The early psoriatic arthritis screening questionnaire: a simple and fast method for the identification of arthritis in patients with psoriasis

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Abstract

Objective. Dermatologists usually see patients with psoriasis before arthritis develops, making them well placed to diagnose early PsA (ePsA). This study aimed to develop a rapid and robust screening questionnaire for predicting PsA in patients with psoriasis referred to a specialized joint dermatology-rheumatology combined clinic.

Methods. In all, 228 psoriasis patients naïve to DMARD treatment were administered two screening questionnaire: the new Early ARthritis for Psoriatic patients (EARP) questionnaire and the existing Psoriatic Arthritis Screening and Evaluation (PASE) questionnaire. The diagnostic accuracy of the two questionnaires for the diagnosis of ePsA was compared by receiving operating characteristics curves.

Results. After psychometric analysis, a simplified questionnaire of 10 items was found to have good internal reliability (Cronbach's α = 0.83) and was much faster and simpler to administer than the PASE. Both the EARP and PASE questionnaires presented similar receiving operating characteristics curves (specificity 91.6 and 67.2 and sensitivity 85.2 and 90.7, respectively) in identifying ePsA patients by using the cut-off value of 3 for EARP-10 and the standard cut-off value of 44 for PASE. The CASPAR criteria for PsA were present in 61 (26.7%) of the patients at clinical presentation and in 32.9% at 1-year follow-up, and the EARP score of ≥3 correlated with clinically determined arthropathy by a rheumatologist.

Conclusion. The EARP questionnaire is simple and fast to administer and proved robust for the identification of PsA in the dermatological setting. Dermatologists should consider the EARP for patients attending clinics, as it correlates well with early PsA diagnosis.

Key words: screening questionnaire, ePsA, PASE, psoriasis.

Introduction

PsA is an inflammatory arthritis associated with psoriasis that can have either an indolent or rapidly progressive course. The exact proportion of patients with psoriasis who will develop PsA is an area of significant controversy, with studies demonstrating a range from as low as 6% to as high as 42% [1, 2]. Typically psoriasis patients initially seek treatment for their skin and then are referred to a rheumatologist as arthritic symptoms develop. However, concurrent PsA in psoriasis patients may be overlooked in dermatology and general medicine practices, particularly in the early stages of the disease, as enthesitis-related manifestations at clinically inaccessible sites may be difficult to recognize, and inflammatory markers may remain normal.

Several factors contribute to the delay in diagnosis of PsA. These include the lack of awareness among patients...
of the relationship between skin symptoms and joint symptoms and the absence of a specific diagnostic marker. Ideally every psoriasis patient with musculoskeletal pain should be evaluated by a rheumatologist, but this is not practical. Accordingly, several groups developed screening questionnaires for use in the dermatology or general practice setting to identify individuals that might be at high risk for the development of PsA [3–5]. These include the Toronto Psoriatic Arthritis Screen (ToPAS) screening questionnaire, the Psoriatic Arthritis Screening and Evaluation (PASE) questionnaire, the Psoriasis and Arthritis Questionnaire [3–5] and the Psoriasis Epidemiology Screening Tool (PEST) questionnaire [6]. None of these questionnaires is focused on early diagnosis of PsA, and the reference population included patients already on DMARDs. The ToPAS screening questionnaire [5] was also designed for family medicine to help to recognize psoriasis, nail lesions and joint manifestations. The other two questionnaires are focused more on the prevalence of joint disease among patients with psoriasis. Peloso et al. [3] developed the Psoriasis and Arthritis Questionnaire, a 12-item questionnaire in a cohort of 108 patients, and they found a sensitivity of 0.85 and specificity of 0.88 in predicting PsA for a score of ≥7. By testing the same questionnaire in a larger cohort of psoriasis patients, Alenius et al. [3] could not confirm the same diagnostic accuracy, and the cut-off was set to 4.

Ibrahim et al. [6] developed a five-question questionnaire—the PEST—starting from a community-based survey of people with psoriasis and found a sensitivity of 0.92 and specificity of 0.78 in predicting PsA.

