Efficacy of Tidal Irrigation in Milwaukee Shoulder Syndrome

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ABSTRACT. ***Objective.*** To assess the efficacy of tidal irrigation in patients with Milwaukee shoulder syndrome (MSS).

Methods. Ten patients with clinical diagnosis of MSS underwent ultrasound examination and tidal irrigation followed by instillation of methylprednisolone and tranexamic acid. A single shoulder was treated in 9 cases; in one patient with bilateral shoulder involvement, both shoulders were treated at different times. Six patients had longlasting disease (Group A) unsuccessfully treated with repeated joint fluid aspirations and intraarticular corticosteroid injections. Four patients had recent-onset illness without radiologic damage but with clinical findings similar to classic MSS (Group B), not previously treated with corticosteroid injections with symptoms dating from 3 months or less. Clinical examination including evaluation of adverse events, range of motion, and pain score by a 100 mm horizontal visual analog scale was scheduled just before tidal irrigation and after 2 and 6 months following the procedure in all cases.

Results. Short- and longterm safety was excellent in all patients. Group A patients experienced short-lived improvement so that tidal irrigation had to be repeated within 6 to 10 months. No further therapy was necessary in any of the Group B patients during a mean followup of 16.5 months (range 12–24) due to a persistent clinical improvement without clinically detectable joint effusion.

Conclusion. Closed-needle joint irrigation is a minimally invasive procedure, which led to a significant improvement in both pain and active motion in patients with longstanding symptoms. Patients with recent-onset disease recovered completely. (First Release June 1 2007; J Rheumatol 2007;34:1545–50)

Key Indexing Terms:
MILWAUKEE SHOULDER SYNDROME APATITE CRYSTALS TIDAL IRRIGATION

Apatite-associated destructive arthropathy (Milwaukee shoulder syndrome, MSS) is a degenerative disorder affecting predominantly elderly women, characterized by dissolution of the fibrous rotator cuff and destruction of the glenohumeral joint. Synovial fluid is usually noninflammatory, tinged with blood, and contains microaggregates of basic calcium phosphate crystals (BCP) and particulate collagens[1,2]. The prevalence is unknown, but the disorder is felt to be rare.

The disease is often monoarticular but bilateral shoulder involvement can occur[3]. Knee and hip may also be affected[4]; other joints such as elbow, ankle, wrist, and intertarsal joints are less commonly involved; classificative criteria are still lacking, even if clinical, radiological, and synovial fluid analysis might be considered suggestive for the diagnosis in most cases.

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Most patients have slowly progressive disease while others have marked deterioration over a span of a few months[5,6]. Therapy is supportive in most cases, limited to joint rest, nonsteroidal antiinflammatory drugs (NSAID)[7], repeated aspirations, and intrarticular corticosteroid injections[8-11]. Surgical procedures, including joint replacement, may be helpful in selected cases but improvement is often only limited[12].

Tidal irrigation, followed by instillation of methylprednisolone and tranexamic acid, proved to be beneficial in 2 of our patients some years ago[13], so we decided to treat 10 additional patients in this way.

MATERIALS AND METHODS

Patients. Ten patients admitted to the rheumatology outpatient clinic of the University Hospital of Pavia entered the study. All patients fulfilled all the criteria reported in Table 1; in the absence of a definite set of classification or diagnostic criteria for MSS, we used criteria largely reported in the literature, and we decided that all of these criteria needed to be present for enrolling a patient[14-17]. All patients gave their informed consent for intraarticular treatment according to the local Ethical Committee recommendations. The main demographic and clinical data of the patients are shown in Table 2. In all cases the presence of joint effusion was evident on examination, as well as a reduction in passive and active range of motion (ROM) of the involved joint.

A single shoulder was treated in 9 cases; in one patient (case 4) with bilateral shoulder involvement, both shoulders were treated at different times. Six patients (cases 1–6, Group A) had longlasting disease, unsuccessfully treated with repeated joint fluid aspirations and intraarticular corticosteroid injec-

Table 1. Inclusion criteria. Patients had to satisfy all criteria to be enrolled in our study.

