

CASE REPORT

Supratentorial pilocytic astrocytoma in children

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Abstract

Brain tumors hold second place in tumoral pediatric pathology and have a complex etiopathogeny. The authors describe the case of a child aged 2 years and 4 months with increased intracranial pressure, symptomatology accompanied by rapid deterioration of general condition. Head CT imaging examination showed intra-neuraxial replacement space process, supratentorial. Histopathological examination revealed the typical grade I pilocytic astrocytoma. Time of diagnosis and surgical intervention is essential for further evolution and prognosis.

Keywords: pilocytic astrocytoma, supratentorial, intracranial hypertension.

■ Introduction

Brain tumors comprise approximately 20% of all childhood malignancies, second in frequency only to acute lymphoblastic leukemia [1].

Infratentorial brain tumors prevail in children (60%), but in infants and toddlers most of the tumors are supratentorial, like in adults [2]. The incidents of brain tumors have a continuous increasing rate in children on one hand because of many factors, which influence the nervous system development beginning with the gestational period and on the other hand because of the means of complex exploration of central nervous system.

All statistical data shows an increased frequency of intracranial tumors (ICT) in children correlated with repeated nuclear accidents, which have a major influence on neuroectodermal tissue development. Some genetic factors were also blamed: dysfunction of the p53 tumor suppressor gene; the activation of some oncogenes. The connection between brain tumors in children and antipolio vaccination or rubella is known. The recent researches have proved that the malignant process appears on tissues which have suffered prior pathological changes: inflammatory, proliferative, dystrophic, irritation and traumatic.

The characteristic feature of these previous lesions is the fact that they do not have the tendency to regress, but it is possible to transform in a certain percentage in intracranial tumors, due to the intervention of general or local factors, exogenous or endogenous. The male to female ratio is approximately 1:1, except for supratentorial low grade gliomas, in which case it is approximately 2:1 [3]. From the histopathological point of view, neuroepithelial tissue tumors prevail.

Astrocytoma is the most common brain tumor, accounting for more than half of all primary central

nervous system malignancies [4]. Researchers report that the annual incidence is approximately 14 new cases per million in children under 15 years.

Astrocytoma has neuroectodermal origins, from astrocytic nevrogliia; it is classified in four categories depending on the grade of malignancy. Grade I astrocytoma is a benign tumor that predominantly arises in infratentorial locations such as the cerebellum and diencephalic region and rarely arises in supratentorial locations, in any hemispheric lobe, but especially in the frontal lobe [5].

■ Patient and Methods

The authors describe the case of a child aged 2 years and 4 months, male, hospitalized in the No. I Pediatric Clinic of the Emergency County Hospital of Craiova in December 2008. He was hospitalized for repeated vomiting and acute dehydration syndrome, which had begun 24 hours before the presentation. Clinical records pointed out a urinary tract infection with *Proteus mirabilis* three weeks prior. We performed the usual paraclinic tests, funduscopic examination, neuropsychiatric examination, head CT scan and histopathologic examination of the tumor.

■ Results

In this case the clinical examination performed on arrival revealed a non-feverish, conscious, cooperating child with average general status, with dry oral mucosa, reduced salivation, persistent abdominal skin fold; with moderate tachycardia; normal respiratory; with supple abdomen, sensitive to palpation; repeated vomiting, "in jet", containing food, subsequently liquids; with normal intestinal transit; without signs of meningeal irritation and without other neurological signs.

Biological investigations have highlighted a moderate hypochromic anemia, a moderate leukocytosis (11700/cmm), hypocalcemia, normal sedimentation rate, acute phase reagents with normal values, all urinary tests with normal values. Surgical examination ruled out acute abdomen. The patient was rebalancing from hydro-electrolytic and acid-base point of view, with initial favorable clinical evolution. Subsequently, the status of patient had deteriorated and the following signs and symptoms came out: pavor night crises, psychomotor agitation alternating with drowsiness and lethargy, frontal headache, recurrence of vomiting, intermittent convergent strabismus. Neuropsychiatric examination additionally showed: palatine wave deviated from the median line, pronounced hypotonia; normal osteo-tendinous and abdominal skin reflexes; abnormal bilateral plantar reflex (positive bilateral Babinski sign); motility examination – inability to maintain independent orthostatism; control over the head – present; discrete stiff neck; medium equal

pupils, reactive. A fundoscopic examination revealed papilledema.

