

## TCT-201

**Intravascular ultrasound (IVUS) validation of non-invasive and invasive measures of carotid stenosis severity in the CARUS Registry. [Carotid Artery Intravascular Ultrasound academic registry]**

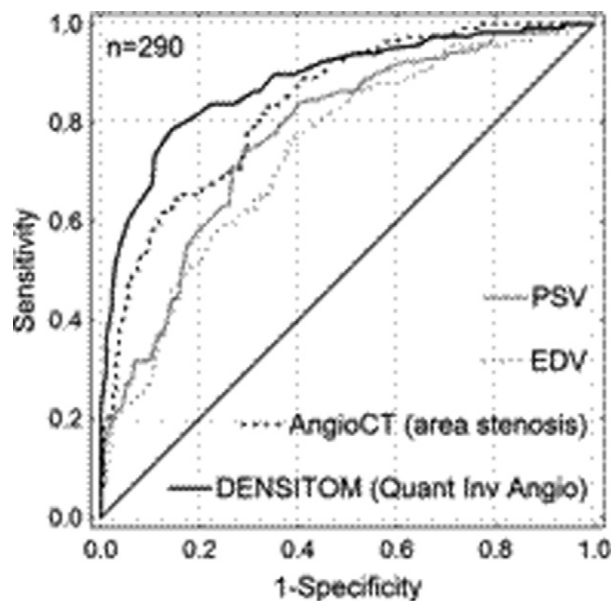
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**Background:** Carotid revascularization guidelines denote the internal carotid artery (ICA) stenosis severity -taken together with ipsilateral brain ischaemia symptoms- as the key clinical decision-making determinant.

**Methods:** To validate non-invasive (duplex Doppler velocities - PSV and EDV; CT angiography area stenosis, AngioCT) and invasive (classic quantitative angiography QA diameter stenosis, DS, and densitometric stenosis severity, QA-DENSITOM) ICA imaging modalities against the vascular imaging gold standard, IVUS. Index ICAs were IVUS-imaged (unprotected-107; proximal EPD-51, distal EPD-132) in 290 consecutive patients (age 47-83y, 187 men, 104 asymptomatic and 186 symptomatic) referred for carotid revascularization decision-making.

**Results:** By univariable model, PSV (AUC 0.77, cutoff 2.58m/s, PPV 0.64, NPV 0.80), EDV (AUC 0.74, cutoff 0.75m/s, PPV 0.57, NPV 0.80), AngioCT (AUC 0.79, cutoff 72%, PPV 0.61, NPV 0.85), DS (AUC 0.80, cutoff 61%, PPV 0.65, NPV 0.82), and QA-DENSITOM (AUC 0.88, cutoff 74%, PPV 0.79, NPV 0.86) all predicted  $\geq 75\%$  IVUS ICA stenosis ( $p < 0.001$  for all) (Fig). Multivariable model, however, eliminated PSV, EDV and DS, leaving AngioCT and QA-DENSITOM as sole independent diagnostic modalities. The best AUC (0.91), with a high sensitivity (0.85), specificity (0.82), PPV (0.76), and NPV (0.89) was for AngioCT combined with QA-DENSITOM. **Conclusions:** These findings are consistent with an important role of non-invasive angiography rather than isolated duplex Doppler as a gate-keeper for invasive evaluation. On QA, densitometric ICA stenosis severity evaluation outperforms other parameters.



## TCT-202

**Effect of Contralateral Occlusion on Index Internal Carotid Artery (ICA) Duplex Doppler Velocities: Quantitative Analysis Using Intravascular Ultrasound (IVUS) to Match Index ICA Stenosis Severity**

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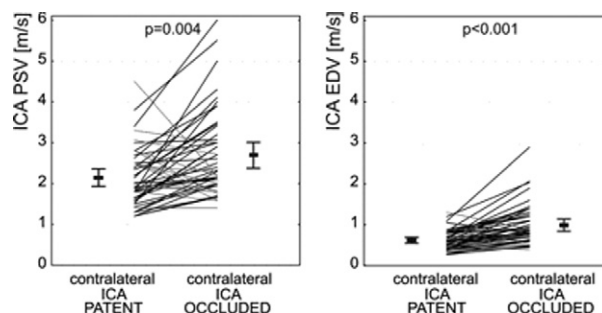
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**Background:** Contralateral ICA occlusion may result in a compensatory increase in the index ICA flow. Nevertheless, current guidelines on duplex Doppler velocities application to evaluate ICA stenosis severity do not correct for contralateral ICA occlusion.

