Numerical modelling of flow diverter devices using isogemetric analysis

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ABSTRACT

Endovascular flow diversion has become a state of the art treatment method for a broad range of intracranial aneurysms. In particular, flow diverter devices (FDDs), tubular stent-like implants which stop the blood movement in the aneurysm by diverting its flow away from the site, have shown significant advantages in the treatment of complex aneurysms which cannot be safely handled by other approaches (e.g. surgical clipping and endovascular coiling). Because of the nature of the method and different types of aneurysms, complexities come both in the clinical decision-making and the device placement procedures. Our focus in the present contribution will be on the Acandis Derivo Embolization Device (DED, Acandis, Pforzheim, Germany). DED is a self-expandable FDD composed of 48 nitinol composite wires with a radiopaque platinum core to enhance its visibility on X-ray imaging [1].

Numerical simulations can help with the choice of correct devices and with improving the control and precision of device placement procedures. However, because of the complexities of the braided flow diverters geometries and the necessity of introducing several contact pairs between individual wires, creating analysis suitable numerical models and performing simulations for these devices are considered to be non-trivial. Having these in mind, the current contribution aims to first construct a fast modelling scheme to re-create the braided flow diverter geometries using NURBS basis functions, and then to investigate the remaining challenges on the way to achieving a thorough numerical simulation framework.

REFERENCES

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