



CHEST

For specialists in:
Pulmonology, Critical Care, Sleep Medicine,
Thoracic Surgery, Cardiopulmonary Interactions,
and related disciplines

Computerized resting ECG analysis for the detection of coronary artery stenosis after coronary revascularization in comparison with angiographic findings

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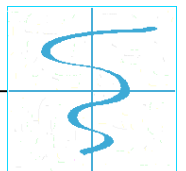
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Disclosures

- Dr. J.T. Shen is founder and managing member of Premier Heart LLC and co-inventor of the web-based 3DMP method
- The other authors have no disclosures to make



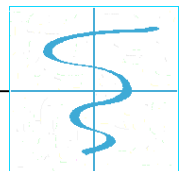
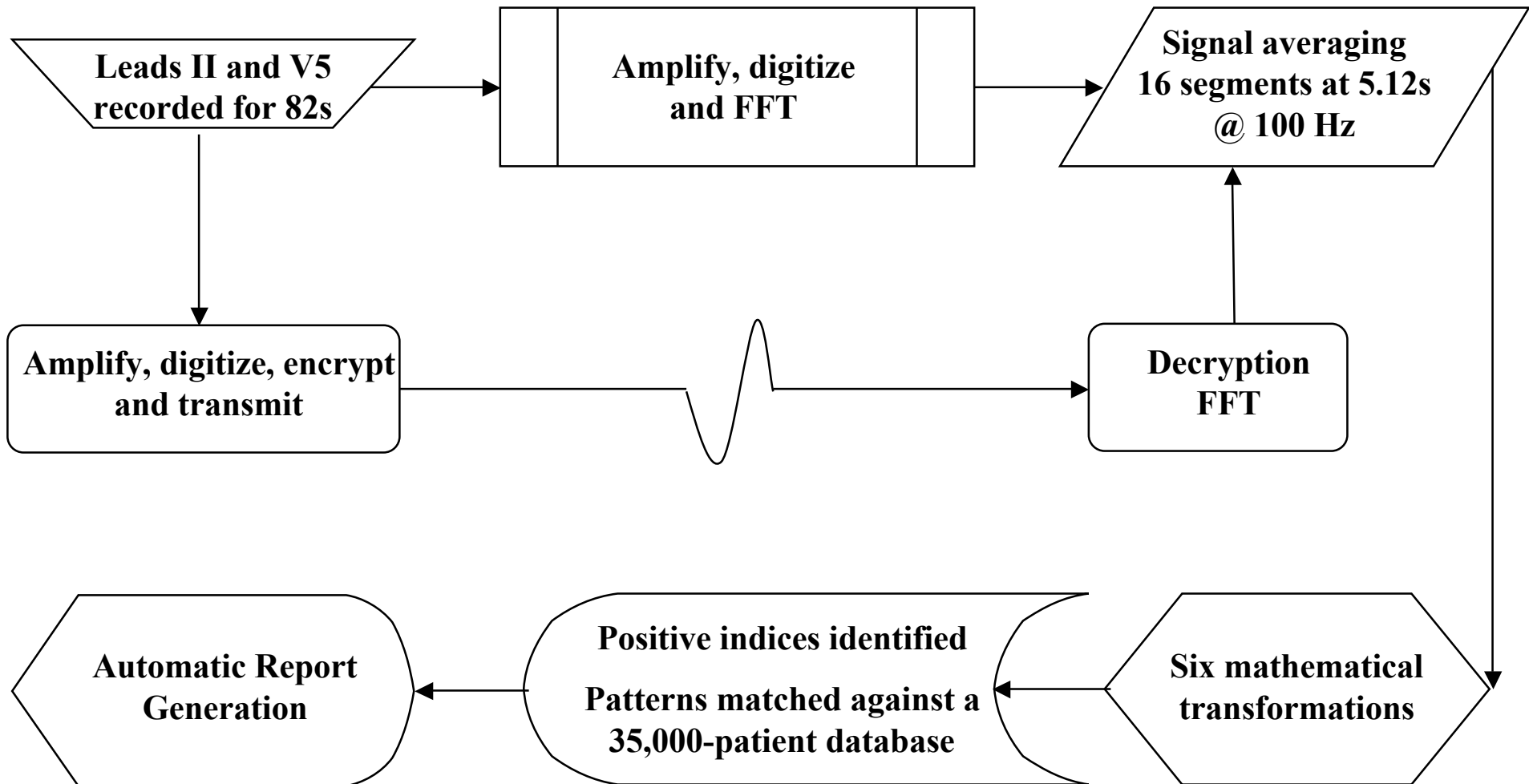
3DMP