Recently Dominguez et al. [4] developed the PASE questionnaire, which consists of symptom and function subscales. This was predominantly designed to score joint involvement for the early identification of PsA. However, in our hands, the PASE was cumbersome for patients and rather time consuming. In the present study we evaluated a cohort of psoriasis cases using a screening questionnaire that was progressively simplified without losing diagnostic accuracy. We undertook this in a joint dermatology–rheumatology early psoriasis clinic, and we report the development of a new questionnaire—Early Arthritis for Psoriatic Patients (EARP)—that is very user friendly and easy to administer. We compared the EARP with the PASE, as the latter existing questionnaire was developed for screening potential early PsA (ePsA). Herein we report that the EARP is a new rapid screening method for the identification of PsA in the psoriasis clinic of Verona University Hospital.

Patients and methods

Study design

The study was done in a randomized, investigator-blinded design. Patients completed both the EARP (initial format having 14 questions) and the Italian translation of the PASE questionnaire, both of which were self-administered before the patient was clinically evaluated by the rheumatologist. The two questionnaires were administered in a random sequence (1/1).

The PASE questionnaire [4] consists of two subscales: symptoms and function. The back-translation from Italian to English yielded no appreciable differences. The possible answers consist of five categories (1–5) related to the level of agreement with the statement (strongly agree to strongly disagree). A total score was calculated by summing the score for each question, with a range of 15–75.

The EARP questionnaire was developed through review of the typical symptoms and signs seen among patients with an established diagnosis of PsA. Fourteen questions were jointly selected by a group of experts of the Verona University. Patients were asked about possible recent episodes of joint swelling, enthesitis, dactylitis, and back and hand morning stiffness occurring during the past 12 months. The questionnaire was composed of dichotomous (yes/no) items; the total score was calculated by summing the score of each question.

The time taken by the patient to complete the PASE and EARP questionnaires (14 items) was measured. The study was approved by the Ethics Boards of the University of Verona and written consent was obtained from all cases.

Patients

The patients were approached to enroll in the study while in the waiting room of the psoriasis clinic of the University of Verona. This clinic is jointly staffed by both dermatologists and rheumatologists. GPs in the Verona region typically refer the most severe cases and possibly those with psoriasis and joint symptoms to this particular outpatient clinic. Adults between the ages of 18 and 85 years, with an established diagnosis of psoriasis that were naïve to systemic treatment with a DMARD, were enrolled. We excluded individuals known to be affected by long-standing PsA or with a concomitant diagnosis of RA, gout and other rheumatic diseases.

Rheumatological assessment

After filling out the questionnaires, all patients underwent blood tests (CRP, ESR, RF, ACPA) and a full clinical, radiographic assessment independently of knowledge of the questionnaire findings. The clinical examination was performed by an experienced rheumatologist. This included the 68-joint count for swelling and tender joints. The presence of possible enthesitis was assessed by the Maastricht Ankylosing Spondylitis Enthesis Score (MASES) index [7]. Patients were also questioned about the presence of previous bouts of dactylitis, namely, a history of sausage-like digital swelling in the previous 6 months. The Classification Criteria for Psoriatic Arthritis (CASPAR) diagnostic criteria were applied [8].

Statistical analysis

Statistical analyses were performed using the SPSS 17.0 (Chicago, IL, USA) and STATA10.1 software packages. Continuous data with normal distribution were expressed as mean (s.o.); data with normal distribution with the
Shapiro–Wilk test were expressed as median (interquartile range). *P* < 0.05 was considered significant.

**Principal component analysis**

To identify the number of the underlying components of the initial EARP-14 questionnaire, the Pearson’s correlation matrix was explored by means of principal component analysis (PCA) [9]; items weakly correlated with the others (*r* < 0.20) were excluded from further analysis. The number of components was determined on the basis of eigenvalues of the correlation matrix >1. Item-component correlations, i.e component loading, >0.40, in absolute value, were chosen to identify a simple component structure. At the end of this analysis, the component number was forced to one to obtain a single scale.

