

## Resolving power of contrast-enhanced ultrasound detection of carotid plaque neovascularization

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Nowadays the degree of carotid plaque neovascularisation seems to be one of the main markers of its instability and shows the high risk of cerebrovascular complications. The only noninvasive method of life-time visualization of intraplaque neovascularization is contrast-enhanced ultrasound (CEUS). The accuracy of this method is still questionable, as there is no common approach to the data evaluation and the minimal detectable diameter of the vessels is not also determined yet. And this research is dedicated to the latter.

We studied 27 patients. In each case we performed contrast enhanced ultrasound, and then carotid endarterectomy with following pathomorphologic examination of the removed plaques. The quantitative analysis of the degree of vascularisation during the CEUS and the light microscopy was based on fundamental principles of stereology. During the ultrasound we analyzed 20 plaque images equidistant in time, during the morphological research - 4-7 equidistant plaques cross-sections. The area of plaque was encircled in each image and the amount of vessels in this area was counted.

We measured the density of vessels by dividing the total number of vessels by the sum of plaque areas in each image. We also determined the density of vessels depending on their diameter during histologic examination.

Intraplaque neovascularization was found in all 27 plaques both during CEUS and histologic examination. The number of vessels per 1 cm<sup>2</sup> was 6-51 [ $21 \pm 14$ /cm<sup>2</sup>] on CEUS imaging and 19-224 [ $236 \pm 249$ /cm<sup>2</sup>] on histology. We didn't find any significant correlation between these parameters ( $R=0,26$ ,  $p=0,19$ ), and there was no correlation between the amount of vessels found on CEUS and the density of vessels  $<20 \mu\text{m}$  in diameter ( $R=0,2$ ,  $p=0,31$ ). Nonetheless, there exists a significant correlation between the results of visualization by CEUS and the density of vessels with the diameter  $>20 \mu\text{m}$  ( $R=0,46-0,76$ ,  $p=0,0000-0,015$ ), and higher correlation between the CEUS results and the density of vessels  $\geq 30 \mu\text{m}$  ( $R=0,76$ ,  $p=0,0000$ ). Furthermore, we found no significant difference between absolute values of CEUS results and the density of vessels  $\geq 30 \mu\text{m}$  on histology ( $p=0,67$ ).

Thus we demonstrated the high resolving power of CEUS in identification of carotid intraplaque neovascularization, which enables to detect microvessels more than  $30 \mu\text{m}$  in diameter.