

Impact of the use of musculoskeletal ultrasound by rheumatologists in patients with shoulder and hand complaints compared with traditional clinical care

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ABSTRACT

Objectives. To compare the routine use of musculoskeletal ultrasonography (MSUS) with traditional clinical care in daily practice at shoulder and hand level.

Methods. An observational study was performed in four rheumatology departments. Within each department, 2 rheumatologists were selected; one rheumatologist used MSUS, and the other followed traditional rheumatology care. Consecutive patients with nontraumatic pain, hand numbness or disability, or pain and/or limitations in the shoulder were selected. We collected information regarding the clinical and MSUS diagnoses, changes in diagnosis and treatment following MSUS, local injections, the rheumatologist's satisfaction and the use of health care resources. A descriptive analysis was performed.

Results. A total of 168 patients were analysed, with 104 and 64 patients in the MSUS and traditional care groups, respectively. MSUS led to a diagnosis and therapeutic change in 53 (52%) and 55 patients (54%), respectively. The rate of local injection was 47% in the MSUS group (73% unexpected, 61% performed using US) compared with 21% in the traditional group ($p=0.001$). According to the rheumatologists, MSUS was useful in 72 cases (71%) and extremely useful in 20 cases (20%), and the rheumatologists reported a higher satisfaction with their patient evaluations ($p<0.001$). The MSUS group required fewer additional tests (38% vs. 81%, respectively, $p<0.001$), fewer medical visits (46% vs. 84%, $p<0.001$), and lower direct costs (11 vs. 30 euros, $p<0.001$) than the traditional care group.

Conclusions. Compared with traditional care, the routine use of MSUS in rheumatology practice at hand and shoulder level can lead to important improvements in care, thereby reducing the number of additional tests and medical visits.

Introduction

Musculoskeletal ultrasonography (MSUS) is a useful tool for rheumatologists in helping to guide both the clinical diagnostics and decisions related to patient treatment and follow-up (1-4). In

many countries, the use of MSUS has increased dramatically over the past few decades (5-7). Indeed, it has been reported that in Canada and Spain, nearly half of all rheumatologists currently use MSUS in daily practice (5, 6).

MSUS provides a number of advantages over other imaging techniques; for example, performing MSUS is fast, does not carry radiation or anxiety risks, and provides valuable additional information to the physical examination when planning local injections (8). Moreover, compared with traditional practice, using ultrasound to localise the joint and soft tissue during fluid collection greatly improves the success rate of diagnostic synovial fluid aspiration and the response to sonograph-guided local steroid injections (3, 4, 9).

The routine use of MSUS in rheumatology practice can reduce diagnostic uncertainty, improve treatment and follow-up related decisions, and reduce the use of health care resources such as additional testing and medical visits. As a result, the positive impact of MSUS in terms of costs to the health care system is evident. Few studies, however, have investigated the economic impact of MSUS. In addition, most published studies are based on the role of an MSUS expert in a rheumatology department within the context of a research protocol. Thus, little information is available regarding the use of MSUS in practice.

Diseases in the upper extremities are common in rheumatology. In patients with suspected carpal tunnel syndrome, it has been estimated that MSUS is both cost-effective and less troublesome compared with nerve conduction studies (10-12). In addition, MSUS is an effective imaging method for evaluating the rotator cuff (13).

The aim of the current study was to analyse the impact of MSUS in daily rheumatology practice with regard to additional tests, additional medical visits, costs and medical satisfaction in patients with hand and/or shoulder complaints.

Material and methods

This study was an observational one-visit study performed in 4 rheumatology

departments in which the use of MSUS has been integrated into daily practice. Within each department, two rheumatologists were selected: one rheumatologist used MSUS, and the other rheumatologist (with similar clinical experience as the first) followed traditional clinical care (without MSUS). The patients were not randomised, but they were included as they were attended in usual care by every rheumatologist. Consecutive patients who were 18 years or older with non-traumatic pain, hand numbness or disability, or nontraumatic pain and/or limitations in the shoulder were included. Shoulder and hand complaints had to be new complaints and therefore were not diagnosed at the time of the medical visit. Patients who were referred solely for the purpose of performing ultrasound-guided local injections were excluded. Each patient who enrolled in the study provided written informed consent. MSUS was used in the MSUS group according to medical criteria following the standardised protocol of the Ultrasound School of the Spanish Society of Rheumatology. The following variables were collected: a) socio-demographics: age and gender; b) clinical variables: clinical diagnosis (*i.e.* inflammatory arthritis in cases in which the final diagnosis was any type of arthritis, and noninflamma-

tory disease in cases in which any other disease, including tendonitis, was diagnosed), MSUS use, MSUS diagnosis, changes in the therapeutic approach in cases in which MSUS was performed, and local steroids injections; c) the use of health care resources: image techniques that were required during the first medical visit, estimated extra time due to MSUS use, additional laboratory tests (apart from the tests performed during the first visit), imaging and other tests/techniques, and costs of additional imaging tests and nerve conduction studies; and d) doctor-related variables: years of clinical practice, MSUS expertise (advanced, intermediate, or low), the doctor's opinion regarding the utility of MSUS as assessed using a questionnaire (not as useful, useful or very useful), and the doctor's satisfaction with the evaluation of each patient as assessed using a visual analogue scale (VAS) from 0–10.

