

CARTO system. The 4 unsuccessful sites were located 1.6-1.9 cm from the balloon's surface and had P-potential amplitude of 0.05 - 0.29 (median 0.18) mV. The activation time of the 33 reconstructed P-potentials differed from the activation time measured by the contact catheter by 0-5 (median 2) msec.

Conclusions: The non-contact mapping system consistently reconstructs discrete P-potentials within 1.5 cm of the surface of the balloon. Low amplitude potentials generated further than 1.5 cm may not be identified.

1114-18 Improvement of Ventricular Function Following Catheter Ablation of Frequent Ventricular Arrhythmias

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Incessant supraventricular tachycardia may be result in reduction of left ventricular function. This is usually termed tachycardia-induced cardiomyopathy and can be reversed by pharmacologic suppression or radiofrequency catheter ablation (RCA) of the arrhythmia. However, RCA is also successful in reducing frequent ventricular ectopy in patients. We hypothesized that successful RCA of patients with idiopathic cardiomyopathy and frequent ventricular ectopy may improve their left ventricular function. Methods: We performed a retrospective analysis of the change in the left ventricular ejection fraction (LVEF) in patients with baseline left ventricular dysfunction in the absence of identifiable cause who underwent successful RCA at our center. Methods: The LVEF was determined by transthoracic echocardiography obtained from the patient's records before and after the procedure. The mean number of ventricular ectopic beats (VEB) per hour was assessed by 24 hour Holter monitoring before and between 1-12 months after the ablation procedure. Results: A total of 18 patients were identified which included 16 males and 2 females. Each patient underwent RCA for frequent ventricular ectopy and/or repetitive monomorphic VT. The mean age of the patients was 44.4 ± 17.7 years (range 18-81 yrs). The VEBs per hour declined significantly from 1308 ± 859 to 46 ± 123 ($p < 0.005$). Meanwhile, there was an improvement of the mean LVEF from $33.2 \pm 6.4\%$ to $45.6 \pm 7.5\%$ ($p < 0.001$) following RCA with no syncope or significant ventricular arrhythmias in follow-up. Conclusion: Successful treatment with RCA significantly reduced the frequency of ventricular ectopy and simultaneously improved LVEF in this select group of patients. While such patients may also be considered candidates for implantable defibrillators, given their initial poor LVEF, our data suggest LVEF improvement may result from RCA alone. Since left ventricular dysfunction is an important factor in determining survival risk in patients with ventricular arrhythmias, further study is warranted to determine if long term survival is improved by successful RCA of frequent ventricular ectopy when there is no other etiology of reduced ventricular function.

POSTER SESSION

1115 Insights Into the Electrocardiogram and Clinical Syndromes

Monday, March 31, 2003, Noon-2:00 p.m.

McCormick Place, Hall A

Presentation Hour: 1:00 p.m.-2:00 p.m.

1115-3 80-Lead Body Surface Map Compared With Physician and 12-Lead ECG in Detection of Acute Myocardial Infarction

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Background: Improved spatial ECG sampling with Body Surface Mapping (BSM) has been shown to increase detection of acute myocardial infarction (AMI). We compared, prospectively, a BSM algorithm with a 12-lead ECG algorithm (12SL™V233) and a physician's 12-lead ECG interpretation in emergency patients with suspected AMI.

Methods: From December 2001 until April 2002 103 patients were recruited consecutively. All patients presented with ischemic type chest pain and had a BSM and 12-lead ECG (Marquette Mac 5K) recorded. The following were documented for each patient; the BSM algorithm diagnosis, 12-lead ECG algorithm diagnosis, the admitting physician's 12-lead ECG interpretation and Troponin-I (cTnI) or CKMB at 12 hours post onset of symptoms. AMI was defined by presentation with chest pain and an elevation of cTnI $> 1 \mu\text{g/L}$ or CKMB $> 25 \text{U/L}$. Comparisons were evaluated by McNemar's test.

Results: 53 of the 103 patients had AMI as defined by elevated cTnI or CKMB. The 12-lead ECG algorithm diagnosed 17 patients with AMI (sensitivity 32%, specificity 98%), the admitting physician 24 patients with AMI (sensitivity 45%, specificity 94%) and the BSM algorithm 34 patients with AMI (sensitivity 64%, specificity 94%). The BSM algorithm improved the diagnostic yield by a factor of 2.0 ($p < 0.001$) and 1.4 ($p = 0.002$) compared with the 12-lead ECG algorithm or the admitting physician respectively. There was no significant difference in specificity.

