Department of Surgery
2026 Research Day
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Title Temporal and Cellular Dynamics of Collagen Deposition in Arterial and Venous Thrombi

Author(s) and Affiliations: Shiffoni Sukhlal, Department of Surgery

Faculty Mentor(s):
Gurtej Singh, Nicos Labropoulos, PhD

Background: Thrombosis is a major cause of cardiovascular morbidity and mortality, contributing to conditions such as stroke, myocardial infarction, pulmonary embolism, and deep vein thrombosis. Classical models of thrombus maturation describe a gradual transition from a fibrin-rich clot to collagen-rich fibrotic tissue during later stages of thrombus organization. However, emerging evidence suggests that extracellular matrix remodeling may occur much earlier than previously appreciated. Preliminary observations indicate that collagen fibrils can be detected within 48 hours of thrombus formation, suggesting that early extracellular matrix deposition may influence thrombus stability, resistance to thrombolysis, and the likelihood of thrombus resolution. Notably, arterial and venous thrombi differ in composition and hemodynamic environment, which may lead to distinct remodeling trajectories.

Methods: Arterial and venous thrombi will be generated using a stasis-induced thrombosis rat model and harvested at defined early time points following occlusion. Collagen deposition will be assessed using Picrosirius Red staining and quantified through digital image analysis to determine collagen fraction within thrombus cross-sections. Scanning electron microscopy will be used to characterize fibrillar microarchitecture and confirm collagen ultrastructure through identification of fibrils with characteristic periodic banding. To identify the cellular sources of collagen production, immunohistochemical and immunofluorescence analyses will detect fibroblast and myofibroblast markers within thrombi. Spatial relationships between fibroblast-like cells and collagen-rich regions will be quantified to determine when collagen-producing cells appear and whether they originate from the vessel wall or infiltrating cell populations.

Results: Preliminary data demonstrate that collagen deposition occurs earlier than traditionally described during thrombus development. Picrosirius Red staining identified collagen in both arterial and venous thrombi as early as Day 2 following thrombosis, indicating that extracellular matrix remodeling begins during the acute phase of thrombus formation. Distinct patterns of collagen deposition were observed between arterial and venous thrombi across Days 2, 4, and 8, supporting vessel-specific remodeling trajectories. Scanning electron microscopy confirmed the presence of fibrillar extracellular structures with characteristic periodic banding consistent with collagen ultrastructure.

Conclusions: These findings suggest that early collagen deposition is a previously underrecognized feature of thrombus remodeling and may play a critical role in determining thrombus stability and fate. Differences in the timing and spatial distribution of collagen deposition between arterial and venous thrombi may contribute to their distinct biological behaviors and responses to therapy. Ongoing studies will define the cellular sources and mechanisms driving early extracellular matrix remodeling.