

## PP-15

림프부종에서 항원제시 유사  
지방기질세포가 특징짓는  
면역편향 기질-면역 상호작용  
(Immune-skewed stromal-immune axis  
defined by antigen-presenting-like  
adipose stromal cells in lymphedema)



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**Purpose:** Lymphedema is characterized by chronic inflammation, fibrosis, and adipose tissue remodeling; however, the stromal cell subsets underlying these changes remain poorly defined. This study aimed to characterize disease-associated adipose stromal cell (ASC) subsets and their immune interactions in human lymphedema using single-cell transcriptomic analysis.

**Methods:** Subcutaneous adipose tissue was obtained from 12 patients with advanced-stage lymphedema (ISL stage 2–3) and 6 anatomically matched controls. Stromal vascular fractions were isolated and subjected to droplet-based single-cell RNA sequencing. After quality control and genotype-based demultiplexing, 40,578 high-quality single-cell transcriptomes were analyzed (control 19,053; lymphedema 21,525). Differential expression, pathway enrichment, and ligand–receptor interaction analyses were performed, and selected stromal subsets were validated by flow cytometry.

**Results:** Overall major stromal lineages were preserved between groups; however, a distinct ASC progenitor subset (ASC\_c2) was significantly expanded in lymphedema (mean fractional increase +12.8%,  $P < 0.05$ ). ASC\_c2 further segregated into two mutually exclusive subsets: a VCAM1<sup>+</sup> vascular-associated subset (V-ASCs, +7.9%,  $P < 0.05$ ) associated with extracellular matrix remodeling and a CD74<sup>+</sup>HLA class II–expressing immune-associated subset (I-ASCs, +4.4%,  $P < 0.01$ ).

I-ASCs demonstrated increased CXCL14 expression ( $\log_2FC$  0.62, adjusted  $P < 0.01$ ) and enrichment of interferon-responsive genes. Ligand–receptor analysis identified enhanced CXCL14–CXCR4 interactions between stromal cells and CD8<sup>+</sup> T cells in lymphedema. Flow cytometry confirmed expansion of CD74<sup>+</sup>HLA-DR<sup>+</sup> stromal cells (12.6% vs. 6.26% in controls,  $P < 0.05$ ).

**Conclusion:** Advanced-stage lymphedema is associated with quantitative expansion of immune-associated stromal subsets and enhanced stromal–T cell interactions, supporting a link between stromal remodeling and adaptive immune activation in chronic disease.

