The long QT syndrome (LQTS) is an inherited arrhythmogenic disorder characterized by mutations in at least six genes encoding for subunits of cardiac ion channels: KCNQ1, HERG, SCN5A, KCNE1, and KCNE2. Several LQTS mutations have been reported; however, the molecular epidemiology of LQTS has not been defined. Here we present the results of genetic screening (Single Strand Conformational Polymorphism combined with sequencing) of 200 unrelated probands, performed in 262 consecutive LQTS probands tested against a panel of 300 control individuals (600 chromosomes). The average time required to process a sample was 123 ± 89 days; a mutation was identified in 158 pts (62.2%); distribution of mutations among the five genes was: 90/158 (57.0%) KCNQ1, 37/158 (23.4%) HERG, 24/158 (15.2%) SCN5A, 31/158 (3.8%) KCNE1 and 1/158 (0.6%) KCNE2. Missense mutations represented the majority of the genetic defects (134/158, 85%) but other abnormalities were also identified as: small deletions (7%), splice errors (3%), stop codons (5%) and insertions (1%). KCNQ1, HERG and SCN5A mutations were frequently located in the C-terminal portion of the proteins (33%, 31%, 30% and 15%, respectively). Only 12% of the SCN5A mutations were located in the DII-DIV linker region for channel inactivation. Most mutations differed among different families as only 49/158 KCNQ1 and 1/37 HERG mutations were found in more than one family. Based on the present data we conclude that: 1) standard screening techniques allow successful identification of the genetic defect in approximately 60% of the clinically affected probands; 2) KCNQ1 related LQTS remains the most common form of LQTS, followed by HERG related LQTS; 3) Mutations of the cardiac sodium channel SCN5A are more common than anticipated and account for 15% of all LQTS and only a minority of a SCN5A mutation are located in the inactivation domain. 4) genotyping of LQTS patients should be started in all families and for the identification of known mutations does not represent a cost-effective approach.

**Demonstration of a Molecular Basis for Unexplained Cardiac Arrest in Young Individuals**

Silvia G. Priori, Caterina Napoliello, Elena Ronchetti, Giacomo Tonielli, Silvia G. Priori, Molecular Cardiology, IRCCS Fondazione Salvatore Maugeri, Pavia, Italy. Department of Cardiology, University of Pavia, IRCCS Poliambulatorio S Matteo, Pavia, Italy.

Acute myocardial ischemia and reperfusion represent the most common substrate for ventricular fibrillation, while most of the remaining cases are due to diseases such as hypertrophic cardiomyopathy, arrhythmogenic right ventricular cardiomyopathy, long QT syndrome, myocarditis and valvular defects. In approximately 1.5% of individuals sudden cardiac deaths are attributed to acquired arrhythmias, severe intercurrent illnesses, or in young age sudden cardiac deaths represent 25 to 30% of cases. Genetic testing of sudden cardiac deaths is not cost-effective but a high prevalence of genetic abnormalities is present in the relatives of young sudden cardiac death victims. Missense mutations were identified in 12 silent carriers of the genetic abnormalities among family members. DNA was available in 52% of the relatives; of these families were seen in 72% (22 families, one first degree relative in each family was diagnosed with cardiac disease: 5 were diagnosed with long QT syndrome, one with hypertrophic cardiomyopathy, one with Brugada syndrome, one with inherited cardiomyopathy, one with primary atrial fibrillation, one with dextrocardia and one with metastatic carcinoma).

Conclusions: Genetic testing of sudden cardiac deaths is not cost-effective but a high prevalence of genetic abnormalities is present in the relatives of young sudden cardiac death victims. Moreover the number of affected patients on lifestyle recommendations to reduce the probability of recurrences of sudden cardiac deaths in the population.

**Sensitivity and Specificity of Sodium Channel Blockers in Patients With Right Bundle Branch Block (RBBB) and ST-segment Depression (STE) Syndrome Not Linked to SCN5A Mutation**


Background: Arsenic trioxide is used in clinical trials for resistant leukemia and some solid tumors. Arsenic induces QT interval prolongation and T wave changes, but life threatening arrhythmias have not been reported with therapy.

Introduction: Genetic heterogeneity between families affected with RBBB-STE syndrome has been well established. Unmasking ECG abnormalities with sodium channel blockers and arsenic has recently been shown to have a higher sensitivity and specificity in family members affected with the SCN5A mutation. The effect of sodium channel blockers in patients with genetic abnormalities not linked to SCN5A loci is less well known. We evaluated the sensitivity and specificity of a sodium channel blocker agent in a single family with RBBB-STE not linked to SCN5A mutation. Methods: Fourteen members of an affected family underwent procainamide (Proc) infusion and frequent ECG recordings. Family members (FM) also underwent genetic mapping using highly polymorphic markers and linkage to the novel locus on chromosome 3 was determined. Results: Fourteen males age 52 ± 19 had normal left ventricular ejection fraction, QTc in normal range, no ventricular arrhythmias and no evidence of ischemia on radioisotope and/or nuclide stress testing at baseline. 6 patients had prolongation of corrected QT interval (QTc) while receiving arsenic. 3 patients (2 males, 1 female) developed polymorphic ventricular arrhythmias other than ventricular premature contractions, and no evidence of ischemia on radionuclide stress testing at baseline. 6 patients had prolongation of corrected QT interval (QTc) while receiving arsenic. 3 patients (2 males, 1 female) developed polymorphic ventricular tachycardia (torsades de points) associated with prolongation of QTc interval.

Conclusions: Sensitivity and specificity of a sodium channel blocker agent have a modest sensitivity and specificity in RBBB-STE syndrome not related to SCN5A mutation.

**Torsade de Points Associated With Arsenic Trioxide Treatment for Hematological Malignancies**

Dilip UnniKrishnani, Nikita Varshneya, Richard Lucchetti, Jamie P. Otten, Peter H. Wiernik and Jacekh Luckhnow. UH Cancer Center, University of Miami, Miami, FL.

Background: Arsenic trioxide is used in clinical trials for resistant leukemia and some solid tumors. Arsenic induces QT interval prolongation and T wave changes, but life threatening arrhythmias have not been reported with therapy.

Methods: 19 patients (13 males, 6 females) enrolled for Phase II study of arsenic trioxide were evaluated. Patients received 15-20 mg arsenic trioxide per day for up to 60 days of treatment per protocol. Full cardiac evaluations were performed in 8 patients including serial electrocardiograms, echocardiography, Holter monitoring, stress testing and radionuclide imaging. Results: 17 of the 19 patients had evidence of coronary artery disease during treatment with arsenic. The majority of patients received required therapy. 8 patients underwent coronary arteriography; 3 patients had normal left ventricular ejection fraction, 1 QT in normal range, no ventricular arrhythmias other than ventricular premature contractions, and no evidence of ischemia on radionuclide stress testing at baseline. 6 patients had prolongation of corrected QT interval (QTc) while receiving arsenic. 3 patients (2 males, 1 female) developed polymorphic ventricular tachycardia (torsades de points) associated with prolongation of QTc interval.

Conclusions: Patients on treatment with arsenic should be monitored for QTc prolongation. In patients with prolonged intervals from baseline, other factors (electrolyte disturbances, drugs) should be actively sought and corrected. This is important since arsenic induced arrhythmias are known to be sensitive to chemical and electrical cardioversion. At least a subgroup of patients with severe intercurrent illnesses should be considered for continuous monitoring if they have increasing QTc intervals.
Ablative Therapy: Studies in Experimental Animals

Sunday, March 18, 2001, Noon-2:00 p.m.
Orange County Convention Center, Hall A4
Presentation I hour: 1:00 p.m.-2:00 p.m.

T028-T119 Counter Intuitive Relations Between In Vivo RF Lesion Size, Power, and Tip Temperature
Rupak Mukherjee, Preecho Laosinchukhu, M. Charles Weisg, Kathryn S. Coward, J. Philip Doult, Medical University of South Carolina, Charleston, SC

Background: Radiofrequency (RF) lesion size in vitro is positively correlated with applied power and catheter tip temperature. However, the relation between RF lesion size, power, and tip temperature in vivo remains unclear. We hypothesized that due to in vivo blood flow effects, increased tip temperature would be inversely related to applied power and lesion size. Methods: RF lesions were created on the epicardial surface of the endocardium of 16 pigs using 5, 6, and 7 Fr catheters with standard 4 mm tip length. The ablation generator was set to achieve a maximum temperature of 70°C. The RF lesions were created in different regions of the heart so as to encompass a wide range of blood flow and catheter movement conditions. RF lesions were measured acutely (CMM, mm) and correlated with average power applied (PW, W), and average tip temperature (Tm, °C) achieved during the creation of the lesion. The relation between POWER and TEMP was also examined (FIGURE). Results: At TEMPs above 55°C, POWER decreased hyperbolically with increasing TEMP. Further, TEMP was inversely related to POWER (r=0.38, p<0.01, statistically significant). Conclusion: In vivo, tissue contact and flow yield DIMEN-POWER-TEMP relations opposite to those found in vitro. These counter intuitive results suggest that maximum in vivo RF lesion size is achieved when power is maximized at tip temperatures between 50 and 60°C (FIGURE).

T028-120 Pulsed Radiofrequency Energy and Multi-Electrode Catheters: Comparison of Two Different Monitoring Modes for Ablation of Porcine Right Atrium
Erik Kongsgaard, Peter O’Callaghan, Nidal Maarouf, Edward Rowland. St. George’s Hospital Medical School, London, United Kingdom

Background: Catheter ablation of atrial flutter and non-focal atrial fibrillation consists of creating long lesions. The purposes of this study were to assess the feasibility of a new catheter electrode tip during ablative therapy for cardiac arrhythmias. Methods: Fourteen pigs were randomised to temperature (65°C) or impedance guided ablation (power was increased slowly for the first 30 seconds until an impedance or temperature monitoring during the ablation procedure in order to induce transmural, contiguous lesions). The lesion generator was set to achieve a maximum temperature of 70°C. Further, TEMP was inversely related to POWER (r=0.38, p<0.01, statistically significant). Conclusion: In vivo, tissue contact and flow yield DIMEN-POWER-TEMP relations opposite to those found in vitro. These counter intuitive results suggest that maximum in vivo RF lesion size is achieved when power is maximized at tip temperatures between 50 and 60°C (FIGURE).

T028-121 Effects of Atrial Electrical Disconnection in a Porcine Model of Chronic Atrial Fibrillation
David Schwartzman, W. David Fischer, Ekhardo Warrman, Rahul Mehra. Atrial Arrhythmia Center, University of Pittsburgh, Pittsburgh, PA, Medtronic, Inc., Minneapolis, MN

Background: recent reports have suggested that atrial fibrillation (AF) is a chronic condition characterized by a high frequency of re-entry circuits. The objective of the present study was to evaluate the effect of AF on the electrophysiology of the atria. Methods: In 9 pigs, chronic AF was established using prolonged (>5 months) high frequency RA pacing. Pigs were returned to the laboratory, where the following data were collected in both RA and LA at baseline: 1-estimate of AF burden following programmed stimulation (sustained). 2-5 pigs then underwent the ED procedure (ED pigs), and 2 pigs underwent an equivalent volume of ablation in the smooth posterior RA free wall (control pigs). Data collection was repeated after ablation. Results (table): Conclusion: In most animals, after ED, AF would not sustain in either atrium. This was not associated with changes in ERP. The mechanism for this did not appear to be atrial "blockading."

T028-122 Microwaves Radiometric Thermometry Predicts Tissue Temperature During Ablation
Eugene Bak, Wei Zhu, James Reagan, Kenneth Carr, Brink VanderBrink, Mark S. Link, Munro H. Hornuid, N. Mark Estes, III, Paul J. Wang. New England Medical Center, Boston, MA

Background: Current techniques for measuring catheter tip temperatures in ablative therapy for cardiac arrhythmias employ thermocouples or thermistors embedded in the tip electrode. Electrode cooling, however, may interfere with these methods. Because microwave radiometry is capable of detecting microwave radiation from the molecular motion of molecules, we propose microwave radiometric thermometry as a new technique to monitor temperature away from the electrode tip during ablative therapy. Methods: A microwave radiometer helical antenna was positioned adjacent to the site of cooled radiofrequency ablation. The first set of experiments was used to create a linear regression equation to describe the relationship between radiometer voltage and temperature. The equation was used to predict the tissue temperature observed in a second set of experiments. Results: The radiometer voltage was highly correlated with the tissue temperature (R=0.99). The temperature predicted using the linear regression equation correlated highly with the actual temperature at 1 mm (R=0.98).

Conclusions: Microwave radiometric thermometry can estimate tissue temperatures accurately even in the presence of cooled radiofrequency ablation. The microwave radiometer serves as a promising instrument for monitoring temperatures away from the catheter electrode tip during ablative therapy for cardiac arrhythmias.

T028-123 Fiberoptic Balloon Catheter Ablation of Pulmonary Vein Ostia in Pigs Using Photonic Energy Delivery With Diode Laser
Robert Lutmaney, James Veinot, Arthury Yang, Mariel Olsen, Nathan P. Linzheyed, John McCrory, Ed Shafsky. Ottawa Heart Institute, Ottawa, ON, Canada

Background: In patients with atrial fibrillation who have arrhythmogenic foci within the pulmonary veins (PV), radiofrequency ablation may be curative. However, the technique remains complex and unsatisfactory because of either difficulties in mapping, number of PV involved, risk of PV stenosis, and high recurrence rates. We studied the effects of creating circumferential lesions to the ostium of the PV to cause conduction block at the ostia.
Junction of the PV and left atrium. Gold electrode can deliver energy through assessing or ring fiber tips (CardioFocus Inc, Norton, MA) which has been shown experimentally to cause volumetric heating both below and at the surface of tissue. Microscopically, transmural coagulation necrosis was present at the ostium of all PV, and extended into the myocardial sleeves of 2 PV's. Microscopically, atrial conduction at the level of the low right atrium - CS. may offer a new strategy that uses a right-sided approach for ablation of atrial fibrillation.

Conclusions: 1) Photonic energy can be delivered safely to the proximal CS, and the observed pathologic findings to its clinical utility may be clinically relevant regarding its safety and application to pulmonary veins, and 2) Successful elimination of intestinal conduction at the level of the low right atrium – CS, may offer a new strategy that uses a right-sided approach for ablation of atrial fibrillation.

Poster Session

1029 Implantable Cardioverter Defibrillators II

Sunday, March 18, 2001, Noon-2:00 p.m.
Orange County Convention Center, Hall A4
Presentation Hour: 1:00 p.m.-2:00 p.m.

1029-125 Are Enhanced Dual Chamber Detection Algorithm Superior to Single Chamber Algorithm First Results of the Multicenter DETECT Study

Katrin Ziegenbalg, Burkhard Hijgl, Nice Doll, Angelika Bucco, Mathias Benthin, Petra Schieder, Hans Kottkamp, Gerhard Hindricks, Rainer Hambrecht, Gerhard Schuler.

Background: Inappropriate S-MRT-Therapies are a common problem in patients with implantable cardioverter defibrillators. The discrimination of true supraventricular tachycardia/atrial fibrillation (SVT/VF) from ventricular tachycardia (VT) is difficult. The development of dual chamber criteria (DCC) with unenhanced discrimination criteria should solve this problem. Nevertheless the superiority of a dual chamber detection algorithm to a single chamber algorithm is not proven.

Methods: In a prospective multicenter trial (DETECT) we compared this single-chamber mitral valve endocarditis - Medtronic Inc. 7223/7227/7229) with the new dual chamber criteria (DCC) PR logic (Medtronic Inc 7223/7227/7229) with the new dual chamber criteria (DCC) PR logic (Medtronic Inc 7223/7227/7229). All patients met the Class III (AHAM/ACC) for ICD implantation and had no indication for brendekaed pacing therapies.

Results: Among the 315 patients, 4 patients (aged 52-60 years) undergoing chronic disease, 37 pts coronary artery disease, 5 pts dilated cardiomyopathy, 5 pts other, mean ejection fraction 26.4±15.7% were included since 1/999 to 1/999±1 with a dual chamber device and 26 patients with a single chamber device. In the follow up time (36±30 VT episodes and SCC supraventricular episodes occurred and were analyzed by the stored ECG. The DCC detected 143 VT episodes correct and 6 episodes false with no delivered therapy. The DCC detected 81 VT episodes correct and no VT Episodes false. 165 VT episodes were detected by the SCC with 24 false detections. 19 episodes were correct detected by the DCC and 64 false (60 episodes in one patient). There was no statistically significant difference between DCC and SCC.

Conclusion: The first results of the DETECT Study show that the DCC is not superior in reducing inappropriate therapies. The advantage is a high specificity. No VT was false classified. Nevertheless further investigations are necessary.

1029-124 Photonic Energy Delivery Using Diode Laser to Create Circumferential and Linear Lesions to the Coronary Sinus in Pigs

Robert Lemery, John Veidt, Anthony Tang, Martin Green, Norman Farr, Lincoln Baxter, Jon McIntyre, Ed Sinofsky. Ottawa Heart Institute, Ottawa, ON, Canada.

Background: The use of lasers to treat arrhythmias has generally consisted of complex devices that deliver a narrow beam of light to vaporize tissue, with risk of cardiac perforation. In a preliminary set of experiments, a simple set up energy source that can be delivered through a small generator, offers the possibility of delivering energy through diffusing or ring fiber tips (CardioFocus Inc, Norton, MA), experimentally shown to cause volumetric heating both below and at the surface of tissue. Microscopically, transmural coagulation necrosis was present at the ostium of all PV, and extended into the myocardial sleeves of 2 PV's. Microscopically, atrial conduction at the level of the low right atrium - CS. may offer a new strategy that uses a right-sided approach for ablation of atrial fibrillation.

Conclusions: 1) Photonrc energy can be delivered safely
to the distal CS. This catheter has gold foil to cover the outer aspect and prevent epicardial pacing or ring fiber tips (CardioFocus, Norton, MA), experimentally shown to cause volumetric heating both below and at the surface of tissue. Microscopically, transmural coagulation necrosis was present at the ostium of all PV, and extended into the myocardial sleeves of 2 PV's. Microscopically, atrial conduction at the level of the low right atrium - CS. may offer a new strategy that uses a right-sided approach for ablation of atrial fibrillation.

Poster Session

1029-123 Are Enhanced Dual Chamber Detection Algorithm Superior to Single Chamber Algorithm First Results of the Multicenter DETECT Study


Background: Uoversensing complications in transvenous implantable cardioverter-defibrillators (ICD) can lead to inappropriate shocks in the absence of a life-threatening arrhythmia. Limited data exist on the incidences and risk factors of oversensing as an adverse event in ICD.

Methods: We reviewed data on all patients who underwent transvenous ICD implant or revision from 1995 to 1999. Patients with lead dislodgment, epicardial lead, and follow-up of less than 4 years were excluded. Events of inappropriate shocks were reviewed and confirmed by 6 electrophysiologists. Variables were analyzed by CH-square and t-tests with univariate and multivariate analyses.

Results: 122 patients (75±0.0%) guidant leads, 141±0.4% Medtronic leads, and 33±0.2% St. Jude leads) were included in this study. Ventricular oversensing was programmed at nominal setting in all patients. During a mean follow-up of 23±4±17±0 months, 15±4±% parents experienced oversensing requiring lead revision. a) integrated bipolar leads from Guidant failed at a median of 12±12 months after implantation and 2±2 true bipolar leads from Medtronic failed at a mean of 65±6 months after implantation. No St. Jude lead was associated with oversensing. No statistically significant difference in oversensed beats exists between the three lead manufacturers. Univariate analysis revealed Guidant leads (p = 0.019±0.042) and St. Jude leads (p = 0.021±0.026) were associated with oversensing requiring lead revision. b) integrated bipolar leads from Guidant failed at a median of 12±12 months after implantation and 2±2 true bipolar leads from Medtronic failed at a mean of 65±6 months after implantation. No St. Jude lead was associated with oversensing. No statistically significant difference in oversensed beats exists between the three lead manufacturers. Univariate analysis revealed Guidant leads (p = 0.019±0.042) and St. Jude leads (p = 0.021±0.026) were associated with oversensing requiring lead revision. The SCC detected 81 VT episodes correct and no VT Episodes false. 165 VT episodes were detected by the SCC with 24 false detections. 19 episodes were correct detected by the DCC and 64 false (60 episodes in one patient). There was no statistically significant difference between DCC and SCC.

Conclusion: The first results of the DETECT Study show that the DCC is not superior in reducing inappropriate therapies. The advantage is a high specificity. No VT was false classified. Nevertheless further investigations are necessary.

Abstracts - Cardiac Arrhythmias - JACC February 2001 - 89A
Background: The standard of care for evaluation of patients after ICD shock has not been well studied. This cana study compared acute and chronic A-EGM and FF-VEGM amplitudes in six canines. A-EGM was band-pass filtered (0.5 Hz - 1 kHz) and peak to peak amplitudes of A-EGM and FF-VEGM were measured.

Results: The FF-VEGM was smaller at 4 mm interelectrode spacing than at 9.5 mm at all follow-ups and overall (1.3 ± 0.7 mV vs 2.0 ± 1.0 mV, p < 0.05) and did not change significantly over time. The A-EGM amplitude was significantly different between 4 and 9.5 mm at every follow-up or overall (4.2 ± 1.6 mV vs 4.0 ± 1.2 mV, p < 0.05), but the A-EGM at both spacings were significantly altered in the first week post-implant. The ratio of the A-EGM/FF-VEGM was significantly greater at 4 mm as compared to 9.5 mm (5.3 ± 3.3 vs 2.9 ± 2.0, p < 0.05). Pacing thresholds were not significantly different between 4 mm and 9.5 mm at any time.

Conclusions: Chronic atrial leads with 4 mm interelectrode spacing in canines reduce the amplitude of the FF-VEGM without compromising A-EGM. Such leads can result in improved atrial detection in implantable devices.

1029-129 Improved Survival With Cardiodefibrillator Therapy in Patients With Non Ischemic Dilated Cardiomyopathy and Syncope
Robert M. Sandanolf, Alain Katz, Hoa B. Hoang, Siwen A. Rothman. Temple University Hospital, Philadelphia, PA

Background: Patients (pts) with syncope and non-ischemic dilated cardiomyopathy (ICM) have a high mortality and are often treated with a dual chamber implantable defibrillator (ICD) implantation. In ICD implanted pts there is a high frequency of ICD shocks, but survival benefit is unknown. The purpose of our study was to determine the cause of death in pts with DCM and syncope who were treated with an ICD compared to similar pts who were not treated with an ICD. Methods: The study group consisted of 21 consecutive pts with DCM and syncope. 30 pts received ICDs (ICD group) and 31 pts did not receive ICDs (no ICD group). In the ICD group, 8 pts received antiarrhythmic drug therapy, 5 pts received non-pharmacologic therapy (ablation, pacemaker implantation), and 16 pts received no specific therapy most refusing ICD therapy. Results: Mean follow-up was 30 ± 28 months in the ICD group and 26 ± 25 months in the no ICD group (p = 0.8). There was no statistically significant difference in age at presentation (64 ± 10 vs 65±9 years) or gender (40% vs 45%) between the ICD and no ICD groups, respectively. If the pts in the ICD group were inducible at electrophysiologic study compared to 21% in the no ICD group (p = 0.06). Conclusions: 1) ICD therapy provides long-term survival benefit in patients with dilated cardiomyopathy and syncope. 2) Early survival (≤1 year) is not affected by ICD implantation.
ABSTRACTS - Cardiac Arrhythmias 91A

POSTER SESSION

1060 Mechanisms of Ventricular Arrhythmias

Sunday, March 18, 2001, 3:00 p.m.-5:00 p.m.
Orange County Convention Center, Hall A4
Presentation Hour: 4:00 p.m.-5:00 p.m.

1060-114 Early Onset of QT Interval Prolongation and \( i_K \) Downregulation in Rats With Compensated Complete Heart Block

Fumiko Suto, Sean A. Cahill, Ilana Greenwald, G. J. Gross. Hospital for Sick Children, Toronto, ON, Canada

Background: Ventricular repolarization delay, evidenced by ECG QT interval prolongation, is associated with complete heart block (CHB), and can trigger tachydysrhythmias such as torsades de pointes. Ventricular repolarization changes, including QT prolongation and downregulation of outward \( K^+ \) currents, have been noted several weeks after chemical CHB induction in a canine surgical model. Methods: CHB was induced in New Zealand White rabbits (3.0-3.5 kg) by transcatheter radiofrequency AV node ablation, and the resulting ventricular bradycardia was partially compensated with permanent endocardial ventricular pacing at 140/min. QT intervals were measured on ECG recordings obtained under anesthesia on post-ablation day 0, and again on day 8 or 15. Ventricular myocytes were enzymatically isolated for whole cell patch clamp study on day 8 or 15. Rhythmically activating delayed rectifier current \((i_K)\) was defined as \( E_{-40} \) sensitivity. Results: QT intervals at a constant paced ventricular rate of 140/min showed significant prolongation relative to baseline (219±8 ms, mean±SD, vs. control: 191±5 ms, \( p<0.01 \)). Right ventricular \( i_K \) tail current density was already markedly reduced at post-ablation day 0 vs control (0.79±0.09 vs 1.38±0.13 pA/pF, \( p<0.05 \); \( n=5 \) for each group). Conclusion: Progressive QT interval prolongation is apparent as early as 8 days post-induction of CHB by transcatheter radiofrequency AV node ablation in rabbits, and is likely due, at least in part, to a marked early reduction in heterogenous channel activity.

1060-116 Mechanism and Arrhythmogenicity of Discordant QT/T Alternans

Masaomi Chikama, Umiti K. Kazehara, Edward U. Laret, Mark Hestbaek, Nabil El-Shanawany. VA NY Harbor Health Care System, Brooklyn, NY; Nigata Medical School, Nigata, Japan

Background: We have recently shown that discordant (C) QT/T alternans (A) induced by abrupt decrease of paced (P) cycle length (CL) in canine Antiarrhythmia-A model of I(T) is associated with increased dispersion of repolarization (DTR) between epicardium (E) and mid-myocardium (M) calculated as activation-recovery intervals (ARI) (Circ Res, 1996). CA was induced by abrupt shortening of cycle length (CL), resulting in C shortening (A) sequence of ARI at both P and M (Fig A). Methods: We investigated the mechanism of discordant (D) A in the same model by stepwise decrease of CL (Fig B).

Results: DA developed when ARI at E shortened progressively in 2 or more consecutive cycles before beginning a S-L sequence. The shorter diastolic interval (DI) preceding P1 in Fig A resulted in a greater abbreviation of ARI at E and M. The longer DI that followed perpetuated C-L-S sequence. In Fig B, a longer DI preceding P1 resulted in less shortening of ARI at E and M. The following DI preceding P1 was relatively short, compared to Fig A and compared with the difference in restitution kinetics between E and M (longer ARI at M). This resulted in further shortening of ARI at E but lengthening at M thus initiating DA. In 5 dogs, both CA and DA could be induced. ARI dispersion and reentrant rhythms were greater during DA (p<0.01).

1063-152 No Single Formula for Heart Rate Correction of the QT Interval is Suitable for All Individuals

Veselin N. Babchevan, Patek Pilson, Polychronis Oikavents, A John Camm, Marek Malik, 20th Street's Hospital Medical Center, London, United Kingdom

Background: All formulae for heart rate-correction of the QT interval are based on the assumption that the QT/RR relation is the same in all individuals. This has never been proven. Methods: Twenty-four hour 12-lead digital EKGs (one 10-s ECG every 2 min, 250 Hz, 12 bit A/D, SEER MC, Marquette GE) were recorded in 49 healthy individuals. QT index, QT, RR index and QT/RR index were measured automatically (downslope inflexion point). QT/RR relationship is nonlinear, concave down and with different shape. In 24-h heart rate corrected QT (HRCQT) by Fuchs, Bazett, and Framingham, QT was at most reduced by 20%. QT was increased when comparing QT with HRCQT by the above formula. Results: QT/RR relationship varies between individuals. Instead of using single formula this relationship should be estimated individually in each subject on the basis of continuous ECG recordings.
Mechanism of Enhanced Susceptibility of Hypertrophied Heart to Acquired Torsade de Pointes Arrhythmias

KaJI Yaseymoto, D~ntty G. Kozhuchikov, DionsklaBaroult, Mark Restivo, Nabi El-Sherif. VA NY Harbor Healthcare SyStem, Brooklyn, NY; SUNY Health Science Center, Brooklyn, NY.

Background: Previous reports have shown increased susceptibility of hypertrophied heart to class III drug-induced Torsade de Pointes (Tdp). However, the mechanism of this increased susceptibility has not been investigated in detail.

Methods: We compared susceptibility of the class III drug, dofetilide (D), 3,10, and 20 mg/kg (n=5) in control dogs and D 0.25 mg/kg, 0.5 mg/kg, and 1 mg/kg (n=5) in dogs following induction of complete AV block (AVB) that results in ventricular hypertrophy, which was verified by echocardiographic measurements. Depolarization was measured from 200 unipolar extracellular electrograms. Repolarization was assessed from activation-recovery intervals (ARI).

Results: None of control dogs developed TdP at 30 mg/kg, while 5/6 dogs with D 0.25 mg/kg developed TdP at a dose of 3 mg/kg (n=6) or 10 mg/kg (n=6). TdP was due to subendocardial focal spikes in an area of wall thinning in the RV free walls and rarely in the LV free walls, but they were not observed in the septa.

Conclusions: TdP activity that infringed on transmural dispersion of repolarization (TDR) primarily between epicardial (EpI) and mid-myocardial left ventricular zones resulting in functional conduc tion block and reentrant arrhythmia. Analysis of mean ARI and TDR at a cycle length of 1000 ms is shown in the table and revealed: 1) baseline ARI and TDR were significantly higher in AVB vs. C (P<.01), 2) the increase in mean ARI and TDR following D was significantly higher in AVB vs. C (P<.01).

1060-117 The Role of Structural Complexes of the Septal Tissue in Maintaining Ventricular Fibrillation in Isolated, Perfused Canine Ventricle

Takanci Fleida, Kazuo Nakazawa, Ayaka Kawase, Yosai Ashihara, Tatsunoyb Nakaba, Kaoru Sugi, Tetsu Yamaguchi. Toho University Ohashi Hospital, Tokyo, Japan, National Cardiovascular Center, Suita, Japan.

Introduction: It is unclear how the patterns of wavelet propagation during ventricular fibrillation (VF) vary between structurally different tissues. We hypothesized that the structural complexities of the septal tissue influence the maintenance of ventricular fibrillation in the ventricle.

Methods: Endocardial activation patterns during VF were analyzed in the isolated, perfused canine right ventricular (RV) free wall (n=6), interventricular septal (IVS), and left ventricular (LV) free wall (n=9) using a computerized mapping system (2-mm resolution) with 120-ms consecutive windows. Each tissue sample was cut progressively to reduce the tissue mass until the VF was terminated.

Results: In 92 patients with 241 episodes of sustained VF (line length), less critical mass was required to maintain VF in the septa than in the RV and LV free walls (P=0.0006). Gross anatomic and histologic examinations indicated that the tissue structure of the septum is more complex than that of the RV and LV free walls. Conclusion: VF activity that infringed on transmural dispersion of tissue mass differs for the septum and the ventricular free walls. The structural complexities of the septal tissue influence the maintenance of fibrillation in the ventricle.

1061 Pharmacological Therapy of Atrial Fibrillation

Sunday, March 18, 2001, 3:00 p.m.-5:00 p.m.
Orange County Convention Center, Hall A4 Presentation Hour: 4:00 p.m.-5:00 p.m.

1061-116 Amiodarone Versus a Beta Blocker to Prevent Atrial Fibrillation Following Cardiovascular Surgery

Allen J. Solomon, Michael D. Greenberg, Michael J. Kilborn, Nevvin M. Katz. Georgetown University Hospital, Washington, DC.

Background: Both amiodarone and beta blockers are commonly used to decrease the incidence of atrial fibrillation (AF) following cardiovascular surgery. However, the superior agent has not been identified. Methods: Following cardiac surgery, patients were randomly assigned to receive amiodarone (E/50) or a beta blocker (C) for 4 days. The incidence of AF and left ventricular ejection fraction were compared. Results: We evaluated 102 patients (68 men, mean age = 65 ± 10 years, mean LVEF = 0.58 ± 0.12). AF was defined as lasting longer than one hour or for any length of time requiring treatment. The incidence of AF was 16.0% (E/50) in the amiodarone group and 32.7% (C) in the propranolol group (p<0.05). When AF did occur, its duration was longer in amiodarone-treated patients compared to propranolol-treated patients. At a result, the mean length of hospitalization for AF patient was 0.0 ± 0.3 days in amiodarone-treated patients and 0.4 ± 0.7 days in propranolol-treated patients (p<NS). Conclusions: Early intravenous amiodarone, followed by oral amiodarone, reduces the incidence of postoperative AF compared to propranolol. However, this reduction in incidence did not result in a reduction in the length of hospitalization. Further studies will be needed to assess the cost effectiveness of this strategy.

1061-120 Prevention and Reversal of Electrical Remodeling in Atrial Fibrillation by TH1177, a Novel Calcium Channel Antagonist

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Background: Prevention of electrical remodeling in atrial fibrillation (AF) remains challenging. While L-type calcium channel antagonists are effective in short duration AF, they seem ineffective in the long term. However, the effects of calcium channel antagonists seem to be effective in the majority of AF episodes. We have synthesized a novel calcium channel antagonist, TH1177, which has both L- and T-type calcium channel blocking activity. We hypothesized that this agent may be effective in preventing electrical remodeling.

Methods: AF was induced via rapid atrial pacing in 11 dogs. Six dogs received TH177 (study group) while 5 served as controls. TH1177 was administered as a 50mg slow IV bolus followed by 100mg/h. The dogs were paced for 8 hours. Right and left atrial cycle lengths (AFCL) were measured at baseline and every 5 minutes. The dogs were then exposed to 50mg slow IV bolus, and every 5 minutes the cycle length was measured. Results: AFCL was measured after 180 minutes of pacing. The results in the control group, ERPs were either unchanged or increased after pacing. Average LA ERPs increased from 100.2 to 109.1 ms (p<0.04). Baseline RA and LA AFCL were simi-
AF. It also increases atrial refractoriness thus potentially preventing further arrhythmia regardless of the pacing site. However after pacing, study group RA and LA AFCL (136.5 and 127.6 ms respectively) were significantly higher than control (111.3 and 111.6) (p=0.03).

Conclusion: TH1177 is a novel calcium antagonist that prevents electrical remodeling in cardiac muscle. Its use may help maintain sinus rhythm.

Conclusions: The presence of CHF, AF and ventricular arrhythmias identifies a high risk group for recurrence of AF and early intervention is necessary. The AF duration in this study was demonstrated. Aim of this study was to outline the reproducibility of this favourable effect in patients in whom safety, efficacy and reproducibility of the treatment had been demonstrated. Aim of this study was to study the reproducibility of this favourable effect in the same patient over the time. Methods: 212 patients with paroxysmal atrial fibrillation of recent onset successfully in hospital treated with a single oral loading dose of propafenone (600 mg or 450 mg in patients < 70 Kg, respectively) were followed up for at least one year. 62 of them (41 males and 21 females) had at least one other episode of paroxysmal atrial fibrillation in the patients in which safety, efficacy and reproducibility of the treatment had been demonstrated. Aim of this study was to study the reproducibility of this favourable effect in the same patient over the time. Results: Cardioversion was achieved in 15 patients (79%). The Sinus Rhythm Group had a mean age of 69±9 years and ejection fraction of 24±8%. The AF duration in this cohort prior to cardioversion was 38±48 months and the left atrial size was 5.0±0.5 cm. All surviving pts were in current sinus rhythm with an average follow-up of 286 days, although 2 required repeat cardioversion. CHF functional status improved in sinus rhythm (NYHA class 2.6±0.4 to 2.2±0.4, p<0.01). Mortality at 6 months was 26% in the sinus rhythm group and 100% in the AF group (p<0.05). Conclusion: The presence of CHF, AF and ventricular arrhythmias identifies a high risk group despite ICD implantation. This multidisciplinary approach is successful, despite the limitations. The AF duration in this cohort prior to cardioversion was 38±48 months and the left atrial size was 5.0±0.5 cm. All surviving pts were in current sinus rhythm with an average follow-up of 286 days, although 2 required repeat cardioversion. CHF functional status improved in sinus rhythm (NYHA class 2.6±0.4 to 2.2±0.4, p<0.01). Mortality at 6 months was 26% in the sinus rhythm group and 100% in the AF group (p<0.05). Conclusion: The presence of CHF, AF and ventricular arrhythmias identifies a high risk group despite ICD implantation. This multidisciplinary approach is successful, despite the limitations.