**Multiple correspondence analysis phase**

The multiple correspondence analysis phase (MCA) or homogeneity analysis (HOMALS) [10] is designed to test item internal homogeneity and reliability for each dimension of the PCA. This method uses the yes/no answers as nominal category responses, and enables optimal grading for each category response of the questions (called optimal weights); consequently, an optimal score for each subject could be obtained. The optimal score of a subject is the sum of the optimal weights of the item options chosen. According to the criterion of internal consistency, MCA computes a homogeneity index (called Guttman’s *η*), and the optimal reliability determined by Cronbach’s *α* coefficient is a one-to-one transformation of Guttman’s *η* [11]. Good internal consistency has been suggested if Cronbach’s *α* > 0.70, and good homogeneity has been suggested if Guttman’s *η* > 0.30 [11]. Correlations between each item and the total score of the questionnaire, the total score excluding that specific item (item–rest) and between the optimal item and the total score were calculated.

**Receiver operating characteristic curves**

The receiver operating characteristic (ROC) curves were constructed to investigate the diagnostic performance of PASE and of the newly developed EARP questionnaire. The area under the curve (AUC) provided a measure of the overall discriminative ability of the prediction rule. The ROC curves were used also to identify possible discriminatory cut-off points for the questionnaires using the Youden test. The sensitivity and specificity were determined for several cut-off values of the prediction score.

**Psoriasis patient follow-up**

Patients with psoriasis but without a diagnosis of PsA at baseline according to the CASPAR criteria were once again evaluated after 1 year to ascertain whether clinical PsA had evolved. The clinical examination was performed by an experienced rheumatologist applying the CASPAR criteria [8]. The baseline EARP scores were compared with the total numbers of cases with PsA at the end of this period.

**Results**

**Patient assessment**

The initial study population included 386 patients; 85 patients previously treated with DMARDs, 42 affected by long-standing PsA and 31 with concomitant rheumatic disease were excluded as per protocol (Fig. 1). The 228 remaining patients had never been previously investigated by a rheumatologist, and all of them completed both PASE and EARP questionnaires. The CASPAR criteria were present in 61 (26.7%) of the patients at clinical presentation. The clinical characteristics of these patients are listed in Table 1.

All patients had a further rheumatological assessment at the 3-month interval, and this allowed the identification of 14 additional cases (6.1%) of ePsA by 12 months. The clinical characteristics of this second group of patients are also listed in Table 1.

**Questionnaire completion and EARP refinement**

The original items of the EARP questionnaire comprised 14 items (the EARP-14). The PASE questionnaire was completed in 6 (2) [mean (SD)] min, whereas the EARP-14 required 2 (1.5) min. The correlation matrix among the questions of the EARP-14 revealed that four questions (q2, q4, q12, q13) were weakly correlated (*r* < 0.20) with the others and were then excluded from the PCA (Table 2). The PCA identified two dominant components (eigenvalues > 1), explaining 54% of the total variance, and 75% of the pairwise correlations of the 10 questions examined. As all items were binary, component loading patterns are equal to optimal item–total correlation (Table 2). This component includes the 10 items composing the final 10-item EARP questionnaire (EARP-10), henceforth referred to as the EARP (Table 3). The four questions removed were as follows: Do you feel that your joints are limiting your movement? Is your back stiff for >15 min when you wake up? Do you have plantar burning and pain when you walk? And do your knees swell? The internal criterion index (Guttman’s *η*) of the MCA/HOMALS scaling was equal to 0.394, and the Cronbach’s *α* coefficient was 0.83, indicating a good scaling [11]. The raw item–total score correlations varied from 0.79 (q1) to 0.48 (q10) (Table 2); the same trend was found for the raw item–rest correlation from 0.71 (q1) to 0.36 (q10) and for the optimal item–total score correlations from 0.81 (q1) to 0.46 (q10). This suggests that the sum row scores or the sum optimal scores were good [10] values of the true scores of the continuous unidimensional factor underlying the 10-item set and are useful to detect ePsA.

