Carotid Disease, Carotid IMT and Risk of Stroke

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Director, Clinical translational Division
Department of Neurology, Miller School of Medicine,
Miami Florida, USA

Jan 19, 2013, 2:00-3:00 pm
Carotid Disease, Carotid IMT & Risk of Stroke

- Definition
- Vascular Risk/Stroke Risk
- Should we screen for it (and whom)?
Carotid Stenosis

Prevalence

>50%: 2-8%
>80%: 1-2%

Stenosis Annual Stroke Risk

<table>
<thead>
<tr>
<th>Stenosis</th>
<th>Annual Stroke Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;50%</td>
<td>&lt;1%</td>
</tr>
<tr>
<td>50-80%</td>
<td>0.8 - 2.4%</td>
</tr>
<tr>
<td>&gt;80%</td>
<td>1 - 5%</td>
</tr>
<tr>
<td>ACS Progression</td>
<td>2 - 10%</td>
</tr>
</tbody>
</table>

With CAD 10-30%
With PAD 25-50%

A Rijbroek et al. Eur Neurol 2006;56:139
US CRITERIA FOR CAROTID STENOSIS

What US criteria to use for the degree of carotid stenosis?
# US CRITERIA FOR CAROTID STENOSIS

<table>
<thead>
<tr>
<th>NASCET STENOSIS GRADE</th>
<th>ROBINSON ET AL.</th>
<th>NEDERKOORN ET AL.</th>
<th>ZWIEBEL</th>
<th>ABURAHMA ET AL.</th>
<th>FILIS ET AL.</th>
<th>NICOLAIDES ET AL.</th>
</tr>
</thead>
<tbody>
<tr>
<td>0%</td>
<td>PSV &lt;150 EDV &lt;50</td>
<td>PSV &lt;150 PSV&lt;ICA/PSV&lt;CCA &lt;2.0</td>
<td>PSV &lt;110 EDV&lt;40 PSV&lt;ICA/PSV&lt;CCA &lt;1.8 EDV&lt;ICA/EDV&lt;CCA &lt;2.6</td>
<td>PSV &lt;120</td>
<td>PSV &lt;150 EDV &lt;50 PSV&lt;ICA/PSV&lt;CCA &lt;1.5</td>
<td>PSV &lt;120 EDV &lt;40 PSV&lt;ICA/PSV&lt;CCA &lt;2.0 EDV&lt;ICA/EDV&lt;CCA &lt;2.6</td>
</tr>
<tr>
<td>1-9%</td>
<td></td>
<td></td>
<td>PSV &lt;130 EDV&lt;40 PSV&lt;ICA/PSV&lt;CCA &lt;1.8 EDV&lt;ICA/EDV&lt;CCA &lt;2.6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10-19%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20-29%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30-39%</td>
<td>PSV &lt;190</td>
<td></td>
<td>PSV &lt;140</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>40-49%</td>
<td></td>
<td>PSV &lt;250 EDV &lt;100</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>50-59%</td>
<td>PSV &lt;270 PSV&lt;ICA/PSV&lt;CCA &lt;3.7 EDV&lt;ICA/EDV&lt;CCA &lt;5.5</td>
<td>PSV &lt;150</td>
<td>PSV &lt;200 EDV &lt;70 PSV&lt;ICA/PSV&lt;CCA &lt;2.2</td>
<td>PSV &lt;250 EDV &lt;130 PSV&lt;ICA/PSV&lt;CCA &lt;3.2 PSV&lt;ICA/EDV&lt;CCA &lt;10 EDV&lt;ICA/EDV&lt;CCA &lt;2.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>60-69%</td>
<td></td>
<td></td>
<td>PSV ≥150 EDV ≥65 PSV&lt;ICA/PSV&lt;CCA ≥5.5</td>
<td>PSV &lt;250 EDV &lt;90</td>
<td>PSV &lt;250 EDV &lt;190</td>
<td>PSV &lt;250 EDV &lt;130 PSV&lt;ICA/PSV&lt;CCA ≥4.0 PSV&lt;ICA/EDV&lt;CCA ≥5.5</td>
</tr>
<tr>
<td>70-79%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>80-89%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>90-99%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>100%</td>
<td>No flow</td>
<td>No flow</td>
<td>No flow</td>
<td>No flow</td>
<td>No flow</td>
<td>No flow</td>
</tr>
</tbody>
</table>

