

# Neuroimaging Highlight

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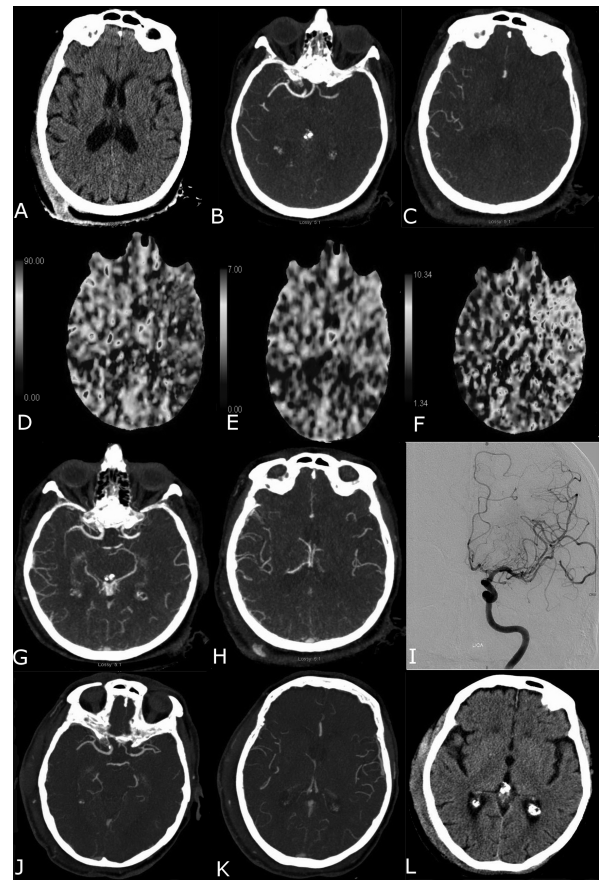
## CTA Source Images as a Predictor of Final Infarct Volume are Time-Dependent

Submitted by: Dylan Blacquiere, Miguel Bussière, Cheemun Lum, Dar Dowlatshahi

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Avascularity on CT angiography source images (CTASI) may better predict final infarct volume in acute stroke as compared to early ischemic changes on non-contrast CT<sup>1-4</sup>. These CTASI findings may represent infarct core and help determine the extent of salvageable tissue<sup>3</sup>. However, the extent of avascularity on CTASI may overestimate infarct volume if transit of contrast is prolonged due to proximal artery occlusion. We present a case where CT-perfusion (CTP) and time-resolved CT-angiography (CTA) identified salvageable tissue thought to be infarcted on CTASI.

An 81-year-old female with a history of atrial fibrillation anticoagulated with warfarin with no concurrent antiplatelet therapy presented to the emergency department with acute right hemiplegia and global aphasia. The international normalized ratio (INR) was subtherapeutic at 1.7. Initial CT showed no early ischemic changes (Figure A). CT-angiography showed a left M1 occlusion with reduced filling of the distal vessels (Figure B). CT-angiography images were acquired on a 320 slice scanner (Toshiba Aquilion One, Japan). The scanning parameters were as follows: 80kv, 100mA, one second rotation, volume acquisition. Thirty cc's of intravenous contrast (Iopamidol, Bracco, Princeton, NJ) was injected at a rate of 5 cc/sec. A total of 18 volumes were acquired (13 volumes every second with one second interval followed by five volumes with five second interval). A large area of avascularity in the middle cerebral artery (MCA) territory seen CTASI suggested a large infarct core with minimal penumbra (Figure C). Conversely, CTP revealed a large area of cerebral blood flow / cerebral blood volume mismatch and suggested a small infarct core. This was corroborated by MTT acquired at 12 seconds. (Figures D-F). Using the time-resolved CTA function of the Toshiba Aquilion ONE™ volume CT scanner, we reprocessed the original CTASI images obtained two seconds from the original acquisition and revealed contrast within vessels in the left MCA territory, presumably filling via leptomeningeal collaterals (Figures G-H). Consistent with the CTP findings, these images suggested relatively oligemic but potentially salvageable tissue. The patient received intravenous tPA 29 minutes after symptom onset, and was then transferred to the angiography suite for possible intra-arterial therapy. Groin



**Figure:** Initial non-contrast CT (A) showed no early ischemic changes. Initial CTASI (B,C) demonstrated occlusion of the left M1 and avascularity in most of the corresponding MCA territory. CTP had shown decreased cerebral blood flow (D) with preserved cerebral blood volume (E) suggesting a flow/volume mismatch. Mean transit time was increased in the left hemisphere (F). Time resolved CTASI reprocessed two seconds after initial acquisition (G,H) showed delayed filling of MCA branches via collateral vessels; subsequent left carotid angiography (I) demonstrated recanalization of the left M1 trunk. Prior to angiography, The following day, CTASI (J,K) and non-enhanced CT (L) showed persistent vessel patency with no ischemic damage.

From the Department of Medicine – Division of Neurology (DB, MB, DD), The University of Ottawa; and the Department of Diagnostic Imaging – Diagnostic and Interventional Neuroradiology Section (MB, CL), The Ottawa Hospital, Ottawa, Ontario, Canada.

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Correspondence to: Dylan Blacquiere, Department of Medicine – Division of Neurology, University of Ottawa, The Ottawa Hospital, Civic Campus, Room 2196b, 1053 Carling Avenue, Ottawa, Ontario, K1Y 4E9, Canada.

puncture was one hour and 47 minutes after symptom onset. Recanalization of the M1 branch (due to intravenous tPA) was demonstrated at the time of the initial left internal carotid angiogram (Figure I). With minimal wire and microcatheter maceration of residual thrombus in a proximal right M2 branch, complete recanalization (TICI 3) was achieved. At 24 hours follow-up, the patient had no residual clinical deficits and repeat CT and CTA showed no infarct, with persistent patency of the left MCA vessels (Figures J-L).

A large area of avascularity on the initial CTASI obtained in the acute management of this patient suggested a large final infarct volume with little salvageable tissue. Yet, CTASI reprocessed in a delayed fashion after contrast injection showed delayed filling of MCA branches through leptomeningeal collaterals and more accurately predicted the extent of salvageable tissue. In cases where the transit of contrast through the cerebrum is delayed, such as in poor cardiac output states or proximal vessel occlusion, source images acquired early may overestimate infarct core and final infarct volume. Time-resolved CTA or CTP can be helpful in more accurately identifying infarct core and guiding decisions regarding the appropriateness of thrombolytic therapy. A post-contrast unenhanced CT may also be useful as a surrogate for time-resolved CTA if this is unavailable.

## REFERENCES

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