The correlation with plaque morphology and better resolution to identify these vulnerable plaques is, I think, a key question, along with their prevalence which might not be high.

Ralph De Palma (2016)

The value of pursuing carotid (or any) plaque imaging in patients with "ACS" depends on the risk of stroke in such persons while receiving current optimal medical treatment (MT) alone and the options available for additional or alternative treatments to reduce this risk. If the aim is to offer CEA or CAS in addition to current optimal MT, then the average annual risk of ipsilateral stroke in these patients must be at least 2.5% (as was the risk for patients given MT alone in ACAS).

Anne Abbott (2016)

PLAQUE MORPHOLOGY ASSESSMENT:

1. Possible? Accurate? Reproducible?
2. Easy to Perform at reduced cost?
3. Relevant for Clinical Decision beyond severity of stenosis?
4. Could it improve detection of patients at high risk of stroke?
Plaque Echolucency and the Risk of Ischaemic Stroke in Patients with Asymptomatic Carotid Stenosis Within the First Asymptomatic Carotid Surgery Trial (ACST-1)

A. Huibers a,b, G.J. de Borst b, R. Bulbulia c, H. Pan c, A. Halliday a,*, on behalf of the ACST-1 collaborative group

Eur J Vasc Endovasc Surg (2016) 51, 616-621

Table 3. Correlation 1 and Schematic of tests by plaque echolucency (including number of patients).

<table>
<thead>
<tr>
<th>Echolucency</th>
<th>Patients with echolucent plaque (n = 403)</th>
<th>Patients with non-echolucent plaque (n = 674)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>61 (3.4%)</td>
<td>96 (1.4%)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>No</td>
<td>342 (86.6%)</td>
<td>674 (98.6%)</td>
<td></td>
</tr>
</tbody>
</table>

It must also be understood that the ACST trial was conducted before the widespread implementation of intensive medical therapy that has diminished the stroke risk picture markedly.

ASYMPTOMATIC CAROTID DISEASE

Progression Rate and Ipsilateral Neurological Events in Asymptomatic Carotid Stenosis


Annual incidence of progression of stenosis: 5.2%

Ipsilateral events occurred in 17%

Diabetes and previous contralateral symptoms: independent association with ipsilateral events

High rate of progression of lesions (>2 grades) associated with ipsilateral events

3.4% vs 8%

ENHANCED ACTIVITY INDEX (EAI) IN ACS

112 Plaque Studies from 112 patients – ACSRS data base

ENHANCED ACTIVITY INDEX

% stenosis

Enlargement of plaque

Juxta – luminal black area

Disruption of echogenic cap

Ulceration

GSM and P40

ACSRS STUDY

SIGNIFICANT PARAMETERS

- Low echogenicity (GSM < 30).
- Heterogeneity (DWA).
- Juxta-luminal location of the echolucent area (JLBA).
- Stenosis > 70%.
- Hypertension.

923 Patients with > 70% asymptomatic carotid stenosis

<table>
<thead>
<tr>
<th>No Pts</th>
<th>5 yrs stroke risk</th>
<th>1 yr stroke risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>495</td>
<td>&lt; 5%</td>
<td>&lt; 1%</td>
</tr>
<tr>
<td>202</td>
<td>5 - 9.9%</td>
<td>1 - 2%</td>
</tr>
<tr>
<td>142</td>
<td>10 - 19.9%</td>
<td>2 - 4%</td>
</tr>
<tr>
<td>84</td>
<td>&gt; 20%</td>
<td>&gt; 4%</td>
</tr>
</tbody>
</table>

697 / 923 (74.6%) of patients could be saved from unnecessary carotid intervention

ACSRS: RISK STRATIFICATION

PLAQUE MORPHOLOGY ASSESSMENT

Framework of processing steps

IMAGE-BASED PARAMETERS

PLAQUE MORPHOLOGICAL STUDIES AND THE CONTROVERSY OF ASYMPTOMATIC CAROTID STENOSIS (ACS) AND THE SELECTION OF PATIENTS FOR INVASIVE TREATMENT

WHAT CAN / SHOULD BE DONE?

1. Plaque morphological studies can be performed with CAHDU in all clinical settings
2. Identification of instability markers in ACS
3. Objective assessment of the effect of OMT
4. Reduction of unnecessary carotid interventions

Paradigm shift in ACS from intervention modality (CEA or CAS) to selection of a true high stroke - risk group
ASYMPTOMATIC CAROTID STENOSIS >70%  

EFFECT OF OMT  

- Increase in echolucency (GSM) and heterogeneity of the plaque  
- Fibrous proliferation  
- Thickening of the echogenic cap  
- Reduction on inflammatory activity within the plaque  
- Healing of plaque ulceration

PLAQUE MORPHOLOGY STUDIES – COULD THEY BE A GAME CHANGING?  

OMT must be attempted as first line of treatment for ACS  
Interventions for ACS should be reserved for high-risk subgroup of patients/lesions  
- Very severe stenosis > 90%  
- Unstable plaques: JLBA > 8 mm² / EAI > 65 / Risk Stratification > 6% (ACSRS)  
- Severe stenosis w/contralateral occlusion  
- Ipsilateral silent brain infarcts (?)  
- Concomitant active coronary / peripheral disease (??)  

