

LETTER TO THE EDITOR

USE OF MUSCULOSKELETAL ULTRASOUND IN CLINICAL STUDIES IN PHYSIATRY: THE “STETHOSCOPE” IS ALSO BECOMING THE “PEN”

In parallel with the ever-increasing use of musculoskeletal ultrasound (MSUS) in physical and rehabilitation medicine (PRM), the number of publications by physiatrists on this subject is also increasing (1). In order to provide a worldwide overview of the literature on this topic, we have reported previously on the country/journal/year distribution (2). However, in an attempt to draw the attention of physiatrists towards other possible topics to be studied with MSUS, the aim of the current paper is to provide an in-depth analysis of the relevant literature, with special emphasis on topic distribution. As it is likely that MSUS will soon become one of the most important diagnostic tools for physiatrists (similar to, or more important than, electromyography), we believe that such analysis is essential in developing the future plans of our society.

A PubMed search was performed in December 2012 using the following key words: “musculoskeletal ultrasound”, “musculoskeletal ultrasonography”, “muscle ultrasonography”, “tendon ultrasonography”, “joint ultrasonography”, “nerve ultrasonography”, and “ultrasound guided injection”. The key word “rehabilitation” was added to all of these search alternatives (e.g. “musculoskeletal ultrasonography” AND “rehabilitation”) in order to include publications by physiatrists and papers published in the field of rehabilitation.

A total of 268 publications was found for the period January 1988 to December 2012. The journal categories and article types are listed in Tables I and II, respectively. The study types were as follows: randomized controlled 33 (12.3%), controlled (non-randomized) 60 (22.4%), cross-sectional 71 (26.5%), cohort/case studies 46 (17.2%), review 16 (6%) and case report 42 (15.6%).

A total of 245 (91.5%) papers were *in vivo* human studies, 21 (7.8%) were cadaver studies, and 2 (0.7%) were studies conducted in bovine animals. The body regions and tissues studied are summarized in Fig. 1; knee (18.7%), shoulder (13.4%), muscle (26.1%) and tendon (17.2%) were the most commonly studied regions and tissues.

Table I. Journal categories regarding publications on musculoskeletal ultrasound

Category	n (%)
Physical and rehabilitation medicine	123 (45.9)
Radiology	42 (15.7)
Orthopaedics	23 (8.6)
Rheumatology	21 (7.8)
Neurology	21 (7.8)
Sports medicine	5 (1.9)
Physiology	4 (1.5)
Others <sup>a</sup>	29 (10.8)

<sup>a</sup>Plastic surgery, dermatology, anaesthesia, pain, obstetrics and gynaecology, and urology.

Table II. Article type distribution for publications on musculoskeletal ultrasound (MSUS)

Type	n (%)
Original article	189 (70.5)
Case report	33 (12.3)
Clinical/technical note, education	22 (8.3)
Review	16 (6)
Video gallery	6 (2.2)
Letter	2 (0.7)

Concerning pathologies, orthopaedic problems (29.9%) were the overwhelming category, followed by peripheral neuropathies (particularly entrapments) (16.4%), neurological disorders (stroke, spinal cord injury, traumatic brain injury, cerebral palsy, and spasticity) (13.1%), osteoarthritis and rheumatological disorders (12.7%), muscle disorders (myositis, mass lesions, myofascial pain syndrome) (7.1%), and physiological conditions of muscles or tendons (13.8%). In 182 studies (67.9%) MSUS was used as a diagnostic tool, in 63 studies (23.5%) it was used for guiding interventions, and in 23 (8.6%) as both a diagnostic and interventional tool. While there were no quantitative or semi-quantitative assessments in 109 (40.7%) papers, 23 (8.6%) papers comprised semi-quantitative, 104 (38.8%) papers comprised quantitative evaluations, and 32 (11.9%) included both.

Dynamic imaging or power Doppler were used in 16.4% of the studies. Twenty-two (8.2%) papers were validity/reliability studies for MSUS, and in 23 studies (8.6%) intra-observer and/or inter-observer testing had been performed. While a few studies (13.4%) had used at least one other imaging technique for comparison, most of the studies used only MSUS.

