

| Time ( $\pm$ 1 mo)    | 1 Yr           | 2 Yr           | 3 Yr           | 4 Yr           |
|-----------------------|----------------|----------------|----------------|----------------|
| Systolic BP (mmHg)    | 147 $\pm$ 24*  | 145 $\pm$ 10*  | 144 $\pm$ 20*  | 148 $\pm$ 20*  |
| Diastolic BP (mmHg)   | 78 $\pm$ 13*   | 78 $\pm$ 10*   | 78 $\pm$ 12*   | 70 $\pm$ 12*   |
| #Anti BP Meds         | 1.7 $\pm$ 0.9* | 1.8 $\pm$ 0.9* | 1.7 $\pm$ 0.9* | 1.9 $\pm$ 1.0* |
| Survival entire group | 01 $\pm$ 0%    | 84 $\pm$ 10%   | 70 $\pm$ 21%   | 72 $\pm$ 28*   |
| Cr $\geq$ 1.0 mg/dl   | 07 $\pm$ 2%    | 00 $\pm$ 1%    | 80 $\pm$ 4%    | 88 $\pm$ 11%*  |
| Cr $\geq$ 2.0 mg/dl   | 86 $\pm$ 2%    | 72 $\pm$ 3%    | 64 $\pm$ 0%    | 46 $\pm$ 0%*   |

\* $p < 0.05$ , \*\* few deaths were related to end-stage renal disease

**Conclusion:** Successful SR for RAS demonstrated a significant decrease in systolic and diastolic BP's, and the number of antihypertensive drugs required to control the BP. An elevated baseline Cr adversely influenced survival. These renal artery stenoses should be vigorously looked for, and treated with SR before renal dysfunction occurs.

### 1024-75 Primary Stent Deployment for Obstructive Lesions of the Subclavian or Innominate Artery

J.R. Laird, R. Mehran, L.F. Sattler, J.J. Popma, A. Greenberg, T. Bucher, C. Altmeyer, M. Maatoo, M.D. Leon. *Washington Hospital Center, Washington, DC, USA*

Obstructive lesions of the innominate or subclavian artery can result in arm claudication, symptoms of subclavian steal, or symptoms related to diminished flow down an internal mammary artery bypass graft (coronary-subclavian steal). To evaluate the role of primary stenting for the treatment of this condition, we performed 30 primary stent procedures in 30 patients (10 males, 62  $\pm$  10 years) with stenosis (24/30) or occlusion (6/30) of the innominate or subclavian artery. All procedures were performed with the Palmaz medium tubular slotted stent. The primary indication for the procedure was arm claudication in 5 (17%), subclavian steal syndrome in 9 (30%), myocardial ischemia in 15 (50%), and need to gain access for another procedure in 1 (3%). Technical success was achieved in 29 (97%) procedures. There was one failure due to inability to cross a chronic total occlusion of the innominate artery with a guidewire.

|                             | Baseline        | Final           | p        |
|-----------------------------|-----------------|-----------------|----------|
| Reference diameter (mm)     | 7.01 $\pm$ 1.50 | 6.92 $\pm$ 1.23 | NS       |
| Minimal lumen diameter (mm) | 1.94 $\pm$ 0.98 | 6.25 $\pm$ 1.35 | < 0.0001 |
| % Diameter stenosis         | 67.7 $\pm$ 15.3 | 9.9 $\pm$ 10.1  | < 0.0001 |

Mean systolic pressure difference between the upper extremities was 38.4  $\pm$  18.9 mm Hg pre and 0.7  $\pm$  2.7 mm Hg ( $p < 0.0001$ ) immediately post stenting. There were no major complications (death, MI, stroke). One patient (3%) required surgical repair of the brachial artery after using this approach to recanalize an occluded subclavian artery.

**In Conclusion:** 1) Primary stenting of the subclavian or innominate artery is safe and effective with excellent acute angiographic and hemodynamic results. 2) Cerebral or distal embolization did not occur even when treating subclavian occlusions 3) Long term studies are required to evaluate the durability of this technique.

