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Atrioventricular nodal re-entry tachycardia: a potential morbidity condition in Williams syndrome

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Background: Williams-Beuren syndrome (WS) is an autosomal dominant disorder characterized by dysmorphic facies, cardiovascular diseases, mental retardation and idiopathic hypercalcemia. Cardiovascular defects are found in up to 80% of the pts, the most common of which is supralvalvular aortic stenosis, being present in 48.8% of pts. Other frequent cardiovascular manifestations are stenosis of pulmonary arteries, mitral valve anomalies, stenosis of peripheral arteries, atrial and ventricular septal defects. Only little information exists about the occurrence of arrhythmias in the setting of this syndrome.

Methods: Data about WS pts were retrospectively revised with the aim to identify conditions that required invasive procedures for arrhythmic events.

Results: In the last twelve months, two patients affected by WS underwent radiofrequency catheter ablation (RFCA) for atrio-ventricular nodal re-entry tachycardia (AVNRT) at our institution. Pt #1, a 17 years old boy with a familiar history of thalassemia and thyropathy, suffered from recurrent episodes of palpitation followed in one case by syncope. Propafenone and Sotalol therapy resulted ineffective to prevent tachycardia episodes. Echocardiographic evaluation revealed the presence of bicuspid aortic valve and light supralvalvular aortic stenosis. Pt # 2, a 12 years old boy had a history of a small interventricular septal defect spontaneously closed. Echocardiographic study excluded other congenital heart defects. He suffered for recurrent episodes of palpitations, requiring repeated admission in emergency. In both patients slow-fast AVNRT was induced during electrophysiologic study with a single extrastimuli protocol (cycle length 322±29.6msec). RFCA of slow pathway was successfully performed in both pts, without any complications.

Conclusions: Besides congenital heart disease, potential morbidity in WS pts can derive also from AVNRT.

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POSTER HALL

Tools: catheters, sources, mapping, navigators

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Gold-alloy tip electrode: A new "deep lesion" technology for catheter ablation?

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Radiofrequency (RF) catheter ablation is widely used to induce focal myocardial necrosis using the effect of resistive heating through high frequency current delivery. It is current standard to limit the target tissue-electrode interface temperature to a maximum of 60 to 70° to avoid scar formation. Gold (Au) exhibits a thermal conductivity of nearly four times greater than platinum (Pt-Ir) (3.17 W/cm Kelvin versus 0.716 W/cm Kelvin), therefore it was hypothesized that RF ablation using a gold electrode would create broader and deeper lesions as a result of a better heat conduction from the tissue-electrode interface and additional cooling of the gold electrode by "heat loss" to the intracardiac blood. To test this hypothesis, we performed in-vitro isolated liver and pig heart

and in-vivo dog model investigations comparing lesion depths of a new Au-alloy tip electrode to standard Pt-Ir electrode material.

Mean lesion depth in liver tissue for Pt-Ir was 4.33 ± 0.45 mm (n = 60) whereas Au electrode was able to achieve significantly deeper lesions (5.86 ± 2.41 W whereas Au allowed to apply 9.64 ± 3.78 W indicating a statistically significant difference (p<0.05). In-vitro pig heart tissue Au-ablation (n=20) increased statistically significantly lesion depth (Au: 4.85 ± 1.01 mm, Pt-Ir: 2.96 ± 0.81 mm, n=20; p<0.001). Again, Au allowed to apply significantly more power (p<0.001). In the in-vivo dog model (n=4), the Au electrode achieved deeper lesions as indicated by a relative difference of 31% for lesion depthwhite and 15% for depthred (n.s.).

Gold tip electrode catheters were able to induce deeper lesions using RF ablation in-vitro and in an in-vivo dog-model as compared to Platinum-Iridium tip electrode material. In liver and in pig heart tissue, the increase in lesion depth was associated with a significant increase in the average power applied with the gold electrode at the same level of electrode-tissue temperature as compared to platinum material.

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Pre-ablation determination of expected power output as indication of lesion size during radiofrequency ablation: verification of an experimental algorithm applied in patients with accessory pathways

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Purpose: to develop an algorithm determining the target temperature (tp) needed for a desired lesion size for any obtained catheter position, by measuring the tp rise to a test pulse (dT) and correlate this to power-output when ablating accessory pathways.

Methods: experimental model: in pigs the catheter tip was positioned in the left ventricle and 0.6 W applied for 5 s and ablation then performed with unchanged tip position. Development of algorithm: dT was measured and ablation then performed at target tp 70 or 60°C and volume determined. Regression analysis between dT and lesion volume was performed and curves extrapolated to target tps 55-85°C. Testing of algorithm: A target volume of 300 mm³ was tested by measuring dT and then ablating with the target tp suggested by the algorithm. Clinical testing: in patients with accessory pathways pre-ablation test pulse was applied and power output during ablation at target tp 70°C was registered.

Results: the algorithm was developed from 34 lesions. Volume ranged from 13-1440 mm³. There was a significant negative correlation between dT and volume for 70°C and 60°C target tp (r = 0.95 and 0.74), and between dT and power output r = 0.97 for target tp 70°C. The algorithm was tested in 6 animals (15 lesions), target volume 300 mm³. Target tp ranged from 62-85°C. Lesion volume was 310±93 mm³. The variance on this lesion volume was significantly smaller (p<0.02) than the variance on lesion volume for target tp of 70°C. Clinical testing was done in 5 patients, 9 test pulses. dT ranged from 0.1-0.9°C. A significant negative correlation was found between dT and power-output, r = 0.73, not significantly different from the correlation found in the animal experiments.

Conclusion: the tp rise to a pre-ablation test pulse can evaluate the impact of electrode tissue contact and cavitary cooling on lesion size. Using this information to choose a target tp allows creation of a more controllable lesion size. Preliminary clinical testing suggests that a similar relation between dT and ablation parameters is present during ablation of accessory pathways in humans.