years. HRT slope was calculated from the first twenty beats. Fractal scaling coefficients, with prematurity. The fractal properties of this variation are unaffected by the type of beat groups. Following PACs, C \text{Fractal} = 1.16 \pm 0.02 and following PVCs, C \text{Fractal} = 1.19 \pm 0.03.

Conclusion: In normal subjects, HRT slope differs for PACs and PVCs and correlates with prematurity. The fractal properties of this variation are unaffected by the type of beat groups. By taking into account the presence of the PVC and combining with a fractal scaling analysis, risk stratification may be enhanced.

POSTER SESSION

1114 Mapping and Ablation of Ventricular Tachycardia

Monday, March 18, 2002, Noon-2:00 p.m.
Georgia World Congress Center, Hall G
Presentation Hour: 1:00 p.m.-2:00 p.m.

1114-111 Epicardial Radiofrequency Ablation of Ventricular Myocardium: Mechanisms of Lesion Formation and Damage to Adjacent Structures
Guilherme Feneion, Kleber Ponzi, Angelo de Paula, Paulo Leite School of Medicine, Sao Paulo, Brazil.

Background: Epicardial radiofrequency (RF) ablation has been increasingly used in patients with ventricular tachycardia, but the mechanisms of epicardial lesion formation are not well understood.

Methods: In 23 dogs (16-25 Kg), we compared epicardial (Epi, n=7) versus endocardial ablation (Endo, n=7), using fluoroscopy-guided, standard techniques (70°C/60 sec; 60 W). Further, epicardial RF delivery was assessed during catheter tip irrigation (500 ml of water) and with a holder to assure optimal electrode-tissue contact (n=6). In the latter, thermally-insulated (TI) electrodes (50% tip surface) were also used (n=3). In the Endo group, percutaneous techniques were used. In the Epi group, a millinatrix catheter was inserted and a sheath was placed in the pericardial space.

Results: Power (10 vs 11 W), catheter tip temperature (68 vs 67°C) and impedance (157 vs 165 Ohms) during RF delivery, and lesion dimensions were similar in Epi and Endo groups. In Endo, 11/31 (35%) lesions were transmural, compared to 2/25 (8%) in Epi (p<0.001). With optimal electrode-tissue contact, power outputs (17 vs 16 W; p=0.001) and pacing thresholds (0.2 vs 3.7 mA; p=0.004) were lower in Epi. However, lesion dimensions were similar and transmural lesions did not occur (depth 3.0 vs 1.5 mm). Catheter irritation (13 mL/min) allowed delivery of high power outputs (42 W; 40°C) and consistently produced transmural lesions, (51%); 65±2.1 mm. At constant power (20 W), active electrode-tissue necrosis (52 vs 27°C; p<0.05) and lesion dimensions were similar for conventional and TI electrodes. However, damage to parietal pericardium and lungs occurred with conventional electrodes only, RF delivery directly to these structures without contacting the epicardium was not possible due to high impedance.

Conclusion: Optimal RF ablation is not possible without producing deep, transmural lesions and is associated with a significant energy loss due to poor electrode-tissue contact. The lack of cooling effects limits power delivery in the pericardial space.

Damage to adjacent structures results from passive heat conduction from catheter tip and not from resistive heating of tissue. TI electrodes may prevent damage to these structures.

1114-112 Epicardial Ablation of Ventricular Tachycardia: Location of Successful Ablation Site and Long-Term Follow-Up
Nassir F. Marrouche, Robert Schweikert, Wald Saliba, Christopher Cole, Andrea Natale.
Cleveland Clinic, Cleveland, Ohio.

Background: We describe results and location of epicardial ablation to treat ventricular tachycardia refractory to endocardial ablation.

Methods and Results: Nineteen patients (mean age 46±21 years, 16 men) presented for epicardial mapping and ablation of monomorphic VT. Of these 19 VTs, 17 appeared to originate from the epicardium. Of these 17 patients, 5 had coronary cardiomypathy, 4 had idiopathic cardiomypathy, and 11 had normal hearts. Twelve of these patients were successfully ablated with epicardial lesions after endocardial lesions both with 4 mm tip and cooled-tip catheters were delivered without effect. The location of the successful ablation sites in all 12 patients was along the main branches of the coronary arteries. After a mean follow-up of 13±5 months no recurrence of VT was observed. One patient had transient symptoms of pericarditis that resolved quickly within 48 hours with nonsteroidal anti-inflammatory agent. No other complications were observed.