Digital Database Driven Multi Phase

- A Computerized Expert ECG System
 - Sophisticated mathematical analysis
 - Validated digital patient database
- An innovative, non-invasive diagnostic device for myocardial ischemia due to coronary artery disease



Signal and Digital Data Processing



3DMP Database

- 35,000 cases
 - Confirmed medical diagnosis
 - Benchmark references for pattern recognition
- Proprietary software for data interpretation
 - Automated comparison to database
 - Diagnosis of myocardial ischemia
- Automatic scoring system
 - Quantitative assessment of severity of myocardial ischemia



Clinical Study

- Previous study (*Weiss et al, 2002*) showed good sensitivity and specificity of 3DMP in the prediction of hemodynamically relevant coronary stenosis
- Evaluation of 3DMP in patients after revascularization (PCI, CABG) w/o acute chest pain
 - Follow-up for re-stenosis, de novo stenosis, graft stenosis
- Convenience sample of an unselected patient population scheduled for coronary angiography
- Comparison to angiography



Patients

- 213 patients scheduled for follow-up angiography
 - 68 female, 68.2 +/- 8.3 yoa
 - 145 male, 61.8 +/-9.8 yoa
- Coronary revascularization at least 6 weeks before study
 - 147 PCI, 63.2 +/-10.3 yoa
 - 55 female (37%), 68.6 +/- 7.8 yoa
 - 92 male (63%), 60.0 +/- 10.2 yoa
 - 66 CABG, 65.3 +/- 8.6 yoa
 - 13 female (20%), 66.3 +/- 10.0 yoa
 - 53 male (80%), 65.0 +/- 8.3 yoa



Coronary Angiography

- Standard procedures
- Immediate classification of results by angiographer
- Independent classification by second cardiologist
- Dichotomous classification of hemodynamically relevant coronary stenosis
 - Stenosis “NO”: $< 70\%$ stenosis ($< 50\%$ LCA)
 - Stenosis “YES”: $> 70\%$ stenosis ($> 50\%$ LCA)
- Both investigators blinded against 3DMP results