**Society of Radiologists in Ultrasound**

**US Consensus ICA stenosis**

*Radiology, Nov 2003*

50-69%  PSV  125-230 cm/sec

>70%     >230 cm/sec
# Diagnostic Ultrasound Criteria for Carotid Stenosis

Non-Invasive Neurosonology Lab

<table>
<thead>
<tr>
<th>Carotid Stenosis</th>
<th>PSV (cm/sec)</th>
<th>EDV (cm/sec)</th>
<th>PSV ICA/CCA</th>
<th>EDV ICA/CCA</th>
<th>Spectral Broad</th>
</tr>
</thead>
<tbody>
<tr>
<td>0%</td>
<td>&lt;120</td>
<td>&lt;40</td>
<td>&lt;1.8</td>
<td>&lt;2.4</td>
<td>&lt;30</td>
</tr>
<tr>
<td>1-39%</td>
<td>&lt;120</td>
<td>&lt;40</td>
<td>&lt;1.8</td>
<td>&lt;2.4</td>
<td>&lt;40</td>
</tr>
<tr>
<td>40-59%</td>
<td>&lt;170</td>
<td>&lt;40</td>
<td>&lt;1.8</td>
<td>&lt;2.4</td>
<td>&lt;40</td>
</tr>
<tr>
<td>60-79%</td>
<td>&gt;170</td>
<td>&gt;40</td>
<td>&gt;1.8</td>
<td>&gt;2.4</td>
<td>&gt;40</td>
</tr>
<tr>
<td>80-99%</td>
<td>&gt;250</td>
<td>&gt;100</td>
<td>&gt;3.7</td>
<td>&gt;5.5</td>
<td>&gt;80</td>
</tr>
</tbody>
</table>
Carotid artery stenting: Is there a need to revise ultrasound velocity criteria?

Brajesh K. Lal, MD, a Robert W. Hobson II, MD, a,b Jonathan Goldstein, MD, c Elie Y. Chakhtoura, MD, c and Walter N. Durán, PhD, a,b Newark, NJ

Table I. Distribution of ultrasound velocity measurements in CAS patients

<table>
<thead>
<tr>
<th>Patient group</th>
<th>n</th>
<th>Angiographic stenosis (%)</th>
<th>PSV (cm/s)</th>
<th>EDV (cm/s)</th>
<th>PSV/EDV</th>
<th>ICA/CCA</th>
</tr>
</thead>
<tbody>
<tr>
<td>All patients</td>
<td>90</td>
<td>5.4 ± 9.1</td>
<td>120.4 ± 32.4</td>
<td>41.4 ± 18.6</td>
<td>3.3 ± 1.2</td>
<td>1.6 ± 0.5</td>
</tr>
<tr>
<td>Patients with PSV &lt; 130</td>
<td>52</td>
<td>3.8 ± 8.0</td>
<td>98.9 ± 22.3</td>
<td>32.2 ± 11.8</td>
<td>3.5 ± 1.2</td>
<td>1.4 ± 0.5</td>
</tr>
<tr>
<td>Patients with PSV ≥130</td>
<td>38</td>
<td>7.4 ± 9.9</td>
<td>155.3 ± 31.9</td>
<td>52.3 ± 19.5</td>
<td>3.3 ± 1.2</td>
<td>1.9 ± 0.5</td>
</tr>
<tr>
<td>Patients with PSV ≥130 and ... &lt;20%</td>
<td>6</td>
<td>24.6 ± 3.8</td>
<td>185.0 ± 25.2</td>
<td>56.3 ± 28.1</td>
<td>3.9 ± 1.5</td>
<td>2.5 ± 0.3</td>
</tr>
<tr>
<td>Patients with PSV ≥ 130 and ... &gt;20%</td>
<td>32</td>
<td>4.1 ± 7.4</td>
<td>141.0 ± 12.4*</td>
<td>51.2 ± 28.1</td>
<td>3.1 ± 1.2</td>
<td>1.7 ± 0.4*</td>
</tr>
</tbody>
</table>

Values represent mean ± SD.