In the last two decades, MSUS has gained an intriguing place in musculoskeletal medicine, as it has in PRM. Because of its various advantages (e.g. convenience, cost-effectiveness,

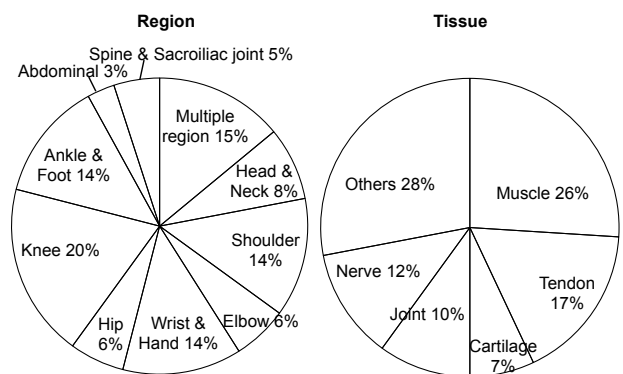


Fig. 1. The distribution of the regions and tissues studied with musculoskeletal ultrasound.

absence of radiation, etc.), once it is introduced in a PRM department, the MSUS probe very rapidly becomes “the stethoscope” of physiatrists (3–5). Naturally, it can be used in a wide range of musculoskeletal investigations, thus its probe also becomes “the pen” of physiatrists. In this retrospective analysis of the literature, we explored how MSUS had been utilized in that sense.

Regarding the distribution of journals publishing articles on MSUS, it seems that although the categories PRM, radiology, neurology and orthopaedics are in the majority, publications also fall into the categories rheumatology, sports medicine, physiology, plastic surgery, dermatology, anaesthesia, pain, obstetrics and gynaecology, and urology. This widespread distribution may stem from the advantages of MSUS as an alternative imaging tool in the evaluation of several musculoskeletal conditions (6–10).

Unless localized inside a bone or covered with a bony tissue, almost any musculoskeletal structure can be visualized using MSUS equipped with appropriate settings. Likewise, a wide range of tissues and regions were the topic of different publications, with a majority of publications on knee/shoulder (as the regions) and muscle/tendon. This distribution may be due to the clinical interest of individual physicians/centres rather than a lack of awareness as to what structures/tissues can be evaluated with MSUS. Furthermore, although it is easier to learn/perform interventional US compared with diagnostic US (which requires a lengthy education), we attribute the finding of more publications in the diagnostic category to the fact that interventional studies are more difficult to perform compared with cross-sectional studies (which is the most common type according to our results). On the other hand, excluding the need for particular basic studies (in cadaver/bovine), the above-mentioned advantages of US may have facilitated human studies.

In general, during US imaging, the diagnostic approach is as follows: first, we try to determine whether a particular structure is present or absent. Then, we evaluate whether it is of normal (expected) shape/size and, lastly, we assess its echogenicity, vascularity or (in case of a moving structure) dynamic motions. These steps may involve qualitative, semi-quantitative and quantitative (or combined) methods of assessment. The results of this study demonstrated that approximately half of the papers comprised quantitative or semi-quantitative evaluations. Yet, in order that US results can be widely understood and compared, they should be defined in a more standardized way. In this regard, with the help of intra- and inter-rater reliability testing, US can be made less user-dependent. Comparison of US and other “less user-dependent” imaging tools (i.e. computed tomography, magnetic resonance imaging) may be an alternative method; however, there have been only a few such groups of studies published in the rehabilitation literature.

Since our results specifically examine only the academic products of the use of MSUS in physiatry, information on how MSUS is actually utilized in those individual departments falls outside the scope of this paper. However, we can draw attention

to some other dimensions of US imaging that do not seem to be studied frequently by physiatrists, i.e. Doppler or contrast-enhanced imaging, speckle tracking and sonoelastography (7).

In short, in updating our previous paper on MSUS publications (mainly from the perspective of topic distribution), we have tried to show how physiatrists are progressing in this regard. There is still a long way to go, and in addition to the need to enrich the academic applicability of MSUS, there is a parallel need for optimum training. Yet, the importance of appropriate imaging in prompt diagnosis and therapeutic follow-up of musculoskeletal pathologies is ever-increasing.

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