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Concise Report

The Belfast musculoskeletal ultrasound course

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Objectives. To conduct a training course in musculoskeletal ultrasound (MSUS) for rheumatologists in Northern Ireland with the aim of equipping the participants with a basic knowledge of the theoretical and practical aspects of MSUS as they are applied to rheumatology.
Methods. Between September 2007 and June 2008, 10 rheumatologists attended a course in basic MSUS that was delivered by 7 rheumatologists with experience in MSUS. The course consisted of five separate modules that included tutorials on MSUS, self-directed learning of scanning techniques and personal mentoring. Progress was monitored throughout the course by the use of personal logbooks. Competency was formally assessed using the Royal College of Physicians' Direct Operational Procedural Skills (DOPS) assessment and an exit examination.
Results. Five trainees completed the entire course and passed both the practical and written elements of the exit examination. All were deemed to have attained a basic level of competency in MSUS. The main obstacle to completion of the course was a lack of scanning practice and an inability to complete the required number of scans and DOPS assessments. Participants were more likely to fulfil the requirements of the course if they were employed full time in the regional rheumatology unit where the course was based. All participants reported high levels of confidence in their basic scanning skills at the conclusion of the course. They also felt that the training enhanced their clinical examination skills and their understanding of musculoskeletal anatomy.
Conclusions. A basic MSUS training course can be successfully delivered using a modular design that takes account of the trainee's level of experience and their work schedule. Important elements of such a course should include personal mentoring and the recording of scanning activity using a logbook. Periodic assessment of the trainee's performance is a useful means to motivate learning. Basic training in MSUS should become an accepted part of the routine training of rheumatologists in the UK.

Key words: Ultrasonography, Training, Education, Assessment, Rheumatology practice.

Introduction

Musculoskeletal ultrasound (MSUS) training in rheumatology has reached a critical point in the UK after a decade when the use of this imaging modality has become increasingly popular within our specialty. A number of European countries, including Germany, Italy and Spain, already include some experience in MSUS as part of their rheumatology training but in the UK, most of the rheumatologists who practice MSUS have acquired their skills in an *ad hoc* fashion [1].

The British Society for Rheumatology (BSR) conducts basic and advanced courses in MSUS on an annual basis. These are extremely popular with its members and heavily oversubscribed. Short courses of this nature are a useful stimulus to learning [2], but are not intended to be a substitute for the painstaking task of acquiring the experience that is required to achieve competency in MSUS. In 2005, an editorial in this Journal called for a more formal, structured approach to MSUS training in rheumatology in the UK [3]. In response, we describe our experience in conducting an extended MSUS training programme for rheumatologists in Northern Ireland. We believe that a modular format of this kind could be readily incorporated into Specialist Training Programmes for rheumatologists in much the same way as is already commonplace in other specialties such as obstetrics and gynaecology [4].

Methods

Two of the authors (A.J.T. and S.A.W.) met in the summer of 2007 and agreed the design of a course, the aim of which would be to equip the participants with a basic knowledge of the theoretical and practical aspects of MSUS applicable to rheumatology. It was our objective that, on completion of the course, trainees would be able to: (i) understand the basic theory of US; (ii) perform unsupervised, the standard scanning techniques for the shoulder, elbow, hand and wrist, hip, knee, ankle and foot; (iii) perform and semi-quantitatively grade power Doppler; and (iv) recognize and interpret basic MSUS abnormalities such as effusion, synovitis, tenosynovitis, tendonopathy, bone irregularity and erosion. These aims and objectives conform to the recommended curricula of the basic and intermediate level courses run by the Ultrasound School of the Spanish Society of Rheumatology [5] and the European League Against Rheumatism (EULAR) Ultrasound Group [6].

The course consisted of five modules that were delivered over a 10-month period from September 2007 to June 2008.

Module 1

Five weekly tutorials covering the basic theory of MSUS and normal scanning techniques as described by the EULAR Ultrasound Group [7]. Each tutorial lasted 3 h. One hour was devoted to a didactic lecture and 2 h to the scanning of normal subjects. Trainees were required to attend at least 75% of these sessions before moving on to Module 2.

Module 2

Self-directed learning of normal MSUS (with mentoring). Each trainee was assigned a mentor to give personal feedback and assistance to the trainee throughout the course. The trainee was responsible for making regular contact with his/her mentor. After a period of practice on normal subjects, the trainee was

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required to perform five representative scans each of the normal shoulder, elbow, hand and wrist, hip, knee, ankle and foot. Representative images from each scan were saved on the hard disk drive of the scanner for future review by the mentor.

Assessment. The trainee had to show competence in scanning each region by passing a formal assessment of their scanning technique based on the Direct Operational Procedural Skills (DOPS) Assessment of the Royal College of Physicians of the UK (http://www.jrcptb.org.uk/assessment/performance/Documents/DOPS%20Form%20Generic.pdf). One DOPS assessment had to be completed for each joint region before the trainee could progress to the next module of the course.

Module 3

Self-directed learning of abnormal MSUS (with mentoring).