Conclusion: In our preliminary experience epicardial mapping and ablation of VT is safe and feasible. The majority of successful ablation sites appeared located along the epicardial course of the coronary arteries.

1114-113 Is Noncontact Mapping Associated With a Higher Complication Rate Than Conventional Mapping in Catheter Ablation of Complex Arrhythmias?
Karheiz Seldi, Monika Rameken, Margit Varg, Harald Schwacke, Andreas Brandt, Jochen Senges, Heart Center, Ludwigshafen, Germany.

Non-Contact Mapping (NCM) permits high density endocardial mapping of arrhythmias. Its usefulness for mapping of complex arrhythmias to guide catheter ablation has been demonstrated. Aim of this study was 1) to evaluate the safety of NCM in 108 patients (pts) in whom catheter ablation was guided by NCM, 2) to compare the complication (C) rate of catheter ablation guided by NCM with the C rate observed with conventional mapping (CM) in 213 pts. Catheter ablation was performed in 321 consecutive pts with complex arrhythmias (55 ectopic atrial tachycardias, 104 atrial flutter, 19 atrial fibrillation, 75 ventricular tachycardia, 68 ventricular ectopy). CM was performed in the first 213 pts, NCM was used in the following 108 consecutive pts. All percutaneous (C < 4 weeks) were registered. Main C categories are listed below. Using a logistic regression model determinants which were associated with a higher C rate were evaluated (adjusted to clinical and procedure parameters). The only independent predictor which was associated with a higher C rate was an impaired left ventricular function with ejection fraction <40% (OR 4, Cl.1.06 - 14.8), NCM was associated with a higher C rate compared with CM (p=0.003) and with a 1.8 C rate. Conclusion: The C rate in catheter ablation with NCM was 5.3% compared to 6.6% with conventional mapping. Using a logistic regression model NCM was not associated with a higher C rate. The only independent risk factor associated with a higher C rate was an impaired left ventricular function.

Complications (C): Comparison CM vs NCM

<table>
<thead>
<tr>
<th>C (n=213)</th>
<th>C (n=108)</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pericardial effusion</td>
<td>4 pts (1.9%)</td>
<td>3 pts (2.8%)</td>
</tr>
<tr>
<td>Thromboembolic C</td>
<td>4 pts (1.9%)</td>
<td>2 pts (1.9%)</td>
</tr>
<tr>
<td>Vascular C</td>
<td>5 pts (2.3%)</td>
<td>4 pts (3.7%)</td>
</tr>
<tr>
<td>Other C</td>
<td>1 pt (0.5%)</td>
<td>1 pt (0.9%)</td>
</tr>
<tr>
<td>C total</td>
<td>14 pts (6.6%)</td>
<td>10 pts (9.3%)</td>
</tr>
</tbody>
</table>

1114-114 Differential 12 Lead Electrocardiographic Manifestations of Arrhythmogenic Right Ventricular Dysplasia Versus Right Ventricular Outflow Tract Ventricular Tachycardias

