evening. After correcting ischemic time for each patient's simultaneously measured activity level, a significant circadian fluctuation of ischemic time was still observed ($p < 0.001$) with an early morning peak at 6 a.m.

Conclusion: There is an underlying endogenous circadian rhythm of ischemic vulnerability, which is independent of exogenous factors. Exogenous factors are most potent as triggers of ischemia at the time of morning peak of the endogenous variation in vulnerability for ischemia.

990-49 Inadequate Pre-Hospital Medical Therapy in Patients Undergoing Percutaneous Coronary Revascularization: Results from the CAVEAT Trial

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Background: Patients with known coronary artery disease may be receiving inadequate medical therapy prior to referral for percutaneous coronary revascularization. *Methods:* To examine the medical treatment of patients referred for percutaneous coronary revascularization, we analyzed pre-hospital treatment data and concomitant medical conditions from the CAVEAT I trial. *Results:* Of the 1,012 patients referred for revascularization 68.3% had unstable angina, 17.6% had stable angina, 9.8% had chest pain after myocardial infarction, and 4.3% were asymptomatic with a positive functional study. Prior to PTCA or directional atherectomy (DCA), patients had low rates of treatment with aspirin, nitrates, calcium channel blockers, beta-blockers, and anti-lipid agents (Table). Pre-hospital medications were associated with the following conditions: aspirin-none, nitrates-none, calcium channel blockers-hypertension ($p = 0.004$) and absence of unstable angina ($p = 0.046$), beta blockers-hypertension ($p = 0.01$), and anti-lipid agents-hyperlipidemia ($p \approx 0.0001$) and number of diseased vessels ($p = 0.035$). *Conclusions:* These data strongly indicate that patients referred for percutaneous coronary revascularization have inadequate pre-hospital medical treatment.

	PTCA (N = 500)	DCA (N = 512)
Aspirin	60.4%	58.6%
Nitrates	53.8%	51.8%
Ca Blockers	49.0%	45.7%
Beta Blockers	32.2%	34.8%
Anti-Lipid Agents	11.0%	11.1%

990-50 Suspected Ischemic Chest Pain: Accuracy and Cost Efficiency of Emergency Department-based Evaluation

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Hospital admissions to exclude myocardial ischemia as one possible cause of unexplained chest pain (CP) are costly and have a low positive diagnostic yield. This prospective study was performed to determine whether a comprehensive emergency department (ED)-based cardiology service provides accurate diagnoses with a significant cost savings. A special cardiology service providing consultations, exercise testing and echocardiography was used to evaluate 97 consecutive emergency department patients (pts) (44 male, 53 female) who presented with CP. The pts had one or more risk factors for coronary artery disease, a suspicious but atypical CP pattern, and no ECG/enzyme evidence of acute myocardial injury. To qualify, each pt had to be considered an appropriate candidate for hospital admission to evaluate CP by the ED physician. Based on negative exercise testing results performed upon clinical evaluation in the ED, all pts were discharged to continued non-cardiac ambulatory work-up. Mean cost of the evaluation was $1683 ± $871. A control group of 36 pts with similar symptoms underwent identical diagnostic procedures on an in-patient basis. In all cases, myocardial ischemia origin of the CP was excluded and the pts were discharged to various out-patient services. The mean cost of their hospital stay was $6358 ± $1884. We conclude that comprehensive cardiology service within an emergency department is a reliable alternative to hospitalization and results in a 74% cost-reduction for evaluation of a pt with atypical chest pain.

990-51 Mechanisms and Predictors of Late Death in Asymptomatic Patients After Myocardial Infarction. A Prospective Study on Remodeling

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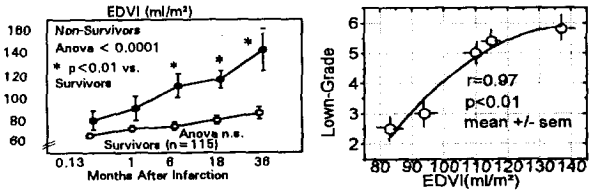
Although left ventricular (LV) dilation after myocardial infarction (Mi) carries an adverse prognosis, it is unclear whether individual patients indeed die with progressive remodeling, and how dilation is related to death.

