by physical examination. They were false negative and true negative respectively (Table 4).

Table 5: Validation of x-ray and USG in the diagnosis of shoulder pain.

Validity tests	X-ray	USG
Sensitivity	13.3%	93.3%
Specificity	90.9%	54.5%
PPV	50.0%	58.3%
NPV	60.6%	92.3%
Accuracy	59.5%	70.3%

Sensitivity of USG to diagnose different type of shoulder pathology was 93.3%, specificity 54.5%, positive predictive value 58.3%, negative predictive value 92.3% and accuracy 70.3 whereas Sensitivity of x-ray to diagnose different type of shoulder pathology was 13.3%, specificity 90.9%, positive predictive value 50.0%, negative predictive value 60.6% and accuracy 59.5% (Table 5).

DISCUSSION

Painful shoulder is a very common rheumatological condition. In most patients, it results from periarticular lesions involving the rotator cuff, the biceps tendon, and the subacromial-subdeltoid bursa.[8] Tendinitis and tears of the rotator cuff, biceps tendinitis, and subacromial-subdeltoid bursitis are the most common lesions for shoulder pain.[9] But our study found more adhesive capsulitis along with those findings. It has been established that tendon degeneration occurs as part of the aging process.[10] Consequently, tendinitis and tears of the rotator cuff usually occur in patients over 50 years of age and the cause of these lesions is thought to be tendon degeneration, repetitive trauma, or both.[11] In our study the right shoulder pain was found 70% in male cases whereas 64.7% in female cases. Left shoulder was found 30% in male cases and 35.3% of female cases only. The difference of right and left shoulder joint pain indicate that the shoulder joint pain was higher in right side compared to left side due to the usual practice of right hand in any type of hand work among the study patients.

Our results show that the clinical diagnosis of periarticular conditions in the painful shoulder is not very accurate compared with US diagnosis. Other authors have also reported the low accuracy of clinical assessment compared with intraoperative anatomic lesions in the diagnosis of periarticular shoulder conditions.[3,12] In contrast with our results, Leroux et al reported satisfactory sensitivity but poor specificity for clinical tests, particularly for determining the location and type of rotator cuff lesions; the probable explanation is the difference in population.[13]

Sensitivity of x-ray to diagnose different type of shoulder pathology was 13.3%, specificity 90.9%, positive predictive value 50.0%, negative predictive value 60.6% and accuracy 59.5%. Whereas sensitivity of USG to diagnose type of shoulder pathology was 93.3%,

specificity 54.5%, positive predictive value 58.3%, negative predictive value 92.3% and accuracy 70.3%. The difference was statistically significant which indicate that USG is more sensitive modality in the evaluation of abnormality in shoulder joint pain compared to plain x-ray. This result shows similarity with Salek et al study.[2] Clinical examination is usually supplemented by plain radiography. However, the ability of this technique to show only non-specific indirect signs of chronic rotator cuff lesions limits its use for ruling out osteoarthritis, periarticular calcification, and other bone causes of shoulder pain. Other diagnostic procedures such as computed tomography, arthrography, and arthroscopy cannot be considered for routine examination because of their invasiveness. Currently, both magnetic resonance imaging (MRI) and high frequency US are used to evaluate soft tissue disorders of the shoulder.[5] The diagnostic value of MRI for shoulder pathologies has been widely reported however, it is expensive, time consuming, and not widely available.[14,15] The availability of USG in rheumatological practice offers the possibility of establishing a more accurate diagnosis of the painful shoulder and therefore improving the treatment of this common disorder.

Limitations of ultrasonography include lack of visualization of the posterior aspect of supraspinatus and infraspinatus tendons, limited view of the glenohumeral joint and lack of desirable patient position during sonographic examination due to restricted painful movements of the shoulder joint. Small sample size is also a limitation of our study.

CONCLUSION

From the findings of present study it can be concluded that USG is a sensitive and accurate imaging modality for evaluating the cause of shoulder pain. USG of shoulder can be regarded as a useful imaging modality to find out non skeletal causes of painful shoulder as tendinitis, tendon displacement, and bursitis. However, further studies can be undertaken including larger number of patients with MRI comparison.

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REFERENCES

1. Meislin RJ, Sperling JW, Stitik TP. Persistent shoulder pain: epidemiology, pathophysiology, and diagnosis. Am J Orthop. 2005;34(12 Suppl):5-9.
2. Salek KM, Mannan M, Chowdhury AZ, Haque MA, Kaiser MS, Nabi S, et al. Comparison between ultrasound and plain x-ray in evaluating the cause of shoulder pain. Mymensingh Med J. 2011;20(1):16-21.
3. Naredo E, Aguado P, Miguel E De, Uson J. Painful shoulder: comparison of physical examination and ultrasonographic findings. Ann Rheum Dis. 2002;61(2):132-36.
4. Bhargava SK. Ultrasound of musculoskeletal system. Sir J.C. Bose Memorial Oration. Indian J Imag. 1996;6:53-61.
5. Chang CY, Wang SF, Chiou HJ, Ma HL, Sun YC, Wu HD. Comparison of shoulder ultrasound and MR imaging in diagnosing full-thickness rotator cuff tears. Clin Imag. 2002;26:50-4.
6. Cullen DM, Breidahl WH, Janes GC. Diagnostic accuracy of shoulder ultrasound performed by a single operator. Australas Radiol. 2007;51(3):226-9.
7. Porcellin G, Paladine P, Campi F, Paganelli M. Arthroscopic treatment of calcifying tendinitis of the shoulder: clinical and ultrasonographic follow-up findings at two to five years. J Shoulder EIb Surg. 2004;13:503-8.
8. Bartolozzi A, Andreychik D, Ahmad S. Determinants of outcome in the treatment of rotator cuff disease. Clin Orthop. 1994;308:90-7.
9. Stevenson JH, Trojian T. Evaluation of shoulder pain. J Fam Pract. 2002;51(7):605-11.
10. Dalton SE. The conservative management of rotator cuff disorders. Br J Rheumatol. 1994;33:663-70.
11. Seitz AL, McClure PW, Finucane S, Boardman ND, Michener LA. Mechanisms of rotator cuff tendinopathy: intrinsic, extrinsic, or both? Clin Biomech. 2011;26(1):1-12.
12. Moosmayer S, Heir S, Smith HJ. Sonography of the rotator cuff in painful shoulders performed without knowledge of clinical information: results from 58 sonographic examinations with surgical correlation. J Clin Ultrasound. 2007;35(1):20-6.
13. Leroux JL, Thomas E, Bonnel F, Blotman F. Diagnostic value of clinical test for shoulder impingement syndrome. Rev Rhum. 1995;62:423.
14. Lawson TL, Middleton WD. MRI and ultrasound evaluation of the shoulder. Acta Orthop Belg. 1991;57(1):62-9.
15. Apatheodorou A, Ellinas P, Takis F, Tsanis A, Maris I, Batakis N. US of the shoulder: rotator cuff and non-rotator cuff disorders. Radiographics. 2006;26(1):e23.