Criteria
Age ≥ 70 yrs
Painful shoulder ≥ 1 month despite conventional treatment
Severe range of motion reduction (maximum active abduction ≤ 60°)
Rotator cuff tear detected by ultrasonography
Intraarticular (glenohumeral) effusion detected by ultrasonography
Blood-tinged synovial fluid with nucleated cell count < 2000/μl
Alizarin red-stained microaggregates in synovial fluid
Exclusion of inflammatory rheumatic disorders including rheumatoid arthritis, seronegative spondyloarthropathy, polymyalgia rheumatica, and septic arthritis

tions. All these patients had recurrence of joint pain and swelling within 1 month following joint aspiration and corticosteroid injection. Moreover, we performed the procedure in 4 additional patients (cases 7–10, Group B) who had recent-onset illness not previously treated with corticosteroid injections.

All Group A patients had pretreatment radiographic lesions[18,19], including high-riding humeral head, cystic degeneration of the humeral tuberosities, erosions of cortical bone at the site of insertion of the rotator cuff, narrowing of the glenohumeral joint space, only mild subchondral bone sclerosis, and little or no osteophytosis. Minimal or no obvious skeletal lesions were found by radiographic analysis in the Group B patients (Figure 1).

Dynamic grayscale ultrasonography was performed with a 6–11 MHz linear transducer in real time (Nemio, Toshiba America Medical Systems, Tustin, CA, USA). The patient was scanned while seated on a revolving stool that permits easy positioning during the scanning of both shoulders. Each component of the rotator cuff and the biceps tendon in the bicipital groove were examined in both axial and sagittal planes. Evaluation of the supraspinatus, infraspinatus, and subscapularis tendons included views in internal and external rotation of the shoulder[20]. Joint effusion was evaluated with ventral transverse section in the coracoacromial window in neutral position, ventral transverse section during maximal external rotation, and ventral transverse section during maximal internal rotation[21]. All patients had both rotator cuff tear (partial or complete) and large glenohumeral joint effusion (Figure 2). In particular, the rotator cuff tear was complete in all the patients in Group A, while it was partial in Group B patients (involving the supraspinatus tendon in all cases and the infraspinatus in 2 cases).

Routine synovial fluid analysis included in all cases nucleated cell count, polarized light microscopy examination of fresh samples, and light microscopy examination of Alizarin red stained preparations[17,22]. Apatite crystals were suspected by presence of glossy, nonbirefringent chunks staining positively with Alizarin red and recorded as 0–3+[17,23]; we considered all with scores 2+ and higher as positive.

The synovial fluid volume before the first irrigation ranged from 55 to 190 ml (median 85) and nucleated cell count in synovial fluid ranged from 50 to 1790/μl (median 260). Four patients (cases 1, 3, 4, and 6) also had a few extracellular calcium pyrophosphate dihydrate (CPPD) crystals[24,25].

Tidal irrigation. The procedure was performed on 11 shoulders from 10 patients as described[13]. Briefly, after sterile preparation and local anesthesia with 2% lidocaine, we inserted into the joint space, under ultrasound (US) guidance, a 14-gauge indwelling intravenous cannula (length 50 mm), radioopaque, without fixation wings (Medical Division, Braun Melsungen AG) connected to a 3-way closed system; approach to the shoulder was posterior in 7 cases and anterior in 4 cases. The choice of the best approach was done on the basis of the distribution of effusion evaluated by US examination. The joint was evacuated and then reinstilled with fresh saline (30–120 ml) that was then removed. The irrigation was continued until 1500–2000 ml of saline solution passed through the joint; in all cases the amount of fluid in the joint after the procedure was evaluated by US and quantified as 10–25 ml. After lavage we injected 40 mg of methylprednisolone acetate (MPA) and 0.5 g of tranexamic acid. The whole procedure takes about 60 min. Tidal irrigation was performed in all patients at the beginning of the study and then repeated when necessary on a clinical basis, i.e., recurrence of shoulder pain and/or effusion.

Clinical examination including evaluation of adverse events, active ROM, and pain score by a 100 mm horizontal visual analog scale (VAS) was scheduled just before tidal irrigation and after 2 and 6 months following the procedure in all cases. All patients were also interviewed by telephone 15 and 30 days after the procedure to evaluate pain score and adverse events and after 4 months for pain score only. Further visits were done every 6 months or when required from clinical symptoms.

Statistical analysis. Differences on VAS pain score and ROM were evaluated by Wilcoxon test using Med–Calc software (Marienkarke, Belgium).

