Medical Ultrasonography
2012, Vol. 14, no. 2, 120-124

Teaching basic shoulder ultrasonography to orthopaedic postgraduate trainees – effectiveness of a training workshop

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Abstract

Introduction: Ultrasound examination of the shoulder conducted by orthopaedic surgeons in the diagnosis and treatment of shoulder conditions is increasingly reported. Shoulder ultrasound is not a mandatory component of postgraduate orthopaedic training in the United Kingdom. The aim of this study was to assess the effectiveness of the shoulder ultrasound teaching workshop administered to postgraduate orthopaedic surgical trainees. **Methods:** Orthopaedic trainees participated in a teaching workshop on shoulder ultrasound examination with particular emphasis on demonstrating the Acromioclavicluar joint (ACJ) and the long head of the biceps (LHB) in the bicipital groove. The ability of the trainees to demonstrate the ACJ and the LHB using ultrasound was then assessed. **Results:** Thirty three orthopaedic trainees participated in this study. Twenty three (70%) trainees were able to demonstrate the ACJ and 14 (42%) trainees were able to demonstrate the LHB without assistance, following the ultrasound teaching workshop. The skills acquired by the trainees were independent to the year in training and previous shoulder experience ($p>0.05$). **Conclusion:** Our study shows that a basic shoulder ultrasound teaching workshop can be effective in equipping postgraduate orthopaedic trainees with basic ultrasound techniques. It could potentially become part of a structured orthopaedic training programme.

Keywords: workshop, ultrasound, shoulder, postgraduate, training

Introduction

Musculoskeletal ultrasound is a well-established modality of investigation of various shoulder pathologies including bicipital tendonitis, rotator cuff tears and acromioclavicular joint (ACJ) pathologies such as ganglia [1-4]. Ultrasound may also help in guiding ACJ [5] and bicipital groove steroid injections [6]. Office based ultrasound performed by orthopaedic surgeons has been increasingly explored, as it allows a definite diagnosis to be made in a one stop clinic [7] and treatment to be planned (or in cases of injections treatment to be administered).

Although the effectiveness of teaching musculoskeletal ultrasound workshops delivered to rheumatologists has been reported [8,9], there seems to be no report of the effectiveness of shoulder ultrasound teaching to orthopaedic surgeons and hence the purpose of this study. The aim of this study was to assess how effectively shoulder ultrasound can be taught to post graduate orthopaedic trainees by means of an ultrasound teaching workshop.

Received 11.03.2012 Accepted 09.04.2012
Med Ultrason
2012, Vol. 14, No 2, 120-124
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Material and methods

A workshop on ACJ and the long head of biceps (LHB) tendon ultrasonography was conducted at a District General Hospital in the UK.

Participants

Thirty three postgraduate orthopaedic trainees of the regional training programme took part in the workshop. They were asked to fill a questionnaire enquiring about

their year of training, subspecialty area of interest, previous shoulder surgical experience and number of previous shoulder arthroscopic procedures they had participated in. They were also asked whether they had undertaken any shoulder ultrasound courses in the past.

The workshop was divided into 2 parts:

Part 1 – Theory session

A 15 minute theory talk on shoulder ultrasound was conducted by an instructor (senior author, MW). During this the use of ultrasound to demonstrate the shoulder anatomy with particular stress on rotator cuff anatomy and diagnosing clinical shoulder conditions such as rotator cuff tear, ACJ synovitis, and biceps tendon pathologies were discussed. Details of the ultrasound machine and the ultrasound probe used for these purposes were described.

Part 2 – Practical session

The same instructor demonstrated shoulder ultrasound examination techniques on the shoulder of a healthy volunteer using Sonosite M Turbo portable ultrasound machine (SonoSite Inc., WA, USA) with the musculoskeletal ultrasound probe set to frequency of 7 to 13 MHz. Supraspinatus, Infraspinatus and Subscapularis tendons were demonstrated. The ACJ and the LHB were demonstrated in detail with respect to the position and direction of the probe and the position of the arm during the examination. The ACJ was demonstrated as a deep groove between the acromion and clavicle when the probe was placed directly on the joint in a vertical position (fig 1). The LHB was demonstrated in the biciptal groove as a rounded structure visualized between the two lips of the groove by keeping the probe perpendicular to the arm in transverse position (fig 2). The limb was placed in neutral position to get biciptal groove easily accessible to the probe.

Assessment

Following the demonstration by the instructor, each trainee was asked to demonstrate the ACJ and the LHB in the biciptal groove. Each trainee was scored according to their ability to demonstrate these anatomical landmarks (Score 1 – able to demonstrate without any assistance, Score 2 – able to demonstrate with assistance from the instructor).

