2004 Mihara Prize Awardee's Summary

ULTRASOUND IMAGING IN STROKE

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Atherosclerosis is still a major course of morbidity and mortality worldwide and in particular in industrialized countries and although extensive research in atherosclerosis has been performed for more than a century, many mechanisms causing and supporting atherogenesis are still not understood. In particular experimental models fail to mirror the discontinuous natural course of human disease, with longstanding asymptomatic stages until all-of-a-sudden symptoms due to local thrombosis or distal embolism occur. Only since the last quarter of the 20th century imaging modalities became available to investigate the complex history of atherosclerosis prospectively in humans. From its infancy in Japan (Satomura and Kaneko 1958), Doppler sonography has been used for non-invasive vascular analysis and expanded our diagnostic repertoire (Hennerici et al. 1976)[1-2].Later duplex ultrasound both applied extra- and intracranially have been used (Hennerici et al. 1982)[3]. Today high resolution vessel online studies of wall morphology (Hennerici et al. 1984)[4], plaque development (Hennerici et al. 1985)[5] and vascular remodeling (Hennerici et al. 1991)[6] can all be performed in individual patients as well as in large clinical trials.

At the other end of the spectrum, compensatory hemodynamic mechanisms have been identified in patients with few or no symptoms but extensive cerebrovascular disease. This led to the new concept that these patients do not need any surgical or interventional therapy because of the natural high capacity of complex networks from large and small arteries (Hennerici et al. 1987)[7] and was recently confirmed by careful re-analysis of NASCET and ECST). Regression of atherosclerosis, long assumed not to exist, could be observed both naturally and during appropriate treatment (e.g. statins) or preventive

risk factor modulation (Hennerici et al. 1985)[5].

For the acute stage ultrasound is used in addition to other brain and vascular imaging modalities (CT, CTA, MRI and MRA) and in particular to predict outcome and prognosis if combined herewith (Hennerici et al. 2000)[8]. More recent developments facilitate perfusion imaging of brain tissue (Hennerici et al. 2004)[9] and hence allow short step monitoring of critical conditions after severe strokes in patients treated on stroke units. Echo-contrast enhanced ultrasound studies are used and have been modified in our days to identify in more detail progressive vascular inflammation (one of the leading mechanisms causing atherosclerosis) and different stages of oligemia in early stroke (Hennerici et al. 2004)[10]. Ultrasound mediated gene therapy and various special modifications of ultrasound characteristics used for thrombolysis of large and small vessel strokes are future weapons against stroke and illustrate the change from a purely diagnostic technology for its innovative treatment potential (Hennerici et al. 2004)[11].

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