To examine the distribution of the sociodemographic, clinical, and other variables between the two study groups, we used the Student's *t*-test, the Mann-Whitney U-test, or contingency tables where appropriate. Bivariate regression analyses were also performed. The Statistical Package for Social Sciences (SPSS) (version 15.0) for Windows was used to analyse the data. Statistical

significance was set at a *p*-value <0.05. Direct costs were estimated according to the official prices established by the Spanish Health System in euros (€) (15). We added an incremental 12.2% to update the prices to 2011 as follows: magnetic resonance imaging (MRI; €217), MSUS (€39) and shoulder plain x-ray (€18), and the nerve conduction study (€97).

Results

A total of 168 patients were included in the study (104 patients in the MSUS group and 64 in the traditional clinical care group). The mean professional clinical practice for the doctors in the MSUS and traditional care groups was 12 years and 11 years, respectively. Three sonographers had the advanced level and one the intermediate level (Ultrasound School of the Spanish Society of Rheumatology) with a range of experience with MSUS of 4–12 years. Two departments employed a Logic E9 machine (General Electric), one department a Logic 5 Pro (General Electric) and one department used a Mylab25 gold (Esaote).

This was the first visit to a rheumatology department for 86% and 89% of the patients, respectively. The evaluated joints and the distributions of age and gender were similar between the groups (Table I). Shoulder pain was the primary symptom in patients with shoulder complaints (in 91 and 94% of the patients in the MSUS and traditional care groups, respectively). Suspected arthritis (in 34 and 32% of the patients in the MSUS and traditional care groups, respectively) and suspected carpal tunnel syndrome (in 27 and 22% of patients, respectively) were the primary causes in the hand study. Inflammatory arthritis was diagnosed in 7 of 85 shoulders (8%), 34 of 79 hands (43%) and in 1 of 4 patients with both hand and shoulder complaints (25%). MSUS was performed in 101 of the patients (97%) in the MSUS group, and the results led to a change in diagnosis in 53 patients (52%) and a change in the treatment approach in 55 (54%) patients. The mean estimated increase in time for the medical visit due to MSUS use was 12 minutes (SD 4 min-

Table I. Features of patients who were treated by rheumatologists with routine use of MSUS and by those who performed traditional clinical care (*i.e.* without MSUS).

Variable	MSUS group (n=104)	Traditional care group (n=64)	<i>p</i> -value
Women, n (%)	76 (73)	45 (66)	0.690
Age in years, mean (SD)	59 (15)	55 (13)	0.200
Joint evaluated, n: shoulder/hand/both	51/50/3	34/29/1	0.780
Inflammatory arthritis, n (%)	28 (27)	16 (25)	0.780
Patients with local steroid injections, n (%)	49 (47)	14 (21)	0.001
Patients with additional tests ¹ , n (%)	40 (38)	52 (81)	<0.001
Patients with additional medical visits, n (%)	48 (46)	53 (84)	<0.001
Direct cost (€) per patient, mean (SD) ²	11.5 (36)	30.7 (21)	0.002
Doctor satisfaction (0-10), mean (SD)	8.2 (0.9)	7 (1.6)	<0.001

MSUS: musculoskeletal ultrasonography.

¹Additional tests included imaging techniques, laboratory testing, nerve conduction study, and MSUS (for the traditional care group). Patients in the MSUS group received the following tests: 16 received plain x-rays, 28 received a laboratory test (10 of whom also underwent an imaging technique), 3 received an MRI, 2 underwent a nerve conduction study, and 1 underwent a synovial biopsy. In the traditional care group: 41 received an ultrasound examination, 18 received an x-ray (13 of whom also receive an ultrasound examination), and 9 received a laboratory test.

²Imaging techniques (*e.g.* x-rays, magnetic resonance imaging), nerve conduction studies, and MSUS (for the traditional care group).

utes). The rheumatologists considered MSUS to be useful in 72 (71%) cases, extremely useful in 20 (20%) and of little value in 9 (9%) of the cases.

The rate of local steroid injections in the MSUS group was 47% (ranging from 33–66%, depending on the department), of which 36 (73%) were not clinically expected and 30 (61%) were guided by ultrasound.

There were no significant differences in the percentage of patients who had already had imaging during their first visit. Conversely, additional laboratory and/or imaging tests/techniques were ordered in 62% of the patients with hand complaints (50% of the MSUS group and 82% of the traditional care group) and in 46% of the patients with shoulder complaints (23% of the MSUS group and 79% of the traditional care group).

Finally, the patients in the traditional care group were also more likely to require additional medical visits (OR 5.6; 95% CI 5.2–6) (Table I and Fig. 1). The original joint pain was the reason for the additional visits in 47% of the patients in the MSUS group and 73% of the patients in the traditional care group.

