Evolution of Rapid Middle Cerebral Artery Recanalization During Intravenous Thrombolysis for Acute Ischemic Stroke

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Intravenous recombinant tissue plasminogen activator (rtPA) is thought to benefit patients with acute ischemic stroke by producing early reperfusion.1 Transcranial Doppler (TCD) is a noninvasive method that can monitor the recanalization process in real time when occlusion occurs in the proximal intracranial vessels.

We present our findings during rtPA infusion in a 56-year-old man with acute ischemic stroke to illustrate the time course of changes that occur in a middle cerebral artery (MCA) stem occlusion treated by intravenous thrombolysis. We used a 2-MHz portable unit (Multigon 500 500 mol/L) with a pulse-wave transducer mounted on a head frame (Marc 500, Spencer Technologies) to insonate the MCA at a constant angle through the temporal bone. At the initiation of rtPA treatment, only minimal antegrade flow was visualized (Figure, frame 1), indicating MCA main-stem near-occlusion. The MCA flow signals started to improve 30 minutes later (frames 2 and 3). Microembolic signals were heard as chirping sounds with unidirectional appearance on screen (white arrow, frame 2), consistent with the beginning of clot breakdown and washout. A brief period of a stenotic signal was seen (frame 4), representing early partial recanalization. This was rapidly followed by the appearance of a hyperemic low-resistance flow (frames 5 and 6), indicating complete reperfusion of the MCA stem. Thus, a complete recanalization was achieved within 36 minutes of initiation of rtPA infusion. Once the residual blood flow signals around the clot started to improve, only a few additional minutes were necessary to achieve complete recanalization.

This case demonstrates rapid recanalization of a presumed embolic clot occluding the MCA stem. TCD can detect residual blood flow around the clot, which may play a role in the process of intracranial clot dissolution similar to myocardial infarction.2 TCD can noninvasively monitor recanalization and has a potential to identify patients who may not require additional thrombolysis or other clot disruption therapies.

References
TCD recordings were obtained via transtemporal approach at a depth of 53 mm with an 11.8-mm gate of insonation. Graphic below spectra frames shows presumed clot location in MCA main stem. Frame 1, Minimal flow signal in proximal MCA at time of IV rtPA bolus (13:02). After 30 minutes of continuous IV rtPA infusion: frames 2 and 3, early restoration of flow signals with increasing frequencies and microembolic signals (arrow); frame 4, turbulent stenotic signal with audible chirping components, suggesting clot dissolution; frame 5, hyperemic flow with velocities elevated above age-expected values and relatively low pulsatility (Gosling pulsatility index 0.73), indicating distal vasodilation; frame 6, hyperemic flow with velocities elevated above age-expected values and normal pulsatility (Gosling pulsatility index 0.93), showing proximal MCA reperfusion with distal vasomotor response.
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