

Endobotica

Robotic solutions for safe and efficient endovascular treatment: fewer complications, faster recovery.

In a nutshell

Ischemic stroke is one of the leading causes of death and disability worldwide with more than 3 million deaths per year. It is an emergency condition in which a thrombus blocks the blood flow in a cerebral artery, which results in progressive brain damage. Currently, the most efficient treatment for large vessel occlusions is mechanical thrombectomy – a minimally invasive endovascular procedure. Even though this procedure is more efficient than other treatments, such as thrombolysis, it presents several challenges and the death and disability burden is still very high with more than 30% of the patients ending up with moderate to severe disability. With our robotic system TREX (Thrombus Robotic EXtractor) we address the main challenges of thrombectomy concerning the efficacy and safety of the procedure, as well as the safety and comfort of the operator.

Why is our technology important?

With TREX, we address the following three main problems in mechanical thrombectomy: 1) Delayed clot removal due to insufficient information about the thrombus; 2) Risk of arterial perforation or dissection; 3) Health risk for the interventionalist due to X-ray exposure. The three procedural problems lead to a significant economic burden – poor outcome for the patient results in increased costs for postoperative care and rehabilitation, while the current clinical setting is associated with increased risks of cancer and orthopedic complications for the operators, both having a detrimental societal and health system impact.

Our solution is a high-precision teleoperated robotic system providing the interventionalist with assistance in interacting with the clot, crossing it, and identifying its key characteristics, crucial for the subsequent choice of thrombectomy technique. The product is a system comprising a haptic leader device, manipulated by the interventionalist seated in a radiation-protected cabin, and a follower device, receiving commands from the leader device and performing semi-autonomously the clot interaction. Clot identification is done based on the force and position sensing of the follower device together with image analysis of the instruments visible under X-rays. The result is a faster and safer blood flow restoration, and therefore better outcome for the patient.

The benefits of our solution

The main advantages of our solution are:

- Intuitive teleoperation for a faster learning curve and more efficient navigation to the occlusion
- Safe and efficient clot crossing achieved through a closed-loop control algorithm ensuring a clot interaction force lower than 5g
- *In situ* mechanical characterization of the thrombus for subsequent decision on the most appropriate thrombectomy technique
- Increased first-pass success rate thanks to the identification of the clot's extremities and mechanical properties

Keywords

Endovascular; Ischemic stroke; Mechanical thrombectomy; Robotics; Teleoperation

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