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Abstracts

Valves in the Heart of the Big Apple VIII: Evaluation and Management of Valvular Heart Diseases 2014

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ent's own tissue according to the shape of mold faithfully. In this study, 3D printer was used for design of the preparation molds for Biovalve family and valvular function was evaluated in vitro and in vivo. **Methods and Results:** 3D printers (Projet or Objet) could reproduce easily the 3D-shape and size of native heart valves regardless of types within several hours. Only 1-month subcutaneous embedding of the assembling of 2 conduit parts and 3 sinus parts produced aortic or pulmonary valve-shaped Biovalves from completely autologous connective tissue with collagen and fibroblasts. As an aortic valve Biovalve in vitro evaluation using a pulsatile circulation circuit showed excellent valvular functions. Mean flow was maintained up to 10 days in the saline solution at 37°C with high durability. Upon implantation of the Biovalves in a beagle or a goat model good valvular function was obtained for 6 months. Combination with stents (Goodman Co.) at the mold embedding formed stent-impregnated Biovalves. By catheter-induced implantation of the Biovalves TAVI in a goat model or TPVI in a canine model were performed. In addition, mitral-type and tricuspid-type Biovalves were similarly formed by 3D molding in body. Their leaflets and tendinous cords were connected robustly and seamlessly. In a canine model, after surgical replacement postoperative echocardiography showed smooth movement of the leaflets with little regurgitation under systemic circulation. In all implantation study, the luminal surface after implantation was very smooth and fully covered with thin neointima including endothelial cells without thrombus formation. **Conclusion:** Functional, autologous, 3D-shaped, aortic, pulmonary, mitral, and tricuspid valves with clinical application potential were formed by only in body embedding of specially designed molds, which could be prepared by 3D printer within several hours.

Long Term Evaluation of In-Body Tissue Engineered Heart Valve (Biovalve)

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Objective: A novel autologous aortic valve with a metallic stent (Biovalve Stent) was developed, using simple, safe and economical in-body tissue engineering. In this study, the long-term evaluation of the Biovalve Stent for transcatheter implantation was investigated in a goat model. **Methods:** Biovalve Stents were prepared by 2-month embedding of the molds, assembled using plastic rods and a metallic stent, in the subcutaneous spaces of goats. After extracting the molds and removing the plastic rods only, Biovalve Stents with tri-leaflets similar to those of the native aortic valves were constituted from completely autologous connective tissues. Twelve out of 15 Biovalve Stents were implanted in the aorta in situ and other 3 Biovalve Stents were implanted in the pulmonary artery (PA) in situ with transcatheter technique. **Results:** In both aortic and PA cases, the Biovalve Stents were successfully implanted. Angiography showed smooth movement of the leaflets with a little regurgitation under the systemic and pulmonary circulation. The Biovalve Stents were extracted 1, 2, 5 or 6 months after implantation. The leaflets of the Biovalve kept their shape and elasticity even after 5 months and neither calcification nor thrombi were observed. Histological examination showed the cell populations inside the valves and endothelial cells covering the laminar surface of the valve leaflets. **Conclusions:** The Biovalve Stent satisfied the higher requirements of systemic and pulmonary circulation in goats for maximum 6 months with the potential for transcatheter implantation.

Role of Matrix Metalloproteinas in Complications of Thoracic Aorta Aneurysm

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Objective: Matrix metalloproteinases (MMPs) are endopeptidases involved in extra-cellular matrix remodelling, associated with both physiological and pathological processes of several human tissues and systems, such as vascular system. It is well known their involvement in mediating both beneficial and pathological aorta effects, such as abdominal aorta aneurysms and its complications. On the contrary, unclear data exist about their role in the pathophysiology of sporadic thoracic aorta aneurysm (TAA) and its complications. Thus, the aim of this study was to analyse the role of MMPs in TAA complications, i.e. rupture and dissection. **Methods:** Aortic specimens obtained from 73 patients (51 men and 22 women, age 61.7±10.7 years) affected by TAAs, 18 patients with type A aortic dissection (TAD) and 30 controls were utilised for histo-pathological and immune-histochemical analyses. In addition, a second control group of 128 subjects (61 men and 67 woman, age 61.1±5.8 years) was enrolled to examine the role of single nucleotide polymorphisms (SNPs) of MMP-9 (NM-004985), MMP-2 (NM-001121363.1) genes in diseases risk. **Results:** Three different patterns of MMPs (extracellular, intracellular and mixed) with different concentration (low, moderate, elevated) have been observed in case aorta samples. The pattern with elevated MMP amount in aorta samples from TAD cases was also characterised by increased cystic medial degeneration, without substitutive fibrosis, and plurifocal medial apoptosis. In the context of TAA aorta samples, we identified three phenotypes: phenotype I (normal wall); phenotype II (moderate wall thickness); phenotype III (thin and weak wall). In particular TAA phenotype III mainly observed in case samples showed the same histological features of TAD with elevated MMP concentration with a mixed pattern. In addition, significant associations were observed between the 1562C/T MMP-9 and -735C/T MMP-2 SNPs and the risk of both TAA and TAD. **Conclusions:** Our data suggest a crucial role of both MMP-2 and MMP-9 in both TAA and its complications, such as TAD. In future they might be considered as new criteria in TAA surgical indications.