Progression of carotid plaque volume predicts cardiovascular events

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Introduction

Carotid IMT and Plaque measurement by ultrasound

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Plaque is more closely related to coronary artery disease than IMT and is a stronger predictor of stroke or MI

Brook R et. al. ATVB 2006;26:656-62.
Johnsen, SH et al. Stroke 2007;38;2873-2880
Spence JD. Atherosclerosis. 2011;220:34-5.
Measurement of IMT, plaque area and volume

1

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IMT=0.95 mm  PA=0.38 cm²  PV=297 mm³
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2

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IMT=1.01 mm  PA=0.19 cm²  PV=24 mm³
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Scannning and plaque area measured by Maria DiCicco RVT;
IMT by Andrew House M.D., plaque volume by Khalid Al-Shali M.D.
Correlation Between Carotid Intimal/Medial Thickness (IMT) and Atherosclerosis: A Point of View from Pathology Finn AV, Kolodgie FD, Virmani R. ATVB 2009 online
Purpose

We report results of

- The first study to assess prediction of cardiovascular events by progression of TPV

- The first to compare progression/regression of carotid IMT, TPA and TPV in patients attending vascular prevention clinics.
Methodology

Baseline

• 349 patients with baseline TPA between 40 and 600 mm$^2$
• From Stroke Prevention Clinic or the Premature Atherosclerosis Clinic at University Hospital, London, Ontario, Canada.

Measurement of **total plaque volume (TPV), total plaque area (TPA), and intima media thickness (IMT)** at baseline
Methodology

1 Year F/U

• Measurement of TPV, TPA and IMT at 1-year follow-up

Classified participants into 3 groups

Progression: An increase by more than median of TPV change

Stable: Change smaller than median of TPV change, either increase or decrease

Regression: A reduction by more than median of TPV change
Methodology

5-Year F/U

• Follow-up annually for 5 years
• Ascertainment of outcomes such as stroke, TIA, myocardial infarction, and death
Results

- 349 patients enrolled in the study.
- The median duration of follow-up was 3.17 years, (0.07-5 years).

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<th>Total</th>
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<tr>
<td>Death</td>
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<tr>
<td>Stroke</td>
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<tr>
<td>Transient ischemic attack</td>
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<td>Myocardial Infarction</td>
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<td>Total cardiovascular events</td>
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<td>Dropouts</td>
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<th>Number of patients at risk</th>
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Results

The median change in TPV = 27mm³
Regression = TPV reduction >27 mm³
Progression = TPV increase >27 mm³
Stable = TPV change <27 mm³

†Kruskal–Wallis H test for continuous variables
Pearson χ² test for categorical variables
I. All cardiovascular events

- Groups:
  - Regression
  - Stable
  - Progression

- Proportion with cardiovascular events

- Days:
  - 0 250 500 750 1000 1250 1500 1750

- Number surviving:
  - 306 297 284 278 263 77 35 24

- Progression of TPV

- Progression of IMT

- p-value < 0.001

- p-value = 0.143

- p-value = 0.455
II. Stroke/TIA/death

Progression of TPA

Progression of TPV

Progression of IMT

Groups
- Regression
- Stable
- Progression

Number surviving
- 323 313 299 293 276 80 39 27

Number surviving
- 306 299 287 281 265 78 36 25

p-value = 0.097

p-value = 0.001

p-value = 0.886

Days
- 0 250 500 750 1000 1250 1500 1750

Days
- 0 250 500 750 1000 1250 1500 1750

Days
- 0 250 500 750 1000 1250 1500 1750
III. Stroke/myocardial infarction/death

- Groups
- Regression
- Stable
- Progression

P-value = 0.008

- Progression of TPV
- Progression of IMT

Number surviving:
- 306
- 300
- 288
- 282
- 268
- 80
- 36
- 24

Proportion with stroke/MI/death vs. Days
Conclusion

- Progression of TPV strongly predicted cardiovascular events.
- The prediction remained significant after adjustment for coronary risk factors in Cox regression.
Limitation

The relatively small sample was determined by the funding available.

The progression of TPV significantly predicted events in such a small sample.

TPV is a powerful tool for assessing clinically relevant effects of therapy.
Application

Treating arteries instead of treating risk factors. The measurement of TPV is a cost-effective way to assess new therapies for atherosclerosis.
Acknowledgement
Acknowledgement
Reference

3) Spence JD. Carotid plaque measurement is superior to IMT Invited editorial comment on: Carotid plaque, compared with carotid intima-media thickness, more accurately predicts coronary artery disease events: A meta-analysis-Yoichi Inaba, M.D., Jennifer A. Chen M.D., Steven R. Bergmann M.D., Ph.D. Atherosclerosis 2012 January;220(1):34-5.
Reference