Table 2. Demographics and main clinical characteristics.

Case	Sex	Age	Affected Shoulder	Duration of Symptoms, mo	Previous Treatment	Followup, mo	No. of Tidal Irrigations	Interval Between Tidal Irrigations	
								First	Last
1	F	78	L	240	CS injections NSAID	18	4	6	4
2	F	79	R	132	CS injections NSAID	24	5	6	6
3	F	77	R	120	CS injections NSAID	16	3	6	6
4	F	80	R	72	CS injections	36	6	8	4
			L	53	CS injections Paracetamol	36	4	10	8
5	F	87	R	12	CS injections NSAID	21	3	6	10
6	F	83	L	10	CS injections NSAID	6	2	6	–
7	F	71	R	3	Paracetamol	12	1	12 +	–
8	F	79	R	2	NSAID	24	1	24 +	–
9	F	78	R	1	NSAID	16	1	16 +	–
10	F	75	L	1	NSAID	14	1	14 +	–

CS: corticosteroid; NSAID: nonsteroidal antiinflammatory drugs.

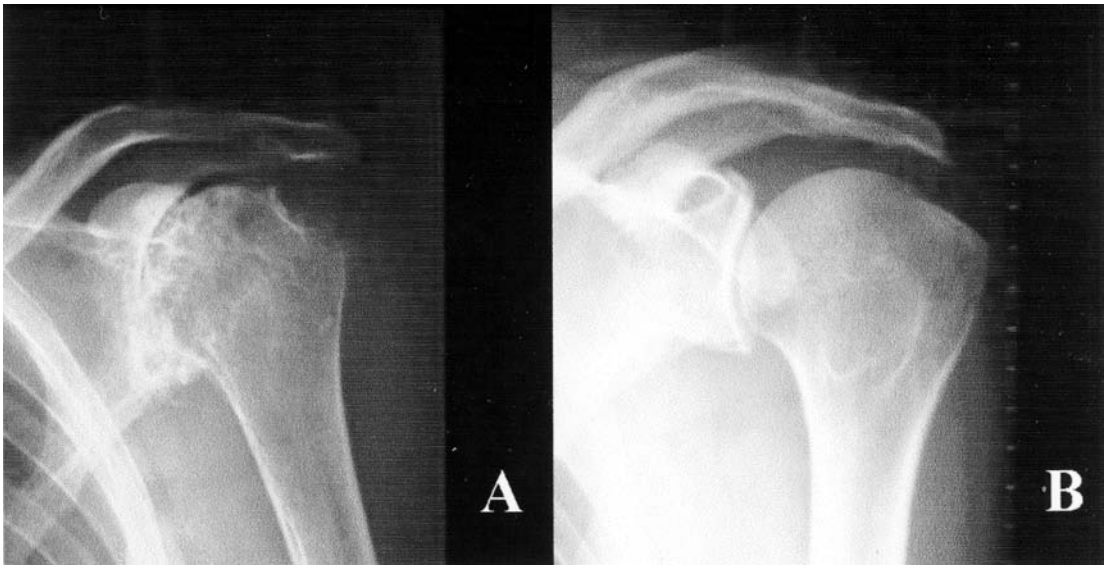

Figure 1. Anteroposterior plain radiographs of the glenohumeral joint. A. Patient 2 (longlasting disease): glenohumeral joint space narrowing, superior subluxation, cystic degeneration of the humeral tuberosities. B. Patient 8 (early disease): no obvious skeletal lesions.