Conclusion: The BSM algorithm improves detection of AMI with no significant loss of specificity compared with the 12-lead ECG algorithm or physician's 12-lead ECG interpretation. These results are of significance particularly in the early detection and management of AMI

1115-4

Are Differences in the ECG Repolarization Patterns Between Males and Females Determined by Sex Hormones?

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Background: Differences in ventricular repolarization between males and females electrocardiograms (ECGs) have been described. The causes of these differences are not known, but hormonal influences are suspected. We hypothesized that such influences could be revealed by studying the distribution of repolarization patterns among genders within various age groups. **Methods:** We defined repolarization pattern as male when the amplitude of J-point was $\geq 0.1 \text{mV}$ and the angle between ST segment and baseline (ST angle) was ≥ 20 degrees, in one or more of the leads V1-V4. Normal ECGs from 529 males and 544 females, ages 5-96 years were studied. The ECGs were distributed among 9 age groups, with a similar number of ECGs in each sub-group of males and females. **Results:** The distribution of ECG repolarization pattern in males was as follows: In children under the age of 12 years, 60% of ECGs showed male pattern. The prevalence of male pattern increased thereafter, reaching 91% in the age group 17-24 years. It progressively declined with advancing age bottoming out at 14% in males of age 76-96 years. Comparison of pattern distribution between age groups in males was significant ($p < 0.001$). In females, 73% of children under the age of 16 showed a female pattern, 84% of all females older than 16 years showed a female pattern. Comparison between genders showed a significant difference in the overall distribution of patterns ($p < 0.001$). Heart rate did not influence the repolarization pattern. **Conclusions:** Whereas the distribution of male and female repolarization patterns was nearly constant in females across all age groups, the males showed a progressive increase in the male pattern from childhood to puberty, followed by a gradual decline through rest of life. This appears to parallel the change in male hormone levels at puberty and a decline in these levels in elderly males. Our findings support the hypothesis that gender differences in ECG repolarization are of hormonal origin.

1115-5

Prognostic Value of the Admission Electrocardiogram in Non-ST Elevation Acute Coronary Syndromes Treated With Very Early Revascularization

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Background: Limited information is available regarding the prognostic impact of the different presentations of acute myocardial ischemia on the admission electrocardiogram (ECG) in patients treated with very early revascularization for non-ST-elevation acute coronary syndromes (NSTACS). **Methods:** We conducted a prospective cohort study in 1450 consecutive NSTACS patients stratified according to the presence of new ST-segment depression, new T-wave inversion or no ECG changes on admission. All patients underwent coronary angiography and if appropriate subsequent revascularization within 24 hours of admission. The primary endpoint was all-cause mortality and recorded for a mean of 20 months. **Results:** In-hospital mortality was 2.1% in patients with no ECG changes, 4.4% in patients with ST-segment depression, and 0.2% in patients with T-wave inversion. Cumulative rates of death at 36 months were 8.0% in patients with no ECG changes, 19.1% in patients with ST-segment depression, and 5.1% in patients with T-wave inversion ($p = 0.0001$ by log-rank). After adjusting for potential cofounders, both, ST-segment depression (hazard ratio 2.2) and T-wave inversion (hazard ratio 0.4) were found to be significant independent predictors of long-term mortality. **Conclusion:** New ST-segment depression and new T-wave inversion on the admission ECG herald a very different prognosis in NSTACS patients undergoing very early revascularization. In contrast to the considerable morbidity and mortality seen in patients with ST-segment depression, T-wave inversion is associated with an excellent outcome independently of potential cofounders including sex.

1115-6

Repolarization Complexity and Abnormality for Prediction of All-Cause and Cardiovascular Mortality: The Strong Heart Study

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Background: Analysis of repolarization abnormality and complexity on the ECG using the QTc interval and principal component analysis (PCA) of the T-wave vector have been demonstrated to predict all-cause and cardiovascular (CV) mortality. Novel descriptors of T-wave morphology have been suggested as measures of repolarization heterogeneity and as markers of adverse prognosis. However, whether these new T-wave descriptors provide additional prognostic information beyond QTc and the PCA ratio has not been examined.

Methods: Predictive values of QTc, PCA, and novel ECG variables characterizing the T-wave loop were assessed in 1729 American Indian participants in the first Strong Heart Study exam with all T-wave measurements. T-loop morphology was quantified by the ratio of the second to first eigenvalues of the T-wave vector (PCA ratio), by the T-loop area (TLA) projected onto the dominant vector plane and by the sum of the squares of the 4th to 8th eigenvalues, the absolute T-wave residuum (TWR).

