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Time calibration of a novel phenomenological thrombus formation model through global sensitivity analysis and a Bayesian approach

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Type B aortic dissection (TBAD) is a severe medical condition that affects the descending aorta. In TBAD, the aortic wall ruptures, initiating a new aortic volume, i.e., the false lumen. In addition, the coverage of the thrombus in the false lumen varies based on rheological and morphological conditions. Complete false lumen thrombosis leads to a beneficial healing outcome. On the contrary, partial or patent thrombosis lead to adverse prognosis. The study of thrombus evolution in time in TBAD is therefore of critical importance. The real-time formation of the thrombus formation is still unclear. In this study, a phenomenological thrombus formation model is employed [1]. Its model parameters are commonly affected by epistemic uncertainty. The time calibration of the model is based on in-vitro results [2]. Model parameter calibration is performed with Bayesian inference and solved with a MCMC method. A global sensitivity analysis is performed through a polynomial chaos surrogate. The introduction of this step decreases the number of input variables given to the inference problem, ensuring the calibration of the model influential parameters only. The proposed methodology shortens the Bayesian inference problem's computational burden and calibrates the thrombus formation model to the experimental results.

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