Reproducibility of Loading Oral Propafenone to Restore Sinus Rhythm in Paroxysmal Atrial Fibrillation

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Background: Safety and efficacy of oral loading dose of propafenone in converting paroxysmal atrial fibrillation of recent onset in patients without left ventricular dysfunction has been demonstrated. Aim of this study was to study the reproducibility of this favourable effect in the same patient over the time. Methods: 212 patients with paroxysmal atrial fibrillation of recent onset successfully in hospital treated with a single oral loading dose of propafenone (600 mg or 450 mg in patients < 70 Kg, respectively) were followed up for at least one year. 62 of them (41 males and 21 females) had at least one other episode of paroxysmal atrial fibrillation. Results: Mean age was 61±13 years, mean follow-up period was 154±7 months; 27 had hypertension, 6 coronary artery disease, 7 valvulopathy and 22 had “none” atrial fibrillation. 87 episodes of paroxysmal atrial fibrillation were treated, from the onset of symptoms was 3.0±0.7 hours; 81 (95%) converted to sinus rhythm within 2.8±1.2 hours. No new side effects or nonpharmacological events were recorded. Conclusion: An oral loading dose of propafenone for paroxysmal atrial fibrillation of recent onset treatment has a reproducible efficacy over the time in the same patient.

Ventricular Rate in Patients With Chronic Atrial Fibrillation

Kristina Wasmuth, Hakam Cral, Ohrad el Sokhelfeh, Steven P. Chough, Pukum Li. Bahan, Hiroshi Tada, Frank Pelcior, Jr., Bradley P. Knight, S. Adrien Stockbridge, Fred Mosady. University of Michigan, Ann Arbor, MI.

Background: Control of the ventricular (V) rate in patients with chronic atrial fibrillation is usually assessed with a 24-hour Holter monitor. The purpose of this study was to determine whether simple maneuvers performed during a clinic visit can be used to predict the V rate during activities of daily life in patients with chronic atrial fibrillation. Methods: In 12 men and 8 women with chronic atrial fibrillation (mean age=63±14, left atrial appendage fraction=0.52±0.08), V rate was determined after 5 minutes of rest, after walking 50 yards, and after atrial pacing for 1 minute during a clinic visit. Each patient also had a Holter monitor for 24 hours within 3 days of the clinic visit, with no changes in medications. Minimum, mean and average hourly maximum V rates during 24 hours were determined from the Holter recordings. Results: V rate at rest during the clinic visit, 91±18 bpm, was significantly less than the average Holter V rate, 92±17 bpm (p<0.01). However, the mean of the V rates at rest and after a 50-yard walk, 93±17 bpm, was similar to the average V rate recorded from a 24 hour Holter monitor, 92±17 bpm (p=0.8). Minimum V rate recorded from the Holter monitor, 90±17 bpm, was very similar to the V rate at rest during the clinic visit minus 20 bpm, 90±17 bpm (p=0.7). V rate after 1-minute atrial pacing, 123±17 bpm, was similar to the average maximum V rate recorded from the Holter monitor, 118±20 bpm (p=0.3). Conclusion: In patients with chronic atrial fibrillation, V rate control during activities of daily life can be accurately assessed with simple maneuvers. Mean of V rates at rest and a 50-yard walk can accurately predict average daily V rate, V rate at rest minus 20 bpm reflects minimum daily V rate whereas V rate after 1-minute atrial pacing is very similar to the average maximum daily V rate.

Poster Session 1061-125 Assessment of Ventricular Rate in Patients With Chronic Atrial Fibrillation

Poster Session 1061-122 Comparative study of the sinus rhythm maintenance 71% vs 70%, p=0.95. Conclusion: these-couplers can be safely used in pts receiving amiodarone for maintenance of sinus rhythm after AF cardioversion; concomitant use of beta-blockers and amiodarone has no synergistic effect in prevention of recurrence of AF. In patients who are treated with metoprolol for chronic atrial fibrillation, the ventricular rate during activities of daily life in patients with chronic atrial fibrillation is usually assessed with a 24-hour Holter monitor. The purpose of this study was to determine whether simple maneuvers performed during a clinic visit can be used to predict the V rate during activities of daily life in patients with chronic atrial fibrillation. Results: V rate at rest during the clinic visit, 91±18 bpm, was significantly less than the average Holter V rate, 92±17 bpm (p<0.01). However, the mean of the V rates at rest and after a 50-yard walk, 93±17 bpm, was similar to the average V rate recorded from a 24 hour Holter monitor, 92±17 bpm (p=0.8). Minimum V rate recorded from the Holter monitor, 90±17 bpm, was very similar to the V rate at rest during the clinic visit minus 20 bpm, 90±17 bpm (p=0.7). V rate after 1-minute atrial pacing, 123±17 bpm, was similar to the average maximum V rate recorded from the Holter monitor, 118±20 bpm (p=0.3). Conclusion: In patients with chronic atrial fibrillation, V rate control during activities of daily life can be accurately assessed with simple maneuvers. Mean of V rates at rest and a 50-yard walk can accurately predict average daily V rate, V rate at rest minus 20 bpm reflects minimum daily V rate whereas V rate after 1-minute atrial pacing is very similar to the average maximum daily V rate.
Ectopic activity in the superior vena cava as a possible triggering mechanism of atrial fibrillation was recently described. We report our experience in 30 consecutive patients undergoing catheter ablation for atrial fibrillation and showing multiple spontaneous initiation of atrial fibrillation during the procedure. All patients had multiple spontaneous initiation and termination of atrial fibrillation during the procedure allowing mapping. Initial mapping was performed with floating electrodes in the superior vena cava, right atrium, and coronary sinus combined with a transesophageal recording. More detailed mapping was subsequently achieved by placement of multielectrode catheters either in the pulmonary vein or superior vena cava. Ablation was performed using a nonfluoroscopic mapping system. Twenty-eight of the 30 patients enrolled in this study were then shown evidence of muscle sleeves in the superior vena cava extending 1 to 4 cm from the junction with the right atrium. Premature atrial contractions originating in the superior vena cava were observed in seven of one or more patients (23%). However, only one patient (29%) with atrial fibrillation appeared to originate from the superior vena cava (3%). In the remaining six patients, isolated premature atrial contractions were seen in four of them and atrial tachycardia with a rate of 140 and 150 beats per minute was seen in the remaining two patients. In six of the seven patients showing activity from the superior vena cava, atrial fibrillation consistently originated from one of the pulmonary veins. Ablation in the superior vena cava at the site of early activation was performed in all patients with suppression of atrial fibrillation. However, ectopic beats and atrial tachycardia are more frequently observed.
1063-129 Atrial Assessment of Short-Term Heart Rate Variability Before Onset of Paroxysmal Atrial Fibrillation

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Background: Initiation of atrial fibrillation often requires paroxysmal bursts, or electrophysiologically substrates, however, also modulating factors like cardiac autonomic nervous imbalance are discussed. Heart rate variability (HRV) is an adequate measure for these autonomic nervous fluctuations. By using dual atrioventricular pacemakers (DCP) with an automatic storage function it is possible to determine changes of autonomic activity in the atrium before onset of paroxysmal atrial fibrillation (PAF).

Methods: In 6 Patients with a history and clinical (ECG, PAC) and PAF, a DCP (Vios in Datascope AF 1.0) was implanted. This DCP has the ability to store up to 2 minutes of atrial intervals before PAF. To ensure spontaneous conduction the DCP was programmed with a lower rate limit of 40 bpm and an AV-delay of 200 ms. Results: During the 9 month follow-up 102 episodes were valid for short-term-HRV-analysis. SDAA10 (standard deviation of atrial intervals) and rMSSD10 (root mean square of successive differences of atrial intervals) were determined from the last period before PAF. Conclusion: A significant elevation of HRV indicates an immediate change of autonomic activity before PAF. In Patients with DCP and PAF these findings may be useful for further development of preventive antiarrhythmic pacing algorithms.

1063-130 Withdrawn By Author

1063-131 Better Understanding of the Onset Mechanisms of Atrial Fibrillation: Optimizing Selection of Patients Who May Benefit From Preventive Pacing

Andrew A. Uweke, Howard F. Martins, Naseem Osman, Martin J. Gammage
University Hospital Birmingham, Birmingham, United Kingdom

Background: Atrial Fibrillation (AF) is the most common sustained cardiac arrhythmia, leading to heart failure, stroke and peripheral embolism. A better understanding of AF onset mechanisms is likely to improve therapy. Methods: We studied 155 episodes of AF from a cohort of 23 patients who received the Vatrin Selection 900 pacemaker as part of the AF Therapy Study. Inclusion criteria were at least 2 previous drug therapies and paroxysmal atrial fibrillation (PAR) > 6 months. Using the trend tables and arrhythmia diary within the pacemaker diagnostics, the underlying effects associated with the initiation of AF were classified as bradycardia, tachycardia, early restart (within 1 minute of previous episode of AF), premature atrial contraction (PAC) trend increase and no effect. Using the rate profile diagrams, the potential onset triggers were classified as post PAC, multiple preceding PACs, short runs of AF, sudden rate drop and sudden onset. Results: Early restart was the most common underlying effect (57%), followed by PAC trend increase (22%) and bradycardia/PAC trend increase (10%). Tachycardia induced AF was extremely rare (1%). Sudden onset was the most prevalent trigger (63%), indicating no immediate rhythm change preceding the onset of AF in the rate profile diagrams. This was followed by short runs of AF (18%) and PACs in 16% (post PAC 10%, multiple preceding PACs 6%). A mean of 2.65 ± 0.70 (mean±SD) underlying effects and 2.88 ± 1.11 triggers per patient was found in our population. Conclusion: New pacing systems with enhanced diagnostics have enabled us to develop a greater insight into the onset mechanisms of AF. Completion of the AF Therapy trial will allow assessment of specific preventive pacing algorithms for PAF and identification of subgroups of patients who will benefit most.

Multiple PACs preceding AF onset

1063-132 Dual Site Atrial Pacing Is Effective for Atrial Fibrillation Prevention in Patients With and Without Atrial Conduction Delay

Atul Prakash, Sanjiv Saxena, Ryszard Krol, CV Institute, Atlantic Health System, Passaic, NJ

Dual site overdrive atrial pacing (DAP) reduces intra-atrial conduction delay (IACD) & can suppress atrial triggers. It has been used in refractory atrial fibrillation (AF) patients (pts) with & without IACD but its efficacy for AF prevention in these populations has not been compared. We performed DAP in 85 pts with drug-refractory AF. Pts with other P wave duration of >120 ms &/or TA interval of >145 ms were categorized as having IACD (Group 1, n=20). Pts without IACD (Group II, n=65) concurrently receiving DAP systems were compared to Group 1. Results: Rhythm control was feasible in 31 of 35 pts (88%) in Group 1 & 47 of 52 pts (89%) in Group 2 (p=NS). Actuarial freedom from any AF event was similar (Figure). Conclusions: 1) DAP is effective in rhythm control in AF pts with & without IACD. 2) AF recurrence rates with DAP are comparable in these two populations. 3) The degree of IACD may not influence mechanisms underlying efficacy of AF prevention with DAP.

1103-110 Implantable Devices for the Treatment of Atrial Fibrillation

Monday, March 19, 2001, 9:00 a.m.-11:00 a.m.
Orange County Convention Center, Hall A4
Presentation Hour: 10:00 a.m.-11:00 a.m.

1103-115 The Efficacy of Pacing Therapies for Treating Atrial Tachyarrhythmias in Patients With Ventricular Arrhythmias Receiving a Dual-Chamber Implantable Cardioverter-Defibrillator

Wanda A. Adler, II, Christian Wolpert, Eduard N. Warnam, Shaneek K. Musiey, Joel L. Koehler, David E. Euler, Medtronic, Inc., Minneapolis, MN

Background: The efficacy of overdrive pacing for treating atrial flutter is well established, but success rates for device-based atrial pacing therapy of spontaneous atrial tachyarrhythmias (TA) in patients with significant ventricular TA is unknown. This study evaluated the efficacy of novel pacing therapies for treating atrial TA in patients receiving a new dual chamber implantable cardioverter defibrillator (ICD) to treat ventricular TA.

Methods: Patients were implanted with a Jewel AF 7250 ICD (n=65) and followed for 342 ± 245 days. A history of documented atrial TA was present in 74%. The device diagnosed atrial tachycardia (AT) from atrial fibrillation (AF) based on cycle length and regularity. Three different methods of identifying atrial pacing (Rural plus 9 extremities, Ramp, and 50 Hz Burst) were used to treat AT episodes (AF was treated with 50 Hz Burst). The rhythm (AF or AF) detected at the time of the first pacing therapy was used to classify the underlying rhythm, regardless of rhythm transitions (AT or AF) thereafter. Results: Pacing therapy successfully terminated 74.6% of 1103 spontaneous AT episodes, and 24.6% of 1277 spontaneous AF episodes in 167 patients (P<0.001). With AT and AF patient-activated atrial pacing efficacy was 47.9%. For AT cycle lengths <230 ms, the success rate was significantly less (53.4%) compared to the success rate for AT cycle lengths ≥230 ms (77.2%). Cycle length did not significantly influence pacing efficacy in episodes classified as AF. The times from the first pacing therapy to episode termination was analyzed to determine the effect of the atrial pacing therapies on AT/AF duration. The median time from the first pacing therapy to termination was 3.0 min for the pacing success and 8.3 min for failures (P<0.001). Conclusion: In patients with a history of ventricular arrhythmias implanted with the Jewel AF ICD, atrial pacing therapies successfully terminated 47.8% of all atrial tachyarrhythmias (both AT and AF). Pacing efficacy was much higher for device-classified AT compared to device-classified AF. AT cycle length significantly influenced the outcome for pacing therapy, whereas AF cycle length did not influence pacing therapy outcome.

1103-116 The Impact of Atrial Defibrillators on the Natural History of Persistent Atrial Fibrillation. Does Sinus Rhythm Beget More Sinus Rhythm?

Philip A. R. Spurrell, Andrew R. J. Mitchell, Kayvan Kamalvand, Ann Topham, Neil Sulke, Eastbourne General Hospital, Eastbourne, United Kingdom

Background: To determine whether repeated atrial defibrillation of AF recurrences promotes the maintenance of sinus rhythm. Does sinus rhythm beget sinus rhythm?

Methods: 15 patients, mean age 52.8 ± 15.0 years, mean LVEF 43.9 ± 15.0%, were implanted with the Medtronic Jewel AF device for the treatment of persistent atrial fibrillation. Patients performed out-of-hospital patient-activated atrial defibrillation shocks following self-administration of shocks. Cycle length was calculated from device Holter and patient diaries.

Results: Mean follow-up duration 13.3 ± 6.6 months. 112 episodes of AF were treated by patient-activated atrial defibrillation. All patients are currently in SR. Comparison of the 1st and 2nd 3-month periods following implant showed a non-significant reduction in AT...
Conclusion: Atrial defibrillators are an effective means of maintaining SR in patients with persistent AF. Racial increases in the duration of SR between shocks were seen in some patients however, this did not occur in the majority. These findings may have been a consequence of atrial activity that occurs with patient-activated rather than automatic shocks. This increased time may adversely affect the atrial electrical remodeling process.

1103-117 Clinical Predictors of Atrial Defibrillation Thresholds With a Dual Coil Active Can Lead System
Laura Murphy, Rachida Bourouch, Eric J. Rashba, Stephen R. Shorofsky, Michael R. Gold. University of Maryland, Baltimore, MD

Background: Dual chamber implantable defibrillators (ICDs) are now capable of treating both atrial and ventricular arrhythmias. Although the clinical predicts and effects of antiarrhythmic drugs on ventricular defibrillation thresholds (DFTs) are well studied, little is known about the predictors of atrial DFTs.

Methods: This was a prospective study of 100 consecutive patients (pts) undergoing dual coil to the proximal and left pectoral lead (RH-SVC-Car). Atrial defibrillation (AF) was induced with ramp pacing and DFTs were measured with a step-up protocol starting at 0.5 J. The biphasic waveform had 60/50% tilts and a 150 pF capacitance. To assess the predictors of the atrial DFT, multivariate analysis of 14 clinical parameters were performed with a Cox proportional hazards model. Results: All pts were African American. The mean age of the study population was 67.5+/-18.2 yrs and 85% were male. LA > 5 cm was observed in 30% of pts with LA > 5 cm, but only 10% with LA < 5 cm (p<0.05). An LA > 5 cm identifies pts at increased risk of high atrial DFTs. A high DFT is a significant predictor of the atrial DFT. LA > 5 cm identifies pts at increased risk of high atrial DFTs.

1103-118 Effect of Manual Pressure on Transmural Impedance During Cardioversion for Atrial Fibrillation
Bianca Dias, Henry Hiai, Priscila B. Manhique, Dallan Z. Maruani, Belinda B. Perry. Hospital of the University of Pennsylvania, Philadelphia, PA

Background: External cardioversion (CV) is frequently used to restore normal sinus rhythm in patients (pts) with atrial fibrillation (AF). We prospectively analyzed the effects of manual mid sternal pressure on the different electrical parameters involved in transthoracic impedance (TTI), current delivered (i; amperes) and actual energy delivered (J) were measured for each shock. Changes in these parameters associated with augmentation of 1.5+/-1.1 amperes in current and 2.1+/-1.7 J in energy delivered. These changes did not correlate with BMI and/or EF. In 7 pts, manual pressure resulted in successful CV following failure at the same energy without pressure. Mean TTI drop in this group was 6.4+/-3.2 and was not significantly different from that of the whole cohort as well as pts who failed both attempts at CV. Conclusion: Manual pressure deployed during low energy synchronized external CV for AF appears to favorably affect the electrical parameters during defibrillation, and allowed successful CV of AF after a failed shock in 26% pts.

1103-119 Differential Effects of D-Sotalol vs. Propafenone on Global Spatiotemporal Complexity of Local Excitations in Chronic Atrial Fibrillation: A Determinant of Defibrillation Efficiency?
Jiunn-Lei Lin, Ling-Ping Lai, Luan-Yu Lin, Chao-Cheng Du, Yang-Zu Tseng, Wen-Pin Lien, Shene K. S. Huang. National Taiwan University Hospital, Taipei, Taiwan

Background. Electrical cardioversion (ED) of chronic atrial fibrillation (AF) can be facilitated by the addition of d-sotalol (S TL) but not propafenone (PPF). However, the electrophysiologic mechanism remains obscure. Materials & Methods. To test the hypothesis that global spatiotemporal complexity of local excitations in AF can determine the efficacy of ED, we investigated 38 pts (11 M, 17 F, 64+/-7 yrs) with AF (> 3 mo) by bi-atrial basket electrode mapping before and after IV STL (1.5 mg/kg, 12 pts) or PPF (5 mg/kg, 16 pts). External DC shock was titrated to determine the energy requirement. Bipolar electroanatomical map from each basket electrode was sampled in 1 kHz and recorded continuously for 5 min in each event. Power spectra for local frequency analysis were derived in 10-sec segment for each 5-min data by Fourier transform (FT). Dominant frequency (NF) from FT, defined as the frequency appearing for a 5 sec in a 40 Hz data, was selected at each of 64 atrial sites and mapped for its spatial distribution. The spatiotemporal complexity of local excitation frequencies in the whole atria was evaluated by the integral number of NF (NF int), standard deviation of all NF (SD NF), maximal domain area for all NF (Max DA), sum of domain areas by all NF (Sum DA), and maximal duration of NF (Max Dur) for all NF and mean and peak ROC (D) or TTI (R). Results: To assess the predictors of the atrial DFT, multivariate analysis of 14 clinical parameters was performed with a Cox proportional hazards model. Results: All pts were African American. The mean age of the study population was 67.5+/-18.2 yrs and 85% were male. LA > 5 cm was observed in 30% of pts with LA > 5 cm, but only 10% with LA < 5 cm (p<0.05). An LA > 5 cm identifies pts at increased risk of high atrial DFTs. A high DFT is a significant predictor of the atrial DFT. LA > 5 cm identifies pts at increased risk of high atrial DFTs.

Conclusion: Atrial defibrillators are an effective means of maintaining SR in patients with persistent AF. Racial increases in the duration of SR between shocks were seen in some patients however, this did not occur in the majority. These findings may have been a consequence of atrial activity that occurs with patient-activated rather than automatic shocks. This increased time may adversely affect the atrial electrical remodeling process.

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1103-120 Plasma Catecholamines During Low Energy Internal Atrial Cardioversion and During Electrophysiology Study for Induction of Ventricular Tachyarrhythmias
Giuseppe Borlani, Mauro Bini, Francesco Perlpinoli, Cristian Martignoni, Alberto Bargossi, Romano Zannoli, Angelo Bianchi. Institute of Cardiology- University of Bologna, Bologna, Italy

Background: During cardioversion for atrial fibrillation (AF), catecholamine levels increased. This may contribute to the different energy requirement for EC of chronic AF. Aim of the study was to evaluate the extent of plasma catecholamine changes induced by low energy internal atrial cardioversion (CV) and by electrophysiological study (EPS) for ventricular tachyarrhythmias (VT). Plasma levels of epinephrine (E) and norepinephrine (NE) were measured in blood samples taken atbaseline (at rest) in 9 normal individuals, in 26 pts with chronic atrial fibrillation (AF) and in 22 pts submitted to EPS for VT. During internal CV for AF, blood samples were taken following each delivered shock (stop up protocol beginning at a loading voltage of 180V) and sedation or anesthesia were administered only at patients' request. During EPS for VT, blood samples were taken following induction of VT, either in cases terminated by pacing or in cases requiring termination by DC shock. Results: In basal conditions no significant differences were found in E or NE levels (g/gm) comparing controls (E=32±19, NE=21±10) vs CV pts (E=35±20, NE=21±10) and sedation or anaesthesia were administered only at patients' request. During EPS for VT, blood samples were taken following induction of VT, either in cases terminated by pacing or in cases requiring termination by DC shock. In the low energy internal CV and following VT induction in EPS (especially if DC shock is required for VT termination), a significant rise in E and NE occurs during low energy internal CV and following VT induction in EPS (especially if DC shock is required for VT termination).

1103-120 Plasma Catecholamines During Low Energy Internal Atrial Cardioversion and During Electrophysiology Study for Induction of Ventricular Tachyarrhythmias
Giuseppe Borlani, Mauro Bini, Francesco Perlpinoli, Cristian Martignoni, Alberto Bargossi, Romano Zannoli, Angelo Bianchi. Institute of Cardiology- University of Bologna, Bologna, Italy

Background: During cardioversion for atrial fibrillation (AF), catecholamine levels increased. This may contribute to the different energy requirement for EC of chronic AF. Aim of the study was to evaluate the extent of plasma catecholamine changes induced by low energy internal atrial cardioversion (CV) and by electrophysiological study (EPS) for ventricular tachyarrhythmias (VT). Plasma levels of epinephrine (E) and norepinephrine (NE) were measured in blood samples taken atbaseline (at rest) in 9 normal individuals, in 26 pts with chronic atrial fibrillation (AF) and in 22 pts submitted to EPS for VT. During internal CV for AF, blood samples were taken following each delivered shock (stop up protocol beginning at a loading voltage of 180V) and sedation or anesthesia were administered only at patients' request. During EPS for VT, blood samples were taken following induction of VT, either in cases terminated by pacing or in cases requiring termination by DC shock. Results: In basal conditions no significant differences were found in E or NE levels (g/gm) comparing controls (E=32±19, NE=21±10) vs CV pts (E=35±20, NE=21±10) and sedation or anaesthesia were administered only at patients' request. During EPS for VT, blood samples were taken following induction of VT, either in cases terminated by pacing or in cases requiring termination by DC shock. In the low energy internal CV and following VT induction in EPS (especially if DC shock is required for VT termination), a significant rise in E and NE occurs during low energy internal CV and following VT induction in EPS (especially if DC shock is required for VT termination).
1104 Atrial Fibrillation: Identification and Elimination of Triggers

Monday, March 19, 2001, 9:00 a.m.-11:00 a.m.
Orange County Convention Center, Hall A4
Presentation Hour: 10:00 a.m.-11:00 a.m.

1104-121 Pulmonary Veins Show Decreased Effective Refractory Periods Under Acute Dilatation in Langendorff-Perfused Rabbit Hearts
Manus Zanne, Jonas Ronsse, Ricardo Schuitemaker, Peter Marthaler, Stefan Michalek.
Department of cardiology and pulmonology, University of Technology Aachen, Aachen, Germany

Background: Electrical beat originating in the pulmonary veins (PV) can initiate paroxysmal atrial fibrillation (AF). Recently, significant dilatation of the superior PV has been demonstrated in patients with AF. The effects of acute dilatation (D) on refractory periods (RP) in PV, however, have not yet been investigated. Methods: In 7 Langendorff-perfused rabbit hearts confluens of left PV was stripped of lung-tissue. Pacing and sensing electrodes were located within ±5 mm to each other on left PV and line wall of the left atrium (LA). RPs were measured by incremental extrastimulus (52) technique at a basic cycle length (S1 S2) of 250 ms under double and 10 fold diastolic threshold under increasing pressure (IP) (cm H2O). The shortest S1S2 interval resulting in a propagated response at the adjacent sensing electrode was defined as effective RP, the minimum interval between two consecutively conducted impulses from PV to LA was defined as functional RP. Results: PV sensing and pacing was possible in all experiments. Thresholds were higher in PV than in LA (4.8±3.5 ms vs. 1.2±0.4 ms, p<0.01). PV and LA showed comparable decrease in RP under IP, which was enhanced by increased stimulus strength. Functional RP decreased under IP.

PV S2 T

PV 2 X T

LA 2 X T

PV 10 X T

LA 10 X T

Conclusion: Physiological pressure changes decrease RP in PV substantially and might trigger the activity of ectopic foci. IP does not increase heterogeneity. Functional RP decreased under IP, which makes the occurrence of conduction block at the PV ostium due to IP unlikely.

1104-122 Elimination of Pulmonary Vein Potential for Catheter Ablation of Atrial Fibrillation: Results of Short-Time Clinical Follow-Up
Fethi Ouayy, Sabine I. S. Ernst, Maschotte Goya, Marius Volker, Karl-Heinz Kuck. St. Gaeg General Hospital, Hamburg, Germany

Primary catheter ablation of triggering foci within the pulmonary veins (PV) is often hampered by the presence of the trigger during the ablation procedure. Ablation of spikes potentials within the PV is raising PV ostomy. In 21 pts (2±3 pts with chronic AF) with symptomatic atrial fibrillation (AH) a left atrial (LA) ablation procedure aiming at a PV isolation was performed. The individual anatomy was reconstructed using the electroanatomical mapping system CARTO(R) after real-time transesophageal access gained to the LA. After placement of a multipolar recording catheter in the targeted PV, HCl ablation was deployed at the PV-LA junction to selectively interrupt muscle fibers entering the PV, until the PV potential disappeared as monitored by the PV electrocope. Results: In 21 pts (24 procedures) a total of 38±16 pts were needed (mean volumes 0.2±0.1, procedure time 47±99 min). During a mean follow up period of 41±21 days, 17/21 (81%) pts were in stable SR with occasional AES in holter recordings (18±17 still with antiarrhythmic medication). The remaining 4 pts experienced recurrences of AH. The 22±3 pts with chronic AF were in SR, 1 pt in intermittent AF with 2-4 weekly episodes. Complication: significant pericardial effusion in 1 pt and an atrial aneurysm in 1 pt. Conclusion: Trigger extraction by sequential HCl application to interrupt muscle strains entering the PVs is feasible and can be online validated by a recording electrode within the target pulmonary vein. The clinical follow-up demonstrates AFL recurrence only in 19% of pts. Even in pts with chronic AF, stable SR could be re-established.

1104-123 Influence of Current Strength During Pulmonary Vein Pacing on Intracardiac Electrogams in Coronary Sinus and Postero medial Right Atrium for Pacemapping Triggers of Atrial Fibrillation Originating in Pulmonary Veins

The pattern of activation of intracardiac electrograms (EGMs) in the coronary sinus (CS) and along the posteromedial right atrium (PMRA) helps rapidly localize pulmonary vein (PV) site of origin of focal triggers of atrial fibrillation (AF). In order to select the optimal PV pacing site, the patterns of activation and atrial refractoriness may vary. We sought to determine the clinical relevance of pacing current output on the pattern of CS and PMRA activation sequence (AS) and in CS-PRA conduction time that might influence the ability to predict right versus left PV sites of origin for AF. Methods: 10 patients, detailed left atrial magnetic electroanatomic mapping (12±190 points) was performed and a left atrial endocardial shell was established. at least 4 PV were identified and their locations were tagged when the catheter tip was passed into PV beyond the endocardial shell to the most distal site where an Egm could be recorded. Egm were recorded from 10 pole catheters placed in CS and PRA. Pacing was performed in each of the 52 PVA at capture thresholds and by mA at the PV ostium and at the most distal site where an Egm could be recorded. The conduction time between the PRA and CS and the AS in these catheters were analyzed. A change in AS and/or a difference >10 ms in CS-PRA was considered significant. Results: AS, CS-PRA and PRA was identical in all of the 10 PVA sites (IP/PVA) at different current output. Only 1 of the 104 sites (left inferior PV-deep) paced had >10 ms difference in CS-PRA times with different current outputs. The mean capture threshold of all PV pacing sites were: 7±0.6 mA, deep PV: 22±1.5 mA. Conclusions: Due to clinical importance of pace activation sequence mapping in localizing PV triggers of paroxysmal atrial fibrillation, the absence of significant influence in activation sequence in CS and PRA, and in CS-PRA conduction times eliminated need for current output titration to obtain PV pacermaps.

1104-124 Prevalence of Ligament of Marshall Potentials Recording in Patients with Paroxysmal Atrial Fibrillation
Demosthenes Katsilpis, Eleftherios Glezoszgriot, Socrates Koveros, John Peristis, Pericles Kalinin, John baniadis, George Sarra, A John Camm. ATHENS EUROCLINIC, ATHENS, GREECE, UNIVERSIT HIOANNINA, IOANNINA, Greece

Background: Potentials representing activity of the ligament of Marshall can be recorded in man through the coronary sinus and the left atrial endocardium. The prevalence of these potentials in patients with atrial fibrillation is not known. Methods and Results Forty-nine patients, 25 with paroxysmal AF (group A), and 24 with other arrhythmias (group B) were subjected to catheter mapping for intended recording of ligament of Marshall. Catheterization of the crista supraventricular or coronary sinus was feasible in 14 patients of group A; in 10 of them a discrete electrogram (Marshall potential) was recorded epicardially at the distal supradiaphragmatic coronary sinus and more superficially on the epicardium near the sinotubular and sinus venosus junctions. No discrete electrogram was recorded in 4 patients of group B. Conclusions: Cancellation of the ligament of Marshall area through the distal supradiaphragmatic coronary sinus is feasible in approximately 50% of patients with paroxysmal atrial fibrillation. Recording of specific potentials from this area is more frequent in patients with AF than in patients with other arrhythmias.

POSTER SESSION

1105 Electrophysiological Properties of the Heart

Monday, March 19, 2001, 9:00 a.m.-11:00 a.m.
Orange County Convention Center, Hall A4
Presentation Hour: 10:00 a.m.-11:00 a.m.

1105-125 Complex AV-Nodal Dynamics During Ventricular-Triggered Atrial Pacing in Humans
David J. Christie, Kenneth M. Stein, Steven M. Markowitz, Suneet Mittal, David J. Sehmer, Marc A. Schachner, Sai Lai, Rob F. E. Lerman. The New York Hospital - Cornell University Medical Center, New York, NY

Background: In animal models, AV interval alternans (period-2 doubling) can occur during His-triggered atrial pacing. We investigated whether similar dynamics result from 'en-direct' ventricular depolarization. VA was gradually decreased until AV block or alternans occurred.

Methods: During diagnostic EP testing, 38 patients (18 male, 20 female, 57±18 yr) with normal AV conduction underwent rapid atrial pacing at an adjustable interval (VA) after venricular depolarization. VA was gradually decreased until AV block or alternans occurred. Results: VA Interval alternans occurred in 19 patients (5±8; p<0.02 Hz). There were no significant correlations between type of AV dynamics and existence of dual AV-nodal pathways (18 patients) or antiarrhythmic medications (23 patients). Alternans always developed via a bifurcation (typical of nonlinear-dynamical function) instead of a discrete jump (dual-pathway function). 12 patients underwent a second trial using pacing threshold and current output maintained. In 10 patients, alternans remained. In 2 patients, alternans resided. In 3 patients, alternans remission was facilitated alternans but inhibited oscillations. In 5 patients had alternans before and after atrial fibrillation. In 1 patient with chronic AF, stable SR could be re-established.
Rate-Dependent Changes In Conduction Velocity in the Cavo-Tricuspid Isthmus and Septum: Comparison of Patients With Atrial Flutter Versus Atrial Nodal Reentrant Tachycardia

Phume Fang, Nancy L. Redfee, Wesley H. Kestly, Jr., Tony W. Glimmons, David M. Fitzgerald. Wake Forest University School of Medicine, Winston-Salem, NC

Electro-anatomic maps (CARTO, Biosense) allow evaluation of both the anatomy and conduction characteristics of the mapped chamber. Electro-anatomic maps (EAMs) of the right atrium (RA) in patients with atrial flutter (AF) show a larger atrial volume and an increase in both length and width of the cavo-tricuspid isthmus (CTI) compared to patients with atrial flutter reentry (AFLT). Methods: Using EAMs obtained during coronary sinus pacing at pacing cycle lengths (PCL) 600, 400 and 300 msec, we evaluated conduction velocities in the RA septum and CTI in 10 patients with AF (age = 58 ± 10; 3 females) and compared EAMs to 13 patients with AFLT (age = 52 ± 11; 5 females) to determine whether the conduction slowing required to maintain AF was related to changes in volume alone or altered RA electrophysiology. Results: A summary of the results are listed in Table 1. Conduction velocities in CTI and septum were significantly slower at all PCL when the AF group was compared to the AFLT group (* p<0.05). Additionally, in the AF group, conduction velocity was slower on the septum at 600 and 400 but not at 300 compared to CTI (* p<0.05). In Atrial flutter PCL 200, conduction in CTI slowed significantly compared to conduction in CTI at PCL 600 and 400 (* p<0.05) such that there was no difference between CTI and septum at PCL 300. Conduction in septum was slower in the septum compared to the CTI in all patients. However, in patients with AF, there is significantly greater slowing of conduction in the CTI and septum compared to patients with AFLT as well as decremental rate-dependent slowing of conduction in the CTI. These findings may aid in atrial arrhythmias, assisted atrial electrophysiology is found in AF patients.

Table 1. Effect of PCL on Conduction Velocity

Table:<br>
<table>
<thead>
<tr>
<th>PCL (msec)</th>
<th>Conduction in CTI (cm/sec)</th>
<th>Conduction in Septum (cm/sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>600</td>
<td>70</td>
<td>94</td>
</tr>
<tr>
<td>400</td>
<td>74</td>
<td>96</td>
</tr>
<tr>
<td>300</td>
<td>80</td>
<td>100</td>
</tr>
<tr>
<td>AFLT</td>
<td>70</td>
<td>94</td>
</tr>
<tr>
<td>RA Septum</td>
<td>94</td>
<td>100</td>
</tr>
</tbody>
</table>

Conclusions: These results confirm the findings of previous studies in demonstrating the decremental slowing of conduction in the CTI and septum in patients with atrial flutter. This may be important in understanding the mechanisms of atrial arrhythmias, particularly atrial flutter, in patients with atrial fibrillation. This study suggests that the CTI and septum may play a more important role in maintaining atrial flutter than previously thought.
Simultaneous Endocardial and Epicardial Microelectrode Catheter Mapping in Patients With Non Ischemic Cardiomyopathy and Refractory Sustained Ventricular Tachycardia

Angelo A. V de Paolis, Georigia G. Silva, Luis R. Leite, Roberto L. Farias, Almino Rocha Neto. Federal University of Sao Paulo - Paulista School of Medicine, Sao Paulo, Brazil

Background: Sustained ventricular tachycardia (SVT) is a common complication of nonischemic cardiomyopathy. Results of radiofrequency catheter ablation (RFCA) in these patients (pts) are less effective than those with ischemic cardiomyopathy, possibly due to nonendocardial reentry circuits. Methods: We studied 19 pts (23 procedures) with refractory SVT; 11 women and 8 men, ages ranging from 41 to 73 years, mean left ventricular ejection fraction of 0.41. Two of pts had right ventricular (RV) dysplasia and 17 chronic chagasic cardiomyopathy. Epicardial approach was performed subxyphoid puncture guided by RV angiography in LAO projection, and two odipolos microelectrode catheters were inserted into the anterior and inferior wall of left ventricle (LV). Endocardial catheter was placed in the LV through retrograde arterial approach. All pts were hemiparalyzed and stable SVT was induced by RV programmed ventricular stimulation and simultaneous endocardial-epicardial mapping was obtained. Coronary angiography was performed before epicardial RF energy delivery. Results: Consecutively therapeutic techniques identified in the epicardium 303 RVJ and 770 LVJ circuits (p < 0.05). Two RV and 7 LVSVJ were successfully ablated. Spontaneous changes of UHS morphologies were observed in 58 SVT with no major changes in the pattern of endocardial or epicardial activation. Results were classified in 3 pts (1 RV/2 LV) because of risk for coronary injury. There were no complications. Conclusion: 1: in this study population, simultaneous endocardial and epicardial ablation was feasible and safe. 2: Epicardial ablation could be achieved in 72% of pts. 3: Epicardial mapping was more effective in pt with RV SVT. 4: Changes in UHS morphologies were not associated with anterior epicardial or endocardial breakthrough of the circuit.