Background: The differential diagnosis for left bundle/inferior axis right ventricular tachycardia (VT) includes arrhythmogenic right ventricular dysplasia (ARVD) and idiopathic right ventricular outflow tract (RVOT) ventricular tachycardias. Since they are due to different mechanisms, it should be possible to distinguish between the two conditions using the 12-lead ECG during spontaneous VT. Methods: Nine patients with a definite diagnosis of ARVD and eighteen patients with RVOT VT were identified from the Mayo Foundation database. Patient age for the ARVD group was 43 ± 22 years and for the RVOT group was 45 ± 27 years. None of the ARVD patients had underlying heart disease. In the RVOT group, one patient had hypertension, one had coronary artery disease and two had mitral valve prolapsae. 12-lead ECGs of spontaneous left bundle ventricular tachycardias were analyzed for over 80 parameters including morphologies, amplitudes, duration of Q to nadir, transition points and the presence of notching. Results: There were significant differences (using Fisher’s Exact Test and 2-tailed p-value) in the 12-lead VT ECGs between the two groups. 99/100 (99%) ARVD patients had onset of Q to nadir of S duration (Lead V1 or V2) equal or greater than 60 msec versus 7/18 (41%) RVOT patients (p = 0.007). 9/18 (50%) RVOT patients had deep S (lead V1 or V2) versus 3/39 (9%) ARVD patients (p = 0.007). 9/100 (9%) ARVD patients had QRS duration (Lead V1 or V2) equal or greater than 140 msec versus 6/18 (33%) RVOT patients (p = 0.0027). 11/18 (61%) VT RVOT patients had deep S waves (Lead I) versus 9/9 (100%) ARVD patients. 7/18 (39%) RVOT patients had R-wave notching (Lead I) versus 5/18 (28%) RVOT patients (p = 0.037). Conclusion: The 12-lead ECG of VT in ARVD is significantly different from that of RVOT. Specific characteristics of the 12-lead ECG in VT discriminate between ARVD and RVOT. This information may be useful in determining the underlying disease process to reduce the risk of misclassifying ARVD as benign RVOT VT.

1114-115 Is Catheter Ablation of Hemodynamically Unstable Ventricular Tachycardia Feasible Using Noncontact Mapping?
Karheiz Seldi, Monika Rameken, Margit Varg, Harald Schwacke, Andreas Brandt, Jochen Senges, Heart Center, Ludwigshafen, Germany.

Hemodynamic collapse precludes extensive catheter mapping to identify the target region in patients with ventricular tachycardia (VT) with conventional sequential catheter mapping. However, the non-contact mapping system (NCM) computes virtual electrograms simultaneously at more than 3000 ventricular sites. A single beat of the VT seems to be insufficient to map the VT. The purpose of this study was to assess the clinical utility of NCM for mapping and ablation unstable VT. Methods: We evaluated 29 patients (pts) with an implantable cardioverter defibrillator (ICD) with drug refractory monomorphic and hemodynamically unstable VT (4 pts had ischemic VT and 5 pts had nonischemic VT, ejection fraction <33%). All pts had at least 3 epicardial leads of unstable VT (mean cycle length 295±75 ms) during the month before treatment. Catheter ablation was performed with a linear lesion at the diastolic pathway just before the exit site. Radiofrequency energy was delivered during sinus rhythm and efficacy was assessed by programmed ventricular stimulation. All pts had a regular follow up in our ICD clinic.
Radiofrequency Catheter Ablation of Ventricular Tachycardia Using a Virtual Dynamic 3-D Endocardial Mapping System Based on Sonomicrometry

Alida E. Borger van der Burgt, Natasa M. S. de Groot, Marianne Bosterna, Lieslelot van Elven, Ernst E. van der Walt, Martin J. Schuit, Leiden University Medical Center, Leiden, The Netherlands.