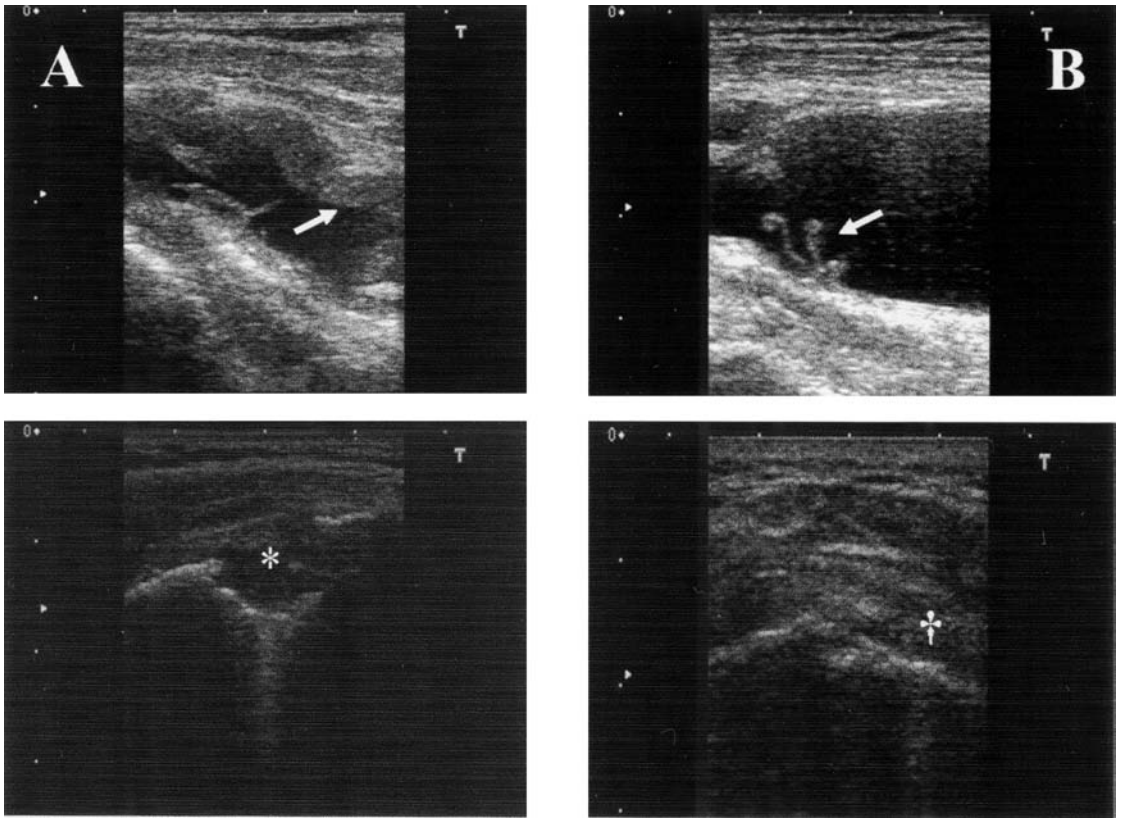

Figure 2. Ultrasound images. A. Patient 2 (longlasting disease): large glenohumeral joint effusion, synovial hypertrophy (arrow), complete rotator cuff tear (*). B. Patient 8 (early disease): large glenohumeral joint effusion, synovial hypertrophy (arrow), partial rotator cuff tear (†).

RESULTS

Short- and longterm safety was excellent in all patients. No procedure-related adverse events were recorded at any time. A significant short-term clinical improvement was found in all patients; however, the results were quite different according to the diagnosis and disease duration. As shown in Table 2,

Group A patients (with classical longlasting MSS, radiographic skeletal lesions, and previous intraarticular corticosteroid injections) experienced short-lived improvement so that tidal irrigation had to be repeated within 6 to 10 months. On the other hand, no further therapy was necessary in any of the Group B patients (with early disease) during a mean followup of 16.5 months (range 12–24) due to a persistent clinical improvement without clinically detectable joint effusion (Table 2).

Pain. As shown in Figure 3, in Group A patients, the median pain score improved from 91 to 40 after 15 days, and clinical improvement was still significant after 4 months ($p = 0.02$). After 6 months the pain score values were still a little lower than pretreatment values (median VAS 80; interquartile range, IQR, 67–87; $p = 0.03$), but 5 out of 7 shoulders needed a second irrigation because of recurrence of pain and of large joint effusion. In Group B patients the pain score dropped from 96 to 0 within 15 days ($p < 0.001$). None of these patients had clinical relapse during the followup period. A slight increase in pain was reported by only one patient (case 7) 6 months after irrigation.

Active motion. A partial improvement was observed after tidal irrigation in Group A patients. Maximal abduction improved from 30° (25°–37.5°) to 80° (range 60°–80°) after 2 months ($p = 0.02$) and at 6 months the maximal abduction was still 60° (52.5°–65°) ($p = 0.03$; Figure 4A). A more dramatic and persistent recovery in ROM of the involved shoulder was observed in all of the Group B patients (Figure 4B). The maximal abduction improved from a pretreatment value of 32.5° to 150° 2 months after the irrigation ($p < 0.001$) and this improvement was maintained at 6 and 12 months in all patients.