PSV, Peak systolic velocity; EDV, end-diastolic velocity; ICA/CCA, internal carotid artery–common carotid artery ratio.

*P < .001.
†P = .02.
Clinical Definition of Carotid ATH?

Carotid Plaque/IMT?
Carotid Plaque

Plaque Size
thickness, area, volume

Plaque Surface
smooth, irregular, ulcerated

Plaque Histology
fat, fibrous, Ca, hemorrhage
Do carotid plaque characteristics: size, surface irregularities, morphology, change the risk of stroke?
**Risk of Stroke/MI/VD: MCPT Plaque Thickness**

MCPT Q75 > 1.9 mm and Combined Vascular Outcome (IS, MI, VD)

**ICA Stenosis**
- 60-80%: 2%
- > 80%: 1%
- Occlusion: 0.5%

Rundek T, Sacco RL, et al., *Neurology* 2008
Plaque Presence and Risk of Stroke/MI

<table>
<thead>
<tr>
<th>Study</th>
<th>N</th>
<th>Age (y); F</th>
<th>Follow-up (y)</th>
<th>Event</th>
<th>Plaque presence adjusted HR (95% CI)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARIC³⁶</td>
<td>12,375</td>
<td>45-64; 54%</td>
<td>7</td>
<td>MI, CHD death</td>
<td>With AS: 2.96 (1.54-3.30) Without AS: 2.02 (1.42-2.41)</td>
</tr>
<tr>
<td>KIHD³⁹</td>
<td>1288</td>
<td>42-60; 0%</td>
<td>≤2 y</td>
<td>MI</td>
<td>4.15 (1.50-11.47)</td>
</tr>
<tr>
<td>Yao City²²</td>
<td>1289</td>
<td>60-74; 0%</td>
<td>4.5</td>
<td>Stroke</td>
<td>3.2 (1.4-7.1)↑</td>
</tr>
<tr>
<td>MDCS²³</td>
<td>5163</td>
<td>46-68; 60%</td>
<td>7</td>
<td>MI, CHD death</td>
<td>1.81 (1.14-2.87)</td>
</tr>
<tr>
<td>Northern Manhattan⁴⁰</td>
<td>1939</td>
<td>&gt;40; 59%</td>
<td>6.2</td>
<td>Stroke</td>
<td>3.1 (1.1-8.5)</td>
</tr>
<tr>
<td>Rotterdam²⁴</td>
<td>6389</td>
<td>&gt;55; 62%</td>
<td>7-10</td>
<td>MI</td>
<td>Severe; 1.83 (1.27-2.62)</td>
</tr>
</tbody>
</table>

+ Framingham, Tromso, MESA, San Danielle ....

HR: 1.5 - 4.5
<1-2%/y

ASE CONSENSUS STATEMENT (Soc Vas Med). JASE 2008
Risk of Stroke/MI/VD: TcPA Plaque Area in Tromsø

The Tromsø Study
10-Year Follow-Up
N=6,584

HR1_{Q41/2} Stroke
1.7 men
1.6 women

Does plaque surface irregularity or plaque calcification change risk of stroke?

Ulcerated Carotid plaque

Spence JD. Neurology 2011;77:1–1
Carotid Plaque Echolucency Increases the Risk of Stroke in Carotid Stenting

The Imaging in Carotid Angioplasty and Risk of Stroke (ICAROS) Study

Giorgio M. Biasi, MD, FRCS; Alberto Froio, MD; Edward B. Diethrich, MD; Gaetano Deleo, MD; Stefania Galimberti, PhD; Paolo Mingazzini, MD; Andrew N. Nicolaides, MS, FRCS; Maura Griffin, MSc, PhD; Dieter Raithel, MD; Donald B. Reid MD, FRCS; Maria Grazia Valsecchi PhD

Figure 5. Neurological complication rates in 2 subgroups identified by GSM levels (A, stroke; B, stroke plus TIA).

Circulation. 2004;110:756-762
What is Carotid cIMT?

US Measure of ATH?

