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# Towards model-based rupture risk assessment of abdominal aortic aneurysms

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## Introduction

Knowledge of the wall stress distribution can help to predict the rupture risk of abdominal aortic aneurysms (AAA's) [1]. Although AAA wall stress results from combined action between the blood and the wall, previously published models for patient-specific wall stress assessment did not include fluid-dynamic effects.

## Objective

To facilitate the incorporation of blood/wall interaction in AAA wall stress assessment, a method for generating patient-specific hexahedral finite element meshes of the AAA lumen and wall is presented. The applicability of the method is illustrated by a simulation of blood/wall interaction in a characteristic AAA.

## Mesh Generation

From a CT image, the lumen centrelines and boundary surface are determined by semi-automated centreline tracking [2] and segmentation using a 3D Active Object [3] (Fig. 1).

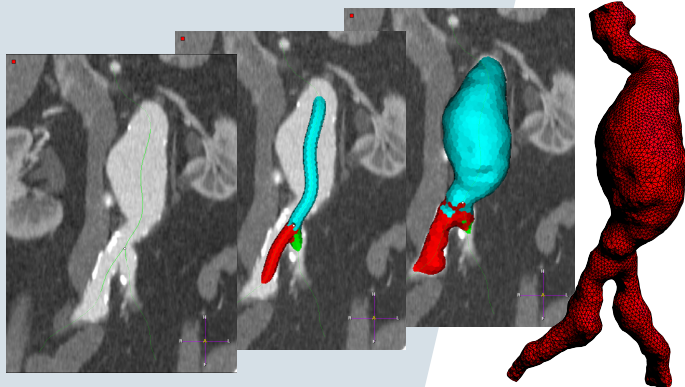


Figure 1 Lumen segmentation and segmented boundary surface.

A centreline-based initial lumen mesh is incrementally transformed to fit the segmented boundary surface. A wall mesh of uniform thickness is generated around the lumen (Fig. 2).

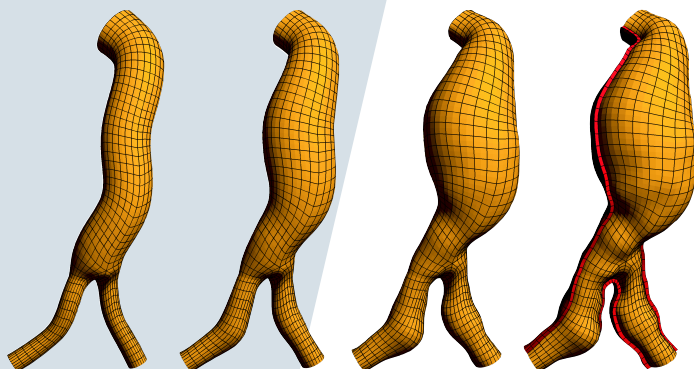


Figure 2 Lumen mesh transformation (orange) and wall mesh (red).

## Blood/wall interaction

Blood/wall interaction in the AAA is simulated using a decoupled approach yielding the wall stress (Fig. 3), blood velocity distribution (Fig. 4) and wall shear stress (Fig. 5).

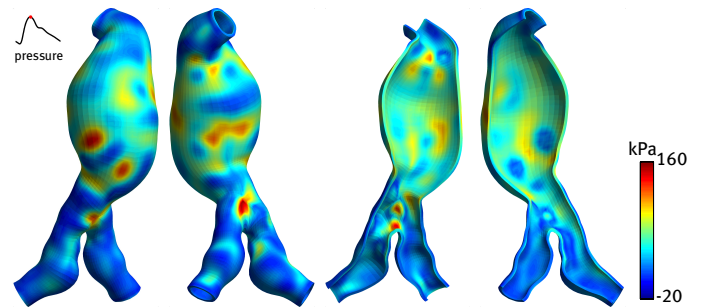


Figure 3 Maximal principal stress in the AAA wall.

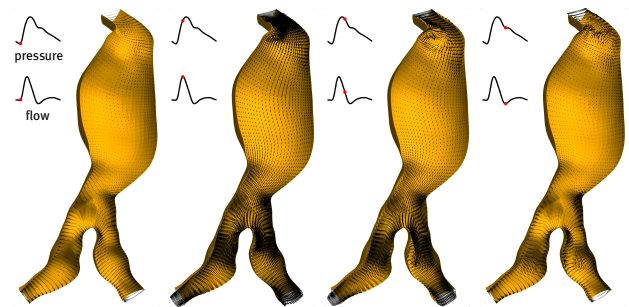


Figure 4 Blood velocity distribution in the AAA lumen.

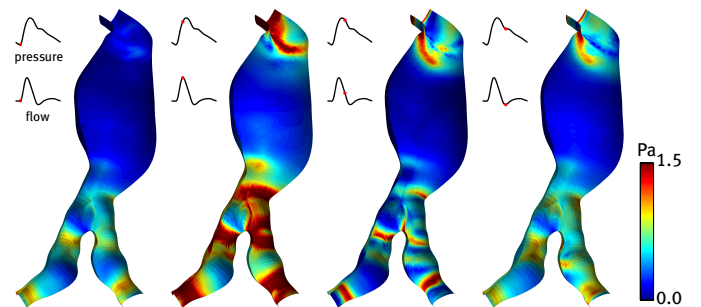


Figure 5 Shear stress on the AAA lumen/wall interface.

## Discussion

The method yields a flexible approach to generating patient-specific hexahedral meshes of the AAA lumen and wall. This approach facilitates studies of the effect of blood/wall interaction on AAA rupture risk.

## Acknowledgement

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## References

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