Head CT scan imaging examination showed: intra-neuraxial space replacement process, supratentorial, heterogenous, developed in the left frontal region, with dimensions of 65/74 mm, with many lobes appearance, presenting anarchical vascularity, with central necrosis, with a parasagittal component adjoining the scythe, presenting infracortical development; adjoining vasogenic edema and mass effect on ventricular structures with compression of the left ventricle; ventricular system displacement and engagement phenomena under brain scythe. Tumoral process described determines secondary obstructive hydrocephaly, proof of this being transependymal periventricular edema, adjoining the right lateral ventricle (Figures 1 and 2). The head CT scan computer reveals intra-neuraxial space replacement process, supratentorial, with astroglial origin probably. A possible xanthocytoma cannot be excluded. Also, one can observe the secondary obstructive hydrocephaly.



Figure 1 – P1–P3 (CT axial native sections) – heterogenous, supratentorial, neuraxial space replacement process, left temporo-frontal developed, bulky and hypodense, without significant cyst elements, adjoining vasogenic edema and mass effect on ventricular structures with compression of the left ventricle; secondary obstructive hydrocephaly, proof of this being transependymal periventricular edema, adjoining the right lateral ventricle.

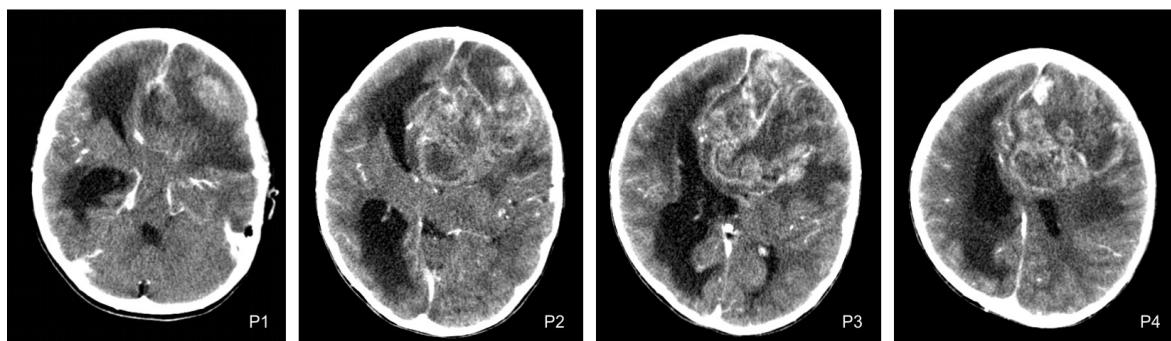


Figure 2 – P1–P4 (CT axial native postcontrast sections) – heterogenous matrix of the tumoral mass, with anarchical vascularity and central necrosis; the tumor's limits are more evident and the brain vessels are deviated to the right; the transependymal hypodense edema secondary to the ventricle obstruction and the vasogenic peritumoral edema is more visible too; a specific aspect for a intra-neuraxial, supratentorial space replacement process; intraoperative – stage I benign astrocytoma (up to Kernohan).

The patient was transferred to a Neurosurgical Service where total ablation of the tumor was performed.

Histopathologic examination revealed the typical pilocytic astrocytoma (grade I), a well-circumscribed mass, which does not infiltrate surrounding tissue, composed of astocytes – stellate cells – interwoven with a fine fibrillary background, presence of Rosenthal fibers, absence of atypical mitoses and the presence of a characteristic microcystic component.