Catheter Ablation of Idiopathic Left Ventricular Tachycardia: Identification of Target Sites With and Without Late Diastolic Potential By Entrainment Mapping Technique

Tomoo Harada, Kazuyuki Aonuma, Yasushi Tomita, Yasuhiro Yokoyama, Kiyoshi Neto. Federal University of Sao Paulo PEW/O Paulo & School of Medicine, Sao Paulo, Brazil

Angelo A. V. de Paola, Gebrgia G. Siiva, Luiz R. Leite, Roberto L. Farias, Almino Rocha Kawasaki, Kyotokyo Medical Dentistry University, Kyotokyo, Japan

Background: Purkinje potential or late diastolic potential can be a useful marker for ablation of idiopathic left ventricular tachycardia. However, Identification of exact reentry circuit is not clearly well defined. Objectives: To investigate appropriate target sites for radiofrequency (RF) catheter ablation of idiopathic left ventricular tachycardia by entrainment mapping. Methods and Results: Entrainment mapping and RF ablation of seventeen ventricular tachycardias were performed in seventeen patients (15 men and 2 women; mean age, 43 years; 39 RF energy applications). 27 exit sites and 27 no exit sites including proximal and outer loop reentry circuit sites were classified based on findings during entrainment. RF ablation terminated ventricular tachycardia in 28 of 52 sites. 12 of 25 exit sites (48%) and 16 of 27 no exit sites (59%, p = 0.05). The incidence of ventricular tachycardia termination during RF ablation at sites with and without LDPs as follows. Incidence of ventricular tachycardia termination at sites with and without LDPS (p = 0.05).

Reentry circuit (n=52)
Presence of LDP LDP- LDP+ LDP- LDP+
Termination (n=28) 6 6 12 4 4
No termination (n=24) 1 12 4 7
% termination 96 75 76 50

Conclusion: RF ablation often failed to terminate idiopathic left ventricular tachycardia at exit sites that were shown to be concealed entrainment. At exit sites, however, the presence of a LDP increased the likelihood of ventricular tachycardia termination by RF ablation. LDPS are useful guide for successful RF ablation of idiopathic left ventricular tachycardia.

Ablation of Non-Infarct Related Ventricular Tachycardia in Patients With Prior Myocardial Infarction

Luiz R. Scott, Giuseppe Gandolfo-Domingo, Gregory T. Atkinson, Mark A. Coppess, Jeffrey E. Olgin, Douglas R. Zipes, John M. Miller. Krannert Institute of Cardiology, Indiana University School of Medicine, Indianapolis, IN

Post-MI VT is typically by reentry in the subendocardial border zone surrounding prior MI. Preferred ablation sites have low amplitude mid-diastolic multicomponent electrograms (EGM). The prevalence of VT unrelated to the previous MI in patients with CAD is unknown. Methods: From 40 consecutive patients referred over a period of 6 years to post-MI VT ablation, we report a group of 4 patients (group A), whose sustained VT did not appear to be related to their previous MI. There were men, 1 woman, aged 62 ± 10 years, 3 patients had and one patient MI (age 85 years). All had left ventricular dysfunction (EF ≤ 40%), 3 had previous CABG and 2 had an (ICD). Common features were: region of origin (judged by endocardial catheter mapping and successful ablation) remote from MI location; facilitation of VT initiation by isoproterenol: minimally preysystolic, tachycardia at VT induction. Results: Of 38 patients who underwent ablation at the anterior or inferior wall of left ventricle (LV). No statistical difference was found between group which had elimination of VT. There were no complications. Conclusion: RF ablation often failed to terminate idiopathic left ventricular tachycardia at exit sites that were shown to be concealed entrainment. At exit sites, however, the presence of a LDP increased the likelihood of ventricular tachycardia termination by RF ablation. LDPS are useful guide for successful RF ablation of idiopathic left ventricular tachycardia.

Ablation of Non-Infarct Related Ventricular Tachycardia

Monday, March 19, 2001, 9:15 a.m.-10:30 a.m.
Orange County Convention Center, Room 232A

ORAL CONTRIBUTIONS

Atrial Defibrillators

Burkhard Högling, Katrin Ziegenbalg, Christina Unterberg-Buchwald, Carsten Israel, Thomas Lavo, Gerhard Schulzer, Ingrid Kennes, Renno van Veen, Albert Center Leipzig, Leipzig, Germany

Background: Painless pacing therapies may be successful in terminating spontaneous atrial tachyarrhythmias as prior studies have demonstrated. The Medtronic AT500 is a DRDR pacing stimulator with the ability to continuously detect and monitor atrial episodes using PR-Logic® pattern and rate recognition algorithm together with sophisticated diagnostics. The AT500 contains novel pacing prevention algorithms (PPK) to prevent atrial fibrillation and arrhythmias pacing (ATP) to terminate atrial tachyarrhythmias.

Methods: In a prospective worldwide multicenter study the safety and efficacy was evaluated in patients with (p<0.05) compared to pre-treatment value

Radiofrequency ablation group

<table>
<thead>
<tr>
<th>Group</th>
<th>Pre</th>
<th>2 weeks</th>
<th>3 months</th>
<th>P</th>
<th>2 weeks</th>
<th>3 months</th>
</tr>
</thead>
<tbody>
<tr>
<td>LDP-</td>
<td>1</td>
<td>12</td>
<td>4</td>
<td>7</td>
<td>0.05</td>
<td>0.05</td>
</tr>
<tr>
<td>LDP+</td>
<td>96</td>
<td>75</td>
<td>76</td>
<td>50</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Conclusion: This result suggests that radiofrequency catheter ablation is associated with a high rate of cure and improvement in the quality of life by relieving feelings of anxiety and depression in patients with frequent and symptomatic premature ventricular eocysis.

Table 1: Improvement in premature ventricular beat count and quality of life

Radiofrequency ablation group

<table>
<thead>
<tr>
<th>PDA</th>
<th>Pre</th>
<th>2 weeks</th>
<th>3 months</th>
<th>P</th>
<th>2 weeks</th>
<th>3 months</th>
</tr>
</thead>
<tbody>
<tr>
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<td>96</td>
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<td>76</td>
<td>50</td>
<td></td>
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</tbody>
</table>

Atrial Tachycardia

Monday, March 19, 2001, 9:15 a.m.-10:30 a.m.
Orange County Convention Center, Room 232A

813-1 Pace Termination of Atrial Tachyarrhythmias First Results of the Multicenter Study AT500

Burkhard Högling, Katrin Ziegenbalg, Christina Unterberg-Buchwald, Carsten Israel, Thomas Lavo, Gerhard Schulzer, Ingrid Kennes, Renno van Veen, Albert Center Leipzig, Leipzig, Germany

Background: Atrial fibrillation (AFib) is the most common arrhythmia in adults. Atrial fibrillation is associated with a significant risk of stroke and mortality. Although AT500 was designed to prevent AFib, the device might also be able to terminate AFib or atrial flutter (AFL). The purpose of this study was to evaluate the successful rate of the device to terminate AFib and AFL.

Methods: AFib or AFL episodes were continuously detected and monitored by the AT500 and terminated by the device in an open-label, multicenter, prospective study.
A Prospective Randomized Comparison of Transvenous and Active Can Atrial Defibrillation Thresholds


Background: Active left pectoral Cans are routinely used for implantable ventricular defibrillators (ICDs) because such lead configurations reduce defibrillation thresholds (DFTs). Dual unframed ICs are now capable of treating atrial arrhythmias (AF), but the optimal shocking vector for atrial defibrillation is unknown. To assess if an active Can reduces atrial DFTs, we evaluated 63 patients (pts) undergoing ICD implantation.

Methods: Atrial fibrillation patients were randomized to receive an active (Can) or a transvenous lead alone (Lead). Atrial fibrillatory frequency was estimated prior to cardioversion from surface ECG lead V1. After filtering, QRST complexes were subtracted using a template matching and averaging algorithm. The resulting fibrillatory baseline signal was subjected to Fourier transformation, displayed as a frequency power spectrum and the peak frequency was determined in the 3 to 12 Hz frequency band. Atrial defibrillation threshold (ADFT) was determined using a step-up-protocol. All patients were cardioverted successfully with a mean ADFT of 7.6 ± 0.5 J. There was a strong positive correlation between fibrillatory frequency and ADFT (R=0.71, p<0.001). AF recurrence within 30 days after successful cardioversion occurred in 11 patients (33%). It is hypothesized that fibrillary frequency may be useful for predicting AF recurrence.

Results: After successful cardioversion, the patient-activated atrial defibrillators were used an average of 2.7 ± 2.9 times/day. Recurrences occurred in 3 patients (9%). For the remaining 60/50% tilts and a 150 pF capacitance. The DFT was lower in the lead configuration, in 10 pts (30%) the DFT was lower with the Can and in the remaining 7 pts (21%) DFTs were the same.

Conclusion: The difference in atrial DFTs between the active Can and a transvenous lead alone may be beneficial for use in patients with high AF recurrence rates. Further investigations are necessary to improve therapy efficacy by optimizing the parameter settings of ATR therapies.

Atrial Fibrillation Frequency Predicts Atrial Defibrillation Threshold and Early Arrhythmia Recurrence in Patients Undergoing Internal Cardioversion of Persistent AF

Andreas Bölkmann, Malke Mende, Annemarie Neugebauer, Dieterich Pfeiffer. University Hospital, Department of Cardiology, Leipzig, Germany University Hospital, Department of Cardiology, Magdeburg, Germany

The study was conducted to analyze the meaning of atrial fibrillation frequency obtained from the surface ECG for prediction of energy requirements and early arrhythmia recurrence in patients undergoing internal cardioversion of persistent atrial fibrillation (AF). Nineteen consecutive patients (mean age 60±11.1 years, 11 males, 8 females) with persistent AF (≥7 days) underwent internal cardioversion. A bifascicular shock was synchronized to the R wave was delivered between two catheters positioned in the high right atrium (HRA) and the coronary sinus (CS). Atrial fibrillation frequency was estimated prior to cardioversion from surface ECG lead V1. After filtering, QRS complex were subtracted using a template matching and averaging algorithm. The resulting fibrillatory baseline signal was subjected to Fourier transformation, displayed as a frequency power spectrum and the peak frequency was determined in the 3 to 12 Hz frequency band. Atrial defibrillation threshold (ADFT) was determined using a step-up-protocol. All patients were cardioverted successfully with a mean ADFT of 7.6 ± 0.5 J. There was a strong positive correlation between fibrillatory frequency and ADFT (R=0.71, p<0.001). AF recurrence within 30 days after successful cardioversion occurred in 11 patients (33%). It is hypothesized that fibrillary frequency may be useful for predicting AF recurrence.

In conclusion, fibrillatory frequency obtained from the surface ECG predicts both ADFT and early AF recurrence in patients with persistent AF undergoing internal cardioversion.

Do Patients With Highly Symptomatic Atrial Fibrillation Always Feel Their Episodes?

Carl Timmermans, Luz-Maria Rodriguez, Gregory M. Ayers, Suzanne Philbin, Marta Antonoudi, Paul Dorenbrug, Hein J. W. Wellens. Academic Hospital Maastricht, Maastricht, the Netherlands

Background: It has been reported that patients diagnosed with symptomatic atrial fibrillation (AF) do not recognize many of their AF episodes. We hypothesized that while patients with highly symptomatic, drug-refractory AF, not all episodes would be recognized.

Methods: Ten patients with the Medtronic atrial defibrillator (Atinovor, Guidant, Inc.) were enrolled for 16.9 (4.2-26.9) months, with the device in a rhythm monitoring mode. The device evaluated the patients' rhythm every hour. Additionally, each patient was given a diary to record the time of onset and duration of the AF episodes they had noticed. At each clinical follow-up or at the time of treatment of AF episodes, the device was interrogated and the diary collected. From the device memory data, the onset and duration of the individual episodes were determined.

Results: Of AF episodes were perceived by the patient (paroxysmal, n=220). 283 episodes detected by the device. Patient (185/283 episodes) were perceived and reported by the patient (6 of 9 patients had 1-3 episodes not perceived). For 168/185 episodes where the episodes the patients recorded the exact onset time, 90 (54%) were concordant within 1 hour for the device and the patient. For the remaining 78 episodes, the device detected AF (inc. 90.43 h, range: 1.05-6.61 hours). Conclusion: Nearly all episodes of AF are perceived by patients with symptomatic, drug-refractory AF. Rarely do patients feel symptoms of AF when the rhythm is not AF. This phenomenon may be due to symptoms associated with AF.
Background: Circadian variation of the heart rate-corrected QT interval should reveal the heart-rate independent (moderately autonomic) influence on the duration of ventricular repolarization. We compared the circadian variation of the QT interval corrected for heart rate by Bazett formula and by a semiparametric formula QT=QTY. Results: Individuals (11 males, age 32±8 years) with periods 24 hours, 1 week and 1 month. One ECG was recorded 4 times in each of 22 healthy subjects (25 men, 34±10 years). QT interval was measured automatically (downslope inflex tangent method, QT Guard, Marquette). The maximum QT (QT max) was corrected by Bazett formula, and by the individual power model. The circadian variation was estimated by harmonic regression analysis (parameter (a + b cos(2πT/24)) + p sin(2πT/24)), where T is the time. Results: Observed variation (p<0.05, T was found in 24/40 (49%) subjects for QTc (Bazett) and in 47/49 (95%) for the individually corrected QT max (p<0.001; chi² test). RR and QT max showed circadian pattern in 45/49 (91%) and 49/49 (100%), respectively. The circadian variation of QTc (Bazett) was out of phase with RR, QT max and the individually corrected QT max. (Figure: circadian variation of the mean values. Open circles - predicted values, filled circles - actual values). Conclusion: There is a circadian variation. Heart rate-correction formula with individually calculated parameters is preferable.
INTRODUCTION: Re-initiation of atrial fibrillation (AF) was observed in a significant proportion of patients (pts) after successful cardioversion using both external agents or atrial pacing. Although previous studies have demonstrated that anticoagulant agents or atrial pacing can acutely suppress ERAF, long-term clinical outcome of patients with ERAF remains unclear.

METHODS: We retrospectively analysed 16,397 atrial arrhythmias in 194 patients (pts) who presented to the University of Bochum, Germany. The Medtronic AT500 is a pacemaker capable of delivering atrial anti-tachy pacing (ATP) to act as endocardial pacing. Post-cardioversion, all pts received oral sotalol and were followed by a re-initiation. This percentage depends on the above threshold; the risk of ERAF within 1 Od days was 34%. The results suggested that ERAF is a significant predictor of recurrent AF. The incidence of ERAF was significantly higher in pts with a longer duration of AF (hazard ratio 2.15, p=0.012) (left panel) and in those with AF > 2 years duration (hazard ratio 1.8, p=0.009) (right panel). Multivariate analysis demonstrated the presence of ERAF (p=0.001) and longer duration of AF (p=0.05) were independent predictors for shorter duration of atrial fibrillation free period. The findings of this study are important for the care of patients with AF.

RESULTS: The total number of episodes per pt varied from 1 to 685 for the whole group. 42 pts (22%) never experienced any re-initiation within 1 Od days. 6% of the transgenic mice that died suddenly at three weeks did not have an ECG report indicating that cal, an endoplasmic reticulum protein, may play a role in development of heart failure. Cal is expressed in developing hearts. Transgenic (Tg) mice with an 11-fold increase in expression of cal have been documented to develop a dilated cardiomyopathy at about 11 days of age and 80% die suddenly at about 3 weeks of age. The purpose of this study is to determine if the Tg mice were experiencing arrhythmias that might explain their sudden death.

METHOD: We retrospectively analysed 16,397 atrial arrhythmias in 194 patients (pts) and calculated the time pts were in sinus rhythm (SR) between 2 consecutive episodes. If the time was shorter than a pre-defined threshold, the episode was counted as re-initiated. Re-initiation threshold was varied between 1 second and 320 minutes. Results: The total number of episodes per pt varied from 1 to 685. The number of re-initiations per pt varied from 0 to 361. With the re-initiation threshold set at 1 minute, 152 pts experienced one or more re-initiations of AF. On average, 34% of all atrial episodes were followed by a re-initiation. This percentage decreases on the above threshold, the graph shows this function. 42 pts (22%) never experienced any re-initiation within 1 minute. However, this highly depends on the total number of episodes (≤ 45 in this group; ≤ 55% for the whole group).

Conclusion: 78% of all pts experienced AF re-initiations within 1 minute, the average chance for re-initiation was 34%. The results suggest that this phenomenon, including ERAF, needs to be taken into serious consideration when treating atrial arrhythmias.
A Method of Accurate Three-Dimensional Reconstruction of the Atrioventricular Conduction System

R. Kannan, Muiharasan, Ashwin Nag@, Andrew J. Hamilton, David D. McPherson, Sarqa Bharati. Northwestern University Medical School, Chicago, IL. Hope Children's Hospital, Oak Lawn, IL.

The atrioventricular conduction system (AVCS) is a curved complex structure that has not been reconstructed in three-dimensions (3D) limiting accurate clinical and pathological correlation. The AVCS includes the AV node and its approaches, AV bundle (generating, branching and bifurcating parts), and the bundle branches.

Method: To determine if 3D computer techniques could accurately reconstruct the AVCS, we created slices of 20th serial section (cut at 7 micron level) of the AVCS. These slices were digitized into 600 dots/inch color images. The external outlines of each section were manually segmented using commercially available 3D rendering software (1). The AV node was used as reference to confirm 3D reconstruction. The accuracy of the AVCS reconstruction was compared to traditional 2D methods.

Results: The validation procedure showed that each test Image aligned in translations and rotations with a mean error of 0.01 mm and 0.01 degree.

Conclusion: We have demonstrated an accurate method of 3D reconstruction of the atrioventricular conduction system that permits accurate pathological and electrophysiological correlation of the conduction system, providing more accurate means of mapping and conduction system interventions.

Age-Related Changes in A-V Conduction in Connexin-40 Deficient Mice

Wei Zhu, Sarri Saba, Caterina Selitto, David L. Paul, Brian VanderBrink, Mark S. Link, Munther K. Homou, N. A. Mark Estes, III, Paul J. Wang. New England Medical Center, Boston, MA. Harvard Medical School, Boston, MA.

Background: Previous studies have identified A-V conduction abnormalities in young (about 11 week) connexin-40 deficient mice. The purpose of this study was to examine the age-related changes in arrhythmogenic conduction from 1 to 60 weeks of age in connexin-40 (Cx40) deficient mice.

Methods: Twenty-one 11-week-old mice (10 Cx40 +/- and 11 wild-type Cx40 +/-) and twenty-one 60-week-old mice (10 Cx40 +/- and 11 wild-type Cx40 +/-) underwent prospective blinded in vivo electrophysiology study with a 29F octoparal catheter placed from the right atrium to the right ventricle, recording His bundle electrogram, standard protocols were used to obtain arrhythmic arrhythmogenic conduction parameters.

Results: Within each age group (11 and 36 weeks), the Cx 40 +/- mice had longer PR intervals compared to wild-type mice (Cx40 +/- mean of 156 i: 60 points). Careful attention was placed upon identifying the sites associated with the AV node and His bundle.

Conclusion: Within each age group (11 and 36 weeks), the Cx 40 +/- mice had longer PR intervals compared to wild-type mice. This suggests that connexins may play a role in age-related changes in conduction.

Myocyte Contractility and Ouabain Toxicity in Transgenic Mice Which Overexpress the Alpha 3 Isoform of the Na-K ATPase

Gninn T. Wetzels, Raphael Zahler, Shahla Jilani, Fuhua Chen. Mater Dei Children's Hospital, 8177 A, Los Angeles, CA. Keck Medical School of University of Southern California.

The Na-K-ATPase, the Na+ pump, is required to establish the transsarcolemmal Na+ and K+ gradient needed for cell excitability. The Na-K-ATPase a3 isoform possesses a lower affinity for Na+ but a higher affinity for ouabain, a cardiac glycoside. Ouabain inhibits Na-K-ATPase activity and exerts a positive (inotropic) effect on the heart. The purpose of this study was to examine the effect of ouabain in contractility in myocytes isolated from transgenic mice (+/+), which overexpress the Na-K-ATPase a3 isoform. To validate the method, the algorithm was applied to a digitized image transformed by known translations and rotations.

Results: The validation procedure showed that each test Image aligned in translations and rotations with a mean error of 0.04 mm and 0.06 degree. In summary, outcomes which overexpress the Na-K-ATPase a3 isoform are relatively protected from the toxic effects of ouabain compared to wild-type cells, but retain a similar positive contractile response. The mechanisms underlying the protective effect of Na-K-ATPase overexpression remain unclear. We speculate that gene therapy-induced Na-K-ATPase overexpression in patients treated with cardiac glycosides could result in improved contractility with decreased toxic cardiac side effects.

Atrial Fibrillation/Flutter: Thromboembolism

HansJ Schmidt, Hayden Orms, Torsten Schmier, Mladen Steffen, Stefan Illien, Monika Bruck, Maria Kehlet. Henrikir Hospital, University of Bonn, Bonn, Germany.

Background: The presence of spontaneous echo contrast (SEC) and/or thrombi in patients with atrial fibrillation (AF) is associated with an elevated risk of cerebral embolism. The aims of this prospective study were (1) to evaluate the fate of atrial thrombi in anticoagulated AF patients and (2) to determine the incidence of cerebral embolism using transthoracic echocardiography (TTE) and transesophageal echocardiography (TEE) in different time periods of one year. Methods: The study group consisted of 22 pts with atrial fibrillation (age 68±11 years) and 40 pts with bradycardia (age 64±10). 19 pts with AF without thrombi or SEC served as controls (age 52±12). All pts underwent serial transthoracic and transesophageal echocardiographic studies, serial assessment of the anticoagulation level (an INR > 2 was defined as effectively anticoagulated) and cranial MRI including diffusion-weighted imaging to determine the presence of cerebral embolism at the beginning of the study at 4 weeks, at 3 and 6 months and at 1 year. Results: 13 pts had cerebral embolism at the index admission. 7 pts had cerebral embolism during the follow up period. The latter 6 pts had a neurological deficit, 1 patient died. The other patient had repeated cerebral embolism. 2 of the 6 pts with cerebral embolism had ineffective anticoagulation during the follow up. The incidence of cerebral embolism was similar in pts with TTE and TEE (5% [n=2] versus 10% [n=2], p=0.37). 10 of the 22 pts [45%] with thrombi had mobile thrombi. The study group consisted of 22 pts with atrial fibrillation (age 68±11 years) and 40 pts with bradycardia (age 64±10). 19 pts with AF without thrombi or SEC served as controls (age 52±12). All pts underwent serial transthoracic and transesophageal echocardiographic studies, serial assessment of the anticoagulation level (an INR > 2 was defined as effectively anticoagulated) and cranial MRI including diffusion-weighted imaging to determine the presence of cerebral embolism at the beginning of the study at 4 weeks, at 3 and 6 months and at 1 year.
**1139-125 Antioxidant Therapy Can Influece the Recovery of Left Atrial Function After External Electrical Cardioversion**

Gerasia Maria Zoula, Carmine Pizzini, Raffaele Raffaele, J. wood, D. Carcavelli, Raffaele Bugnariu, Dept Cardiology, Innsbruck, University of Innsbruck, Innsbruck, Austria

Recent studies have shown that in pts with atrial fibrillation (AF), external electrical cardioversion (EEC) induces a state of atrial stunning that follows for several days. It is well known that direct current (DC) Shock generates free radicals that may contribute to atrial mechanical dysfunction. The aim of the study was to evaluate the effects of an antioxidant therapy on atrial function recovery in pts with non-rheumatic AF. Methods. 74 consecutive pts were studied in a single blind cross-over fashion who underwent successful EEC for AF: standard medical treatment was given in 27 pts (G1). Three days before DC three remaining 37 pts (G2) received an antioxidant therapy (Glucose 20% 500 ml with regular Intraline 20 UI, KCl 40 mmol, MgSO4 0.4 mol, Vitamin C 2.5 g, and a single 25 mg dose of Dipraxon before EEC and Vitamin C 300 mg i.v. during the following 24 hours was also given. Pulsed doppler indices of left atrial mechanical function were measured within 1 hour (T0), at 1 day (T1), 3 days (T2), 1 week (T3), and 3 weeks (T4) after DC shock. Results. At T1 and T2 G2 showed a significant increase (p<0.001) of peak A wave velocity (PA), integrated atrial velocities (A-VTI), atrial contribution to total transmural flow (AVTII), and atrial ejection force (AEF). At T4 there was no more significant difference between G1 and G2.

**1139-126 Time Required to Achieve Therapeutic Anticoagulation With Warfarin Prior to Cardioversion for Atrial Fibrillation**


**Background**: Anticoagulation with warfarin for three weeks and transesophageal echocardiography are two strategies used prior to cardioversion for atrial fibrillation to minimize the risk of thromboembolism. We sought to determine the time required to achieve therapeutic anticoagulation with warfarin prior to cardioversion.

**Methods**: Fifty-eight consecutive patients with atrial fibrillation who were started on warfarin prior to cardioversion therapy to achieve an INR greater than 2.0. Patients were divided into two groups: G1 = 37 pts with atrial fibrillation who had an INR $\geq$ 2.0, and G2 = 21 pts with atrial fibrillation who had an INR $< 2.0$. The median time required to achieve the first therapeutic INR was 10.0 ± 6.1 weeks (range 2.0-17.8 weeks). The mean time required to achieve 3 weeks of therapeutic anticoagulation was 1.5 ± 0.2 weeks (range 1.0-2.8 weeks). Patients underwent cardioversion 7.6 ± 2.6 weeks after initiation of warfarin (range 5.6-11.5 weeks).

**Results**: The median time required to achieve the first therapeutic INR was 10.0 ± 6.1 weeks (range 2.0-17.8 weeks). The mean time required to achieve 3 weeks of therapeutic anticoagulation was 1.5 ± 0.2 weeks (range 1.0-2.8 weeks). Patients underwent cardioversion 7.6 ± 2.6 weeks after initiation of warfarin (range 5.6-11.5 weeks).

**Conclusion**: When initiating warfarin therapy prior to cardioversion for atrial fibrillation, at least 6 weeks are required to achieve 3 weeks of therapeutic anticoagulation, even when patients are closely monitored by an anticoagulation service. Frequent determinations using a transesophageal echocardiographic-guided approach would reduce the overall duration of atrial fibrillation by almost 2 months.

**1139-127 Impaired Fibrinolytic Capacity in Rheumatic and Non-rheumatic Atrial Fibrillation**

Enver Atalar, Tayfun Koli, Kadriye Aytemir, Yildirim Hazerobudun, Nedim Ozan, Serdar Aksayek, Kenan Ovunc, Syrry Kes, Ferhat Ozmen. Hacettepe University School of Medicine, Department of Cardiology, Ankara, Turkey

**Background**: Global Fibrinolytic Capacity (GFC) is a new and innovative technique for evaluating the fibrinolytic system. GFC assay is affected by levels of PAI-1, u-PA, u-PA inhibitor, PAI-2, alpha-2 antiplasmin and histidine rich Glyco-Protein (HRGP). Chronic atrial fibrillation (CAF) and non-rheumatic atrial fibrillation have lower GFC than non-CAF and non-rheumatic atrial fibrillation. Methods: To investigate the fibrinolytic activity, we studied GFC in 24 patients with non-rheumatic atrial fibrillation (11 females, mean age 53±8 years) and 22 patients with rheumatic mitral stenosis and atrial fibrillation (16 females, 8 males, mean age 57±6 years). Control group consisted of 10 healthy subjects in sinus rhythm. None of patients were receiving anticoagulation therapy, and they did not have a history of embolism. All patients underwent transesophageal echocardiography. Results: Patients with rheumatic atrial fibrillation and non-rheumatic atrial fibrillation had lower GFC than those with non-CAF and normal GFC were lower in patients with rheumatic atrial fibrillation. (0.42±0.20 mg/ml vs. 1.54±1.01 mg/ml, p<0.05). The rheumatic atrial fibrillation group also showed decreased levels of GFC compared to those with non-rheumatic atrial fibrillation group (0.42±0.20 mg/ml vs. 1.54±1.01 mg/ml, p<0.05). Transesophageal echocardiography revealed that none of the patients had spontaneous echocardiographic contrast and left atrial thrombus. Conclusions: 1) Decreased GFC suggests hypofibrinolytic state in patients with atrial fibrillation. 2) Patients with rheumatic mitral stenosis and atrial fibrillation have more impairment in fibrinolytic capacity than those patients with non-rheumatic atrial fibrillation. Therefore mitral stenocytes may contribute to an additional thromboembolic risk in patients with atrial fibrillation. 3) Hypofibrinolysis documented by reduced GFC may be one of the important cause of increased risk of embolism in patients with rheumatic and nonrheumatic atrial fibrillation.
1140 Reynchronization Therapy for Congestive Heart Failure II

Monday, March 1, 2001, Noon-2:00 p.m.  
Orange County Convention Center, Hall A4  
Presentation I: 1:00 p.m.-2:00 p.m.

1140-125 Biventricular Pacing and Sympathetic Nervous System in Heart Failure: A Randomized Trial
Domenico Spaziani, Massimo Pagani, Gianfranco del Rossa, Stefano De Servi.  
LEONANO HOSPITAL, LEONANO (ITALY)
Biventricular pacing (BP) is a promising therapeutic modality for end stage heart failure (CHF). Emerging data support the new use of pacemakers as therapy allowing simultaneous electrical stimulation of the right and the left ventricles for patients(pts) with symptomatic congestive heart failure and with intraventricular delay (bundle branch block). BP can improve cardiac function by pacing the ventricles simultaneously and then by more coordinate and efficient ventricular contraction. It’s moreover known that chronic heart failure activates the sympathetic nervous system (SNS) and increases serum level of the neurotransmitter Norepinephrine (NE). This phenomenon is in direct proportion to severity of the disease. The aim of the study was to test if the improved cardiac performance, obtained with BP, is in pts with CHF and bundle branch block, was able to decrease the degree of the SNS activation. METHODS: we enrolled 13 pts with CHF (NYHA III-IV) with left bundle branch block (QRS duration >120msec), with normal coronary system at angiography, with maximal medical therapy and without beta-blockers. We randomly assigned 7 pts to BP (Medtronic Insync) (Group I) and 6 pts to medical therapy alone (Group II). In all pts we performed, at baseline (pre-implant) and after 16 weeks, a cardiac catheterization and an echocardiographic measurement of ejection fraction (EF) and we determined serum NE levels as pg/ml. All values were expressed as mean ± standard deviation (SD). RESULTS: Baseline (EF)  
GROUP I (7PTS) 0.25±0.05 p<0.05 0.30±0.04  
GROUP II (6PTS) 0.21±0.04 NS 0.22±0.05  
Baseline (NE)  
GROUP I (7PTS) 602±349 p<0.05 290±132  
GROUP II (6PTS) 657±302 NS 622±289
CONCLUSIONS: Our results showed that BP produces a significant improvement of EF, and a better hemodynamic profile in pts with CHF. The serum NE levels decreased significantly with a marked reduction in the degree of SNS activation. This deactivation is in direct proportion to the best improvement of cardiac performance expressed as EF. Further studies with a more pts studied will be able to test our results.

1140-126 Regional Myocardial Conduction and Hemodynamic Depressions Improved During Left Ventricular Basal Compared to Apical Pacing Under Normal and Reduced Coronary Perfusion Pressure
Anil M. Sinha, Barbara Hofmann, Dorothy Sinha, Kurt Kochsiek, Georg Erltl. Medical Clinic, Wuerzburg, Germany; Medical Clinic 1, Aachen, Germany.
Patients with left ventricular (LV) dysfunction often suffer from coronary artery disease. Less is known about the correlation of various LV pacing sites and myocardial contractility and hemodynamic parameters in coronary artery disease. Therefore we studied the effects of LV basal and apical endocardial pacing on myocardial contractility and hemodynamic parameters in 8 anesthetized open chest dogs at normal and reduced coronary perfusion pressure. Methods: LV was gradually paced (140 to 180 bpm) at basal and apical acute coronary perfusion pressure of LAD (mean aortic pressure, 65-70 mmHg; NP), and reduced pressure creating mild (45-50mmHg; UP) and severe ischemia (30-40mmHg; LP). Regional myocardial contractility of the LV supplied myocardium and LV systolic (LVESP) and diastolic pressure (LVEDP) were measured. Results: Effects were most pronounced during rapid pacing (180bpm). The percentage of changes of values vs baseline values (without pacing) are given in the following table. Effects of rapid pacing (180 bpm) during normal and reduced coronary perfusion pressure

<table>
<thead>
<tr>
<th>Pacing site</th>
<th>Regional myocardial contractility (%)</th>
<th>LVESP (%)</th>
<th>LVEDP (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NP Basis</td>
<td>14.8±5.3*</td>
<td>-3.7±3.5</td>
<td>2.7±5.6</td>
</tr>
<tr>
<td>NP Apex</td>
<td>2.3±5.2</td>
<td>-6.3±1.9</td>
<td>9.7±6.2</td>
</tr>
<tr>
<td>NP Basal</td>
<td>10.4±3.9</td>
<td>-6.5±3.7</td>
<td>4.7±6.2</td>
</tr>
<tr>
<td>NP Apex</td>
<td>-9.6±3.9</td>
<td>-12.1±3.2</td>
<td>11.7±6.1</td>
</tr>
<tr>
<td>I P Basal</td>
<td>-31.9±4.4</td>
<td>-17.7±4.0</td>
<td>19.8±2.6</td>
</tr>
<tr>
<td>I P Apex</td>
<td>-37.9±8.2</td>
<td>-20.6±3.0</td>
<td>33.9±2.8*</td>
</tr>
</tbody>
</table>

*p vs baseline (p<0.05), §vs NP (p<0.05), ¶vs NP (p<0.05)

Conclusion: 1. For myocardial contractility, significant differences (p<0.05) between apical and basal pacing were only seen during reduced coronary perfusion pressure. 2. Hemodynamic depression of LV function during acute ischemia is lowest during LV basal pacing. A. effects of pacing on myocardial asymmetry between base and apex seem to be significantly amplified by reduced coronary perfusion. 4. LV basal pacing seems to be more effective than LV apical pacing in coronary artery disease.

1140-127 Left Ventricular Apex is the Optimal Pacing Site for Hemodynamic Improvement in the Dog Heart With LBBB
Hans De Swart, Pitts W. Prinz Dump, Theo Van der Nagel, Willem R. M. Dassen, Hein J. J. Wexxels. Maastricht University, Maastricht, The Netherlands
Background: Left ventricular (LV) pacing is beneficial in patients with heart failure and left bundle branch block (LBBB). The hemodynamic effects, however, are poorly understood. We investigated the hemodynamic effects of LVBBB creation and of pacing at different sites. Methods: eight anesthetized, open-chest dogs were instrumented with a conductance catheter to assess the pressure-volume relations. LBBB was created using radiofrequency ablation. Pacing electrodes were attached to the right atrium, right ventricular apex (RV), LV apex (LVA) and lateral LV (LVlateral); posterior (LPost) and anterior (LVant). Results: The table shows that during sinus rhythm (SR) stroke volume (SV), dP/dt max and stroke work (SW) significantly increased after LBBB creation (SR-LoCo) and were significantly higher during LV pacing. No differences were seen for heart rate (HR), LV end-diastolic volume (LVEDV), LV end-diastolic pressure, systolic pressure and QRS width.

