Acute coronary syndromes
The prognostic importance of hypertension, diabetes and vectorcardiographic markers

Akademisk avhandling

som för avläggande av medicine doktorsexamen vid Sahlgrenska akademin vid Göteborgs universitet kommer att offentligen försvaras i hörsal Carl Kylberg, Medicinaregatan 7, Göteborg, fredagen den 29 november 2013 kl. 09.00

av

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Avhandlingen baseras på följande delarbeten:

I Acute coronary syndromes--the prognostic impact of hypertension, diabetes and its combination on long-term outcome.
Lingman M, Herlitz J, Bergfeldt L, Karlsson T, Caidahl K, Hartford M.
Int J Cardiol. 2009;137:29-36.

II The impact of hypertension and diabetes on outcome in patients undergoing percutaneous coronary intervention.
Lingman M, Albertsson P, Herlitz J, Bergfeldt L, Lagerqvist B.
Am J Med. 2011;124:265-75.

III Transient repolarization alterations dominate the initial phase of an acute anterior infarction.
Lingman M, MD, Hartford M, Karlsson T, Herlitz J, Rubulis A, Caidahl K, Bergfeldt L. *Submitted*

IV The spatial QRS-T area angle predicts increased risk for sudden cardiac death after acute coronary syndromes.
Lingman M, Hartford M, Karlsson T, Herlitz J, Rubulis A, Caidahl K, Bergfeldt L.
Submitted

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Abstract

Research questions:

1 Is hypertension and diabetes associated with the future risk of death, and recurrent manifestations of cardiovascular disease in acute coronary syndromes (ACS)?
2 How does myocardial ischemia affect depolarization and repolarization of the heart during the early phase of an acute myocardial infarction?
3 What is the prognostic value of accepted vectorcardiographic markers in relation to future risk of sudden cardiac death after ACS?

Methodology: Papers I, III and IV studied patients with ACS prospectively and consecutively included at the coronary care unit of Sahlgrenska University Hospital. Paper I deals with 2,329 patients who were followed for a median of 8 years. Paper III included 57 patients who were diagnosed with an anterior ST-elevation myocardial infarction with vectorcardiographic (VCG) registration starting within 4 hours from onset of chest pain and showing dynamic ST-vector magnitude. Paper IV investigated 643 patients who were subject to cardiac ultrasound and VCG registration during hospital stay and followed for 30 months. Clinical data and data on complications and pharmacological treatment were collected from hospital records and interviews. The Swedish National Population Register, the Swedish Cause of Death Register and the Swedish Hospital Discharge Register completed end-point data in paper I, II and IV. Paper II included 44,268 patients in the Swedish Coronary Angiography and Angioplasty Registry (SCAAR) during 2006 through 2008 with the whole spectrum of coronary artery disease. They were followed for an average 1.9 years. The SCAAR was also merged with the Swedish prescribed drug Register. All prognostic results were adjusted for background data.
Results: Paper I reports that diabetes was a predictor of death (HR 1.79; 95% CI 1.52-2.10) with an additive effect of hypertension (HR 2.10, 95% CI 1.71–2.57). In paper II hypertension increased the risk of myocardial infarction, stroke and congestive heart failure with a strong additive adverse effect of diabetes while hypertension alone was not a marker of the risk of death. The 10% increase in the risk of myocardial infarction during follow-up by hypertension was quadrupled by diabetes. In paper III the overall ventricular repolarization dispersion (Tarea) almost tripled (118 vs. 41μVs; p<.0001) and the heterogeneity of the action potential morphology (ventricular gradient) was 2.6 times higher (127 vs 49 μVs; p<.0001) at maximum than at minimum ischemia as judged from the degree of ST-elevation. In paper IV a wide angle between the main direction of depolarization and repolarization (QRS-T area angle) increased the risk of sudden cardiac death by 63% after adjusting for the left ventricular ejection fraction.
Conclusions: Diabetes is strongly associated with the risk of death after an ACS with a small additive effect of hypertension. Hypertension alone is associated with myocardial infarction, stroke and congestive heart failure during follow-up but diabetes is a more important risk factor. Myocardial ischemia initially and transiently increases the heterogeneity of repolarization which might explain why the risk of ventricular fibrillation is also transient and lacks prognostic value. A wide QRS-T area angle measured early after an acute coronary syndrome predicts sudden cardiac death regardless of left ventricular dysfunction.

Key words: Acute coronary syndromes; hypertension; diabetes; percutaneous coronary intervention; prognosis; myocardial ischemia; coronary artery disease; electrocardiography; vectorcardiography; arrhythmia; sudden death; electrophysiology; prognosis

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