2:30

ACTIVATION AND REPOLARIZATION IN PATIENTS WITH POSSIBLE MYOCARDIAL HIBERNATION DUE TO AN OBSTRUCTION OF THE LEFT ANTERIOR DESCENDING CORONARY ARTERY

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To determine the relation of myocardial hibernation to activation and repolarization of the heart, a QRST isoarea map (A-map) and an isochrone map (C-map) were constructed from data recorded in 16 pts with a stenosis (>75%) of the left anterior descending artery. Left ventriculography and ECG mapping were performed before and 6 months after percutaneous transluminal coronary angioplasty (PTCA). None had the prior myocardial infarction. Body surface unipolar electrocardiograms were recorded with a 87-lead system at a sampling interval of 1 msec. The data of 50 normals served as controls. Left ventricular (LV) wall motion was evaluated with the centerline method. Impaired LV wall motion of the anterior wall was normalized 6 month after PTCA in 5 pts. In A-map of the 5 pts, an abnormally negative area was located over the anterior chest before PTCA. The negative area over the chest and asynergy of the anterior LV wall disappeared after PTCA in the 5 pts. The activation times derived from C-map of all the pts were within the normal range (mean+2SD of 50 normal subjects) both before and after PTCA. These findings demonstrate that the epicardial activation may be preserved almost normal whereas repolarization properties are markedly modified due to the severe subendocardial myocardial ischemia at the lesion of the possible hibernation with reversible left ventricular wall motion abnormalities. The combination study of QRST isoarea and isochrone maps may provide useful information on activation and repolarization of myocardial ischemia.

3:00

MAPPING STUDIES OF VENTRICULAR ARRHYTHMIAS IN ISOLATED HUMAN HEARTS.

S. Kimber, E. Sevaptsidis, S. Massé, T. Chen, J. Butany, C. Feindel, E. Downar. University of Toronto, Toronto Ontario.

To overcome problems associated with animal models, of ventricular tachycardia, the feasibility of performing detailed endocardial and epicardial mapping studies during ventricular arrhythmias in isolated human hearts was pursued. Transplant recipient human hearts were taken immediately at explantation and perfused with a 50:50 blood:Tyrodes solution mixture in a Langendorff perfusion system. Arrhythmias were induced by programmed stimulation and mapped using right and left ventricular balloon arrays and an epicardial sock array. Each array comprised 112 electrode recording sites at 10 mm intervals.

Ventricular tachycardia was inducible in 4/7 human hearts studied. Underlying cardiac pathology included dilated cardiomyopathy (1) hypertrophic cardiomyopathy (1) and ischaemic heart disease (2). In the hypertrophic cardiomyopathy, two morphologies of monomorphic ventricular tachycardia were induced. These arose from adjacent sites on either side of an area of functional block. Isochrone maps of these ventricular tachycardias showed evidence for a reentrant mechanism. To study its anatomical features, the area of block was localized, excised and subjected to detailed histological examination. Three dimensional reconstruction of the area showed patchy transmural scar with a thin, discontinuous layer of surviving endocardial fibres.

Therefore, the isolated human heart preparation is an excellent method for the detailed study of ventricular tachycardia, allowing a unique opportunity to make functional and anatomical correlations. It also allows the in situ study of naturally occurring arrhythmogenic substrate. Using this method evidence for a reentrant mechanism in ventricular tachycardia associated with the late stages of hypertrophic cardiomyopathy was seen.

2:45

"MULTI-USE" REENTRY IN A FUNCTIONAL SHEET OF SURVIVING SUBENDOCARDIUM.

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In ischaemic heart disease, most ventricular tachycardias are thought to be due to a single reentry path along a discrete bundle of surviving muscle fibres. Such a reentry path has one entry and one exit point.

New intra-operative mapping studies of ventricular tachycardia using simultaneous unipolar and high-gain bipolar recordings revealed evidence of an extensive sheet of surviving subendocardium in some patients. Such a sheet can have multiple entry and multiple exit points allowing for different reentry paths at different times all in the same heart. In one patient, five different ventricular tachycardias could be induced, four of which utilized such a sheet. Two of these tachycardias had the same exit point (site of origin) but two different entry points with a long and short return path resulting in long and short tachycardia cycle lengths. The same sheet sustained another tachycardia with one entry and two exit points resulting in two separate "sites of origin" on the endocardium. Such sheets were also seen to insert in the left bundle branch system.

CONCLUSION: Simultaneous Unipolar and High-Gain Bipolar electrograms provide evidence of a sheet of surviving subendocardium with functional pleomorphism. Such a structure may account for unexplained tachycardia cycle lengths changes and for unsuccessful surgical ablation directed at apparent sites of origin.

3:15

EXPERIENCE WITH A RIGHT VENTRICULAR BALLOON ARRAY FOR CARDIAC MAPPING.

E. Downar, T. Chen, I.D. Parson, L.Harris, E. Sevaptsidis, S. Massé, L.L. Mickleborough, W. Willimas. University of Toronto, Toronto Ontario.

Initial attempts to map the right ventricle (RV) with a simple ellipsoid left ventricular (LV) balloon electrode array, were thwarted by the peculiarities of RV topology. A custom mould was therefore used to fabricate an anatomically-correct balloon which conformed to the major features of the RV. A flexible nylon cloth sock enveloped the balloon and allowed attachment of 112 silver bead electrodes. The entire array was introduced across the tricuspid valve in the deflated state and proper location in the apex and outflow tract was ensured by leader sutures.

Eight patients were mapped using this device. In two patients with Tetralogy of Fallot, inducible ventricular tachycardia (VT) was accurately located to the outflow tract though not to the site of earlier correction. Pressure at the site of earliest activation during VT terminated the tachycardia. In five patients with ischaemic VT, a septal origin was suggested by simultaneous activation in both ventricles. In one patient with Chagasic cardiomyopathy, global mapping was performed using the RV balloon with a LV balloon and an epicardial sock. One VT originated in the RV epicardium followed at 92 msec by subjacent RV endocardial activation and broke into the LV endocardium on the left septum at 100 msec. A second VT arose in the endocardium of the LV free-wall, spread to overlying epicardium at 82 msec and entered RV on the right septum at 152 msec. Both VT's were successfully ablated surgically.

We conclude that RV balloon mapping alone can be definitive in congenital heart disease and enables successful global mapping in diffuse cardiomyopathies.