Symptomatic postthrombotic disease affects at least 30-50% of patients with deep vein thrombosis.

Percutaneous balloon angioplasty and stenting of iliofemoral venous segment have recently improved the outcomes for patients with severe PTS related to venous outflow obstruction.

Regular wearing of individually selected compression garments with regular follow-up alleviates symptoms in many patients. However, compression therapy does not eliminate chronic structural postthrombotic changes, implies lifelong treatment, ineffective in many cases, and low overall patient compliance remains a serious challenge (Raju S. et al., 2007).

Postinflammatory vein wall remodeling and destruction of the venous valves is considered to be the main morphological substrate for PTD.
Autotransplantation of a valve-containing venous segment demonstrates good 5-year results in half of patients (Maletti O., Perrin M., 2007). However, there is currently low correlation between hemodynamic effect and clinical success of deep vein surgery in published literature.

**Methods:**

The main goal of this study is to develop a novel surgical technique on venous neovalve formation to correct deep axial reflux and improve venous outflow in postthrombotic disease.

We performed the first series of in vitro experiments using methods of mathematical modeling to develop a novel surgical technique on venous neovalve formation. Five macroscopically intact (n=5) common femoral veins were taken on autopsies from individuals without history of venous thrombosis. Five (n=5) common femoral veins were taken on autopsies from individuals with PTD.

During mathematical modeling appropriate dimensions of the neovalve were determined to resemble morphology of a native valve. An optimal vein wall thickness for neoleaflets was determined to enable appropriate elasticity and coaptation.

The surgical technique involves complete transection of the common femoral vein, eversion of the proximal end of the vessel with simultaneous endophlebectomy and creation of neoleaflets from the inverted vein wall by interrupted sutures.
The hydraulic probe demonstrated good competency of the neovalve at 1.5 atm in vitro.

The absence of outflow obstruction was predicted as less than 20% stenosis during the maximal valve leaflets separation.

Conclusions:

- A novel experimental model of autologous deep venous neovalve was created and evaluated "in vitro".

- "In vivo" experiments to evaluate hemodynamic effect, thrombosis risk, and long-term hemodynamic effect.