A Classification Scheme for Assessing Recanalization and Collateral Formation following Cerebral Venous Thrombosis

Adnan I. Qureshi MD

Address Correspondence:

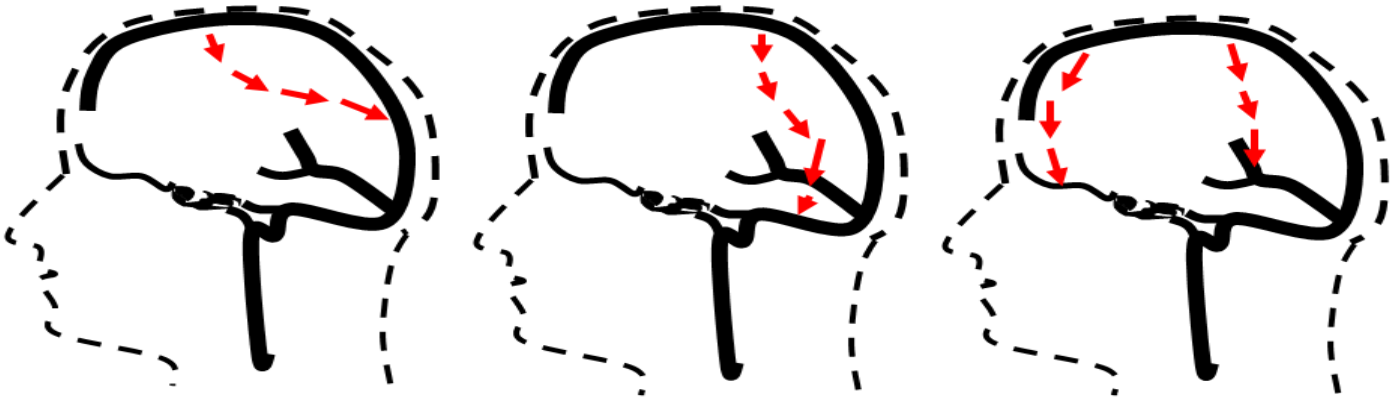
Zeenat Qureshi Stroke Research Center, University of Minnesota, Minneapolis, MN

There has been substantial emphasis placed on categorizing recanalization and collateral formation in patients with acute arterial occlusion resulting in ischemic stroke.[1-4] Such methods of semi-quantitatively classifying the severity of arterial occlusion for prognostic purposes and assessing the response to treatment have become an integral part of clinical studies.[3-4] However, no such method exists for classifying either recanalization or collateral formation in patients with cerebral venous thrombosis. A method with two components is described that can be used to classify recanalization and collateral formation in patients with cerebral venous thrombosis using serial magnetic resonance (MR) or computed tomographic (CT) venography or catheter based angiography with venous phase imaging. The recanalization is classified as follows (see Figure): grade I, partial recanalization of one or more occluded dural sinus with improved collateral flow; grade II, complete recanalization of one sinus but persistent occlusion of the other sinuses [A-no residual flow, B-non occlusive flow]; and grade III, complete recanalization. The collateral formation is classified as follows: grade I, collaterals-bypass occluded segment of dural venous sinus but connect within the same sinus; grade II, collaterals bypass occluded segment but connect with a different sinus; and grade III, collaterals bypass the occluded segment and connect with different circulation. The classification recognizes the superficial and deep venous circulation as distinct pathways with different prognostic implications[5] that can be linked through collateral pathways. Further studies are required to assess the inter-observer reliability of the proposed classification and assess the ease of use in clinical studies and practice. Identification of patterns of recanalization and/or collateral formation associated with minimal residual deficits may assist in selecting patients with cerebral venous thrombosis who can benefit from early trans-venous thrombolysis[6].

References:

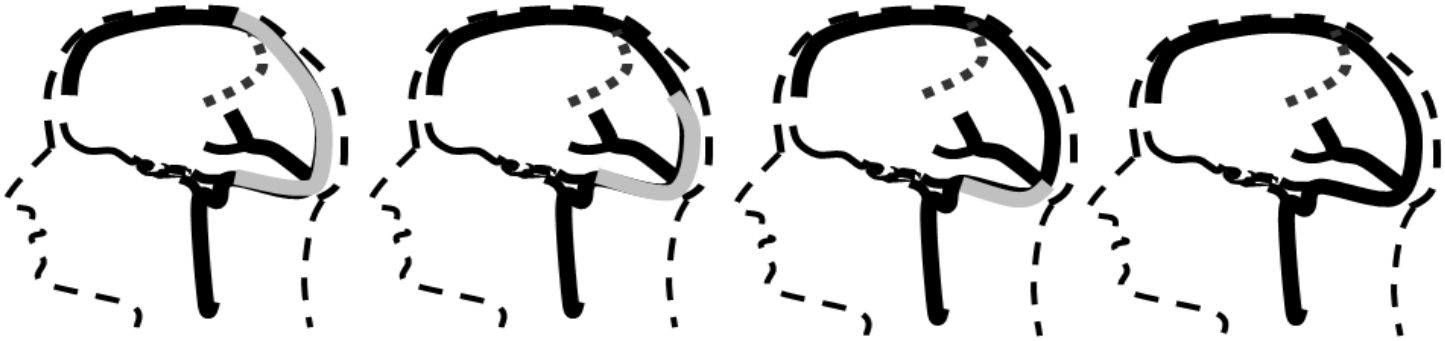
1. Qureshi AI. New grading system for angiographic evaluation of arterial occlusions and recanalization response to intra-arterial thrombolysis in acute ischemic stroke. Neurosurgery 2002;50:1405-14.
2. Mohammad Y, Xavier AR, Christoforidis G, et al. Qureshi grading scheme for angiographic occlusions strongly correlates with the initial severity and in-hospital outcome of acute ischemic stroke. J Neuroimaging 2004;14:235-41
3. Khatri P, Neff J, Broderick JP, et al. Revascularization end points in stroke interventional trials: Recanalization versus reperfusion in IMS-I. Stroke 2005;36:2400-3
4. Tomsick T, Broderick J, Carrozella J, et al. Revascularization results in the interventional management of stroke II trial. AJNR Am J Neuroradiol 2008;29:582-7.
5. Ferro JM, Bacelar-Nicolau H, Rodrigues T, et al for ISCVT and VENOPORT investigators. Risk score to predict the outcome of patients with cerebral vein and dural sinus thrombosis. Cerebrovasc Dis. 2009;28:39-44.
6. Philips MF, Bagley LJ, Sinson GP, et al. Endovascular thrombolysis for symptomatic cerebral venous thrombosis. J Neurosurg 1999;90:65-71.

Zeenat Qureshi Stroke Research Center, University of Minnesota, Minneapolis, MN



Grade I	Grade II	Grade III
Collaterals bypass occluded segment of dural venous sinus but connect within the same sinus	*Collaterals bypass occluded segment of dural venous sinus but connect with a different sinus*	*Collaterals bypass occluded segment of dural venous sinus but connect with a different circulation (through deep or cavernous venous sinus circulation)*
If multiple patterns exist, then highest grade must be selected		

Collateral grades



Recanalization grades

Grade I	Grade II	Grade III
Partial recanalization (antereograde flow through part of the sinus) of one or more occluded dural venous sinus with improved collateral flow or visualization of branches	*Completed recanalization (antereograde flow through all the sinus) of one dural venous sinus but persistent occlusion in other venous sinuses* ***A.*** *No residual flow defect* ***B.*** *Non-occlusive flow defect*	*Complete recanalization of all occluded venous sinuses*
If multiple patterns exist, then highest grade must be selected		