ORIGINAL ARTICLE Musculoskeletal Imaging

Early musculoskeletal MRI findings in a cohort of patients with psoriasis in central Greece

Dimitra Alifakioti[1], Efterpi Zafiriou[1], Angeliki Roussaki-Schulze[1], Katerina Vassiou[2,3], Paschal Thriskos[2], Marianna Vlychou[2]

[1]*Department of Dermatology, University General Hospital of Larissa, Greece*
[2]*Department of Radiology, University General Hospital of Larissa, Greece*
[3]*Department of Anatomy, Medical School, University of Thessaly, Larissa, Greece*

SUBMISSION: 05/04/2022 - ACCEPTANCE: 16/05/2022

ABSTRACT

Purpose: The purpose of the presence cohort study is to investigate the extent of early articular involvement of peripheral skeleton determined by MRI in patients with psoriasis.

Materials and methods: Seventy five (75) eligible patients with psoriasis and nail involvement were assessed according to NAPSI, PASI score and underwent a 3 Tesla MRI study of either hand or foot, depending on the most affected area.

Results: Based on our findings, bone oedema was found in 41% of our patients (31 patients), cysts were found in 9% corresponding to seven patients. Both bone radiological findings were recorded to 7% corresponding to five patients. In soft tissue imaging findings we included mostly the sausage digit and six patients were recorded with this abnormal finding. In the last radiological finding category concerned the joints, erosions were recorded in 26 patients (35%), synovitis in 49 (65%), enthesitis in 44 patients (59%), tendonitis in 36 patients corresponding to 48% of total patients and all the above simultaneously in 15 patients corresponding to 20% of all patients. All patients with positive inflammatory findings were suffering from nail psoriasis and were associated with a high NAPSI score. A statistically significant correlation was found between group 4 with NAPSI score 120-160 and overall imaging findings of either hand (p – 0.03) or foot (p=0.04).

Conclusion: MRI is a useful tool with an important diagnostic role in the detection of early psoriatic arthritis (PsA) of the peripheral skeleton, in a selected group of patients with extensive cutaneous involvement and nail psoriasis. Collaboration between radiologists and dermatologists could prevent the development of psoriasis into PsA and irreversible joint disease.

CORRESPONDING AUTHOR, GUARANTOR

Marianna Vlychou, MD, PhD, Department of Radiology, University General Hospital of Larissa, Greece
E-mail: mvlychou@med.uth.gr

KEY WORDS psoriasis, psoriatic arthritis, nail psoriasis, MRI

Introduction

Psoriasis is a chronic inflammatory skin disease, which affects 1-3% of the general population worldwide and is equally common in men and women. [1]. Psoriatic arthritis (PsA) is a severe, persistent, erosive and deforming disease, manifested as peripheral or axial, with potentially irreversible joint lesions.

Approximately 30% of patients suffering from psoriasis may develop psoriatic arthritis during their lifetime. Skin psoriasis precede PsA's symptoms in about 75% of patients with a time of apparition from 3 to 8 years [2]. Some common characteristics in patients suffering from psoriasis allow considering psoriasis in nails, scalp, and intergluteal area as unfavorable signs and very often predictors of PsA evolution. [3]. It has also been reported that the risk of PsA is increased in patients with more than three extensive skin lesions. [4]

It is estimated that up to 40% of patients with psoriasis have undiagnosed PsA. [2] [5]. Nowadays, it is a matter of great importance to diagnose PsA in the early stages even at the first appearance of any muskuloskeletal symptoms, in order to limit the extent of the disease by introducing the appropriate treatment. [6] This role is mainly dedicated to dermatologists who will face psoriasis earlier than any other specialists, will be called to distinguish among the patients the ones with greater risk to develop PsA and initiate an effective treatment for both diseases. [7]. Advanced imaging modalities, including high resolution ultrasound and MRI in patients with psoriasis and PsA very often confirm the presence of early joint inflammation and bone deformation.

The purpose of the presence study is to investigate the extent of early articular involvement of peripheral skeleton determined by MRI in patients with psoriasis prior to systemic treatment.

Materials and methods

This observational single-center study took part in a tertiary referral hospital in central Greece and it was a fulfilled in collaboration of the Dermatology and the Radiology Department. The study was approved by the local ethic committee of the hospital and all patients gave written informed consent prior to study participation.

