USE OF CAROTID INTIMA-MEDIA THICKNESS AND PLAQUE VOLUME TO PREDICT SINGLE OR MULTI-VESSEL CORONARY ARTERY DISEASE.

Owen, KS.[12], Menown, IB.[2], Jennings, M.[1], Skillen, K-L.[1], Zhang, X.[1,2], Regan, B.[3], Burtenshaw, D[3], O'Maolmhuaid, F.[3]

[1] Ulster University
[2] Southern Health and Social Care Trust
[3]Dublin City University
email: owen-k@ulster.ac.uk

INTRODUCTION

Increased carotid intima-media thickness (cIMT) has been extensively evaluated as a marker of cardiovascular risk. However, there are only limited data correlating cIMT and other carotid measurements with the presence and anatomical severity of coronary artery disease (CAD).

PROBLEM

Currently the two gold standard methods for diagnosing CAD are Invasive Coronary Angiography (ICA) and Computed Tomography Coronary Angiography (CTCA). With over 250,000[1] ICA's and 42, 340[2] CTCA's performed in the UK each year, at a cost of £2500 and £500 retrospectively, this is an enormous cost to the health service. ICA and CTCA both require radiation and in the case of the former, a day in hospital. Of those undergoing diagnostic angiograms, almost two two-thirds do not have obstructive coronary artery disease[3]. Therefore, a screening method ought to be established to ensure the right patients are being referred for these two procedures.

METHODS

Patients with a history of ischemic-type chest pain or angina equivalent undergoing ICA or CTCA underwent high-resolution B-mode ultrasound to measure cIMT via B-mode 3D-imaging.
Secondary, the measurement of total plaque volume and maximum area reduction was taken using latest generation hardware and software. cIMT measurements were adjusted for Age and sex. Normal ranges were defined based on large previous independent population studies.
Exclusion criteria where those patients not receiving ICA or CTCA, were unable to sign consent, under 18, or unable to lie flat with mobility issues.

RESULTS

The study population comprised 181 subjects (72.5% male). Mean age was 66.3±11.61SD years. Cardiovascular risk factors included family history of CAD (72%), current or ex-smoker (59%), history of hypertension (67%), hyperlipidemia (66%) or diabetes 22.5%).
On ICA or CTCA, severe disease (≥70% area stenosis or positive pressure wire study) was present in at least 1 coronary artery in 125 (69.1%) of patients. Severe multivessel disease was present in 77 (42.5%) of patients.

cIMT ≥50th percentile vs cIMT <50th percentile predicted the likelihood of severe disease in at least 1 coronary artery (89.6% vs 10.4%; relative risk 2.8; p<0.00001; positive predictive value 82%, negative predictive value 70%; accuracy 79.1%). Similarly, cIMT ≥50th percentile predicted the likelihood of severe disease multivessel disease (90.9% vs 9.1%; relative risk 3.2; p<0.00004).
While cIMT ≥75th percentile was also associated with likelihood of single or multivessel disease, it did not improve the predictive value compared with the cIMT ≥50th percentile. 3D imaging of total plaque volume and maximum area reduction did not significantly improve prediction of CAD.
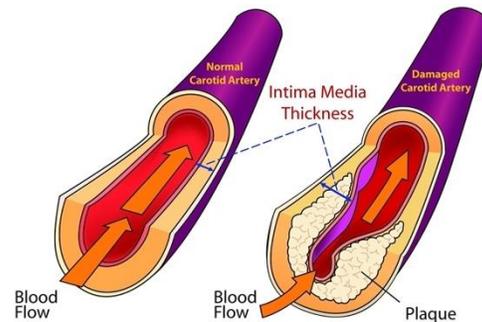

Figure 1 Schematic of normal common carotid artery on the left. On the right a damaged common carotid artery with a buildup of atheroma between two innermost layers, which reduces blood flow.

DISCUSSION

Results are encouraging with cIMT ≥50th percentile predicting an increased risk of severe CAD in at least one or more vessels. This would support the thinking that the common carotid artery mirrors the coronary arteries.
While the over and under 75th percentile did not improve this predictability there may be a more accurate cut point between these two groups. It is worth remembering that the population being tested where all symptomatic of ischemic type chest pain and to get a better idea of the negative and positive predictive values it would be helpful to consider more subjects from the CTCA population as those patients are more likely to have normal coronary arteries.
However, the assessment of cIMT may be a useful tool to help identify patients most likely to benefit from further invasive investigation.

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