### 1024-76 Spontaneous Aortic Rupture: A Not-So-Rare Cause of Sudden Death in Young People

C. Basso, C. Foscura, D. Corrado, A. Angelini, G. Thione. *Dept. Pathology, University of Padua, Padova, Italy*

Among 269 consecutive cases of juvenile sudden death ( $\leq$  35 years) collected in the time interval 1979-1996, 13 (5%) had a mechanical cardiac arrest due to aortic rupture. They consisted of 2 mycotic aneurysms, 1 "parchment-like" aorta and 10 dissecting aneurysms. The latter, all males, aged 17 to 35 years (mean 26.3), presented the following risk factors, which are all congenital in nature: isolated isthmal coarctation in 2, Marfan syndrome in 2, isthmal coarctation associated with bicuspid aortic valve (BAV) in 2, and isolated and normally functioning BAV in 4. Histology of the dissected aortic wall showed equally severe degenerative changes consisting of elastic fragmentation and cystic medial necrosis. Further, a review of our anatomical collection of aortic dissection in the general population disclosed a 12% frequency of BAV, considering that the frequency of BAV in normal people is nearly 1%, the association between BAV and aortic dissection does not appear casual ( $p < 0.001$ ).

**In Conclusion:** a) spontaneous aortic rupture is a not-so-rare cause of sudden death in the young (5%); b) in this subset of population risk factors are represented by congenital structural defects present since birth; c) the natural history of BAV entails the risk of spontaneous aortic laceration and sudden death, either in the isolated form or in association with isthmal coarctation; d) under these circumstances the aortic tunica media shows an intrinsic structural weakness very similar to that observed in Marfan syndrome, such

as to suggest a congenital, most probably genetic defect; e) echo monitoring of the aortic root should be recommended in subjects with BAV; f) familial and molecular genetic investigations are needed to settle the question.

### 1025 P Wave Signal Averaging by Body Surface Mapping

Sunday, March 29, 1998, 5:00 p.m.-7:00 p.m.  
Georgia World Congress Center, West Exhibit Hall Level  
Presentation Hour: 5:00 p.m.-7:00 p.m.

### 1025-89 Body Surface Mapping During Left Atrial Pace Mapping: Evaluation of Spatial Differences in P-Wave Configuration

A. Sippens-Groenewegen, F.X. Roithinger, D.B. Scholtz, P.R. Steiner, M.D. Lesh. *University of California, San Francisco, CA, USA*

**Background:** Use of the P wave morphology to identify the origin of atrial tachycardia prior to catheter ablation has been of limited clinical value due to the low resolution of the standard 12-lead ECG. The aim of this study was to assess the performance of body surface P wave mapping in localizing left atrial ectopic activity.

**Methods:** 62-lead ECG mapping was carried out during transeptal left atrial pacing at up to 7 endocardial sites in 5 patients without structural heart disease. Echocardiography confirmed normal atrial size and morphology. Bipolar pacing was performed at long cycle lengths to achieve atrial capture after previous T-U wave offset. Biplane fluoroscopy and intracardiac electrocardiography were used for guidance of catheter positioning and to relate each catheter location to the left atrial anatomy. A P wave integral map was computed for every particular ectopic atrial activation sequence. Morphologic variation in the P wave integral maps was visually determined for each patient by examining spatial differences in the location of the extremes and the contour of the zero line.

**Results:** Left atrial sites where pacing was conducted included all 4 pulmonary veins, the left atrial appendage, the interatrial septum, the anterolateral wall, and the mitral annulus. The P wave integral maps all demonstrated dipolar voltage distributions. Distinct spatial differences among the P wave integral map patterns were observed at a mean of 5.0  $\pm$  1.4 left atrial sites per patient (range 4 to 7 sites per patient).

**Conclusions:** These preliminary data show that a spatial surface map representation of the P wave morphology enables identification of various sites of ectopic left atrial impulse formation. Clinical application of body surface mapping may lead to improved electrocardiographic localization and noninvasive recognition of left-sided atrial tachycardia foci prior to ablative therapy.

### 1025-90 Detection of Concealed Accessory Atrioventricular Pathway by P-Wave Signal-averaged Electrocardiogram

T. Yoshida, T. Hiraki, T. Hamada, I. Kubara, M. Ohga, H. Ikeda, T. Imaizumi. *Kurume University, Kurume, Japan*

**Background:** It is difficult to differentiate atrioventricular reciprocating tachycardia (AVRT) due to the accessory atrioventricular pathway (AP) from atrioventricular nodal reentrant tachycardia (AVNRT) when the ventricular pre-excitation is absent on standard ECG. Electrophysiological studies (EPS) have demonstrated the anterograde conduction in the concealed AP is blocked near the AP-ventricular interface during sinus rhythm. We examined whether P wave signal-averaged electrocardiogram (P-SAECG) is useful to detect the concealed AP.

