

# PATIENT-SPECIFIC AORTIC ENDOGRAFTING SIMULATION: FROM DIAGNOSIS TO PREDICTION

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Traditional surgical repair of an ascending aortic pseudoaneurysm is complex, technically challenging, and associated with significant mortality. Despite the use of endovascular approaches to treat aortic diseases is rapidly arising thanks to the innovations in catheter-based technologies, few interventions have addressed diseases of the ascending aorta because of the related anatomical and physiological challenges. In this context, the integration of biomechanical aspects, regarding both vascular target and prosthesis design, might be helpful to predict the procedure outcome [1-2]. Moving from such considerations, in the present study we describe the use of a custom-made stent-graft to perform an entirely endovascular repair of an asymptomatic ascending aortic pseudoaneurysm in a patient, who was a poor candidate for open surgical intervention (Fig. 1). We also discuss the possible contribution of a dedicated patient-specific simulation and medical images analysis in the procedure planning (Fig. 2). In particular, we have compared the simulation prediction based on pre-operative images with postoperative outcomes (Fig 3). The agreement between the computer-based analysis and reality encourages the use of the proposed approach for a careful planning of the treatment strategy and for an appropriate patient selection, aimed at achieving successful outcomes for endovascular treatment of ascending aortic pseudoaneurysms as well as other aortic diseases.

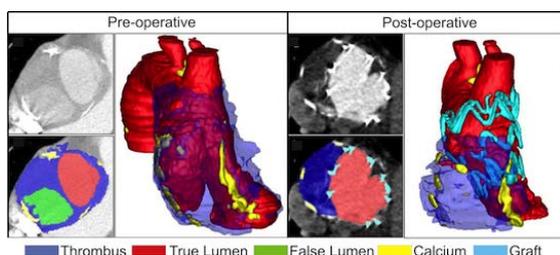


Figure 1: Segmentation of pre- and post-operative images: original grayscale image slice; segmented image slice and resulting 3D reconstruction.

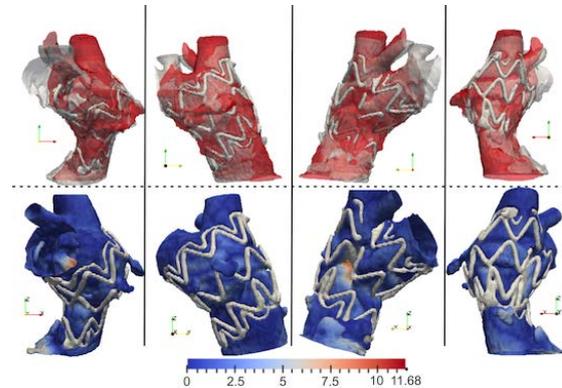


Figure 2: Pre-operative versus post-operative. Top: the 3D pre-operative luminal profile (white) is superimposed to the post-operative graft/vessel configuration (red); Bottom: contour plot of the point-wise distance between the pre-operative and post-operative surface.

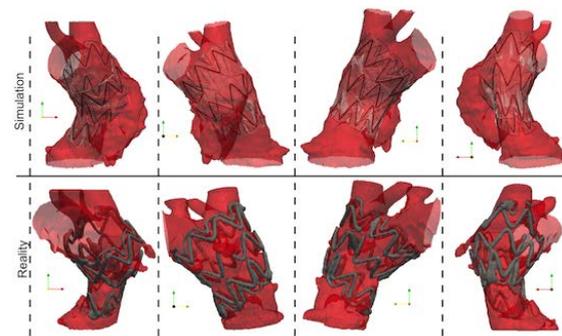


Figure 3: Results of the simulation compared, with respect to different views, with the 3D reconstruction of the post-operative endograft/vessel configuration derived from CTA images.

## Bibliography

[1] F. Auricchio et al. Carotid artery stenting simulation: from patient-specific images to finite element analysis, *Medical Engineering & Physics* 33 (2011) 281-289.

[2] M. Conti et al. Impact of carotid stent cell design on vessel scaffolding: a case study comparing experimental investigation and numerical simulations, *Journal of Endovascular Therapy* 18 (2011) 397-406.