

SEGMENT-SPECIFIC ACCELERATION OF EXTRACRANIAL CAROTID BLOOD FLOW IN HYPERTENSIVE PATIENTS WITH ISCHEMIC HEART DISEASE

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Abstract. This study evaluated segment-specific patterns of extracranial carotid blood flow in patients with isolated arterial hypertension and patients with concomitant ischemic heart disease. A total of 120 patients and 20 apparently healthy individuals were examined using color duplex ultrasonography. Maximum blood flow velocity was assessed bilaterally in the common, internal, and external carotid arteries. Patients with combined arterial hypertension and ischemic heart disease demonstrated consistently higher velocities across all carotid segments. Compared with isolated hypertension, the increase ranged from 11.0% to 12.4% in the common carotid arteries, reached 20.0% in both internal carotid arteries, and ranged from 16.6% to 17.6% in the external carotid arteries. The relative differences were even greater when compared with healthy controls. Despite the overall acceleration, bilateral symmetry was largely preserved.

Keywords: arterial hypertension; ischemic heart disease; carotid artery; duplex ultrasonography; maximum flow velocity; vascular remodeling.

Relevance. Arterial hypertension produces chronic mechanical stress on the vascular wall and promotes arterial stiffness and structural remodeling. In patients with established ischemic heart disease, coronary atherosclerosis may coexist with abnormalities in other arterial territories, reflecting a polyvascular disease process. Duplex ultrasonography is a non-invasive method that combines morphological imaging with functional flow velocimetry and may therefore provide additional information about extracranial arterial involvement. Contemporary vascular guidelines recognize duplex ultrasound as an important method for evaluating carotid and other peripheral arterial territories.

Aim of the study. To characterize bilateral and segment-specific differences in maximum carotid blood flow velocity among patients with isolated arterial hypertension, patients with hypertension and ischemic heart disease, and apparently healthy individuals.

Materials and methods. The study included 120 patients divided into two groups. Group I consisted of 60 patients with arterial hypertension without clinical or instrumental evidence of ischemic heart disease. Group II included 60 patients with concomitant arterial hypertension and ischemic heart disease. The control group consisted of 20 apparently healthy individuals without hypertension or clinically established cardiovascular disease. Color duplex ultrasonography was performed using a Vivid E95 ultrasound system, GE Healthcare, equipped with a 7.5–12 MHz linear transducer. Maximum blood flow velocity was measured separately in the right and left common carotid arteries, internal carotid arteries, and external carotid arteries. Quantitative variables were expressed as mean values with standard deviations.

Discussion. In the common carotid arteries, patients with isolated hypertension had a maximum velocity of 115.3 ± 10.1 cm/s on the right and 112.7 ± 9.4 cm/s on the left. In patients with concomitant ischemic heart disease, the corresponding values increased to 128.1 ± 12.1 and 126.7 ± 11.4 cm/s. Therefore, the relative increase associated with ischemic heart disease was 11.0% on the right and 12.4% on the left. The control group demonstrated lower common carotid velocities of 105.5 ± 8.9 cm/s on the right and 103.7 ± 8.7 cm/s on the left. Compared with the control group, Group II showed increases of 21.4% and 22.2%, respectively. More pronounced intergroup differences were observed in the internal carotid arteries. In Group I, right- and left-sided velocities were 78.1 ± 8.5 and 76.9 ± 7.6 cm/s. In Group II, both values increased by approximately 20.0%, reaching 93.7 ± 10.2 cm/s on the right and 92.3 ± 9.4 cm/s on the left. Compared with healthy participants, the increase was 32.3% in the right internal carotid artery and 29.6% in the left artery. In the external carotid arteries, maximum velocities were 72.2 ± 6.4 and 70.6 ± 6.1 cm/s in Group I and 84.9 ± 7.6 and 82.3 ± 7.1 cm/s in Group II. The relative increase reached 17.6% on the right and 16.6% on the left. Compared with the control values of 66.3 ± 5.2

and 65.4 ± 5.1 cm/s, Group II demonstrated increases of approximately 28.1% and 25.8%. The difference in the right external carotid artery reached statistical significance at $p < 0.05$.

Conclusion. Concomitant arterial hypertension and ischemic heart disease are associated with bilateral acceleration of blood flow in the common, internal, and external carotid arteries. The greatest relative differences were observed in the internal carotid segments, while right-to-left symmetry was largely preserved. The findings support a systemic and multisegmental pattern of vascular remodeling and indicate that detailed carotid duplex profiling may complement cardiovascular risk assessment.

References

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