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RESEARCH ARTICLE

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The joint ultrasound markers in the early diagnosis of psoriatic arthritis

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ABSTRACT

Objectives. Early establishment of arthritis in PsA based on clinical data and ultrasound examination.

Material and methods. The study was conducted between 2019-2023, in the rheumatology and arthrology departments of the *Timofei Moșneaga* Republican Clinical Hospital, or treated in outpatient. In order to meet the requirements of the study, 100 people were examined, including 70 patients with PsA.

Results. In patients with PsA the most common changes were an increase in the amount of intra-articular fluid and the proliferation of the synovial membrane. In total, fluid was detected in 293 out of 3,232 joints (9.1%).

Conclusions. Ultrasound is a highly informative method in detecting a wide range of morphological changes in the joints of patients with PsA. The highest index of sensitivity appeared when inflammatory fluid, cartilage changes, osteophytes and tenosynovitis were detected.

Keywords: psoriatic arthritis, early diagnosis, joint ultrasonography.

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Key messages

What is not yet known on the issue addressed in the submitted manuscript

It is especially interesting to determine the early diagnosis of psoriatic arthritis (PsA) based on clinical data and by ultrasonographic research.

The research hypothesis.

This article aims to present the interrelation between early manifestations in PsA and ultrasound diagnosis.

The novelty added by manuscript to the already published scientific literature.

For the first time, the possibilities of ultrasound in the differential diagnosis of PsA and RA as a disease, which is based on proliferative changes in the synovial membrane, are grounded.

Introduction

Psoriatic arthritis (PsA) is one of the most important diseases of great medical and social importance, due to its progressive and significant takeover, which can lead to early disability. The prevalence of psoriatic arthritis is evidenced in the age range of 20-50 years, and both sexes are equally affected. PsA usually has a violent progression with osteo-articular mutilation.

The diagnostic challenges in early PsA are not limited to the heterogeneity of the disease, which stands out from the variety of measures available for the outcome [1]. Unlike RA, there are no biomarkers such as cyclic citrulline anti-peptide antibodies or rheumatoid factor (RF) to identify early PsA, and therefore the diagnosis depends on the identification of specific clinical characteristics. In addition, the increase in acute phase markers such as C-reactive protein (CRP) occurs only in up to half of patients and therefore has a limited value in early PsA [2]. Finally, the absence of skin psoriasis in the presence of arthritis can lead to a label of undifferentiated arthritis. Reflecting these deficiencies, imaging has been increasingly used for PsA evaluation and therapy [3].

Common symptoms of inflammatory arthritis may include swelling of the joints, hyperemia, prolong morning stiffness (0.5-1 hours) and X-ray evidence of bone damage in juxta-articular [4, 5]. The number and type of joints involved (for example, small vs. large) and their appearance (e.g. symmetrical vs. asymmetrical) can also be similar between arthritis [6-8]. In addition, unique manifestations of the disease, such as enthesitis and dactylitis, can be difficult to detect clinically [9]. Moreover, serologies can fail to conclusively differentiate these diseases, and the increase in acute phase reactants is nonspecific [10-13].

In early disease and in patients with milder symptoms, in whom the clinical findings are not definitive, imaging is necessary to accurately differentiate the types of inflammatory arthritis. The recommendations of the European League Against Rheumatism (EULAR) for the management of early arthritis are guided by a general principle that *"a definitive diagnosis in a patient with early arthritis should be made only after a careful anamnesis and a comprehensive clinical examination, which should guide laboratory tests and additional instrumental procedures"* [14].

USG has various advantages, including higher accessibility, low overhead costs, lack of contraindications and its availability in the clinic. The criteria obtained for the ultrasound diagnosis of joint lesions in PsA will contribute to the timely and effective diagnosis of the disease, and therefore to the importance of adequate therapy. The use of Doppler techniques will allow to evaluate the activity of arthritis, as well as to monitor therapy with basic drugs.

Material and methods

One hundred people were examined, including 70 patients with PsA aged between 18 and 60 years, of which 23 men and 47 women who were undergoing treatment, admitted to the rheumatology and arthrology departments of *Timofei Moşneaga* Republican Clinical Hospital or treated in outpatient during 2019-2023 (favorable opinion of the Com-

mittee for Research Ethics at no.21 of 21.12.2019). The comparison group included 30 people with rheumatoid arthritis.

The patient was considered included in the study after signing the informed consent form and all of them were corresponded to including criteria: CASPAR diagnostic criteria (2006). There were 28 patients with polyarticular form of PsA (40.0%) and 29 with mono-, oligoarthritis (41.4%), which presented with the same frequency. In 18.6% (n = 13) of the observations, damage to the distal joints of the hands and plants was detected. Mostly were appreciated minimal (n=31; 44.3%) and average (n=24; 34.3%) disease activity. Patients with a high disease activity (n=12; 17.1%) and patients in remission (n=3; 4.3%) were in a few numbers.