Seventy five (75) eligible patients (table 1) were recruited among patients presenting at our dermatological outpatient department and suffering from psoriasis, without any previous systemic treatment. Inclusions criteria were nail involvement and at least one of the following: psoriasis of the intergluteal/perianal area or scalp, and/or more than 3 extensive skin lesions. Data concerning family history, duration of the disease, type of psoriasis and localization, co-morbidities and their treatment, preexisting local treatment for psoriasis and atypical symptoms or complaints for stiff joints were recorded.

The severity of the disease was assessed by the Psoriasis Area and Severity Index (PASI) score. PASI Score combines the severity (erythema, induration and desquamation) and percentage of affected area. A PASI score < 5 corresponds to mild disease, 5-10 represents moderate disease and > 10 severe plaque psoriasis.

Moreover, nail involvement which was almost present on the majority of our patient, was evaluated by the Nail Psoriasis Severity Index (NAPSI). This score is used to evaluate the severity of nail bed psoriasis and nail matrix psoriasis by area of involvement in the nail unit. Each nail has a matrix score 0-4 and a nail bed score 0-4. The total nail score is the sum of those 2 individual scores 0-8. The sum of all nails involved is the NAPSI score for the patient at consultation time. Patients were classified according to total NAPSI of both hands and feet's nails in the following rating: mild nail psoriasis NAPSI < 40, moderate NAPSI 40-80, severe NAPSI 80-120, very severe NAPSI 120-160.

Finally, the impact of the disease in patients' quality of life was evaluated by using the Dermatology Life Quality Index (DLQI), consisting of ten items concerning symptoms, feelings, daily activities, leisure, work, personal relationships and treatment. The score ranges from 0 to 30. A score 0-5 indicates a small impact on quality of life, 6-10 moderate impact, 11-20 very large and 21-30 extremely large impact.

Following the dermatological assessment, patients were

TABLE 1. Inclusion and exclusion criteria of the study	
Inclusion criteria	**Exclusion criteria**
Age > 18 years old	Pregnant or breastfeeding women
Presence of nail psoriasis and at least one of the following: • psoriasis of the scalp • psoriasis of the intergluteal/perianal areas • more than 3 extensive psoriasis lesions	Considered to be non-compliant or unwilling to cooperate
No previous systemic therapy for psoriasis	Consider to be unable to fill in the questionnaires recording quality of life
Compliance with 3 Tesla MRI	History of rheumatoid arthritis or other type of arthritis.
Written informed consent to study participation and data protection	

TABLE 2 Demographics		
Parameters	**Average/ Standard Deviation**	**Percentage %**
Age (years) mean	50 (±13)	
PASI mean	8 (±5)	
DLQI mean	14 (±4)	
Parameters	**n**	**Percentage %**
Gender Female Male	 30 45	 40% 60%
Site of psoriasis: Nail psoriasis Scalp Intergluteal involvement Simultaneous involvement	 75 60 65 59	 100% 80% 87% 79%
NAPSI sum of nails in hands and feet <40 40-80 80-100 100-160	 44 22 6 3	 59% 29% 8% 4%
Musculoskeletal symptoms	40	53%

asked for potentially articular, joint or bone symptoms or complaints the last weeks. All patients underwent a 3 Tesla MRI study of an extremity; hand or foot, depending either on the most affected area or randomly (table 2).

