INTRODUCTION

• It is estimated that over 2 m patients worldwide have ESRD and this number continues to grow at a constant rate of ~7% per annum [1,2].
• This study aimed to monitor and calculate the morphological alterations of two arterio-venous (AV) fistulas created for haemodialysis.
• The non-contrast MRI data are from two fistula types: a) Radial-Cephalic (left wrist); and b) Brachial-Cephalic (left elbow).
• This study aimed to monitor and calculate the morphological alterations of two arterio-venous (AV) fistulas created for haemodialysis.
• The follow-up study includes data from a pre- and from post-operation time-points (A (2-4wk), B (4-6wk), C (6-8wk) and D (23-25wk).
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METHODS

• MR imaging work was performed on a 3T-MRI scanner (Siemens MAGNETOM-Trio).
• 3D surface models were constructed from the anatomical images using a semi-automated segmentation technique performed with ITK-Snap (PICSL, USA). Further image processing and calculations were performed using Segment (MedvisoAB) and VMTK (Orobix, Italy) [3].
• Specific geometric parameters such as: Bifurcation and Planarity angles, Curvature, Tortuosity and Area Ratios were calculated [4].
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• Icem-CFD and Fluent (Ansys Inc) were used to generate the meshes and for the numerical solutions, respectively. Assumptions considered: a)

RESULTS

• Fig. 2 shows the contour plots of Wall Shear Stress (WSS) and time-averaged WSS distributions and local normalised helicity (LNH) ii沙发urfaces for all four after operation scans sessions.
• Fig. 3 presents the percentage differences between A-C scan and C-D scan for both VA types.
• Fig. 4a presents the WSS max value for both steady and pulsatile simulations for all scans.
• Fig. 4b shows the Area exposed to Total area Ratio.
• Table 1 presents the quantitative changes for all measured geometric features.

DISCUSSION

• Earlier studies [6] on other vessels indicated that geometric changes alter the haemodynamic field within vessels.
• Geometric results (Table 1) shows a consistent increase for anastomosis area ratio and for bifurcation angle during the first 3 scans and a significant decrease at the last scan. Fig. 3 reflects these changes in histograms.
• A significant high WSS observed on AV fistulae model for the first scan (Fig. 2, Fig. 4a), and a gradually decrease along time, due to fistula remodeling. Fig. 4b depicts the area ratio for low (4 dynes/cm²) and high WSS (70 dynes/cm²) (threshold values 0.4 and 7 Pa, respectively).
• Further studies however are warranted to evaluate: a) the effect of arm position on morphological and haemodynamical changes; and b) possible correlation between geometric and haemodynamical parameters and their impact on AVF maturation.

REFERENCES


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