We assessed 131 consecutive asymptomatic patients during 5 years after uncomplicated first myocardial infarction (Mi). In each, coronary angiography was performed at 4 weeks, LV end-diastolic (EDVI) volume (ml/m^2), Lown-grade and QT-duration, corrected for heart rate (QTc, ms) were measured at 4 days, 4 weeks, 0.5, 1.5, and 3 years by gated SPECT, Holter and 12-channel ECG, respectively. During an average follow-up of 59.7 months, 16 patients died (mortality 12.2%, median survival time of 30 months). Death was proceeded by progressive LV dilation (left figure) and occurred suddenly in 14 of 16 patients (88%). Extend and severity of ventricular arrhythmias, as indicated by a rise of Lown-grade from 2.8 ± 0.5 to 3.6 ± 0.5, 5.0 ± 0.4, 5.4 ± 0.3 and 5.8 ± 0.2 at 4 days, 4 weeks, 6 months, 1.5 and 3 years, respectively ($p < 0.00001$), increased before death. This was associated with a rise of QTc from 457 ± 6 at 4 days to 480 ± 9 before death ($p = 0.01$). In contrast, EDVI (left Figure) and Lown-grade did not rise and QTc even decreased (457 ± 8, 456 ± 8, 424 ± 4, 414 ± 5, 399 ± 4) in survivors ($p < 0.05$). Extend of LV dilatation correlated with severity of ventricular arrhythmias (right Figure). Non-survivors did not differ in drug therapy, electrolytes or initial coronary status and exercise tests were negative. These findings indicate that progressive LV dilatation (remodeling) may provide a proarrhythmic substrate for sudden death after Mi, which deserves more detailed analysis.



990-52 Long-term Prognostic Significance of Treadmill Ischemia in "Low-risk" Patients with Coronary Artery Disease

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Patients with stable single or 2-vessel coronary artery disease (CAD) and normal, or mildly depressed left ventricular function have a good prognosis. We have investigated the long-term prognostic significance of a positive exercise test (ExTest) in this population to establish whether it is useful in identifying a "high-risk" subgroup within a recognised "low-risk" population. Between 1987–94, 162 patients with documented single (n = 89) or double (n = 73) vessel CAD (excluding left main and proximal left anterior descending CAD), left ventricular ejection fraction >35% (mean 51%, range 36–72%) on radionuclide ventriculography, and an interpretable ExTest were assigned to receive medical therapy. There were 123 males and 39 females (mean age 60 yrs). A positive ExTest for ischemia was present in 104 (64%) pts. Pts were followed for a mean period of 49 months (range 6–82 months), during which time 34 (21%) had cardiac events (cardiac death n = 3, myocardial infarction (AMI) n = 14, unstable angina n = 6, elective revascularisation n = 11). Similar proportion of pts with a positive ExTest and a negative ExTest suffered cardiac events (all events, including revascularization) during follow-up (21% and 20.7% respectively). Kaplan Meier survival analysis demonstrated no difference between the groups. Survival analysis also failed to demonstrate any difference in the incidence of acute cardiac events (cardiac death and AMI) between positive and negative ExTest groups; of 15 events, 6 (40%) occurred in those with a positive Extest. Pts with 2-vessel disease suffered significantly more events than those with 1-vessel disease (29% vs 14.6%, $p < 0.05$), but there was no difference in acute events (cardiac death and AMI) between the two subsets. Even in pts with 2-vessel disease, there was no difference in survival in those with and without a positive ExTest. The data indicate that although detection of ischemia by exercise testing is useful as an initial diagnostic tool, once the coronary anatomy and left ventricular function are known, the presence of ischemia on treadmill exercise is of limited prognostic value in "low-risk" pts with stable CAD. These findings are consistent with reports demonstrating that acute cardiac events often result from plaque rupture in non-significantly stenosed vessels.

990-53 Effects on Cardiovascular End Points and Psychological Variables of Metoprolol and Verapamil in Patients with Stable Angina Pectoris — The Angina Prognosis Study in Stockholm (APSIS)

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The effect of treatment with metoprolol or verapamil was investigated in 809 patients with stable angina pectoris. End points for the study were: death,

nonfatal cardiovascular events and three psychological variables reflecting aspects of quality of life. Nonfatal cardiovascular events included acute myocardial infarction, incapacitating or unstable angina, cerebrovascular and peripheral vascular events. The psychological variables were aggregate measures of psychosomatic symptoms and sleep disturbances and an evaluation of life satisfaction on a visual analogue scale. The mean age of the patients was 59 ± 7 years and 30% were women. The patients were followed for a total of 2887 patient years, with a median follow-up time of 3.6 years. Total cardiovascular mortality in the metoprolol versus verapamil group were 5.4% versus 6.2% and 4.7% versus 4.7% respectively. Nonfatal cardiovascular events occurred in 26.4 and 24.1%, respectively. Psychosomatic symptoms and sleep disturbances were significantly improved in both treatment groups. The magnitude of change was small and not significantly different. Life satisfaction did not change on either drug. Withdrawals due to side effects occurred in 11.1 and 14.6%, respectively.

