Case report

Anaplastic ependymoma of the cerebellum and fourth ventricle with calcification without clear contours and hemorrhages: a case report and literature review

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ABSTRACT

First case: A 2-year-old boy was brought to our center via emergency room due to possible periodic headaches that had been developing for 3 months. We noted gait instability, marked ataxia when walking. Brain MRI: diagnosed, which revealed and a space-occupying lesion of the posterior cranial fossa, (PCF). Diagnosis: Tumor mass in the posterior cranial fossa, the presence of changes in the posterior cranial fossa.

Second case: An 8-year-old boy was brought to our center via the emergency room. According to the mother, the child received a head injury and has been experiencing nausea, dizziness, and repeated vomiting accompanied by muscle weakness. MRI, show a mass with calcifications and hemorrhages in the posterior cavity. They were admitted for possible evaluation and management treatment.

Key words: anaplastic ependymoma, posterior cranial fossa, radiotherapy, chemotherapy, adjuvant treatment

INTRODUCTION

Ependymomas are neuroepithelial neoplasms that may arise from ependymal cells, from the ventricles of the brain and central spinal canal, and from spinal remnants. According to the American Central Brain Tumor Registry in the United States the annual incidence of ependymoma is 1 per 100,000 citizens [1]. The classification of ependymomas has changed since its last publication by the WHO of central nervous system tumors. Such as inclusion, definition, histology, although in this category glioblastoma, astroblastomas and embryonal tumors were included, in the family group of ependymal tumors, due to the molecular evidence related to these types of tumors [2]. Over the past few years, large-scale studies have been conducted on the linear sequence of multiple pediatric germ cell cancers, with pediatric ependymomas accounting for less than 5% of the combined sample size. One group of exome sequence studies, which are whole genomes, reports that linear germ cell pathologic types represent 4.7% of the rare pathogens in children with ependymomas; thus, other individual investigations range from 0 to 21% [3]. Other studies in recent years confirm that total resection and posterior focal radiotherapy are associated with event-free survival. Overall survival should be considered as a standard of care, without mentioning the benefit shown by chemotherapy, but survival remains a matter of debate [4]. Advances in chemotherapy in both children and adults are well established, but it has no established role in adjuvant therapy. Cisplatin can be considered in both populations as the main regimen for residual pathology after surgery, or also as initial therapy when surgery is not yet established, or with additional radiation. In the pediatric population, chemotherapy may be considered to delay the type of radiation or to increase the likelihood of total resection in second-look surgery. Some agents such as bevacizumab and lapatinib have been shown to have no role in adjuvant therapy in ependymomas, but are still under investigation for recurrences [5].

CASE PRESENTATION

First case

A 2-year-old boy was brought to our center via ambulance with complaints of periodic headaches that had been developing for 3 months. During the physical examination, we noted the presence of acute otitis media, which had been present for approximately one month. We noted gait instability and marked ataxia when walking. A contrast-enhanced cranial magnetic resonance imaging (MRI). The borders of the lesion were visualized. A non-contrast-enhanced computerized tomography (CT) scan of the head revealed a 10 × 27 × 15 mm hypodense formation on the right side of the fourth ventricle, with areas of calcification and irregular contours. Shown in figure 1.

The tumor located in the fourth ventricle was surgically removed with the aid of neurophysiological monitoring, and the patient was transferred to the intensive-care unit (ICU). Postoperative results confirmed an anaplastic ependymoma, WHO grade 3 (fig. 3). After the follow-up, the patient was treated conservatively, with no signs of instability, and the patient was sent home under conservative treatment and expecting consultation by our oncology department.

