Outcome prediction using perfusion parameters and collateral scores of multi-phase and single-phase CTA in acute stroke: need for one, two, three or thirty scans?

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Background: Clinical outcome in acute ischemic stroke (AIS) is positively influenced by swift reperfusion achieved with endovascular treatment (EVT) and good collateral status. Collaterals can be assessed using different imaging modalities and a variety of different scoring systems have been introduced to predict infarct size, outcome or response to recanalization. We applied different scoring systems on single- and multi-phase CT angiography (sp and mp CTA) and compared them to CT perfusion (CTP) parameters to identify a collateral score, which reliably predicts clinical outcome and provides an alternative to CTP.

Methods: A total of 102 patients with AIS due to isolated anterior circulation occlusion who underwent multimodal CT imaging and were treated endovascularly with newer generation devices were identified from a prospective database approved by the local ethics committee and included. Collateral status was assessed on sp CTA and mp CTA images by a senior neuroradiologist, a resident in neuroradiology and a medical student. Mp CTA images were derived from CTP. Four different scoring systems were applied and compared to CTP parameters including correlation, receiver operating characteristics (ROC) and outcome analyses.

Results: Positive correlations were observed between all collateral scores as well as with CTP parameters ($p<0.01$ for each). The stratification of collateral scores across the extent of perfusion deficit, significant differences could be found ($p<0.01$ for each score). Stepwise logistic regression showed that probability of a favorable outcome was highest, when patients were not hypertensive, had high baseline ASPECTS and good collaterals on sp CTA (OR 5.82, 1.53 and 1.47, respectively; 95% CI 1.83-18.51, 1.03-2.27 and 1.11-1.94, respectively). ROC analysis revealed that a collateral score assessed on sp CTA discriminated best between favorable and unfavorable outcome.

Conclusions: Collateral status evaluated on sp CTA may suffice for outcome prediction and decision making in AIS patients, potentially obviating further imaging modalities like mp CTA or CTP.