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EARLY DETECTION OF PSORIATIC ARTRITIS:AN INTEGRATED ARTIFICIAL INTELLIGENCE-BASED DIAGNOSTIC MODEL FOR PRECLINICAL IDENTIFICATION

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Annotation: Psoriatic arthritis (PsA) is a chronic inflammatory condition that frequently develops in patients with psoriasis, affecting approximately 20–30% of individuals with skin disease. Delayed diagnosis often leads to irreversible joint damage, functional impairment, and reduced quality of life. Early

identification is critical to prevent progression, achieve remission, and improve long-term outcomes. Recent advancements from 2025–2026, including refined screening tools, advanced imaging modalities, and ongoing biomarker research, have significantly enhanced diagnostic precision and enabled earlier intervention. Delayed diagnosis leads to irreversible joint damage, disability, and reduced quality of life. Early detection remains challenging due to heterogeneous clinical presentation and lack of highly specific biomarkers.

Keywords. Psoriatic arthritis, PsA, early detection, early diagnosis, subclinical PsA, preclinical PsA, PEST (Psoriasis Epidemiology Screening Tool), PASE (Psoriatic Arthritis Screening and Evaluation).

PSORIAZLI ARTRITNI ERTA ANIQLASH: DOKLINIK BOSQICHDA ANIQLASH UCHUN SUN'IY INTELLEKT ASOSIDAGI INTEGRATSIYALASHGAN DIAGNOSTIK MODEL

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Annotatsiya: Psoriazli artrit (PsA) — surunkali yallig‘lanish kasalligi bo‘lib, u ko‘pincha psoriaz bilan og‘rigan bemorlarda rivojlanadi va teri kasalligi mavjud bo‘lgan shaxslarning taxminan 20–30% ini qamrab oladi. Kechikkan tashxis qo‘yilishi ko‘pincha bo‘g‘imlarning qaytmas shikastlanishiga, funksional cheklanishlarga va hayot sifatining pasayishiga olib keladi. Erta aniqlash kasallik rivojlanishini oldini olish, remissiyaga erishish va uzoq muddatli natijalarni yaxshilash uchun muhim ahamiyatga ega.

2025–2026 yillardagi so‘nggi yutuqlar, jumladan takomillashtirilgan skrining vositalari, ilg‘or tasvirlash usullari va biomarkerlar bo‘yicha tadqiqotlar diagnostika aniqligini sezilarli darajada oshirdi hamda erta aralashuv imkonini yaratdi. Shunga qaramay, klinik ko‘rinishlarning xilma-xilligi va yuqori spetsifik biomarkerlarning yetishmasligi sababli erta tashxis qo‘yish hanuz murakkab hisoblanadi.

Kalit so‘zlar: psoriazli artrit, PsA, erta aniqlash, erta tashxis, subklinik PsA, doklinik PsA, PEST, PASE.

РАННЯЯ ДИАГНОСТИКА ПСОРИАТИЧЕСКОГО АРТРИТА: ИНТЕГРИРОВАННАЯ ДИАГНОСТИЧЕСКАЯ МОДЕЛЬ НА ОСНОВЕ ИСКУССТВЕННОГО ИНТЕЛЛЕКТА ДЛЯ ДОКЛИНИЧЕСКОГО ВЫЯВЛЕНИЯ

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Аннотация: Псориатический артрит (ПсА) — хроническое воспалительное заболевание, часто развивающееся у пациентов с псориазом и поражающее примерно 20–30% лиц с кожными проявлениями. Запоздалая диагностика нередко приводит к необратимому повреждению суставов, функциональным нарушениям и снижению качества жизни. Раннее выявление имеет решающееезначение для предотвращения прогрессирования заболевания, достижения ремиссии и улучшения долгосрочных результатов лечения.

Последние достижения 2025–2026 годов, включая усовершенствованные скрининговые инструменты, современные методы визуализации и активные исследования биомаркеров, значительно повысили точность диагностики и позволили проводить более раннее вмешательство. Тем не менее ранняя диагностика остаётся сложной задачей из-за гетерогенности клинических проявлений и отсутствия высокоспецифичных биомаркеров.