It can be observed in Figure 3 the dense cellular tumor with the presence of a biphasic particularly pattern consists of spindle-shaped cells and areas with star-shaped cells in a laxer stroma. Spindle cells have eosinophilic cytoplasm, ovoidal nuclei with slightly longitudinal incisure and also with slightly nuclear hyperchromasia and pleomorphism (Figure 3).

The mitosis and necrosis are absent, but in some areas it can be observed an inconspicuous microvascular

proliferation. The presence of Rosenthal fibers and bodies with eosinophytic granular bodies are the most typical features of pilocytic astrocytoma.

The Rosenthal fibers are elongated structures with blazing red color (high eosinophilia), usually like astrocytic elongated bodies; we can observe this aspect mostly on dense area levels. In Figure 4 it can also be noticed the presence of round, intracellular structures with globulous shape, eosinophytic aspect and PAS positive reaction. These are more frequent in the lax tumoral areas (Figure 4).

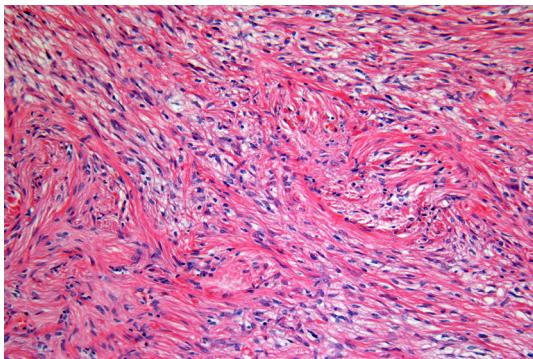


Figure 3 – Pilocytic astrocytoma – typically biphasic aspect with dense bundles of spindle-shaped cells and areas with star-shaped cells in a laxer stroma (HE stain, 100×).

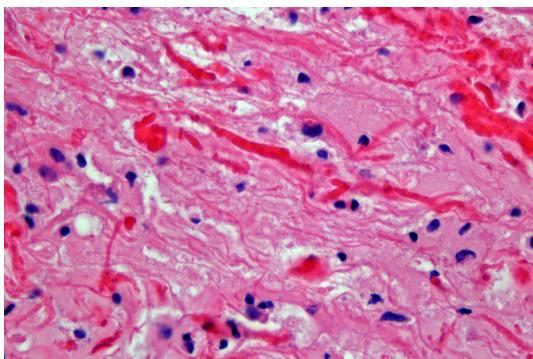


Figure 4 – Pilocytic astrocytoma. Rosenthal fibers and eosinophytic granular bodies (HE stain, 200×).

Eosinophytic granular bodies are typically associated, but not exclusively, with three non-painful neuroepithelial tumors: pilocytic astrocytoma, pleomorphic xanthoastrocytoma and ganglioglioma. It is possible for these bodies to have a lysosomal origin, this fact being confirmed by electron microscopy, and their presence is very useful for the astrocytomas differential diagnosis with other nervous tumors.

Discussion

According to the classification of the *World Health Organization* (WHO), the following clinicopathologic entities can be distinguished: pilocytic astrocytoma (WHO stage I), diffuse astrocytoma (WHO stage II), anaplastic astrocytoma (WHO stage III), and glioblastoma multiforme (WHO stage IV) [6]. Pilocytic astrocytomas (WHO stage I) arise throughout the neuraxis, but preferred locations include the optic nerve, optic chiasm / hypothalamus, thalamus and basal ganglia, cerebral hemispheres like in our case, cerebellum, and the brain

stem [7, 8]. These tumors show low cellularity, low proliferative and mitotic activity, and rarely metastasize or undergo a malignant transformation. Generally, they do not aggressively infiltrate surrounding tissue and regressive changes in long-standing lesions are common [9, 10]. These tumors are the main CNS neoplasm of neurofibromatosis type I (NF I). Findings on cytogenetic analysis are typically normal, although gains of chromosomes 7 and 8 are observed in one third of tumors.

Mutational inactivation of the TP 53 gene does not appear to play a role in the evolution of this tumor. In our case, cytogenetic analysis was normal.

