MRI PREDICTORS OF HEMORRHAGIC TRANSFORMATION IN 474 CONSECUTIVE STROKE PATIENTS TREATED BY IV THROMBOLYSIS

Rody EL NAWAR^{1,2}, MD, Jennifer YEUNG¹, MD, Julien LABREUCHE³, Marie Laure CHADENAT¹, MD, Duc Long DUONG¹, MD, Maxime DE MALHERBE⁴, MD, Yves Sebastien CORDOLIANI⁵, MD, Bertrand LAPERGUE^{6,7}, MD, Fernando PICO^{1,7}, MD, PHD

¹ Department of Neurology and Stroke Center, Centre Hospitalier de Versailles, Versailles, France
² Gilbert and Rose-Marie Chagoury School of Medicine, Lebanese American University, Beirut, Lebanon
Email : roudynawar@hotmail.com
³Univ. Lille, CHU Lille, EA 2694 - Santé publique: épidémiologie et qualité des soins, F-59000 Lille, France.
⁴Department of Radiology, Centre Hospitalier de Versailles, Versailles, France
⁵Department of Radiology, Hopital Prive de Parly 2, Versailles, France
⁶Department of Neurology and Stroke Center, Hopital Foch, Suresnes, France
⁷Université Versailles Saint-Quentin en Yvelines et Paris Saclay

Background and Objective: Clinical and biological risk factors of hemorrhagic transformation (HT) after IV thrombolysis (IVT) have been well established in several registries such as SISTMOTS¹. The added value of MRI parameters have been studied in small samples and are controversial^{2,4}. Our objective is to evaluate the added value of MRI variables in HT in the above clinical and biological factors.

Methods: We enrolled between January 2011 and August 2017, a total of 474 consecutive patients with brain infarction (BI) proven by MRI and treated by IVT alone at our primary stroke center. Baseline demographic, clinical, biological and imaging characteristics were collected. MRI parameters were: volume of brain infarction in cm³ (B1000 diffusions, ADC< 500.10-6 mm²/s), parenchymal Flair hyperintensity, hyperintense vessel sign, number of microbleeds, subcortical white matter hyperintensity (Fazekas scale) and thrombus length.

Figure 1: Study flow chart

Abbreviations: ICH=intracranial hemorrhage; IVT=intravenous thrombolysis; MRI=magnetic resonance imaging

References:
1- Wahlgren, Nils, et al. "Thrombolysis with alteplase for acute ischaemic stroke in the Safe Implementation of Thrombolysis in Stroke-Monitoring Study (SITS-MOST): an observational study." *The Lancet* 369.9558 (2007): 275-282.
2- Marsh, Elisabeth B., et al. "Predicting hemorrhagic transformation of acute ischemic stroke: prospective validation of the HeRS Score." *Medicine* 95.2 (2016).
3- Scalzo, Fabien, et al. "Multi-center prediction of hemorrhagic transformation in acute ischemic stroke using permeability imaging features." *Magnetic resonance imaging* 31.6 (2013): 961-969
4- Liu, F., et al. "Prediction of hemorrhagic transformation in acute ischemic stroke: MRI texture analysis versus visual inspection of Gd enhancement."

Results: 301 patients out of 474 were included (64%). Main causes of exclusion were combined thrombectomy (n=88) and no MRI before IVT (n=44). In bivariate analyses, HT was significantly associated with the presence of more hyperintense vessel sign, thrombus length (> 8mm), higher BI volume (B1000 and ADC < 500). However, in multivariate analysis, only BI volumes were significantly associated with HT. The discrimination value of the multivariable model including both DWI volume and clinical model (AUC, 0.80; 95%CI, 0.74 to 0.86) was significantly improved compared to the model based only on clinical variables (p=0.012) (i.e. age and NIHSS)

Conclusions: Brain infarction volume on DWI appears to be the only predictive MRI parameter adding value to the clinico-biological parameters in HT.

Figure2: Receiver operating characteristic (ROC) curves for prediction of post-thrombolysis ICH by clinical model and MRI parameters.

Abbreviations: ADC=Apparent Diffusion Coefficient, AUC=area under the curve, DWI=diffusion weighted imaging, ICH=intracerebral hemorrhage

Corresponding author: Fernando PICO, MD, PhD
FPico@ch-versailles.fr
Department of Neurology and Stroke Center, Centre Hospitalier de Versailles, Versailles, France
177 Rue de Versailles, 78150 Le Chesnay
Université Versailles Saint-Quentin en Yvelines et Paris Saclay