Renewed interest in porcine and horse heart and pulmonary vein anatomy in an experimental model for atrial fibrillation treatment

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Introduction

Atrial fibrillation is the most common cardiac arrhythmia diagnosed in man. It is frequently initiated by multiple scattered triggering foci located in the myocardial sleeves extending into the pulmonary vein walls. Currently, the efficacy and risks of catheter ablation as an ultimate treatment option for the most obstinate forms of atrial fibrillation are actively debated.

As a result, alternative approaches such as the intraluminal implantation of expandable ablation devices are under investigation. However, the search for more efficient and safer ablation techniques is hampered by a lack of in-depth data on the fine anatomical architecture of the pulmonary veins in any experimental animal model considered. In the current investigation, pigs were chosen as animal model. As apart from humans, horses are also prone to develop atrial fibrillation. Therefore the present study was extended towards this species as well.

Objectives

• To evaluate the presence and pattern of the myocardial sleeve in pulmonary veins of horses histologically. (Fig. 3, 4)
• To map the pulmonary vein topography and variability in pigs and horses by anatomical dissection and silicon casts, which provide a better overview. (Fig. 2, 5, 6)
• To measure the stretch tolerance of the pulmonary vein orifices in pigs by a biomechanical stretch test. (Fig. 1, 7, 8, 9)

Results

![Fig. 1](image1)

Fig. 1 To analyse the stretch tolerance of the pulmonary vein orifices, a prerequisite for using expandable intraluminal ablation devices, pulmonary vein tissue, taken at the level of ostium II, was stretched to various lengths.

![Fig. 2](image2)

Fig. 2 Section cast of the left atrium, as seen from the facies auricularis of the heart, of a pig. The interatrial septum is located in the lower left corner of the image. The v. pulmonalis lobi accessoria is pointed with the probe.

Two ostia (I, II) drain the different lung lobes. This constant pattern was seen in all pigs. Ostium II is used for slant placing because of fewer small branches and less variation. (Fig. 5-8, 9)

More variation in the branching pattern and in the amount of ostia was observed in horses.

- Stretching up till 170% of the original diameter caused no apparent histological damage in any of the samples.
- Stretching the pulmonary vein orifices from 180% onwards, myocardial damage could be detected microscopically.

Conclusion

These results provide fundamental data essential for the further development and in vitro and in vivo testing of a new surgical technique in the treatment of atrial fibrillation in humans and horses.

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