Plaque morphological studies to objectively assess efficacy of OMT in ACS > 70% and identify persistent markers of plaque instability

Cognitive deterioration associated to severe bilateral carotid disease  
(functional brain imaging and mental objective evaluation)

MANAGEMENT OF ASYMPTOMATIC CAROTID STENOSIS  

The natural history of asymptomatic severe carotid artery stenosis  

Medical therapy with statins/aspirin failed to control very severe asymptomatic carotid stenosis

PREDICTORS OF INS/DTH  

- STENOSIS 90-99%: 1.98 HR  
- CHRONIC RENAL FAILURE: 5.4 HR  
- DIABETES: 2.6 HR

PLAQUE MORPHOLOGY STUDIES – COULD THEY BE A GAME CHANGING?

OMT must be attempted as first line of treatment for ACS
Interventions for ACS should be reserved for high-risk subgroup of patients/lesions
- Very severe stenosis > 90%
- Unstable plaques: JLBA > 8 mm² / EAI > 65 / Risk Stratification > 6% (ACSRS)
- Severe stenosis w/contralateral occlusion
- Ipsilateral silent brain infarcts (?)
- Concomitant active coronary / peripheral disease (??)

Plaque morphological studies to objectively assess efficacy of OMT in ACS > 70% and identify persistent markers of plaque instability

Cognitive deterioration associated to severe bilateral carotid disease (functional brain imaging and mental objective evaluation)
EDITORIAL

Asymptomatic Carotid Stenosis. Identifying Patients at High Enough Risk to Warrant Endarterectomy or Stenting

J. David Spence, MD, FRCPC; David Pets, MD, FRCPC; Frank J. Veith, MD, FACS

The current situation in the United States is deplorable: as many as 95% of CEA and CAS procedures are being performed in patients with asymptomatic stenoses, and most of these patients are more likely to be harmed than helped by these interventions. This is being justified on the basis of historical stroke risks in the ACAS and the Asymptomatic Carotid Surgery Trial. These risks no longer pertain. Three recent studies have shown that in the era of intensive medical therapy, the ipsilateral stroke risk of patients with ACS is now well below the risks of stenting or endarterectomy, even in the recent Carotid Revascularization Endarterectomy Versus Stenting Trial (CREST) trial.

NEED TO RE-ASSESS THE PRESENT GUIDELINES ON THE MANAGEMENT OF CAROTID DISEASE (ASYMPTOMATIC)

PLAQUE MORPHOLOGY ASSESSMENT in ACS

DIFFICULTIES

• Evolution of advanced image processing and analysis methods with HDU - there is a need for external validation.

• Operator dependency: reduced by new software for semi-automatic quantification and analysis on the same platform via internet

• Comparability with advanced biological plaque imaging (NMR, PET-Scan, CEUS)

• Standardization of OMT and its effect on plaque structure

• Paradigm shift in ACS from intervention modality (CEA or CAS) to selection of a true high stroke risk group

INDICATIONS FOR INTERVENTION IN ACS

• Stenosis > 90%

• Severe stenosis w/ contralateral occlusion

• Ipsilateral silent brain infarcts (T2)

• Persistence of markers of lesion instability on OMT
MEDICAL MANAGEMENT IN ASYMPTOMATIC CAROTID STENOSIS

With contemporary medical treatment the stroke risk may be <1%.

OMT – GAME CHANGER

PLAQUE ECHODENSITY AND TEXTURAL FEATURES ARE ASSOCIATED WITH HISTOLOGIC CAROTID PLAQUE INSTABILITY

MANAGEMENT OF CAROTID STENOSIS

ASYMPTOMATIC DISEASE – HOW TO INTERVENE?

- Surgical Risk: 0.5%
- Stroke Risk: < 0.5% / year
- Restenosis: 7.4%
- Cranial nerve injuries: 3.8%

Follow-up: 46 months (6 – 120)

ASYMPTOMATIC CAROTID DISEASE

OPTIMAL MEDICAL TREATMENT

- Risk Factors Control
  - Arterial Hypertension
  - Dislipidemia (LDL reduction)
  - Management of Diabetes, Renal Dysfunction
  - Smoking
  - Diabetes

- Life – Style Modification
- Anti-Platelet Treatment
- Statins

IS CHOICE BETWEEN INTERVENTIONAL TREATMENT THE REAL ISSUE IN ASYMPTOMATIC CAROTID DISEASE?

NO!

IT IS THE ADEQUATE SELECTION OF PATIENTS!!
Carotid angiographic characteristics in the CREST trial were major contributors to peri-procedural stroke and death differences between carotid artery stenting and carotid endarterectomy.

<table>
<thead>
<tr>
<th>TYPE OF LESION</th>
<th>CEA</th>
<th>CAS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contiguous/long</td>
<td>3.1%</td>
<td>6.1%</td>
</tr>
<tr>
<td>Remote / Sequential + long</td>
<td>0.0%</td>
<td>6.3%</td>
</tr>
<tr>
<td>Remote / Sequential + short</td>
<td>1.6%</td>
<td>5.2%</td>
</tr>
</tbody>
</table>

PLAQUE MORPHOLOGY ASSESSMENT

Degree of Stenosis

Gold Standard

Activity Index (AI)

Enhanced Activity Index (EAI)

Ultrasonic Activity Index (UAI)

Inter-observer reproducibility

Unequivocal black area

Simple “ladder” score of 4 features

Bayes Factor

Probability sum of 154 features

Moderate new Bayes Factor on 7 features

RMM / echogenic content

Rayleigh theoretical estimators

Texture features

IMAGE-BASED PARAMETERS

2002

2011

2014

Framework of processing steps