

Profiling post-EVAR morphometry and hemodynamics through image-based computational analysis:
comparison among endovascular devices

Original

Profiling post-EVAR morphometry and hemodynamics through image-based computational analysis: comparison among endovascular devices / Raptis, Anastasios; Tasso, Paola; Xenos, Michalis; LODI RIZZINI, Maurizio; Gallo, Diego; Morbiducci, Umberto; Matsagkas, Miltiadis. - STAMPA. - (2018). ((Intervento presentato al convegno LIVE 2018 - Leading Innovative Vascular Education tenutosi a Patras nel 24-26 May 2018.

Availability:

This version is available at: 11583/2708878 since: 2018-05-28T14:46:32Z

Publisher:

Institute of Vascular Diseases, Greece

Published

DOI:

Terms of use:

openAccess

This article is made available under terms and conditions as specified in the corresponding bibliographic description in the repository

Publisher copyright

(Article begins on next page)

Profiling post-EVAR morphometry and hemodynamics through image-based computational analysis: comparison among endovascular devices

Anastasios Raptis¹, Paola Tasso², Michalis Xenos^{3, 1}, Maurizio Lodi Rizzini², Diego Gallo², Umberto Morbiducci², Miltiadis Matsagkas^{1, 4}

¹*Institute of Vascular Diseases, Laboratory for Vascular Simulations, Ioannina, Greece*

²*Department of Mechanical and Aerospace Engineering, Politecnico di Torino, Torino, Italy*

³*Department of Mathematics, University of Ioannina, Ioannina, Greece*

⁴*Department of Vascular Surgery, Medical School, University of Thessalia, Larissa, Greece*

Abstract

Background. Endovascular aneurysm repair (EVAR) results in redirection of blood through the deployed endograft (EG). The possibility of an adverse post-EVAR event leading to reintervention or even to a fatal scenario, is real. Our objective was to identify possible unique post-implantation morphological and hemodynamic EG characteristics.

Methods. We reconstructed the pre- and post-EVAR CT scans of AAA subjects treated either with Endurant or Excluder EGs (N=10 per EG). Hemodynamic descriptors such as time- and surface-averaged wall shear-stress (TAWSS, AWSS), along with helicity-based indexes, are quantitatively assessed and compared with the hemodynamics in healthy vascular models (N=10). A complementary centerline-based geometrical analysis of the post-EVAR infrarenal vascular region, was carried out.

Results. Regarding hemodynamics, regions with higher TAWSS are larger in Excluder and healthy subjects than in Endurant subjects. Patients treated with Endurant presented the lowest AWSS, while the highest value is found for Excluder patients. Regarding morphometry, treated subjects present a higher number of torsion peak values than healthy subjects, located close to the bifurcation in Excluder group, and in the limbs in Endurant group. As an average, patients treated with Endurant presented the highest values of curvature and torsion in the limbs.

Conclusion. The findings indicate that the clinically observed propensity to thrombogenicity in EG devices can be explained in terms of local hemodynamics while reportedly pro-thrombotic hemodynamic structures correlate with the postoperative aortoiliac geometry. In perspective, our study suggests that future clinical follow-up studies could incorporate geometrical analyses, monitoring shape variations that can cause clinically significant hemodynamic disturbances.