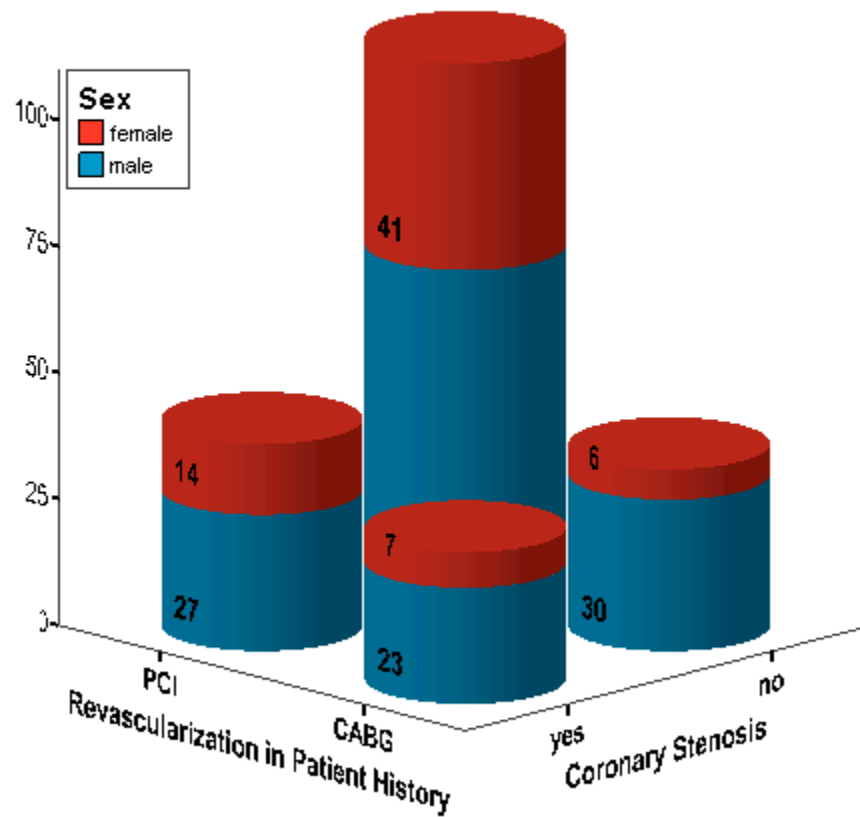
3DMP ECG

- Prior to angiography after 20 min rest
- Limb leads and V5
- 82 second simultaneous recording of leads II and V5
- Amplification, digitization, transmission to central server (after ECG quality check)
- Calculation of severity score (0 to 20)
 - Higher values associated with higher likelihood of coronary stenosis
 - Cut-off > 4 indicative of hemodynamically relevant stenosis
- ECG technician and Premier Heart staff blinded against angiograms

