Anatomy of the veno-muscular pumps of the lower limb

Jean-François Uhl and Claude Gillot

URDIA Anatomy research Unit EA4465 – Paris Descartes University
45 rue des Saints Pères - 75006 - Paris

**Objective:** To study the anatomy of the veno-muscular pumps of the lower limb, particularly the calf pump, the most powerful of the lower limb, and to confirm its crucial importance in venous return.

**Methods:** 300 cadaveric limbs were injected with green Neoprene latex followed by an anatomical dissection. 500 investigations by CT venography showed the venous anatomy by interactive 3D modeling.

**Results:** The foot pump is the starter of the venous return. The calf pump can be divided into 2 anatomical parts: the leg pump located in the veins of the Soleus muscle, and the popliteal pump ending in the popliteal vein with the unique above-knee collector of the medial gastrocnemial veins (MGV).

*At the leg level,* the lateral veins of the Soleus are the bigger ones. They drain vertically into the fibular veins. The medial veins of the Soleus, smaller, join the posterior tibial veins horizontally.

*At the popliteal level,* MGV are the largest veins, which end uniquely as a large collector into the popliteal vein above the knee joint. This explains the power of the gastrocnemial pump: during walking, the high speed of the blood ejection during each muscular systole acts like a nozzle creating a powerful jet into the popliteal vein.

Finally, the thigh pump of the biceps and semimembranosus muscles pushes the blood of the deep femoral vein together with the quadriceps veins into the common femoral vein.

**Conclusion:** The veno-muscular pumps of the lower limb create a chain of events by their successive activation during walking. They play the role of a peripheral heart, which combined with venous valves serve to avoid gravitational reflux during muscular diastole. A stiffness of the ankle or/and the dispersion of the collectors inside the gastrocnemius could impair this powerful pump and so, worsen venous return, causing development of severe chronic venous insufficiency.