

MP5-1

Experimental Studies of Novel Transcatheter Flow Reducer in Pulmonary and Systemic Circulation

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Introduction: Flow reduction is sometimes needed to reduce pressure and prevent downstream vessel damage or to promote circulatory remodelling. We have recently reported preliminary data regarding the efficacy and retrievability of a new transcatheter flow restrictor (TFR; Occlutech GMBH, Germany) implanted in the systemic vein in a swine model. We report herein additional results obtained in the same animal model in which a TFR with refined shape was implanted in both systemic and pulmonary circulation.

Method: A refined prototype flow reducer (Occlutech GMBH, Germany) made of nitinol mesh with polyurethane covering was implanted percutaneously in the proximal left pulmonary artery (n=1) and in the intrahepatic segment of the IVC (n=2) in 3 domestic swine (weight 40-60 kg). The shape of the device was selected based on our computational fluid dynamics (CFD) study in order to optimize flow pattern and minimize risk of thrombosis. Following implantation, all animals were placed on warfarin as thromboembolic prophylaxis.

Results: The implantation procedure was uneventful with an initial pressure gradient of 4-5 mm Hg across the IVC device and 20 mm Hg across the LPA device, with no adverse changes in the systemic arterial pressure and oxygen saturation. All animals were euthanized 2 to 3 weeks after TFR implantation due to weakness and swelling of the left front limb which onset in all animals 2 weeks after TFR implantation without signs of increased venous congestion or heart failure. In one animal with device implanted in the IVC, catheterization prior to euthanasia showed good TFR patency with no pressure gradient across the device and moderate venous collateralization. In this animal, the device was easily retrieved using snare technique. The post-mortem examination of the animal with TFR implanted in the LPA showed fully patent device with moderate endothelialization but no signs of neo-intima in the TFR's fenestration.

Conclusion: Transcatheter flow reduction in the systemic and pulmonary circulation using this device appears to be feasible with a smooth operator learning curve and possibility to retrieve the device weeks after implantation.