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Abdominal aortic aneurysm ruptures risk prediction, an open challenge for vascular surgeons

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Abdominal aortic aneurysms (AAAs) rupture is one of the main causes of death in the world. Nowadays, there is consensus that current criteria to assess the aneurysm rupture risk (maximum transverse diameter and growth rate) cannot be considered as reliable indicators. Hence, the clinical management of aneurysmatic patients faces the challenge of identifying if other indices could be used as rupture predictors. Recently, rupture predictor indices have been proposed; among them are asymmetry, effect of intra-luminal thrombus, wall stiffness and thickness saccular index, mechanical stress. Some of these indices have been more successful than others due to the difficulty for extracting in-vivo and non-invasive information, difficulty in its implementation in daily clinical management. To overcome this limitation and considering the influence of the AAA morphology on aneurysm rupture potential, some size and shape geometric indices, based on lumen centerline, have been proposed and have been correlated with the hemodynamic stresses, as an indicator of the rupture risk. The main advantage of the geometric indices is that they can be determined, in easy way, from computed tomography. The objective of this study is to discuss the basics of this approach and how it can help to gain physical insight based on quantitative results. The results up to now obtained show that statistical techniques could be an appropriate method to determine potential correlations and that other indices like, asymmetry, deformation rate, AAA length, saccular index, are important and could also be readily incorporated into surgeon's decision making.

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In vivo tissue engineered blood vessels

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There's a large clinical need for novel vascular grafts. Tissue engineered blood vessels (TEBVs) have great potential to improve the outcome of vascular grafting procedures. We present a novel approach to generate autologous TEBV *in vivo*. Polymer rods were engineered and implanted, evoking an inflammatory response that culminates in encapsulation by a fibro-cellular capsule. We hypothesized that, after extrusion of the rod, the fibro-cellular capsule differentiates into an adequate vascular conduit once grafted into the vasculature. Rods were implanted subcutaneously in pigs. After 4 weeks, rods with tissue capsules grown around it were harvested. Tissue capsules were grafted bilaterally as carotid artery interposition. One and 4-week patency were evaluated by angiography where upon pigs were sacrificed. Tissue capsules before and after grafting were evaluated on tissue remodeling using immunohistochemistry, RNA profiling and mechanical testing. Rods were encapsulated by thick, well-vascularized tissue capsules, composed of circumferentially aligned fibroblasts, collagen and few leukocytes, with adequate mechanical strength. Patency was 100% after 1 week and 87.5% after 4 weeks. After grafting, tissue capsules remodeled towards a vascular phenotype. Gene profiles of TEBVs gained more similarity with carotid artery. Wall thickness and aSMA-positive area significantly increased. Interestingly, a substantial portion of (myo) fibroblasts present before grafting expressed smooth muscle cell markers. While leukocytes were hardly present anymore, the lumen was largely covered with endothelial cells. Burst pressure remained stable after grafting. In conclusion, autologous TEBVs can be created in the subcutis, with sufficient mechanical strength enabling vascular grafting. These grafts differentiate towards a vascular phenotype upon grafting.

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