A symptom risk questionnaire for use in screening for NIDDM

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185 **Coronary Artery Disease Is Associated With Low Insulin Sensitivity Independent of Insulin Levels and Cardiovascular Risk Factors.** MARIAN REWERS*, RALPH D'AGOSTINO JR, GREGORY BURKE, DANIEL ZACCARO, JOE SELBY*, PETER SAVAGE* for the Insulin Resistance Atherosclerosis Study (IRAS), Denver, CO

Elevated fasting and post-OGTT insulin levels have been associated with coronary artery disease (CAD). However, it is unknown whether this relationship is independent of that found with insulin resistance. IRAS is the first population study that measured insulin sensitivity (S_I) directly, using Bergman's minimal model analysis of a frequently sampled intravenous tolerance test.

Among 1482 IRAS participants aged 40-69 years, 91 had definite CAD (past myocardial infarction, major Q wave, or coronary artery bypass or angioplasty) confirmed by medical records. One unit difference in S_I (10^{-4} min^{-1} /μU/ml) was associated with a 22% lower odds ratio of CAD after adjusting for demographic (age, sex, ethnicity, center) and CAD risk factors (hypertension, HDL, LDL cholesterol and smoking). Log transformed insulin levels fasting (FIns) or 2 h after OGTT (2hIns) were not associated with CAD after adjustment for risk factors:

Independent variables in the model	OR	p
Demographic#+ S_I	S_I =0.70	.001
Demographic + FIns	FIns =1.45	.034
Demographic + 2hIns	2hIns =1.13	.380
Demographic + CVD factors*+S_I	S_I =0.78	.028
Demographic + CVD factors +FIns	FIns =1.20	.355
Demographic + CVD factors +S_I+FIns	S_I =0.78	.052
	FIns =1.04	.880

#age,sex,ethnicity,center;*HDL-ch,LDL-ch,smoking,hypertension

The association of CAD with low insulin sensitivity is independent of and much stronger than the association with fasting or post-OGTT insulin levels.

186 **Relatively More Atherogenic Coronary Heart Disease Risk Factors in Prediabetic Women than in Men.** **STEVEN HAFFNER*, HEIKKI MIETTINEN, San Antonio, TX**

Subjects with non-insulin dependent diabetes mellitus (NIDDM) have a two-fold increased risk of coronary heart disease (CHD) in men and four-fold in women relative to non-diabetic subjects. The reasons for the greater increase in CHD in women is not well understood. Since some studies suggest that duration of clinical diabetes and degree of hyperglycemia only have a modest relation to CHD in NIDDM, we hypothesized that the women who eventually convert (CONV) to NIDDM ("prediabetics") would have a more atherogenic pattern of CHD risk factors (RF) than men CONV relative to subjects who do not convert (NCONV) to NIDDM. We examined this issue in the 7-8 year follow-up of the San Antonio Heart Study. Age-adjusted baseline data are by conversion status and gender are:

	Men		Women		p-value	
	CONV	NCONV	CONV	NCONV	CONV	SEX X CONV
n	66	638	117	907		
TRIG(mg/dl)	174	139	156	101	<.001	.008
HDL C(mg/dl)	39.3	43.9	43.5	51.2	<.001	.010
DBP(mmHg)	75.3	74.7	73.5	69.7	<.001	.010
F INS(µU/ml)	15.6	10.6	17.5	9.8	<.001	.009

The significant conversion status x sex interaction term indicates that women who CONV have relatively greater CHD RF than men who CONV compared to NCONV subjects. After adjustment for fasting insulin levels, the conversion status x sex interaction term is no longer statistically significant suggesting that the greater hyperinsulinemia in prediabetic women subjects may in part explain their greater CHD RF. Thus, the excess risk for CHD in women with NIDDM relative to men with NIDDM may be partially due to their excess cardiovascular risk even prior to the onset of diabetes.

