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Non Invasive Imaging

COMPUTATIONAL FLUID DYNAMICS: MORPHOLOGICAL AND HEMODYNAMIC CHANGES IN ABDOMINAL AORTIC ANEURYSM

Poster Contributions
Hall C
Sunday, March 30, 2014, 3:45 p.m.-4:30 p.m.

Session Title: Non-Coronary Cardiac CT
Abstract Category: 18. Non Invasive Imaging: CT/Multimodality, Angiography, and Non-CT Angiography
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Objectives: The purpose of this study was to demonstrate qualitatively and quantitatively the morphological and hemodynamic changes in abdominal aortic aneurysm (AAA), in order to find predictor factors of progression and of rupture of AAA compared with healthy aorta, based on multidetector CT (MDCT) datasets using the possibilities of Computational Fluid Dynamics (CFD).

Materials and Methods: 30 patients with AAA (diameter≥40mm, age = 62±14 years) and 30 patients with healthy aorta (age 51±12 years) underwent MDCT. The aortic lumen was extracted by means of semi-automatic segmentation process with dicom viewer interface (Osirix, Pixmeo, Switzerland). The fluid was solved with Lattice Bolzmann Method as Newtonian incompressible particles fluid with pulsting flow (Xflow, Next Limits technologies, Madrid). Diameters, volumes, blood flow velocities, regional wall shear stress (WSS) were quantified. Statistics..

Results: The AAA maximum diameter and thrombus volume positively correlated to time to peak systolic velocities (r=0,6 ;0,5) and inversely correlated to peak systolic WSS(r=0,4;0,6) The peak systolic WSS in the abdominal aorta of AAA patients was lower significantly than normal aorta group ($p<0.01$) Peak WSS (Pa) of proximal neck, aneurismal sac, and distal neck were 0,38; 0,15; 0,31 respectively. In infrarenal abdominal aorta, WSS of posterior wall (0,17Pa) was always lower than anterior wall (0,22Pa). Maximum acceleration and deceleration of velocity were found highest at the suprarenal abdominal aorta for two group patient.

Conclusion: Increase in AAA maximum diameter and thrombus volume is significantly correlated with the decrease in systolic WSS. CFD provide better predictors of aortic rupture risk. Our method can be used routinely in clinical practice.