

Clinical update no. 558

7 May 2020

What is likely to help improve patient outcome after ischaemic stroke?

Spoiler: it is likely to be treatment based on perfusion imaging and better selection of patients for intervention.

Non contrast brain CT and time based criteria are not an optimal approach.

Selected Topics: Emergency Radiology

A PRIMER ON COMPUTED TOMOGRAPHY PERFUSION IMAGING FOR THE EMERGENCY PHYSICIAN

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Clinical trials show better outcomes with perfusion based inclusion criteria, and also the potential for delayed reperfusion (DEFUSE 3, DAWN trials) up to 24hr to be of benefit.

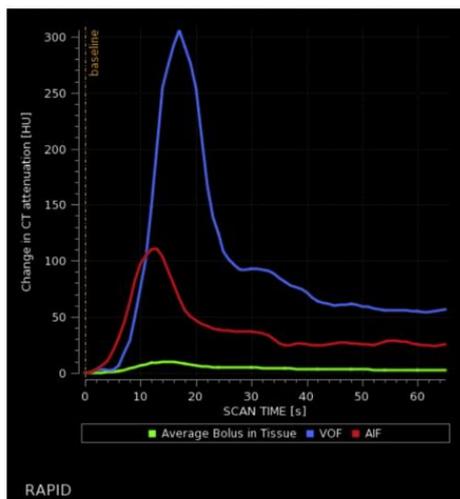


Figure 1. Arterial inflow function (AIF) and venous outflow function (VOF) tracings of a computed tomography (CT) perfusion scan, demonstrating a rise in AIF attenuation first, followed by VOF attenuation, ending with the VOF function reaching a plateau.

Software packages analyse arterial and venous flow on a CT-angiogram to assess perfusion. This gives a measure of infarcted brain and an ischaemic penumbra which may be salvagable by reperfusion.

Brain tissue with <30% normal blood flow (CBF) will infarct. Although not infarcted at the time of imaging it is not salvagable. It is referred to as an *ischaemic* core. MRI is the gold standard as a measure of an *infarcted* core. The terminology can be confusing.

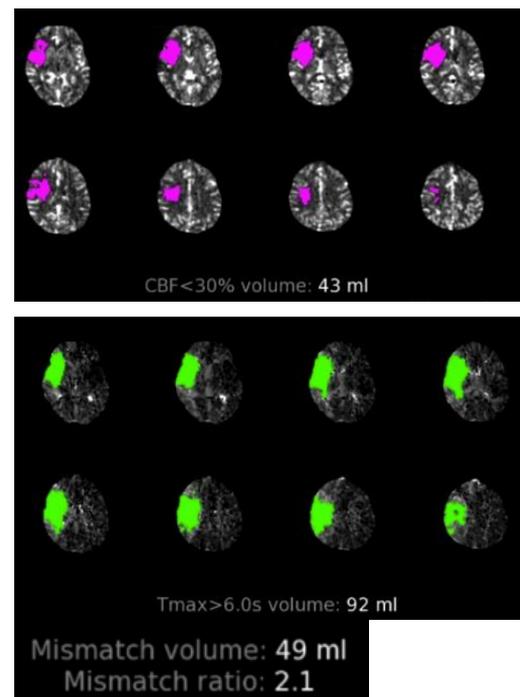
An ischaemic penumbra contributes to the clinical deficit but does not have the CBF <30% indicating inevitable subsequent infarction. Blood flow is through collateral circulation bypassing the arterial occlusion.

$T_{max} > 6$ is a measure of slower blood flow and of brain ischaemia.

The difference between CBF and T_{max} is the ischaemic penumbra that may be salvagable.

Cerebral blood flow (CBF)	Volume-flow of blood per unit time. Steepest slope of attenuation-time curve.
T_{max} & time to peak (TTP)	Time to maximal contrast enhancement.
$T_{max} > 6$ seconds ($T_{max} > 6$ s)	Areas of delayed blood arrival greater than 6 s.
Ischemic core	$T_{max} > 6$ and CBF <30%
Penumbra	$T_{max} > 6$ minus core volume
Mismatch ratio	Penumbra volume/ischemic core volume

Case: 50yr man with wake up stroke with aphasia and dense left sided weakness, NIHSS 11, imaged 20hr from when last seen well.



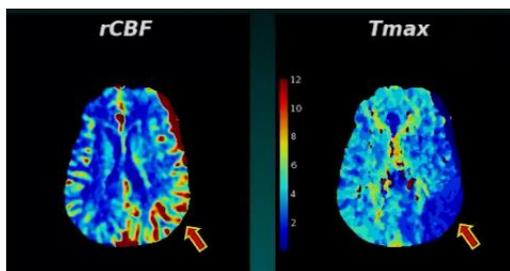
He underwent endovascular thrombectomy with good recovery and independent at home.

