Peak systolic velocity ratio as a new parameter for carotid artery stenosis grading

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Background

Duplex sonography is a widely used as a screening method for carotid artery stenosis. Morphological measurements (B-mode images and color flow imaging) are the main criteria for low and moderate degrees of stenosis. Increased velocities in the stenosis indicate narrowing, but the appearance of collateral flow and decreased poststenotic flow velocity prove a high degree stenosis ($\geq 70\%$). Multiparametric approach using additional criteria refer to the effect of a stenosis on prestenotic flow in common carotid artery, the extent of poststenotic flow disturbances, and derived velocity criteria is intended to increase the reliability and the standard of ultrasonic results reporting for arteriosclerotic disease in carotids.

Aim

The aim of the study was to compare correlations between percentage of internal carotid artery (ICA) stenosis using computed tomography angiography (CTA) and sonographic parameters: PSV_{max} , PSV ratio (PSV_{max} in stenosis using linear probe / PSV_{max} >3 cm distal to stenosis using transcranial probe) and a lumen reduction in B-Mode.

Material and methods

Duplex sonography of carotid arteries using linear probe 5–12 MHz and transcranial probe 2–4 MHz were performed in consecutive patients with carotid artery stenosis $>50\%$ in 2 laboratories. PSV_{max} , PSV ratio and lumen reduction in B-Mode (NASCET) were evaluated. All patients underwent also CTA within 2 weeks with measurement of stenosis by dedicated software using both diameter (NASCET) and area of lumen reduction. Spearman correlation coefficient was used for evaluation the correlation between sonographic and CTA stenosis grading.

Results

Totally 35 patients (18 males, 17 females, mean age 71.9 ± 8.4 years) were enrolled to the pilot part of the study during 6 months. Higher correlations between stenosis grading using CTA diameter/area reduction were achieved for PSV ratio ($r = 0.65$ / $r = 0.65$, $p < 0.05$) than for PSV_{max} ($r = 0.53$ / $r = 0.55$, $p < 0.05$) or lumen reduction in B-Mode ($r = 0.56$ / $r = 0.56$, $p < 0.05$), resp. PSV ratio cut-off of 4.5 had 69% sensitivity, 84% specificity, 79% positive and 76% negative predictive value for detection of 70% stenosis. 1A

Figure 1. Grading of carotid stenosis. A – measurement of PSV_{max} , B – measurement of PSV distal to stenosis, C – measurement of residual lumen, D – measurement of normal lumen diameter distal to stenosis

Conclusion

Peak systolic velocity ratio seems to be better parameter for internal carotid artery stenosis grading than maximum peak systolic velocity or measurement of lumen reduction in B-Mode.

Acknowledgement: Study was supported by the Ministry of Health of the Czech Republic grants No. 17-31016A, 16-30965A.