**Methods:** 51 subjects [age 63(58.5-71)y; median(IQR), 32 men] with contralateral ICA occlusion were identified in database of 322 ICA IVUS studies in 295 consecutive patients referred for carotid revascularization decision-making. Nearest neighbour search algorithm was used to pair each patient with contralateral ICA occlusion with a same-gender subject with contralateral ICA patent and close-to-identical index ICA stenosis severity by IVUS criteria. A satisfactory match was found for 94.1% subjects with contralateral ICA occlusion (48 subject pairs).

**Results:** Index ICA IVUS minimal lumen area was 7.5(5.8-9.5) v 7.2(5.7-9.4) mm<sup>2</sup>, reference area was 23.4(19.7-27.2) v 22.8(19.8-26.6)mm<sup>2</sup>, and area stenosis was 69(55.3-77.5) v 69(54.9-77.3)% ( $p > 0.6$  for all) and those measures were highly correlated between the paired subjects ( $r = 0.99$ ,  $r = 0.95$ , and  $r = 0.84$  respectively,  $p < 0.001$  for all). Mean index ICA velocity overestimation in subjects with contralateral ICA occlusion was 0.56m/s for PSV and 0.26m/s for EDV (95%CI 0.26-0.85 and 0.17-0.36m/s respectively,  $p < 0.01$  for both) (Fig) and its magnitude was not related to index ICA stenosis severity ( $r = 0.13$ ,  $p = 0.29$  for  $\Delta$ PSV and  $r = 0.02$ ,  $p = 0.89$  for  $\Delta$ EDV).

**Conclusions:** Use of uncorrected velocity criteria can lead to overestimation of ICA stenosis severity in a significant proportion of patients with contralateral ICA occlusion.



## TCT-203

**Reproducibility of in Vivo Virtual Histology Intravascular Ultrasound Evaluation of the Carotid Atherosclerotic Plaque Using Novel Quantitative Parameters**

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**Background:** Virtual histology intravascular ultrasound (VH-IVUS) enables high resolution (axial  $\leq 120\mu\text{m}$ ) atherosclerotic plaque imaging. Current VH image analysis methodology has several limitations related largely to employing semi-quantitative/qualitative image evaluation algorithms. Reproducibility of quantitative carotid VH-IVUS image analysis is not established.

**Methods:** In 21 consecutive patients with significant carotid atherosclerosis (age 52-83 years, men-76%, recently symptomatic lesion-43%, angiographic diameter stenosis 48-87%) we used two 20MHz IVUS transducers (EagleEye, Volcano Corp) to image the lesion. Inter-transducer and inter-observer reproducibility was evaluated for measuring (QIVus 2.0 software, Medis) the plaque peak total content of necrotic core (NC), fibrofatty (FF), fibrotic (FT), and calcific (Ca), component (absolute and per cross-sectional plaque area proportionate content) as well as several novel VH-IVUS plaque parameters such as minimal fibrous cap (FC) thickness (if  $> 120\mu\text{m}$ ); peak confluent necrotic core (cNC) area, angle and thickness, and peak cCa area and arc.

**Results:** NC ranged 1.5-12.5mm<sup>2</sup> (7.1-54.2%), FF 3.3-28.2mm<sup>2</sup> (17.1-78.2%), pFT 7.5-33.2mm<sup>2</sup> (47.3-81.9%), Ca 0.75-4.9mm<sup>2</sup> (1.2-25.5%). cNC-area was 0.5-8.9mm<sup>2</sup>, cNC-thickness 0.4-2.1mm, cNC-arc 25-241°, cCa-area 0.3-4.2mm<sup>2</sup>, and cCa-arc was 44-268°. Minimum FC thickness was 0.21-0.53mm. Mean inter-observer measurement variability of absolute/proportionate peak plaque content was 4.2/7.2% for NC, 5.5/7.7% for FF, 5.2/8.2% for FT, 5.0/6.2% for Ca; mean inter-transducer measurement variability was respectively 7.2/10.2%, 7.2/8.4%, 6.1/7.0%, 8.6/11.7%. For cNC-area, cNC-thickness, cNC-arc, cCa-area, cCa-arc, and minFC thickness mean inter-observer/inter-transducer measurement variability was 3.8/5.9%, 3.7/5.2%, 3.2/5.9%, 5.1/7.4%, 3.1/4.8%, and 4.7/3.2%. The between-observers and between-transducers measurement differences were not statistically significant ( $p \geq 0.1$ ).

**Conclusions:** Quantitative VH-IVUS carotid plaque evaluation using the proposed parameters is highly reproducible. These findings provide grounds for the use of quantitative VH-IVUS in cross-sectional and longitudinal studies of carotid atherosclerosis.