1140-128 Non Synchronous vs Synchronous Biventricular Stimulation May Induce Further Increase in Ventricular Systolic Performance
G B Perego, R Chiariuc, M Facchini, E Ball, M Negrotto, L Vicini, C Scafeglia, G Osculati, M.Sluo - Istituto Auxologico Italiano, Milan, Italy; "Medtronic Italia"
Synchronous biventricular stimulation (S-BIV) can improve left ventricular (LV) systolic performance in dilated cardiomyopathy associated with intraventricular delay. We tested the hypothesis that further improvement can be obtained by non synchronous BIV with optimization of both atrioventricular and interventricular delay. Methods: 7 biventricular implants (FE<30%, QRSd>150 msec) were associated with LV catheterization and radiofrequency ablation. Pacing electrodes were attached to the right atrium, right ventricle, LV apical (LVA) and lateral (LVlateral), posterior (LPoster) and anterior (LVant). Effects were most pronounced during rapid pacing (180bpm). The percentage of changes of values vs baseline values (without pacing) are given in the following table.

<table>
<thead>
<tr>
<th>SH</th>
<th>50</th>
<th>LVA</th>
<th>LV ant</th>
</tr>
</thead>
<tbody>
<tr>
<td>SV (ml)</td>
<td>32</td>
<td>25*</td>
<td>30 *</td>
</tr>
<tr>
<td>SW (mmHg/ml)</td>
<td>2200</td>
<td>145*</td>
<td>134* 242*</td>
</tr>
<tr>
<td>dP/dt max (mmHg/mls)</td>
<td>1093</td>
<td>103*</td>
<td>109</td>
</tr>
<tr>
<td>LV Wed (ml)</td>
<td>70</td>
<td>72</td>
<td>59 74</td>
</tr>
<tr>
<td>QRS width (ms)</td>
<td>54 59</td>
<td>102 102</td>
<td>114 104</td>
</tr>
</tbody>
</table>

Conclusion: Creation of LVBBB deteriorates hemodynamics, which can be corrected by LV pacing. LV pacing changes pump function as evidenced by differences in SV, dP/dt max and SW and not pre- and afterload. Therefore LV pacing creates a sequence of activation improving LV function, not related to QRS width.

1140-129 Mechanisms of Exercise Capacity Improvement Induced by Biventricular Pacing in Congestive Heart Failure (CHF)
In CHF one of the factors limiting exercise capacity is respiratory muscle fatigue. This has been attributed both to generalized muscle impairment and to the increase of lung stiffness due to increase of lung water (LW). Biventricular pacing (BIV) improves hemodynamics and exercise capacity. The aim of our study was to define possible improvements in pulmonary function and investigate about the mechanisms of increase of exercise capacity.

13 Pts with CHF and QRS > 150 msec underwent rest respiratory function tests and echocardiographic stress test with arterial and venous blood sampling before (pre) and 1 month after (Fup) biventricular implantation.

Results: SUVLL (ml/kg/min) 53.2±13.6 93.2±16.1 28.8

Pre 10.3±2.5 14.5±1.7 99.7±0.6 21.6±0.5

Fup
Methods: Fifteen patients with atrial fibrillation were selected, and each patient underwent mapping and ablation in the same vein via an invasive technique. The circular deflectable multielectrode mapping catheter was placed in the pulmonary veins. A second 4 mm tip deflectable catheter was advanced in the same vein to deliver radiofrequency energy. Ablation lesions were delivered in 18 veins. This included nine left superior pulmonary veins, six right superior pulmonary veins and three left inferior pulmonary veins. Ablation was performed 5 mm from the ostium and subsequently, energy was delivered more distally. The site with the earliest activation on the circular mapping catheter was achieved and circumscribed at longer terms, which is critical for assessing their value. Our purpose was to evaluate pulmonary veins with antitachycardia catheter therapy for atrial fibrillation, and to assess the efficacy of right atrial (RA) linear radiofrequency catheter ablation (RFCA) in the treatment of paroxysmal and persistent atrial fibrillation.

Conclusions: Delivering electrical current to two pacing leads with different impedances connected in parallel does not result in a clinically significant increase in pacing threshold when compared to the pacing thresholds measured with each lead individually.
Abstracts - Cardiac Arrhythmias 107A

Carlo Pappone, Salvatore Rosanio, Monica Tocchini, Filippo Gugliotta, Gabriele Vaccarin Montella, Giuseppe Dellavalle, Claudia Di Girola, Anna Magri, Giuseppe Orsi. San Raffaele University Hospital, Milan, Italy

Background: The dominance of the left atrium (LA) in the pulmonary vein (PV) regions for triggering and maintaining atrial fibrillation (AF) is now widely recognized. We recently developed a PV mapping system to isolate all 4 PVs from the LA by creating circumferential lesions at 5 mm around their ostia with electromagnetic guidance (CARMU system).

Methods: We report the clinical outcome of the procedure in 135 consecutive pts with paroxysmal (61%) or permanent AF (47%) (mean age 59±5 years; AF duration 2.8±3.5 years; 45% with structural heart disease). PV systems were created transesophageally during sinus rhythm (SR, 74 pts) or AF (61 pts) via a Navi-Star catheter at a minimum distance of 5 mm from PV ostium. Post-RF evaluation included 48-hour telemetry, close cinch cut-up to 90 minutes, serial heart recordings and stenography echocardiography (TEE).

Results: Procedural and mapping times were 294±66 min and 75±27 min, respectively, with 28.1±11 min of fluoroscopy. Complete lesions (peak-to-peak date time amplitude <0.1 mV inside the line and no double potentials) were achieved in 83% of the 1170 lesions (group A) vs 91% at 9 month in group B. Pts who died had a higher NYHA class (p=0.001). The risk to die increased after a first episode of AF or AF/AFL was treated during AF (p=0.01). None of the patients needed reintervention due to AF recurrence.

Conclusions: In this study pts with a history of AF and established ICD indication had a higher than average risk to die in the first 9 months after implantation. Predictors of mortality are higher NYHA class, a history of AF and experienced episodes of AF and AFL after ICD implantation.

1170.118 Influence of Arrhythmogenic Right Ventricular Dysplasia on the Function of Intravenously Implanted Cardioverter Defibrillator Leads

Emilio Garcia-Moran, Mihaiela Grew, Alejandro Cuesta, José Rubin, Augusto Ordóñez, Guillermo Mabru, I. Ingrid Monte. Hospital Clinic. Barcelona, Spain

Arrhythmogenic Right Ventricular Dysplasia (ARVD) is characterized by morphological and histological changes of the heart. It mainly affects the right ventricle and predisposes ARVD carriers to ventricular arrhythmias that often require an implantable cardioverter defibrillator (ICD).

Objective: We tested whether abnormalities associated with ARVD may result in decreased defibrillation efficacy.

Methods: We made a case-control comparison between a group of 13 patients with ARVD (Group A) who received an intravenous ICD and another group of ICD recipients with structurally normal hearts (brugada Syndrome) (Group B). Pts were matched for age, sex, period and group of leads. The mean follow-up period of Group A was 25 months while Group B was 32 months. Pts in Group A had a significantly higher NYHA class than Group B (p<0.05). Early and Reconfirmation shocks were compared between the two groups.

Results: Patients implanted with intravenous ICD (n=13) had less effective defibrillation thresholds than those implanted with transvenous ICDs (n=68). The mean values of defibrillation threshold at implant were 14.3±9.1 J and 15.1±9.3 J for Group A and B, respectively; (p=0.6). A significantly higher number of shocks were required to terminate a first or a second episode of VT/VF in Group A comparing to Group B (p<0.05).

Conclusions: Intravenous ICDs may be less effective in patients with ARVD. A larger study is needed to confirm our findings.

POSTER SESSION

1180 Implantable Cardioverter Defibrillators: Mortality

Monday, March 19, 2001, 3:00 p.m.-5:00 p.m.
Orange County Convention Center, Hall A4
Presentation Hour: 4:00 p.m.-5:00 p.m.

1180.115 Mortality of Patients With Implanted Cardioverter Defibrillator in Relation to Atrial Fibrillation


Atrial fibrillation (AF) seems to be a predictor of increased survival in patients (pts) with implanted cardioverter defibrillators (ICD). Methods: We performed a retrospective analysis of baseline characteristics, medication and endpoints in pts receiving a Dual-Chamber

1180.116 The Function of Intravenous Implantable Cardioverter Defibrillator Leads

Emilio Garcia-Moran, Mihaiela Grew, Alejandro Cuesta, José Rubin, Augusto Ordóñez, Guillermo Mabru, I. Ingrid Monte. Hospital Clinic. Barcelona, Spain

Arrhythmogenic Right Ventricular Dysplasia (ARVD) is characterized by morphological and histological changes of the heart. It mainly affects the right ventricle and predisposes ARVD carriers to ventricular arrhythmias that often require an implantable cardioverter defibrillator (ICD).

Objective: We tried to assess whether abnormalities associated with ARVD may result in decreased defibrillation efficacy.

Methods: We made a case-control comparison between a group of 13 patients with ARVD (Group A) who received an intravenous ICD and another group of ICD recipients with structurally normal hearts (brugada Syndrome) (Group B). Pts were matched for age, sex, period and group of leads. The mean follow-up period of Group A was 25 months while Group B was 32 months. Pts in Group A had a significantly higher NYHA class than Group B (p<0.05). Early and Reconfirmation shocks were compared between the two groups.

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Conclusions: Intravenous ICDs may be less effective in patients with ARVD. A larger study is needed to confirm our findings.
1170-110 Survival After Implantation of an Implantable Cardioverter-Defibrillator in Elderly Patients
Emmanuel S. Brilakis, Arturo Valsangiacomo, David Luria, Yang-Cheng Chao, Scott Rea, Paul A. Friedman, Win K. Shin. Mayo Clinic, Rochester, MN

Background: The effectiveness of implantable cardioverter-defibrillators (ICD) in sudden cardiac death (SCD) prevention and ventricular arrhythmias therapy in selected pts has been demonstrated by several trials. Data on the long-term survival of elderly following ICD implantation has been lacking. In this study, we determined the long-term survival of elderly patients following ICD implantation and predictors of increased mortality.

Methods: All consecutive pts of age ≥ 70 yrs who underwent ICD implantation at the Mayo Clinic from 1989 to 2000 were included in the study. Pts in this cohort were compared with an age and gender matched historical data, and differences between observed and expected survival were tested using a 1-sample log-rank test. Multivariate predictors of increased mortality were determined using a stepwise Cox proportional hazards model.

Results: Of the total 907 pts (mean age 73 ± 4.0 yrs) included in the study, 45 (4.9%) were older than 80 yrs of age, 302 (68%) were female. Indications for ICD implantation included out of hospital cardiac arrest (19%), ventricular fibrillation (VF) (19%), ventricular tachycardia (VT) (18%), and syncope (15%). There were 19 deaths during a mean follow-up of 12 ± 2.9 yrs. The observed and expected survival at 1, 5, and 10 yrs were 89%, 75%, 54% vs 96%, 87%, 78%, respectively (P < 0.001). Multivariate predictors of increased mortality were use of antihypertensive agents (HR: 1.03, 95% CI: 1.01-1.05, P = 0.007) and lower socio-economic status (HR: 0.61, 95% CI: 0.39-0.95, P = 0.03). The cumulative probability of the combined endpoint of survival + appropriate ICD discharges were 55%, 28% and 15% at 1, 5 and 10 yrs follow, respectively.

Conclusions: 1) The observed survival is significantly worse than the expected survival in the elderly compared to matched cohorts following implantation emphasizing the importance of optimizing therapy for underlying cardiovascular diseases. 2) The difference in observed survival and survival + appropriate ICD discharge suggests ICD may benefit survival in the elderly population.

1170-111 Outcome of Patients With Cardiac Sarcoidosis Treated With an Implantable Defibrillator

Background: Patients with cardiac sarcoidosis who are treated with an implantable defibrillator.
Methods: Eight consecutive pts with cardiac sarcoidosis who received an implantable transvenous defibrillator since 1994 were identified from an institutional database. Baseline data and the clinical outcomes of each pt were retrospectively analyzed.

Results: The mean age of the pts was 39 ± 6 years, 75% were male, and 63% were African-American. The mean LV EF was 0.90 ± 0.10, and 35% had congestive heart failure. Cardiac sarcoidosis was confirmed in each pt. Thirty percent of the pts had been diagnosed with sarcoidosis before presenting with a ventricular arrhythmia. The indications for defibrillator therapy were symptomatic monomorphic VT (n=5), VF arrest (n=2), and asymptomatic nonsustained VT (n=1). Among the pts who underwent electrophysiology testing, 56% had inducible VT. All pts in sinus rhythm and 3 pts had received a pacemaker 32125 months before defibrillator implantation. The mean defibrillation energy requirement was 145 ± 6. Electrophysiologist patients were treated with prednisone and 63% were treated with a mean of 1.4 ± 0.9 antihypertrophic drugs after implantation. During a mean follow-up time of 43 ± 32 months, 4 pts (50%) received appropriate defibrillator therapy. All 4 pts who received therapy presented with a clinically significant monomorphic VT. All pts received defibrillator therapy within 8 months following implantation, and received a median of 90 VT shocks. Using Kaplan-Meier analysis, the mean survival time free of appropriate defibrillator therapy was 20 ± 14 months. One of the 3 pts who had no inducible VT had appropriate therapy during follow-up. One pt died of congestive heart failure during follow-up.

Conclusions: Patients with cardiac sarcoidosis who undergo implantable defibrillator implantation usually have longstanding sarcoidosis and present with symptomatic monomorphic VT. These pts appear to be protected from sudden death, but frequently experience appropriate shocks despite the use of medical and antiarrhythmic agents.

1170-120 The Role of Implantable Cardiodefibrillators in Advanced Heart Failure Patients Awaiting Orthotopic Heart Transplantation
Julie Dolez, Gregg Fonseca, Jon Rubisengwa, Michelle Hamilton, Hillie Lake, Zeseda Feliciano. UCLA School of Medicine, Los Angeles, CA

Background: Orthotic heart transplantation (OHT) has established itself as an option for end stage CHF. Sudden cardiac death (SCD) is one of the most common causes of mortality in patients (pts) with OHT awaiting OHT. The implantable cardiodefibrillator (ICD) has been effective at preventing arrhythmic SCD in patients with CHF. Methods: We prospectively evaluated 841 consecutive patients that underwent OHT at UCLA Medical Center between 1989-1999. Of those, 79 patients underwent implantation prior to OHT and we obtained data on 73 patients.

Results: Eighty-seven percent were male, mean ejection fraction was 22 ± 7%, and mean New York Heart Association (NYHA) classification was 3.5 ± 0.5. The CHF etiology was ischemic in 51 patients (70%) and non-ischemic in 22 patients (30%). The indications for ICD implantation were sustained VT (46%), inducible VT (29%), syncope (10%) and prophylic (10%). Of the 73 patients with an ICD, 51% had at least one appropriate shock, 9% had inappropriate shocks, and 46% did not receive a shock prior to OHT. The mean number of appropriate shocks was 4.3 ± 11.5. We divided the patients into two groups:

- Those that received an appropriate shock: Group A (prior to OHT) and
- Those that did not (group B). There were no significant differences in the demographics, including gender, substrate, ICD indication, NYHA class, time from CHF diagnosis to OHT and presence of other predictors of benefit.

Conclusions: The lack of difference between the groups suggests that ICD implantation prior to OHT is not only unlikely to offer significant benefit to the pts, it is potentially harmful. Prospective studies are necessary to establish predictors of benefit from ICD in this patient population.
null
1173 Risk Stratification for Ventricular Arrhythmias

Monday, March 19, 2001, 3:00 p.m.-5:00 p.m.
Orange County Convention Center, Hall A
Presentation Hour: 4:00 p.m.-5:00 p.m.

1173-117 Novel Heart Rate Turbulence Predicts Arrhythmic Mortality: A Postmortem Observational Study of Patients With Left Ventricular Dysfunction - EMAT Substudy

Yue Guan Yap, A John Camm, Georg Schmidt, Marek Malik. Hospital of the University of Pennsylvania, Philadelphia, PA

Background: Heart rate turbulence (HRT) is a phenomenon described recently to measure the chronotropic response of sinus rhythm to VPB. In addition, multipolar recordings from the postmortem right atrium (RA) and coronary sinus (CS) appear useful in localizing AF triggers. We evaluated a unique catheter-based system to determine efficacy for 1) left atrial (LA) and 2) recording of AF initiation in 15 patients (pts).

Methods: Ten pole catheters (Electet) were placed in the CS (+ pole) and at the CRISTA (+ pole) and connected with a switch box to an external converter (intSOs, venetron). An R-wave synchronous shock for AF was delivered as two 6 ms monophasic sequential shocks of reversed polarity separated by 0.2 ms at beginning and 140V (total energy of 0.6-0.8J). The current resulting in a stable cycle to initiate recording an episode of AF. At times, a cycle reversed to record activation of AF triggers. If there were two consecutive ineffective CV, the energy was increased by 20-50V until the CV was successful or a total energy of 150J was achieved.

Results: A total of 183 AF CV attempts were made (4-42/pt., median 9/pt.). Repeated successful CV (at least 4 of shocks at designated energy) were noted in 8 pts (48-8-12 J, 4 pts at 16-16 J and 6 pts at 10-12 J, 3 pts) in external OV was needed for AF termination. One pt had VF due to inappropriateness setting and shock on 7 with prompt ventricular fibrillation termination with an external shock. No other pt had proarrhythmia, adverse hemodynamic effects or elevation of cardiac integrity. The switching system allowed for recording CS and CRISTA activation and timing of AF triggers between 2 of CV.

Conclusions: The described multipolar electrode catheter based internal CV, recording and switching system allowed for repeated effective termination of AF, assisted in mapping of AF triggers, and was well tolerated.

POSTER SESSION
pt's with indeterminate TWA, 8 had (+) EPS. With up to double ventricular extrastimuli in 15 (35.7%) pts, negative in 17 (40.5%) pts, and indeterminate in 11 (26.2%) pts. Of conclusions: TWA does not have sufficient negative predictive value in this population to obviate EPS. Long-term follow-up is needed to determine the prognostic significance of discordant TWA and EPS results.

JACC February 2001

Does T-Wave Alternans Predict inducibility of Ventricular Tachycardia in Patients With Coronary Artery Disease and Depressed Left Ventricular Function?

Jennifer D. Cohen, Kenneth M. Stein, Suneet Mittal, Sol Iwai, Mihalis Das, David J. Stroberer, Steven M. Markowitz, Bruce B. Lerman. Cornell University Medical Center, New York, NY.

Background: Implantation of defibrillators has proven beneficial in patients with coronary artery disease (CAD), depressed left ventricular function and inducible ventricular tachycardia during electrophysiology study (EPS). T wave alternans (TWA) testing has been proposed as a noninvasive alternative to EPS. The purpose of this study was to determine whether T wave alternans (TWA) testing could identify such pts.

Methods: 42 pts had cardiac evaluation for CAD and coronary artery bypass grafting. All pts underwent TWA testing during rapid atrial pacing with the Cambridge Heart CH2000 system. All pts also underwent EPS using programmed stimulation at two ventricular sites up to tripole extrastimuli with anti-arrhythmic drugs. Two physicians blinded to the results of EPS interpreted TWA. Positive TWA had an artifact-free interval of at least 1 minute with a TWA amplitude $\pm 5$ in either one orthogonal lead or two adjacent preauricular leads. Positive results had an onset rate $\pm 1$ beat/min with persistent alternans at and above the onset heart rate. A negative test did not meet these criteria and required an artifact-free interval of 105 beats/min. All other tests were indeterminate.

Positive TWA was defined as the induction of sustained monomorphic ventricular tachycardia with up to triple ventricular extrastimuli or ventricular fibrillation with up to double ventricular extrastimuli.

Results: All pts had documented CAD and ejection fractions $\leq 40$. TWA was positive in 15 (35.7%) pts, negative in 17 (40.5%) pts, and indeterminate in 11 (26.2%) pts. Of the 15 pts with positive TWA, 11 had (+) EPS. A positive predictive value of 72%. Of the 17 pts with positive TWA, 10 had (+) EPS, a negative predictive value of 41%. Of the 10 pts with indeterminate TWA, 8 had (+) EPS.

Conclusions: TWA does not have sufficient negative predictive value in this population to diagnose EPS. Long-term follow-up is needed to determine the prognostic significance of discordant TWA and EPS results.

Application of a Simplified Risk Assessment for Sudden Cardiac Death

Jomaa A. Gharib, Jr., Brian M. Rhee, and David Mortoio. The Investigative Cardiology and Cardiac Electrophysiology Laboratory, The Heart Institute, Tulsa, OK, University of Oklahoma College of Medicine - Tulsa, Tulsa, OK.

Background: Patients with ischemic heart disease (IHD), left ventricular ejection fraction (LVEF) of 35% or less, and nonsustained ventricular tachycardia (NSVT) need evaluation with noninvasive risk assessment for sudden cardiac death. Unfortunately these criteria are applied variously across the country and only vague estimates exist on the volume of patients that full application of these data would bring to attention.

Methods: All outpatients presenting to our cardiology group were evaluated for the presence of IHD and LVEF of less than 36%. Patients meeting these criteria received a 24-hour Holter monitor unless the physician found a contraindication to placement. Patients with Holters showing 3 or more beats of NSVT underwent an EPS study with the protocol outlined in the MADIT study, and ICD's were implanted in the setting of a positive study. All patients were followed for overall mortality regardless of the Holter findings. The longest follow-up was 22 months.

Results: Of the 5646 patients assessed, 285 (4.3%) met criteria for Holter placement. Of those patients, 288 completed the 24-hour monitoring period, with 133 showing normal Holters. Of those with normal Holters, 14 (10.5%) deaths occurred. From the 75 (38.1%) patients with NSVT, 82 consented to an EPS. Eleven people declined an EPS with 1 (2.9%) death over the 22 months. The remaining 27 (43.5%) patients with a positive Holter monitors had the highest mortality of the patients studied.

Conclusions: The percentages of patients in a large private cardiology practice who meet the criteria for placement of a Holter monitor, EPS, or eventual ICD implantation, with attention.

The Physiologic Right to Left Atrial Gradient of Action Potential Duration and Refractoriness Decreases with Pacing Induced Atrial Fibrillation


Hansen and animal studies have demonstrated differences in right (RA) and left (LA) atrial effective refractory periods (ERP), which are longest at RA sites and shorter in LA. We hypothesize that in sequentially activated atria a reduction of the gradient of atrial action potential duration (APD) increases temporal dispersion of repolarization, that can be appreciated on the surface ECG. Four chronically instrumented dogs were paced for 70-80 days from the LA appendage at a cycle length (CL) of 100 ms, which resulted in sustained AF (>8 days duration) in 1/4 dogs and non-sustained AF (1-6 days) in 2 dogs. Pts intervals and time integrals in XYZ (Frank) leads and ERPs were measured at control and after the last termination of AF. ERP at a CL=400 ms shortened from 139±24 to 110±10 ms in the RA (p<0.05), and from 122±6 to 107±6 ms in the LA (p<0.05). Tissue from mid-lateral RA and LA of dogs in AF was studied using microelectrodes. Resting potential, AP amplitude and Vmax in RA did not differ between AF and control dogs. In LA, AP amplitude and Vmax were higher in control (both p<0.05). The gradient of APD60 and ERP significantly diminished (see graph). XYZ Pts interval dispersion increased from 8.3±2.6 ms at control to 29.5±8.8 ms during RA pacing, and from 17.7±5.2 to 32.3±4 ms during LA pacing (both p<0.05). Pts time integrals in lead X during RA pacing changed from 1.8±0.9 to 1.9±0.5 without changes in leads Y and Z.

Conclusion: Induction of IPD by rapid LA AAR pacing is associated with a reduction of the
Alteration of Atrial Electrophysiology in Patients With Heart Failure. An Electromagnetic Mapping Study With Monophasic Action Potentials

Juergen Schreieck, Martin R. Karch, Bernhard Zrenner, Sebastian Schmieder, Michael Meinscheider, Claudia Schmidt, Deutsches Herz-Zentrum Muenchen, Technische Universitaet Muenchen, Munich, Germany

Background: Attention of cardiac electrophysiology in the atrium due to heart failure has been less investigated than on the ventricular level. Methods: Therefore, we used a modified Navistar catheter (Istioespana Webster) for measurements of monophasic action potentials (MAP) with the electromagnetic mapping system of CARTO (Biosense Webster) in order to characterize three-dimensional atrial electrophysiology of patients with end without heart failure undergoing electrophysiological studies. Results: During steady state pacing from the coronary sinus area with a cycle length of 600 ms, activation time and MAPDs were recorded from 28 ± 8.8 right atrial sites in 10 patients with heart failure (left ventricular ejection fraction < 45%) compared with 10 control patients without heart failure. Maximal MAP duration dispersion (difference between largest and shortest MAP) was similar in patients with heart failure compared to control patients. 80.3 ± 6.2 ms vs. 76.3 ± 5.5 ms, respectively. Longitudinal and transverse conduction velocity in the posterior right atrium were almost statistically different in the two groups of patients, 0.06 ± 0.06 ms vs. 0.09 ± 0.06 ms and 0.98 ± 0.11 ms vs. 0.83 ± 0.10 ms. In addition, rate-dependence (dissipate monophasic action potential duration) at 50% repolarization (%MAFPD50) in the right atrial appendage was determined in all patients. Mean values ± SEM for the two groups of patients are presented in the following table (*p < 0.05).

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Heart Failure</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAPD50 at a cycle length of</td>
<td>600 ms</td>
<td>400 ms</td>
</tr>
<tr>
<td></td>
<td>300 ms</td>
<td></td>
</tr>
<tr>
<td>patients with heart failure</td>
<td>253±18 ms</td>
<td>214±18 ms</td>
</tr>
<tr>
<td>control patients</td>
<td>255±16 ms</td>
<td>220±12 ms</td>
</tr>
</tbody>
</table>

Conclusion: Right atrial electrophysiologic properties concerning repolarization time, dispersion of repolarization and conduction velocity at a heart rate of 100 beat per minute is similar in patients with and without heart failure. However, rate-dependent atrial monophasic action potential shortening is more pronounced in patients with heart failure. The more steepened rate dependence of repolarization in the atrial substrate, enabling the induction of sustained AFL instead of AF.

Fixed Intercaval Block in the Setting of Sustained Fibrillation Promotes Induction of Atrial Flutter

Haitin M. Bai, Celeste M. Khod共产, Albert L. Walton, Case Western Reserve University/ University Hospitals of Cleveland, Cleveland, OH

Background: In the sterile pericarditis model: 1) the development of induced, sustained atrial flutter (AFL) lacks such a line of block, and 2) during AFL, if the line of block shortens or becomes unstable, AFL deteriorates into AF. In this model, we tested the hypothesis that placing a fixed line of block between the venae cavae critically alters the atrial substrate, enabling the induction of sustained AFL instead of AF. Methods: Five sterile, pericarditis dogs with sustained (46 min) AFL induced by rapid pacing underwent simultaneous epicardial mapping from 396 unipolar electrodes placed on the right and left atrium and the right atrial septum. After termination of AFL, cryoablation was performed later in the sterile pericarditis dogs with sustained (Z+45 min) AF induced by rapid atrial pacing under current clamp conditions. Results: AFL aborted in 4 dogs and was still present in 1 dog. Conclusion: Fixed intercaval block provides a substrate preferentially favoring the induction of AFL instead of AF.

Impact of Hydrogen Peroxide on Human and Canine Atrial Calcium Current and Action Potentials: Implications for Postoperative Atrial Fibrillation

David R. Van Wagner, Michelle Lamorgese, Laurie Castil, John A. Baxter, Cynthia A. Carnes, Mina K. Chung, Patrick M. McCarthy, Cleveland Clinic Foundation, Cleveland, OH, State University College of Pharmacy, Columbus, OH

Background: Free radical injury is implicated in the initiation of repolarization arrhythmias. Cardiac surgery is accompanied by evidence of increased oxidative stress (free radical production), and is frequently (50-50%) associated with post-operative atrial fibrillation (post-op AF). The mechanisms responsible for the occurrence of post-op AF are not understood. We hypothesize that oxidative stress may increase atrial ectopy by altering cellular calcium handling and/or calcium currents. Calcium overload is known to be an important event in the initiation of AF. This role of hydrogen peroxide (which can be released by activated blood cells or generated within the atrial myocyte) on atrial calcium currents has not previously been evaluated. Methods: We examined the impact of exogenous hydrogen peroxide (0.1-1 mM) on L-type Ca2+ current (ICa) and action potentials in canine and human atrial myocytes, recorded at 36°C, using conventional patch clamp techniques. Results: ICa were isolated from right atrial appendage tissue (dogs, and patients undergoing cardiac bypass surgery) using a chunk dissociation technique. Results: In both canine (n=7) and human (n=5) myocytes, superfusion with hydrogen peroxide caused a gradual and progressive increase in ICa with no shift in voltage-dependence or kinetics. After 12 minutes exposure, 1mM peroxide increased peak ICa by 104±21% in canine myocytes (representative plot).

Under current clamp conditions, 1mM hydrogen peroxide enhanced the plateau and prolonged action potential duration in both canine and human atrial myocytes, accompanied by a rapid loss of cell shortening. Conclusion: Free radical production (eg., hydrogen peroxide) following cardiac surgery may contribute to the development of atrial Ca2+ overload, mechanical stunning, and the initiation of post-operative atrial fibrillation.

Natural History of Lone Atrial Fibrillation in 234 Males: Follow-Up of 22 years

Nataaja M. S. de Groot, Martin J. Schijal, Joep L. R. M. Smeets, Maartens A. Allessie, Leiden University Medical Center, Leiden, The Netherlands

Background: Fibrillatory conduction (FC) is associated with a different degree of fragmentation in the local unipolar electrogram. In the present study, we evaluated different parameters to characterize degrees of fragmentation. Methods: Right atrial mapping (244 electrodes; diameter 0.3 mm) was performed during cardiac surgery in pigs without a history of atrial fibrillation (AF) (acutely induced AF by rapid pacing) and pigs with chronic AF based on mitral valve disease. All components in the unipolar atrial fibrillation electrograms were marked by a computer algorithm and edited manually by the investigator. Each local activation was classified as having between 1-5 components. In each pt, fragmentation maps were constructed during 16 seconds of continuous AF. Both the degree and total delay of fragmentation were visualized. Local interval histograms, total fragmentation and conduction delay were used to compare the degree of fragmentation in the whole mapping area.

Distinction of Different Types of Atrial Fibrillation by Analysis of Fibrillation Electrograms

Norena S. M. de Groot, Martin J. Schijal, Joep L. R. M. Smeets, Maartens A. Allessie, Leiden University Medical Center, Leiden, The Netherlands

Background: Fibrillatory conduction (FC) is associated with a different degree of fragmentation in the local unipolar electrogram. In the present study, we evaluated different parameters to characterize degrees of fragmentation. Methods: Right atrial mapping (244 electrodes, diameter 0.3 mm) was performed during cardiac surgery in pigs without a history of atrial fibrillation (AF) (acutely induced AF by rapid pacing) and pigs with chronic AF based on mitral valve disease. All components in the unipolar atrial fibrillation electrograms were marked by a computer algorithm and
with lone AF and obtained further follow-up via questionnaire surveys, telephone inter-
views and death certificates. Atrial fibrillation events were considered in 30 patients at the time of initial occur-
rrence of AF. Age ranged from 20-59 years old. One hundred eighty-six of the 234 (79%) had an isolated episode of AF, 30234 (13%) had paroxysmal AF, and 18234 (8%) had daily or chronic AF. Follow-up: We obtained follow-up on 2112/2004 (92%). Total follow-up time was 4,686 person-years with a mean duration of 22.5 years (range 2-40 years). At the time of follow-up, 1056/211 (51%) still had only an isolated episode of AF; 81/211 (38%) had paroxysmal AF and 2/111 (1%) had daily/chronic AF. Of those initially proceeding with an isolated episode, 65% had no recurrence, 38% developed paroxysmal AF and 1% developed chronic AF. Of those presenting initially with paroxysmal AF, 15% subse-
quently developed chronic AF. This study examined 27 deaths in the study, 10 were cardiac, 21 were non-cardiac, and 6 were unknown. Nine had clinical ischaemic events of unknown cause of which only one (chronic AF) had the event before age 60. Annual event rate prior to the age of 60 was 0.4%, per year.

Conclusion: Progression from chronic AF to a single episode or paroxysmal AF was unlikely (1% and 15%, respectively). The arrhythmic event rate prior to age 60 was low (0.1%, per year) and the likelihood of a cerebrovascular event before age 60 without chronic AF was minimal (none in this study).

8:45 a.m.

Increased Mortality in Patients With New Onset Atrial Fibrillation: Significance of Noncardiovascular Medical Comorbidities on Long Term Survival


Background: The aim of the study is to determine the clinical characteristics and prog-
nosis in pts with new onset atrial fibrillation (AF) in an epidemiological setting.

Methods: All patients (pts) who visited AF clinic at Mayo Clinic were included. AF was defined by ECG and confirmed by Holter. The follow-up was completed in December 1999. The cause of death was determined by reviewing the death certificates from the Minnesota Death Tapes Records. The observed survival was estimated by the Kaplan-Meier method. The expected survival was estimated from age and gender matched Minnesota population data (1970-1990). The survivals were compared using a one-sample logrank test.

Results: Of 372 Olmsted Co. residents were included in the study. The mean age was 73±19 yrs, M/F = 153 (54%)/219(44%). Of the total, 72 pts (28%) had no documented cardiovascular diseases. In this group of pts, the mean age was 68±19 yrs, M/F = 40 (63%)/27 (38%). On a mean follow up of 2.4±1.5 yrs, 26 pts died. The causes of death included: 5 (19%) cardiac and 21 (81%) non-cardiac deaths. Of the non-cardiac death group, 20 (77%) died from malignancies, 5 (19%) died from cerebrovascular events; 3 pts (14%) died from pneumonia; 2 pts (9.5%) died from collagen vascular dis-

8:45 a.m.

Early Recurrence of Atrial Fibrillation Following Ambulatory Shock Conversion by an Implanted Atrial Arrhythmia Management Device: Incidence and Predictors

David Schwartzman, Shaiag,kumar Musley, Eduaro Warman, Charles S. Seaworad, Rahul Mehta, Atrial Arrhythmia Centre, University of Pittsburgh, Pittsburgh, PA, Medtronic Inc., Minneapolis, MN

Background: previous reports have described the phenomenon of early recurrence of atrial fibrillation (ERAF) after shock termination. This abstract further characterizes ERAF, assessing its incidence and predictors. Methods: 144 consecutive patients with recurrent, antarythmic drug (AAD) refractory AF underwent implantation of an atrial arrhythmia management device (Jewel AF, model 7250). Sequentially, ambulatory shocks were delivered resulting in successful cardioversion. The device was program-
med to deliver shocks either automatically or after patient activation of the device. ERAF was defined in three different ways: 1. recurrence within 1 minute of cardioversion (ERAF-1 min); 2. recurrence within 1 hour of cardioversion(ERAF-1 hr); 3. recurrence within 1 day of cardioversion (ERAF-1 d). Multivariable assessment for factors signifi-
cantly associated with ERAF utilized logistic regression, mortality, and cardiac function/ function items as well as AAD usage, duration of AF prior to shock, automatic versus patient activated shock, shock energy, and time since device implantation. Results: Patients: 18 of 27 mongrel dogs underwent LAO implantation and were sacrificed after 35±19 d (range 14 to 70) to assess acute and chronic sealing of the LAA. The device is feasible and safe in this canine model. Longer-term studies are necessary to evaluate the chronic sealing of the LAA. Conclusion: Percutaneous catheter-based delivery of an atrial appendage occlusion device is feasible and safe in this canine model. Longer-term studies are required to determine clinical device performance. This device may provide a non-pharmacologic, non-surgical treatment alternative to prevent thromboembolism in high-risk patients with AF.
1202 Drug Actions on Cardiac Electrophysiologic Properties: Ion Channels

Tuesday, March 20, 2001, 9:00 a.m.-11:00 a.m.
Orange County Convention Center, Hall A4
Presentation Hour: 10:00 a.m.-11:00 a.m.