The ROC curves were constructed to investigate the diagnostic performance of PASE and EARP (Fig. 2). For EARP, a cut-off point of 3 was found to be associated with the best diagnostic performances, whereas for PASE, the cut-off of 44 defined by the authors of the questionnaire was used. The measured AUC was 0.895 [standard error (S.E.) 0.030; 95% CI 0.836, 0.954] for PASE, whereas the
AUC of EARP was slightly higher at 0.906 (S.E. 0.025; 95% CI 0.857, 0.955) (Fig. 2).

The EARP false-positive rate (i.e. with a score $\geq 3$ but without PsA) was 22.3% (19 of 85 patients), and the false-negative rate was 3.5% (5 of 143 patients); i.e. ePsA patients with a score $<3$ on the EARP but with PsA. This yields a sensitivity of 85.2% and a specificity of 91.6%. The specificity and sensitivity of the PASE was 90.7% (95% CI 54.3, 78.4) and 67.2% (95% CI 79.7, 96.9), respectively. Sensitivity and specificity rose to 87.5% (95% CI 76.8, 94.4) and to 81.5% (95% CI 68.5, 90.7), respectively, with a cut-off equal to 36 rather than 44. In the 14 patients who developed PsA within the following year, the baseline EARP score was $>3$ in 10, whereas a PASE score $>44$ was present in only 5 of the patients.

**Discussion**

In this study we have shown that a large proportion of patients with psoriasis exhibit previously unrecognized signs of ePsA, and that this can be reliably collected using the new EARP screening questionnaire. Moreover, the EARP was extremely quick to administer in
TABLE 2 Raw item–total, raw item–rest and optimal item–total correlations of EARP

<table>
<thead>
<tr>
<th>Question no.</th>
<th>Raw item–total correlation</th>
<th>Raw item–rest correlation</th>
<th>Optimal item–total correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.791</td>
<td>0.711</td>
<td>0.811</td>
</tr>
<tr>
<td>2</td>
<td>0.687</td>
<td>0.582</td>
<td>0.682</td>
</tr>
<tr>
<td>3</td>
<td>0.511</td>
<td>0.394</td>
<td>0.486</td>
</tr>
<tr>
<td>4</td>
<td>0.616</td>
<td>0.503</td>
<td>0.615</td>
</tr>
<tr>
<td>5</td>
<td>0.733</td>
<td>0.635</td>
<td>0.744</td>
</tr>
<tr>
<td>6</td>
<td>0.666</td>
<td>0.554</td>
<td>0.674</td>
</tr>
<tr>
<td>7</td>
<td>0.492</td>
<td>0.382</td>
<td>0.493</td>
</tr>
<tr>
<td>8</td>
<td>0.477</td>
<td>0.364</td>
<td>0.456</td>
</tr>
<tr>
<td>9</td>
<td>0.662</td>
<td>0.546</td>
<td>0.647</td>
</tr>
<tr>
<td>10</td>
<td>0.590</td>
<td>0.464</td>
<td>0.568</td>
</tr>
</tbody>
</table>

TABLE 3 The EARP questionnaire

<table>
<thead>
<tr>
<th>Question</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do your joints hurt?</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Have you taken anti-inflammatory more than twice a week for joint pain in the last 3 months?</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Do you wake up at night because of low back pain?</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Do you feel stiffness in your hands for more than 30 minutes in the morning?</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Do your wrists and fingers hurt?</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Do your wrists and fingers swell?</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Does one finger hurt and swell for more than 3 days?</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Does your Achilles tendon swell?</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Do your feet or ankles hurt?</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Do your elbow or hips hurt?</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

The final 10 items of the EARP questionnaire were chosen after the psychometric analysis. Each positive answer is scored as one, and the final score is calculated by summing the positive answers.