Results: After mean follow-up of 3.7 ± 0.9 years, there were 168 deaths from all causes, including 55 CV deaths. In univariate analyses, prolonged QTc, increased PCA ratio, TLA and TWR were significant predictors of all-cause and cardiovascular mortality ($p < .001$). In multivariate analyses adjusting for age, sex, body mass index, diastolic and systolic blood pressures, HDL and LDL cholesterol levels, triglyceride level, albuminuria, alcohol use, prevalent diabetes and coronary heart disease, history of smoking and study

center, both an abnormal PCA ratio ($\chi^2=7.3$, $p=.007$) and TLA ($\chi^2=7.5$, $p=.006$) were significant predictors of CV mortality. However, adding TLA to the combination of clinical variables and the PCA ratio provided only minimal additional prognostic value to the overall model (overall $\chi^2=287.5$ to $\chi^2=290.3$). In contrast, both an abnormal QTc ($\chi^2=49.5$, $p<.001$) and TWR ($\chi^2=49.5$, $p<.001$) remained strong predictors of all-cause mortality in multivariate analyses, with an increase in overall χ^2 from 221.5 to 230.3. **Conclusions:** Novel descriptors of heterogeneity of repolarization provide additional prognostic information beyond QTc and PCA ratio for prediction of all-cause and CV mortality.

1115-7

Distinction Between Ventricular Tachycardia/ Ventricular Fibrillation Patients and Patients With Uncomplicated Post-Infarction Follow-Up: Comparison of Noninvasive Wedensky Modulation and Ejection Fraction

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Background: Subthreshold stimulation without capture reduces the stimulation threshold and changes the action potential of subsequent suprathreshold stimulation (Wedensky modulation). Wedensky modulation may be noninvasively invoked and quantified by surface residuum (WSR) of wavelet decomposition of modulated and reference ECGs.

Methods: This study compared the power of left ventricular ejection fraction (EF) and of WSR for the separation of patients with an uncomplicated follow-up (>6 months) after myocardial infarction (MI) and patients with spontaneous symptomatic VT/VF and ischaemic heart disease (VT/VF). In total, 25 VT/VF patients (64±9 years, 25 men) and 48 MI patients (63±9 years, 34 men) were subjected to a 2 ms noninvasive transthoracic modulation of 5 and 20 mA delivered 20 ms after R wave fiducial; i.e. synchronously with R wave peak. For each subject, EF and WSR within 10 ms window centred around the modulation (WSR values C5, and C20 corresponding to 5, and 20 mA modulation, resp.) were evaluated. Multiple backward stepwise regression analysis was used to assess the relative performance of WSR parameters and EF. Receiver operator characteristics (ROC) were calculated and the area under the ROC curve was used to compare predictive power.

Results: All parameters significantly differentiated VT/VF patients from MI patients: EF - 38.1±14.8 for VT/VF, 53.8±11.6 for MI, $p<8 \times 10^{-6}$; C5 - 496.8±269.5 for VT/VF, 1142.9±659.7 for MI, $p<10^{-6}$; C20 - 580.0±307.1 for VT/VF, 1187.1±750.8 for MI, $p<4 \times 10^{-5}$. Both WSR parameters survived the multiple regression analysis against EF with p-values of 0.001 for EF, 0.003 for C5, and p-values of 0.0005 for EF, 0.02 for C20. The areas under the univariate ROC curves were 79.9% for EF, 82.1% for C5, and 79.2% for C20. The multivariate ROC curve combining EF and C5 resulted in the area of 89.0%.

Conclusion: Noninvasive Wedensky modulation separates VT/VF patients from uncomplicated post-MI patients independently of EF. The separation by EF and by Wedensky modulation are mutually additive. Thus, noninvasive Wedensky modulation is likely to prove useful in step-wise identification of patients requiring antiarrhythmic therapy, such as ICD implantation.

1115-8

Valsartan Improves Early Morning and 24-Hour Heart Rate Variability

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Background: Diurnal variation in the autonomic nervous system produces sympathetic overactivity in the early morning. Most sudden cardiac deaths occur at this time, due to arrhythmias associated with increased sympathetic tone. Heart failure (HF) patients have demonstrated blunting of heart rate variability (HRV), shown to be a strong independent predictor of sudden cardiac death. Valsartan treatment has shown benefit in HF. We evaluated the hypothesis that valsartan improves HRV in the early morning hours and throughout a 24-hour period.