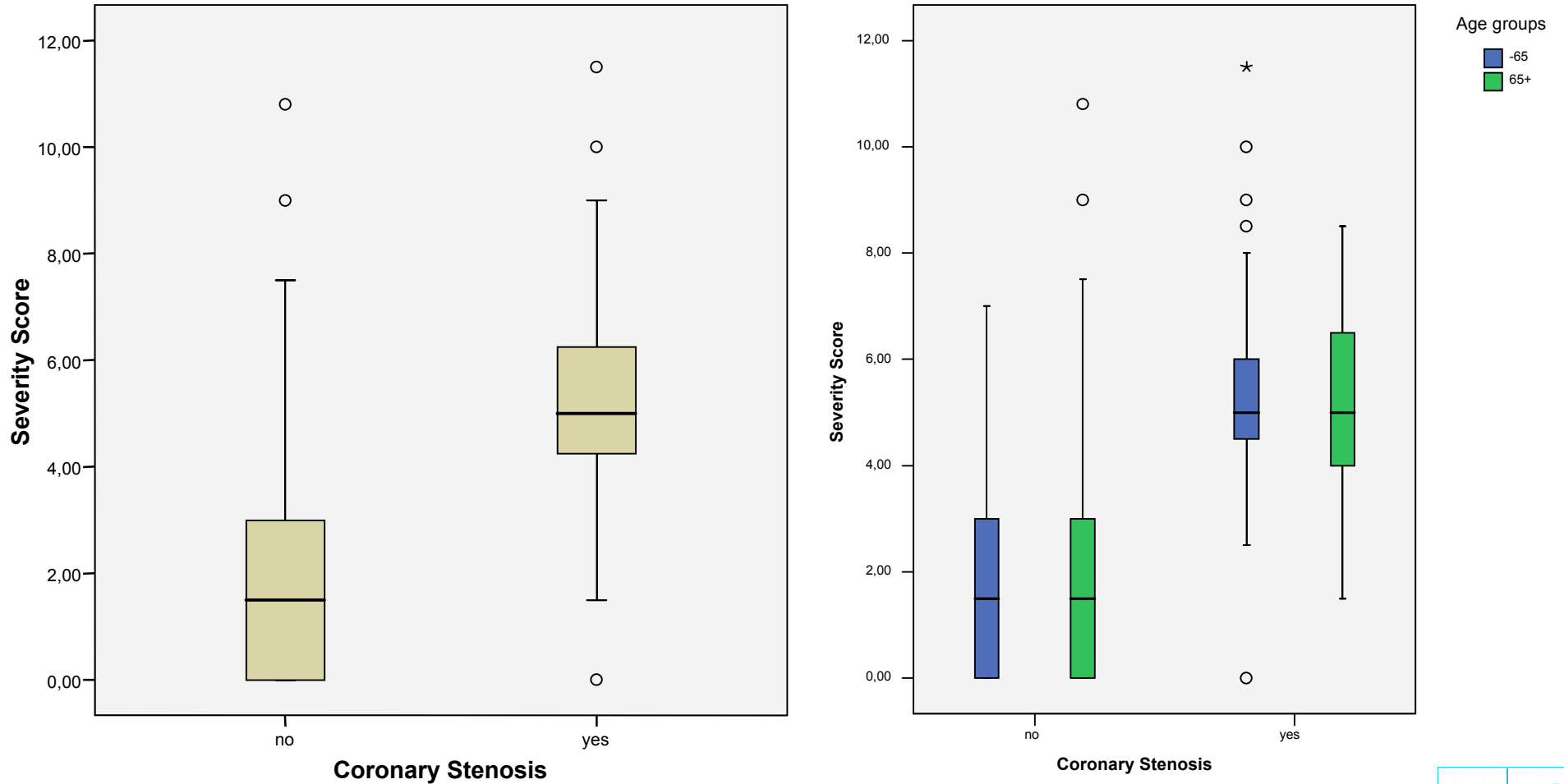


Coronary Stenosis

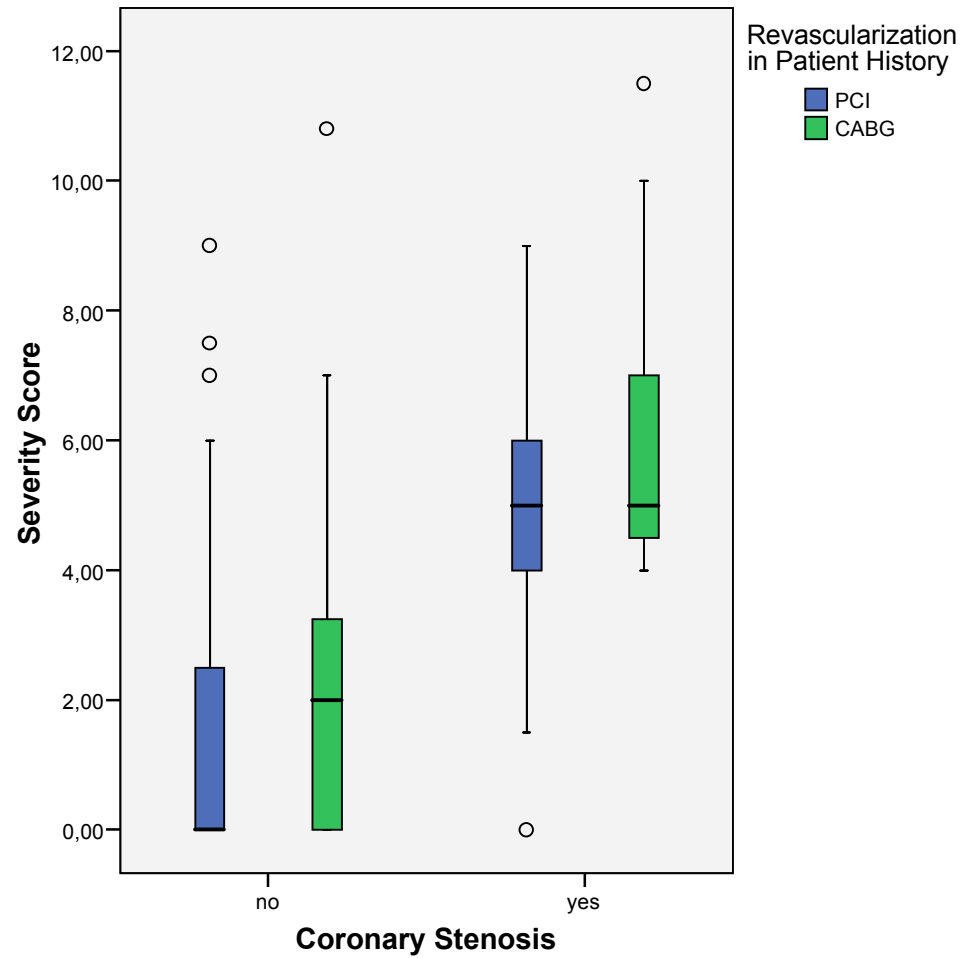
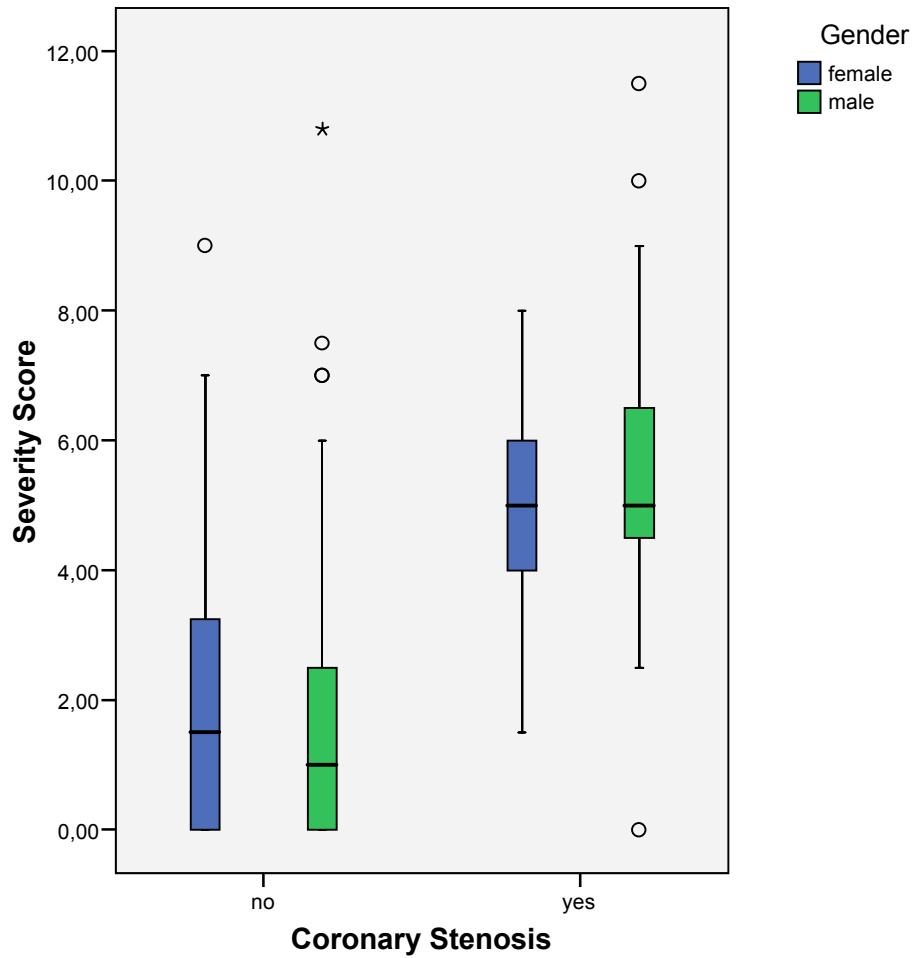
- 71 of 213 patients (33%)
- No gender or age differences
- More frequent in CABG group