Conclusion: This large scale long term study shows that both drugs were well tolerated and had the same effect on mortality, cardiovascular end points and measures of quality of life.

991 Ventricular Arrhythmias: Selected Topics

Wednesday, March 22, 1995, 9:00 a.m.–11:00 a.m.
Ernest N. Morial Convention Center, Hall E
Presentation Hour: 9:00 a.m.–10:00 a.m.

991-68 Potential Impact of Serial Drug Testing on the Clinical Outcome of Survivors of Cardiac Arrest, as Assessed in the Propafenone Arm of CASH Trial

Jürgen Siebels, Riccardo Cappato, Rudolf Rüppel, Michael Schneider, Michael Schlüter, Thomas Meinertz, Karl-Heinz Kuck. *University Hospital Eppendorf and St. Georg Hospital, Hamburg*

The study design of the Cardiac Arrest Study Hamburg (CASH) trial allows retrospective assessment of serial drug testing (SDT) predictive value. Regardless of pts assignment to one of the 3 drug arms (propafenone (P), metoprolol and amiodarone) all pts undergo programmed electrical stimulation (PES) before and after oral drug administration; the assigned drug is then administered regardless of the response to SDT. Disclosure of data on P and ICD in survivors of cardiac arrest after premature termination of the former arm allowed retrospective assessment of the predictive value of SDT. In the P arm, age was 57 ± 13 yrs; 46 (79%) out of 58 pts had ischemic heart disease. During baseline PES, a sustained ventricular arrhythmia (sVA) could be induced in 25 (63%) pts assigned to P. After oral P (300–900 mg/day), 13 (52%) among inducible, but 22 (67%) among noninducible pts at baseline presented a sVA in response to PES. During a median follow-up of 11 months, sVA or sudden death occurred in 2/13 (15%) nonresponders, 2/5 (40%) responders, in 2/7 (29%) pts who became inducible after P and in 3/22 (14%) who were not inducible during baseline and after P. The second PES could not be performed in 11 (19%) pts due to the occurrence of spontaneous VA arrhythmias after P administration; sVA during follow-up were documented in 5 (45%) such pts. The positive and the negative predictive values of SDT with P were 60% and 15%, respectively.

Conclusion. Data from this study suggest that, in survivors of cardiac arrest, SDT with P carries a poor predictive value to guide drug therapy. This observation prompts further investigation to assess the utility of SDT as a strategy in pts at risk of sudden death.

991-69 Out-of-Hospital versus In-Hospital Death in the ESVEM Trial

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Perfect antiarrhythmic therapy may not impact on total arrhythmic death (AD) (defined as death associated with ventricular tachycardia, ventricular fibrillation or asystole) or all cause mortality if AD is not preventable. Death associated with an arrhythmia may occur in-hospital (IH) as an inevitable consequence of the disease process, be considered AD and not be preventable. Out-of-hospital AD, however, may be preventable by perfect antiarrhythmic therapy. We evaluated IH-AD, OH-AD, non-arrhythmic cardiac death (CAR), non-cardiac death (NCD) and total deaths in the ESVEM trial in all 486 patients randomized. Deaths were OH-AD if arrhythmic death occurred OH or if out of hospital arrhythmias preceded admission and directly caused death. OH AD accounted for 41% of all deaths. Baseline characteristics were comparable for OH-AD and IH-AD groups (e.g., ejection fraction, disease etiology, sex, age, beta blocker use, prior antiarrhythmic drug failure). Eighty-six percent of OH deaths were AD while 22% of IH deaths were AD ($P < 0.001$). Twenty of 87 arrhythmic deaths occurred in the hospital.

