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Clinical, functional, and microvascular predictors of interstitial lung disease in systemic sclerosis

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Introduction: Systemic sclerosis (SSc) is a chronic autoimmune disease characterised by immune dysregulation, vasculopathy, and progressive fibrosis. Systemic sclerosis-associated interstitial lung disease (SSc-ILD) is a leading cause of morbidity and mortality. Early identification of clinical and microvascular markers linked to ILD is crucial for risk stratification and timely intervention.

The study aims to evaluate risk factors associated with the presence of SSc-ILD through comparative analysis of clinical, functional, serological, echocardiographic and microvascular parameters.

Material and methods: This study analysed 41 adult patients with SSc (American College of Rheumatology/European Alliance of Associations for Rheumatology 2013) treated at the EUSTAR centre in Kyiv (2022–2024). Patients were stratified into ILD and non-ILD groups based on high-resolution computed tomography. Variables assessed: SSc subtype, modified Rodnan Skin Score (mRSS), autoantibodies (anti-Scl-70, ACA), pulmonary function (forced vital capacity [FVC], diffusion capacity of the lungs for carbon monoxide), 6-minute walk test (6MWT), and echocardiographic indices (left ventricular ejection fraction, E/A ratio). Microvascular damage was evaluated via nailfold videocapillaroscopy (NVC) using Cutolo patterns. Statistical analysis employed Mann-Whitney U and Fisher's exact tests ($p = 0.05$).

Results: The cohort was predominantly female (mean age 56.2 ± 12.4 years; disease duration 8.9 ±6.4 years). Interstitial lung disease was present in 63.4% of patients and was significantly associated with diffuse cutaneous SSc (96.2% vs. 26.7%; $p = 0.001$), higher mRSS (22.9 ±8.9 vs. 15.5 ±7.4; $p = 0.007$), and anti-Scl-70 positivity (57.7% vs. 19.2%; $p = 0.024$). The ILD patients showed lower FVC (74.9% vs. 96.5%; $p = 0.010$) and shorter 6MWT distance (281.5 ±64.5 m vs. 396.7 ±59.5 m; $p = 0.001$). An E/A ratio 0.8 was more frequent in ILD (57.7% vs. 20.0%; $p = 0.025$). Interstitial lung disease was also associated with advanced NVC patterns, reduced capillary density, and more frequent digital ulcers (69.2% vs. 33.3%; $p = 0.049$).

Discussion: The SSc-ILD is associated with a severe systemic phenotype marked by skin fibrosis and anti-Scl-70 positivity. Reduced FVC and 6MWT indicate functional impairment, while the higher prevalence of E/A 0.8 suggests early diastolic dysfunction may contribute to exercise intolerance. The association between advanced NVC patterns and ILD supports the link between microvascular damage and internal organ involvement.

Conclusion: In SSc, ILD identifies a high-risk subgroup with functional decline and advanced vasculopathy. Integrated assessment, including pulmonary, cardiac, and microvascular evaluation, is crucial for early risk stratification and personalised management.