- Endothelium
- Intima
- Media
Carotid IMT protocols


An Update on Behalf of the Advisory Board of the 3rd, 4th and 5th Watching the Risk Symposia, at the 13th, 15th and 20th European Stroke Conferences, Mannheim, Germany, 2004, Brussels, Belgium, 2006, and Hamburg, Germany, 2011

P.-J. Touboul  M.G. Hennerici  S. Meairs  H. Adams  P. Amarenco  N. Bornstein
L. Csiba  M. Desvarieux  S. Ibrahim  R. Hernandez Hernandez  M. Jaff
S. Kownator  T. Naqvi  P. Prati  T. Rundek  M. Sitzer  U. Schminke  J.-C. Tardif
A. Taylor  E. Vicaut  K.S. Wbo

ASE CONSENSUS; Soc Vas Med. JASE. 2008
Adjusted CHD Incidence Rate per 1,000 Person-Years Adjusted by cIMT Categories With and Without Plaque

For every cIMT category (Q), for the overall group (green bars), men (yellow), or women (orange), **having carotid plaque is associated with a higher CHD incidence.**
### Carotid IMT and risk of MI, Stroke

Large population based studies

<table>
<thead>
<tr>
<th>Population</th>
<th>Mean Age, y</th>
<th>Event Rate for MI (per 1000 Person-Years)</th>
<th>Event Rate for Stroke (per 1000 Person-Years)</th>
<th>Mean IMT, mm</th>
<th>Maximal IMT, mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARIC*</td>
<td>54</td>
<td>4.4</td>
<td>2.4</td>
<td>0.63±0.16</td>
<td>...</td>
</tr>
<tr>
<td>Rotterdam Study⁵,⁷,⁸</td>
<td>70</td>
<td>...</td>
<td>11.3</td>
<td>0.80±0.16</td>
<td>1.03±0.22</td>
</tr>
<tr>
<td>CHS⁵</td>
<td>73</td>
<td>9.6</td>
<td>10.2</td>
<td>...</td>
<td>1.03±0.20</td>
</tr>
<tr>
<td>Kitamura 2004⁹</td>
<td>66</td>
<td>...</td>
<td>5.9</td>
<td>...</td>
<td>1.03±0.43</td>
</tr>
<tr>
<td>MDCS¹⁰,¹¹</td>
<td>57</td>
<td>3.2</td>
<td>2.4</td>
<td>0.77±0.15††</td>
<td>...</td>
</tr>
<tr>
<td>CAPS¹²</td>
<td>50</td>
<td>10.7</td>
<td>5.0</td>
<td>0.73±0.16</td>
<td>...</td>
</tr>
</tbody>
</table>


CIMT >75th percentile (>1mm) are considered high and indicative of increased CVD/Stroke risk (2-5x)

ASE CONSENSUS STATEMENT (Soc Vas Med)
JESI 2008
Should we screen for asymptomatic Carotid stenosis, plaque, IMT?

Yes, No, Maybe…..
Should we screen for Asymptomatic Carotid Stenosis?

- The actual stroke reduction from screening asymptomatic ACS patients and treatment is unknown.

- The benefit is limited by a low overall prevalence of treatable ACS in general population.

US Preventive Services Task Force

Ann Intern Med 2007;147:860-70
Screening for Asymptomatic Carotid Artery Stenosis

A Society of Neuroimaging / Society of Vascular and Interventional Neurology

- **Selected pts** (>65y, 3+ CVD RF: HTN, CAD, smoking, dyslipidemia) **is recommended**
- In all pts undergoing **coronary artery bypass** can be considered
- Selected pts undergoing artery bypass (>65y; prior stroke/TIA, PAD, CEA; DM, smoking, left main coronary stenosis) **is strongly recommended**

*J Neuroimaging 2007: 17:19-47*
Population Screening for ACS is not recommended

Class III, Level of Evidence B

Screening for Nontraditional Markers

cIMT, CAC, ABI
hsCRP, Leu, Homocysteine, lipoprotein(a)
periodontal disease

Insufficient evidence to support their routine use!

Screening for Nontraditional Markers of ATH: IMT/plaque

The Gold Standard for risk assessment: Framingham Risk Scoring system
(individual’s 10-y % risk of MI or death based on age, sex, Total Chol, HDL, smoking)

For those at intermediate FRS screening for carotid ath may be of value.

US Preventive Services Task Force.
Who should be screened for Carotid IMT/Plaque?