# Deaths (% deaths)	AD (% Total AD)	CAR (% Total CAR)	NCD (% Total NCD)
IH-Death	20 (23%)	41 (98%)	26 (72%)
OH-Death	67 (77%)	1 (2%)	10 (28%)

Ideal antiarrhythmic therapy may not impact on AD and total death as suspected; in the ESVEM trial, the 1 and 4 year actuarial mortality from OH AD was 8% and 18%. These values may indicate more precisely those patients who benefit from prefect antiarrhythmic therapy. With 8% 1 year OH-AD, 92% could be treated unnecessarily.

991-70 Decreasing Risk of Symptomatic Sustained Ventricular Tachycardia in Myocardial Infarction Patients

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Our knowledge of natural history in survivors following myocardial infarction (MI) is mainly based on data collected before the fibrinolytic era. In a prospective risk stratification study, 823 MI survivors underwent 24-h Holter monitoring (HM) 12–16 days after the acute event. Ventricular extrasystoles (VES) were present in 77% of the pts, ≥ 20 VES/h in 10%, ventricular pairs (VP) in 27%, ventricular salvoes (VS) in 12% and nonsustained ventricular tachycardias (>5 consecutive VES)(nsVT) in 9%. During the 12-months follow-up (only one patient was lost) there were 66 (8%) deaths, 26 sudden or instantaneous (SD)(39%), 23 non-sudden, 6 non-cardiac and 11 of unknown causes. SD-rates were 3% in those with monomorphic VES, 9% with ≥20 VES/h or VP, 10% with VS and 13% with nsVT ($p = 0.01$). Only one pt developed a symptomatic sustained ventricular tachycardia 2 months after discharge and only 5 pts had syncopes of unknown origin.

Conclusion: In the fibrinolytic era, arrhythmias are still as prevalent as at the time before thrombolysis. The sudden death rate is also similar. However, symptomatic sustained ventricular tachycardia has become an extremely rare event.

991-71 Electrophysiologic Findings in Patients with Obstructive Sleep Apnea Associated Ventricular Asystole

Wolfram Grimm, Jürgen Hoffmann, Ulrich Köhler, Volker Menz, Jörg H. Peter, Bernhard Maisch. *Philipps-University Marburg, Germany*

Fourteen patients (47 ± 11 years) with ventricular asystole of 5.6 ± 2.7 sec (range: 3.1–13.6 sec) due to complete atrioventricular (AV) block (n = 8), sinoatrial (SA) block or sinus node (SN) arrest (n = 5) or both (n = 1) occurring exclusively during sleep apnea episodes as documented by cardiorespiratory polysomnography underwent conventional electrophysiologic study: evaluation of sinus node function included rate corrected SN recovery time (CSNRT), sinoatrial conduction time (SACT, Narula method), and sinus rate (SR) response to atropine (0.02 mg/kg). CSNRT of <550 ms, SACT of <125 ms, and SR increase after atropin to >90 bpm were considered to be normal. Assessment of AV-conduction included AH- and HV-intervals, AV-Wenckebach periods, and AV nodal effective refractory periods (ERPs) before and after atropine. None of the 14 pts received digitalis, beta-blockers or verapamil during polysomnography or EP study. 6 pts (42%) had hypertensive heart disease, 1 pt (8%) had coronary disease, and 7 pts (50%) showed no evidence of structural heart disease.

Results: SN function was normal in 12 of 14 pts (86%). Two pts had slightly prolonged SACTs (160 and 165 ms respectively). CSNRT and SR response to atropine was normal in all pts. *AV nodal function* was normal in 8 of 14 pts (57%) and abnormal in 4 pts (43%): 2 pts had prolonged AH-intervals of 135 and 143 ms, and 2 pts had AV-Wenckebach points at 520 and 730 ms and AV nodal ERPs of 500 and 700 ms respectively. AV-nodal function normalized after administration of atropine in all 4 pts. *His-Purkinje system function* was normal in 8 pts (57%), and 6 pts (43%) had slightly prolonged HV-Intervals (range: 59–63 ms). Intra- or infra His block was not observed in any pt.

In conclusion, normal or only slightly abnormal electrophysiologic findings in most patients with sleep apnea associated ventricular asystole support the hypothesis that ventricular asystole is due to a neurally mediated cardioinhibitory reflex. However, it remains unsolved, why sleep apnea associated prolonged ventricular asystole does occur in some pts and does not occur in other pts despite severe obstructive sleep apnea.