Blood-Brain Barrier Disruption by Low-Frequency Ultrasound

To the Editor:

Dr Reinhard and coworkers report a case of cerebral gadolinium extravasation after 300 kHz ultrasound “treatment” using the same device that has been applied in the Transcranial Low-Frequency Ultrasound Mediated Thrombolysis in Brain Ischemia Study (TRUMBI) trial.1,2 This interesting observation improves our understanding of the underlying pathophysiology of the hemorrhagic complications that occurred in stroke patients during the TRUMBI study. The assumption that low-frequency ultrasound might cause blood-brain barrier disruptions and thus increase the risk of intracerebral hemorrhage—particularly in the presence of recombinant tissue plasminogen activator—appears convincing and is corroborated by our rat experiments using 20 kHz ultrasound.3 In this MRI study, low-frequency insonation caused a dose-dependant increase in T2-relaxation time which serves as an indicator for vasogenic brain edema and thus indicates blood-brain barrier disruption. Increased ultrasound energy, furthermore, caused circumscribed cortical hemorrhagic lesions that appeared like traumatic cerebral contusions histologically. These findings suggest that mechanical ultrasound effects might be responsible for blood-brain barrier disruptions and bleeding complications. Because mechanical effects decrease with higher frequencies, we would recommend the use of ultrasound frequencies in the upper kHz range (ie, >300 kHz) for treatment purposes. Extensive preclinical evaluation of new devices, however, is obligatory.

Disclosures

None.

Blood-Brain Barrier Disruption by Low-Frequency Ultrasound
Tibo Gerriets, Maureen Walberer, Max Nedelmann, Georg Bachmann and Manfred Kaps

Stroke. 2007;38:251; originally published online December 14, 2006;
doi: 10.1161/01.STR.0000254444.19772.33
Stroke is published by the American Heart Association, 7272 Greenville Avenue, Dallas, TX 75231
Copyright © 2006 American Heart Association, Inc. All rights reserved.
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/38/2/251

Permissions: Requests for permissions to reproduce figures, tables, or portions of articles originally published in Stroke can be obtained via RightsLink, a service of the Copyright Clearance Center, not the Editorial Office. Once the online version of the published article for which permission is being requested is located, click Request Permissions in the middle column of the Web page under Services. Further information about this process is available in the Permissions and Rights Question and Answer document.

Reprints: Information about reprints can be found online at:
http://www.lww.com/reprints

Subscriptions: Information about subscribing to Stroke is online at:
http://stroke.ahajournals.org//subscriptions/