

# **Ultrasound evaluation of atherosclerosis and other cardiovascular sources of cerebral embolism**

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## **Abstract**

The search for embolic sources has high priority in patients presenting with suspected cerebral embolism. Non-invasive cardiovascular ultrasound is frequently used to reveal the presence of carotid stenosis and cardiac disorders with embolic potential. Transesophageal echocardiography (TEE) provides images of aortic atherosclerosis, shown to be associated with increased risk of stroke. Some guidelines claim that TEE should be reserved for younger patients. In recent years microembolic signal (MES) detection with transcranial Doppler has emerged as a tool with potential of identifying patients at high risk of recurrent embolism.

We compared the diagnostic value of transthoracic and transesophageal echocardiography in relation to age in stroke/TIA patients. We found that among 453 patients investigated with TEE during 3 years, TEE had a higher proportion of relevant findings, e.g. complex aortic arch atheromas, in patients aged > 50 years compared to those < 50 years.

Carotid stenosis is a well known cause of embolism; however the association between routinely described plaque morphology and risk of recurrent embolism is not clear. In 197 patients with symptomatic high grade carotid stenosis, we found a strong correlation between the side of symptomatic stenosis and occurrence of microembolic signals on transcranial Doppler compared to the contralateral hemisphere. The occurrence of MES, however, only tended to correlate to plaque morphology.

Complex aortic atheromas are often found in the distal aortic arch or proximal descending aorta. Therefore, we investigated if regional flow conditions, with retrograde diastolic flow, make plaques located in the aorta distal to the cerebral branches relevant as sources of cerebral embolism; we found that this possibility does exist.

Previous research has shown hyperlipidemic rabbits to be a useful atherosclerosis model. The possibility to perform serial non-invasive evaluation of the aorta in the same animal would add a new dimension in the study of pathophysiology and treatment effects. Therefore, we validated high frequency transthoracic ultrasound for repeated in vivo measurements of aortic intima-media thickness in hyperlipidemic rabbits.

To conclude, our study shows that TEE has the highest yield of relevant information in stroke/TIA patients above 50 years of age. In carotid stenosis, plaque morphology as described by Gray-Weale scaling shows only a tendency to correlate with microembolism. Local flow conditions can allow plaques located in the aorta distal to the cerebral arteries to embolize to the brain. To facilitate future studies of aortic atherosclerosis, we developed and validated an animal model for repeated ultrasound investigations of aortic intima media thickness.

*Keywords:* stroke, atherosclerosis, aorta, echocardiography, ultrasound, IMT, MES, WHHL

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- I. Wetterholm R, Bech-Hanssen O, Blomstrand C, Volkmann R, Caidahl K.  
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- II. Zuromskis T, Wetterholm R, Fréden-Lindqvist J, Jatuzis D, Obelieniene D,  
Caidahl K, Volkmann R.  
Prevalence of microemboli in symptomatic carotid artery disease:  
A transcranial Doppler study before carotid endarterectomy  
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- III. Svedlund S, Wetterholm R, Volkmann R, Broomé M, Caidahl K.  
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- IV. Wetterholm R, Caidahl K, Volkmann R, Brandt-Eliasson U,  
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Imaging of atherosclerosis in WHHL rabbits using high-resolution  
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