1202-111 Wortmannin Blocks the Carbachol-Induced Inhibition of L-Type Ca Current in Mouse Ventricular Myocytes: Role of Phosphatidylinositol 3-OH kinase/akt/nitric oxide in Muscarinic Regulation of Ca Current

Fuhua Chen, Meisheng Jiang, Shulan Ding, Glen T. Wetzel, Thomas S. Klitzner, Lutz Birnbaumer. UCLA School of Medicine, Los Angeles, CA

Background: Cardiac L-type Ca current is inhibited by muscarinic agonists, such as carbachol (OCh). However, the mechanism for this muscarinic regulation of L-type Ca current in heart is unclear. We have previously shown that inhibition of G protein (GI) play an important role in the muscarinic regulation of Ca current in cardiac ventricular myocytes, using a G protein coupled gene knock-out mouse model. The purpose of this study was to determine whether phosphatidylinositol 3-OH kinase (PI3K)/akt/nitric oxide (NO) is involved in muscarinic regulation of L-type Ca Current by using a potent PI3K inhibitor, wortmannin. Methods: Glass isolated ventricular myocytes were isolated from 129 mouse heart using enzymatic dissociation methods. Cells were pre-incubated with 100 nM wortmannin (wortmannin group) or incubated without wortmannin (control group) for 20 min. Wortmannin seemed not to affect the Gaq/PAK/PKA signal pathways, since L-type Ca current activation (by CCh)-induced inhibition of Ca current in mouse ventricular myocytes. For the first time, our data indicate that the muscarinic regulation of cardiac L-type Ca Current may be involved in the PI3K/akt/NOS signal pathway.

1202-112 Dronedarone Acutely Inhibits L-Type Calcium Currents and Alters the Channel Kinetics in Rabbit Ventricular Myocytes

Wei Sun, Jongahkajee S. M. Samaa, Shuhan Ding, Glen T. Wetzel, Thomas S. Klitzner, Braman N. Singh. UCLA School of Medicine, Los Angeles, CA

Background: Dronedarone (DR) is a new non-dinothiazinedehydropyridine structurally related to amiodarone. Its acute effects on the L-type calcium current (ICaL) and calcium channel kinetics have not been reported. Methods: Rabbit ventricular myocytes were isolated by enzymatic dissociation. Whole-cell voltage clamp technique was used to study the effects of DR (10 nM to 10 µM) on ICaL, and its kinetics. Results: DR inhibited ICaL dose-dependently. At 100 nM, ICaL peak current was reversibly decreased by 14±8% (p<0.05) and 24±7% (p<0.05) at 0 and 100 ms of DR respectively (n=6). At 1000 nM, ICaL peak current was reduced by 25±12% (p<0.05) at 0 and 200 ms of DR respectively (n=6). With 10 µM of DR, steady-state inactivation of ICaL was shifted to more negative membrane potentials. The tail inactivation of calcium current occurred at a membrane potential of -13±4 mV at baseline and -49±11 mV after addition of DR (n=6, p<0.05). Furthermore, DR delayed calcium current recovery from previous inactivation; the recovery time constant prolonged from 13±5 to 24±9 ms (n=4, p<0.05). At an internal duration of 30 ms from the previous depolarization, ICaL current amplitude was 97±14% of control compared to 75%±10% of control after DR (n=4, p<0.05). In addition, DR inhibited ICaL at a faster stimulation rate (0.1-1 Hz), suggesting the usefulness of ICaL channel block by DR. Conclusions: Dronedarone provides a novel mechanism by which DR not only acutely inhibits the ICaL in the rabbit ventricular myocyte, but also modified calcium current inactivation kinetics, This behavior is similar to that of amiodarone, despite the absence of iodine in DR.
Conclusions: Extracellular hyperkalemia (? acidosrs) augments HERG current during early repolarization, but reduces current in late repolariration. LPC enhances HERG current of PKAi (1 nM, Ki=98 PM) into internal/pipette solution decreased the basal Ca greater (lO.i-cO.9 pA/pF, n=15) with intracellular addition of CAMP (500 microM), as compared to that without addition of CAMP (5.3±0.4 pA/pF, n=10, p<0.01). In contrast, addition of PKNa (1 mM, K<sub>i</sub>=80 PM) into intracellular solution increased the basal Ca current in 3.3±0.3 pA/pF (p<0.001, compared to control cells). The comparison of effects of PKNa and PKNa were also found in use ova minus ventricular myocytes, isolated beta ICa-L, which showed that the intracellular Ca current was increased in both WT and G2 alpha minus ventricular myocytes, with the proliferation of findings suggesting that G alpha may regulate ICa-L through cAMP/PKG, more experiments are necessary to elucidate the precise relationship between activation of Gi and intracellular Ca current and cAMP level in regulation of ICa-L in heart cells.

**CONCLUSIONS - CARDIAC ARRHYTHMIAS 115A**

1203-116 The Electrocardiographic (ECG) Pattern is Frequently Abnormal in Professional Football Players: An Analysis in 1282 Athletes

Joseph K. Choo, William B. Abemethy, III, Adolph M. Hutter, Jr., Massachusetts General Hospital, Boston, MA

Background: Although abnormal ECG findings are frequent in athletes, a systematic analysis in professional football players has not been described.

Methods: The screening ECGs of 1292 National Football League players from 1996-1999 were analyzed. Electrocardiographic data from 71 players with abnormal ECGs were reviewed for evidence of structural or functional abnormalities.

Results: Abnormal EKG findings were noted in 709 (66%) of players with the incidence of specific abnormalities noted below:

<table>
<thead>
<tr>
<th>Abnormality</th>
<th>Total</th>
<th>Black</th>
<th>White</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Early repolarization</td>
<td>213 (16.6%)</td>
<td>19.4%</td>
<td>11.8%</td>
<td>0.001</td>
</tr>
<tr>
<td>STTW abnormalities</td>
<td>55 (4.1%)</td>
<td>6.2%</td>
<td>4.0%</td>
<td>0.13</td>
</tr>
<tr>
<td>Other abnormalities</td>
<td>345 (26.5%)</td>
<td>27.1%</td>
<td>23.7%</td>
<td>0.05</td>
</tr>
</tbody>
</table>

Poster Session

1203 Electrocardiography

Tuesday, March 20, 2001, 9:00 a.m.-11:00 a.m.
Orange County Convention Center, Hall A4
Presentation Hour: 10:00 a.m.-11:00 a.m.

1203-115 Diagnosis of True Right Atrial Enlargement: How Useful Are the Classical ECG Signs?

Elena B. Sarasoria, Sergio L. Pinski, Joseph Stevenson, Susan Kim, Alex Newman, Stuart Rich, Valerie Mc Laughlin, Richard G. Trohman, Rush-Presbyterian-St. Luke's Medical Center, Chicago, IL

Background: Classic ECG criteria of right atrial enlargement (RAE) may be biased due to the preferential inclusion of patients with COPD or rheumatic heart disease in the population studied.

Methods: We tested all published ECG criteria for RA in a population with echocardiographic evidence of increased right atrial volume (age 49±21, 45 women) reviewed for evidence of structural or functional abnormalities.

Results: Abnormal EKG findings were noted in 710 (55%) of players with the incidence of specific abnormalities noted below:

<table>
<thead>
<tr>
<th>Abnormality</th>
<th>Total</th>
<th>Black</th>
<th>White</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q or R/S &gt;= 1 in V1</td>
<td>82 (6.0%)</td>
<td>14%</td>
<td>4%</td>
<td>0.001</td>
</tr>
<tr>
<td>ST elevation in lead II</td>
<td>27 (2.0%)</td>
<td>3%</td>
<td>2%</td>
<td>0.13</td>
</tr>
<tr>
<td>ST elevation in lead III</td>
<td>20 (1.5%)</td>
<td>2%</td>
<td>1%</td>
<td>0.44</td>
</tr>
<tr>
<td>ST elevation in lead aVF</td>
<td>24 (1.8%)</td>
<td>3%</td>
<td>1%</td>
<td>0.01</td>
</tr>
</tbody>
</table>

Conclusion: Abnormal EKG findings are common in professional football players with repolarization abnormalities significantly more common in black compared with white players. Electrocardiographic studies excluded structural heart disease in all those tested.

1203-117 Grade 3 Ischemia on Presentation in Acute Myocardial Infarction Predicts Rapid Progression of Necrosis and Less Myocardial Salvage With Thrombolytic Therapy

Yoichi Bannbora, Douglas A. Grady, Kathy B. Gates, Alejandro Barbalagusa, Peter Ummensensen, Ioana B. Jorgatosa, Hayme B. Lehnmen, J. Leblon, L. Wagner, Mass General Hospital, Boston, MA

Background: The definition of myocardial infarction (MI) is increasingly dependent on ECG evolution rather than absolute changes in chemistry. The severity of ischemia, as reflected by Grade 3 ischemia (G3) on the admission ECG is associated with larger infarct size (IS) even with reperfusion. However, the underlying mechanism is still unknown. We assessed whether G3 is associated with larger area at risk (AR) or more rapid progression of necrosis, and whether adenosine reduces IS in pts with grade 2 (G2) and G3 ischemia undergoing thrombolysis. Methods: 49 myocardial infarction pts underwent Tc-99m sestamibi SPECT before (AR) and 6-14 days after (IS) thrombolysis. Pts were divided into 3 groups based on the absence (G0), presence (G1) of terminal QRS distortion in ≥2 adjacent leads (point/R wave ≥0.05 in leads with qR configuration or presence of S wave in leads with RS configuration). Data are presented as median (25, 75 percentile).

Results: Time to therapy was similar in the 2 groups (2.67 [1.67, 3.22] h vs. 2.96 [2.33, 4.00] h; p=.83). Among pts receiving placebo, AR was 36% (14, 49) of the left ventricle in the G0 group and 46% (13, 69) in the G3 (p=.47), IS was 16% (5, 36) and 40% (12, 60), respectively (p=.06). The ratio IS/AR was 91% (41, 73) and 80% (63, 100), respectively (p=.06). Among pts receiving adenosine, AR was 21% (10, 47) of the LV in the G0 and 38% (21, 47) in the G3 (p=.44). IS was 5% (0. 17) and 17% (5, 22), respectively (p<.15), and the ratio IS/AR was 31% (0. 59) and 87% (28, 85), respectively (p=.23). Linear regression model revealed that the IS/AR ratio is related to G3 (p<.0121); adenosine reduces IS (induced to AR) is related to the grades of ischemia and is reduced by adenosine, but was not independently related to time to therapy. In the G3 group necrosis progressed rapidly over time, whereas in the G2 group necrosis progressed more slowly. In pts with G2 there may be more time for myocardial salvage with reperfusion.
116A ABSTRACTS - Cardiac Arrhythmias

204 Coronary Pacing I
Tuesday, March 20, 2001, 9:00 a.m.-11:00 a.m.
Orange County Convention Center, Hall A4
Presentation Hour: 10:00 a.m.-11:00 a.m.

204-119 Exogenous Myocardial Tissue-Based Biosensing of Dynamic Chronotropic Regulation
David J. Christini, Jeff Walden, Jay M. Edelberg. Weill Medical College of Cornell University, New York, NY

Background: Many electronic pacemakers determine pacing rate by responsive-electrophysiological measurement of physiologic-demand surrogates (e.g., QoG). Studies have shown, via comparison with healthy sinus rate, that such estimations are less than ideal. Pacemaker rate regulation might be improved by utilization of biologically-based biosensors to measure the rate regulatory elements.

Methods: Neonatal FVB mouse hearts were transplanted into the peronea or saphenous vein of old FVB mice. Between 17 and 41 days post-transplantation, electrocardiographic (ECG) activity of the endogenous and exogenous hearts was measured simultaneously and compared quantitatively via polynomial curves fit to mean interbeat-interval series. To address the problem. The LLD is composed of a mandrel with an expandable metal locks along the length of the entire lead lumen. RESULTS: The LLD was used to extract the coronary sinus. In 5 pts preoperative testing could not be performed due to anatomical reason. In 5 pts a sufficient PP increase was seen with pacing RV outflow tract and LV in 7 pts the optimal LV site was identified by testing different CV.

Conclusion: Dynamic chronotropic regulation might be improved by utilization of biologically-based biosensors as rate regulatory elements.

1204-120 Coronary Sinus Stenosis in Patients With Congestive Heart Failure and Previous Heart Surgery
Dusan T. Kozovic, Henny Hsieh, Behzad B. Pavli, David Callans, Andrea Russo, Reginald T. Ho, Karl L. Wong, Manisha Ashar. University of Pennsylvania Medical Center, Philadelphia, PA

Biventricular pacing is a new and promising therapeutic option for patients with congestive heart failure and significant intraventricular conduction delay. Over a 18-month period, a biventricular pacing system was successfully implanted in 61 of 67 (91%) patients with CCT segment in the pre-discharge ECG, and 3 measurements of at least one of the following: CK-MB, troponin T (Tn T), or troponin I (Tn I). Patients with arrhythmogenic ECGs, pre-implantation atrial fibrillation or ventricular tachycardia were excluded from the study. The study included 69 patients with functional class I-II and 3 for whom optimal AV-delay in BV-pacing, whereas LV-pacing at optimal AV-delay did not lead to a narrowing of Q, maximal individual benefit could be achieved by testing different LV and RV sites prior to implantation.

204-121 Benefit of Preimplant Coronary Sinus Venogram and Hemodynamic Testing in Patients Selected for Biventricular Pacing in Congestive Heart Failure
Jürgen Vogt, Barbara Lamp, Johannes Heinze, Bert Hamlyn, Leon Krater, Gero Tanderrich, Reiner Korter, Dieter Hoffbauer. Heart Center Northrhine-Westfalia, Bad Oeynhausen, Germany

Background: In patients (pts) with congestive heart failure and left bundle branch block the success of biventricular (BV) pacing depends on access to the target coronary vein (CV) and hemodynamic response. Method: 64/ 41 (pts) planned for transvenous uv stentation, a proeporion venous technique was attempted in 40 pts. 4 pts had an anomaly of the coronary sinus. In 5 pts preoperative testing could not be performed due to anatomical reason. The study population consisted of 26 pts (age 62.1 years, NYHA 3.5+0.4, V02 max 14.2+1.7 mllkg/min, ejection fraction 26+7%). Cycles of 10 paced beats and 30 seconds were paced with different atrio-ventricular (AV) delays. We measured atrial blood pressure (BP) and QoG (130-250 Hz) during AV(pacing) left biventricular pacing (BVAF mode) using electrophysiology catheters in the right atrium, right ventricle, BP and the CV.

Results: BP increased from 201+14 mm Hg at baseline to 222+15 mm Hg (+29%, p=0.001) at BV pacing with optimal AV-delay and 84+16 mm Hg (+29%, p=0.001) at BV pacing respectively. QoG was increased from 195+23 ms at baseline to 159+17 ms (-13%, p=0.001) at BP but not at LV pacing. The best individual pacing mode was BV in 15 pts (PP+30%, QoG+53% and LV in 16 pts (PP+31%, QoG+24%). LV pacing (PP+61%, QoG+81%) 5 pts did not show any improvement. In 3 pts a sufficient PP increase was seen with pacing AV(outflow tract and LV in 7 pts the optimal LV site was identified by testing different CV.

Conclusion: A new lead locking device for the Removal of Pacemaker and ICD Leads
Charles Keirnagran, G. Frank O. Tyes, Charles W. Coyle, Sean Coe. St. Michael’s Hospital, Toronto, ON, Canada

BACKGROUND AND METHOD: Intravascular lead removal effectiveness has improved over the last decade with the addition of a number of new techniques and devices: countertraction, metal and polymer sheaths, locking stylets, various snares, and laser assisted lead extraction. Despite these advances, the lack of a stable, predictable lead extraction platform has remained a major limiting factor to successful lead removal. A further improvement in lead extraction success rate requires locking stylets that consistently reach and lock at the lead tip. A new Lead Locking Device (LLD) was developed to address the problem. The LLD is composed of a mandrel with an expandable metal helical stylet. The LLD is inserted into the lead to be removed and is deployed, locks along the length of the entire lead lumen. RESULTS: The LLD was used to extract 54 leads (31 atrial, 32 ventricular and 21 other) in 51 consecutive patients from 04/99 to 11/99. Implantation times ranged from 6 months to 17.5 years. One-third of the leads were implanted in excess of 93.3 years. The indications, degree of encrusting and scarring in tissue, and morphology were very similar to previous studies. The LLD reached the tip of the lead 91% (70/84) of the time. Eighty-three leads were completely extracted and no complications occurred as a result of the LLD. One lead had a fractured coil, which resulted in a partial removal. The LLD was unlocked, withdrawn and re-lokked successfully in eight leads. The Extimer Laser was used in 7% (6/84) of the leads. Traction alone was used in the remaining 19 (23%) of the leads. CONCLUSIONS: The new Lead Locking Device (LLD) reached the distal tip in leads with undamaged coils and locked firmly in all leads. The LLD provided a strong, stable lead extraction platform around which various dissecting sheaths can be advanced. The locking mechanism of the LLD appears to be reversible when needed.

204-123 Reduction of Free Radicals Production at Reoxygenation After Anoxia in Chronically Paced Embryonic Chick Heart
Xavier M. Lymn, Lukas Koppenenger, Nazima Parel, Anne C. Ruchat, Eric Pfeifer. Division of Cardiology, University Hospital, Lausanne, Switzerland, Institute of Physiology, Lausanne, Switzerland

It was demonstrated in animals that acupuncture significantly reduces the production of reactive oxygen species (ROS) which contribute to tissue injuries during an episode of anoxia-reoxygenation. The heart of 3.5-day-old chick embryos was stimulated at 110% of the intrinsic heart rate (HR) to follow the developmental changes of HR during the study period. After 24 hours of chronic asynchronous ventricular apical pacing hearts were submitted to 80 minutes of anoxia then reanoxified with 100% O2. Peak and total ROS production was measured at reoxygenation.

204-124 Reduction of Free Radicals Production at Reoxygenation After Anoxia in Chronically Paced Embryonic Chick Heart
Xavier M. Lymn, Lukas Koppenenger, Nazima Parel, Anne C. Ruchat, Eric Pfeifer. Division of Cardiology, University Hospital, Lausanne, Switzerland, Institute of Physiology, Lausanne, Switzerland

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Atrial Fibrillation Originating in Pulmonary Veins

Koichiro Kumagai, Naomichi Matsumoto, Hideaki Tojo, Hiroo Noguchi, Hideko Nakashima, Naoki Gondo, Keijiro Saku. Fukuoka University Hospital, Fukuoka, Japan

Background: Atrial fibrillation (AF) is associated with chronic pulmonary vein (PV) potentials. The mechanism of PV foci is lacking. We performed ablative procedures to determine whether PV foci can be ablated or not.

Methods: A total of 21 patients (20 males, 1 female) with AF underwent PV isolation procedure. Ablation catheters were used, including the Acesso (BIOTRONIK, Berlin, Germany). The PV potentials were recorded during PV isolation. Ablation was performed at the site of PV potentials.

Results: A total of 21 patients were included in the study. Among them, 20 AF patients (90%) had PV potentials. The mean number of PV potentials was 3.7 ± 2.0. Ablation was performed at the site of PV potentials. A total of 30 RF applications were performed. Complete PV isolation was achieved in 21 patients (100%). A total of 30 RF applications were performed. Complete PV isolation was achieved in 21 patients (100%).

Conclusions: PV foci can be ablated with catheter ablation. Further studies are needed to determine the efficacy of PV ablation in the treatment of AF.

POSTER SESSION

1205 Atrial Fibrillation Ablation: Targeting the Pulmonary Veins

Tuesday, March 20, 2001, 9:00 a.m.-11:00 a.m.
Orange County Convention Center, Hall A4
Presentation Hour: 10:00 a.m.-11:00 a.m.

1205-126 Influence of Pacing Sites in an Individual Pulmonary Vein on Intracardiac Electrograms in Coronary Sinus and Postero меди Real Atrial Ablation for Pacemapping Triggers of Atrial Fibrillation Originating in Pulmonary Veins


Activation sequence (AS) of intracardiac electrograms (IFG) and the conduction times between the posterior biomedical right atrium (PRA) and coronary sinus (CS) help localize pulmonary vein (PV) sites of origin. RF ablation can be guided by identifying the site of origin of PV activity. We sought to determine the influence of pacing sites within the PV on the conduction times between the CS and PRA.

Methods: In 8 patients with AF, intracardiac electrograms were recorded during atrial pacing from 3 different sites: 1) the coronary sinus (CS), 2) the right atrium (RA), and 3) the PV. The AS and conduction times between the CS and PRA were analyzed.

Results: The conduction times between the CS and PRA were 10 ms longer than the conduction times between the CS and RA. The AS was longer in the CS than in the RA. The AS was longer in the CS than in the PV. The AS was longer in the CS than in the PRA.

Conclusions: The conduction times between the CS and PRA are longer than the conduction times between the CS and PV. The AS is longer in the CS than in the RA. The AS is longer in the CS than in the PV. The AS is longer in the CS than in the PRA. The conduction times between the CS and PRA can be used to identify the site of origin of PV activity.
Background: Biventricular pacing improves symptoms in patients with severe heart failure. This study investigated the potential mechanism of benefit from biventricular pacing.

Methods: 21 patients (64 ± 13 yrs, 14 male) with class III/IV heart failure and QRS duration >140ms who had biventricular pacemaker implanted (Medtronic Inc) were followed. Pattern of CS, HRA and CS activation was evaluated. Results: Right Upper PV pacing was associated with early activation of distal CS in all pts. Left upper PV pacing was associated with early activation of distal CS in all pts. However with left upper PV pacing, HRA preceded the activation of proximal CS and HRA and His atrial activation prior to proximal CS. Pacing of right side PVS was associated with proximal to distal CS activation. Right upper PV pacing was associated with early activation of HRA prior to His and CS activation. Right lower PV pacing was associated with His atrial activation prior to HRA. Thus, closely analysing the sequence of activation of CS activation and its relationship to His and HRA may help localize the origin of atrial premature beats so as to limit mapping of PVs. Sequence of CS activation was not significantly different between biventricular pacing and sinus rhythm. HRA activation significantly preceded His (20±13 ms) and proximal CS activation (26±17ms, P<0.001). In 11/12 patients CS activation was proximal to distal. Right lower PV pacing was associated with relatively early activation of His area that preceded the HRA by 11±11 ms. Proximal CS activation was simultaneous with His, and CS activation was proximal to distal in all pts. Left sided PV pacing was associated with early activation of distal CS in all pts. However with left upper PV pacing, HRA preceded the activation of proximal CS by 20±10ms (P<0.001) and is 0±18 (P=0.00) both His and HRA preceded activation of proximal CS. In left lower PV pacing His and HRA activation followed activation of proximal CS in 11/12 patients. Conclusion: Left upper and lower PV pacing was associated with early activation of distal CS. Left upper PV pacing was associated with HRA and His atrial activation prior to proximal CS. Pacing of right sided PVS was associated with proximal to distal CS activation. Right upper PV pacing was associated with early activation of HRA prior to His and CS activation. Right lower PV pacing was associated with His atrial activation prior to HRA. Thus, closely analysing the sequence of activation of CS activation and its relationship to His and HRA may help localize the origin of atrial premature beats so as to limit mapping of PVs.
Effects of Biventricular Pacing on Cardiac Myocytes Apoptosis

Cristina TosiGuerra, Maria Cristina Pucinelli, Alessandra Sabini, Andrea Collesi, Antonio Micheletti, Paolo Pieragnoli, Nicola Mussil, Cristina Ciapetti, Gian Franco Geronzi, Luigi Parati. Department of Internal Medicine and Cardiology, Florence, Italy.

Background: The development of dilated cardiomyopathy (DCM) involves apoptosis of cardiomyocytes. Troponin-I: troponin I (TNI) is an important survival factor, which inhibits cardiac myocytes apoptosis (CMA) in vivo and its levels are reduced in 857-5
modulate the clinical, mechanical, and "eurohormonal progression of systolic heart fail-
ure.

Results: In the NCRT group, there was a trend correlating ESV to NE level (p<0.06, n=35)
11:20 a.m.

857-5

Quantitative Assessment of Left Ventricular Contractile Synchrony During Biventricular Pacing Using Color Kinesis Echocardiography

Carlo Pappone, Salvatore Rosano, Monica Tocchi, Eustacho Agostoni, Gabriele Vicedomini, Adriano Scalvisi, Simone Galletti, Patrizio Mazzoni, Giovanni La Canna. San Raffaele University Hospital, Milan, Italy.

Background: Biventricular pacing (BVP) is a promising therapeutic modality for heart failure (HF) pts with diastolic dysfunction who are not candidates for cardiac resynchronization therapy. Previous studies have demonstrated improved left ventricular (LV) function, however, left ventricular end-systolic volume (LVEDV) and clinical status have not been consistently improved with BVP. The current study was performed to assess the impact of BVP on LV systolic and diastolic function.

Methods: We compared the hemodynamic effects of BVP to right ventricular apex (RVA) pacing in a group of 10 pts with DCM (NYHA II-III, median age 65 yrs, 70% male, LV ejection fraction 30% ± 10%). Patients were randomized to RVA or BVP pacing for 4 weeks. Hemodynamic parameters, including LV systolic function and diastolic filling were assessed using transthoracic echocardiography.

Results: There were significant improvements in LV ejection fraction (p<0.05) and LV end-diastolic volume (p<0.01) with BVP compared to RVA pacing. Pre-pacing values were 30 ± 10% and 60 ± 10 mL, respectively, and post-pacing values were 35 ± 10% and 50 ± 10 mL, respectively. These improvements were maintained throughout the 4-week study period. There were no significant differences in heart rate, mean arterial blood pressure, or end-diastolic volume.

Conclusion: BVP significantly improves LV systolic and diastolic function in pts with DCM. These findings support the use of BVP as a therapeutic option for pts with DCM who are not candidates for cardiac resynchronization therapy.

11:45 a.m.

1236-112 Does Atrio-Ventricular Synchrony During Ventricular Tachycardia Improve Blood Pressure Response?

Tarsis Tanaka, Alan Kadi, Jeffrey Goldberger. Northwestern University Medical School, Chicago, IL.

Background: Atrio-Ventricular synchrony may be a potential mechanism contributing to hemodynamic tolerance of ventricular tachycardia (VT). Methods: During electrocardiographic studies we compared the hemodynamic effects of VT to right ventricular apex (RVA), left ventricular outflow tract (RVOT), and Atrio-Ventricular (A-RVA, A-RVOT) pacing at the same rate as the VT in 7 patients (4 men) with eight hemodynamically tolerated inducible VTs (1 patient had two VT rates). Mean age was 26-62 years and mean VT cycle length was 240±40 ms. Four patients had coronary artery disease and three had other cardiac diseases. Mean cycle length of the induced VTs and pacing was 270±100 ms. VA block or dissociation was present in all VTs, RVA, RVOT, A-RVA, A-RVOT (AV interval 150-180 ms) pacing were each instituted for 30 seconds. Blood pressure (BP) was continuously recorded for 30 seconds from a 5F femoral arterial catheter. Mean BP was measured every 5 seconds. There were no significant differences in BP between RVA, RVOT, A-RVA, and A-RVOT pacing at each rate. Conclusions: Despite contemporary treatment, high-risk post-MI patients were still more likely to die from arrhythmic than non-arrhythmic cardiac death. Risk stratification of post-MI patients from arrhythmic death remains a worthwhile exercise.
and 70% of the VT cycle length timed from ventricular events recorded from the RV apex, Bohuslav Finta, Howard Frumin, Judy Soura, Gregg W. Stone, Bruce R. Brady, David A. Beaumont Hospital, Royal Oak, MI

ReSUltS: 1-year follow-up data were available for 2,289 of 2,760 PAMI patients who if they can be extrapolated to the myocardial infarction (Ml) patients treated with primary percutaneous coronary intervention (PCI).

AVT pacing at 3 VA intervals. If most favorable response to AVT pacing was selected, was accomplished using a dual-channel EP stimulator. Three VA intervals, 50%, 60% due to AV dyssynchrony is postu- lated to be the cause of the mechanism. We sought to determine whether AVT pacing during induced VT results in lower hemodynamic tolerability. Methods: Consecutive patients with inducible sustained MVT without 1:1 ventriculo-atrial (VA) conduction during electrophysiology study were included. Continuous arterial blood pressure monitoring was performed with intravascular line. After tachycardia had persisted for 30 seconds, ventricular triggered atrial pacing was initiated using a dual-channel EP stimulator. Three VA intervals, 50%, 60%, and 70% of the VT cycle length timed from ventricular events recorded from the RV apex were used in a randomized fashion. Pacing was continued for at least 30 seconds at each VA interval. Results: AVT was attempted in 10 patients with sustained MVT. Patients were aged 74+-7 years and all were male; mean LVCI was 0.20+-0.11. Two patients developed atrial fibrillation during attempts at atrial pacing and were therefore excluded from the analysis. Mean arterial blood pressure (mABP) at baseline was 91.4 mm Hg and during induced MVT was 59.2 mm Hg. Differential response was seen to AVT pacing at 3 VA intervals. If most favorable response to AVT pacing was selected, mABP during pacing was 60.1 mm Hg, which was significantly (p<0.014) higher than that during VT. Conclusions: Ventricular triggered atrial pacing during induced VT can result in improved blood pressure and better tolerability of the tachycardia. This might be a useful modality to maintain hemodynamics during VT ablation or during attempts at termina- tion by anti-tachycardia pacing.

Hemodynamic Collapse During Ventricular Tachyarrhythmia?
S. Chinakar Samt, G. Mustafia Chaudhry, Craig S. Vinch, David C. Vent, Thomas F. Marchese, Charles I. Haffajee, St. Elizabeth’s Medical Center of Boston, Boston, MA, Medtronic Inc, Minneapolis, MN

background: Hemodynamic col- lapse is frequently associated with monomorphic ventricular tachy- cardia (MVT). It has been shown that there is a direct relationship between blood pressure and sinus rate during MVT. Prolonged vascula- tory period to atrial dilatation due to AV dysynchrony is postu- lated to be the cause of the mechanism. We sought to determine that whether AVT pacing during inducible VT results in lower hemodynamic tolerability. Methods: Consecutive patients with inducible sustained MVT without 1:1 ventriculo-atrial (VA) conduction during electrophysiology study were included. Continuous arterial blood pressure monitoring was performed with intravascular line. After tachycardia had persisted for 30 seconds, ventricular triggered atrial pacing was accomplished using a dual-channel EP stimulator. Three VA intervals, 50%, 60%, and 70% of the VT cycle length timed from ventricular events recorded from the RV apex were used in a randomized fashion. Pacing was continued for at least 30 seconds at each VA interval. Results: AVT was attempted in 10 patients with sustained MVT. Patients were aged 74+-7 years and all were male; mean LVCI was 0.20+-0.11. Two patients developed atrial fibrillation during attempts at atrial pacing and were therefore excluded from the analysis. Mean arterial blood pressure (mABP) at baseline was 91.4 mm Hg and during induced MVT was 59.2 mm Hg. Differential response was seen to AVT pacing at 3 VA intervals. If most favorable response to AVT pacing was selected, mABP during pacing was 60.1 mm Hg, which was significantly (p<0.014) higher than that during VT. Conclusions: Ventricular triggered atrial pacing during induced VT can result in improved blood pressure and better tolerability of the tachycardia. This might be a useful modality to maintain hemodynamics during VT ablation or during attempts at termina- tion by anti-tachycardia pacing.

Are Risk Factors for Sudden Death in Myocardial Infarction Patients treated with percutaneous Coronary intervention Different? Analysis of the PAMI Database
Bhoothan Pinto, Howard Frumin, Judy Boro, Gregg W. Ebano, Bruce D. Reddy, David A. Cox, Eulogio Garcia, Lori L. Grines, Kimberly A. Skriling, Cindy L. Grines, William Beaumont Hospital, Royal Oak, MI

Background: Coronary atherosclerosis, left ventricular dysfunction and ventricular arrhythmias are established risk factors for sudden death (SD). Because these factors have been determined mostly in the pre-reperfusion and thrombolytic era, it is not known if they can be extrapolated to the myocardial infarction (MI) patients treated with primary percutaneous coronary intervention (PCI).

Methods: We included PAMI-1, PAMI-2, Stent-PAMI-1, and Stent-PAMI-2. Pilot databases for the outcome data in MI patients who received PCI. We then compared demographic, clin- ical and angiographic characteristics between the patients who died of SD on one hand and 1) the patients who died of other documented causes and 2) all MI patients on the other hand. Our goal was to determine whether any of these characteristics are associ- ated with sudden death as opposed to death from all other causes as or opposed to sur- viving in MI patients treated with PCI.

Results: 1-year follow-up data were available for 2,289 of 2,760 MI patients who received PCI. In 152 (6.8%) patients who died during follow-up period the cause of death was as follows: 18: SD, 77: other cardiac causes, 2: stroke, 1: bleeding, 36: non-car- diac, 16: unknown. Heart failure, left ventricular dysfunction and residual aten-
Electroanatomic Characteristic of the Left Atrium in Patients With Atrial Fibrillation

Background: Magnetic electroanatomic mapping allows for the coupling and display of catheter-based electrophysiologic information and images. We sought to characterize the electroanatomic substrate of the left atrium (LA) in patients with paroxysmal or persistent atrial fibrillation.

Methods: During sinus rhythm, the activation and conduction characteristics of the LA were documented. Detailed endocardial maps of the LA (47 to 263 points) were created allowing for the assessment of LA volume and the anterior to posterior (AP) LA dimension.

Results: A total of 23 patients were examined; 10 of which had paroxysmal and 13 of which had persistent atrial fibrillation. For all patients, the earliest site of LA activation during sinus rhythm was the superior medial septum and the latest activation was in the apical posterior wall and LA appendage. All values are expressed as the mean ± standard deviation.

LA Electroanatomic Characteristics

- Voltage (mV): 2.7 ± 0.9
- AP Dimension (mm): 41 ± 6.8
- Activation Time (ms): 92 ± 15
- Voltage (mV): 2.7 ± 0.9
- AP Dimension (mm): 41 ± 6.8
- Activation Time (ms): 92 ± 15

Conclusions: Magnetic electromagnetic mapping allows for detailed characterization of the LA in patients with AF without or with other arrhythmias.

Viral Myocarditis in Patients With Lome Atrial Fibrillation

Kengo F. Kosano, Kazunari Nakamura, Yoichi Nakamura, Miki Kakioki, Koichi Ohta, Hiroshi Sato, Yuko Katayama, Sachiyo Nagase, Kenichi Hisamatsu, Hiromi Matsubara, Tetsuro Emori, Tohru Ohe. Cardiovascular Medicine, Okayama University Medical School, Okayama, Japan

Background: Lome atrial fibrillation (LAF) is a common arrhythmia, but its etiology is poorly understood. Recently, it is suggested that viral infection is one of the causes of LAF. We therefore investigated the presence of viral myocarditis in human atrial lesions of LAF patients. In addition, viral genome assessment was performed to evaluate viral infection.

Methods: Atrial tissue samples were obtained from 12 LAF patients (10 men and 2 women, mean age 51.8 ± 11.5 years). Immunohistological cell marker analysis was performed for myocardial cells in 10, and surgical resection sample in 1. Clinical AF was chronic in 4 and paroxysmal in 8. The aim of the study was to evaluate the presence of viral myocarditis in 12 patients with LAF. In addition, viral genome assessment was performed to evaluate viral infection.

Results: Histological analysis showed an increased number of interstitial cells in 4 out of 12 patients who were defined as borderline myocarditis. Immunohistological cell marker analysis revealed that there were increased numbers of interstitial cells in 4 out of 12 patients who were defined as borderline myocarditis. Immunohistological cell marker analysis revealed that there were increased numbers of interstitial cells in 4 out of 12 patients who were defined as borderline myocarditis. Immunohistological cell marker analysis revealed that there were increased numbers of interstitial cells in 4 out of 12 patients who were defined as borderline myocarditis. Immunohistological cell marker analysis revealed that there were increased numbers of interstitial cells in 4 out of 12 patients who were defined as borderline myocarditis.
Background – Radiofrequency (RF) ablation of common flutter requires the creation of a complete block to produce bidirectional conduction block in the cavo-tricuspid isthmus. Pulsed energy delivery has been shown to be effective in producing homogeneous bipolar lesions. This randomized study compares the efficacy and safety of RF energy delivery with those of a conventional continuous energy delivery of de novo flutter ablation in patients with structural heart disease (SHD). Methods and Results – Consecutive pts at our institution were randomized to RF application with a 2-mm tip thermocouple catheter (Cordis Websterj (Group 1) or irrigated 8-mm-tip thermocouple catheter (Cordis Webster Thermocool) (Group 2). The endpoint was the achievement of bidirectional isthmus block, and a crossover was performed after 15 unsuccessful applications (3 patients, cross-over from pulsed to continuous mode, n=11). No statistical difference was observed in the efficacy and safety of RF application between the 2 groups. Conclusions: RF ablation using pulsed energy delivery was found to be as effective and as safe as conventional sinusine energy delivery for flutter ablation. With pulsed energy delivery significant less energy amount was required to achieve bidirectional isthmus block and the reduction of delivered energy was associated with significant reduction of felt pain.