CT perfusion may not always exclude stroke in potential mimics such as seizure or complex migraine because there can be perfusion defects in those mimics.

However it can be of value, as the following cases show.

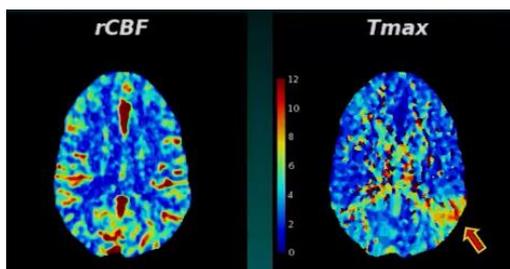
Distinguishing Acute Ischemic Stroke from Common Stroke Mimics in the Era of CT Perfusion Scanning

Case 1: 62yr-M, confusion, dysphasia, though no weakness. Brain CT clear. CT-angio shows no vascular occlusion. CT-perfusion shows *increased* perfusion.

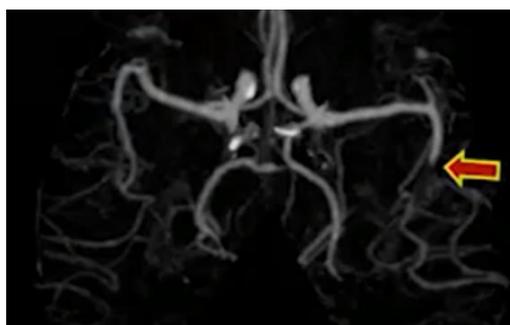


MRI confirmed underlying glioma with seizure, and not from underlying ischaemia.

Case 2: 66yr-M, dysphasia. Brain CT clear.

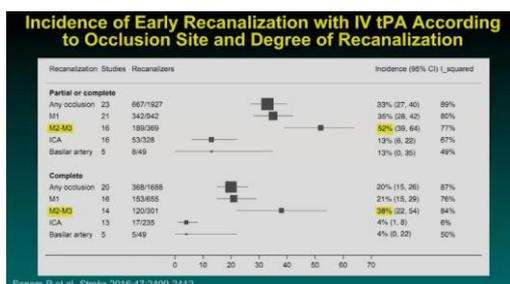


No ischaemic core but ischaemic penumbra. CT-A shows occlusion distal M2/3 left MCA.



Thrombolysed with door-needle time 26 min.

Recanalisation varies with location of occlusion with higher rates for M2/3 obstruction.



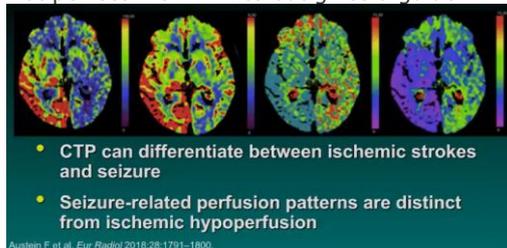
Stroke mimics account for up to 1/3 patients initially diagnosed as strokes in the ED

Neurology® Clinical Practice

Do efforts to decrease door-to-needle time risk increasing stroke mimic treatment rates?



Yes. Imaging can clarify without giving delays. Not perfect with mimics but gives a guide.



Research

Improving acute stroke care in regional hospitals: clinical evaluation of the Victorian Stroke Telemedicine program

From MJA, May 2020, reporting telemedicine for stroke. They liked it, and reported reduced delays. Curiously reported only 9% as "not stroke" (30% in other reports), and TIA in 37%, which get better by definition. There was haemorrhage in 292 of 854 patients after thrombolysis (often minor), though symptomatic (NIHSS deterioration of 4 points or more) in 4%. This compared to 16% prior to telemedicine which underscores the risk in hospitals inexperienced in stroke care.

Editorials

Telemedicine is improving outcomes for patients with stroke

Although the editorial concludes improved outcomes, there is no data presented on clinical outcome except for reduced ICH.

THE NEW ENGLAND JOURNAL OF MEDICINE

ORIGINAL ARTICLE

Endovascular Thrombectomy with or without Intravenous Alteplase in Acute Stroke

This article was published on May 6, 2020, at NEJM.org.

for the DIRECT-MT Investigators*

It is unclear whether thrombolysis provides benefit before thrombectomy. This Chinese study reported non-inferiority of thrombectomy alone, however noted the lack of clinical recovery despite reperfusion likely due to irreversible injury. Perfusion studies may better identify patients likely to benefit.

These updates are a review of current literature at the time of writing. They do not replace local treatment protocols and policy. Treating doctors are individually responsible for following standard of care.