Methods: In this prospective, open-label, blinded-endpoint trial, 55 patients (69% male, 31% female, age 68 ± 12 years) with HF underwent HRV analysis (from 6-10 AM and over 24 hours) before and after 12 weeks of valsartan treatment (mean dose = 261 ± 59.3 mg/day). Patients were NYHA class II (61%) or III (39%), CAD 56%, mean LVEF 19%; 85% on ACE inhibitors, 55% on beta blocker therapy.

Results: There were statistically significant improvements in heart rate and SDNN index between 6 and 10 AM; improvement in SDNN was of borderline significance (Table). All parameters were significantly improved over the 24-hour interval.

Conclusion: The improvements in HRV over 24 hours were thought to be predominantly vagal. The improvements over the 6 to 10 AM interval, although less than those occurring over 24 hours, indicate a sympathetic component, and suggest that valsartan improves HRV via a mixed sympathetic/parasympathetic effect in patients with HF.

Change in HRV Indices

	6-10 AM			24 Hour		
	Baseline	12 Weeks	P Value	Baseline	12 Weeks	P Value
Heart Rate (bpm)	78.5	75.5	0.0037	78.2	76.0	0.0046
SDNN (ms)	79.6	88.2	0.0597	79.4	90.9	0.0002
SDNN Index (ms)	36.1	40.2	0.0284	31.6	36.7	0.0010
SDANN (ms)	60.7	67.7	0.1347	60.5	73.6	0.0001

1115-9

The Effect of Ischemic Preconditioning Is Preserved on QT Dispersion in Elderly Patients Undergoing Coronary Angioplasty

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Background: Previous reports on the protective effects of ischemic preconditioning are still controversial. We sought to investigate the effects on QT dispersion in patients with adult and aged patients undergoing coronary angioplasty. Moreover we examined the effect of pretreatment of nicorandil on QT dispersion to assess the hypothesis that opening of K_{ATP} channel will affect ischemic preconditioning in adult and/or aged patients.

Methods: Consecutive 40 patients who underwent balloon inflation at least twice during coronary angioplasty were randomly allocated to either nicorandil group (3mg/hr infusion intravenously) or placebo group, group based on their age: adult group (age<65 years) and aged group (age>65 years). 60-second coronary occlusions of the proximal two-thirds of left anterior descending coronary artery were performed with 5-minutes interval. **Result:** 1. Baseline QT dispersion was similar in all groups. 2. Nicorandil administration significantly protected the increase in QT dispersion in both adult and aged groups. 3. Similar changes on QT dispersion were observed in both adult and aged groups.

Conclusion: 60-second coronary occlusion was effective for ischemic preconditioning in view of QT dispersion in both adult and aged patients equally. Moreover, K_{ATP} channel mimics ischemic preconditioning in both adult and aged patients.

	Placebo (Aged) N=11	Placebo (Adult) N=9	Nicorandil (Aged) N=12	Nicorandil (Adult) N=8
Age(yrs)	71±5	58±4	76±5	59±6
M/F	8/3	6/3	7/5	6/2
1 st balloon inflation	42±15	37±7	38±11	40±11
Before	77±16*	73±17*	51±12	55±16
After				
2 nd balloon inflation	44±17	35±7	36±7	39±8
Before	55±16	47±11	45±14	45±9
After				

($p<0.05$ vs nicorandil group)

1115-10

Amiodarone Increases Transmural Heterogeneity of Repolarization in Patients With Cardiac Death

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Background: A prolongation of the descending part of the T wave (TpTe) was suggested to reflect increased transmural repolarisation heterogeneity and arrhythmogenicity. Amiodarone (A) is known to prolong QT interval in a homogeneous way. Failure to do so could increase arrhythmic risk. We therefore investigated QT intervals in survivors (SUR) and victims of cardiac death (CD) in A and placebo (P) treated post-myocardial infarction patients.

Methods: In 24-hours recordings from 866 EMIAT patients (462 A, 404 P) obtained 1 month after randomisation, QT and QTpeak intervals were measured automatically by the Pathfinder software (Reynolds Med Tec). All intervals were averaged over 10-ms RR interval bins from 550 to 1150 ms in each recording. Results were then grouped into A and P treated patients and split into SUR and CD.

Results: QT intervals in the A group were longer than in the P group at all RR intervals. However, whereas QTpeak and TpTe increased proportionally in SUR (QTpeak 54± 4% vs TpTe 46± 4%) the prolongation of QT especially at high heart rates in the CD group was mainly due to an increase in TpTe (QTpeak 22± 33% vs TpTe 78± 33%, $p=3.8 \times 10^{-11}$). The picture shows the percentage of TpTe of the prolongation of QT in SUR (circles) and CD (filled dots). Values of >100% are due to a shortening in QTpeak.