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Abstract 24: Targeting Inflammatory Protagonists with Nuclear Imaging: A Novel Dual-Radiotracer Approach



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Introduction: Atherosclerotic plaque development and progression, signifies a complex inflammatory disease, mediated by a multitude of dual-cellular interactions between proinflammatory leukocytes including the subset of monocyte derived macrophages and T-lymphocytes. This study tested a novel dual-radiotracer protocol capable of targeting all proinflammatory leukocytes and activated macrophages simultaneously in human diseased arteries to quantitatively detect key inflammation drivers and high-risk plaque vulnerability.

Methods: Human symptomatic carotid plaque samples were incubated in radioactive tracers targeting leukocyte function antigen-1 receptor present on pro-inflammatory leukocytes [^{111}In -Danbirt] and somatostatin receptor subtype-2 present on activated macrophages [$^{99\text{m}}\text{Tc}$ -Demotate]. Dual-SPECT/CT scanning was performed using ultrahigh-resolution focused imaging (Vector 5, MiLabs). After scanning, plaque segments were immunohistochemically stained to assess co-localization of inflammatory cells with the SPECT tracer's signal.

Results: SPECT scanning detected locally inflamed regions throughout heterogeneous plaques where leukocyte signal was significantly higher compared to macrophages in all regions ($P < .001$). Leukocytes strongly correlated with T-lymphocytes cells [$r = .953; P < .001$] and clusters of leukocytes colocalised with macrophage cells in regions of collagen fiber degradation. Local leukocyte detection in the fibrous cap and shoulder regions revealed a significant positive correlation between SPECT leukocyte signal and immunohistochemistry cell area fraction [$r = .725; P < .001$]. A weak positive trend was identified for macrophages alone [$r = .085; P < .730$].

Conclusions: Capturing global leukocytes levels is a requisite to detect local vulnerable shoulder and cap regions. A quantitative SPECT-based metric, for detecting local inflammation levels, provides a promising approach for early-detection screening.

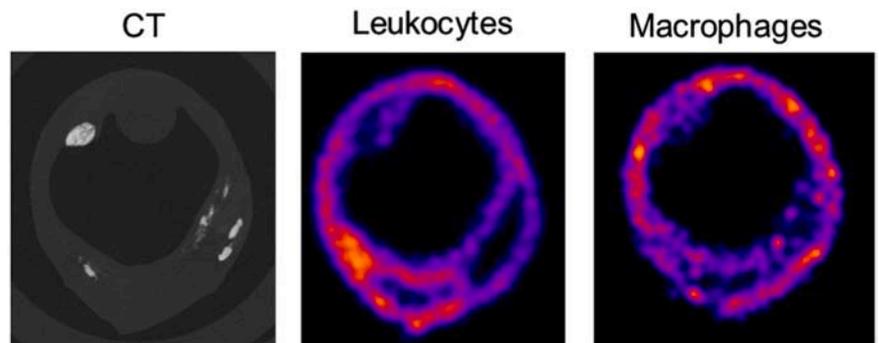


Figure 1. Dual-SPECT/CT scan of local inflammation detection in human carotid plaque.

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