Ключевые слова: псориатический артрит, ПсА, раннее выявление, ранняя диагностика, субклинический ПсА, доклинический ПсА, PEST (инструмент скрининга эпидемиологии псориаза), PASE (оценка и скрининг псориатического артрита).

Introduction. Current challenges include the absence of a single definitive biomarker and reliance on clinical features that may emerge late. Validated screening tools such as PEST, PASE, and EARP questionnaires identify high-risk psoriasis patients for rheumatology referral, with independent predictors including prior joint swelling (OR 5.8), arthralgia history (OR 3.5), dactylitis-like finger/toe swelling (OR 2.7), nail involvement (OR 1.9), hyperlipidemia, and prolonged topical corticosteroid use. Recent expert consensus (e.g., 2025 Chinese edition and international Delphi processes) defines phased progression: at-risk individuals (genetic/clinical factors without symptoms), subclinical inflammation (imaging-detected

without clinical signs), and very early PsA (musculoskeletal symptoms plus imaging abnormalities).

Clinical charecteristics. Peripheral Arthritis: The most common presentation (≈86–90% of cases), often asymmetric and oligo- or polyarticular. Small joints of hands/feet are frequently involved, with distal interphalangeal (DIP) joint predominance as a hallmark feature distinguishing PsA from rheumatoid arthritis (RA). Proximal interphalangeal, metacarpophalangeal, wrists, knees, ankles, and hips may also be affected. Onset can mimic gout-like acute episodes or evolve patterns over time.

Enthesitis: Inflammation at tendon/ligament insertions into bone, present in ≈30–50% of patients and often the initial symptom (e.g., heel pain/Achilles enthesitis in one-third of cases). It is a key domain in multidomain disease and more prevalent in difficult-to-treat (D2T) or complex-to-manage PsA.

Dactylitis ("sausage digits"): Swelling of an entire digit due to joint, tendon, and soft-tissue inflammation; occurs in 45–50% of patients, most commonly in toes (2nd–4th). It is one of the most distinctive and striking features of PsA.

Axial Involvement: Sacroiliitis and/or spondylitis in 25–50% of cases, often asymmetric/unilateral and coexisting with peripheral disease (isolated axial in 2–4%). Features include lower back pain (initial symptom in 5–28%), non-marginal bulky syndesmophytes, and atypical skipping vertebral involvement, differing from ankylosing spondylitis.

Other Patterns: Arthritis mutilans (severe destructive form with telescoping digits, rare but characteristic); pencil-in-cup deformities on imaging; relative lack of periarticular osteoporosis compared to RA.

Reduction in diagnostic delay Prevention of erosive joint damage

Cost-effective targeted biologic initiation

Personalized rheumatology-dermatology collaboration model

Diagnostic Criteria. Psoriatic arthritis (PsA) is classified primarily using the Classification Criteria for Psoriatic Arthritis (CASPAR), developed in 2006 by an international collaborative group and remains the gold standard in 2026. These criteria are classification tools designed for research and clinical studies but are widely applied in practice to support diagnosis, especially when distinguishing PsA from other inflammatory arthritides like rheumatoid arthritis (RA). No new standalone classification criteria have replaced CASPAR as of February 2026; recent literature (including 2025–2026 publications from EULAR, GRAPPA, and expert consensuses) continues to reference CASPAR as the primary framework for confirming clinical PsA, particularly in established disease.

This study proposes:

1. A triple-layer diagnostic system (clinical + molecular + imaging).
2. AI-based predictive modeling rather than static classification criteria.
3. Preclinical detection before radiographic damage.
4. Personalized preventive intervention strategy.

Unlike conventional CASPAR-based diagnosis, this model aims at disease prediction rather than confirmation.

Step 1: Screen psoriasis patients annually using clinical risk score. Step 2: Moderate/high-risk patients undergo biomarker panel testing. Step 3: If CII elevated → perform MSUS.

Step 4: AI model integrates data and provides predictive risk percentage.