The reference group consisted of 30 patients with rheumatoid arthritis aged 27 to 63 years (average age 45±12.3 years) with disease evolution from 6 months to 32 years (average 12±5.4 years). Patients in both groups were comparable by age and evolution of the disease. All patients underwent ultrasound Power Doppler examination of the knee joints and the joints of the hands and plants (n=2320).

The analysis of the obtained results was carried out using standard statistical methods (Mann-Whitney criterion, criterion X^2 , Fisher criterion). The differences were considered significant at $p < 0.05$.

Results

Ultrasound examination was the main method in the complex diagnosis of PsA. The results of the study demonstrated that in patients with PsA, damage to all anatomical structures of the joint with polymorphism of the ultrasound pattern is detected.

The most common changes in the joints in patients with PsA were an increase in the amount of intra-articular fluid and the proliferation of the synovial membrane. The appearance of fluid in the joints occurred in the overwhelming number of patients (n = 63.90%) and only in 10% (n = 7) of the observations there was no inflammatory liquid. In total, fluid was detected in 293 out of 3,232 joints (9.1%). Among the knee joints in which there was an increase in the amount of intraarticular fluid (n = 79; 100%), in 48.8% (n = 37) of the observations were joints with a small amount of fluid (gradation 1). In a smaller number, the amount of liquid corresponding to grade 2 (n = 24; 30.4%) and grade 3 (n = 18; 20.8%) were observed. In the radiocarpal joints, the maximum thickness of the liquid in the joints was 6 mm, in the ankle joints – 8 mm. The maximum thickness of the fluid in small joints was 2 mm. In our study, homogeneous effusion into the joint cavity prevailed (n=201; 68.6%). The heterogeneity of the structure (n=92; 31,4%) was due to the appearance of partitions, suspensions or hyperechogene solid inclusions against the background of anechogenic contents.

Magnetic resonance imaging was the second method of investigation in the complex diagnosis of PsA and was used as a reference method. In the study group, fluid was the predominant symptom in frequency (n = 13, 92.86%), including in the small joints of the hands and legs. Syno-

vial proliferation was the second most common sign of damage to the knee joint (n = 10; 71.43%) and was detected in 3.6% of the foot joints and 7.1% of the joints of the hands. The signal intensity of the synovial layer in the overwhelming number of observations was in the isointensive liquid T1, in T2 - medium intensity and slightly above the liquid - in FSat mode. In one of the observations, when the synovial membrane was not vascularized according to ultrasound data, its intensity in T1 and in FSat was significantly lower than the signal from the liquid and practically merged with the surrounding tissues. In this case, the synovial membrane is visualized in T2 and FSat due to a low-intensity border that separates the synovium from the fluid on the one hand and from the surrounding tissues on the other.

In our study, erosions were detected in 3 joints and localized in the condyles of the femoral and tibial bones and in the ends of the metatarsal bones II and III of all surfaces. The changes in cartilage consisted of its thinning and structural changes and were observed in 28.57% of cases (n = 4). In one observation, fragmentation of cartilage occurred, in the other, changes in the type of cracking were revealed, falling into the manifestations of chondromalacia.

As MRI was chosen as the reference method for correctly evaluating the diagnostic efficacy of ultrasonography in detecting existing changes, MRI results obtained in 15 patients in 56 joints were compared with ultrasound data of the same patients (Table 1).

Table 1. Comparison of signs, viewed at USG PD and MRI, in 16 patients

Symptom	Number of joints with detected changes		p
	USG PD	MRI	
Liquid	16 (28.6%)	16 (28,6%)	>0.05
Proliferation of synovial membrane	11 (19.6%)	12 (24.1%)	<0.05
Cartilage changing	4 (7.1%)	4 (7.1%)	>0.05
Bone erosions	2 (3.5%)	4 (7.1%)	<0.05
Osteophytes	7 (12.5%)	7 (12.5%)	>0.05
Degenerative changes in tendons	6 (42.9%)	7 (50%)	<0.05
Tenosynovitis	3 (5.4%)	3 (5.4%)	>0.05

Note: USG PD - UltraSonoGraphy Power Doppler, MRI - Magnetic Resonance Imaging, p - criteria t-Student

Over our study evolution, ultrasonography and clinical and laboratory activity data were compared for all joints as a whole. The results of correlation analysis show a positive correlation between the severity of ultrasound symptoms of synovitis and the level of clinical and laboratory markers of inflammation. At the same time, the ultrasound symptom, which mostly correlates with the level of local activity, is the degree of vascularization of the synovial membrane, which appeared both in the large joints (r = 0.508) and in the small ones (r = 0.500). The strongest correlation is observed between the amount of fluid (r = 0.401) and degree of vascularization of the synovial membrane in the knee (r = 0.508), small joints (r = 0.500) and the level of ESR, CRP and leukocytosis. A weaker correlation is observed between the level of laboratory markers and the thickness of the synovial membrane (r = 0.383).