Imaging. At the US evaluation, all Group A patients had recurrence of glenohumeral joint effusion after 6 months and persistence of villous synovial hypertrophy. Rotator cuff lesions were unchanged after 6 and 12 months as were radiographic features after 12 months.

In Group B patients no obvious effusion or synovial thickening was present after 6 and 12 months. Rotator cuff tears remained unchanged in all cases, as were skeletal radiographic pictures after 12 months.

DISCUSSION

Closed-needle tidal joint irrigation has been proposed in knee ostheoarthritis[26-28], in CPPD knee synovitis[29], and in septic arthritis[30]. This study confirms our preliminary results showing that this procedure may be effective in patients with MSS too[13]. Closed-needle joint irrigation is minimally invasive, can be readily performed in a day-hospital setting, and does not require postoperative rehabilitation. Adverse events are rare, and similar in type and frequency to those occurring after arthrocentesis[26]. Accordingly, no adverse events were observed in our series.

Although a primary pathogenic role is still controversial[31], BCP crystals were proven to activate release of collagenases and neutral proteases by synoviocytes and chondrocytes[32,33]. Further, the interaction between BCP crystals and macrophages can lead to the synthesis and release of several cytokines that can reinforce the action on synoviocytes and chondrocytes[34]. The mechanism by which tidal irrigation could work in MSS is probably based on the removal of intraarticular crystals and cartilage debris[35,36]. Tranexamic acid, already proposed for hemophilic hemarthrosis[37], may also act by reducing bleeding and preventing plasminogen activation that is known to play a role in neutral proteases activation[38]. Tranexamic acid has been shown to be useful also in preventing bleeding after knee arthroplasty[39]. So it is possible that tranexamic acid instillation might have contributed to the results of tidal irrigation by preventing blood loss as well as by inhibiting the plasminogen activation system. More studies

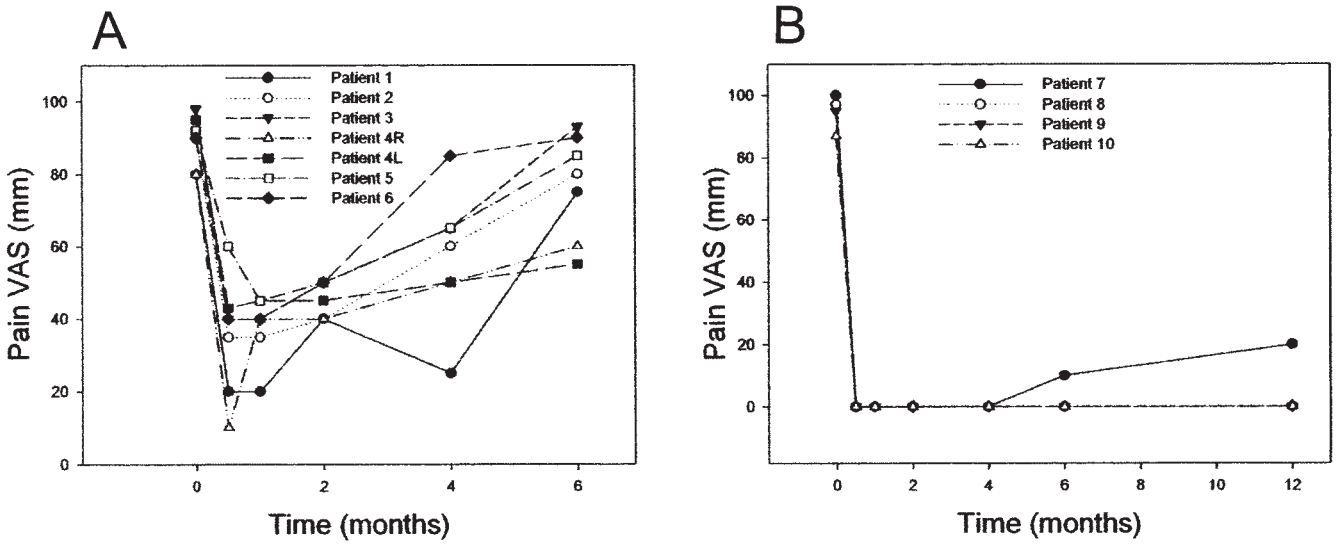

Figure 3. VAS pain score. A. Group A (patients with longlasting disease). B. Group B (patients with early disease).