Intermediate risk:
10%-20% 10-year risk of CHD

<table>
<thead>
<tr>
<th>Prevalence in the US adult population over age 20</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Risk &lt;10%</td>
<td>35%</td>
</tr>
<tr>
<td>Intermediate 10-20%*</td>
<td>40%</td>
</tr>
<tr>
<td>High &gt;20%</td>
<td>25%</td>
</tr>
</tbody>
</table>

*Maybe be miscalibrated among women and young men (6-20%)

ASE CONSENSUS STATEMENT (Soc Vas Med); NHANCE III
## Carotid Plaque Reclassifies FRS Stroke Risk in General Population

<table>
<thead>
<tr>
<th></th>
<th>Low FRS</th>
<th></th>
<th>Moderate FRS</th>
<th></th>
<th>High FRS</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No (%)</td>
<td>10-year risk (%)</td>
<td>No (%)</td>
<td>10-year risk (%)</td>
<td>No (%)</td>
<td>10-year risk (%)</td>
</tr>
<tr>
<td>Overall</td>
<td>505 (26)</td>
<td>11.4</td>
<td>920 (47)</td>
<td>15.6</td>
<td>541 (27)</td>
<td>26.0</td>
</tr>
<tr>
<td>No plaque</td>
<td>285 (56)</td>
<td>5.8</td>
<td>402 (44)</td>
<td>11.5</td>
<td>178 (33)</td>
<td>27.6</td>
</tr>
<tr>
<td>Plaque</td>
<td>220 (44)</td>
<td>18.3</td>
<td>518 (56)</td>
<td>18.6</td>
<td>364 (67)</td>
<td>25.0</td>
</tr>
<tr>
<td>p Value</td>
<td>0.001</td>
<td></td>
<td>0.020</td>
<td></td>
<td>0.325</td>
<td></td>
</tr>
<tr>
<td>MCPT ≥1.9 mm</td>
<td>62 (12)</td>
<td>24.7</td>
<td>173 (19)</td>
<td>25.1</td>
<td>157 (29)</td>
<td>30.7</td>
</tr>
<tr>
<td>p Value</td>
<td>0.004</td>
<td></td>
<td>0.002</td>
<td></td>
<td>0.319</td>
<td></td>
</tr>
</tbody>
</table>


GENIC, Framingham, ARIC, Tromso, San Danielle...
2010 ACCF/AHA Guidelines for assessment of CV risk in asymptomatic adults

<table>
<thead>
<tr>
<th>Test</th>
<th>Class</th>
<th>Evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>cIMT/plaque</td>
<td>IIa</td>
<td>B</td>
</tr>
<tr>
<td>FRS</td>
<td>Ib</td>
<td>B</td>
</tr>
<tr>
<td>CAC</td>
<td>IIa</td>
<td>B</td>
</tr>
<tr>
<td>CRP</td>
<td>IIa</td>
<td>B</td>
</tr>
<tr>
<td>ECG</td>
<td>IIa</td>
<td>C</td>
</tr>
<tr>
<td>ABI</td>
<td>IIa</td>
<td>B</td>
</tr>
<tr>
<td>MRI plaque</td>
<td>NO Benefit</td>
<td></td>
</tr>
</tbody>
</table>

*Circulation* 2010;122: 2748-2764
Common Carotid Intima-Media Thickness Measurements in Cardiovascular Risk Prediction
A Meta-analysis

Hester M. Den Ruijter, PhD; Sanne A. E. Peters, MSc; Todd J. Anderson, MD; Annie R. Britton, PhD; Jacqueline M. Dekker, PhD; Marinus J. Eijkemans, PhD; Gunnar Engström, MD, PhD; Gregory W. Evans, MA; Jacqueline de Graaf, MD, PhD; Diederick E. Grobbee, MD, PhD; Bo Hedblad, MD, PhD; Albert Hofman, MD, PhD; Suzanne Holewijin, PhD; Ai Ikeda, PhD; Maryam Kavousi, MD, MSc; Kazuo

Context The evidence that measurement of the common carotid intima-media thickness (CIMT) improves the risk scores in prediction of the absolute risk of cardiovascular events is inconsistent.

Objective To determine whether common CIMT has added value in 10-year risk prediction of first-time myocardial infarctions or strokes, above that of the Framingham Risk Score.