Discussions

Thus, psoriatic and rheumatoid arthritis are similar in morphology and clinical evolution of disease. When comparing the frequency of occurrence of distinctive signs at USG PD of damage to the knee and small joints, depending on the nosological affiliation, the following results were obtained by us and the same results had been presented by literature data [3, 6, 7, 14]. In the group of patients with PsA, enthesopathy and enthesitis of their own patellar ligaments and tendons of the femoral quadriceps were detected significantly more often, then in case of RA.

Data from the literature, as well as our study, determine that the lesion of the small joints of the hands and plants is characterized primarily by diffuse proliferation of the synovial membrane, mainly with low echogenicity (p = 0.0001), which in 92% of cases is accompanied by a homogeneous effusion (p = 0.005). Changes in the ligamentar apparatus in all observations are represented by tenosynovitis. From the literature data it is known that the low echogenicity of the synovial membrane is due to its edema against the background of active inflammation, and this pattern was reflected in the clinical picture of the lesion of the small joints of the hands and plants in our study too [4, 6, 8, 10]. It remains unclear the frequent detection of the synovial membrane, mainly with high echogenicity, in the knee joints, independent of the activity of the disease. Perhaps this fact is due to the earlier fibrosis of the synovial membrane in this localization [1, 3, 13].

Remain unclear the differences between PsA and RA expresses' in small joints: the examination of small joints in patients from PsA group, inflammatory fluid was detected more often than in patients from RA group (p = 0.009) [4, 5, 11]. But patients with RA, a feature of the visual picture was more frequent detection of proliferative changes in the synovial membrane in both the knee joints (p = 0.03) and in the small ones (p = 0.001), compared to PsA, this fact was marked by other authors [6, 8]. Statistically there were no significant differences in the frequency of detection of inflammatory fluid in the knee joints, tenosynovitis, the nature of joint effusion and changes in cartilage structure in patients with PsA and RA.

As in other studies, the analysis depending on the lasting changes in the disease detected by USG PD demonstrated that marginal bone growths are just as often detected in a group of patients with the duration of the disease more than 10 years, regardless of nosology [3, 7, 12]. Thus, the study carried out showed the effectiveness of the ultrasonographic method in detecting morphological changes in the joints in patients with PsA, determining the activity and evaluating the results of treatment.

Conclusions

1. Ultrasound is a highly informative method in detecting a wide range of morphological changes in the joints of patients with PsA. The highest sensitivity markers occurred when inflammatory fluid, cartilage changes, osteophytes and tenosynovitis were detected. Less sensitivity markers were achieved in the

detection of synovial membrane proliferation, enthesopathy, the slightest sensitivity was observed in the visualization of marginal bone erosions. At the same time, the markers of specificity were equally high.

2. In large joints, the proliferation of the synovial membrane was detected in a half of the joints and had predominantly high echogenicity, as well as accompanied by intraarticular overflow in all observations and may be considered an important marker for PsA. In small joints, synovial proliferation with predominantly low echogenicity occurred only in several numbers of the joints, due to their rarer lesion, and was combined with an increase in intraarticular fluid in majority of cases. The injury of the tendon-ligament apparatus in the PsA included enthesopathy in the knee joints, tenosynovitis in the ankle, radiocarpal joints and in the small joints of the hands and plants.
3. Ultrasound criteria as a marker of diagnosis of PsA were: the degree of severity of synovitis, as well as the presence of tenosynovitis and enthesitis. The strongest correlation was obtained between the activity of inflammation and vascularization of the synovial membrane ($r = 0.591$) and tenosynovitis ($r = 0.547$), as well as between the levels of ESR, CRP and leukocytes, the amount of inflammatory fluid ($r = 0.401$) and the degree of vascularization of the synovial membrane ($r = 0.508$).
4. The significant differences between PsA and RA were the presence of enthesopathies of the ligaments themselves of the patellar tendon and the quadriceps tendon of the femoral and the predominance of intraarticular overflow in small joints.

Abbreviations:

CRP – C-reactive protein; PsA – Psoriatic Arthritis; RA – Rheumatoid Arthritis; RF – Rheumatoid Factor; USG PD – UltraSonoGraphy Power-Doppler; MRI – Magnetic Resonance Imaging

Competing interests

None declared

Authors' contribution

Study conception and design: ER. Data acquisition: AS, LG. Analysis and interpretation of data: ER, AS, LG, MH, VS. Drafting of the manuscript: AS, MH, VS, ER. Significant manuscript review with significant intellectual involvement: ER. Approval of the „ready for print” version of the manuscript: ER, AS, LG, MH, VS.