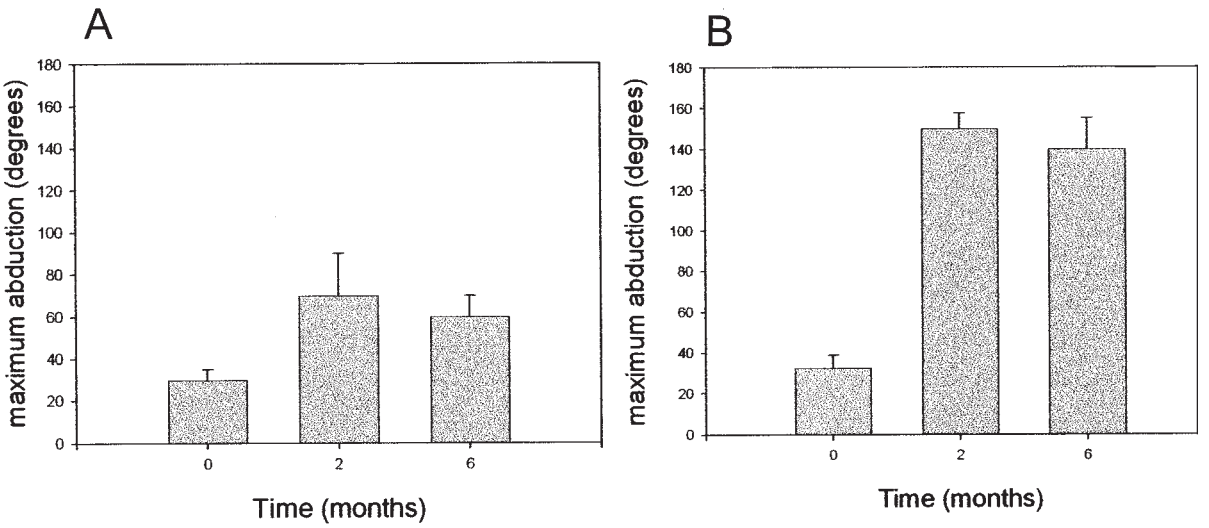

Figure 4. Active range of motion. A. Group A (patients with longlasting disease). B. Group B (patients with early disease).

are needed to clarify to what extent it contributed to the positive outcome of tidal irrigation.

In patients with longlasting symptoms, this procedure led to significant improvement in both pain and active motion lasting at least 4 months in 6 out of 7 shoulders. This improvement was more sustained than previously obtained in the same shoulders by joint aspiration followed by corticosteroid injection alone. However, clinical benefit was only partial and was limited by the extent of preexisting joint and rotator cuff damage.

Very interesting results have been obtained in 4 patients with recent-onset disease characterized by all the symptoms described in Table 1. All these patients presented complete clinical recovery that was stable for at least one year. No detectable relapse was found in any case after 12 to 24 months.

Since well defined classification and/or diagnostic criteria for MSS do not exist, we can only speculate that patients presenting with age ≥ 70 years, painful shoulder for ≥ 1 month, severe ROM reduction, US detected partial rotator cuff tear, and noninflammatory blood-tinged synovial fluid with Alizarin red stained microaggregates may represent a very early phase of the disease, possibly progressing to a classical MSS. Moreover, we cannot be sure that a simple procedure of synovial fluid aspiration followed by intraarticular steroid might have had the same positive and longlasting result as tidal irrigation in these patients.

However, since we used very strict clinical, laboratory, and US criteria to enroll patients, and keeping in mind both the possible dramatic progression of MSS[40] and the absence of adverse events as well as the simple application of tidal irrigation, we think that this procedure might be considered even in patients with the characteristics described (see Table 1) and without a clear clinical picture of MSS.

Although our study has some limitations, such as the small number of patients and the lack of a control population, we argue that tidal irrigation may be useful in patients with established MSS and may be even more useful in patients with a clinical picture suggestive (even if not diagnostic) for an early disease phase. Our study may prompt researchers to design multicenter controlled clinical trials to study different therapeutic approaches in MSS, and to design classification criteria applicable to classic MSS but also considering the possibility of a diagnosis in an earlier phase.

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