Ultrasound assessment of carotid atherosclerosis focusing on plaque characteristics and changes over time

Akademisk avhandling

Som för avläggande av medicine doktorsexamen vid Sahlgrenska Akademin vid

Göteborgs Universitet kommer att offentligen försvaras i hörsal Arvid Carlsson,

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Av

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Avhandlingen baseras på följande delarbeten:

I. Percentage white: a new feature for ultrasound classification of plaque echogenicity in carotid artery atherosclerosis.
Prahl U, Holdfeldt P, Bergström G, Fagerberg B, Hulthe J, Gustavsson T.
Ultrasound Med Biol. 2010 Feb;36(2):218-26. Epub 2009 Dec 16.

II. Slightly elevated high-sensitivity C-reactive protein (hsCRP) concentrations are associated with carotid atherosclerosis in women with varying degrees of glucose tolerance.
Prahl U, Wikstrand J, Bergström GM, Behre CJ, Hulthe J, Fagerberg B.
Angiology. 2010 Nov;61(8):793-801. Epub 2010 Jun 13.

III. Carotid plaque burden and echogenicity in a prospective study of 64-year-old women
Prahl U, Bergström GM, Fagerberg B, Hulthe J
In manuscript

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ABSTRACT

In a clinical perspective better methods to identify subjects at increased cardiovascular risk are needed. Atherosclerotic plaques of the carotid arteries with low echogenicity have been related to future clinical events. However, better methods to assess plaque characteristics are needed as well as more information on the variability and change over time of echogenicity in relation to occurrence and total area of non-stenotic carotid plaques. The aims were to develop a new method for plaque assessment, study variability over time and to examine plaque characteristics in relation to diabetes mellitus and hsCRP.

A population sample of 64-year-old Caucasian women (n=638) with varying degrees of glucose tolerance underwent assessment of cardiovascular risk factors and bilateral ultrasound of the carotid arteries for measurement of intima-media thickness (IMT), plaque burden and plaque echogenicity, at baseline and at 6 year follow-up. A semi-automated method to evaluate echogenicity (SAMEE) and its main feature, *Percentage White* (PW) were developed with the visual Gray-Weale classification as reference method. PW was then also analysed in images from the follow-up examination.

The SAMEE program and its main feature, *Percentage White* (PW), was constructed and validated to handle different technical and artifact-related sources of variability. We showed that PW is highly reproducible and correlates to a higher extent than GSM with a number of cardiovascular risk factors. Our results suggest that the problem of multiple plaques in individual subjects in our data set is best managed by measuring the average PW of all plaques. Plaque area increased as expected during 6 years of follow-up, but this was not accompanied by a change in echogenicity. Diabetes was associated with increased plaque burden and plaque echolucency at baseline. Risk factor intervention and new medication may have impacted the findings at follow-up. hsCRP≥2mg/ml as a risk marker of future cardiovascular disease was associated with carotid bulb IMT and total plaque area among women with carotid plaques. Taken together, the SAMEE program and measurement of PW may be potentially valuable tools in the identification of subjects at increased cardiovascular risk. This has to be investigated in future studies.

Key words: Ultrasound, Carotid artery, Women, Plaques, Echogenicity, Atherosclerosis, hsCRP, Semi-Automated Method to Evaluate Echogenicity