Regarding the initial symptomatology, a review of medical literature [11] indicates the occurrence of signs related to increased intracranial pressure (ICP) in up to 75% of patients regardless of the location of the tumor: headaches, vomiting and lethargy – all signs present in our patient. Seizures present at diagnosis in at least 25% of patients with supratentorial astrocytomas [8] and focal motor deficits occurring in up to 40% of patients with hemispheric tumors were absent in our case. Other positive signs were: bilateral positive Babinski sign having the significance of cerebellar tonsils engagement, that is a neurosurgical emergency; palsy of cranial nerve VI is common and results in the inability to abduct one or both eyes like in our patient; stiff neck associated to increased intracranial pressure pleads for supratentorial tumor [8]; affection of consciousness – obtundation, drowsiness – prevailing either in deep tumors with basal ganglia affection or in any tumor which causes pressure cones on median line structures [12].

CT scan imaging or MRI must be performed prior to the lumbar puncture (LP) [13] to rule out the presence of hydrocephaly in those patients suspected of having a brain tumor. Hydrocephaly places the patient at risk for herniation because of the procedure.

Generally, the lumbar puncture is deferred as long as two weeks postoperatively in order to avoid identifying tumor cells that may have disseminated because of surgery. A postoperative MRI is required to measure the extent of the surgical resection and the detection of residual disease. Postoperative MRI [13] evaluation must be performed within 72 hours of the surgery in order to delineate residual tumor from the post-surgical inflammatory changes that are visualized on MRI at this time [14]. Surgical resection alone is enough to cure the majority of low-grade astrocytomas. A review of medical literature indicates that in low-grade astrocytomas [8], complete surgical resection is associated with 5-year survival rates up to 95–100% without further treatment. Patients with subtotal resections may have only a 60–80% survival rate over similar periods; however, after partial resection, long-term progression-free intervals may ensue. Current operative mortality rates are less than 1%.

Regarding differential diagnosis, this was done in a first clinical stage with benign intracranial hypertension (pseudotumor cerebri – infections, intoxications, endocrine and metabolic disorders, cardio-respiratory insufficiency) and meningitis; in the second stage, of the imaging diagnosis with hydrocephaly (any cause), with intracranial or subarachnoid hemorrhage, subdural or

epidural effusion, cerebral abscess or parasitic cyst, arterio-venous malformation; and in the third stage of the histopathologic diagnosis, other tumors frequently met in children were ruled out: ependymoma, medulloblastoma, choroid plexus papilloma or carcinoma, craniopharyngioma, hemangioblastoma, teratoma, primary intracranial Ewing sarcoma, metastatic solid tumor (neuroblastoma, rhabdomyosarcoma) [2, 15, 16].

Intracranial tumors appear and usually evolve slowly progressive through the gradual accumulation of neurological signs revealing a certain cerebral location on a clinical intracranial pressure background.

High tolerance of the nervous system relating to intracranial tumors development in children makes the neurological focal syndrome minimal [1]. In the state phase, neurological syndrome is complete. Non-diagnosis of intracranial tumors in the state phase will lead to postponement of surgical treatment. Continued evolution of intracranial tumors will lead to gradual decompensation of CNS, neurological deficit irreversibly increasing (plegia, aphasia, blindness, deafness) with change of the state of consciousness from drowsiness (basal ganglia affection) to coma (brain stem affection) [17]. Prognosis is determined by the histopathologic structure of the intracranial tumors and by the anatomical situation and surgical accessibility [4, 18, 19]. It must also be taken into consideration the neurological and psychiatric sequelae possible in children with operated brain tumors.

Conclusions

In conclusion, our patient was diagnosed with a brain tumor, a pilocytic astrocytoma, which is a benign tumor, frequent in children, but with an unusual location in this case. Unexpected apparition of increased intracranial pressure symptomatology in a child, accompanied by rapid deterioration of the general condition, should alert the clinician to investigate a possible intracranial tumor.

CT examination is a non-invasive and rapid technique that can be used as an imaging modality for the primary assessment of brain tumor. The correct diagnosis can be made through a histopathologic exam.

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