

# COMPUTATIONAL HEMODYNAMICS INVESTIGATION TO DBOULE ANUERSYMS TREATMENT PRIORITY

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## Introduction

Recent improvement in medical devices increased discovery of multiple aneurysms. According to Crawford et al [Crawford 1982] 12.6% aortic aneurysm patients have multiple aneurysms. For DAA surgical treatment, AAA is treated first. However, TAA rupture cases were known for post AAA removal. Therefore, DAA treatment order was investigated by computational hemodynamic simulation in DAA, TAA-removed and AAA-removed geometries.

## Method

DAA geometry was reconstructed from 512x512x477 CT scanned images using VSG Avizo® and Vascular Modelling Toolkit. To compare treatment effect, AAA-removed and TAA-removed models were created from DAA model. Figure 1 illustrates comparison of the three models.

Unsteady Newtonian incompressible Navier Stokes equation was solved. Density of 1050 kilogram per cubic meters and 0.0035 Pascal second were assigned. For boundary condition, the inflow rate and pressure profile taken from Olfusen [Olfusen 2000] was used for inlet and outlet boundary condition. The wall was assumed to be rigid and no split boundary condition was used.

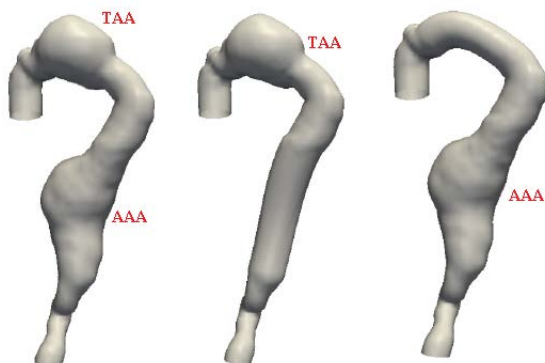


Figure 1: Comparison of DAA (left), AAA-removed (mid) and TAA-removed (right) Model Geometries

## Result

Calculated pre and post surgical treatment pressure along the centre lines of TAA and AAA are compared in Figure 2 and Figure 3.

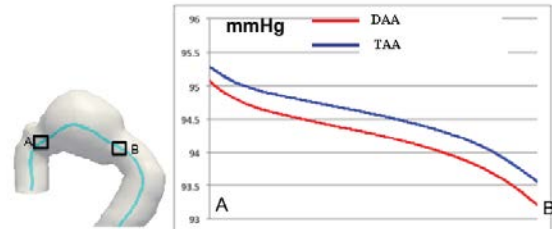


Figure 2: Pressure Comparison between DAA and remaining TAA Along the Centre Line of TAA

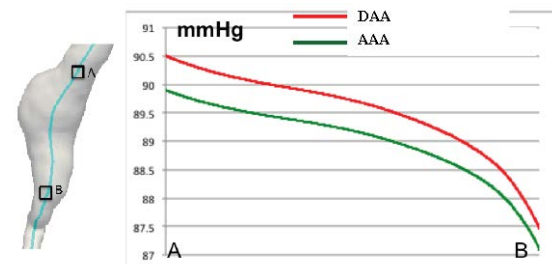


Figure 3: Pressure Comparison between DAA and Remaining AAA Along the Centre of AAA

Comparison between Figure 2 and Figure 3 illustrates about 2.5 mmHg of pressure rise in AAA-removed TAA. For TAA-removed model pressure in remaining AAA was decreased about 0.5 mmHg.

## Discussion

The wall shear stress change was smaller than change in pressure. The highest shear stress was found at the inner wall near TAA. To Summarise, the result implies pressure is considered to be a strong candidate for post surgery TAA rupture case.

## References

- Crawford et al., Archive of Surgery, Vol. 117, pp1393-1400, 1982
- Olfusen et al., Annals of Biomedic. Eng., 2000

## Abbreviations

- DAA: Double aortic aneurysm
- TAA: Thoracic aortic aneurysm
- AAA: Abdominal aortic aneurysm