The radiological assessment of axial involvement in psoriatic arthritis: a validation study of the BASRI total and the modified SASSS scoring methods

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ABSTRACT

Objectives. *To assess the validity of the BASRI and m-SASSS scores for the radiological axial involvement in psoriatic arthritis (PsA). Secondary end-points were to report on clinical, functional and radiographic characteristics of axial involvement.*

Methods. *Inclusion criteria were satisfaction of the CASPAR criteria and the presence of clinical, functional and/or radiological axial involvement. Three observers scored the radiographs by BASRI and m-SASSS. The construct validity was assessed by examining the correlation of instruments with patient reported outcomes and anthropometric measures. The reliability and the feasibility of the scores were also considered.*

Results. *Seventy-seven patients were enrolled (58 M, 19 F, mean age 49.4± 10.8 yrs, disease duration 13.9±7.9 yrs). Both instruments showed some modest but significant correlation with clinical measures. When compared, the BASRI showed a correlation with BASMI (rho=0.47, p<0.001), cervical rotation (rho=-0.49, p<0.001), tragus to wall (rho=0.34, p<0.01) and occiput to wall (rho=0.49, p<0.001), modified Schober test (rho=-0.24, p<0.05) and RLDQ (rho=-0.24, p<0.05). When compared, m-SASSS showed a correlation with BASMI (rho=0.39, p<0.001), cervical rotation (rho=-0.41, p<0.001), tragus to wall (rho=0.31, p<0.01) and occiput to wall (rho=0.42, p<0.001), modified Schober and Schober test (rho=-0.34, p<0.001; rho= -0.32, p<0.01), finger to floor (rho=0.37, p<0.01). No correlation was found with BASFI, BASDAI and HAQ. Test-retest showed a good reliability of the scores. Both were feasible but BASRI was the quickest.*

Conclusion. *Our results showed that BASRI and m-SASSS were valid instruments for use in spondylitis associated with psoriatic arthritis. Longitudinal data is required to provide sensitivity to change of the two scores.*

Introduction

The definition and measurement of axial disease in psoriatic arthritis (PsA) still remain problematic (1). As the frequency of spondylitis in PsA patients is a function of the number and sensitivity of the diagnostic instruments and of disease duration, it may vary between 25% (early disease and clinical assessment only) and 75% (late disease and sophisticated imaging) (2, 3). Psoriatic axial involvement is usually less severe than that of ankylosing spondylitis (AS) and dissimilar in many respects (4). Indeed, some radiographic features of psoriatic spondylitis, such as asymmetrical sacroiliitis, non-marginal syndesmophytes; asymmetrical syndesmophytes, paravertebral ossification, and more frequent involvement of cervical spine seem to be so characteristic as to be potentially helpful in diagnosing PsA and differentiating this condition from some cases of psoriasis with coincidental AS (5, 6). There are no instruments to assess psoriatic spondylitis but such an assessment would provide information on disease evolution and outcome in the individual patient and would be useful in clinical trials. For AS there are the Bath Ankylosing Spondylitis Radiology Index (BASRI) (7), the Stoke Ankylosing Spondylitis Spine Score (SASSS) (8), and a modification of the SASSS (m-SASSS) (9). The BASRI was modified in 2000 as BASRI-total which included the assessment of hips (10).

The aim of the present study was to assess the validity of the BASRI and m-SASSS for the radiological assessment of axial involvement in patients with PsA and compare their individual performance. According to the Outcome Measures in Rheumatology Clinical Trials (OMERACT) filter (11), the present study pursued the following aims: 1) truth (construct validity); 2) discrimination; c) feasibility.

However, secondary end-points were to report on clinical, functional and radiographic characteristics of the axial involvement in a group of patients with established PsA. The present study was designed as longitudinal and this paper reports the results from the first part of the baseline observation.

Patients and methods

Study design

This was a multi-centre study involving PsA patients. Inclusion criteria were:

1. Satisfaction of ClASsification of

Psoriatic Arthritis (CASPAR) classification criteria (12);
2. the presence of clinical (spinal inflammatory pain according to the Calin criteria) (13) and/or radiological axial involvement, regardless of the disease duration.
The study was carried out in 6 Rheumatology Units throughout Italy and the PsA patients were recruited consecutively at the outpatient clinics from January to December 2006.
All patients gave their written informed consent and the study protocol was approved by the local ethics committee.
Standard antero-posterior and lateral radiographs of the cervical, dorsal, lumbar spine, and antero-posterior radiographs of the pelvis were performed in all patients enrolled. The radiographs were mostly hard copy (three were digital images) and were sent to a central site where each radiograph was evaluated simultaneously by three rheumatologists (E.L, A.M, P.S.H), each with many years experience in scoring spinal radiographs in PsA and reaching the final score for each radiograph, in the same fashion of previous studies (6, 14). The same radiographs were scored twice and assessed using the BASRI-total and the m-SASSS (both on two separate occasions), with a 10-month interval.

