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BRAIN TUMORS IN CHILDREN

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ABSTRACT

The etiological factors in the formation of cerebral tumors are unknown. In modern oncology, the main risk factor is specific genetic syndromes (neurofibromatosis, Hippel-Lindau disease, phakomatosis), which occur with disruption of the structure of the nervous tissue. Among the probable causes of oncopathology are exposure to ionizing radiation during high-dose irradiation of the head.

Pathogenesis

In medicine, the mutation-genetic concept of oncopathology has been adopted - the development of tumors is based on an unfavorable change in the cell genome. It is provoked by the action of physical, chemical or biological carcinogens, which as a result causes an increase in proto-oncogenes and stimulates unlimited cell division. Then tumor progression occurs, when several clones of cancer cells arise.

There are 2 types of tumor growth. In the expansive variant, the growing tumor pushes the surrounding tissues apart and compresses them, but does not penetrate into neighboring structures. Invasive growth is characterized by the spread of tumor cells beyond the primary focus, their germination into blood vessels. An increase in the size of a space-occupying lesion is accompanied by symptoms of increased intracranial pressure and compression of the brain.

Classification

Tumors can be benign, consisting of highly differentiated cells, or malignant, which are characterized by invasive growth, metastasis and a less favorable prognosis. Based on the time of occurrence, neoplasms are divided into congenital and acquired. Based on histological type, the following types of brain tumors in children are distinguished:

• Astrocytomas. Detected in 40% of children with cerebral neoplasms. They develop mainly at the age of 5-9 years. They are formed from astrocytes - neuroglial cells that have typical stellate processes.

• Malignant gliomas. Their prevalence reaches 30% among cerebral oncopathologies. Tumors occur in children of all ages. They arise from mutations in the glial cells surrounding neurons.

• Medulloblastomas. They occupy up to 20% of the structure of oncological lesions of the brain, and have a bimodal peak incidence - at 3-4 years and at 8-10 years. Tumors are primitive neuroectodermal formations.

• Ependymomas. Less common neoplasms, which account for up to 10% of the total incidence. The average age of children at the time of diagnosis is 6 years. Ependymomas are neoplasias of the cells of the inner lining of the cerebral ventricles.

Rare forms of childhood cancer include teratomas, germinomas, neuroblastomas and hamartomas. According to the mechanism of formation, there are primary formations, arising from neurons and neuroglia, and secondary ones, which are caused by metastasis of cancer of another localization. 70% of space-occupying tumors are localized infratentorially (in the posterior cranial fossa), the remaining 30% of tumors are located supratentorially.

Symptoms

Children have a high compensatory potential of the nervous system, so clinical manifestations occur only when the tumor is large. The main symptoms are associated with increased intracranial pressure. The child experiences severe paroxysmal headaches that appear for no apparent reason. They are combined with dizziness, flickering of spots before the eyes. The intensity of sensations varies depending on the position of the head.

An important clinical sign is "cerebral" vomiting, which opens suddenly and is gushing in nature. Emetic syndrome is not associated with eating, bending, or physical activity. With cerebral vomiting, there are no precursors: nausea, urge, stomach discomfort. Most often it appears at night or early in the morning, at the height of a headache.

Compression of individual cerebral areas gives focal symptoms, by which the doctor can assume the localization of neoplasia. Often, the child has disturbances in gait and coordination of movements, which is pathognomonic for damage to the cerebellum. Less commonly observed are visual, auditory or speech disturbances. Sometimes the first manifestation of the tumor process is an epileptic seizure.

An important place is occupied by symptoms of mental disorders, the development of which is caused by dystrophic changes in nervous tissue. In children, disturbances of consciousness such as workload and deafness, weakening of concentration and memory are possible. Problems arise with learning new material at school. The child becomes apathetic, lethargic, and ceases to be interested in communicating with parents and peers.

Complications

Primary tumors quickly metastasize, and at diagnosis, about 45% of children have secondary lesions in other parts of the brain. Metastasis is most typical for medulloblastoma. Damage to individual nerve structures is fraught with loss of hearing and vision, severe motor impairment, and mental retardation. A dangerous complication is cerebral coma, which without emergency help can result in the death of the child.