1239-122 Irrigated-Tip Versus 8-mm-Tip Catheters for Radiofrequency Ablation of Common Atrial Flutter in Patients with Structural Heart Disease: A Prospective Randomized Study
Maurizio Landolina, Gaudeno De Ferrari, Rossana Combi, Michئتta Casella, Barbara Petracchi, S.Mattio Hospital - RICCIS, Pavia, Italy

The occurrence of atrial flutter (AFL) may lead to severe impairment of cardiac function in patients with structural heart disease (SHD). Radiofrequency (RF) ablation (RFA) is a curative therapy of common AFL that requires continuous and transmural lesion along the cavo-tricuspid isthmus to obtain complete and bidirectional block. This target may be difficult to achieve due to the presence of anatomical abnormalities of the isthmus, interfusion of right atrium and tricuspid valve insufficiency. Both 8-mm tip and irrigated-tip catheters have been proved to create deeper and wider lesions. Aim of our study was to compare the efficacy and safety of these catheters for AFL ablation in SHD pts. Twenty four consecutive SHD pts with Atrial fibrillation were randomized to ablation with an 8-mm tip thermocouple catheter (Cordis Webster ThermoCool) (group 1) or irrigated 5-mm-tip thermocouple catheter (Cordis Webster Thermodisc) (group 2). The 2 groups were homogeneous in age (60±12 vs 61±13 yrs) and weight (81±12 vs 80±10 kg). Ablation was performed during pacing from coronary sinus with the technique of point-by-point lesions. While all pts a long sheath (SRD Diatech) was used to stabilize the ablation catheter. Saline (0.9%) solution was infused through the irrigated-tip at a rate of 17 ml/min during RF application.

Table 1. Mapping Data

<table>
<thead>
<tr>
<th>Group</th>
<th>Pre-Ablation</th>
<th>Post-Ablation</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group 1 (n=11)</td>
<td>Group 2 (n=13)</td>
<td>p value</td>
<td></td>
</tr>
<tr>
<td>RF pulses (mean SD)</td>
<td>32 (22)</td>
<td>14 (7)</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>RF exit voltage</td>
<td>0.71</td>
<td>1.19</td>
<td>NS</td>
</tr>
<tr>
<td>Power [W, mean SD]</td>
<td>43 (7)</td>
<td>32 (6)</td>
<td>&lt;0.005</td>
</tr>
<tr>
<td>Impedance [Mean SD]</td>
<td>106 (20)</td>
<td>132 (15)</td>
<td>&lt;0.005</td>
</tr>
<tr>
<td>T [c°, mean SD]</td>
<td>48 (3)</td>
<td>40 (1)</td>
<td>&lt;0.005</td>
</tr>
<tr>
<td>Total energy (J, mean SD)</td>
<td>79206 (57304)</td>
<td>27539 (16671)</td>
<td>&lt;0.005</td>
</tr>
</tbody>
</table>

Conclusions: The irrigated-tip catheter is more effective and more rapid than the 8-mm tip catheter. Total energy amount was required to achieve bidirectional isthmus block and the reduction of delivered energy was associated with significant reduction of felt pain.

1239-123 Use of Different Catheter Ablation Technologies for Typical Atrial Flutter: Acute Results and Follow-Up
Hooten Schweikert, Andreas Fassab, Jorg K. Huang, Jochen Knoch, Wilfried Seidt, Lon Castle, Logan Kanagaratnam, Mark Niewoehner, Stephen Pavia, Cathy Lam, Alejandro Perez-Lugomur, Cleveland Clinic Foundation, Cleveland, OH

We report the acute success and short term follow-up in consecutive patients undergoing catheter ablation of typical atrial flutter with different catheter designs, and radiofrequency energy delivery systems. Seventy-nine patients entered the study. Ablation was performed with a cooled tip catheter was performed in 8 patients and with a conventional 4 mm tip catheter (37 patients). Acute successful ablation was achieved in all 42 patients undergoin the procedure with either the cooled or larger size tip (group 1). Among the 37 patients undergoing ablation with 4 mm tip (group 2), cross over to an 8 mm tip or a cooled tip catheter was required in 11 patients (30%). The mean fluoroscopic time was 27 minutes in group 1 and 50 minutes in group 2 (p < 0.05). After a mean follow-up of 6 months no patient in group 1 experienced recurrence of atrial flutter whereas 7 of the 37 patients in group 2 (19%) had recurrence of typical atrial flutter. Conclusion: ablation techniques designed to obtain larger size lesions appeared more effective in achieving acute ablation of typical atrial flutter and in limiting recurrence rate at follow-up.

POSTER SESSION

1239-124 The Effect of a Passive Coronary Sinus Delineation Lead on the Ventricular Defibrillation Threshold
Michael E. Banser, Steven D. Giraud, Charyl R. Killingsworth, Gregory P. Walcott, Raymond E. Ikerer, Guidant Corp., St. Paul, MN, University of Alabama at Birmingham, Birmingham, AL

Background: While a coronary sinus (CS) lead is efficacious for internal electrical atrial defibrillation, the effect of a passive CS lead on the ventricular defibrillation threshold (DFT) is not known. This is an important consideration for the atrio-ventricular defibrillator. Methods: In 8 isoflurane-anesthetized dogs (33±3 kg), we compared the DFTs of 3 defibrillation configurations: (RF) - SVC-Cav, RV - Cav, and RV - SVC all listed as catheter - anode(s); with 3 CS electrode positions: proximal CS (posterior left heart), distal CS (left lateral heart) and removed (out of thorax). Dogs were instrumented with a twoelectrode (RV, SVC) transvenous defibrillation catheter, a left pectoral subcutaneous ICD can electrode, and a CS lead. The delivered-energy DFTs of fixed-dose, biphasic shocks for each of nine test configurations (see below) in each animal were determined in random order according to a multiple-reversal-up-down protocol. Results: See table for test configuration DFTs (in J, two-tailed, p<0.05). By ANOVA, none of the three defibrillation configurations showed a significant different effect between proximal or distal CS positions and the lead removed (p>0.05 for each comparison). However, in the RV-SVC+Cav and RV - Can configurations, the presence of the CS lead trended toward higher DFTs compared to all the other conditions.

Test configuration DFTs (in J)

<table>
<thead>
<tr>
<th>RV - SVC+Cav</th>
<th>RV - Can</th>
</tr>
</thead>
<tbody>
<tr>
<td>no CS</td>
<td>prox CS</td>
</tr>
<tr>
<td>12±4</td>
<td>14±6</td>
</tr>
</tbody>
</table>

1239-125 Electro-Anatomic Mapping of Atrial Flutter: Prompt Diagnosis of Complete Block in the Cavo-Tricuspid Isthmus
Pilula Fang, Nancy L. Pasioloe, Wesley K. Hately, Jr., Tony W. Stavrakis, David M. Fitzgerald, Wake Forest University School of Medicine, Winston-Salem, NC

Electro-anatomic mapping (CARTO, Biosense) as a guide for radiofrequency ablation (RFA) (AF) allows precise marking of ablation points for creation of a line of block in the cavo-tricuspid isthmus (CTI). The disadvantage is the time delay required to generate a map to evaluate conduction post-RFA. Accordingly, we evaluated changes in conduction time in the CTI post-RFA to establish values that would indicate complete block. Methods: 20 patients with AF underwent ablation of the CTI using CARTO for guidance. Complete block in the isthmus was documented with a multi-polar catheter placed near the tricuspid annulus during coronary sinus (CS) and lateral right atrial pacing. Maps were obtained during CS pacing at 600 msec. Parameters measured included conduction time (CT) and conduction variability (CV) measured between 2 sets of points taken on each side of the linear ablation line both pre- and post-RFA with the average of the 3 values reported. Distance between points was measured. Additionally, interval between spikes of double potentials (DP) identified after RFA were measured. Results: Listed in Table 1 and displayed in the graphic. CT prolonged and CV showed significantly (i test) post-RFA with no overlap between pre- and post-RFA values. Wide spaced DPs were recorded post-RFA. Conclusions: Prolongation of CT by ≥70 msec and decrease in CV to ≤3 mean 3 minutes post-RFA. Presence of double potentials along the line with DP interval >100 msec is also consistent with complete block. Using these values as a marker for complete block in CTI could decrease the number of points required to confirm block and shorten procedure time.
Catheterization of the Coronary Sinus for Left Ventricular Pacing: Challenges and Solutions

Imran K. Niazi, MD, Helen Berrier, JoAnn Kiemen, Charles Lanzarott, James McPike. William Parker Center for Clinical Research, Milwaukee, WI

Left ventricular (LV) pacing using a coronary sinus (Cs) lead appears promising for the treatment of congestive heart failure (CHF) in patients (pts) with asynchronous ventricular conduction. Although catheterization of the Cs is usually simple in pts with SVT this is reportedly not the case in some patients with CHF. This study was performed to investigate the anatomical hurdles to successful lead placement, and identify patients where catheterization is more likely to fail. In 24 pts with LVEF <40% and/or CHF, mean LVEF = 23, an investigational over-the-needle lead was introduced into a branch of the Cs for LV pacing. Sixteen pts were male; 19 had ischemic and 5 had nonischemic cardiomyopathy.

Methods: Anatomy was assessed by echocardiography, and by contrast injection into the Cs, right atrium, and into the left main coronary artery, to visualize the Cs during the fluoroscopy. Digital fluoroscopic images were recorded in multiple views.

Results: Lead placement was significantly more difficult in females (median time 120 vs. 65 minutes, p=0.01), and non-significantly greater in cardiomyopathy vs. coronary artery disease pts. (100 vs. 75 minutes, p=0.02). There was no correlation between lead placement time and acute, LVEF, or body surface area. Anatomical hurdles included a distal right atrial, a prominent Eustachian valve, and tortuosity, acute angulation or hypoplasia of the Cs. Cannulation of the coronary sinus with a deflectable-tip luminal catheter, followed by serial catheter and lead exchanges over a guidewire, appeared to be the most promising technique in difficult cases.

Conclusion: Permanent Cs lead placement is sometimes unusually difficult in CHF pts, especially females. Further studies are warranted to devise appropriate equipment and implant procedures.

Single Center Experience With Extraction of Chronic Implantable Defibrillator Leads: Methods and Results

Winfried Fonteyne, Heidi Rottiers, Rene H. Tavernois. Department of Cardiology, University Hospital Ghent, Ghent, Belgium

Background: Pacing leads can be removed with good clinical results. These data cannot be extrapolated to extraction of implantable cardioverter defibrillator (ICD) leads due to their larger size, the severity of fibrosis and the underlying heart disease. This study analyzes the feasibility and safety of the ICD lead extraction, using a stepwise approach.

Methods: Initially simple traction on the lead with a stylet in place was performed. If this was not successful a locking stylet (Cook, Vascormed or Spectranetics) was inserted to obtain distal traction. When the tip was free but the lead could not be removed due to obstruction of the coil, a basket catheter (Cook) was inserted from the femoral vein in order to remove the electrode from below. When the Spectranetics laser sheath became available, it was only used when no distal traction could be obtained with the locking stylet. If the lead was partially removed, surgery was only performed in case of infection or mechanical irritation of the heart.

Results: In 27 patients (pts) 8 venous caval superior (SVC) leads and 27 right ventricular (RV) leads were removed. The reason for removal was distortion of the coil in 9 leads and mal-configuration in 18 pts. The ICD leads were implanted for 40 ± 23 months. All SVC leads (100%) and 4 RSA leads could be extracted by simple traction. With a locking stylet as the only device 13 leads could be extracted completely. The combination of a locking stylet and a basket catheter was used in 5 pts, allowing a complete removal of 3 leads. A locking stylet and the laser sheath was used in 5 pts: 4 leads were removed completely, the remnants of one lead were removed surgically, 3 days later. As a result, 25 RVA leads (93%) were removed completely and 2 RVA leads (7%) partially. No deaths occurred.

Conclusions: Extraction of ICD leads can be performed safely and with good clinical results if multiple extraction facilities are available and used in a stepwise approach. In our experience a laser extraction system is only needed when severe fibrosis of the coil limits distal traction.

Randomized Comparison Between a Low and a New High Impedance True Bipolar Defibrillation Lead

Christina Ummoen, Jena Stearns, Lorne Warkentin, Roger Kingsnorth, Werner Leiner, for the worldwide 6944 Lead Study Group. Department of Cardiology, University Clinic, Goettingen, Germany, Department of Cardiothoracic Surgery, University Clinic

Introduction: The aim of the study is to compare acute and long-term follow-up parameters of a low (Medtronic Sprint 6942) and high impedance (Medtronic Sprint 6944) defibrillation lead. The new high impedance lead is a true bipolar ICD lead which is a silicon-encased device with a polyesterurethane overlay and an lead body passing through on 9 Fr introducer. Both electrodes are steroid-eluting.

Methods: Patients (pts) with classical ICD indications (n=24) were randomized in two groups. Group I pts (n=11, 68% M, 32±11 yrs, 7 VF, 8 VT, 1VFVT, age ≥18) received the 6942 lead, in 18 pts of group II (14 CHD, 6 VT, 10 VT, 2 VT/VT, EF 35±14 %, age ≥18 yrs) the 6944 lead was implanted. Implant success was 100%. Pacing and sensing values, impedances in the pace and shock lead (painless measurement) were measured during implant, at pre discharge and at each follow-up (1,3,6,12 months).

Results: With 80 ms; corrected SNRT > 550 ms; Wenckebach cycle length > 500 ms. While dual chamber (DDD) implantable defibrillators may provide advantages over single chamber (VVI) devices, DDD ICDs are more complex and expensive. The need for DDD ICDs in the absence of serious, non-IAD conditions should be questioned. Further studies are warranted to devise appropriate equipment and implant procedures.

One Wire or Two? The Value of Electrophysiologic Testing to Guide Selection of Single Versus Dual Chamber Defibrillators

Jay H. Curwin, Robert F. Cooney, William Wuest, E. Bill Eckstein, Kelly Shee, Elizabeth Tuffias, John S. Baines, Jr., Stephen L. Winters. Montefiore Memorial Hospital, Milwaukee, WI

While dual chamber (DDD) implantable defibrillators may provide advantages over single chamber (VVI) devices, DDD ICDs are more complex and expensive. The need for DDD ICDs in the absence of serious, non-IAD conditions should be questioned. Further studies are warranted to devise appropriate equipment and implant procedures.
Electroanatomic Mapping in the Chronic Porcine Infarct Model: Use of Bipolar Versus Unipolar Electrograms Compared to Intracardiac Electrocardiography

David J. Callans, John Michlke, Jian-Fang Ren, France E. Marchlholly, Stephen M. Dillon, University of Pennsylvania, Philadelphia, PA

Background: Electroanatomic mapping (EA) has proven useful in characterizing infarcted and ischemic zones during electrophysiologic and interventional procedures. We hypothesized that EA would be more accurate using a bipolar (Bi) compared to unipolar (Uni) electrograms (EGMs) voltage mapping strategy. Methods: EA was performed during atrial fibrillation in a 35 mm tip catheter (1 mm electrode spacing) in 10 pigs 8 weeks after coronary ligation. Voltage criteria were based on previous study as well as values < 0.15 mV. Results: Bi EGMs were more accurate in identifying infarct area (90% vs. 86% for Uni). Bi EGMs were significantly larger than Uni EGMs (2.0 mV vs. 1.4 mV, p < 0.0001). Infarcts were typically located by Uni mapping spacial to their actual location by ICE. Conclusions: Using ICE imaging as a reference standard, FA mapping with Bi EGMs was more accurate than Uni EGMs for identifying infarct area and location in this model. Although inter-

4,7±1.0* 23±7 34±14

Border zone Normal myocardium

9±1* 40±24 50±11

Wall thickness (mm) Area (mm²) % Wall thickness

2.30 p.m.

Complications After Radiofrequency Catheter Ablation of Ventricular Tachycardia

Aldia E. Borcon der der Burs, Lieselot van Enen, Marianne Bootsm, Natalia M. S. De Goost, Martin J. Schalij. Leiden University Medical Center, Leiden, The Netherlands

Background: Ventricular tachycardia (VT) is often associated with a poor prognosis. Therapy modalities include anti-arrhythmic drugs, an implantable cardioverter defibrillator (ICD) and radiofrequency catheter ablation (RFCA). The RFCA is the only potentially curative therapy. This study was performed to evaluate the procedural complications within 48 hours of the procedure. Results: Since 1997, 123 pts (104 male, 19 female, average age 58.2 ± 15.4 yrs) were treated with RFCA for VT, 67 patients with ischemic heart disease, 67, dilated cardiomyopathy, 7 anterograde, 4 right ventricular dysplasia, 2, idiopathic VT. Complications recorded in this study population are described in the table. The procedure was successful in 78% of the pts (non-inducible VT after the procedure). The majority (88%) of the pts did not suffer from any complication. Two pts died because of ischemic heart disease. Two pts suffered from neurological complications (all ischemic heart disease pts) did not have a history of cerebrovascular accidents prior to RFCA. The pts with complications were slightly older than the pts without complications (68.0 ± 10.1 years vs 57.2 ± 15.9 years, NS). Conclusions: Treatment of VT with RFCA is effective and relatively safe. The incidence of complications tends to increase with age.

124A ABSTRACTS - Cardiac Arrhythmias JACC February 2001
Background: The aim of this study was to identify the myocardial scar by electroanatomic voltage mapping and to evaluate the QRS configuration on the surface 12-Lead electrocardiogram (ECG) obtained from multiple pace map sites at the border of the scar in patients with post-infarction VT. Methods: Five patients with unstable VT (VTiP), associated with prior inferior myocardial infarction (MI) were studied. Localization of LV scar was achieved by pacing from multiple sites (46) along the border of the scar, mean of 3±3 sites/Pt. Based on the analysis of the QRS configuration obtained during pace map at the border of the scar, the following ECG algorithm was derived (Figure). The sensitivity and specificity of using this algorithm to predict a particular pacing site at the border of the scar was 72% and 91%, respectively. Conclusions: 1) A simple ECG algorithm guides location of pace mapping along the border of myocardial scar; 2) This ECG algorithm may identify the exit site of unstable VT in pts with prior inferior MI, and 3) may promptly guide ablation in sinus rhythm. Scared myocardium was defined as sites of voltage < 1.5 mV.

**Conclusions:** A comprehensive index of cardiac autonomic status and reflexes can be obtained. Consequently, by combining these parameters a more comprehensive index of cardiac sympathetic and parasympathetic activity (HRV) are parameters currently used to provide a measure of cardiac autonomic status and reflexes. QT dynamics as an independent predictor of mortality in CHF patients.

**Results:** The rate dependence of repolarization was evaluated over 24 hours, during daytime and nighttime periods with measurement of QT/R ratio slopes. QT/R ratio slopes were significantly increased in patients with IDC (p<0.001) compared to a control group of 80 healthy men. The QT intervals (end and apex) of patients with IDC were 60.9±11.2 ms more prolonged compared to the control group. QTi and QTc intervals were significantly increased in patients with IDC (p<0.001) compared to a control group of 80 healthy men. The QT intervals (end and apex) of patients with IDC were 60.9±11.2 ms more prolonged compared to the control group. QTi and QTc intervals were significantly increased in patients with IDC (p<0.001) compared to a control group of 80 healthy men. The QT intervals (end and apex) of patients with IDC were 60.9±11.2 ms more prolonged compared to the control group.

Conclusion: QT dynamics were found to be a prognostic factor using univariate analysis with QTc slope on 24 h. (RR=0.11, p=0.0002); QTc slope (RR=0.71, p=0.016) during daytime and QTc at 800 ms (RR=2.60, p=0.004) during daytime. In multivariate analysis, independent predictors for all-cause mortality were NYHA class III or IV, RR=2.33, p=0.039; low frequency spectra of HRV (cut off inf 4.27 InHz2), RR=0.67, p=0.038 and QTc at 800 ms in day period (cut off sup 404.5 ms, RR=3.32, p=0.005). Conclusion: QT dynamics contribute independently to prognosis in CHF patients. As described previously regarding the spectral domain of HRV, prognostic information is available for day-time periods. Further study with a higher sample size is needed to evaluate QT dynamics as a predictor of sudden death.
ventricular tachycardias (p=0.03), and a decreased heart rate variability (standard deviation of normal-to-normal intervals, p=0.03) were the only independent predictors of cardiac death. Considering the whole population of patients with IDC, a decreased heart rate variability was a better predictor of cardiac death than an increased QTc interval slope. Conclusion: In IDC, an increased QTc/RR interval slope over 24 h may help to identify patients with narrow QRS at risk of major arrhythmic events. The presence of LBBB decreased the prognostic value of QT dynamics in patients with IDC.

**Methods:** This study is to evaluate whether the QTd is a useful marker for identifying patients with HOCM who are at risk of sudden cardiac death. QTd (difference between longest and shortest QT interval) was measured on initial standard 12-lead ECGs of 46 HCM patients (32 men).Case group (Case) consisted of 23 HCM patients who died suddenly. Control group (Con) consisted of 23 HCM patients who survived uneventfully during follow-up. The 2 groups were pair-matched for age (±5 years), sex and maximum left ventricular wall thickness (±1.5 mm). Of 46 patients, 12 had their last ECGs before death available for this study. QT intervals were measured manually using a high-resolution (0.1 mm to 4 ms) digitising board. An in-house program was used for calculating QT and JT intervals, QTc and JT duration (JTc, difference between longest and shortest point of T and JT interval).

**Results:** QTd (74±28 vs 59±21 ms) and JTd (76±32 vs 59±26 ms) from initial ECGs were significantly greater in Case than in Con (p=0.020 and 0.029, respectively) (Figure). Maximum corrected QT intervals (QTc) in Case were similar to Con (489±29 vs 479±27 ms, p=0.19). No systematic changes in QTd or JTd were found from late ECGs of Case compared to those from early ones (71±23 vs 71±26 ms, p=0.64 vs 1 vs 166±29 ms, p=0.5). There was no correlation between maximum left ventricular wall thickness and QTd, JTd, and maximum QTc (r=0.29, p>0.05 for all).

**Conclusion:** Statistically significant differences in the measurements of QTd and JTd were observed between Case and Con. However, the small difference and wide overlap in measurements between Case and Con will limit its clinical use in predicting sudden cardiac death in HCM.

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**126A ABSTRACTS - Cardiac Arrhythmias**

**POSTER SESSION**

**1269 Arrhythmia Mechanisms**

**Tuesday, March 20, 2001, 3:00 p.m.-5:00 p.m.**

**Orange County Convention Center, Hall A4**

**Presentation Hour: 4:00 p.m.-5:00 p.m.**

**1269-113 Atrial Tachycardia in Dogs With Rapid Ventricular Pacing Induced Heart Failure Is Due to Either a Focal or Reentrant Mechanism**

Jayeel Kumar Sahadevan, James Golblewski, Celine Kheslan, Kyung Ryou, Albert L. Waldo, Bruce S. Stambler. Case Western Reserve University/University Hospitals of Cleveland, Cleveland, OH

Atrial tachycardias are common in congestive heart failure (CHF) in humans, but their mechanisms are poorly understood. Our prior studies in a canine model have shown that focal tachycardias may be due to 2 different mechanisms. METHODS: We studied 12 episodes of sustained atrial tachycardia (>5 mins) induced in 12 dogs with CHF induced by rapid ventricular pacing at 260 bpm for 19-60 days. Unipolar electrograms were recorded simultaneously from 394 sites on the epicardium of the right atrium (RA) and the left atrium (LA) and the right side of the atrial septum. Activation maps of 2 consecutive cycles were analyzed from several time periods during each episode of sustained AT (cycle length (CL): 152±12 ms and SD of 10 CLs: 1.2±0.5 ms). RESULTS: The mechanism of AT was macro-reentry in 5 episodes in 5 dogs and a single focus firing rapidly in 7 episodes in 4 dogs. Only 1 AT mechanism was found in each CHF dog. Dogs with locoregional AT did not differ in: 1) AT CL (148±15 vs 157±10 ms); 2) SD of CL (1.2±0.6 vs 1.2±0.3); or 3) method of induction. Dogs with local AT underwent rapid ventricular pacing for a shorter duration compared to reentrant AT (dogs 28±9 vs 46±5 days, p=0.01). In the 5 episodes of macro-reentry, the circuit was constant in each episode but varied in location from episode to episode. In 2 episodes, the reentrant circuit traversed around a functional line of block in the RA free wall. In 3 episodes, the circuit was in the RA and reappeared typical canine atrial flutter with a septal circuit component. In the 7 episodes of local AT, 2 episodes originated from the superior or mid sulcus terminalis and 5 episodes originated within or around the pulmonary veins. CONCLUSIONS: In this CHF model, AT either: 1) has a focal origin near the sulcus terminalis or pulmonary veins; or 2) is due to macro-reentry with visible functional and anatomical components to the circuit; and 3) only one mechanism appears responsible for AT in each CHF dog and is dependent on the duration of ventricular pacing.

**1269-112 Temporal Trends of the Risk of Arrhythmic Versus Non-Arrhythmic Deaths After Acute Myocardial Infarction: A Combined Analysis of Multicenter Trials**

Yeo Guan Yap, Tien Duhong, Martin Bierak, Marek Molfick, Christian Top-Pederson, Lars Kober, Shaart Connolly, Robin Roberts, Bradley Marchant, A. John Cam. St. George's Hospital Medical School, London, United Kingdom

Understanding the temporal trends of the risk of arrhythmic death is crucial to decide the optimal time for risk stratification but the data is lacking. Method: Individual patient data was pooled from the placebo arms of LAMIN, LAMIN, TRAC & DIAMOND-MI who had a recent MI and LEF=40% or frequent VPBs. Temporal trends were examined for all studies from day 45 after MI to allow for different recruitment periods between trials. Rate of arrhythmic (AD) and non-arrhythmic cardiac death (NAD) were compared over 6 monthly intervals after MI. Kaplan-Meier, logistic & Cox regression were used. Results: 3154 patients (median age: 65 [23-92] yr; 2471M) were pooled from all 6 trials at 42 days to 7 years MI (70% AD & 30% NAD). There was no significant change in the proportion of AD vs. NAD over time from day 45 to 2 years after MI (AD:57%[45%-63%]; NAD:55%-61%); p=0.09. The risk of both AD & NAD were greatest in the first 6 months but the risk of AD was consistently higher than that of NAD throughout the 2 years period (rate of death/100 person-year at risk: AD:NAD: 8:0.80; 0.74; 0.64; 0.47; 0.43; 0.21; 0.07; p=0.03) & hypertension (p=0.04). Similar trend was observed when mortality was mea-

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**1265-6 Principal Component Analysis of the T Wave as an Index of Life-Threatening Arrhythmia Risk**

Thomas Hibel, Eva vom Brocke, Marc Rehotz, Patricia Kraft, Jutta Ruf-Richter, Johannes Brachmann, University of Heidelberg, Department of Cardiology, Heidelberg, Germany, Klinikum Coburg, Coburg, Germany

Meaningful noninvasive diagnostic tools are required in order to predict risk for sudden cardiac death, particularly in patients with non ischemic heart disease or apparently normal heart. Abnormal T wave patterns have been linked to the heterogeneity in ventricular repolarization and to be associated with arrhythmic events and mortality. Methods: In this study we evaluated the usefulness of the PCA ratio as a test for identifying patients with HOCM who are at risk of sudden cardiac death. QTd (difference between longest and shortest QT interval) was measured on initial standard 12-lead ECGs of 46 HCM patients (32 men). Case group (Case) consisted of 23 HCM patients who died suddenly. Control group (Con) consisted of 23 HCM patients who survived uneventfully during follow-up. The 2 groups were pair-matched for age (±5 years), sex and maximum left ventricular wall thickness (±1.5 mm). Of 46 patients, 12 had their last ECGs before death available for this study. QT intervals were measured manually using a high-resolution (0.1 mm to 4 ms) digitising board. An in-house program was used for calculating QT and JT intervals, QTc and JT duration (JTc, difference between longest and shortest point of T and JT interval).

Results: QTd (74±28 vs 59±21 ms) and JTd (76±32 vs 59±26 ms) from initial ECGs were significantly greater in Case than in Con (p=0.020 and 0.029, respectively) (Figure). Maximum corrected QT intervals (QTc) in Case were similar to Con (489±29 vs 479±27 ms, p=0.19). No systematic changes in QTd or JTd were found from late ECGs of Case compared to those from early ones (71±23 vs 71±26 ms, p=0.64 vs 1 vs 166±29 ms, p=0.5). There was no correlation between maximum left ventricular wall thickness and QTd, JTd, and maximum QTc (r=0.29, p>0.05 for all).

Conclusion: Statistically significant differences in the measurements of QTd and JTd were observed between Case and Con. However, the small difference and wide overlap in measurements between Case and Con will limit its clinical use in predicting sudden cardiac death in HCM.

**ROC curve were calculated and statistically compared with the area under the PCA ratio ROC curve. Sensitivity and specificity were calculated for predefined cutoff values. Results:**

<table>
<thead>
<tr>
<th>Areas under the ROC curves, Sensitivity, Specificity</th>
<th>PCA ratio</th>
<th>QTd</th>
<th>JTd</th>
<th>QTc</th>
<th>R2NN</th>
<th>RMSSD</th>
<th>p/r2NN</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ROC Area</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>AROC Area</td>
<td>0.84</td>
<td>0.67</td>
<td>0.72</td>
<td>0.69</td>
<td>0.48</td>
<td>0.54</td>
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<tr>
<td>Sensitivity</td>
<td>58%</td>
<td>38%</td>
<td>52%</td>
<td>38%</td>
<td>12%</td>
<td>31%</td>
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<tr>
<td>Specificity</td>
<td>96%</td>
<td>83%</td>
<td>87%</td>
<td>83%</td>
<td>91%</td>
<td>87%</td>
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</tbody>
</table>
| **p**<0.05 marked parameter vs. PCA ratio Conclusion: PCA ratio of the T wave as a marker to identify high-risk patients is superior to compared to the mean 24 h QTc duration and the investigated HRV parameters. QT dispersion does not significantly differ in the ROS area analysis but has less sensitivity and is much more difficult to measure. The sensitivity of the PCA ratio is not high enough for a good test but it is meaningful to conduct further investigations with methods that describe T wave morphology.**
Increased Awareness of Atrial Vulnerability to Tachycardia in the Aged Rat

Hideni Hayashi, Charles Wang, Toshikito Ohara, Chikaya Omichi, Shengmei Zhou, Yuji Miyachi, Peng-Sheng Chen, Hrayr S. Karagueuzian
Cedars-Sinai Medical Center and UCLA School of Medicine, Los Angeles, CA

Background: The incidence of atrial arrhythmia (AA) and atrial fibrillation (AF) increases with age. No animal models of aging have been reported. In the present study we report that old rats are more likely to test atrial vulnerability to induction of arrhythmia and to become arrhythmic under certain conditions.

Methods: Eighty rats (Fisher-344) were divided into young (2-3 months old; n=20) and old (22-24 months old; n=20). The hearts were cannulated, cannulated and perfused through the atria using the Tyrode's solution at a rate of 5.5 ml/min at 37°C. Vulnerability to AT was tested by burst atrial pacing. The spatiotemporal changes of the atria were mapped using optical signals from CCG catheters over an area of 1 by 1 cm. The frame time to frame time correlation coefficient (r) of the cellular uncoupler heptanol (0.002-0.01 mM) on vulnerability was then tested in both groups.

Results: Burst pacing induced AT in all four young rats. In the same pacing protocol induced long-lasting AT in one out of four young rats. In contrast, the same pacing protocol induced long-lasting AT in all four young rats. In the old rats, heptanol (0.002 mM) converted AT to AF in 2 out of 4 rats. In contrast, no AF could be induced in the young rats even when heptanol concentration was raised up to 0.01 mM. During AT optical mapping showed the presence of a periodic single activation wave front in both groups. During AF multiple distinct independent wavefronts were present. Fabulistic studies showed that the ratio of the area occupied by interstitial fibrosis to the total area was significantly larger in the old than in the young rats. In the LA it was 7.1 ± 2.0% vs. 0.3% ± 0.4% (p<0.05 for RA & LA). Conclusions: The old rat is a suitable model to study age-related increase in vulnerability to AT. Atrial-induced increase in vulnerability in the young rats suggests that partial critical cellular uncoupling that might be produced by the increased interstitial fibrosis seen in the old rats may be responsible for the greater vulnerability to AT in the aged rats.

References:

Lack of Spatiotemporal Organization With the Transition From Acute to Chronic Atrial Fibrillation In Vivo


Introduction: Atrial fibrillation (AF) may originate from discrete sites of periodic activity, or rotors. The spatiotemporal changes in rotor activity as acute AF becomes chronic are not yet defined. We studied this transition in vivo by measuring complexity and periodicity of activity using dog atrial electrograms (AEG) with AF.

Methods: Five dogs underwent rapid atrial pacing for 48 hours and developed acute AF. In seven other dogs, atrial fibrillation was induced and the dogs were paced until chronic AF developed (>3 weeks). A 64-electrode basket catheter was placed via a transseptal right atrial approach into the left atrium. Bipolar atrial electrograms of 400 μV were recorded from atrial leads and atrial electrograms with mostly ventricular activity or 60 Hz noise were excluded. To quantify complexity, we calculated sample entropy (SampEn; window = 5s, tolerance = 0.075 S.D., length = 2048), a measure similar to approximate entropy (ApEn) but with less bias, especially for short data sets. To quantify periodicity, we calculated power spectra on filtered 60-s electrograms each 0.25 s on a sliding 10-s window, and noted the frequency and power of the largest peak.

Results: More than 4000 discrete electrograms from 283 bipolar sites were analyzed (average age 36.6 ± 11.1 years). A dominant frequency was identified in 100% of acute AF episodes and 24.3% of chronic AF episodes (p<0.0001). The mean frequency of the largest power spectrum peak was similar in both groups (8.1 and 8.2 Hz, p=0.31). The ratio of the area occupied by interstitial fibrosis to the total area was significantly larger in the old than in the young rats. In the LA it was 7.1 ± 2.0% vs. 0.3% ± 0.4% (p<0.05 for RA & LA). Conclusions: The old rat is a suitable model to study age-related increase in vulnerability to AT. Atrial-induced increase in vulnerability in the young rats suggests that partial critical cellular uncoupling that might be produced by the increased interstitial fibrosis seen in the old rats may be responsible for the greater vulnerability to AT in the aged rats.

References:

Increased Atrial Vulnerability to Tachycardy in the Aged Rat


Introduction: Atrial fibrillation (AF) may originate from discrete sites of periodic activity, or rotors. The spatiotemporal changes in rotor activity as acute AF becomes chronic are not yet defined. We studied this transition in vivo by measuring complexity and periodicity of activity using dog atrial electrograms (AEG) with AF.

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References:
The haemodynamic effects of acute high atrial, coronary sinus, and bilateral pacing.

Background: Atrial fibrillation is associated with various electrophysiological abnormalities. Intratrace pressure and stretch receptors have been found to have an effect on the susceptibility to AF. Bilateral pacing (high and low atrial/extracoronary sinus) has been shown to decrease AF episodes frequency and duration, presumed due to resynchronisation of the atria. To date there is no study observing the haemodynamic effects of bilateral (BiA), right atrial (RA) and coronary sinus (CS) pacing.

Methods: 12 patients with BiA pacemakers were investigated. All had a history of drug refractory paroxysmal AF with no history of sick sinus syndrome or atrioventricular block. Each patient was paced from RA, CS and BiA at 10 beats per minute (bpm) above base rate, 90 and 120 bpm in random order until all modes had been used. After ‘10 minutes pacing transmural echocardiographic data were performed.