Radiological scoring methods
The BASRI, originally described in 1998 (7), was modified by MacKay in 2000 who introduced the BASRI total which is the total score of the BASRI-hip and the BASRI-spine. The final score of BASRI-total ranges from 2 to 16 (10). The BASRI-total includes the scoring method of SI joints, using the grading system of the New York criteria (15).
The m-SASSS is a modified form of the original score (SASSS), which scores every corner of the anterior site of the lumbar and cervical vertebrae on a scale from 0 to 3, and the total score is the sum of both scores and ranges from 0 to 72 (8).
Following the paper by Wanders *et al*. we decided that if >3 scoring sites were missing, the radiographs were excluded. If 3 or fewer sites were missing, the mean of the other scoring sites were used as a substitute for the missing sites (16).

Clinical and functional assessment
In all patients a detailed clinical and functional assessment was performed. Anthropometric measurements included cervical rotation, tragus to wall distance, occiput to wall distance, modified Schober test, Schober test, intermalleolar distance, and finger-to- floor distance (17, 18). Other measures included BASMI (19), BASFI (20), HAQ, Italian version (21) and RLDQ (Revised Leeds Disability Questionnaire), Italian version (22).
The activity of the disease was assessed by the BASDAI (23) as well as the acute phase reactants (ESR, CRP), and patient's and physician's VAS on global disease activity. Moreover, the 68 tender and 66 swollen joint count assessment, skin involvement (PASI) (24), presence and cumulative number of dactylitis, enthesitis (MASES score) (25), extra-articular involvement were carried out on all patients.

Statistical analysis
Statistical analysis was carried out using the SPSS package (SPSS Inc, Chicago, Illinois) (version 13.0). Descriptive data were expressed, if not otherwise specified, as mean ± Standard Deviation (SD). Statistical significance was accepted at $p<0.05$.
The construct validity of the methods was assessed by examining the correlation of the two scoring systems with the measures of spinal mobility, disease duration, and functional measures. The correlation was expressed as Spearman's rho.
No inter-observer variability was carried out, since the two scores were already validated. However, the test-retest reliability for the BASRI-total and the m-SASSS was performed with the intraclass correlation coefficient (ICC), using a mixed model in the reliability procedure in SPSS v13.0.

Table I. Demographic and clinical data of the enrolled patients.

Number of patients (M/F ratio)	77 (58/19)
Mean age (yrs±SD)	49.4 ± 10.8
Mean disease duration (yrs±SD)	13.9 ± 7.9
Peripheral joint involvement, n (%)	61/77 (79)
Evidence of psoriasis, n (%)	69/77 (90)
Nail dystrophy, n (%)	37/77 (48)
Family history of psoriasis, n (%)	42/77 (55)
HLA B27 positive, n (%)	19/60 (32)
Rheumatoid factor positive, n (%)	6/75 (8)
Increased ESR, n (%)	31/75 (41)
Increased CRP, n (%)	40/74 (54)
Patients on traditional DMARDs, n (%)	37/77 (48)
Patients on biological agents, n (%)	45/77 (58)
BASMI median (range)	3 (0-8)
BASFI median (range)	25 (0-92)
HAQ median (range)	0.75 (0-2.75)
RLDQ median (range)	1 (0-3)
BASDAI median (range)	3.3 (0-9.6)

Results
Descriptive, functional and radiological data
Seventy-seven patients were enrolled (58 M, 19 F, mean age 49.4±10.8 yrs, disease duration 13.9±7.9 yrs). The patients showed these clinical spinal measurements (median and range): cervical rotation, degree (45, 0–90), tragus to wall, cm (13, 7–28); occiput to wall, cm (2, 0–24); chest expansion (xiphisternum), cm (3.3, 0.5–5.5); chest expansion (nipple), cm (3, 1–7); modified Schober test, cm (4, 0-9); finger to floor distance, cm (20, 0-70); intermalleolar distance, cm (98, 45–126); BASMI (3, 0–8); BASFI (2.5, 0–9.2); HAQ (0.75, 0–2.88); RLDQ (1, 0–3).
All the detailed descriptive data are reported in Table I.
Some missing data resulted in the following numbers with complete data for full evaluation: the BASRI was scored in 71 patients (92%) and the m-SASSS

Table II. Main results on the comparison between BASRI and m-SASSS with anthropometric and patient reported outcomes.

	BASRI	m-SASSS
Cervical rotation	-0.49*	-0.41*
Tragus to wall	0.34*	0.31*
Occiput to wall	0.49*	0.42*
Chest expansion (xiphisternum)	-0.27^	-0.15
Chest expansion (nipple)	-0.34*	-0.26^
Modified Schober	-0.24^	-0.34*
Schober	-0.22	-0.32*
Finger to floor	0.22	0.37*
Intermalleolar distance	-0.20	-0.09
BASMI	0.47*	0.39v
BASFI	0.14	0.010
RLDQ	0.24^	0.12
HAQ	0.00	0.05

*$p<0.01$, ^$p<0.05$.

in 70 (90%), due to the poor quality of the radiographs of some patients.