187 Identifying Patients at High Risk of Diabetic Foot Ulcer and Amputation JESSIE H. AHRONI*, EDWARD BOYKO*, VICTORIA STENSEL, RUBY FORSBERG, DOUGLAS SMITH, Seattle WA

We prospectively categorized 759 subjects for their risk of developing lower extremity complications by the criteria of the American Diabetes Association (ADA) and the Hansen's Disease Center (HDC). The two level ADA scheme includes more factors than the four level, four factor HDC scheme. Subjects included all diabetic patients followed in a general internal medicine clinic without foot ulcer who agreed to participate. Subjects were 98% male, 78% white race, with a mean duration of diabetes of 11.4 yrs, primarily treated by insulin (47%) and a mean age of 63.2 yrs. We followed subjects an average of 2.5 yrs for the occurrence of a foot ulcer (FU) (n=111, FU risk=14.6%) or a lower extremity amputation (LEA) (n=21, LEA risk=2.8%).

We calculated the sensitivity (sens), specificity (spec) and likelihood (LR) ratio of risk categories to predict FU and LEA. The ADA criteria categorized 100% of the subjects as high risk (sens 100%, spec 0%, LR+=1, LR-=1) for both FU and LEA. The risks of FU and LEA in subjects positive by ADA criteria were identical to the average pre-test values. Therefore the ADA criteria provided no information on risk of FU or LEA in this diabetic population. The HDC criteria categorized 61% as high risk (sens 92%, spec 44%, LR+=1.6, LR-=0.2 for FU and sens 100%, spec 40%, LR+=1.7, LR-=0.0 for LEA). The risks of FU and LEA in subjects positive by the HDC criteria were 21.9% and 4.6%, respectively. HDC criteria positive subjects therefore had a risk of FU or LEA only slightly different from the average pretest risk.

Many findings purportedly useful in determining risk for FU and LEA are not predictive of these complications and need not be elicited during risk screening. Neither the ADA or HDC criteria provided good discrimination between subjects at high and low risk for lower limb complications in this population. More research on this area is clearly needed.

188 **A Symptom-Risk Questionnaire for use in Screening for NIDDM.** JOHANNES B RUIGE, J NICO D DE NEELING, LEX M BOUTER, PIETER J KOSTENSE, and ROBERT J HEINE*, Amsterdam, the Netherlands.

We investigated to what extent a simple questionnaire on symptoms and risk factors could be used to select subjects with a high risk for undiagnosed non-insulin-dependent diabetes mellitus (NIDDM). A general population sample of 2,364 50-74-yr-old Caucasian subjects, *unknown* with diabetes, completed a detailed questionnaire on diabetes-related symptoms and risk factors. Subsequently, they underwent an oral glucose tolerance test (OGTT). A backward stepwise multiple logistic regression was carried out with absence or presence of newly detected diabetes (according to WHO-criteria) as dependent variable and the items from the questionnaire as independent variables. Thirst, shortness of breath during walking, pain during walking - urging to slow down, age, sex, obesity, a positive family history for diabetes, the use of anti-hypertensive drugs and bicycling proved to be independently and significantly ($p < 0.05$) associated with the presence of diabetes. To enable future respondents to compute their own risk of diabetes, the regression coefficients of the items associated with diabetes were transformed into simple risk scores, adding up to an aggregated risk score. The nine selected items were included in a new Symptom-Risk questionnaire which was tested in a *different* population sample not known with diabetes of 779 45-75-yr-old Caucasian subjects, and compared with two existing questionnaires. The American Diabetes Association questionnaire (1993), the Classification Tree questionnaire developed by Herman et al. (1995) and the newly developed Symptom-Risk questionnaire had a sensitivity of 59%, 72% and 72%, a specificity of 57%, 55% and 63%, a positive predictive value of 5.7%, 6.5% and 7.6% and a negative predictive value of 97%, 98% and 98%, respectively. We conclude that these last two questionnaires could be helpful tools in an NIDDM screening program.

A numeral beside an author's name indicates a duality of interest. See page 1A.