The following parameters were documented: Left ventricular outflow tract VTI, CA duration, Diastolic filling period, mitral Deceleration time, pacing to peak mitral flow interval and MitrMitral VT. Results: BiA atrial pacing caused a 3% reduction in E/A ratio/RACS pacing caused an increase in E/A ratio. (P < 0.05).BiA pacing also resulted in the greatest diastolic filling period and the shortest deceleration time at equivalent rates, but these were not statistically significant (p > 0.05). Corrected UV outflow VTI was greatest for CS pacing at the 90, 120 cleaning and 97.9% increase respectively (p < 0.04). Mitral VTI corrected for rate was greatest for CS at 90 and 120 bpm (p < 0.05). Pacing to peak flow interval was shortest for CS at all rates (p < 0.05). Conclusions: There were changes in many of the echo parameters, some of which reached statistical significance; others suggested a trend towards change. This is the first study to look at haemodynamic effects of BiA pacing and suggests there is an effect, the exact significance of which is unclear. These changes may be due to interacting thromboembolism, physiological contraction, or possibly recruitment of atrial myocardium. Haemodynamic effects may play a role in the AF prevention by BiA pacing, along with correction of intratrace conduction defects.

Influence of Overdrive Atrial Pacing on the Occurrence of Atrial Fibrillation After Cardiac Surgery: A Meta-Analysis

Sergio L. Prskal, Elena B. Sipesova. Rush-Presbyterian-St. Luke’s Medical Center, Chicago, IL

Background: Post-operative atrial fibrillation (post-op AF) occurs in up to 40% of patients after cardiac surgery and results in longer lengths of stay and increased costs. Prophylactic overdrive atrial pacing via temporary epicardial wires may decrease the incidence of post-op AF, but results of clinical trials have been inconsistent. Methods: We performed a meta-analysis of all randomized clinical trials that addressed the effect of prophylactic atrial pacing in reducing the incidence of post-op AF. Trials were identified by MEDLINE searches, manual searches of abstracts of major national and international cardiology and electrophysiology meetings, and direct contact with investigators. We used a random-effects model to perform the meta-analysis. Fifteen trials including 1,407 patients were analyzed. Eight trials studied the effect of right atrial pacing, 3 the effects of left atrial or Bachmann’s bundle pacing, and 8 the effects of simultaneous biatrial pacing. The incidence of post-op AF in the control groups (no pacing) was 34%. The overall odds ratio for right atrial pacing was 0.72 (p = 0.07; 95% CI: 0.45 to 1.17; absolute risk reduction 7%). The overall odds ratio for left atrial pacing was 0.60 (p = 0.06; 95% CI: 0.32 to 1.02; absolute risk reduction 12%). The overall odds ratio for biatrial pacing was 0.44 (p = 0.001; 95% CI: 0.29 to 0.62; absolute risk reduction 16%). To prevent one occurrence of post-op AF, 8.5 patients need to be treated with biatrial pacing. Conclusions: Temporary biatrial overdrive pacing is effective in preventing post-op AF, with a 65% odds reduction. The value of single-site right or left atrial pacing is less clear.

POSTER SESSION

Atrial Tachycardia and Inappropriate Sinus Tachycardia: Localization and Ablation

Tuesday, March 20, 2001, 3:00 p.m.-5:00 p.m.
Orange County Convention Center, Hall A4
Presentation Time: 4:00 p.m.-5:00 p.m.

Atrial Imaging in the Detection of Atrial Fibrillation


Background: Atrial fibrillation (AF) is a common and disabling arrhythmia. Accurate detection of AF remains a challenge for both patients and healthcare providers. The present study evaluated the utility of atrial imaging in the detection and localization of AF.

Methods: Atrial imaging was performed in 56 patients (mean age 65 ±10 years) with new-onset AF. Atrial imaging was performed using a novel multi-view imaging system that simultaneously acquires images from four different planes. These images were then reconstructed into a single volume dataset that allows visualization of the entire atrial appendage. The volume dataset was then used to perform a detailed analysis of atrial appendage morphology and function.

Results: Atrial imaging revealed significant atrial remodeling in the majority of patients, with dilatation and thinning of the atrial appendage in 80% of cases. Atrial fibrillation was localized to the left atrial appendage in 70% of cases, with the remaining 30% localized to the right atrial appendage. Atrial imaging also revealed evidence of atrial electrical remodeling, including decreased atrial volume, increased atrial wall thickness, and decreased atrial electrical conductivity.

Conclusions: Atrial imaging is a promising modality for the localization and characterization of atrial fibrillation. Further studies are needed to validate these findings and to evaluate the utility of atrial imaging in the clinical management of atrial fibrillation.

Effect of Long-term and Short-term Ventricular Pacing on Left Ventricular Function

Norbert Tempi, University of Milan, Milan, Italy

Background: The long-term effects of ventricular pacing on left ventricular (LV) function are not well understood. Short-term pacing studies have shown improved LV function, but the long-term effects are unknown.

Methods: We studied 14 patients (mean age 69 ±10 years) with sinus node dysfunction who were scheduled for permanent pacemaker implantation. Patients were randomized to receive either long-term (LTVP) or short-term (STVP) pacing for 3 months. LV function was assessed at baseline and at 3 months using echocardiography.

Results: LV ejection fraction (LVEF) improved significantly in the STVP group (p < 0.05), but not in the LTVP group. LV end-diastolic volume (LVEDV) decreased in the STVP group (p < 0.05), but not in the LTVP group. LV mass index (LVMI) decreased in the STVP group (p < 0.05), but not in the LTVP group. LV systolic and diastolic volumes decreased in the STVP group (p < 0.05), but not in the LTVP group. LV systolic and diastolic performance indexes improved in the STVP group (p < 0.05), but not in the LTVP group. LV wall thickness decreased in the STVP group (p < 0.05), but not in the LTVP group.

Conclusions: Short-term pacing improves LV function, whereas long-term pacing does not. LV size and performance indexes improve with short-term, but not with long-term, pacing.
and specific P wave configurations, and displays the sensitivity (SEN), specificity (SPEC), and positive (PPV) and negative (NPV) predictive values associated with each lead. The best criteria for LA SO0 had a high NPV, but only modest sensitivity, primarily due to the unpredictable PWC of AT arising from or adjacent to the interatrial septum. The SO0 for most focal AT can be reliably approximated with simple criteria to minimize the confounding influence of the preceding T wave. The SO0 (successful ablation site) was assigned to one of 18 predetermined regions based on biplane fluoroscopic images (67 AT) or electroanatomical reconstructions (71 AT). PWC in each lead was analyzed for ability to discriminate SO0 in 3 different dimensions: left (LA) vs right, posterior/anterior (mitral or tricuspid) vs nonannular (crista, pulmonary vein, other), and caudal vs cranial. The origin of AT was an annulus in 57 pts (41%), crista in 34 (25%), pulmonary vein in 16 (12%), and other sites in 11 (8%). AT originated from LA sites in 30 pts (22%), and excluded sites in 16 (11%).

Results: The table indicates highly significant associations (p<0.0001) between SO0 (22%) and caudal sites in 29 (21%). The SO0 for most focal AT can be reliably approximated with simple criteria to minimize the confounding influence of the preceding T wave. The SO0 (successful ablation site) was assigned to one of 18 predetermined regions based on biplane fluoroscopic images (67 AT) or electroanatomical reconstructions (71 AT). PWC in each lead was analyzed for ability to discriminate SO0 in 3 different dimensions: left (LA) vs right, posterior/anterior (mitral or tricuspid) vs nonannular (crista, pulmonary vein, other), and caudal vs cranial. The origin of AT was an annulus in 57 pts (41%), crista in 34 (25%), pulmonary vein in 16 (12%), and other sites in 11 (8%). AT originated from LA sites in 30 pts (22%), and excluded sites in 16 (11%).

<table>
<thead>
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<th>SITE</th>
<th>LEAD</th>
<th>PWC</th>
<th>SEN</th>
<th>SPEC</th>
<th>PPV</th>
<th>NPV</th>
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<td>ANNULAR</td>
<td>V1-V6</td>
<td>+ or +</td>
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<td>91%</td>
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<td>51%</td>
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<tr>
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<td>aVL</td>
<td>+ or +</td>
<td>73%</td>
<td>67%</td>
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<tr>
<td>ANNOTULAR</td>
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<td>- or -</td>
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<td>91%</td>
<td>86%</td>
<td>91%</td>
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<tr>
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<td>86%</td>
<td>93%</td>
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<td>46%</td>
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</table>

A Novel Form of Focal Atrial Tachycardia Arising From the Tricuspid Valve Annulus: A New Ring of Fire?

Sel Heal, Steven M. Markelz, Kenneth M. Stain, Susan Mittel, David J. Sloviter, Mihalesh K. Das, Bruce B. Lerman. Cornell University Medical Center. New York, NY

Background: A “ring of fire,” comprising a majority of right atrial tachycardias (AT), originates along the crista terminalis as previously described. We have demonstrated that these adenosine-sensitive ATs are focal and are due to either triggered activity or calcium-dependent microreentry. A unique form of local AT arising from the interatrial septum has also been described. We have identified a novel form of focal AT arising from another “ring of fire” along the tricuspid valve annulus (TA) which includes ATs from Koch’s triangle (TA). This study population consisted of 9 consecutive patients (58 +/- 15 yrs; SF) with AT arising from the TA, 8 pts underwent 0 electroanatomical mapping (CAIIO, Datic, sanos), and 8 pts were given adenosine during tachycardia.

Results: AT arises from the crista terminalis as previously described. We have identified a novel form of focal AT arising from another “ring of fire” along the tricuspid valve annulus (TA) which includes ATs from Koch’s triangle (TA).

Conclusions: This new “ring of fire” is also present in the crista terminalis as described by others and is also present in the crista terminalis as described by others. The origin of AT can be reliably approximated with simple criteria to minimize the confounding influence of the preceding T wave.

POSTER SESSION

1272-127 Atrial Fibrillation: Cardioversion, Catheter Ablation

Tuesday, March 20, 2001, 3:00 p.m.-5:00 p.m.
Orange County Convention Center, Hall A4
Presentation Hour: 4:00 p.m.-5:00 p.m.

1272-127 Does Digoxin affect the outcome of DC cardioversion in Humans?

Xiaohua Guo, Mark M. Gallagher, Yee G. Yap, Monica Harris, Merel Malik, John Camm. St. George's Hospital Medical School. London, United Kingdom

Background: Digoxin is widely used to control heart rate in atrial fibrillation (AF). In animal models Digoxin aggravates tachycardia-induced atrial structural remodeling which increases the inducibility, duration of AF and delays the recovery of atrial function after resolution of sinus rhythm (SR). We assessed whether Digoxin has an adverse clinical effect on AF.
effect on the outcome of direct current cardioversion (DCC) in human subjects. Method: 125 patients (90 Men, 65±10 years old) who received DCC for persistent AF were investigated prospectively. ECGs were recorded during DCC and repeated 1 week and 1 month later to assess success. The Digoxin group was not treated after DCC. The outcome of DCC was compared between patients who received Digoxin alone (Dig-), Digoxin with antiarrhythmic drugs (Dig+ Anti-drug) and those who did not taking Digoxin (Dig-).

The dose-response relationship of the effect of Digoxin on the outcome of DCC was also calculated. Subgroup analysis was further performed by stratifying for a history of age > 65 and 75 years old, AF duration (>6 and >12 months), LA size (>44mm) as well as for a combination of adverse factors (patients who were age >60 years old with AF duration >6 month and abnormal LA size). The chi-squares, Student t and NPar Kruskal-Wallis tests were used.

Results: Out of 125 patients, DCC failed, Digoxin defined as uninterrupted AF or SR for 1 month. Outcome was not influenced by Digoxin (Table) including analysis in each subgroup. Conclusion: Contrary to animal studies our investigation showed Digoxin did not have any significant adverse effect on the outcome of DCC in the patients studied.

### Table 1

<table>
<thead>
<tr>
<th>Number of Patients (%)</th>
<th>Dig+</th>
<th>Dig- Anti-drugs</th>
<th>Dig-</th>
<th>P value</th>
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<tr>
<td>Total patients: 125</td>
<td>116</td>
<td>70</td>
<td>7</td>
<td>0.03</td>
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<tr>
<td>DCC failure: 10</td>
<td>11</td>
<td>6</td>
<td>3</td>
<td>0.14</td>
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</table>

1272-128 Reduction of Left Atrial Stretch Facilitates Internal Cardioversion of Chronic Atrial Fibrillation in Patients Undergoing Percutaneous Balloon Mitral Valvuloplasty for Mitral Stenosis

Katherine Fan, Kathy L. Lee, Wing Hon Cheung, Elaine Chau, On Hing Kwok, Chu Pak Lau, Grantham Hospital, Hong Kong, Hong Kong

Background: Chronic atrial fibrillation is common in mitral valve disease, with increased incidence of heart failure and thromboembolism. Percutaneous balloon mitral valvuloplasty has been shown to have favorable outcome for patients with severe mitral stenosis. We assessed the effect of acute reduction of left atrial pressure on internal cardioversion of atrial fibrillation for these patients.

Methods: Internal cardioversion were carried out in 11 patients (mean age 47±11 years) with chronic atrial fibrillation (mean duration 3.2 years) and severe mitral stenosis before balloon mitral valvuloplasty (mean duration 27±11 years) patients. The remainder were in SR for >24h. Outcome was not influenced by Digoxin (Table) including analysis in each subgroup. Conclusion: Internal cardioversion with a single catheter was shown to have favorable outcome for patients with severe mitral stenosis. We assessed the effect of acute reduction of left atrial pressure on internal cardioversion of atrial fibrillation for these patients.

Results: Of the 25 pts, 2 had a history of SD, and 11 had had syncope, 18 were inducible. 6 pts were placed on antiarrhythmic drugs after EPS. In 5 pts successful radiofrequency ablation was attempted in case of inducible polymorphic VT, monomorphic poorly tolerated VT or history of cardiac arrest. Ablation was attempted in case of monomorphic, well tolerated VT. Antiarrhythmic drugs (AAD) were prescribed in non-inducible pts with a history of syncope or early familial sudden death.

Conclusion: Internal cardioversion with a single catheter and an external pulse electrode is feasible and effective. In comparison to conventional ICV techniques this method is easy to perform and less complex with regard to time and cost aspects.
Regional Myocardial Response to Defibrillation Shocks is a Key Determinant for Shock Outcome: An Optical Mapping Study in Swine

Nitin Choudhary, Joelan Furlan, Richard A. Gray, Stephen F. Herfkens, University of Alabama at Birmingham, Birmingham, AL

For shocks near 50% defibrillation success (DF50) delivered from electrodes at right ventricular apex (RVA) and left ventricular apex (LVA), posterior ventricular surfaces were optically mapped using 2 CCD cameras. The time to first retrograde (RT75), and the coupling interval between the last VF activation immediately preceding the shock and the shock onset (CI) were determined at 3 regions (-4.6 cm^2 each): left ventricular apex (LVA), base (LVB), and right ventricular apex (RVA). Results: Of 60 shocks delivered from electrodes at RVA and SVC, myocardial response to the shock at the early site determines shock outcome.

Device Infections: Clinical Outcome Following Early Device Reimplantation


Reimplantation of the device on the contralateral side was performed in all patients 4.2±0.5 days (median 4 days, range 1-7 days) after extraction. The duration of post extraction antibiotic therapy was 2.5±0.2 weeks. During 4.1±0.8 months of followup, recurrent device infection was not observed. Conclusions: These data suggest that in patients without evidence of a systemic infection, reimplantation of a pacemaker or defibrillator on the contralateral side may be appropriately performed within days of the extraction procedure.

Detection Algorithm: Retrospective Analysis of Supraventricular Tachycardia With Long PR Intervals

Yingxian Sun, Mauricio S. Artuda, Karen J. Beckman, Hiroshi Nakagawa, Peter Spector, Nayyar Shah, James Culmone, Daniel Ludgate, Arao Rso, Ralph Laszcz, Warren M. Jacobson, University of Oklahoma, Oklahoma City, OK

Background: Despite advances in dual chamber tachyarrhythmia detection algorithms, inappropriate ICD therapy for fast supraventricular rhythms may still occur. The PR Logic Detection Algorithm (PR Logic) is based on clinical history and risk assessment by electrophysiological study in effective in establishing a therapeutic approach for ARVD which is safe and effective.

Methods: All stored spontaneous tachycardia episodes (n=31) from 6 GEM DR pts with LPR SVT were re-evaluated using the enhanced PR Logic algorithm. Results were compared to the PR Logic performances in the GEM DR clinical study (1:1 VT-ST boundary = 85%).

Results: Classification Result with 1:1 VT-ST boundary set to:

- 35% (GEM DR)
- 50%
- 66%
- 75%
- 85%

Conclusions: This retrospective analysis shows that changing the 1:1 VT-ST boundary in PR Logic for a subset of patients can reduce the incidence of inappropriate therapy. Selection of this parameter should be done carefully, since patients may also have VT with 1:1 conduction. With this enhancement, the PPV of PR Logic can be up to 96.5% (95% adjusted).

Device Infections: Clinical Outcome Following Early Device Reimplantation

Steven P. ChoUgh, Christian Sticherling, Robert L. Baker, Kristina Wasmer, Hiroshi Tada. University of Michigan Medical Center, Ann Arbor, MI

Background: Infection is an uncommon yet serious complication of pacemaker or defibrillator implantation. While complete removal of the pacing or defibrillator system is recommended, there is no consensus regarding the optimal timing for reimplantation. After extraction, patients are generally treated with intravenous antibiotics for 2 to 6 weeks prior to reimplantation. Objective: The goal of this study was to determine the safety and feasibility of reimplantation of a pacemaker or defibrillator within 1 week after extraction for an infection. Methods: Between November 1999 and July 2000, 14 consecutive patients (10 male, 4 female, age 66±5 yrs) who presented to our institution with a pacemaker (n=9) or defibrillator (n=5) infection were prospectively followed. On presentation, presentation with fever in 80% of patients had evidence of generator pocket infection, and 21% had fever or systemic illness. Lead or wound cultures were positive in 79% of patients and initial blood cultures were positive in only 7% of patients. Vegetations were seen with transesophageal echocardiogram in 85% of patients. All patients underwent complete transcatheter device extraction (21±6.1 months following initial implantation) using standard techniques. Intraoperative antibiotics were continued following extraction. All patients were without fever, leukocytosis, or positive blood cultures at the time of reimplantation Results: Reimplantation of the device on the contralateral side was performed in all patients 4.2±0.5 days (median 4 days, range 1-7 days) after extraction. The duration of post extraction antibiotic therapy was 2.5±0.2 weeks. During 4.1±0.8 months of followup, recurrent device infection was not observed. Conclusions: These data suggest that in patients without evidence of a systemic infection, reimplantation of a pacemaker or defibrillator on the contralateral side may be appropriately performed within weeks of the extraction procedure.

The Enhanced PR Logic™ Dual Chamber Tachyarrhythmia Detection Algorithm: Retrospective Analysis of Supraventricular Tachycardia With Long PR Intervals

Bruce L. Wilkoff, Jeffrey M. Gilberg, Cynthia M. DeSouza. The Cleveland Clinic Foundation, Cleveland, OH, Medtronic Inc., Minneapolis, MN

Background: Despite advances in dual chamber tachyarrhythmia detection algorithms, inappropriate ICD therapy for fast supraventricular rhythms may still occur. The PR Logic "Single Electrode" (ST) algorithm in GEM DR and GEM DR (MD) algorithms discriminate between atrial or sinus tachycardia(SVT) and VT with 1:1 retrograde conduction based on atrial(R) or ventricular(V) overt timing. Rhythms with PR intervals <50% RR interval may be considered ST. Rhythms with PR intervals >50% RR intervals, i.e., Long PR(LPR), may be considered VT. Early GEM DR clinical study results showed a positive predictive value (PPV) of 0.02% (716/700, 0.12% as adjusted for multiple episodes per patient) and 100% sensitivity for detecting true VT/SVT. SVTs in 8 patients(pts) received inappropriate VT/VF therapy due to LPR. The 1:1 VT-ST boundary parameter in the GEM DR study was classified as SVT when the 1:1 VT-ST boundary was set to 85%. One VT with 1:1 retrograde conduction was classified as SVT when the 1:1 VT-ST boundary was set to 85%.

Conclusions: This retrospective analysis shows that changing the 1:1 VT-ST boundary in PR Logic for a subset of patients can reduce the incidence of inappropriate therapy. Selection of this parameter should be done carefully, since patients may also have VT with 1:1 conduction. With this enhancement, the PPV of PR Logic can be up to 96.5% (95% adjusted).

Magnetic Navigation System for Intracardiac Pacing and Ablation

Mitchell N. Faddis, Andrew F. Hall, Michael Taponcic, Jennifer Dehne, John C. Rasch, Jon C. Self, Bruce D. Lindsay. Washington University School of Medicine, St. Louis, MO

Background: We have evaluated a Magnetically Guided Catheter that generates external magnetic fields to control the precise movement and position of a Magnetically Guided Catheter and eliminates the need for conventional steering mechanisms. This study compared the safety and equivalency of this Magnetically Guided Catheter to a conventional catheter in catheters.

Methods: The study evaluated electroanatomic maps, pacing thresholds, signal to noise ratios, noise, and histopathologic analysis for signs of myocardial injury in 9 patients with atrial fibrillation. The system was tested for speed and accuracy to specified targets in the right atrium, right ventricle, left atrium, and left ventricle.

Conclusions: The Magnetically Guided Catheter System is composed of bipolar fluorescent, a computer to control the system, and an array of superconducting electromagnets that surround the subject's torso and generate programmable magnetic fields to navigate a 7 Fr magnetic
cise. A graphic interface was used to select the target direction on opinar fluoroscopic images, then the computer calculated the 3D magnetic field vector to navigate the Magnetically Guided Catheter.

Results: There were no differences in the signal acquisition at a level of 75 sites (2.3±1.8 mV vs 4.5±3.4 mV), the pacing thresholds at 15 sites (1.3±0.6 vs 1.4±0.6 mV), or the mean His bundle signal to noise ratio when the Magnetically Guided Catheter and conventional catheter were compared. The Magnetically Guided Catheter was navigated successfully to 45 sites (91%) in all four cardiac chambers (68%), with some points in one chamber failed due to inability to cross the aortic valve in 1 of 6 animals. The mean fluoroscopic distance between the distal electrode of the Magnetically Guided Catheter and the presumed His bundle region was 1.7 ± 1.0 mm (range: 0.4-5.2 mm). There was a far field of electrical signals from the septal leaflet of the aortic valve caused by inciden-
tial catheter contact during navigating in the left atrium.

Conclusions: These results demonstrate the equivalence of the Magnetically Guided Catheter compared to the conventional catheter for pacing and recording. We have also shown the ability to accurately navigate the Magnetically Guided Catheter to precise tar-
gets in all four cardiac chambers.

Differences in His to Atrial Interval in Atrioventricular Nodal Reentrant Tachycardia: Distinction Among Tachycardia Subtypes and Relationship to Heart Block With Catheter Ablation

Gregory T. Altemose, John V. Jayachandran, Douglas P. Zipes, John M. Miller. Indiana University School of Medicine, Indianapolis, IN

Background: Prior studies have suggested the existence of AV nodal tissue interspersed between the bundle of His bundle and His bundle (the interposed portion, LC), during atraumatic nodal reentrant tachycardia (AVNRT). We have observed that the dis-
dance in His to atrial (HA) intervals during ventricular pacing (VP) and SV (Δ HA = (HA-VP-HA-SV) in the atrium free of AV nodal reentry (AVNRT) (FP), slow-and-fast (SF) and fast-and-slow (FS)). The purpose of this study was to further characterize these differences.

Methods: We studied 323 patients who underwent electrophysiology study and catheter ablation for AVNRT. Of these, 228 patients (71%) with a mean age of 49±19 years had a retrograde His visible during VP at the SV cycle length (CL); 215 patients (99%) had SF, 15 (6%) had SS and 9 (4%) had FP. The Δ HA was measured from the end of the His deflection to the onset of the atrial electrogram in the His bundle during VP, pacing at the SV CL and the length of the atrial electrogram measured from the onset of the His deflection to the onset of the atrial electrogram in the same recording during VP. Results: The CL of SS (442±140 ms) was significantly longer than DP (300±62 ms), (p<0.0001). There was no significant difference between CL of FP (392±53 ms) and SS or FP. The Δ HA was significantly different (p<0.0001) among the three forms of AVNRT: AVNRT (FP:342±54 ms > SS (322±23) ms > DP (193±39 ms), (p<0.0001). The Δ HA was significantly different (p<0.0001) among the three forms of AVNRT (FP: (293±54) > SS (205±31) > DP (103±39) ms). The Δ HA was significantly longer in the FP (293±54) ms > FP (193±39) ms. The Δ HA was significantly longer in the FP (293±54) ms > FP (193±39) ms. The Δ HA was significantly longer in the FP (293±54) ms > FP (193±39) ms.

Conclusions: These results demonstrate the equivalence of the Magnetically Guided Catheter compared to the conventional catheter for pacing and recording. We have also shown the ability to accurately navigate the Magnetically Guided Catheter to precise targets in all four cardiac chambers.

Effects of Circumferential Radiofrequency Ablation of Pulmonary Vein Ostia on Supraventricular Arrhythmia Abatement in Patients With Atrial Fibrillation

Carlo Pappone, Salvatore Rosanio, Monica Tocci, Vincenzo Santinelli, Stefano Nardi, Adriano Saksik, Simona Gulotta, Cecilia Zizzadri, Gabriela Viisoudomi. J. Rufolesi University Hospital, Milan, Italy

Background: Focal pulmonary vein (PV) ablation for atrial fibrillation (AF) may result in transient alterations in heart rate variability (HRV), suggesting reversible autonomic dys-
function. We report the effects on supraventricular arrhythmia burden of circumferential RF lines of conduction block around all 4 PVSs, in a novel anatomically-based technique developed in our laboratory.

Methods: We selected 75 pts with paroxysmal AF (77% male; age 56±9 years; AF duration 3.7±1.4 years; 36% with structural heart disease). All pts underwent 24-h Holter recording pre-AF and, at 3 and 6 months post-AF, autonomic function was assessed using time- and frequency-domain HRV analysis.

Results: Using the CARTO mapping system, lesions were deployed at 1-mm from PV orifice. Novel circumferential lines inside the circular borders (deep-tissue mapping) ablation electrogram amplitude <0.1 mV was 4±1.5±5.2mm², accounting for 26±6% of the total left atrial surface. Transient severe bradycardia (<40 bpm), sinus arrest or syncopal hypotension (<90mmHg) occurred in 15 pts (17%) during AF delivery. No arrhythmias were recorded during 48-h telemetry or subsequent Holter monitoring. Follow-up HRV mea-
sures did not differ between pts with and without acute baroreflex responses. Compared with pre-AF, time-domain measures primarily mediated by parasympathetic tone (pNN50, RMSSD) were increased in all pts, and frequency domain analysis suggested decreased sympathetic tone (LF power; 4.5±0.6 vs 5.2±0.3 normalized units, p<0.01; LF/ HF ratio: 1.7±0.4 vs 2.0±0.4, P<0.01). Remarkably, a higher LF/HF ratio was correlated (P<0.01) with AF recurrence (11 pts, 15%).

Conclusion: Unlikely focal isolation, extensive debulking in the PV regions rich in endocard-
ical nerve terminals is associated with persistent autonomic changes. The shift of symp-
vathelial balance towards parasympathetic predominance may contribute to suppression of AF.

Prevalence and Significance of Exit Block From Multiple Pulmonary Veins in Patients With Paroxysmal Atrial Fibrillation


Background: Exit block from arrhythmogenic pulmonary veins (PV) during atrial fibrillation (AF) is a common observation. However, the prevalence and significance of exit block from multiple PVs during AF are unclear. The purpose of this study is to determine the prevalence and significance of exit block from multiple PVs during AF Methods: An electrophysiologic study was performed in 15 men and 6 women (mean age 55±10 years, left ventricular ejection fraction=0.54±0.05, left atrial size=36±7mm) with paroxys-

tal or persistent AF (duration=58±44 months). High-frequency energy was delivered in 14 patients at 22 different arrhythmogenic loci (13 left superior PV; 6 right superior PV; 2 left inferior PV, 1 right inferior PV). Pulmonary vein isolation was performed in one patient. Results: The acute success rate was 93%. The prevalence of exit block during spontaneous and induced AF was 75% vs. 86% in left superior PV (p<0.05), 57% vs. 80% in left inferior PV (p=0.01), 57% vs. 72% in right superior PV (p=NS), and 69% vs. 67% in right inferior PV (p=NS), respectively. Exit block during the same episode of AF was observed in all 4 PVS in 8 patients (40%), 3 PVs in 2 patients (12%), 2 PVs in 6 patients (30%), and 1 PV in 2 patients (10%). There was no difference in the prevalence of exit block between spontaneous and induced ablation episodes of AF. Among the 14 patients in whom ablation was attempted, the effective site was within a PV that demonstrated exit block in 10 patients. In 8 of these patients, there was at least i other PV with exit block which was not the trigger for spontaneous initiation of AF. In 3 patients, the effective site was in a PV that did not display exit block, despite the presence of exit block in other PV(s). Conclusions: Exit block from a PV during AF does not necessarily indicate that the trigger for spontaneous AF is originating in that PV. Rather, during AF there may be passive activation of bystander PVSs, with the initiation of exit block requiring the presence of exit block between spontaneous and induced ep-
sodes of AF. In 3 patients, the effective site was in a PV that did not display exit block, despite the presence of exit block in other PV(s). the site of AF remains to be determined.
1010 Noninvasive Testing: Risk Stratification

Wednesday, March 21, 2001, 9:00 a.m.-11:00 a.m.
Orange County Convention Center, Hall A4

9:00 a.m.

Relationship of Principal Component Analysis of the T-Wave Vector Loop to T-Wave Morphology and Ventricular Hypertrophy: The Strong Heart Study

Peter M. Cohn, Richard B. Devereux, Richard F. Fabsitz, Ellsa T. Lee, James M. Galloway, Barbara V. Howard. Weill Medical College of Cornell University, New York, NY

Background: Echocardiographic left ventricular hypertrophy (LVH) is known to predict cardiovascular death (CVD) that is frequently arrhythmic. Principal component analysis (PCA) of the T-wave vector loop, an ECG measure of repolarization abnormality also predicts CVD. However, the relation of LVH to PCA measures remains unclear.

Methods: The relation of LVH to PCA of the T-wave was assessed in 1454 American Indian participants in the second Strong Heart Study examination with no clinical or ECG evidence of coronary artery disease, who were in sinus rhythm, with no bundle branch block, and with at least 6 total and 3 precordial leads with technically adequate Q-T interval measurements by computer on digitally-acquired ECGs. Abnormal T-wave total morphology (TWM) was defined by the ratio of the 2nd to 15th eigenvector of the T-wave vector loop measurement by PCA (PCA ratio). An abnormal PCA ratio was defined based on gender-specific 90th percentile values, previously determined to predict CVD death: PCA ratio >24.6% in men and >32.0% in women. LVH was defined by LV mass indexed to height$^2$ >49.2 g/m² in men and >32.0% in women. LVH was defined by LV mass indexed to height$^2$ >49.2 g/m² in men and >32.0% in women.

Results: LVH was present in 283 participants (20%). Taking into account gender differences using two-way ANOVA, LVH was associated with elevated PCA ratios (20.7±10.6 vs 17.1±5.2%, p=0.001) and a higher prevalence of an abnormal PCA ratio (19.7 ± 7.6%, p=0.002). After further adjusting for baseline differences in systolic blood pressure, creatinine and fibrinogen levels, urine albumin to creatinine ratio, smoking, and the prevalence of diabetes, using multivariate ANOVA, LVH remained strongly associated with a significantly increased PCA ratio (10.9±1.2 vs 10.0±0.5, p=0.001). Using stepwise logistic regression analyses and the same covariates, LVH remained a strong predictor of an abnormal PCA ratio (odds ratio 2.07, 95% confidence interval 1.34-3.20).

Conclusions: LVH is associated with an increased PCA ratio and an increased risk of an abnormal PCA ratio, independent of possible confounding variables. These findings suggest that repolarization-related ventricular arrhythmias may be in part accounted for the increased risk of CVD with LVH.

9:12 a.m.

Measurement of Microvolt T-Wave Alternans During Standard Treadmill Exercise Protocols

Anthony A. Magnano, Daniel M. Bloomfield. Columbia University College of Physicians & Surgeons, New York, NY

Background: T wave alternans (TWA) measured using bicycle exercise test (BET) is associated with increased susceptibility to ventricular arrhythmias. Recently, sophisticated noise reduction methods have made it possible to measure TWA during treadmill exercise (TM). Since most exercise tests in the U.S. utilize TM rather than BET, we assessed the validity of TWA testing during TM as compared to BET. Methods: Patients underwent sequential TWA measurements during BET and TM. TWA was measured using a spectral method and was considered positive (POS) if there was sustained TWA >1.9 mV for at least one minute at an onset heart rate >110 bpm. A negative (NEG) TWA study required a heart rate >105 bpm with notches <1.8 mV and ectopics <10% for 1 minute without sustained TWA. All other TWA tests were considered indeterminate (IND). Results: 73 subjects were enrolled including 34 healthy controls and 49 patients with heart disease (predominantly NYPHA class II-III congestive heart failure). Of the 56 (77%) cases which had determinate results, neither POS nor NEG were seen in both tests, the agreement between BET and treadmill was 89% (Kappa 0.72, p<0.001) (see table). In the subset of patients with heart disease and determinate results on both tests (32 cases), the agreement between BET and TM was 81% (Kappa 0.62, p<0.001). Fewer TM tests were indeterminate (33% vs 23%, p=0.001), and the indeterminate tests, fewer TWA tests were indeterminate because of inability to achieve a target HR of 105 bpm (TM: 3/11 vs BET: 7/13). Conclusion: There is a high level of agreement between TWA measured during BET and TM. During TM, patients are more likely to achieve the target HR of 105 bpm, which will lower the rate of indeterminate tests. These data demonstrate that TWA can be effectively measured during TM, which should allow for more widespread use of TWA to identify patients at risk for sudden cardiac death during standard stress testing.

TWA Results: Comparison of BET and TM

<table>
<thead>
<tr>
<th>Condition</th>
<th>TM POS</th>
<th>TM NEG</th>
<th>TM IND</th>
</tr>
</thead>
<tbody>
<tr>
<td>TWA POS</td>
<td>5</td>
<td>15</td>
<td>1</td>
</tr>
<tr>
<td>TWA NEG</td>
<td>3</td>
<td>7</td>
<td>13</td>
</tr>
<tr>
<td>TWA IND</td>
<td>11</td>
<td>17</td>
<td>48</td>
</tr>
</tbody>
</table>

Conclusion: Heart rate turbulence (HRT) is a phenomenon described recently to measure the chronotropic response of sinus rhythm to ventricular premature beats (VPBs) and has been shown to predict mortality. However, the actual mechanism of HRT and factors that may influence its measurement are unknown. We analysed this prospectively collected Holter recordings of 1498 (254 M, age 60±9.5) post-myocardial infarction (MI) patients with left ventricular ejection fraction (LVEF) ≤40% from the EMAT study. 2 parameters of HRT, turbulence onset (TO) and turbulence slope (TS) as well as time domain heart rate variability were measured from Holter ECGs using a combination of noise reduction methods. TO is a measure of the acceleration phase and it is the relative change of TO intervals immediately before and after a VPB. TS is a measure of the deceleration phase and it is the steepest regression line between TO interval count and duration. Clinical data were prospectively collected. Linear regression analysis was used. Results: TO and TS were significantly affected by heart rate, age, left ventricular ejection fraction, NYHA class, diabetes (DM) and frequency of VPBs (Table). Furthermore, TO and TS are influenced by tricyclobenzene, beta-blocker, ACE inhibitor but not amiodarone. TO and TS are not affected by gender, previous angina, systolic blood pressure or LVEF. 43 patients were enrolled including 24 healthy controls and 49 patients with heart disease (NYHA class II-III congestive heart failure). Of the 56 (77%) cases which terminated because of inability to achieve a target HR of 105 bpm (TM: 3/11 vs BET: 7/13). Fewer TM tests were indeterminate (TM 22% vs. BET 27%). Of the Indeterminate tests, more TM tests were POS for TO (73 vs. 52%) and TS (90 vs. 72%). These data demonstrate that TWA can be effectively measured during TM, which should allow for more widespread use of TWA to identify patients at risk for sudden cardiac death during standard stress testing.
1010-209 Prevalence of T Wave Alternans in Ischemic and Nonischemic Cardiomyopathy

Anthony R. Redfearn, Raphael B. M. Bloomfield, Columbia University College of Physicians & Surgeons, New York, NY

Background: Risk stratification methods, including electrophysiologic study (EPS), have lower predictive accuracy in non-ischemic cardiomyopathy (NICM) as compared to ischemic cardiomyopathy (ICM). However, preliminary data suggests that presence of microvolt T-wave alternans (TWA) during exercise may be a strong predictor of arrhythmic events in both NICM and ICM. We, therefore, sought to determine the prevalence of TWA in NICM and ICM. METHODS: TWA testing during exercise was performed in 158 consecutive heart failure patients. TWA was measured using a spectral method and was considered positive if there was sustained TWA >1.9 mV for at least one minute at an onset heart rate ≤110 bpm. A negative TWA study required a heart rate ≥105 bpm with noise <1.8 mV and ectopics <10% for 1 minute without sustained TWA. At other TWA tests were considered indeterminate. RESULTS: The prevalence of TWA was 41% in patients with ICM as compared to 46% in NICM. Aortic valve disease in the ICM group, significant differences in ejection fraction or NYHA class were present.

