Unstable atherosclerotic carotid plaque diagnosis and influence on cerebral hemodynamics

ABSTRACT

Atherosclerosis of carotid arteries belongs to most important risk factors of stroke especially if unstable plaques are detected. However, the formation of the plaques and their transformation to unstable stage are not fully clarified. The aim of this work was to map the actual diagnostic possibilities, innovations in this field and to explore the impacts on cerebrovascular hemodynamics. In partial studies we succeeded to identify the ultrasound characteristics of the atherosclerotic carotid plaque which increases the risk of its progression. Those are the width of plaque, surface irregularities and ulcerations. The differences in elasticity between stable and unstable plaque were found using the novel method of shear-wave elastography with significantly higher average elasticity in plaques asymptomatic stable then in plaques asymptomatic progressive or plaques symptomatic. To extend research opportunities to in vitro studies the hemodynamic model of carotid bifurcation was constructed with the insertion of the plaque extracted during carotid endarterectomy and its function for the studies of hemodynamic changes in carotid stenoses was confirmed. The increase in resistance and pulsatility of cerebral arteries in carotid atherosclerosis correlates with the development of their impairment (microangiopathy). We aimed to identify the independent risk factors of cerebrovascular remodulation (the age, high blood pressure, diabetes mellitus, width of carotid plaque and male gender) and we performed the analysis of the measurement of minute blood flow detected in cervical and cerebral arteries with duplex sonography and quantitative magnetic resonance angiography with good correlation of both methods and their reproducibility for the clinical practice.

KEYWORDS