

## HEMODYNAMIC DISTURBANCES IN GLIAL NEOPLASMS OF THE BRAIN

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The vascularization of glial neoplasms is built up by the branching of the internal carotid or vertebrobasillary system. Benign gliomas (astrocytoma and oligodendroglioma) are poorly vascularized. In the angiogram they are characterized by a scarce network made up of small, thin and short vessels, with regular arrangement and equal caliber (8). Often it occupies the central part of the neoplasm (11, 12). Glioblastomas show adequate vascularization. According to data of V. Lerman (8), the vessels are with unequal caliber, excessively curved, and contain numerous microaneurysms. In the center of the neoplasm necrosis is frequently established. Usually no vessels are visible in the necrotic zone. The basic vascularization is concentrated in the periphery. Many authors (1—5) point out that glial neoplasms lack a characteristic angiographic picture.

To distinguish benign from malignant neoplasms of the neuroglia, regional and global circulatory cerebral phenomena, demonstrated by rheoencephalography and serial cerebral angiography, were used. A total of 85 patients of which 34 with astrocytoma, 2 with oligodendroglioma, and 49 with glioblastoma multiforme were studied. In thirty (88.2 per cent) patients with astrocytoma a marked asymmetry in the pulse wave was established, in twenty six patients the index of cerebral blood filling on the side of the tumour was lower, and in four — higher. The asymmetry coefficient, mirroring the difference in blood filling, amounted to an average of  $29.6 \pm 3.53$  per cent. The time of the ascending part of the REG to the total pulse wave ratio, reflecting changes in the vascular tone on the side of the tumour, amounted to  $13.04 \pm 0.796$ , and on the opposite side — to  $12.93 \pm 0.786$ . Such data point to a tendency towards vascular tone rise on the neoplasm side. The mean values of the other REG indicators did not show noteworthy changes. Cerebral angiography disclosed dislocational vascular changes in 95 per cent of the cases, and the presence of a pathological vascular network — in 40 per cent. In glioblastoma multiforme pulse wave asymmetry was recorded in 92.4 per cent, the index of cerebral blood filling on the side of the tumour being lower in forty three cases, and higher — in six. In the remainder three cases no difference in blood filling was recorded. The asymmetry coefficient amounted to an average  $28.6 \pm 2.59$  per cent. The time of the ascending part of the REG on the side of the tumour was equal to  $0.11 \pm 0.004$ , and on the opposite side —  $0.1 \pm 0.005$  seconds. The ratio of the latter to the total heart cycle time homolaterally to the tumour was equal to  $15.12 \pm 0.742$ , and contralaterally — to  $14.91 \pm 0.601$  per cent. In 92.9 per cent of the cases the angiography revealed dislocational vascular changes, and in 60.7 per cent — the presence of a pathologically altered vascular network.

For illustration we present the following case reports:

1) H. J., aged 36, case record No 2683/68, with astrocytoma in the left temporal lobe.

In the regional (TT) lead the pulse wave index is sharply reduced. The coefficient of asymmetry, reflecting the difference in regional blood filling, is equal to 60 per cent. The tone of the brain vessels is preserved bilaterally

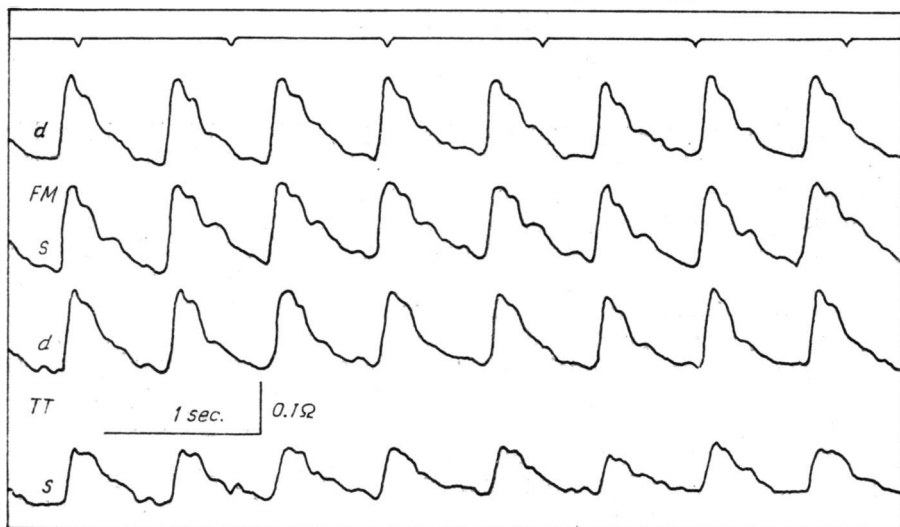


Fig. 1: REG of H. J. with astrocytoma of the left temporal region.