**Methods and Results:** P-SAECG during normal sinus rhythm was performed in 20 normal volunteers (control), 17 patients with AVRT due to the concealed AP, 15 with AVNRT, and 22 with a paroxysmal atrial fibrillation (Paf). The presence of the anterograde conduction in the concealed AP was confirmed in all cases by EPS. The filtered P wave duration (fPd) by the time domain analysis was significantly prolonged in patients with AVRT (131  $\pm$  8 ms) compared to controls (119  $\pm$  4 ms) and patients with AVNRT (118  $\pm$  5 ms) ( $p < 0.05$ ). Although the fPd was similar between AVRT and Paf (134  $\pm$  8 ms), AR20 (power spectrum area ratio of 0-20 to 20-100 Hz) by the frequency domain analysis differentiated AVRT (1.7  $\pm$  0.6) from Paf (3.2  $\pm$  0.9). Ablation of the concealed AP significantly shortened fPd in patients with AVRT (122  $\pm$  5 ms) ( $p < 0.0001$ ) but that of the slow pathway did not in those with AVNRT (118  $\pm$  7 ms). The changes in fPd after ablation were significantly correlated with those in the duration of atrial activity at the ablation site detected by EPS ( $r = 0.69$ ,  $p < 0.01$ ).

**Conclusions:** Our data suggest that P-SAECG is useful to detect the concealed AP, and may provide a new concept of the presence of anterograde

conduction in concealed WPW syndrome and the validity as a research and clinical tool to accurately describe atrial activation patterns.

**1025-91 P-Wave Configuration in the Signal Averaged Electrocardiogram: Which Filter Technique Differentiates Best Between Patients With Paroxysmal Atrial Fibrillation and Healthy Volunteers?**

M. Hofmann, L. Goedel-Meinen, M. Mehren, A. Schömig. *Deutsches Herzzentrum and 1. Med. Klinik, Klinikum rechts der Isar, Technische Universität, Munich, Germany*

**Background:** Delayed ventricular conduction in the signal averaged ECG is a frequent finding in patients with ventricular tachycardias whereas the atrial conduction delays leading to atrial fibrillation are still a matter of research.

**Methods:** The aim of this study was to evaluate which of the most commonly used filter techniques (finite impulse response (FIR), least squares fit (LSQ), unidirectional (Uni) and bidirectional (Bidi)) would differentiate best between healthy volunteers and patients with paroxysmal atrial fibrillation (PAF). The signal averaged p-waves during sinus rhythm of 56 patients with PAF were compared to the p-waves of 50 healthy volunteers (N). All recordings were evaluated by two independent observers and the duration of the p-wave was calculated.

**Results:**

| Filter | P duration (N)    | P duration (PAF)   | p     |
|--------|-------------------|--------------------|-------|
| FIR    | 109.8 (94-177) ms | 133.5 (93-165) ms  | 0.001 |
| LSQ    | 114.5 (85-139) ms | 126.3 (94-152) ms  | 0.001 |
| Uni    | 134 (110-161) ms  | 142.8 (112-178) ms | 0.003 |
| Bidi   | 102 (73-123) ms   | 121 (97-141) ms    | 0.001 |

Dichotomy limits between N and PAF were: 111 ms (Bidi with sensitivity and specificity of 0.84), 121 ms (FIR: sens.+ spec. 0.79), 122 ms (LSQ: sens.+ spec. 0.67) and 138.5 ms (Uni: sens.+ spec. 0.61).

**Conclusion:** In comparison to normals, patients with paroxysmal atrial fibrillation showed a significantly prolonged p-wave in the signal averaged ECG. The absolute duration and the dichotomy limits for "healthy" and "PAF" differed largely between applied filter techniques, so did the evaluated sensitivity and specificity values. Bidirectional filtering lead to the clearest differentiation between patients and normals.

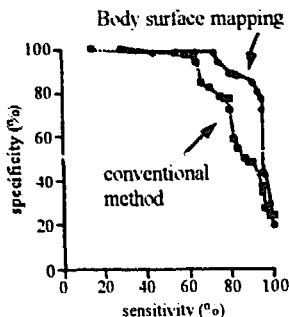
**1025-92 Detection of Patients at Risk for Paroxysmal Atrial Fibrillation Improved by Body Surface Mapping of P-Wave Signal-averaged ECG**

T. Yamada, M. Fukunami, T. Shimonagata, K. Kumagai, S. Sanada, H. Ogita, Y. Asano, N. Hoki. *Osaka Prefectural Hospital, Osaka, Japan*

P wave signal-averaged ECG (P-SAE) using only orthogonal leads has been useful to detect patients (pts) at risk for paroxysmal atrial fibrillation (Paf). To determine whether the detection accuracy of Paf pts would be enhanced by body surface mapping of P-SAE, we studied 55 Paf pts and 45 control pts. P-SAE was recorded with the P wave-triggering method from the orthogonal leads and 16 precordial unipolar leads. The duration (Ad) of filtered P wave was measured in each of 16 leads to obtain the maximum Ad (Ad[map]). Ad was also measured on the vector magnitude (Ad[vector]). Results are shown below.

