Ultrasound-Enhanced Thrombolysis: From Bedside to Bench

To the Editor:

We highly appreciate Tsivgoulis and Alexandrov’s comment regarding our article about sonothrombolysis with transcranial color-coded sonography (TCCS) and recombinant tissue plasminogen activator. However, several conclusions made by these colleagues require a response. The assumption that the multibeam configuration of TCCS causes an increased rate of symptomatic intracranial hemorrhage in the target group is not justified. The overwhelming part of insonation was performed by using the pulsed wave Doppler mode as it was also used by Alexandrov and coworkers in the CLOTBUST trial. As we described in the Methods section, multibeam color-coded mode was only used for the identification of the vessel occlusion before starting the continuous insonation. Additionally, the exact location of the Doppler sample volume at the targeted occlusion site was recurrently proved by intermitted switching from the Doppler mode to the color-coded mode. This interval of switching depends on the examiner’s choice, either using the so called “refreshing-mode” of the device for an ultrashort period (every 7 seconds during continuous insonation for enhancing thrombolysis in our study) or individually when used for diagnostic purpose. This frequent visualization of the Doppler sample volume location allows optimal targeting of the occlusion site by the ultrasound beam. Because the position of transducer at the acoustic window of the temporal bone did not change, the insonation angle did not vary remarkably.

This ability of switching from Doppler mode to color-coded mode by using the same device and transducer makes TCCS such an advanced and useful tool for identifying (and treating) acute intracranial vessel occlusion. As the pulsed wave Doppler mode enables to measure blood flow velocities at a defined location, the color-coded mode displays the flow of the major part of the Circle of Willis at one glance. Also, the modality of brightness-mode is helpful to identify landmarks which allow locating the site of an occluded middle cerebral artery without any residual flow (like in our study) in Doppler or color-coded mode.

The statement by Tsivgoulis that there was only a trend toward a better functional outcome after 90 days as determined by both the modified Rankin Scale and the Barthel Index does not reflect the results of our study correctly. The modified Rankin Scale showed only a trend, but the Barthel Index measurement revealed a highly significant improvement of the target group. However, the Barthel Index is no longer accepted as an end point for stroke trials, so we did not regard this result as valid.

Both transcranial Doppler ultrasound and TCCS enhance thrombolysis by the same high-frequency low-energy “diagnostic” transcranial pulsed wave ultrasound. However, in our opinion TCCS is the more advanced tool offering many advantages compared to transcranial Doppler ultrasound.

Disclosures

None.

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Stroke. 2008;39:e193; originally published online October 23, 2008;
doi: 10.1161/STROKEAHA.108.531848
Stroke is published by the American Heart Association, 7272 Greenville Avenue, Dallas, TX 75231
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Print ISSN: 0039-2499. Online ISSN: 1524-4628

The online version of this article, along with updated information and services, is located on the
World Wide Web at:
http://stroke.ahajournals.org/content/39/12/e193

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