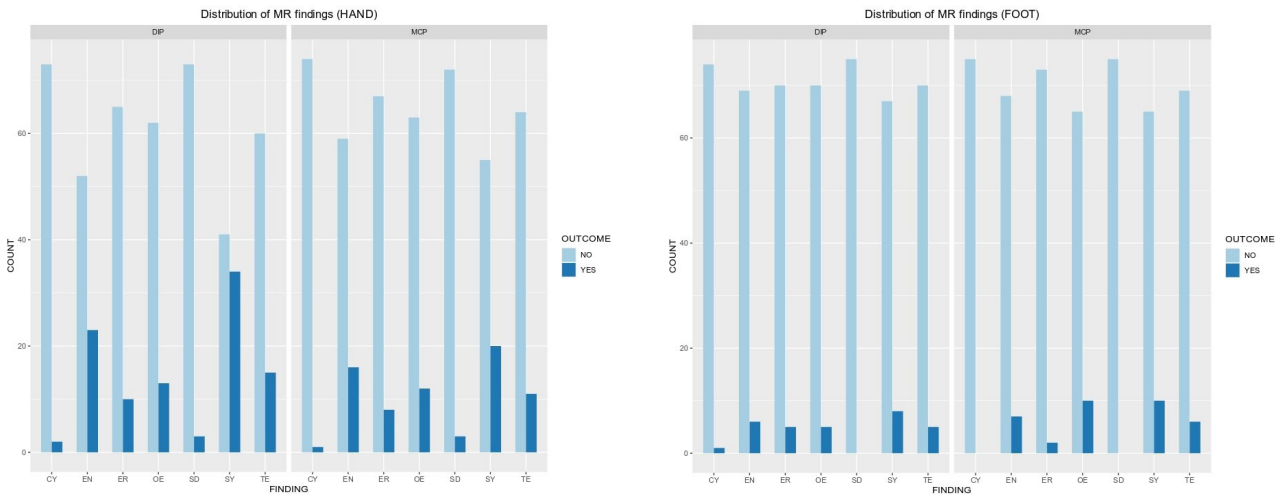
MRI protocol

All patients underwent an MRI examination of the most affected hand or foot at a 3 Tesla scanner (HDx, GE Healthcare) with the same imaging protocol. Sequence parameters included T1 - weighted images at coronal and axial planes, proton density - weighted images with fat saturation at coronal and sagittal planes, short tau inversion recovery images at coronal and axial planes and 3D SPRGR sequence post i.v. gadolinium administration.

The results of the radiological exams were analyzed

TABLE 3 Distribution of MRI findings

Radiological results	Absolute number	Percentage %
No MRI findings, n (%)	21	28%
Bone radiological findings n (%) Oedema Cysts All the above simultaneously	 31 7 5	 41% 9% 7%
Soft tissue radiological findings n (%) Sausage digit	6	8%
Joint radiological findings n (%) Erosions Synovitis Enthesitis Tendonytis All the above simultaneously	 26 49 44 36 15	 35% 65% 59% 48% 20%



Graph 1, 2

by two experienced radiologists. Imaging findings were recorded based on the location of the affected joint and included bone, joint and soft tissue involvement. Bone lesions included bone oedema and cysts, joint lesions included erosions, synovitis, enthesitis and tendonitis of flexor tendons and soft tissue lesions referred to sausage digit morphology.

We assessed small joints of hand and foot including metacarpophalangeal /metatarsophalangeal (MCP/MTP joints), proximal and distal interphalangeal joints (PIP and DIP joints), with emphasis on distal joints accepting that this is the anatomic location primarily affected in psoriatic arthritis of the peripheral skeleton.

Statistical Analysis

Characteristics of male and female patients were presented by frequency distribution based on the aforementioned categories. Analysis was performed on R statistical program, version 3.2.3. Correlation between NAPSI and PASI scores and imaging MR findings including bone and soft tissue involvement were performed using logistic regression test. A p-value <0.05 was considered statistically significant.

Results

All patients were initially evaluated clinically, with respect to the extent of cutaneous psoriatic involvement,

