4TH Conference on Modelling and Simultation in Medicine

7TH September 2004
University of York, U.K.

The session of potential interest to Rheologists involved 3 presentations from University College London. The initial talk by Dr Nick Ovenden looked at the challenging aspects of modelling cerebral arterial venous malformations and the local flow phenomena associated with them. The interaction of these local conditions with the entire neuro- vascular network was also considered. Dr Ovenden asserted that a combination of analytical and numerical techniques was necessary to make such a problem tractable. The analytical techniques used involved the non-linear inviscid behaviour of branchings within the network or the arterial venous system and also the long scale viscous responses in the vessels themselves. The Group had used clinical measurements for parameter estimation. The degree of non-linearity in flow in the presence of arterial venous malformations was highly significant and it was felt that simple electric circuit models of blood flow were unlikely to describe the correct network response. It was concluded that mathematical modelling had considerable potential for the greater understanding of cerebral arterial venous malformations and their treatment response.

Following Dr Ovenden's talk there were two linked presentations by Banaji and Tachtsidis. These two linked talks considered the construction and theoretical considerations of a model, and some predictions from that model, describing the cerebral circulation. The model included descriptions of the biophysics of the circulatory system, essential metabolic biochemistry, essential tissue biochemistry, and a number of important transport processes including convective and diffusive processes in blood. They presented data to demonstrate that this flow model was both descriptive and predictive of flow in varying conditions of carbon dioxide challenge.

The final talk in this session was presented by Kolandavel on behalf of a group working between the University of Leeds and Denmark. This grouping was examining the effects of vessel wall motion on the transport of low density lipo-proteins. The results demonstrated flow dependent concentration polarisation of low density lipo-proteins at the endothelial surface in both pulsastile flow and pulsatile flow with arterial wall motion. In both cases the effect was more pronounced at the inner wall of the bend where wall shear stress was lower. They concluded that although vessel wall motion had a dominant influence on low density lipo-protein transport it was likely that filtration velocity and diffusivity were also important.

This session was attended by about 40 delegates and considerable interest was also displayed by companies manufacturing diagnostic imaging systems. This interest highlights the importance of the bio-physics of blood flow in arterial pathology. This meeting was the 4th in the series of Modelling and Simulation meetings with the 5th in the series to be held in 2006 in Cambridge.

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