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CARDIATIS—TEHMED

AAA—Mechanial properties
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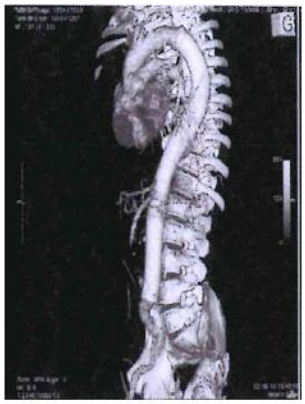
AAA - Mechanical Properties

Aneurysms of the infrarenal aorta can grow up to 800% of their original diameter, thereby changing the mechanical properties of the wall tissue. Thorough understanding of the AAA vascular wall will improve our ability to estimate implants interaction with the vessel wall.

The aortic wall is made of 3 layers: intima, media and adventitia. The biomechanical properties of the vessel wall are predominantly by the structure of media and adventitia. Those 2 layers are significantly affected by aging and gender or different pathological processes (smoking, hypertension, atherosclerosis, aneurysms, dissections). The media consists of elastin, collagen, smooth muscle cells and non-fibrous matrix. Elastin and collages are 2 main contributors to stiffness and strength and are interconnected in orderly fashion. During the AAA pathogenesis it seems that the structural modification of the aortic wall lead to progressive dilatation and possible rupture due to the following reasons: degradation of matrix proteins, decrease of smooth muscle cells, inflammatory infiltration and neovascularization. Primarily the collagen degradation and excessive collagen deposition will result in significant changes of the aortic wall that will change its mechanical properties.

Three main clinical questions are of the crucial importance when dealing with the aortic aneurysms: what are the causes of the aneurysm development, how severe is the risk of rupture and what is the best treatment strategy.

Very little is known to answer these questions: in addition to the investigation on local elasticity there are many unknown variables such as viscoelasticity, tissue plasticity, damage behavior etc. Computation of so many variables is very difficult and requires years of



further investigation in order to achieve even a basic understanding of potential processes being involved in the aneurysm formation and adequate treatment method.

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Special points of interest:

- *Mechanical behavior of AAA is dramatically changes when compared with the initial reference condition: elastin and collages undergo massive modification in addition to decrease of smooth muscle cells, inflammatory infiltration and neovascularization.*
- *Stent grafting vs flow modulation is described in more detail in this issue.*

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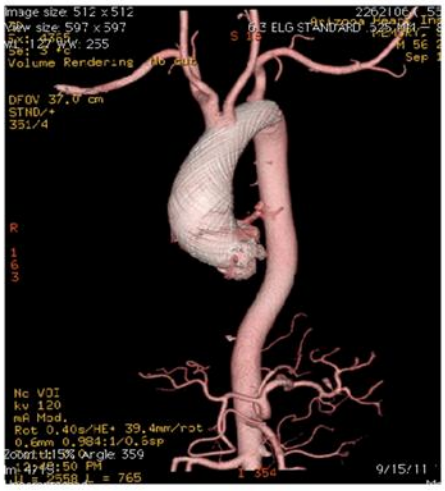
TehMED— Who Are We?

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).

Stent Grafting vs Flow Modulation

AAA is a dilation of the infrarenal aorta of (at least) 1.5 times of the reference diameter. The treatment of the aneurysms is performed once it reaches the clinically accepted threshold level of 5-5.5cm. At this moment 2 treatment options are available: open surgical repair or endovascular aneurysm repair (EVAR). The latter is accepted to be the treatment of choice lately as it provides for at least as good results with minimum trauma to the patient. The EVAR treatment technique utilizes stent grafts or lately flow modulators to conduit the blood flow distally to the aneurysm and protect the weakened aneurysm from the pulsatile blood pressure.

The EVAR procedure can be associated with different problems relating to the stent graft design, primarily relating to the endoleaks, graft migration, graft occlusion and total closure of the side branches covered by the stent graft itself. There are also cases reporting dilation of the proximal aneurysm neck. This is not fully understood, but it might be related to stent graft oversizing, which might in turn result in increased stress on the aneurysm wall. Stent graft migration considers graft dislodgement of at least 5mm from its origination deployment site. The reason of that might be the hemodynamic force that exacerbates force on the vessel wall. Another reason might be poor stent



graft sizing as well as poor proximal fixation.

Stent graft implantation does change the stress pattern in a AAA. The high stresses in the aneurysm region disappear, but remain high in the aneurysm neck, due to the direct contact of the stent graft with the neck region. The length and tortuosity of the thoraco-abdominal aorta contribute to the incidence of stent-graft migration and component separation. Destabilization forces are generated in the kinks of the stent grafts that increase with the square of graft diameter. One of the biggest complications in stent grafting is stroke and paraplegia. In case of paraplegia the presumed etiology is obstruction of blood flow to the anterior spinal artery through segmentation branches of the aorta.

Flow modulation is a novel approach for treatment of the thoraco-abdominal aortic disease, while using completely different treatment approach. The goal of the treatment remains the same: recanalization of the blood flow away from the weakened aneurysm sack and subsequent decrease of the wall shear stress along the aneurysm sack. The endovascular treatment is based upon placement of a multi-layer flow modulator that remains open for the side branches (sufficient pressure drop), but does decrease inflow in the aneurysm sack. The advantages of the flow diverter design are: high flexibility, easy deployment, preservation of the side branches and strong recanalization rate towards the distal circulation.