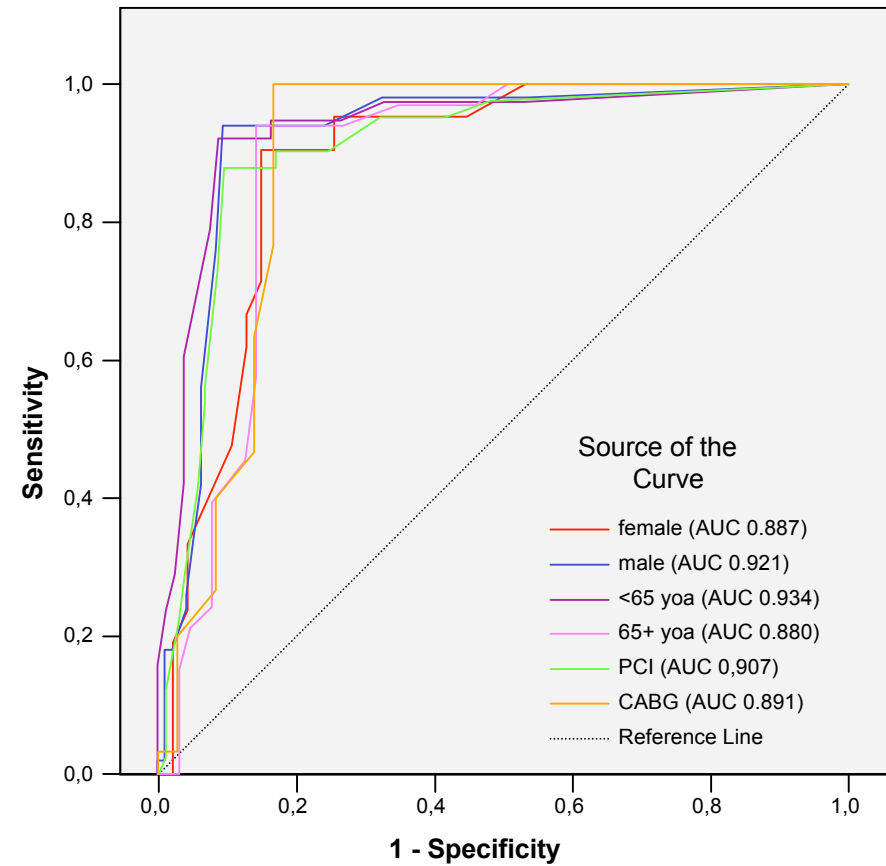
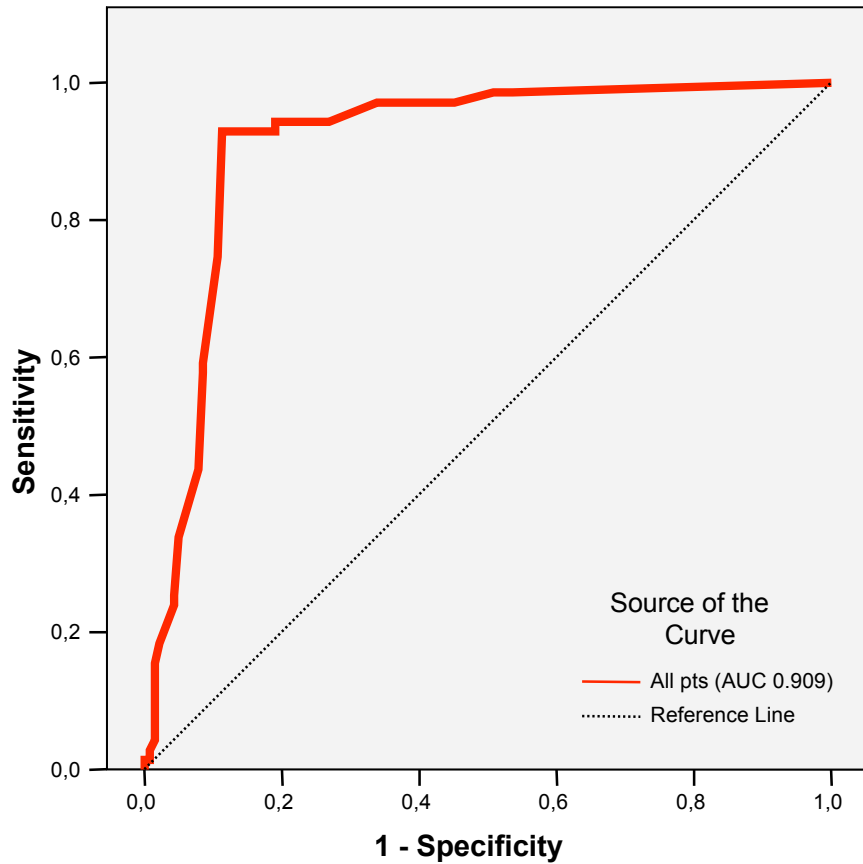
Severity Score