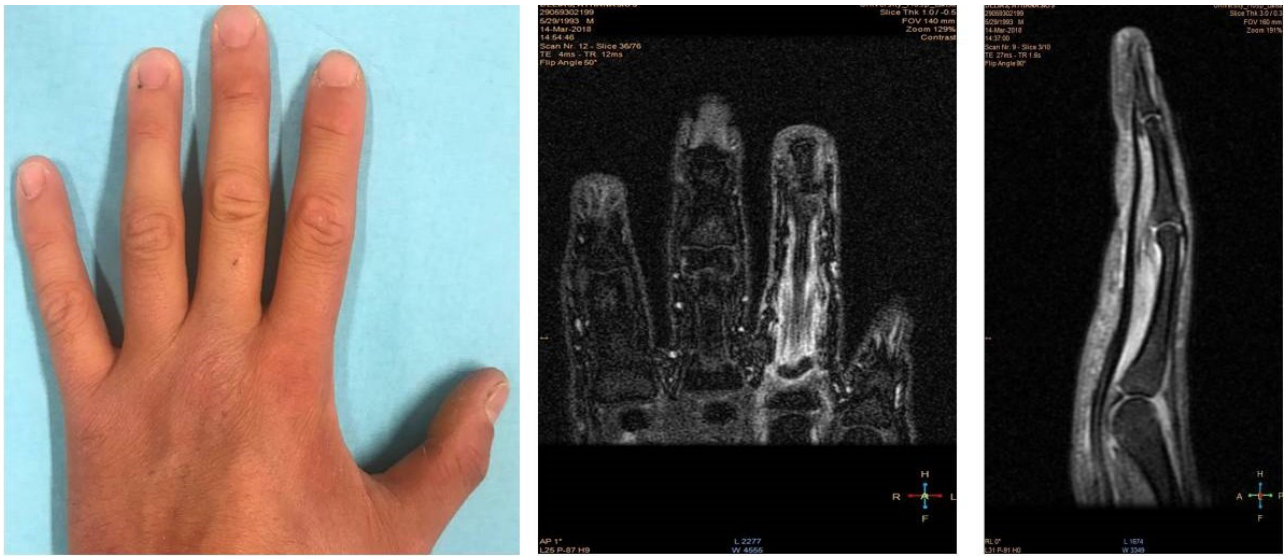


Figure 1:
A. *Nail psoriasis and minor swelling of the index finger.*
B. *MR imaging (3Tesla) of the affected hand. A 3D-SPGR sequence with fat saturation post gadolinium shows prominent enhancement of the index finger involving entheses and flexor tendons, indicative of a sausage digit.*
C. *Sagittal proton density MR image with fat saturation shows flexor tenosynovitis of the index finger.*

nail psoriasis and possible musculoskeletal symptoms. The implementation of both PASI and NAPSI score divided all patients into different categories as follows: Group 1 with PASI score <7, group 2 with PASI score 7-10 and group 3 with PASI score >7. Similarly, there was Group 1 with NAPSI score <40, group 2 with NAPSI score 40-80, group 3 with NAPSI score 80-120 and group 4 with NAPSI score 120-160 (table 3).

The detailed record of involvement per patient determined the extent of bone oedema, cysts, erosions, synovitis, enthesitis, flexor tendonitis in each level of MCP/MTP, PIP and DIP joint. The presence of a sausage digit has also been recorded.

According to our data analysis, bone oedema was found in 41% of our patients (31 patients), cysts were found in 9% corresponding to seven patients. Both bone radiological findings were recorded to 7% corresponding to five patients. In soft tissue imaging findings we included mostly the sausage digit and six patients were recorded with this abnormal finding. In the last radiological finding category concerned the joints, erosions were recorded in 26 patients (35%), synovitis in 49 (65%), enthesitis in 44 patients (59%), tendonitis in 36 patients corresponding to 48% of total patients and all the above simultaneously in 15 patients corresponding to 20% of all patients. The MRI was normal without findings in 21 patients (28%). Almost half of the patients of our study group (53%) complained for musculoskeletal symptoms (Graph 1, 2).

The imaging findings of all joints per level of the hand and foot was collapsed and was correlated with each group of the score categories separately.

A statistically significant correlation was found between group 4 with NAPSI score 120-160 and overall imaging findings of either hand (p – 0.03) or foot (p=0.04). The correlation between distinct imaging findings such as synovitis, tendonitis, enthesitis and erosions and various groups found to be not statistically significant.

Discussion

This study assessed the prevalence of imaging findings in favor of early PsA in patients attending a dermatological center for plaque psoriasis or nail psoriasis. A relatively high percentage of our study group exhibited early musculoskeletal manifestations indicative of PsA, up to 72% namely 54/75 patients. This percentage shows an important prevalence especially taking into account that the patients presenting vague musculoskeletal symptoms and complaints such as pain, stiffness and swelling were the half of our sample (37 patients). The most prevalent inflammatory MRI lesion was synovitis which was present