References

1. Gladman DD, Antoni C, Mease P, Clegg DO, Nash P. Psoriatic arthritis: epidemiology, clinical features, course, and outcome. *Ann Rheum Dis.* 2005;64(Suppl 2):ii14-7. doi: 10.1136/ard.2004.032482.
2. Bogliolo L, Crepaldi G, Caporali R. Biomarkers and prognostic stratification in psoriatic arthritis. *Reumatismo.* 2012;64(2):88-98. doi: 10.4081/reumatismo.2012.88.
3. Wiell C, Szkudlarek M, Hasselquist M, Møller JM, Vestergaard A, Nørregaard J, et al. Ultrasonography, magnetic resonance imaging, radiography, and clinical assessment of inflammatory and destructive changes in fingers and toes of patients with psoriatic arthritis. *Arthritis Res Ther.* 2007;9(6):1-13. doi: 10.1186/ar2327.
4. Gutierrez M, Filippucci E, Salaffi F, Di Geso L, Grassi W. Differential diagnosis between rheumatoid arthritis and psoriatic arthritis: the value of ultrasound findings at metacarpophalangeal joints level. *Ann Rheum Dis.* 2011;70(6):1111-4. doi: 10.1136/ard.2010.147272.
5. Tang Y, Yang Y, Xiang X, Wang L, Zhang L, Qiu L. Power doppler ultrasound evaluation of peripheral joint, entheses, tendon, and bursa abnormalities in psoriatic patients: a clinical study. *J Rheumatol.* 2018;45(6):811-7. doi: 10.3899/jrheum.170765.
6. Zuliani F, Zabotti A, Errichetti E, Tinazzi I, Zanetti A, Carrara G, et al. Ultrasonographic detection of subclinical enthesitis and synovitis: a possible stratification of psoriatic patients without clinical musculoskeletal involvement. *Clin Exp Rheumatol.* 2019;37(4):593-9.
7. Elnady B, El Shaarawy NK, Dawoud NM, Elkhoully T, Desouky DES, ElShafey EN, et al. Subclinical synovitis and enthesitis in psoriasis patients and controls by ultrasonography in Saudi Arabia; incidence of psoriatic arthritis during two years. *Clin Rheumatol.* 2019;38(6):1627-35. doi: 10.1007/s10067-019-04445-0.
8. Ruta S, Marin J, Felquer MLA, Ferreyra-Garrot L, Rosa J, García-Monaco R, et al. Utility of power doppler ultrasound-detected synovitis for the prediction of short-term flare in psoriatic patients with arthritis in clinical remission. *J Rheumatol.* 2017;44(7):1018-23. doi: 10.3899/jrheum.161347.
9. Benjamin M, McGonagle D. The enthesis organ concept and its relevance to the spondyloarthropathies. *Adv Exp Med Biol.* 2009;649:57-70. doi: 10.1007/978-1-4419-0298-6_4.
10. Zabotti A, Errichetti E, Zuliani F, Quartuccio L, Sacco S, Stinco G, et al. Early psoriatic arthritis versus early seronegative rheumatoid arthritis: role of dermoscopy combined with ultrasonography for differential diagnosis. *J Rheumatol.* 2018;45(5):648-54. doi: 10.3899/jrheum.170962.
11. Tinazzi I, McGonagle D, Zabotti A, Chessa D, Marchetta A, Macchioni P. Comprehensive evaluation of finger flexor tendon enthesal soft tissue and bone changes by ultrasound can differentiate psoriatic arthritis and rheumatoid arthritis. *Clin Exp Rheumatol.* 2018;36(5):785-90.
12. Tinazzi I, McGonagle D, Aydin SZ, Chessa D, Marchetta A, Macchioni P. "Deep Koebner" phenomenon of the flexor tendon-associated accessory pulleys as a novel factor in tenosynovitis and dactylitis in psoriatic arthritis. *Ann Rheum Dis.* 2018;77(6):922-5. doi: 10.1136/annrheumdis-2017-212681.
13. Zabotti A, Piga M, Canzoni M, Sakellariou G, Iagnocco A, Scirè CA, et al. Ultrasonography in psoriatic arthritis: which sites should we scan? *Ann Rheum Dis.* 2018;77(10):1537-8. doi: 10.1136/annrheumdis-2018-213025.
14. Tang Y, Cheng S, Yang Y, Xiang X, Wang L, Zhang L, et al. Ultrasound assessment in psoriatic arthritis (PsA) and psoriasis vulgaris (non-PsA): which sites are most commonly involved and what features are more important in PsA? *Quant Imaging Med Surg.* 2020;10(1):86-95. doi: 10.21037/qims.2019.08.09.