Severity Score



ROC Curves



Prediction of Coronary Stenosis

Angiography

		Angiography	
		No Stenosis	Stenosis
3DMP Severity Score	< 4	126	5
	≥ 4	16	66



Prediction of Coronary Stenosis

	n	a priori	Correct	Sens	Spec	PPV	NPV
Total	213	0,333	0,901	0,930	0,887	0,673	0,981
Female	68	0,309	0,868	0,905	0,851	0,548	0,978
Male	145	0,345	0,917	0,940	0,905	0,733	0,982
<65 yoa	117	0,325	0,915	0,921	0,911	0,706	0,980
65+ yoa	96	0,344	0,885	0,939	0,857	0,643	0,981
PCI	147	0,279	0,898	0,878	0,906	0,582	0,980
CABG	66	0,455	0,909	1,000	0,833	0,806	1,000



Summary

- Computerized resting ECG analysis
- Prediction of coronary stenosis after revascularization
 - 90% correct predictions, sensitivity 93%, specificity 89%
 - PPV 67%
 - NPV 98%
- No significant effects on performance from Gender, Age, Type of Revascularization
- Further validation warranted (and planned)



Clinical Implications

- Non-invasive prediction of coronary stenosis
- Screening for stenosis
- Feasible in patients with contraindications to stress testing
- Similar rule-out performance like stress testing (awaits further study)
- Simple application by technicians
- Presence of a physician not required