At the end of the workshop, the opinion of each trainee, regarding the use of ultrasound as an integrated part of clinical examination of the shoulder joint, the relevance of clinic based ultrasound examination to demonstrate shoulder anatomy, and improvement in confidence in performing shoulder ultrasound examination by attending the workshop as compared to pre teaching level was measured on a Visual Analogue Score (VAS) from 0 to 10 (0 being least likely and 10 being most likely for each parameter).

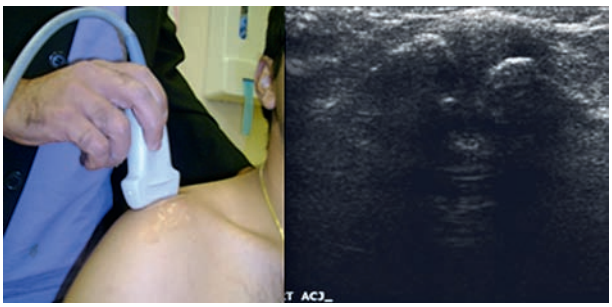


Fig 1. a) ACJ examination; b) Ultrasonographic appearance of the ACJ

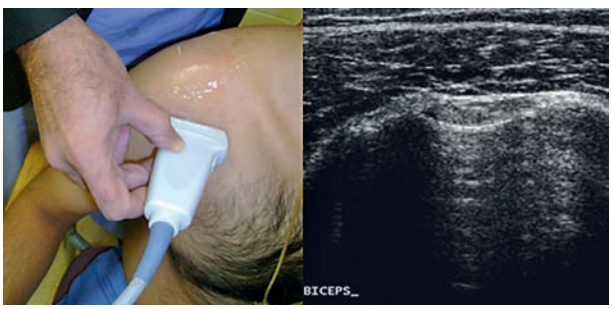


Fig 2. a) LHB in the biciptal groove examination; b) Ultrasonographic appearance of transverse section of the LHB in the biciptal groove

Statistical Analysis

Scores achieved by the trainees were compared with regards to their previous shoulder experience and year in training using chi-squared test (Microsoft excel version 2007) with statistical significance established at the p-value of less than 0.05.

Results

Thirty three trainees attended the teaching workshop. Table I shows the demographics of the trainees. Out of 33, eight trainees were locum appointment for training and not a part of complete rotation. Two were core trainees and working at a senior house officer level but both of them had completed Royal College surgical membership exams (MRCS) prior to the workshop. Rest 23 trainees were part of the postgraduate orthopaedic rotation and were in different years of training. Table II shows the ability of the trainees to localize and demonstrate the ACJ and the LHB using ultrasound after the teaching workshop. Table III shows the attitudes of the trainees to

Table I. Demographics data of the trainees

	Descriptive criteria	Data
1.	Gender Male: female	33:0
2.	Upper limb as area of subspecialty of interest	8
3.	Operative shoulder experience prior to ultrasound workshop expressed in median number of months (range)	6 (0-18)
4.	Median number of shoulder arthroscopic procedures the trainees have participated in, prior to ultrasound workshop (range)	24 (0-200)
5.	Number of trainees who have undertaken previous shoulder ultrasound course	1

Table II. Scores achieved by the trainees

Anatomical landmark	Score 1 (%)	Score 2 (%)
ACJ (n=33)	23 (69.69)	10 (30.31)
LHB (n=33)	14 (42.42)	19 (57.58)

Table III. Visual Analogue Scores (VAS) showing attitudes of trainees for shoulder ultrasound workshop

	Trainees opinion for relevance of ultrasound teaching workshop	VAS score (range)
1.	To perform common examinations (range)	7.75 (1-10)
2.	To recognize normal shoulder anatomy (range)	8.39 (3-10)
3.	To improve confidence in performing shoulder ultrasound examination following the workshop (range)	7.36 (3-10)

Table IV. ACJ and LHB score achieved by the trainees in relation to their year of training in orthopaedics.

No.	Year in Training	Number of trainees achieving Score 1		Number of trainees achieving Score 2		p value	
		ACJ	LBH	ACJ	LBH	ACJ	LBH
1.	1	3	2	2	3	0.555	0.642
2.	2	3	2	2	3		
3.	3	6	5	1	2		
4.	4	4	2	1	3		
5.	5	0	0	1	1		
6.	Locum Appointment for training	5	2	3	6		
7.	Core Trainee	2	1	0	1		
8.	Total	23	14	10	19		

ACJ – acromioclavicular joint; LHB – long head of biceps

the shoulder ultrasound teaching at the end of the workshop (expressed as Visual Analogue Score).

