Summary:

Sufficient vasodilatory and vasoconstrictive reactivity of cerebral arterioles is an important prerequisite for adequate capillary perfusion. To appreciate its capacity during aging and to elucidate its impact on parenchymal integrity we undertook a correlation using ultrasonography and brain MRI. Sixty healthy persons with no stenoses in carotid and vertebral arteries were examined by transcranial doppler ultrasonography (TCD) to assess middle cerebral artery mean flow velocities (MFV) et rest, after 30 sec apnea and after 90 sec hyperventilation. Young persons, N=20, mean age 24,8 (20-32) were compared with middle aged, N=20, 54,8 (40-63) and elderly, N=20, 76,2 (69-84). A cohort of 40 elderly persons, mean age 68,4 (57-85) were evaluated also by MRI using FLAIR and T2-weighted sequences. Their extent of leukoaraiosis measured by the Fazekas scale was correlated with their vasoregulatory capacity.

Results: The steady state mean flow velocity (MFV) in young persons, 71 cm/sec, decreases to 48,1 and to 44,9 cm/sec in the middle and the old aged. The postapnoic vasodilatation in young persons accelerates the MCA blood velocity by 41,7%, while in middle and old age only by 37,9 and 32,7% respectively. The MCA deceleration post hyperventilation by 49,8% in young people decreases to 37,8% and to 29,7% respectively in the older categories. Correlation of periventricular hyperintensities and deep white matter lesions was found closest for the index of resistance (0,45, p<0,05). For the apnoic acceleration and hyperventilatory deceleration it was minimal (0,01 and 0,08 respectively). In the study comparing cognitively intact persons with individuals of decreased mental capacity a significantly diminished cerebrovascular reserve was disclosed in the latter one (Breath hold index (BHI) 0,58±0,41 vs. 1,53±0,53, p<0,05. The
severity of leukoaraiosis was significantly higher in the group with lower score of cognitive functions (2,54 vs. 0,69, p<0,05 for periventricular hyperintesities (PVH) and 2,46 vs. 0,92, p<0,05 for deep white matter lesions (DWML).

Conclusion: The extent of vasoregulatory capacity during aging decreases along with the decreasing basic mean flow velocity (MFV). Its relationship with the initial stages of leukoaraiosis is minimal. The tendency to lower vasoregulatory capacity in the cerebral vessels of cognitively compromised individuals with advanced leukoaraiosis is evident.