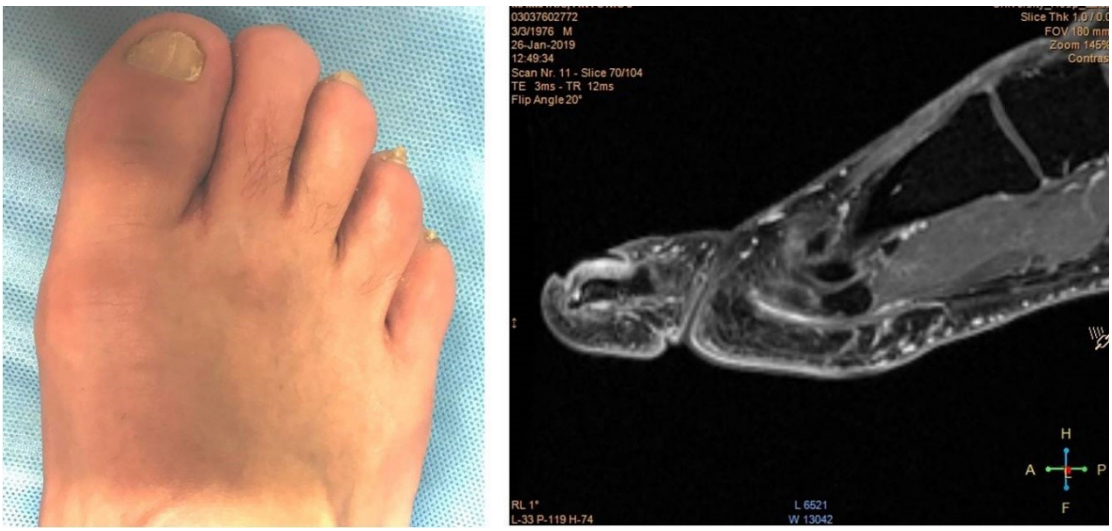


Figure 2:
A. *Nail psoriasis of the right foot.*
B. *MR imaging (3Tesla) of the affected foot. A 3D-SPGR sequence with fat saturation post gadolinium shows clearly the enhancing bed of the psoriatric nail and surrounding oedema of the corresponding phalanx.*

in 65% of the patients. Moreover, all patients with positive inflammatory findings were suffering from nail psoriasis and were associated with a high NAPSI score. These findings are in keeping with Faustini et al, who reported that in a cohort study of 85 patients with psoriasis and negative clinical assessment for PsA, imaging investigation demonstrated evidence of early PsA in up to 47% [8]. A number of publications demonstrate similar subclinical involvement of peripheral joint disease in patients with psoriasis [9-12].

Back in 2005 Scarpa et al, reported that in patients with PsA, MR imaging investigation of the distal interphalangeal joint revealed nail involvement even in cases without clinical onychopathy. [13]. McGonagle et al described that nail, scalp, and intergluteal skin involvement are negative prognostic factor for cutaneous disease and are often predictors of Psoriatic Arthritis (PsA) evolution [3]. Wilson et al in their retrospective, study of 1593 people, described features of psoriasis such as location and more specifically scalp, nail and intergluteal/perianal area as predictors of PsA. In the same cohort, it was underlined that patients with nail psoriasis were 3 times more susceptible to developing PsA. Moreover, the risk of PsA was higher in patients with ≥3 affected sites meaning a more extensive disease and a higher PASI score. [4, 6]. These findings are in keeping with our results indicative of relatively increased incidence of subclinical PsA.

Langenbruch et al, during their retrospective analysis of data from three independent national cross-sectional studies on health care in psoriasis and PsA with a total study population of 4146 patients confirmed that the most important predictor factor remains nail psoriasis. On the contrary, in their study scalp psoriasis was a less significant predictor factor of PsA. [14]. Eder et al in 2016, during their large prospective single-center cohort study, involving patients suffering from psoriasis who were screened annually for arthritis, confirmed that nail involvement of the disease and the extensive cutaneous psoriasis are important risks for PsA [1].

The well-established association, that was been documented by many large studies, between nail psoriasis and enthesopathy is explained by the anatomical proximity between the extensor tendon of the distal phalanx and the nail matrix. [15]. Enthesitis precedes joint inflammation and explains why nail psoriasis precedes PsA. [16-18]. However, in our findings, synovitis was slightly higher compared to enthesitis in MRI studies of our study group, with percentages up to 65% and 59%, respectively.

Interestingly, Faustini et al. in 2016 in their cross-sectional and longitudinal analysis about subclinical joint inflammation in patients with psoriasis, showed no important correlation between the MRI findings and the localization (nail or scalp psoriasis)

of the disease. Our findings indicate a positive correlation between subclinical joint inflammation and the extend of the disease, including nail involvement [8]

Early detection of PsA and subsequent early treatment will prevent irreversible damages of joints and improve the quality of life in patients with psoriasis. The role of dermatologists is crucial towards this direction. MRI is a useful tool with important diagnostic role for detection of early PsA of the peripheral skeleton [19, 20], although the cost of the exam is relatively high and availability of the modality may be limited. A close collaboration between dermatologists and radiologists could be of great importance for the benefit of the patient. The implementation of MRI imaging in selected patients, namely with extensive cutaneous disease and nail involvement, may contribute to early detection of musculoskeletal findings and thus allow the dermatologist to choose the proper treatment and inhibit the evolution towards psoriatic arthritis. **R**