After a further period of practice on patients, the trainee had to perform a minimum number of abnormal MSUS scans of each region. As for Module 2, representative images from each scan were saved for subsequent review by the mentor. In addition, the pathological findings for each scan were recorded in the trainees' logbook, either on paper or personal digital assistant (PDA) format [8].

Once the trainee felt sufficiently confident, he/she underwent a series of DOPS assessments by their mentor. Each trainee was required to carry out a minimum number of abnormal scans and a specified number of DOPS assessments for each joint area as itemized in Table 1.

Module 4

MSUS masterclass sessions. Throughout the duration of the course, lectures were organized to highlight different aspects of MSUS. These were conducted by visiting speakers and local experts and were incorporated into the monthly rheumatology training days for specialist registrars in the Northern Ireland Deanery. A wide variety of subjects were covered including the MSUS of gout, OA and shoulder rotator cuff disease. One speaker presented the results of his research comparing MSUS guided *vs* unguided joint injection and this was used to stimulate discussion on the design of research projects in MSUS.

Table 1. Required number of abnormal scans and DOPS assessments

Region	Minimum number of scans	Required number of DOPS assessments
Shoulder	30	3
Elbow	5	1
Hand and wrist	25	2
Hip	5	1
Knee	10	1
Foot and ankle	25	2

Module 5

Logbook validation and exit examination. At the end of the course, the logbook of each trainee was inspected to ensure that the required number of scans and DOPS assessments had been completed to a satisfactory standard. After passing this assessment, the trainee was allowed to sit an exit examination to test their knowledge and practical skills in basic MSUS. The exam was modelled on an original design conceived by Dr Emilio Filippucci and described in the paper of Taggart *et al.* [1]. The exam consisted of three parts: (i) a 40-min written exam consisting of 20 multiple choice questions designed to test knowledge of MSUS technique, anatomy and pathology followed by four pictorial questions on MSUS image interpretation; (ii) a 30-min examination of normal healthy volunteers; and (iii) a 30-min examination of rheumatic patients. The exam was conducted by three of the course organizers and by an independent external examiner (D.K.). In order to pass the examination, the candidate had to score at least 80% in the written exam and achieve a score of at least 80% in each part of the practical examination.

Questionnaire

At the conclusion of the course, all trainees completed a written questionnaire designed to evaluate the course.

Results

Seven consultant rheumatologists, with experience in MSUS, acted as trainers/mentors on the course. Ten trainees enrolled in the course: six specialist registrars in rheumatology, two rheumatology staff-grade doctors, one consultant rheumatologist and one senior house officer. The group was medically qualified for a median of 7 years (range 4–14 years) and they had a median of 2.5 years of postgraduate rheumatology experience (range 0.5–9 years). Three had no previous experience of MSUS and seven had limited amounts of practical experience acquired during their normal work. Five of the seven participants with limited MSUS experience had attended a BSR Basic Ultrasound Course.

Five trainees completed the course successfully and all passed both the written and practical elements of the examination. The median score for the written examination was 90% (range 83–93%). Figure 1A and B shows some MSUS images taken during the practical examination of patients. Of the five trainees who completed the entire course, three were specialist registrars and two were staff-grade doctors. Four of the group were employed in the regional rheumatology unit in Belfast throughout the duration of the course and one was in full-time

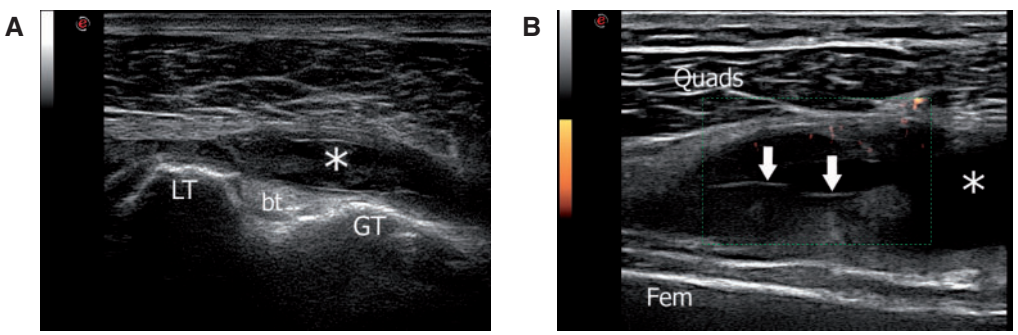

Fig. 1. MSUS images taken during the practical examination of patients. (**A**) Transverse 12–7.5 MHz MSUS image over the anterior aspect of the shoulder showing the long head of the biceps tendon (bt) in the bicipital groove between the greater (GT) and lesser (LT) tuberosities of the humerus. There is an abnormal collection of fluid and debris in the overlying subdeltoid bursa (*). (**B**) Longitudinal 12–7.5 MHz Power Doppler MSUS image over the suprapatellar aspect of the knee showing effusion (*) and synovial hypertrophy (arrows) in the suprapatellar bursa. Fem: femur; Quads: quadriceps muscle.

rheumatology research. Of those who failed to complete the course, one was in full-time research, one was a consultant physician with a specialist interest in rheumatology and three were initially employed in the regional rheumatology unit but subsequently employed in medical posts elsewhere. All of these trainees cited inadequate scanning practice as the main reason for their failure to perform the required number of scans and DOPS assessments.

