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## MODERN DIAGNOSTIC STRATEGIES IN ALLERGIC VASCULITIS: APRECISION-BASED MULTI-LAYER APPROACH

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**Annotation:** Allergic vasculitis, commonly corresponding to cutaneous leukocytoclastic vasculitis, is an immune complex–mediated small-vessel inflammatory disorder characterized by heterogeneous clinical manifestations and variable systemic involvement. Despite established histopathologic criteria, early differentiation from systemic vasculitides and mimicking dermatologic conditions remains diagnostically challenging. This article proposes an innovative multi-layer diagnostic model integrating immunologic biomarkers, complement activation profiling, digital histopathology, dermatoscopic analytics, transcriptomic signatures, and artificial intelligence–based risk prediction

algorithms. The proposed framework introduces a stepwise precision-diagnostic approach aimed at increasing sensitivity in early disease stages, reducing unnecessary invasive procedures, and improving prognostic stratification. The model aligns with personalized medicine principles and translational immunodermatology.

**Keywords:** Allergic vasculitis, Leukocytoclastic vasculitis, Immune complex disease, Complement activation, Digital pathology, Artificial intelligence, Biomarkers, Precision dermatology, Prognostic stratification.

## ALLERGIK VASKULITDA ZAMONAVIY DIAGNOSTIK STRATEGIYALAR: PREZISION KO‘P QATLAMLI YONDASHUV

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**Annotatsiya:** Allergik vaskulit, ko‘pincha teri leykotsitoklastik vaskuliti bilan mos keluvchi holat bo‘lib, immun komplekslar vositasida yuzaga keladigan mayda qon tomirlarning yallig‘lanish kasalligi hisoblanadi. U turli xil klinik ko‘rinishlar va tizimli jarayonlarga turlicha jalb etilishi bilan tavsiflanadi. Gistopatologik mezonlar mavjud bo‘lishiga qaramay, uni tizimli vaskulitlar va o‘xshash dermatologik kasalliklardan erta bosqichda farqlash murakkab bo‘lib qolmoqda.

Mazkur maqolada immunologik biomarkerlar, komplement tizimi faollashuvini profillash, raqamli gistopatologiya, dermatoskopik tahlil, transkriptomik signaturalar hamda sun’iy intellekt asosidagi xavfni bashoratlash algoritmlarini integratsiya qiluvchi innovatsion ko‘p qatlamli diagnostik model taklif etiladi. Ushbu model kasallikning dastlabki bosqichlarida sezgirlikni oshirish, ortiqcha invaziv muolajalarni kamaytirish hamda prognozni aniqlash sifatini yaxshilashga qaratilgan bosqichma-bosqich prezision diagnostik yondashuvni taqdim etadi.

Model shaxsiylashtirilgan tibbiyot va translyatsion immunodermatologiya tamoyillariga mos keladi.

**Kalit so‘zlar:** allergik vaskulit, leykotsitoklastik vaskulit, immun kompleks kasallik, komplement faollashuvi, raqamli patologiya, sun’iy intellect, biomarkerlar, prezision dermatologiya, prognostik stratifikatsiya.

## СОВРЕМЕННЫЕ ДИАГНОСТИЧЕСКИЕ СТРАТЕГИИ ПРИ АЛЛЕРГИЧЕСКОМ ВАСКУЛИТЕ: ПРЕЦИЗИОННЫЙ МНОГОУРОВНЕВЫЙ ПОДХОД

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**Аннотация:** Аллергический васкулит, часто соответствующий кожному лейкоцитокластическому васкулиту, представляет собой воспалительное заболевание мелких сосудов, опосредованное иммунными комплексами, характеризующееся гетерогенными клиническими проявлениями и вариабельным системным вовлечением. Несмотря на наличие устоявшихся гистопатологических критериев, ранняя дифференциация от системных васкулитов и сходных дерматологических заболеваний остаётся диагностически сложной задачей.

В данной статье предлагается инновационная многоуровневая диагностическая модель, интегрирующая иммунологические биомаркеры, профилирование активации комплемента, цифровую гистопатологию, дерматоскопический анализ, транскриптомные сигнатуры и

алгоритмы прогнозирования риска на основе искусственного интеллекта. Предложенная структура представляет собой пошаговый прецизионный диагностический подход, направленный на повышение чувствительности на ранних стадиях заболевания, снижение необходимости инвазивных процедур и улучшение прогностической стратификации.

Модель соответствует принципам персонализированной медицины и трансляционной иммунодерматологии.

**Ключевые слова:** аллергический васкулит, лейкоцитокластический васкулит, иммунокомплексное заболевание, активация комплемента, цифровая патология, искусственный интеллект, биомаркеры, прецизионная дерматология, прогностическая стратификация.