References

1. Eder, L., et al., *The Incidence and Risk Factors for Psoriatic Arthritis in Patients With Psoriasis: A Prospective Cohort Study.* Arthritis Rheumatol, 2016. 68(4): p. 915-23.
2. Gottlieb, A.B. and J.F. Merola, *Axial psoriatic arthritis: An update for dermatologists.* J Am Acad Dermatol, 2021. 84(1): p. 92-101.
3. McGonagle, D., *Enthesitis: an autoinflammatory lesion linking nail and joint involvement in psoriatic disease.* J Eur Acad Dermatol Venereol, 2009. 23 Suppl 1: p. 9-13.
4. Wilson, F.C., et al., *Incidence and clinical predictors of psoriatic arthritis in patients with psoriasis: a population-based study.* Arthritis Rheum, 2009. 61(2): p. 233-9.
5. Belinchon, I., et al., *Dermatologists' Role in the Early Diagnosis of Psoriatic Arthritis: Expert Recommendations.* Actas Dermosifiliogr (Engl Ed), 2020. 111(10): p. 835-846.
6. Kaeley, G.S., et al., *Nail Psoriasis: Diagnosis, Assessment, Treatment Options, and Unmet Clinical Needs.* J Rheumatol, 2021. 48(8): p. 1208-1220.
7. Gottlieb, A. and J.F. Merola, *Psoriatic arthritis for dermatologists.* J Dermatolog Treat, 2020. 31(7): p. 662-679.
8. Faustini, F., et al., *Subclinical joint inflammation in patients with psoriasis without concomitant psoriatic arthritis: a cross-sectional and longitudinal analysis.* Ann Rheum Dis, 2016. 75(12): p. 2068-2074.
9. Erdem, C.Z., et al., *MR imaging features of foot involvement in patients with psoriasis.* Eur J Radiol, 2008. **67**(3): p. 521-5.
10. Egeberg, A., et al., *Incidence and prevalence of psoriatic arthritis in Denmark: a nationwide register linkage study.* Ann Rheum Dis, 2017. 76(9): p. 1591-1597.
11. Hayashi, M., et al., *Superiority of magnetic resonance imaging over conventional radiography in the early diagnosis of psoriatic arthritis.* J Dermatol, 2017. 44(10): p. e232-e233.
12. Spira, D., et al., *MRI findings in psoriatic arthritis of the hands.* AJR Am J Roentgenol, 2010. 195(5): p. 1187-93.
13. Scarpa, R., et al., *Nail and distal interphalangeal joint in psoriatic arthritis.* J Rheumatol, 2006. 33(7): p. 1315-9.
14. Langenbruch, A., et al., *Nail involvement as a predictor of concomitant psoriatic arthritis in patients with psoriasis.* Br J Dermatol, 2014. 171(5): p. 1123-8.
15. Raposo, I. and T. Torres, *Nail psoriasis as a predictor of the development of psoriatic arthritis.* Actas Dermosifiliogr, 2015. 106(6): p. 452-7.
16. Pennington, S.R. and O. FitzGerald, *Early Origins of Psoriatic Arthritis: Clinical, Genetic and Molecular Biomarkers of Progression From Psoriasis to Psoriatic Arthritis.* Front Med (Lausanne), 2021. 8: p. 723944.
17. Ventura, A., et al., *New insight into the pathogenesis of nail psoriasis and overview of treatment strategies.* Drug Des Devel Ther, 2017. 11: p. 2527-2535.
18. Ash, Z.R., et al., *Psoriasis patients with nail disease have a greater magnitude of underlying systemic subclinical enthesopathy than those with normal nails.* Ann Rheum Dis, 2012. 71(4): p. 553-6.
19. Mathew, A.J., et al., *Psoriatic arthritis: lessons from imaging studies and implications for therapy.* Expert Rev Clin Immunol, 2017. 13(2): p. 133-142.
20. Coates, L.C. and P.S. Helliwell, *Psoriatic arthritis: state of the art review.* Clin Med (Lond), 2017. 17(1): p. 65-70.

Ready - Made Citation

Alifakioti D, Zafiriou E, Roussaki-Schulze A, Vassiou K, Thriskos P, Vlychou M. Early musculoskeletal MRI findings in a cohort of patients with psoriasis in central Greece. *Hell J Radiol* 2022; 7(2): 8-14.