All 10 participants felt that the course met its stated aims and objectives. Additional benefits included an improvement in clinical examination skills and in the understanding of anatomy. Expressed as a self-reported visual analogue scale from 0 to 10, the median confidence in examination skills rose from 5 (range 1–8) before the course to 8 (range 5–8) after the course. The median confidence in understanding anatomy increased from 5 (range 1–9) before the course to 8 (range 5–10) after the course. The median confidence in scanning after the course was 8 (range 6–9). Comparison of the responses from those who did and did not complete the course showed a greater improvement in all parameters for the completers.

It proved difficult to estimate, accurately, the time spent by participants on scanning practice throughout the course, but the consensus amongst those who completed the course was that this amounted to >40 h. One tutor (A.J.T.) kept a record of the time spent mentoring his trainee and estimated that he devoted an average of 1.5 h/week to the task throughout the 30 weeks of the course. The course co-ordinator (S.A.W.) spent an average of 1 h/week on a range of tasks that included the preparation of course materials, communicating with trainees and mentors, organizing masterclasses and preparing the exit examination.

Discussion

Over the past 5 years, several groups have developed an international consensus on what educational standards and methods might be employed to develop training programmes for MSUS in rheumatology [5–6, 9–13]. We therefore felt that this was an appropriate time to conduct a MSUS training course for rheumatologists in Northern Ireland. We wanted to explore the practical dilemmas and challenges that such a course might present before integrating such a programme into the routine training of rheumatologists in our Deanery.

All of the trainees who took part in the course judged it to have been a success in achieving its aims and objectives. This applied to those who did not complete all the elements of the course as well as to those who did. The modular design provided a flexibility that allowed trainees to progress at different rates dependent on the amount of time that they were able to devote to scanning.

Lack of time in a busy work schedule was the key barrier to success amongst our trainees. It proved far more difficult to complete the course in the given time if the trainee was working outside the regional rheumatology unit. Those who are working within the unit had the advantage of the constant stimulus of their fellow trainees and mentors. Several of these trainees developed a routine of getting together on a regular basis to scan each other as their work schedules allowed. This camaraderie re-enforced their enthusiasm for their ongoing training.

As expected, the use of mentoring and logbooks were both important elements in the programme. We used the Royal College of Physicians' DOPS assessment as a means of bringing the trainee together with his/her mentor to reinforce good scanning techniques for both normal and abnormal scans. It also encouraged the trainee to carry out the required number of scans before each assessment. We specified these numbers as an estimate of the amount of training that would be required to achieve a basic level of competency (Level 1) in MSUS as described by the Royal College of Radiologists in their Ultrasound Training Recommendations for Medical and Surgical Specialties [14].

The course co-ordinator (S.A.W.) was another important point of contact for the trainees during the course. He communicated with them by email, on a regular basis, to monitor their progress and deal with any practical difficulties that they had. He also undertook the task of organizing the exit examination.

Some may regard the exit exam as an unnecessary exercise in a postgraduate training programme of this kind. It certainly required a considerable amount of additional effort on the part of the course organizers as well as the input from an external assessor. Nevertheless, we feel that the examination was a worthwhile means of assessing standards and motivating the trainees towards the end of the course. Maintaining motivation is always a challenge in any course of this duration and some form of practical assessment is a very useful means of achieving this.

The trainees' questionnaires revealed a self-reported improvement in their clinical examination skills and in their understanding of anatomy during the course. We accept that these data would have been more robust had they been collected prospectively, but these results reflect the positive experience of our group in using MSUS as a teaching tool in undergraduate medical training [15].

MSUS enhances the clinician's diagnostic and therapeutic skills [16], and is increasingly becoming a routine part of clinical management in rheumatology [17]. Our experience in conducting this course has shown us that basic MSUS training is more likely to succeed when it is offered to doctors who are in full-time rheumatology training. Not all regions of the UK are currently in a position to provide the support required to make MSUS an integral part of their rheumatology training programmes but the situation is changing rapidly. Before that goal can be achieved, however, there should be a realistic appraisal of the costs involved. These include the costs of purchasing and maintaining MSUS equipment as well as the costs of training. Trainers and trainees will both require protected time (at least 2 h/week) within their job plans to enable them to acquire the necessary skills for MSUS.

The BSR's Special Interest Group in Ultrasound will shortly publish their guidelines for the MSUS training of rheumatologists, which have been developed after a process of consultation with both rheumatologists and radiologists (David Kane, personal communication). We therefore believe that the time is right for us to join many of our European colleagues in making basic MSUS training an integral part of rheumatology training in the UK.

Rheumatology key messages

- MSUS training can be delivered successfully using a modular approach.
- Basic MSUS training should become an integral part of specialist rheumatology training in the UK.

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