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Researchers make cardiovascular system more visible and surgery safer

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To understand and see the cardiovascular system better, the EU funded SCATh (Smart CATheterization) project has developed new imaging, sensing, geometric and mechanical modelling techniques. Without radiation nor allergic reactions that are commonplace today.

[1]

Cardiovascular diseases are the single most common cause of death in the EU. Minimally invasive and catheter-based approaches are gaining rapidly in importance in the treatment of these diseases. Reduced hospital stay and faster patient recovery are major driving factors for the success of catheter-based diagnosis and therapy. The possibility to treat fragile patients that were deemed inoperable otherwise, forms another important argument.

The intervention itself is highly technical and complex due to (amongst others) the limited access and the poor visualisation. Even extremely experienced and skilled interventionalists are challenged on a daily basis. Current imaging technologies, while powerful, expose patients and surgeons to increased levels of radiation, also the contrast agents used to improve visualization may cause allergic reactions.

New techniques

If it depends on the researchers of the SCATh project [2] (funded by the 7th Framework Program), those problems will soon belong to the past. They have developed new imaging, sensing, geometric and mechanical modelling techniques that will potentially reduce the dependency upon radiation-based techniques and that will potentially improve the visualization and understanding of the cardiovascular system.

Through fusion with intra-operative sensory data 3D vasculature models are computed that deform and adapt in real-time closely mimicking the actual shape of the vasculature.

Novel experimentally validated mechanical models of aortic tissue were developed that shed new lights upon the relation between collagen fiber orientation, stress, tissue softening and tissue damage. Computational efforts allowed transferring this information in real time to the surgeon, providing warning signals when approaching dangerous regions or when applying critical stress levels.

In close collaboration with the medical partners, a dedicated software platform was developed to make all this new guidance information in an intuitive manner accessible to the surgeon.

Robots handling the catheter

Together with the progress made in tracking, modelling and (robotic) handling of the catheter, SCATh hereby established an encompassing platform that might not only simplify, improve the reliability and thus safety of catheterization procedures, but that also might be of great value in training the current and future generation of interventionalists.

The SCATh project has its base in seven countries: Belgium, Spain, Switzerland, Italy, the UK, Norway and Austria.

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