Introduction: Radiofrequency catheter ablation (RFCA) is a potentially curative treatment option of ventricular tachycardia (VT). Endocardial mapping is mandatory to identify target sites for ablation. Fluoroscopy guided RFCA however, is often long-lasting and might be inaccurate. We studied the efficacy of the use of a new 3-D mapping system with a deformable heart model based on the real-time position management (RPM) system. Methods: The RPM system uses sonomicrometry for exact localisation of the catheters in a 3-D space. Two reference catheters form a frame in which the position of the ablation catheter can be determined. The heart model appears as a spherical body which expands to the real endocardial contour by dragging the ablation catheter along the wall. The local activation times are color-coded and superimposed over the model. Results: Twenty-five pts (20 male, 61±16 yrs) with drug refractory VT underwent RFCA with this system. The underlying etiologies were: ischemic heart disease 18 (IHD, 54%), arrhythmogenic right ventricular cardiomyopathy 4 (ARVC, 16%) and idiopathic VT 5 (IDIO, 20%). Three pts were treated successfully with an OHCA (aorta, 2 pts; brain, 1 pt) during the procedure. No differences in AT frequency or burden were observed between periods with and without OHCA (p=0.13). In 16 pts low resistance corridors were identified that expanded to the real endocardial contour by dragging the ablation catheter along the wall. Twenty pts underwent ablation in an AVN reentry circuit (29±6 days), of which 11 pts were excluded if they were started on dofetilide before or within 6 weeks of EPD implantation. Values of pacing and sensing threshold were obtained by using the 3-D reconstruction of the atrial and ventricular myocardium. Atrial pacing thresholds were 42±21 mV and 21±15 mV, respectively. The maximum number of sequences was set at 18. The efficacy of these drugs on atrial arrhythmias (AT). We intended to study the effects of class III antiarrhythmic drugs on atrial fibrillation (AF). Currently, the IAS pacing site is selected indirectly by fluoroscopy and P-wave analysis. The aim of the present study was to develop a novel approach for IAS pacing based on intracardiac echocardiography (ICE, Boston Scientific). Methods: The ICE transducer is positioned into the superior vena cava (SVC) and pulled back into the inferior vena cava by an ECG- and respiration-gated and triggered technique. The right- and left atria are then three-dimensionally (3D) reconstructed (TomTec). Using an "an face" view of the IAS the desired pacing site is selected. The selected spot serves as a reference point for creating a horizontal two-dimensional (2D) template. Real-time, 2D ICE is then used to guide implantation of the atrial pacing lead. After lead positioning and electrical testing another 3D reconstruction is performed in order to select an optimal lead position. Measurements and assessment of P-wave duration are performed off-line. Results: A total of 8 patients were included into this feasibility study. IAS pacing was achieved in all patients including 4 suprafossa1 (SF) and 4 infrafossa1 (IF) lead locations. Measurements and assessment of P-wave duration were 46.6±30.9 min and 32.4±19.8 min, respectively. IAS pacing resulted in a significant reduction of the P-wave duration as compared to sinus rhythm (83.2±129.4 ms; p<0.0001). SF pacing showed a greater reduction in P-wave duration than IF pacing (65.5±7.1 vs. 91.6±13.5 ms). Conclusions: 1. Three-dimensional ICE is a feasible approach for guiding IAS pacing. 2. 3D ICE allows selection of the optimal anatomical pacing site with the shortest P-wave duration. Our data suggest that SF pacing is the preferable method for pacing the IAS.

1115-1109 Percutaneous Treatment for Pacemaker Lead-Related SVC Syndrome

Albert W. Chan, Deepak L. Bhatt, Bruce L. Wilkoff, Marco Roffi, Debabrata Mukherjee, Bruce H. Gray, Christopher T. Balzer, Jay S. Yadav, The Cleveland Clinic Foundation, Cleveland, Ohio, University of Michigan, Ann Arbor, Michigan.

Background: Superior vena cava (SVC) obstruction is an uncommon but serious complication associated with permanent transvenous pacemaker leads. Surgical removal and reimplantation of pacing leads, and use of a new external generator have been the standard management. We report our initial experience with a percutaneous approach to this problem. Methods: Coordinated by the cardiologist electrophysiologist and the interventional cardiologist, the old permanent pacemaker leads were extracted with an excimer laser sheath with constant countertraction on the lead. Silicon sheath and tip inflation, lead misposition and implantation of self-expanding nitinol stent(s) were performed at the site of obstruction. New pacemaker leads were then reimplanted through the reconstituted vein. Patients were discharged the next day if they remained stable during overnight observation. Results: Between 09/2000 and 06/2001, 4 patients aged 24-49 yrs (2 males) presented with SVC syndrome at a median 14 years (range 6-17 years) after pacemaker implantation. All patients underwent successful lead extraction and percutaneous revascularization. For one patient who had severe tricuspid regurgitation due to ruptured atrial and later underwent surgical paracaval pexy implantation, all had successful re-implantation of the transvenous pacemaker system. On clinical follow-up (2-11 months), all patients were free of obstructive symptoms. Conclusions: This "one-step"