Computational comparison of the bending behavior of aortic stent-grafts

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Secondary interventions after endovascular repair of abdominal aortic aneurysms are frequent because stent-graft (SG) related complications may occur (mainly endoleak and SG thrombosis). Complications have been related to insufficient SG flexibility, especially when devices are deployed in tortuous arteries. Little is known on the relationship between SG design and flexibility. Therefore, the aim of this study was to simulate numerically the bending of two manufactured SGs (Aorfix-Lombard Medical (A) and Zenith-Cook Medical Europe (Z)) using finite element analysis (FEA). Global SG behavior was studied by assessing stent spacing variation and cross-section deformation. Four criteria were defined to compare flexibility of SGs: maximal luminal reduction rate, torque required for bending, maximal membrane strains in graft and maximal Von Mises stress in stents. For angulation greater than 60\degree, values of these four criteria were lower with A-SG, compared to Z-SG. In conclusion, A-SG was more flexible than Z-SG according to FEA. A-SG may decrease the incidence of complications in the setting of tortuous aorto-iliac aneurysms. Our numerical model could be used to assess flexibility of further manufactured as well as newly designed SGs.

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