Cerebral collateral flow defines topography and evolution of molecular penumbra in experimental ischemic stroke

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Résumé en anglais	Intracranial collaterals are dynamically recruited after arterial occlusion and are emerging as a strong determinant of tissue outcome in both human and experimental ischemic stroke. The relationship between collateral flow and ischemic penumbra remains largely unexplored in pre-clinical studies. The aim of the present study was to investigate the pattern of collateral flow with regard to penumbral tissue after transient middle cerebral artery (MCA) occlusion in rats. MCA was transiently occluded (90 min) by intraluminal filament in adult male Wistar rats (n = 25). Intracranial collateral flow was studied in terms of perfusion deficit and biosignal fluctuation analyses using multi-site laser Doppler monitoring. Molecular penumbra was defined by topographical mapping and quantitative signal analysis of Heat Shock Protein 70 kDa (HSP70) immunohistochemistry. Functional deficit and infarct volume were assessed 24 h after ischemia induction. The results show that functional performance of intracranial collaterals during MCA occlusion inversely correlated with HSP70 immunoreactive areas in both the cortex and the striatum, as well as with infarct size and functional deficit. Intracranial collateral flow was associated with reduced areas of both molecular penumbra and ischemic core and increased areas of intact tissue in rats subjected to MCA occlusion followed by reperfusion. Our findings prompt the development of collateral therapeutics to provide tissue-saving strategies in the hyper-acute phase of ischemic stroke prior to recanalization therapy.
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