Step 5: High-risk patients receive early targeted therapy (IL-17 or IL-23 inhibitors).

1. Clinical Risk Assessment

Nail psoriasis

Scalp involvement

Obesity (BMI >30)

Family history of PsA

Arthralgia questionnaire (PEST screening tool)

2. Serum Biomarker Panel
IL-17
IL-23
TNF-α
CXCL10
Matrix metalloproteinase-3 (MMP-3)
High-sensitivity CRP
A composite inflammatory index (CII) was calculated.
3. Imaging Protocol
Musculoskeletal ultrasound (MSUS) with Power Doppler:
Achilles tendon
Plantar fascia
Extensor tendon insertions
MCP and PIP joints
Subclinical enthesitis defined as Doppler signal ≥ grade 1.
4. Artificial Intelligence Model
Machine learning algorithms:
Random Forest classifier
Gradient Boosting model
Neural network prediction system
Input variables:
Clinical score
Biomarker composite index
Ultrasound inflammatory score
Output:
Probability score (0–1) for future PsA development.

Prognostic factors. Psoriatic arthritis (PsA) exhibits variable disease course and outcomes, ranging from mild, oligoarticular involvement with good response to treatment to severe, erosive, multidomain disease leading to irreversible joint damage, disability, and reduced quality of life. Prognostic factors influence progression of joint damage, achievement of remission/low disease activity, treatment response, development of difficult-to-treat (D2T) or complex-to-manage (C2M) PsA, and even mortality. Recent

2025–2026 data from EULAR/ACR congresses, GRAPPA initiatives, real-world cohorts, and expert consensuses (e.g., SPEED trial, Chinese consensus, HIPPOCRATES-related insights) highlight key predictors, emphasizing early intensive therapy in high-risk patients to improve long-term prognosis. Emerging evidence indicates that enthesitis precedes synovitis in PsA pathogenesis. IL-23/IL-17 axis activation plays a central role in early inflammatory cascade. Therefore, combining cytokine profiling with Doppler ultrasound may reveal disease at a reversible stage.Artificial intelligence enhances pattern recognition and reduces subjectivity in imaging interpretation. Integration of machine learning in rheumatologic diagnostics represents a paradigm shift toward predictive medicine.

Conclusion. Early detection of psoriatic arthritis substantially reduces joint damage and enhances prognosis. Current strategies combine validated screening tools, clinical predictors, and advanced imaging—particularly MSUS and WB-MRI—for subclinical identification. Innovations from 2025–2026, including DUET ultrasound scoring, total-body PET/CT, and HIPPOCRATES biomarker efforts, promise more accurate, personalized diagnostics. Clinicians should implement routine screening in psoriasis patients and integrate imaging proactively to enable timely intervention and improved outcomes. Early detection of psoriatic arthritis requires transition from symptom-based diagnosis to predictive, biomarker-driven, AI- assisted assessment. The proposed integrated model offers a novel pathway for preclinical identification and personalized intervention, potentially transforming future PsA diagnostics.

Genomic risk stratification.
Microbiome profiling integration.

Wearable inflammation monitoring devices.
Real-time AI ultrasound automation.

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ПРОБЛЕМЫ УПРАВЛЕНИЯ СОВРЕМЕННЫМИ ИНТЕЛЛЕКТУАЛЬНЫМИ СИСТЕМАМИ

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Аннотация: В данной статье рассматриваются актуальные проблемы управления современными интеллектуальными системами, основанными на технологиях искусственного интеллекта и машинного обучения. Анализируются ключевые трудности, связанные с интерпретируемостью моделей, обеспечением надежности, безопасностью, масштабируемостью и функционированием в условиях неопределенности. Особое внимание уделяется вопросам взаимодействия человека и интеллектуальных систем, а также этическим и правовым аспектам их использования. Рассмотрены основные подходы к повышению эффективности управления такими системами и перспективы их дальнейшего развития.

Ключевые слова: интеллектуальные системы, искусственный интеллект, управление, машинное обучение, автономные системы, безопасность, интерпретируемость, адаптивные системы, неопределенность, этика ИИ.

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