As frequencies of radiological SI joints involvement, a bilateral SI joint involvement with a score of ≥2 was found in 38/75 patients (51%), while a unilateral SI joint with a score of ≥3 was found only in 2/75 patients (3%). The remaining 35 patients showed an unilateral grade 1 in 5/75 patients (6%), a symmetrical grade 1 in 2/75 patients (2.6%), a unilateral grade 2 in 1/75 patient (1.3%) and grade 0 in 27/75 (36%). Moreover, cervical spine involvement was found in 27/71 (38%) and lumbar in 29/71 (40%). Axial involvement at the cervical and lumbar spine without sacroiliac involvement was observed in 7/71 patients by BASRI (9.8%) and in 3/70 by m-SASSS (4.28%). Twenty-two patients had fusion of the zygo-apophyseal joints.

Type II syndesmpophytes (chunky) were found in 6/77 patients (7.8%), all on the cervical spine, and paravertebral ossification in 2/77 patients (2.6%), all on the lumbar spine.

A significant correlation was found between the BASRI and the disease duration (rho=0.28, $p<0.05$), while the m-SASSS did not correlate.

Finally the two x-ray scores showed a good correlation with each other (rho= 0.855, $p<0.001$).

Construct validity: comparison of the BASRI and m-SASSS with anthropometric and functional data

Data on the comparison between the radiological scores and the anthropometric and functional outcomes are reported in table II.

In particular, when the BASRI score was compared to the anthropometric and patient reported outcomes, a significant correlation was found with BASMI, cervical rotation, tragus and occiput to wall, modified Schober test and RLDQ. When the m-SASSS score was compared to the anthropometric and patient reported outcomes, a significant correlation was found with BASMI, cervical rotation, tragus and occiput-to-wall, modified and Schober test, and also finger-to-floor. No correlations were found between the two radiological scores and BASFI, as well as no significant correlation was found with BASDAI and HAQ.

The test-retest reliability technique of the scores showed the ICC as 0.97 (95% CI: 0.951–0.981, respectively) for the BASRI and as 0.98 (95% CI: 0.983 and 0.993, respectively) for the m-SASSS.

Feasibility

We recorded the time required for scoring the two methods. The BASRI was the quickest test with a mean time of 2 minutes, while the time needed for scoring the m-SASSS was around 5 minutes. However, the detailed scoring of the vertebral corners involved in the m-SASSS ensures that these measures took longer to complete than the BASRI.

Furthermore, all the three radiograph readers stated that, although both methods were easy to perform, the BASRI was somewhat more straightforward.

Discussion

In this study both the BASRI and the mSASSS were found to be valid and feasible for use in assessing spinal radiological involvement in PsA. Both instruments were easy to use and took little time to complete, both had good test-retest reliability and both showed modest but significant correlations with anthropometric measures of spinal involvement in this disease. However, our results are in keeping with the INSPIRE study (International Spondyloarthritis Interobserver Reliability Exercise) that showed the measures of spinal mobility used in primary AS performed well and are equally reproducible when applied to PsA patients with axial involvement (18).

However, the purpose of this study was to examine the validity of the radiographic outcome measures that had been developed for assessing classical AS. Both instruments were feasible for measuring spinal radiological changes in established PsA. We decided to approach a consensus scoring with 3 simultaneous readers to assess better the validity and feasibility of these two instruments and not to propose a new method to be used in clinical trials. And we decided to perform in this way using the same fashion of previous studies (6, 14). However this approach could be rather labour intensive and not practical in clinical trials.

The BASRI was quicker and easier to perform but it did not encompass the complete range of some features of this condition. In fact, the BASRI was designed to have, by definition, a minimum score of 2, with a mandatory involvement of the SI joints, while in PsA patients it is possible to have axial involvement without a radiological sacroiliitis, as noted above. In this study nearly 10% of the patients showed radiological axial involvement without radiological sacroiliitis. Similarly, the m-SASSS is not able to encompass some radiological features; in fact it does not record sacroiliac involvement, positive in more than 50% of our cases. This could be a possible

explanation of why the BASRI showed a significant positive correlation with disease duration whereas the m-SASSS did not (data not shown). It is noteworthy that our results have been obtained from real clinical practice and this is in keeping with the growing attention on evidence-based clinical practice and recommendations (26, 27).

In conclusion, BASRI total and m-SASSS proved to be valid, reliable and feasible to measure axial involvement in PsA. However, for completeness, the longitudinal study will provide the data on the sensitivity to change of the two scores, fulfilling one more requirement of the OMERACT filter.

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