Data Sources Relevant studies were identified through literature searches of databases (PubMed from 1950 to June 2012 and EMBASE from 1980 to June 2012) and expert opinion.

Study Selection Studies were included if participants were drawn from the general population, common CIMT was measured at baseline, and individuals were followed up for first-time myocardial infarction or stroke.

Conclusion The addition of common CIMT measurements to the Framingham Risk Score was associated with small improvement in 10-year risk prediction of first-time myocardial infarction or stroke, but this improvement is unlikely to be of clinical importance.

Christine Robertson, MBChB; Christopher M. Rembold, MD; Maria Rosvall, MD, PhD; Tatjana Rundek, MD, PhD; Jukka T. Salonen, MD, PhD; Matthias Sizer, MD; Coen D. A. Stehouwer, MD, PhD; Jacqueline C. Wittman, PhD; Karel G. Moons, PhD; Michiel L. Bots, MD, PhD


Conclusions and implications

The addition of common CIMT measurements to the Framingham Risk Score was associated with small improvement in 10-year risk prediction of first-time myocardial infarction or stroke, but this improvement is unlikely to be of clinical importance.
Recently published on CIMT: PROG-IMT

Carotid intima-media thickness progression to predict cardiovascular events in the general population (the PROG-IMT collaborative project): a meta-analysis of individual participant data

Matthias W Lorenz, Joseph F Polak, Maryam Kavousi, Ellisiv B Mathiesen, Henry Völzke, Tomi-Pekka Tuomainen, Dirk Sander, Matthieu Plichart, Alberto L Catapano, Christine M Robertson, Stefan Kiechl, Tatjana Rundek, Moïse Desveneux, Lars Lind, Caroline Schmid, Pronabesh DasMahapatra, Lu Gao, Kathrin Zieglerbauer, Michiel L Bots, Simon G Thompson, on behalf of the PROG-IMT Study Group

Summary

Background Carotid intima-media thickness (cIMT) is related to the risk of cardiovascular events in the general population. An association between changes in cIMT and cardiovascular risk is frequently assumed but has rarely been reported. Our aim was to test this association.

Interpretation

The association between cIMT progression assessed from 2 US scans and CVD risk in the general population remains unproven. No conclusion can be derived for cIMT progression as a surrogate in clinical trials.

1519 myocardial infarctions, 1339 strokes, and 2028 combined endpoints (myocardial infarction, stroke, vascular death) occurred. Yearly cIMT progression was derived from two ultrasound visits 2–7 years (median 4 years) apart. For mean common carotid artery intima-media thickness progression, the overall HR of the combined endpoint was 0.97 (95% CI 0.94–1.00) when adjusted for age, sex, and mean common carotid artery intima-media thickness, and 0.98 (0.95–1.01) when also adjusted for vascular risk factors. Although we detected no associations with cIMT progression in sensitivity analyses, the mean cIMT of the two ultrasound scans was positively and robustly associated with cardiovascular risk (HR for the combined endpoint 1.16, 95% CI 1.10–1.22, adjusted for age, sex, mean common carotid artery intima-media thickness progression, and vascular risk factors). In three studies including 3439 participants who had four ultrasound scans, cIMT progression did not correlate between occasions (reproducibility correlations between r=−0.06 and r=−0.02).
Should we use IMT in clinical practice?
Appropriate Clinical Use of cIMT
Society of the Atherosclerosis Imaging and Prevention and the International Atherosclerosis Society
Atherosclerosis, 2011

Common clinical scenarios (n=33) for the appropriate use of cIMT for CHD risk assessment in clinical setting in:
- Absence of known CHD and stroke
- Known CHD and stroke
- Serial cIMT imaging for monitoring of vascular risk

Technical rating panel rated each indication:
Score 7–9  Appropriate
Score 4–6  Uncertain
Score 1–3  Inappropriate
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Appropriate indications: 7/33
Uncertain 16/33
Inappropriate 10/33

Appropriate indications:
Intermediate risk patients
Metabolic syndrome
Older patients

Inappropriate:
Serial testing
Low risk patients
Very high-risk patients
Why do we screen general populations (>50y) for breast, cervical, prostate and colorectal Ca but NOT for Prevalent ATHEROSCLEROSIS?