Diagnostics

The initial examination of a patient with complaints of headache, dizziness and focal symptoms is carried out by a pediatric neurologist, who, after a physical examination and

obtaining the results of basic studies, refers the child to an oncologist. To diagnose a tumor and verify its histological type, instrumental methods are prescribed:

• CT scan of the brain. The study is used to visualize brain structures and detect a tumor focus, determine the size and density of a tumor. CT scan shows necrosis, hemorrhages, calcifications and other pathologies. To increase the information content of the method, a contrast study is performed.

• MRI of the brain. Magnetic resonance imaging does not cause unnecessary radiation exposure to the child's body and allows a more accurate assessment of objective symptoms. MRI is recommended for gliomas that do not accumulate contrast agent and are therefore poorly visualized on CT images.

• EEG. Assessment of electrical brain activity is necessary to identify foci of hyperexcitation that indicate the location of pathological plus tissue. An EEG is mandatory for patients whose tumor symptoms include periodic seizures.

• Stereotactic biopsy. Neurosurgical intervention to collect a sample of tumor tissue is necessary for histological examination. The laboratory determines the type of formation and the degree of malignancy, which affects the choice of treatment and prognosis of recovery.

• Tests for tumor markers. When diagnosing intracranial germ cell tumors, it is necessary to evaluate the level of alpha-fetoprotein (AFP) and beta-chorionic gonadotropin (hCG). For the study, a sample of blood and cerebrospinal fluid obtained during lumbar puncture is taken.

A consultation with a pediatric ophthalmologist is mandatory. Upon examination, the specialist identifies congestive optic discs and changes in visual fields (heteronymous or homonymous hemianopsia). If hearing loss develops, an examination by a pediatric ENT doctor is necessary. Severe cognitive and behavioral problems require psychiatric evaluation.

Treatment of brain tumors in children

Surgery

At the first stage, in most cases, resection of the tumor is performed, during which surgeons try to remove the tumor as much as possible in order to remove negative neurological symptoms. The material obtained during the operation is sent for histological examination. The only absolute contraindication to surgical intervention is diffuse formations of the brain stem.

To minimize injury to healthy tissue, surgical microscopy techniques are used, and for small formations, removal is performed using radiosurgery. To stabilize the patient's condition in case of severe liquorodynamic disorders, external ventricular drainage or ventriculoperitoneal shunting is performed.

An additional treatment option is bone marrow stem cell transplantation. It is required to increase immunity and stimulate hematopoiesis, since these processes are disrupted during chemoradiotherapy. For transplantation, the patient's own cells obtained before the start of therapy or donor cell material are used.

Conservative therapy

Among conventional methods of treating cerebral tumors, the leading role belongs to radiation exposure. The "gold standard" of radiotherapy in children is 3D conformal irradiation, which has a minimal number of long-term consequences and does not increase the risk of developing

secondary malignant tumors. In pediatric oncology practice, local effects on the tumor or postoperative bed are more often performed.

Chemotherapy is used in young children to reduce the dose of radiation therapy or to temporarily delay it when complications are high. Cytostatics are not effective enough for cerebral oncopathology, so doctors use direct delivery of drugs to the tumor via the intrathecal or intraventricular route. Another way to overcome drug resistance is to select an appropriate chemotherapy regimen.

To improve the child's quality of life, symptomatic medications are recommended: antiemetics, painkillers, psychotropics. For severe cerebral edema, corticosteroids are indicated. Given the rapid weight loss, a high-calorie diet is prescribed. If it is impossible to take regular food, the child is transferred to medicinal concentrates or tube feeding.

Prognosis and prevention

Cerebral tumors are a serious problem, but thanks to modern treatment protocols, 5-year survival is achieved in 60-70% of children. The prognosis depends on the malignancy of the tumor, its size, and the presence of genetic abnormalities. Primary prevention has not been developed. Family doctors and specialized pediatric specialists are required to be oncological vigilant in order to suspect a tumor in the early stages and increase the chances of cure.

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