Tables IV shows the ability of the trainees to localize the ACJ and the LHB according to their year of training. Tables V shows the ability of the trainees to localize the ACJ and the LHB score in relation to their previous shoulder surgery experience. Tables VI shows the ACJ and the LHB scores relative to the number of previous shoulder arthroscopic procedures the trainees have participated in. Scores achieved by the trainees were independent of the year in training and previous shoulder experience ($p > 0.05$). All the trainees (100%) recommended shoulder ultrasound teaching workshop in becoming an integral part of postgraduate orthopaedic training.

Table V. ACJ and LHB score achieved by the trainees in relation to the shoulder experience they had prior to the workshop.

No.	Number of months of shoulder experience (range)	Number of trainees achieving Score 1		Number of trainees achieving Score 2		p value	
		ACJ	LBH	ACJ	LBH	ACJ	LBH
1.	0-3	7	4	6	9	0.395	0.550
2.	3-6	10	7	4	7		
3.	> 6 months	5	3	1	3		
4.	Total	22	14	11	19		

ACJ – acromioclavicular joint; LHB – long head of biceps

Table VI. ACJ and LHB score achieved by the trainees in relation to the number of shoulder arthroscopies the trainees have participated in, prior to the workshop.

No.	Number of shoulder arthroscopy the trainees have participated in (range)	Number of trainees achieving Score 1		Number of trainees achieving Score 2		p value	
		ACJ	LBH	ACJ	LBH	ACJ	LBH
1	0-25	10	5	7	12	0.311	0.199
2	25-50	11	8	2	5		
3	>50	2	1	1	2		
4	Total	23	14	11	19		

ACJ – acromioclavicular joint; LHB – long head of biceps

Discussion

Ultrasound provides dynamic visualization of the shoulder joint and is a non invasive mode of investigation for shoulder pathology. Its ability in diagnosing and quantifying rotator cuff tears is well described [1-4]. Al-Shawi et al [10] investigated the performance of ultrasound examination of shoulder in the hands of orthopaedic surgeons and demonstrated sensitivity of 96.2% and specificity of 95.4% with this approach to diagnose rotator cuff tears. The study further showed that orthopaedic surgeons can gain sufficient proficiency to diagnose rotator cuff tears after performing approximately 200 scans with a portable scanner. Similar results have also been reported by other authors [11,12].

Our study demonstrates that shoulder ultrasound can be effectively taught to orthopaedic trainees using workshops having theoretical and practical sessions. We demonstrated that following a single workshop of ultrasound teaching, the majority of the trainees were able to demonstrate the ACJ and the LHB with no assistance. In our study more trainees were able to demonstrate that ACJ without assistance as compared to the LHB. This may be due to the fact that ACJ is a bony structure with less soft tissue coverage and more easily accessible with an ultrasound probe. It was also interesting to note that the trainees who had more than three months of experience in shoulder surgery and had participated in more than 25 arthroscopic procedures prior to this teaching session required lesser assistance in demonstrating the ACJ. This may suggest that the acquisition of clinical skills required for clinical examination and shoulder arthroscopies can further aid in performing shoulder ultrasound. Such a corelation could not be seen in case of the LHB, possibly because the biciptal groove is not directly examined as a part of routine shoulder arthroscopy. Although, these findings suggest a trend, on statistical analysis skills acquired by the trainees were independent of the year in training and previous shoulder experience.

Our study shows that all trainees supported ultrasound training in becoming an integrated part of orthopaedic post-graduate education system. The fact that in this ultrasound workshop the instructor was an orthopaedic shoulder surgeon rather than a radiologist again demonstrates that shoulder ultrasound can be taught to orthopaedic trainees in- house.

There are certain limitations to this study. The amount of assistance by the trainees in demonstrating the ACJ and the LHB was not quantified. We did not assess the ability of trainees to perform shoulder ultrasound prior to the workshop. Therefore, we cannot definitely say that their ability to perform shoulder ultrasound at the end of the workshop was purely related to them attending the workshop. However, we do not feel that this is a major limitation as only one of the 33 participants had undertaken shoulder ultrasound course prior to the workshop. Similarly the trainees report a substantial increase in confidence in performing shoulder ultrasound following the workshop. Also, the ability of trainees to perform ultrasound at a later date was not assessed, hence we could not determine whether the level of skills demonstrated by the trainees following the workshop were long lasting.

Conclusion

Training postgraduate orthopaedic trainees in shoulder ultrasound will encourage its further use in clinical practice. Our study suggest that shoulder ultrasound can be taught effectively to postgraduate orthopaedic trainees by orthopaedic surgeons in basic ultrasound workshops and the skills acquired through these workshops are not dependent on the seniority or previous experience of trainees in shoulder surgical procedures.

Conflict of interest: none

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