

## **Laura-Lee Farrell**

M.S. Presentation

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5101 Woodruff Memorial Research Building  
Emory University

### **Committee:**

Dr. David Ku, M.D., Ph.D. (Mechanical Engineering, BioEngineering)

Dr. Eliot Chaikof, M.D., Ph.D. (Biomedical Engineering, Professor of Vascular Surgery)

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### **Prosthetic Vein Valve: Delivery and In Vitro Evaluation**

Chronic Venous Insufficiency (CVI) is a painful and debilitating disease that affects the superficial and deep vein valves of the legs. These incompetent valves allow reflux and subsequent pooling of blood. Prosthetic venous valves were constructed from a novel hydrogel biomaterial patented at Georgia Tech. The valves had flexible cusps similar to normal, anatomic venous valves. The purpose of this work was to evaluate the thrombotic potential of the GT venous valve in an *in vitro* study and to design a percutaneous delivery system.

The flow system was modified from a one-pass, flow-through thrombosis assay using whole blood. Whole blood was perfused through the valves to mimic the pulsatile physiologic conditions. Cessation of flow indicated thrombotic obstruction. A group of valves were lined with Dacron to serve as a positive control. Histological analysis was performed using H&E staining and Carstairs' stain (specific for platelets).

Whole blood perfused through GT prosthetic valves exhibited no thrombosis or platelet adherence. All GT valves were patent and competent after blood perfusion. In contrast, all the valves lined with Dacron occluded. H&E staining revealed no thrombus deposition on the GT vein valves. However, the Dacron valves were occluded by thrombus connecting the polymer fibers with adherent platelets, identified by Carstairs' staining.

A percutaneous delivery system was designed after evaluating the GT valves for their compressibility and plastic deformation over time. Appropriate stents, catheters and sheaths were then selected.

The novel vein valve demonstrates excellent patency, low thrombogenicity, and long-term competency with pre-clinical bench testing.

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