QUEST FOR THE LINK BETWEEN THE DYNAMIC BEHAVIOUR OF AN ABDOMINAL AORTIC ANEURYSM AND BLOOD HAEMATOCRIT: FLUID-STRUCTURE INTERACTION STUDY

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ABSTRACT

The Abdominal Aortic Aneurysm (AAA) is a local dilation of the abdominal aorta and it is a cause for serious concern because of the high mortality associated with its rupture[1]. Consequently, the understanding of the phenomena related to the creation and the progression of an AAA is of crucial importance. In this work the complicated interaction between the blood flow and the AAA wall is numerically examined using a fully coupled Fluid-Structure Interaction (*FSI*) method. An FSI simulation is employed in cases where a fluid (e.g. blood) interacts with a solid structure (e.g. arterial wall) causing deformation in the structure and subsequently an alteration of the fluid flow itself. In this kind of systems, physically or computationally heterogeneous components interact dynamically. As a matter of fact, an *FSI* approach is required in biomedical flows as in the present investigation[2].

This study investigates the possible link between the dynamic behaviour of an AAA and the blood viscosity variations attributed to the haematocrit value[3], while it also incorporates the pulsatile blood flow, the non-Newtonian behaviour of blood and the hyper-elasticity of the arterial wall.

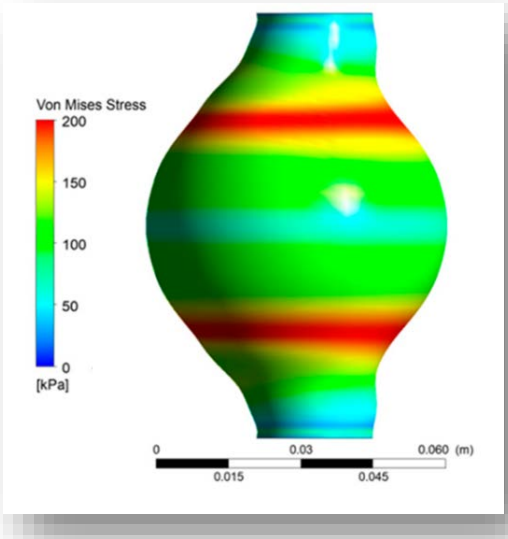

Fig.1 Typical von Mises Stress distribution[4].

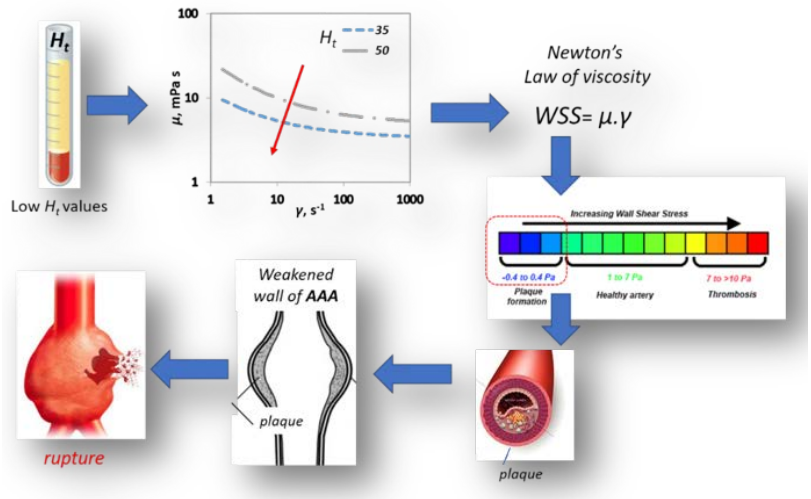

Fig. 2 Effect of H_t on AAA rupture.

It was found that blood viscosity has no significant effect on von Mises stress magnitude and distribution, (Fig. 1), whereas there is a close relation between the haematocrit value and the Wall Shear Stress (*WSS*) magnitude in AAAs. This *WSS* variation can possibly alter the mechanical properties of the arterial wall and increase its growth rate or even its rupture possibility. The relationship between haematocrit and dynamic behaviour of an AAA (Fig. 2) can be helpful in designing a patient specific treatment.

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