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CARDIATIS—TEHMED

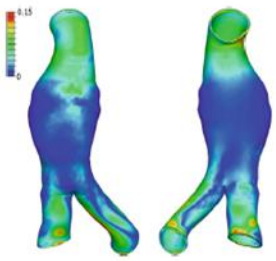
Endovascular Multilayer Flow Modulation Cardiatis/TehMED

From Biomechanical Modeling to Improved Clinical Outcome

Thorough understanding of the cross-correlations between vessel wall biology and mechanical forces exerted to the wall is considered to be the key component in understanding of the aneurysm initiation, growth and potential rupture. Once being completely understood, we may get much closer in understanding how specific implants interact with the environment and influence subsequent aneurysm healing process.

Significant improvement of the imaging technology lately revealed for improved understanding of the aneurysm location, extend, as well as the understanding of the aneurysm perivascular environment. Biomechanical engineers use these information-reach image data sets to create very reliable simulations that resemble physiological conditions inside the vessel lumen. Hence the computational fluid dynamics (CFD) is gaining very high interest of the medical community to be used ahead of the aneurysm treatment to predict the clinical outcome. This patient customized "virtual preparation" of the treatment is already widely used in the world of orthopedics and is gradually being copied in the interventional treatment of thoracic-abdominal aortic disease.

Cardiatis Aortic Aneurysm Service provides for patient-customized determination of the most optimal flow modulator dimensions as well as for determination of the vessel wall shear stress ahead and after placement of the selected flow modulators. This provides the interventionalists, ahead of the treatment, additional info on the flow modulator positioning, understanding of the shear stress alterations after the modulator placement, as well as increases his confidence in clinical outcome before even stepping in the interventional room.



Data Sets Needed for Creation of Aneurysm Models

In order to create an accurate 3D representation of abdominal aneurysms, two inputs are needed: 3D vessel/aneurysm geometry and computational fluid dynamics. Integration of those 2 components results in aneurysm model and calculation of vessel wall distention, strain and stress pattern. The 3D **anatomical data set** is usually acquired with the CT scanners, having decent spatial resolution and not suffering from motion artifacts. The **waveform data sets** (physiological information on the blood flow) can be assessed in 3 different ways: educated guess, Doppler US or MRI.

Patient specific information of the wall shear stress and wall strength distribution improves understanding and identification of those aneurysms that are prone to rupture. The rupture potential is enlarged at those locations where peak ration of wall stress to wall strength is maximal. Once understanding the locations of possible ruptures enhances greatly selection of appropriate device selection.

Cardiatis multilayer flow modulator provides for the optimal treatment of the aortic aneurysm disease by adding several components needed to protect diseased portions of abdominal aneurysms: it conduits the blood flow towards the iliacs, protects the weakened aortic wall from increased blood flow shear stress and does allow for pertinent filling and patency of the side branches.

Inside this issue:

Special points of interest:

- *Cardiatis Aortic Aneurysm Service provides for sizing of required flow modulators and modeling of blood flow shear stress distribution ahead and after modulator deployment*
- *Cardiatis Aortic Aneurysm Service requires 3D data sets acquired on CT (preferably) or MR scanners. Additional blood flow info is added (existing averaged data per gender/age)*

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TehMED— Who Are We?

TehMED is a young and dynamic company based in Ljubljana - Slovenia. TehMED is the certified distributor of the Cardiatis (Isnes, Belgium) products for the Slovenian market. The company is primarily focused at the distribution of the medical products, used in the interventional radiology and minimally invasive surgery.

Presentation of the Cardiatis product range can be done upon request to the Commercial and Marketing Department of the TehMED company (see the contact data to the left).

Aortic Aneurysm Disease — Facts

Abdominal aortic disease is a chronic degenerative disease with prevalence of 1-9% in man and 1-2% in woman. AAA rupture is responsible for ca 2% of cases aged older than 65. Survival rate is in the range of 10-20% after the rupture, even though this varies per clinical report. There are approximatelly 150 000 new cases in the USA annually and around 15 000 deaths per year. The risk factors are atherosclerosis, male gender, hypertension, hyperlipidaemia and tobacco smoking. The prevalence of abdominal aortic aneurysms in smokers is 4 times bigger than in none smokers. Abdominal aneurysm is the 14th leading cause of death in the USA and 10th leading cause of death in old man. 65-85% of abdominal aorta ruptures will lead to death.

Thoracic abdominal disease is less understood, due to its anatomical location and more difficult imaging capabilities. There is an estimation that 10 patients have thoracic abdominal aneurysm per 100 000 person-years. The average age of thoracic abdominal aneurysms is +/- 70 years. 60%-95% of thoracic aorta aneurysm ruptures lead to death. On the contrary of the abdominal aortic aneurysms that are almost always associated with the atherosclerotic disease, the thoracic abdominal aneurysms may occur in total absence of plaque accumulation.

The main problem in detection of both thoracic and abdominal aneurysms is the fact that they are often silent, with no clear simpthoms until they rupture, dissect or embolize. Another problem is misdiagnosis of aortic dissections and/or ruptures as myocardial infarctions.

Epidemiological studies showed that thoracic and abdominal aortic disease is associated with coronary and peripheral artery disease, even though the etiology is not properly understood.

It is important to mention that aortic pathophysiology above and below the diaphragm differ greatly: there are big differences in the vessel wall biomechanical properties, in the atherosclerotic distribution, cell signaling pathways responsible for aneurysms as well as the proteolythic pattern.

Patho-physiology of the thoracic-abdominal aneurysms thought that the aneurysm disease is associated with thinning of the media (mid vessel wall layer), resulting from proteolytic injury to extracellular matrix and smooth muscular cell disappearance. It allows for further proteolytic injury leading to dilatation and rupture.