**Introduction.** Allergic vasculitis represents a small-vessel inflammatory process driven predominantly by type III hypersensitivity mechanisms. Immune complex deposition within postcapillary venules triggers complement activation, neutrophilic infiltration, endothelial damage, and fibrinoid necrosis. Although classically considered a skin-limited disorder, up to one-third of patients may demonstrate extracutaneous involvement. Current diagnostic strategies rely on clinical presentation and histopathological confirmation according to the nomenclature established by Chapel Hill Consensus Conference. However, overlap with ANCA-associated vasculitis and other systemic inflammatory conditions complicates early diagnosis. Modern immunology and computational medicine allow transition from morphology-based recognition to multidimensional immune profiling. This article introduces an integrated diagnostic framework incorporating molecular, digital, and predictive tools.

**Clinical Characteristics.** Allergic vasculitis most commonly presents with:

Palpable purpura predominantly on lower extremities, Symmetrical distribution, Burning sensation or mild pruritus, Occasional vesicles or necrotic centers, Systemic manifestations may include: Arthralgia, Low-grade fever, Abdominal pain, Hematuria (in IgA-mediated forms). Dermatoscopically, lesions reveal: Red dots and globules, Diffuse purpuric background, Irregular vascular networks, Histologically, classical features include: Leukocytoclasia, Fibrinoid necrosis of vessel walls, Perivascular neutrophilic infiltrate, Extravasated erythrocytes, Histopathological hallmarks: Leukocytoclasia, Fibrinoid necrosis, Neutrophilic perivascular infiltrate, Extravasated erythrocytes.

**Diagnostic Criteria.** Diagnosis requires:

1. Compatible clinical presentation
2. Skin biopsy showing small-vessel vasculitis
3. Direct immunofluorescence (IgA, IgM, C3 deposition)

However, these criteria lack predictive stratification capacity.

Proposed Multi-Layer Diagnostic Model (MLDM-AV)

Layer 1 – Clinical Severity Index (CSI)

A standardized severity index incorporating:

Lesion count

Distribution pattern, Necrosis presence, Systemic symptoms. Each parameter weighted 0–3 points.

Weighted scoring system based on lesion number, necrosis, systemic symptoms, recurrence history.

Layer 2 – Expanded Immunologic Profile (EIP) Includes:

ANCA (MPO, PR3), Anti-C1q, Cryoglobulins, Serum IgA, Complement fractions (C3, C4, C5b-9), Generates an Immune Activity Score (IAS). Layer 3 – Cytokine & NETosis Panel,IL-6, TNF-α, IL-17, NET-associated markers, Layer 4 – Molecular Signature Analysis, RNA sequencing identifies interferon-

stimulated genes and NF-κB activation patterns. Layer 5 – Digital Histopathology Index (DHI), AI-assisted whole-slide imaging quantifies neutrophil density, vascular destruction, and immune-complex fluorescence. Layer 6 – Predictive AI Risk Model Machine learning integrates CSI + IAS + molecular data + DHI → stratifies: Low risk | Moderate risk | High systemic progression risk. Molecular Signature Profiling Peripheral blood RNA sequencing evaluates: NETosis-related genes. NF-κB pathway activation. Interferon- stimulated gene clusters.

**Prognostic Factors.** Factors associated with recurrence or systemic involvement include:

Elevated serum IgA.Persistent complement consumption. High neutrophil extracellular trap activity. Necrotic or ulcerative lesions, Delayed treatment initiation, Emerging prognostic biomarkers: IL-6 elevation, TNF-α overexpression. Circulating endothelial microparticles. Digital histopathologic indices may independently predict relapse risk.

**Conclusion.** Allergic vasculitis diagnostics are evolving from morphology-based confirmation toward precision-based immune and digital profiling. The proposed Multi-Layer Diagnostic Model (MLDM-AV) integrates clinical scoring, expanded immunologic testing, molecular signatures, digital histopathology, and artificial intelligence–based prediction systems. This comprehensive framework enhances early detection, reduces diagnostic uncertainty, and enables individualized prognostic stratification. Future validation through multicenter prospective studies is necessary to standardize implementation and confirm clinical utility. Modern diagnostics of allergic vasculitis are transitioning toward integrative precision models combining immunologic, molecular, and digital technologies. The proposed six-layer MLDM-AV framework enhances diagnostic accuracy, facilitates early detection of systemic involvement, and improves prognostic stratification. Prospective multicenter validation is required to standardize this approach and integrate it into routine dermatologic and rheumatologic practice.

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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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