The psoriasis population and was useful in a real-world setting of psoriasis patients presenting in the dermatology clinical setting for the first time. Moreover, patients with symptoms without clinical PsA often progressed to PsA within the following year. The relatively large number of cases recruited and the longitudinal follow-up for 1 year in a dermatological setting suggest that the EARP could be a useful screening tool for ePsA. This needs validation in a new cohort of psoriasis cases.

Twenty-six per cent of patients at baseline fulfilled the CASPAR criteria; such high prevalence rates of PsA in psoriasis have been previously reported by others [2, 12]. However, we cannot rule out a kind of referral bias, given that ours is a joint dermatology–rheumatology psoriasis clinic that might attract a larger proportion of patients with joint problems. For the primary purpose of this study, the development of a PsA screening questionnaire, such a referral pattern would be useful. The clinical signs of the PsA appeared within a year in an additional 6.1% of patients. This is much more than that reported in epidemiological surveys, where only ~10% of cases develop PsA after a decade of follow-up [1]. However, in previous studies the incidence of PsA was reported, rather than assessed, and this inevitably might considerably underestimate the true disease incidence.

Our results underline the importance of periodic rheumatology assessment, or at least rheumatic symptom evaluation, among psoriasis patients with tools such as EARP.

A delayed diagnosis of PsA may result in joint destruction and permanent disabilities, whereas early diagnosis and prompt therapy could prevent this irreversible joint damage [13]. The EARP questionnaire we developed was able to identify most of the PsA patients. The EARP questionnaire revealed an internal homogeneity, as Guttman’s \( \eta \) was equal to 0.394, and \( >0.30 \) is considered the cut-off for high homogeneity. Cronbach’s \( \alpha \) was 0.83, denoting very good reliability [11] and indicating a low degree of error in measuring the characteristic of interest. The question with the best item–total and optimal item–total correlation was q1, followed by q7, which are the most generic questions about general joint pain or hand joint involvement, respectively.

The sensitivity and specificity were 91% and 85%, respectively, for the cut-off value of 3.

In this study, the diagnostic accuracy of EARP was somewhat superior to that achieved by PASE with the cut-off score of 44 identified by the authors [4], and it increased slightly when the cut-off was optimized to 36 (data not shown). However, the main problem for PASE remains its complexity, which makes it unsuitable for a quick survey in outpatient dermatology clinics. The EARP can be administered or even self-administered within a couple of minutes, which favourably compares with PASE requiring >5 min with a trained specialist.

The authors of the PEST questionnaire [6] used 5 items from their original 16 questions. This questionnaire also included questions about familiarity, patient’s thoughts and nail assessment to identify PsA in general practice, and the authors did not exclude known PsA cases [6]. The EARP questions focused specifically on patients’ symptoms to identify new diagnoses of PsA in a dermatological clinical setting.

An obvious limitation of this study is the lack of validation in a different cohort of patients. This will be performed in future EARP validation studies. An additional limitation is the language of the questionnaire, which will need validation in other languages. However, the questions are extremely simple and intuitive and problems in transferring the results into different languages appear unlikely. In conclusion, the EARP questionnaire we developed for identifying psoriasis patients with ePsA is extremely simple and can be self-administered. Its sensitivity and specificity in identifying psoriasis patients who should be referred for a rheumatological
work-up appears to be as accurate as more complex tools.

**Rheumatology key messages**

- ePsA identification is a difficult and controversial topic.
- Many screening questionnaires to detect PsA are not used by dermatologists in everyday practice because of their complexity.
- The EARP is fast and easy for dermatologists to use to identify early symptoms of PsA.

**Disclosure statement:** The authors have declared no conflicts of interest.

**References**


**Fig. 2** ROC curves of EARP items (A) and the PASE questionnaire (B).

Area under the curve of PASE is 0.884 (s.e. 0.031; 95% CI 0.823, 0.9). Area under the curve of EARP-10 is 0.903 (s.e. 0.025; 95% CI 0.854, 0.952).