Discussion

Although MSUS offers distinct advantages in evaluating patients with rheumatic diseases, to our knowledge, this is the first study to demonstrate that the routine use of MSUS as part of a medical visit to a rheumatologist significantly reduces the use of health resources. Complementary tests were requested less often in all of the four participating departments, leading to a cost savings of approximately 50% in the MSUS group compared with the traditional care group. This reduction in additional testing resulted in a significantly lower number of additional visits. The use of MSUS has the additional advantage of increased doctor satisfaction (which is reflected in our results) and likely higher patient satisfaction. For 9 out of every 10 patients, the doctors who employed MSUS felt it was either a useful or an extremely useful addition to the physical examination. Our study also shows that MSUS can reveal more infiltrations, many of which were not predicted before MSUS (1).

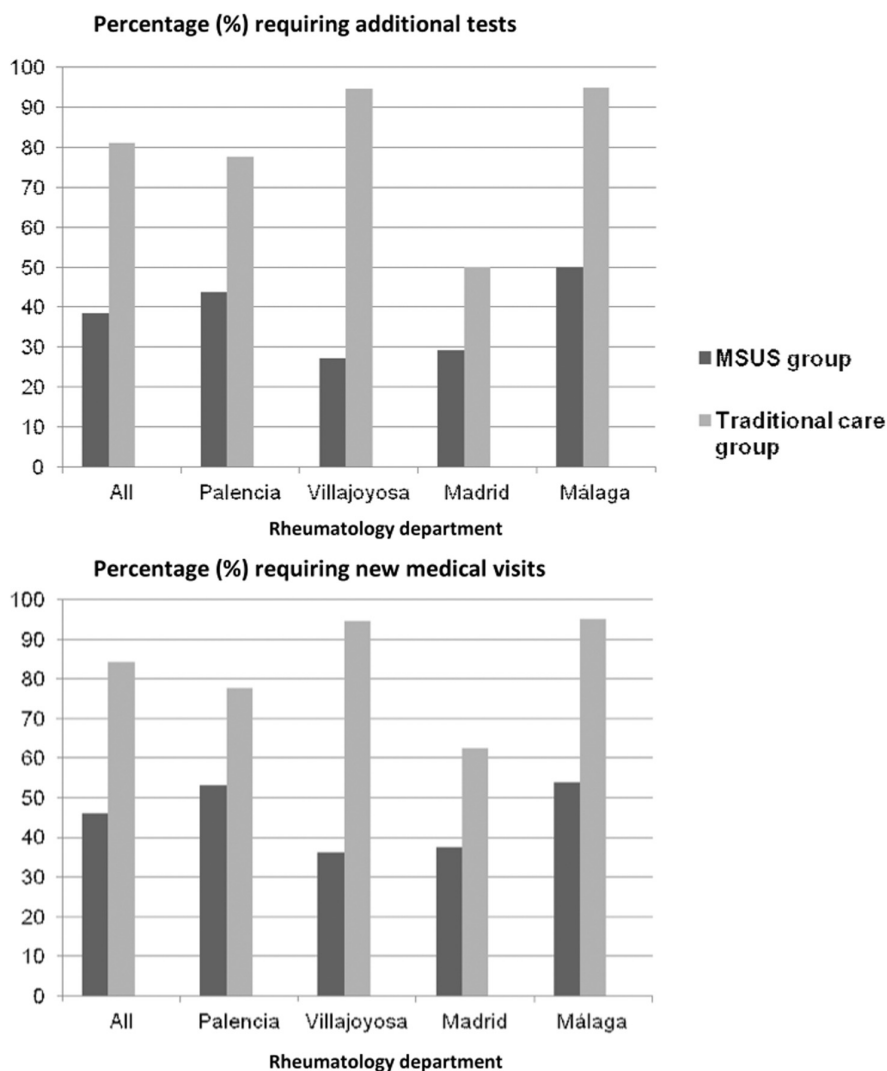


Fig. 1. Distribution of additional tests and medical visits among the rheumatology departments.

MSUS: Musculoskeletal ultrasonography.

Distribution of patients: 41 were from a hospital in Palencia (32 MSUS patients and 9 traditional care patients), 41 were from Villajoyosa (22 and 19, respectively), 46 were from Málaga (26 and 20, respectively), and 40 were from Madrid (24 and 16, respectively).

In our study, we chose the shoulder and hand joints because they are frequent causes of medical consultation and easily examined using MSUS. In fact, it has been reported that up to two-thirds of the MSUS examinations performed by a rheumatologist include the shoulder, elbow and/or hand (1, 5, 15).

The additional time needed to perform ultrasonography during the medical visit in our study was approximately 10–15 minutes, which is similar to results previously reported (1).

Our study was observational, and as such, carries some limitations. To date, we have not found an alternative method to compare medical consultations with respect to MSUS and traditional

care managing. Of note, however, this study included multiple centres, and the results were relatively homogeneous.

In conclusion, the results of this work support the premise that routinely including MSUS in the medical visit is efficient and reduces costs. In addition, the routine use of MSUS in rheumatology practice confers a significant reduction in new visits, complementary tests and direct costs when compared with traditional care.

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