(Fig. 1). On the leftside carotid arteriography  $M_1$  shows elevation,  $M_2$  — oblique displacement in the front view, and arch-shaped elevation in the lateral view. The posterior cerebral artery is lowered in the initial segment, and temporally an avascular zone is outlined.

The dislocation of the left middle cerebral artery, the reduced blood filling index of its territory, as well as the absence of REG evidence of vascular tone rise attest to a benign tumour of the neuroglia, located in the left-temporal zone.

2) S. T., aged 50, case record No 20022/74, with glioblastoma multiforme in the left frontal region.

In the global (FM) lead a moderately manifested hemisphere asymmetry with a reduced pulse wave index on the leftside is established. The asymmetry coefficient is equal to 25 per cent. In the regional (FF) lead, the blood deficit, consistent with the neoplastic zone, is equal to 42.8 per cent. The vascular tone is increased bilaterally (Fig. 2). On the front-view left carotid angiography, the anterior cerebral artery shows arcuate rightside displacement. In the late arterial phase, a delicate pathological vascular network in the left frontal zone is detected.

The dislocation of the left anterior cerebral artery, the pathological vascular network, the marked blood deficit in the left frontal zone and vascular tone rise point to the presence of a leftside frontal glioblastoma.

The results of our study show that benign gliomas are characterized by dislocation of the anterior or middle cerebral artery, and ipsilateral reduc-

tion of the index of brain blood filling, corresponding to the arterial territory wherein the neoplastic process is located, whereas multiform glioblastomas — by arterial dislocation with bilateral rise in the tone of brain vessels, and reduction of the index of brain blood filling, with blood deficit slightly prevailing on the side of tumour. A lowering of the pulse wave values in

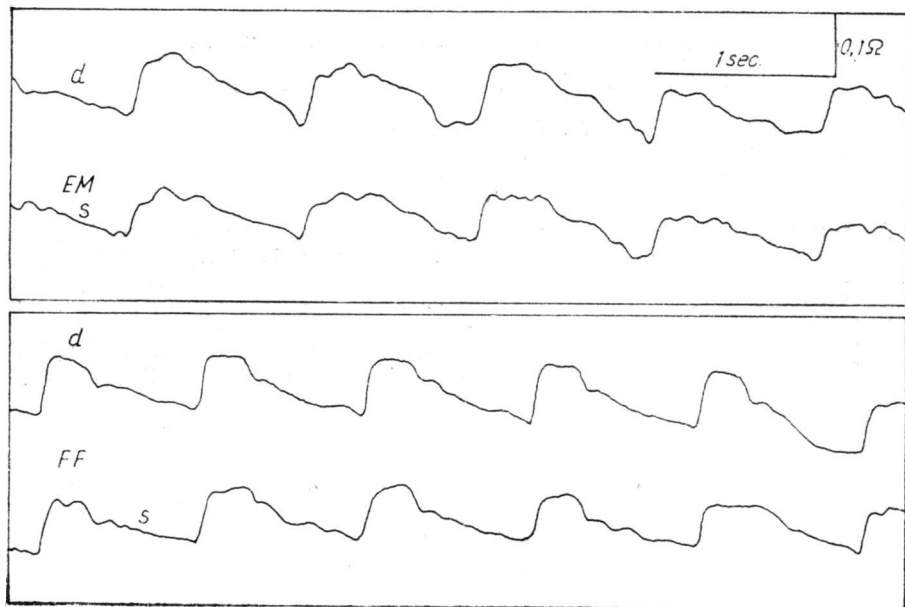


Fig. 2: REG of S. T. with glioblastoma multiforme in the left frontal region.

brain tumours has been described by V. Lerman (5, 6, 7), A. Isfort (10) and others. According to W. Tönis and W. Schiefer (13), the cerebral circulation delay is conditioned by the growing intracranial hypertension, initially exerting compression on veins and capillaries, and subsequently — on the arteries proper. The changes in cerebral hemodynamics in glial tumours are due primarily to the immediate and distant compression of vessels, caused by the steadily growing intracranial hypertension. Also, a definite importance is attributed to the vascular structure of the process and to neurodynamic mechanisms, arising as a result of functional changes in the angioreceptors and vasomotor centers.

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## ГЕМОДИНАМИЧЕСКИЕ НАРУШЕНИЯ ПРИ ОПУХОЛЯХ ГОЛОВНОГО МОЗГА ГЛИАЛЬНОГО ПОРЯДКА

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### Р Е З Ю М Е

Авторы исследуют изменения мозгового кровообращения при опухолях головного мозга глиального порядка посредством РЭГ и четырехсерийной церебральной ангиографии. При доброкачественных глиомах они обнаруживают дислокацию передней или средней мозговой артерии и одновременно снижение индекса кровенаполнения мозга, а при мультиформенных глиобластомах — наряду с ангиографической артериальной дислокацией и двухстороннее повышение сосудистого тонуса и снижение пульсового кровенаполнения с небольшим преобладанием дефицита крови со стороны опухоли.