|                    | Pat          | Control     | p value    |
|--------------------|--------------|-------------|------------|
| Ad[map] (ms)       | 155.5 ± 17.7 | 128 ± 10.4  | p < 0.0001 |
| Ad[vector] (ms)    | 142.6 ± 16.4 | 123.5 ± 9.7 | p < 0.0001 |
| Ad difference (ms) | 12.9 ± 9.4   | 4.5 ± 5.5   | p < 0.0001 |

Ad difference: the subtraction of Ad[vector] from Ad[map]

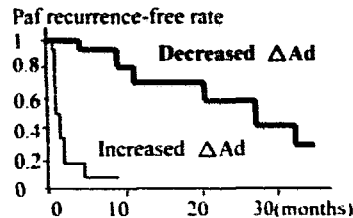


Ad in mapping P-SAE was greater than that in the conventional P-SAE in Paf pts. ROC curve of Ad[map] shifted more upper right sided, in comparison to that of Ad[vector]. When "Ad[map] > 135 ms" and "Ad[vector] > 120 ms" were considered abnormal in each method, the positive predictive value of mapping P-SAE (85%) was significantly (p = 0.01) greater than that of conventional one (85%), while the negative predictive value was comparable (90% vs 85%). Thus, the mapping P-SAE would improve the detectability of Paf pts, in comparison to the conventional method.

**1025-93 Prediction of Efficacy of Pilsicainide to Paroxysmal Atrial Fibrillation by Body Surface Mapping of the P-Wave Signal-averaged ECG: A Prospective Study**

T. Yamada, M. Fukunami, T. Shimonagata, K. Kumagai, S. Sanada, H. Ogita, Y. Asano, N. Hoki. *Osaka Prefectural Hospital, Osaka, Japan*

We reported that patients (pts) with paroxysmal atrial fibrillation (Paf) would have temporal and spatial dispersion of atrial depolarization increased, by use of body surface mapping of the P wave signal-averaged ECG (P-SAE). To determine whether the efficacy of pilsicainide (PC), a new Class Ic drug, on Paf attacks could be predicted in view of the dispersion, we prospectively studied 25 symptomatic Paf pts (the attack frequency > 1/month). At the entry, P-SAE was recorded by the P wave-triggering method from 16 precordial unipolar leads (V1-V6 in standard ECG and two intercostal spaces upper and lower of V1-V6 except V3) before and one hour after the single dose (100 mg) oral administration of PC. As an index of the dispersion of atrial depolarization, we obtained the difference (ΔAd) between the maximum and minimum of filtered P wave duration in 16 recording sites. These pts were followed up for 10 ± 11 months with PC. In 13 of 25 pts, ΔAd decreased after PC (29.2 ± 10.4 to 20.6 ± 5.5 ms, p < 0.01), while ΔAd increased in the remaining 12 pts (22.9 ± 4.7 to 29.6 ± 9.5 ms, p < 0.01). Paf recurrence documented on ECG was significantly less frequently observed in Paf pts with the decreased ΔAd (46% [6/13]) than those with the increased ΔAd (92% [11/12]) after PC (p < 0.0001).



Thus, the efficacy of PC to suppress Paf attacks might be predicted by evaluating the dispersion of filtered P wave duration after the single dose PC administration.

**1025-94 Age Dependent Atrial Activation Delay: Observations Using the P-Wave Signal Averaged Electrocardiogram**

M.E. Vloka, R. Sadurski, D.D. Narula, V. Menon, F.A. Ehlerl, J.S. Steinberg. *St. Luke's-Roosevelt Hospital Center, Columbia University, New York, NY, USA*

The incidence of atrial fibrillation increases with age. The precise explanation is not clear, but age related atrial fibrosis may play a role. We hypothesized that aging would be associated with progressive conduction delay. Atrial activation was assessed by the total P-wave duration (PDur) on signal averaged (SA) ECG in 90 healthy volunteers. Subjects were required to have a normal 12-lead ECG prior to the study and were excluded if hypertension, diabetes, coronary artery disease, congestive heart failure or valvular heart disease were present. P-wave SAECG was performed using the QRS as a trigger and the P-wave as a template to determine PDur from a vector composite of three orthogonal leads.

**Results:** Using linear regression PDur was significantly correlated with age: r = 0.32, p < 0.002, {PDur = 0.23 (age) + 126 ms} (see figure).



**Conclusion:** In the absence of known or detectable disease, atrial activa-

SUNDAY POSTER