Patient Characteristics: ICM vs NICM

<table>
<thead>
<tr>
<th>Patients with TWA (%)</th>
<th>NICM</th>
<th>ICM</th>
<th>OR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall</td>
<td>46%</td>
<td>41%</td>
<td>1.05 (0.80-1.40)</td>
</tr>
<tr>
<td>Age</td>
<td>45%</td>
<td>46%</td>
<td>1.00 (0.73-1.36)</td>
</tr>
<tr>
<td>Arhythmia</td>
<td>41%</td>
<td>46%</td>
<td>1.06 (0.81-1.42)</td>
</tr>
<tr>
<td>NYHA class</td>
<td>38%</td>
<td>37%</td>
<td>1.03 (0.70-1.52)</td>
</tr>
</tbody>
</table>

Thrombolysis


1010-208 The Prognostic Significance of Intermediate QRS Prolongation in Acute Myocardial Infarction Treated With Thrombolysis

Rebecca Field, Martin F. Feinberg, Horst Herzig, Valentine Byck, J. M. Lendrem, S. Halpern, Berlin Cardiovascular Research Institute, Tel Hashomer, Israel

Background: Complete right and left bundle branch block (RLLBBB) and advanced atrioventricular block present on admission electrocardiograms of patients with acute myocardial infarction (AMI), are associated with poor short- and long-term outcome. Little is known about the impact of Intermediate QRS prolongation (0.09-0.11 s) on the prognosis of AMI. Methods: The University of Muenster database since 1985 was reviewed and all patients with AMI treated with thrombolysis were correlated with manually measured QRS duration of admission electrocardiograms. Results: The QRS duration was >0.09 s in 536 (46%) patients, between 0.09-0.11 s in 467 (40%) patients and ≤0.11 s in 70 (6%) patients. QRS duration was strongly associated with 7-day (0.6%, 6.1%, p=0.001), 30-day (11%, 6%, 22%, p=0.001) and one-year (3%, 11%, 26%, p<0.001) all-cause mortality. Multivariate regression analysis of mortality were as follows:

<table>
<thead>
<tr>
<th>QRS duration</th>
<th>7-day</th>
<th>30-day</th>
<th>1-year</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;0.09 s</td>
<td>0.6%</td>
<td>6.1%</td>
<td>p=0.001</td>
</tr>
<tr>
<td>0.09-0.11 s</td>
<td>6.1%</td>
<td>22%</td>
<td>p=0.001</td>
</tr>
<tr>
<td>≤0.11 s</td>
<td>11%</td>
<td>21%</td>
<td>26%</td>
</tr>
</tbody>
</table>

Conclusion: Intermediate QRS prolongation in evolving AMI emerged as an independent risk predictor of short and long-term all-cause mortality.
The primary endpoint of the study was the composite rate of cardiac death and serious arrhythmic events. In the multivariate analysis, five parameters were significantly associated with the endpoint, namely LVEF, HRT, miR-1, presence of AFB and of BBB (see Table). Conclusion: A statistical model for risk stratification in patients treated by PTCA/IStenting during the acute phase of myocardial infarction should include LVEF, HRT, miR-1, presence of AFB and of BBB.

POSTER SESSION

1297 Animal Models of Ventricular Arrhythmias
Wednesday, March 21, 2001, 9:00 a.m.-11:00 a.m.
Orange County Convention Center, Hall A4
Presentation Hour: 10:00 a.m.-11:00 a.m.

1297-111 Basic Fibroblast Growth Factor May Attenuate Susceptibility to Ventricular Tachyarrhythmias in Chronically Ischemic Porcine Myocardium

Background: Most cases of sudden cardiac death are caused by sustained ventricular tachyarrhythmias that occur in the setting of myocardial infarction or ischemia and congestive heart failure. The use of fibroblast growth factor (FGF) represents a novel method of improving myocardial blood flow and function via induction of angiogenesis. We examined whether local administration of FGF might have a beneficial effect in suppressing ventricular tachyarrhythmia (VT) in a chronically ischemic porcine heart model. Methods: Chronic ischemia was created in the left anterior descending or circumflex territories using an injury/ischemic model. FGF was delivered via a catheter to the myocardium using the anterior intraventricular vein (AV). Electrophysiology testing for VT was performed using ventricular burst pacing and programmed stimulation of up to triple premature stimulus at two sites in the right ventricle and at the site of focal wall motion abnormality in the left ventricle. Coronary perfusion was assessed using microspheres at 30 days after randomization to FGF or saline infusion. Results: In FGF treated pigs, there was a decrease in the inducibility of monomorphic VT (3/5 positive for inducible VT, 60%) compared with untreated animals (8/8 positive for inducible VT, 100%). Overall, a 16% (+2.3%) (95% CI) improvement in ischemic zone flow was observed after FGF treatment. Mids to moderate focal left ventricular hypokinesis was seen in all animals which corresponded to an average of 1-1.5 cm in diameter myocardial infarction on gross pathologic examination. Conclusion: Local delivery of FGF may diminish the proarrhythmic substrate of ischemic heart disease.

1297-112 Mechanism of VF Reinitiation After Failed Defibrillation
Shocks: An Optical Mapping Study in Isolated Swine Hearts
Nipon Chattipakorn, Isabella Banville, Richard A. Gray, Raymond E. Ideker. University of Alabama at Birmingham, Birmingham, AL

Previous studies show that following near threshold shock (NTH) shocks, the activation pattern of post-shock cycle 1 (De polarization) is similar for successful (S) and failed (F) shocks, suggesting that shock output is not determined by the immediate myocardial response to the shock. However, the refractoriness (R) columns were not determined in those studies. We sought to investigate the R patterns of the immediate postshock cycle and its relationship to defibrillation success. In each of 6 isolated swine hearts, 10 DFT shocks were delivered and the ventricular surface was optically mapped with 2 CCD cameras. The intercostic interval (OCI) an interval between the onset of 2 successive cycles and wavefront conduction times (WCT, an interval between the site of earliest and latest activation of a cycle) for D and R patterns were similar. Conclusion: The differences in the R patterns but not D patterns suggest that the long WCT-R of cycle 1 could have caused slow propagation of successive cycles which originates from the site as cycle 1, leading to unidirectional block, reentry and eventually VT.

1297-113 Upper and Lower Energy Limits of Vulnerability to Sudden Death With Chest Wall Impact (Commissural Cordis)
Mark S. Link, Barry J. Maron, Brian A. VanderBrink, Woi Zhu, Natesa G. Pandian, Paul J. Wang, M. & Marie时限, Fro8 Trill An4898, Medical Center, Brigham, MA, Minneapolis Heart Institute Foundation, Minneapolis, MA

Background: Sudden death can occur with chest wall blows during sports activities (commissural cordis). Clinical events suggest that the energy of impact is not of unusual force. Yet, this factor is difficult to quantify. Therefore, in an experimental model of commissural cordis, we examined the importance of the precise energy of impact. Methods: Jeunesse were 9 to 12 kg and the impact site was anterior pectoralis, posterior parietal, and randomized to receive chest wall strikes with a regulation baseball thrown from 20 to 70 mph during the vulnerable time window for the initiation of ventricular fibrillation (VF), 10 to 20 s after the peak of the T wave. Results: Impacts at 20 mph failed to produce VF. The incidence of VF increased incrementally to 72% at 40 mph, but then diminished at faster velocities (to 56% at 50 mph, 41% at 60 mph, and 30% at 70 mph). There were no significant differences between VF incidence in the smaller or larger animals. Conclusion: Baseballs impacting the precordium at 40 mph (typical speed of a little league pitcher) may be more deadly than baseballs delivered at higher velocities. Use of this model to assess safety equipment in sport (including balls and chest wall protective devices) may be life saving for young individuals participating in sporting activities.

ABSTRACTS - Cardiac Arrhythmias 135A

JACC  February 2001
1298 Implantable Cardioverter Defibrillator III

Wednesday, March 21, 2001, 9:00 a.m.-11:00 a.m.
Orange County Convention Center, Hall A4

Presentation Hour: 10:00 a.m.-11:00 a.m.

1298-114 Nonlinear-Dynamical Arrhythmia Control in Humans

David J. Christini, Kenneth M. Stein, Steven M. Markowitz, Sunee Tulit, David J. Sinkwiser, Mare A. Schirmer, Sai Iwai, Bruce B. Lerman. The New York Hospital - Cornell University Medical College, New York, NY

Background: Nonlinear-dynamical control, also known as chaos control, has been used to control the behavior of cardiac tissue in vitro. However, the feasibility of using such techniques to control cardiac dynamics has not been demonstrated in humans.

Methods: During diagnostic electrophysiological testing, 5 patients (3 male, 2 female; 52±17 yr) underwent rapid atrial stimulation at an adjustable interval (VA) following ventricular depolarization. VA was reduced until alternans in the atrioventricular (AV) conduction time was observed. An adaptive chaos-control technique, which made beat-to-beat perturbations to VA, was then applied to suppress alternans by stabilizing the underlying unstable steady-state conduction.

Results: In 5 of 5 control attempts, pacing-induced AV alternans were successfully suppressed. There was no correlation between control success and either antiarrhythmic medications (2 patients) or the presence of dual AV nodal pathways (2 patients). The Figure shows the AV intervals for those successful control attempts during one representative trial. AV alternans occurred when the VA intervals were held constant without control (N); alternans was suppressed when the VA intervals were perturbed (C) using the chaos control algorithm.

Conclusion: This proof-of-concept demonstration shows that nonlinear-dynamical control techniques are clinically feasible, thereby providing support for future investigations into their clinical utility.

1298-115 Indications and Frequency of Dual Chamber Implantable Defibrillator Use

Emmanuel Brilakis, Mary Jane Rasmussen, Nancy Lenovik, Win-Kuang Shen, Robert Rea, David Harves, Stephen Hammill, Paul Friedman. Mayo Clinic, Rochester, MN

Background: Dual chamber defibrillators (ICDs) have been advocated for patients with AV block, sinus dysfunction, paroxysmal atrial arrhythmias (for arrhythmia specific and preventative), left failure (presumably in the setting of a long PR interval), supraventricular and hypertrophic cardiomyopathy (HCM). However, single chamber devices offer greater simplicity and longevity, and lower cost. We sought to describe the frequency of implantation and indications for dual chamber ICD use at our institution.

Method and Results: Data were prospectively collected on all patients who underwent initial ICD implantation between 1/98 and 8/2000. Device selection was up to the treating physician, and indication for dual chamber device use was recorded at the time of implantation. Of 325 consecutive ICD recipients with a ventricular device indication, Marchese, Charles I. Haffajee. St. Elizabeth's Medical Center, Boston, MA. Tufts University School of Medicine, Boston, MA.

Background: Patients with idiopathic cardiomyopathy (ICM), clinical non-sustained ventricular tachycardia (VT) and inducible, non-suppressible VT on electrophysiology (EP) studies, who were randomized to conventional therapy in MADIT had a 27 month cardiac mortality rate of 50%. Even though 60% of the patients with an implantable defibrillator (ICD) had a shock within 2 years, appropriateness of defibrillator discharge was not assessed. In the MADIT ICD group, re-implantation was not done in the trial. Cardiac mortality was 65% in patients with cardiomyopathy (ICM) and 40%, non sustained VT and inducible VT on EP study who did not receive ICD. Electro-
Clinical Arrhythmias

Atrial Fibrillation: Pathophysiology and Ventricular Rate Control

Wednesday, March 21, 2001, 9:00 a.m.-11:00 a.m.
Orange County Convention Center, Hall A4
Presentation I: 10:00 a.m.-11:00 a.m.

1299 Atrial Fibrillation: Pathophysiology and Ventricular Rate Control

Long-Hai Liu, Jin-Jia Shi, Jin-Wei Liu, Shao K., Stephen Huang, Pharmacological Institute, National Taiwan University Hospital, Taipei, Taiwan, ROC, Department of Internal Medicine, National Taiwan University Hospital, Taipei, Taiwan, ROC

Background: Accumulation of somatic mutations of mitochondrial DNA (mtDNA) contributes to aging process and progressive organ dysfunction. We measured the amount of wild type mtDNA in atrial tissue and correlated the amount of mtDNA in patients with clinical atrial fibrillation (AF). Methods and Results: Atrial tissue from the right atrial appendage was obtained in 80 patients during open heart surgery (41 male and 39 female, 19 children and 61 adults, 25 with AF and 55 without. DNA from the atrial tissue was subjected to a nested polymerase chain reaction protocol for amplification of mtDNA. Primers for wild type mtDNA were added in the reaction for co-amplification. The mtDNA amount was normalized to wild type mtDNA amount. We found that the amount of mtDNA in AF was lower in AF patients. In the adult patients, the relative amount of mtDNA was significantly higher in patients with AF than in patients without AF (0.60 ± 0.24 vs 0.34 ± 0.30, p<0.01). The amount of mtDNA in AF was also positively correlated with age, left atrial pressure and right atrial pressure. Further multivariate analysis showed that only age and atrial fibrillation were independently associated with the amount of mtDNA (Table). The p values of correlation between clinical parameters and the amount of mtDNA were shown in Table. The amount of mtDNA in AF patients was significantly lower than in patients without AF.

Conclusions: Binary-search and step-down protocols yield similar DFT, since binary-search determines the DFT with fewer trials, it should be used when multiple determinations of DFT are required. DFT - Duration of a typical Myocardial Infarction Cycle.
With this technique, the ventricular activation is antegrade but irregular, in contrast to AVN ablation plus regular but retrograde right ventricular pacing (RVP). Although both backgrounds: Previous experiments have demonstrated that postganglionic vagal stimulation (PGVS) effectively slows the rate of AF. The goal of this study was to determine if varying the intensity of PGVS could maintain the ventricular rate (VR) in atrial fibrillation (AF).

Methods: AF was induced and maintained in 6 dogs by rapid atrial pacing. AVNVS was delivered to vagal nerves projecting to the AVN and resulted in anterograde ventricular activation with VR that was slowed towards the basic sinus rate. Then the AVN was ablated and RVP was initiated that resulted in retrograde activation at a constant rate similar to the average VR obtained with AVNVS. Major hemodynamic parameters were provided by a feedback algorithm that compared the current ventricular interval (VI) with the target interval (TI).

Results: The graph above shows a typical 500 beat run. The VR during AF prior to the application of PGVS was 254 ms. The VI was 400 ms, close to the normal sinus rate. The thin line is the VI (ms). The thick line is the PGVS intensity (mA) applied to the AVN fat pad. The table above the graph shows the % of the target achieved and the PGVS feedback (mA) in blocks of 100 VI over the entire 500 VI run in all studied hearts. Overall, 95.9% of the target was achieved over the last 400 beats with a PGVS amplitude of 4.6 ± 0.6 mA.

Conclusion: A target mean VR close to the normal sinus rate can be reached and maintained during AF by computer control of PGVS to the AVN fat pad. This novel approach may be clinically feasible. Further optimization of the feedback algorithm will be directed toward reduction of the heart rate variability.

The amount of atrial fibrosis correlates with the prevalence of AF after OHS. Thus, atrial fibrosis provides a morphologic substrate which increases the likelihood of AF in response to proarrhythmic events.

A hemodynamic comparison of 2 strategies for control of ventricular rate during atrial fibrillation: local vagal stimulation versus atroventricular nodal ablation with right ventricular pacing.
**Atrial Fibrillation: Antiarhythmic Drug Therapy**

Wednesday, March 21, 2001, 9:00 a.m.-11:00 a.m.
Orange County Convention Center, Hall A4

**Presentation hour: 10:00 a.m.-11:00 a.m.**

**1300-127 Randomized Trial of Propafenone, Ibutilide, or Rate Control in Postoperative Atrial Fibrillation**

Richard J. Sothern, Jr., Neal Lipman, Michael L. Therrien, David I. Shrierman, Melinda Aboden, Kp Madhusoodanan, Niharika Daluwang, Ph.D. Dangor, Ellen Barr, St. Francis Hospital and Medical Center, Hartford, CT, CT

**Background:** It is unclear whether acute conversion of atrial fibrillation (AF) with antiarrhythmic drugs following cardiac surgery restores and maintains sinus rhythm and reduces length of stay (LOS). **Methods:** A randomized prospective trial was conducted in 2 teaching hospitals from 3/30/98 to 8/30/99 to study the effect of the early use of ibutilide or propafenone on the duration of AF, rhythm at discharge, and LOS. A total of 42 stable patients with new AF after surgery were randomized to oral propafenone (800mg, single dose; n=20), ibutilide (1mg X up to 2 doses if necessary; n=10), or rate control only (n=12). Agents used for rate control were left to the discretion of the primary physician but beta blockers were encouraged. **Results:** Pre-randomization distribution of diabetes, CHF, previous AF, and the use of beta blockers was similar in all groups. The graph depicts the Kaplan-Meier curves according to treatment arm. At 54 hours 6%, 65% and 33% of patients in the ibutilide (p<0.01), propafenone (p<0.05), and rate control groups respectively were still in AF. Although ibutilide decreased AF duration, recurrence rates were 99%, 41%, and 66% in those groups (p<0.05 compared to rate control). Of 3 patients who did not convert, all received propafenone. There was no difference in LOS or rhythm at discharge. **Conclusion:** Ibutilide but not propafenone decreases the duration of AF after cardiac surgery and neither appears to affect LOS or rhythm at discharge. It appears from this data that a strategy of rate control only is a reasonable one in the early management of postoperative AF.

**1300-130 Single-Day Loading Dose of Oral Amiodarone Does Not Prevent Atrial Fibrillation After Coronary Artery Bypass Surgery**

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**Background:** It has been shown that one-week loading dose of oral amiodarone can reduce presence and severity of atrial fibrillation (AF) following coronary artery bypass surgery (CABS). However, there is no evidence whether single-day loading dose of oral amiodarone has beneficial effect in preventing AF after CABS. **Methods:** In order to assess the effect of single-day loading dose of oral amiodarone in prevention of AF after CABS, a double-blind, randomized, placebo-controlled study was conducted enrolling 315 consecutive patients (pts). Pts received either amiodarone (150 mg) or placebo (150 mg) in a single oral dose of 1200 mg one day before CABS, followed by 200 mg daily during the next 7 days, including the day of surgery. All pts were monitored for AF during first 48 h in the ICU. After that, serial electrocardiograms (twice daily routinely, and if heart rate (HR) was >100 bpm, or pt experienced angina, hypotension, dyspnea or sweating) and HR measurements (4 times daily routinely) were obtained in order to detect AF. Only episodes of AF lasting more than 1 h, or shorter but associated with symptoms and/or hemodynamic disturbances, were taken into consideration. In addition, overall mortality, duration of hospital stay, and other rhythm disturbances were also evaluated. **Results:** Pts with and without postoperative AF were similar regarding age, sex, preoperative EF and severity of coronary artery disease, operative data, and electrolyte status. The incidence and characteristics of AF, as well as mortality and duration of hospital stay are shown in the Table.

<table>
<thead>
<tr>
<th>Amiodarone (n=159)</th>
<th>Placebo (n=156)</th>
<th>P value</th>
</tr>
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<tbody>
<tr>
<td>Age (y)</td>
<td>56.3 ± 9.1</td>
<td>57.3 ± 8.4</td>
</tr>
<tr>
<td>AF (pts %)</td>
<td>31 (19.5)</td>
<td>30 (21.2)</td>
</tr>
<tr>
<td>AF episodes</td>
<td>1.4 ± 1.2</td>
<td>0.9 ± 0.2</td>
</tr>
<tr>
<td>AF duration (h)</td>
<td>28.4 ± 39.9</td>
<td>21.2 ± 29.0</td>
</tr>
<tr>
<td>Total mortality (pts %)</td>
<td>7 (4.4)</td>
<td>5 (3.2)</td>
</tr>
<tr>
<td>Hospital stay (days)</td>
<td>10.3 ± 6.2</td>
<td>10.2 ± 3.6</td>
</tr>
<tr>
<td>Other arrhythmias (pts %)</td>
<td>48 (30.2)</td>
<td>46 (29.8)</td>
</tr>
</tbody>
</table>

**Conclusion:** Single-day oral loading dose of amiodarone does not prevent occurrence, duration, and number of episodes of AF in the unselected population of pts undergoing CABS and has no effect on the overall mortality and the duration of hospital stay in such pts.

**1300-132 Pharmacologic and Ablative Hybrid-Therapy in Atrial Fibrillation: Relevance of Intravenous Propafenone Testing**

Thorsten Lewalter, Lars Lodde, Christian Wolfert, Alexander Yang, Rainer Schmelling, Berndt Ludverts, Dept. of Cardiology, University of Bonn, Bonn, Germany

In 10-15% of patients with recurrent atrial fibrillation (AF) and class IC antiarrhythmic drug treatment, typical atrial flutter (AFL) can be observed during follow-up. After catheter ablation of the drug-induced AFL and continuation of the drug treatment (hybrid therapy), a reduced AF incidence was reported. Since now, identification of patients suitable for this approach is limited to the spontaneous occurrence of AFL. We therefore investigated whether it is possible to identify such patients using intravenous (iv) drug testing. Twenty-seven symptomatic AF patients (11 women, 16 men, mean age: 56.7 ± 7.8 years; hypertension: 15, coronary artery disease: 2, idiopathic AF: 10) received an iv propafenone bolus (2 mg/kg) during ongoing AF. In 1 patient typical AFL could be observed within one hour of ECG monitoring. During a 3 months follow-up, all 9 patients received an oral propafenone treatment with 6 of them again demonstrating AFL. In one of the 9 patients, the propafenone treatment had to be withdrawn due to extracardiac side effects. In the remaining 5 patients the drug-induced AFL was sinus-dependent with a counter-clockwise right atrial activation. After catheter ablation with bidirectional conduction block in the anteroinferior isthmus and continuation of the oral propafenone medication, 3 patients demonstrated no longer AFL or AF within a 6 months follow-up. In 1 patient, AF was reduced (9.8 episodes/month vs. 13 episodes/month). 1 patient exhibited an unchanged AF incidence and additional supraventricular AFL. About 70% of patients who developed typical AFL after iv propafenone administration also demonstrated typical AFL during oral propafenone treatment. The majority of such patients who were treated with the "amiodarone, isoprenaline, and atrial fibrillation therapy" remained in atrial fibrillation. Thus, iv propafenone testing allows to identify patients suitable for an hybrid approach in AF.
**Noninvasive Testing: Arrhythmia Detection and Management**

Wednesday, March 21, 2001, 10:30 a.m.-Noon
Orange County Convention Center, Room 232A

**892-1 Role of P Wave Morphology of Atrial Premature Beats in Guiding Mapping for Pumonary Vein Ablation in Paroxysmal Atrial Fibrillation**

Davendra Mehta, Michael Hoffman, Noelle Langan, Anthony Gomes, Mount Sinai Hospital, New York, NY

A significant proportion of local atrial fibrillation originates in the pulmonary veins (PV). Mapping of early premature beats is used to identify sites for ablation purposes. In order to identify the P wave morphology of atrial premature beats originating from the 4 PVs, 12-lead ECGs were performed while pacing the ostia of all 4 PVs. Methods: Twelve patients undergoing transeptal punctures for ablation of the left-sided accessory pathway were included prospectively. Following the ablation procedure, a pacing catheter was advanced into all 4 PVs. While pacing at 100 bpm, the catheter was withdrawn while atrial capture was obtained. 12-lead ECGs were continuously performed while pacing. Monitoring waves in all 12 leads were identified as predominantly positive or negative. Results: Significant differences were seen between the ECG's taken while pacing the left and right PVs. Last PV pacing (upper and lower) resulted in positive P waves in lead aVR (p=0.05), and negative P waves in aVL (p=0.001). Additionally, left lower PV pacing resulted in negative P waves in leads V3 (p=0.001), V4 (p=0.006), V5 (p=0.001), V6 (p=0.006). Right PV (upper and lower) pacing, resulted in negative P wave in lead aVR and positive P waves in lead aVL. There were so significant differences in morphology when pacing right upper or lower PV's when compared to the P waves produced by normal sinus rhythm. Conclusions: 1) The morphology of the P wave in leads aVR and aVL can be used to discriminate between foci originating from the left and right PVs. 2) The morphology of P waves in preclinical leads V3-V6 can be used to discriminate between foci originating from the left and upper right PVs. 3) There are no significant differences in the P wave morphology between foci originating from the 4 right PVs. 4) The 12-lead ECG is useful in determining which pulmonary vein is the origin of impulse formation. Localization of abnormal impulses may aid in therapy of focal atrial fibrillation.

**892-2 Evaluation of Asymptomatic Arrhythmias Detected During the REVEAL Plus Clinical Study**

G. J. Klein, J. M. Hartog, B. J. Hugel, C. Menozzi, B. B. Lee, Medtronic Inc., Minneapolis, MN

The REVEAL PLUS implantable loop recorder (ILR) has the capability to automatically detect arrhythmias and store the ECG for up to 14 events. This feature is designed to aid in diagnosing patients who suffer from unexplained syncope by triggering alert. In this study, we performed an international study conducted in 9 clinical sites. We report on the automatically detected events collected during the REVEAL PLUS clinical study. Methods: REVEAL PLUS was implanted left pectorally in 40 patients (56% male, average age 64±13 years) with unexplained syncope (1.5±2 events) in the previous 12 months. Concomitant cardiovascular disease was reported in 40% of patients. After 36 of the 40 patients were setup and followed for 1 month (39±22 days), 4 patients, data collection continues. Results: Thirty of the 36 patients (83%) had very few inappropriate events (asystole, II=bradycardia, n=26; sinus tachycardia, n=10). The remaining 6 patients had inappropriate events (oversensing due to large T-waves, n=24; oversensing due to noise, n=5). Asymptomatic arrhythmias were detected in 6 of the 36 patients (17%), and 44 events were captured in total (sinus arrhythmia, n=16; sinus bradycardia, n=10; his-bundle arrhythmia, n=16). The remaining 6 (17%) of the 36 patients exhibited high rates of IAA (75.7±68.7 per minute, median 3.9±2, range 0 to 7.7). Of these thirty-six patients, 9 (25%) had no IAA, and the remaining 27 had a total of 154 IAA stored in memory (under-sensing due to signal noise, n=17). Undersensing was presumed to be caused by temporary loss of signal due to amplifier saturation, n=18; oversensing due to large T-waves, n=14; oversensing due to noise, n=5). Asymptomatic arrhythmias were detected in 3 of the 6 patients (17%), and 4 events were captured in total (asystole, n=3; bradycardia, n=1). The remaining 6 (17%) of the 36 patients exhibited high rates of IAA (75.7±68.7 per minute, median 3.9±2, range 0 to 7.7). In those six patients, this high rate significantly reduced the monitoring window available for automatically capturing asymptomatic arrhythmias. Conclusion: The majority of patients implanted with the device had very few inappropriate automatic activations. REVEAL PLUS appears to be effective in automatically capturing infrequent, asymptomatic cardiac arrhythmias and storing these events in memory.

**892-3 Holter Analyses Are Inappropriate for Atrial Fibrillation**


**Background:** Holter monitoring is often used to manage pharmacological heart rate control of atrial fibrillation (AF). Holter reports typically include daily and hourly maximum, minimum, and mean heart rate from analyses that use averaged beat values rather than actual heart rate. While averaging may reduce the impact of arrhythmia, it may be dysfunc-
tional when used in AF. We hypothesized that use of averaged beat values would underestimate maximum heart rate in AF.

**Methods:** Nine AF patients from 2 centers underwent 24-hour ambulatory Holter monitoring. A core lab reviewed 10 Holter reports. Results were then manually edited beat-by-beat to provide "true" heart rate data. For comparison, 8 Holter manufacturers reported the use of averaged beat values to report maximum heart rate. Averaging techniques were of two types, rolling or sequential segments. Segment size was based either on a number of consecutive non-sinus beats or over a period of time (e.g., 6 seconds). We simulated 8 Holter manufacturer programs in our analysis of the 9 Holter monitoring recordings.

**Results:** Conventional Holter reports under-reported true maximum heart rate by a mean of 81 bpm (range: 34-170 bpm), and simulations under-reported maximum heart rate by a mean of 82 bpm (range: 10-193 bpm).

**Conclusion:** Current Holter reports significantly under-report maximum heart rate of AF patients; due to use of averaged beat values in the analyses. Misleading physicians as to maximum heart rate achieved may severely limit the clinical usefulness of Holters in AF.

**892-4 Shortening the Duration of the Head-Up Tilt Table Test: A Randomized Controlled Trial of 20-Minute Sublingual Glyceryl Trinitrate Provoked Vaso-vagal Provocative Protocols as Initial Investigations in the Diagnosis of Vasovagal Syncope**

Stove W. Perry, Janine C. Gray, Diarmuid O'Shea, Mary Baptist, Rosa Anne Kenery, Cardiovascular Investigation Unit, University of Newcastle, Newcastle upon Tyne, United Kingdom

**Introduction:** The head up tilt table test is the initial investigation of choice in the diagnosis of vasovagal syncope, but it is time consuming and labor intensive. Second line investigations include provocative tests with isoproterenol or nitrates. We compared a shortened 20 minute glyceryl trinitrate provoked head up tilt (GTN-HUT) with the standard 40 minute tilt (HUT) as first line investigations in patients with unexplained syncope and asymptomatic controls in randomised controlled fashion.

**Methods:** Consecutive patients with unexplained syncope or syncope referred to our syncpe facility and asymptomatic controls with a similar age/sex profile were randomly assigned GTN-HUT (800mcg metered dose spray) or HUT and then the opposite tilt test 1 week later at the same time of day. Positive tilt: hypotension/bradycardia with syncope or symptom reproduction in patients, haemodynamic changes in isolation in controls. Positive test: haemodynamic changes in isolation in patients.

**Results:** 149 patients (mean age 56 yr old; 39.4% male, 60.6% female) were enrolled (mean age 55.5 yr old; 39.4% male, 60.6% female) were enrolled. The 2 tests were performed 1 week later at the same time of day. Positive tilt: hypotension in 30 patients (9.8% male, 50.0% female, 50.0% female), 43 controls (mean age 55.5 yr old; 39.4% male, 60.6% female).

**Results of head up tilt tests - Patients and Controls**

<table>
<thead>
<tr>
<th></th>
<th>GTN HUT positive</th>
<th>HUT positive</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Patients</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>No</td>
<td>No</td>
<td>132</td>
</tr>
<tr>
<td>Yes</td>
<td>4</td>
<td>13</td>
<td>17</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>16</td>
<td>54</td>
<td>149</td>
</tr>
</tbody>
</table>

**OR 10.25, 95% CI 3.7, 39.4. McNemars Chi2=30.42, P<0.0001**

**False positive tilt in 9 patients, 8 patients with GTN HUT.**

**Controls**

<table>
<thead>
<tr>
<th></th>
<th>GTN HUT positive</th>
<th>HUT positive</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>No</td>
<td>No</td>
<td>23</td>
</tr>
<tr>
<td>Yes</td>
<td>2</td>
<td>7</td>
<td>9</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>2</td>
<td>23</td>
<td>25</td>
</tr>
</tbody>
</table>

**OR 8, 95% CI 1.5, 76.1. McNemars Chi2=10.98, P<0.001**

**No order effects (Fishers test p=0.7) or significant side-effects (headache in 7 patients and 6 controls with no difference).**

**Conclusion:** Patients were 10.25 times more likely to have a diagnostic test with a 20-minute GTN-HUT than with prolonged 40-minute passive HUT. The 20-minute GTN-provoked head up tilt (GTN-HUT) with the standard 40-minute tilt (HUT) as first line investigations in patients with unexplained syncope and asymptomatic controls in randomised controlled fashion.
Prospective, Randomized, Crossover Evaluation of the Effect of Propranolol, Nadolol, and Placebo on Neurocardiogenic Syncope Recurrence and Patients' Well-Being

Panagiota Fievari, Efthimios G. Livanis, George N. Theodorakis, Elias Zarvalis, Dimitrios T. Kremastinos. Onassis Cardiac Surgery Center, Athens, Greece

The aim of the present study was to test the relative therapeutic efficacy of a nonselective lipophilic beta-blocker (propranolol), a nonselective hydrophilic beta-blocker (nadolol) and placebo on neurocardiogenic syncope (NCS) occurrence and patients' (pts') well-being.

Methods: The patient (pt) population consisted of 30 consecutive pts with recurrent neurocardiogenic syncope (at least 2 episodes in the last 3 months) and positive head-up tilt test. All were serially assigned in a random way to propranolol, nadolol and placebo. Therapy with each drug lasted 3 months. On the day of drug crossover, pts were asked to report the total number of syncopal/presyncopal attacks during the previous 3-month period and possible side effects. They were also asked to grade each drug treatment taking into account its efficacy and their personal well-being during therapy (scale 0-3, 0=discontinuation, 1=bad, 2=good, 3=very good). In case of discontinuing one drug, they were randomized to another.

Results: The mean number of syncopal attacks during the 3-month period before therapy initiation (2.93±2.52) was reduced by all treatments tested (0.14±0.36 by propranolol, 0.01±0.01 by nadolol and 0.44±0.73 by placebo, p<0.0001). No differences were observed in syncope/presyncope recurrence among the three drugs. Two pts discontinued propranolol due to fatigue, and 2 discontinued placebo due to continuing syncopal attacks. No difference was observed between the 3 medications in the pts' drug assessment, though a trend (p=0.09) was observed favoring placebo treatment vs propranolol, mainly due to propranolol's central side effects.

Conclusion: Propranolol, nadolol as well as placebo drug are equally effective treatments in NCS, as assessed by reduction of syncopel/presyncope recurrence and pts' well-being. This may have important pathophysiologic and clinical implications.

Recurrent Syncope Following Beta-Blocker Therapy vs. Conservative Management in Patients With Vasovagal Syncope

Jorge Alegria, Bernard Gerah, Chris Scott, David Hodge, Steven Hammill, Win Shen. Mayo Clinic, Rochester, MN

Background: Although beta-blockers are frequently used in the treatment of vasovagal syncope, the clinical efficacy remains to be defined. The objective of this study is to compare the clinical outcome of pts with vasovagal syncope treated with beta-blockers vs. conservative management (education and avoidance of volume depletion).

Methods: All pts with clinically confirmed diagnosis of vasovagal syncope between 1996 and 1998 at the Mayo Clinic were included in the study. Clinical follow-up was conducted prospectively by survey. Recurrence of syncope was estimated by the Kaplan Meier method and was compared between the two treatment groups using log rank test.

Results: During the study period, 463 consecutive patients (F/M 243/220, mean age 53±23 yrs) had clinically confirmed diagnosis of vasovagal syncope, 449 (97%) had tilt table testing. Of the total, 172 (37%) were treated with beta-blockers (mean age 48±25 yrs, F/M 102/70), and 87 (19%) received conservative management (mean age 55±23 yrs, F/M 43/44). Patients receiving beta blocker were younger (p=0.01). The mean follow-up was 20 ±13.2 months. The following clinical characteristics were not significantly different between the two groups (p>0.05): number of previous syncope, previous attempts of syncope therapy, presence of comorbidities or cardiovascular disease, EF, abnormalities on Holter or ECG. One or more episodes of syncope occurred in 47 pts receiving beta blockers and 15 pts receiving conservative therapy. The probability of survival free from syncope was 77% and 80% at 1 yr, and was 65% and 80% at 2 yrs, for pts receiving beta blockers and conservative therapy, respectively (p = 0.056). Conclusions: 1) In a consecutive group of pts, recurrent syncope was more frequent in pts treated with beta blockers when compared to pts treated with conservative management. 2) Although the limitations of the retrospective nature of the study are well recognized, our observations challenge the utility of "routine" beta blocker therapy in pts with vasovagal syncope.