

Hyperacute Posterior Circulation Ischemic Stroke: Shed DWI Light

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Posterior circulation strokes (PCS) and transient ischemic attacks (TIA's) account for 15-23% of all ischemic strokes/TIA,^{1,2} the prognosis is similar to anterior circulation in terms of persistent functional disability at three months.^{2,3} They have higher rate of recurrent strokes and TIA⁴ and yet it is Cinderella disease. Baseline National Institute of Health Stroke Scale (NIHSS) is falsely low in patients with PCS and may influence thrombolysis decision.⁵ The current Canadian Best Practice Recommendation for Stroke Care⁶ strongly recommend immediate brain and vascular imaging for all patients with suspected acute stroke patients with computed tomogram (CT)/CT Angiography (CTA) or magnetic resonance imaging (MRI) diffusion weighted imaging (DWI) sequence / magnetic resonance angiography (MRA). American Heart Association guidelines for acute stroke treatment also recommend non-invasive angiography of intracranial vessels if intra-arterial therapy is contemplated⁷ but suggest non-contrast CT (NCCT) alone is sufficient for thrombolysis decision. Both the recommendations do not distinguish anterior and posterior circulation stroke and practice pattern for imaging in acute stroke is highly variable.

Apparently normal NCCT and low NIHSS (≤ 4) may exclude thrombolysis eligible PCS patients presenting in the < 4.5 hours (and in selected patients up to six hours but this remains to be proven in further randomized studies⁸). Magnetic resonance diffusion weighted imaging is better than NCCT to detect early ischemic changes in PCS and MRA would be able to diagnose vertebro-basilar artery occlusion (VBAO). Computed tomogram angiography can also reliably detect VBAO. But absence of visible occlusion does not always translate to good outcome in patients with early DWI lesion.⁹ Computed tomogram angiography source images (SI) pc-ASPECTS ≥ 8 has been associated with favorable outcome in PCS albeit inconsistently.¹⁰ pc-ASPECTS ≥ 7 on DWI has sensitivity of 0.74, specificity of 0.82 and negative predictive value of 0.95 for predicting favorable outcome in PCS¹¹. A similar number for acute basilar artery occlusion is pc-ASPECTS ≥ 8 on DWI.¹² Further MRI perfusion weighted imaging (PWI) can also help in selection of patients for intra-arterial stroke therapies for acute basilar artery occlusion in more reliable manner than CT perfusion.¹³

In a retrospective study published in the current issue of the *Journal*, the role of DWI lesion assessment in hyperacute PCS, as a prognostic marker for early neurological deterioration (END) and unfavorable outcome (UFO) at three months is discussed by Lee *et al.*¹⁴ One-third of patients with PCS presented in first six hours and thus were amenable to thrombolysis. All patients were subjected to diagnostic MRI with mean Door-to-MRI time of 74 ± 149 minutes for all patients, 30 ± 11 minutes for moderate to severe PCS. The over-all

thrombolysis rate was 11.3% and it was associated with worse outcome. The worse outcome is unexpected, but can be explained by selective thrombolysis practice in patients with higher admission NIHSS score, who are more likely to have worse prognosis.² Vertebro-basilar artery occlusion was present in 16% of patients in this cohort, suggesting that thrombolysis rates could be increased at least by 5%. Presence of arterial occlusion in acute PCS is associated with increased incidence of END. These patients likely to benefit thrombolysis, ongoing PRISMS, ATTEST, TEMPO and SWISS studies are assessing the role of thrombolysis in patients with mild NIHSS and proximal intracranial arterial occlusion. All these trials are using CT based entry criteria.

The presence of VBAO was associated with favorable prognosis. This result is contrary to existing literature where presence of VBAO is associated with higher NIHSS at presentation, UFO and higher mortality.¹⁵ Small number of patient population in this study may be one reason for this discrepancy. The primary outcome events, END and UFO were noted in 15.1% and 16.4% patients respectively. These patients presented with higher NIHSS at baseline with median difference of 2.5 and 11 in END and UFO respectively. The UFO is lower as compared to published literature,² possibly patients presented with worse symptoms would not have been eligible for MRI and would have been excluded from the study.

Though the total lesion volumes were significantly higher in patients with END and UFO (Median Difference 6 ml and 2.5 ml respectively); it was not an independent predictor for UFO. Presence of two or more DWI lesions was associated with worse modified Rankin scale. Pontine lesion location was the only DWI characteristic independently predicting END. These findings reiterate the utility of MRI as diagnostic and prognostic tool for PCS. The criticism for this approach would be additional time required to complete the study leading to delay in thrombolysis, restricted feasibility due to stroke and patient related factors, scarce availability of round the clock MRI and diffusion negative TIA or minor stroke¹⁶ which are likely to occur in PCS. The feasibility and availability issues do not have immediate answers but adapting high resolution DWI and a Lean-approach¹⁷ making value-stream-analysis at individual Stroke unit (e.g. pre-hospital notification of possible PCS to the Radiology team in consultation with the Neurologist) can help reduce the time delay related to MRI scan.

The article by Lee *et al* highlights the need for PCS focused research approach using MRI DWI and further randomized studies.¹⁴ National Institute of Health Stroke Scale > 3 is entry criteria for most of the ongoing thrombolysis and intra-arterial therapy trials; NIHSS is not sensitive to the PCS. There is need for development of modified version of NIHSS with special emphasis on PCS stroke. Posterior circulation stroke presenting

in first 4.5 hours of symptom onset, with any severity of neurological deficit demonstrating DWI particularly pontine lesion or with multiple DWI lesions with or without VBAO are eligible IV thrombolysis. A corollary could be patients without a visible VBAO and without any DWI lesion may not be a candidate for thrombolysis. An MRI DWI is challenging to perform in hyperacute phase but has potential to improve the abysmal thrombolysis rates.

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