Second case

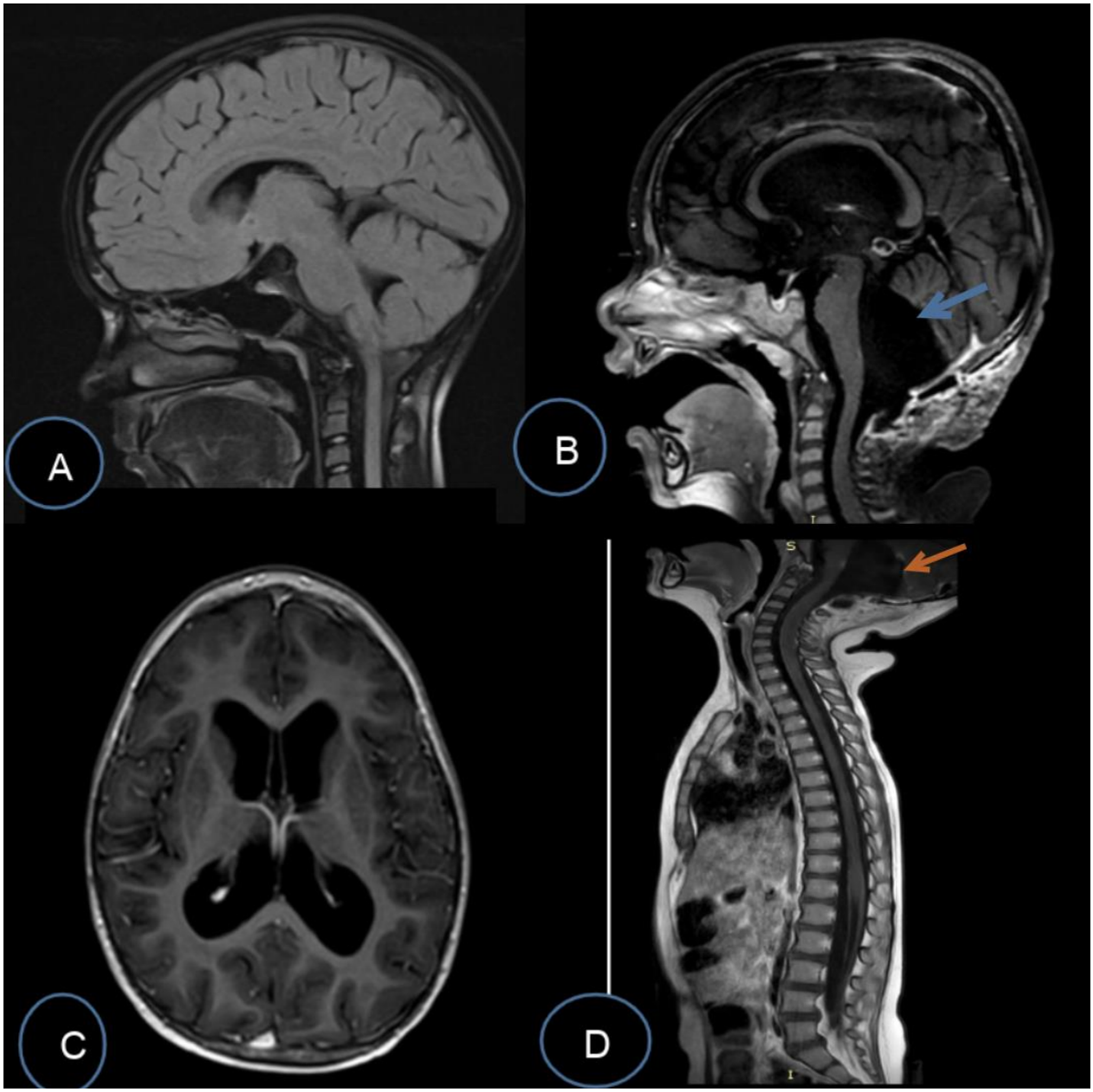
An 8-year-old boy was referred to neurosurgery after initially being admitted to the emergency department with nausea. According to the patient's mother, the child sustained a mild head injury one week ago and has since been experiencing nausea, dizziness, and recurrent vomiting, accompanied by muscle weakness. The child was neurologically intact without any other impairment, but due to the severity of the symptoms, the family urgently sought medical attention at Moscow Children's Hospital. An initial contrast-enhanced brain MRI revealed a space-occupying lesion in the cerebellar vermis, extending into the fourth ventricle. With the aid of intraoperative ultrasound and neurophysiological monitoring, the tumor was surgically removed. An early postoperative MRI confirmed the absence of residual tumor. One month later, histopathology results revealed anaplastic ependymoma, WHO grade 4 (fig. 3).

A CT scan was recommended. After the multidisciplinary meeting, local radiotherapy (59.4 Gy) was recommended for the surgical site, and the patient was then transferred to the pediatric oncology unit (fig. 4). During the postoperative period in the ICU, the patient doesn't show any eventuality, and consultation was recommended after discharge under conservative treatment.

DISCUSSION

Randomized studies have identified anaplastic histology as a significant risk marker, with many authors describing this pathology as a contributing factor to poor clinical outcomes. This recognition led to its classification as a stratified marker of very high risk or poor prognosis. However, with the introduction of molecular phenotyping and the categorization of ependymomas into distinct biological or compartmental subgroups, anaplasia alone is no longer considered the sole risk factor [5–7].

Figure 1. A. Preoperative sagital non-contrast enhanced T1-weighted MRI. **B.** Postoperative sagittal contrast-enhanced T1-weighted MRI of the brain shows no signs of residual tumor. At the level of the cerebellar vermis, a postoperative cavity was observed (blue arrow). **C.** Post-operatory, axial T1-weighted contrast-enhanced MRI depicts lateral ventricular dilation. **D.** Soft tissue edema in the occipital region and cerebrospinal fluid accumulation at the surgical site, accompanied by signs of pneumocephalus (orange arrow).



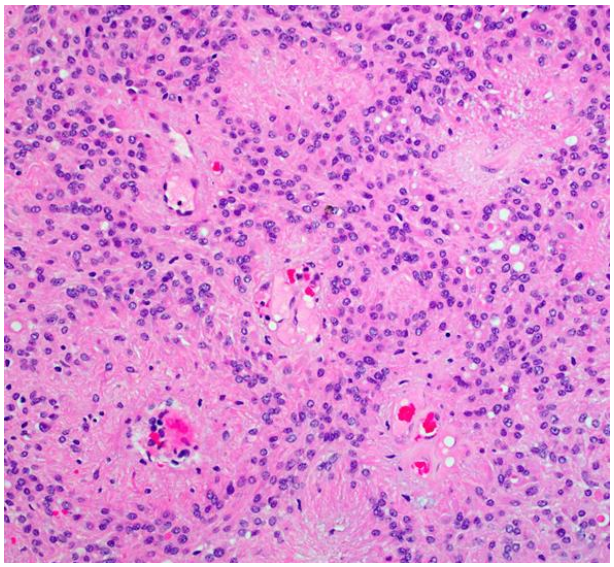
Radiotherapy

Over the past two decades, radiotherapy has been incorporated into various clinical trials for the treatment of brain tumors in children. Since 1977, postoperative radiotherapy has been the standard treatment for patients with ependymoma. Efforts to refine or limit its use have been driven mainly by concerns over its impact on neurological, metabolic, and cognitive functions. However, the effects of irradiation on ependymomas in children remain poorly documented. In contrast, there is a well-established history of radiotherapy use in medulloblastomas, with better-documented outcomes and treatment records [8–10].

Chemotherapy

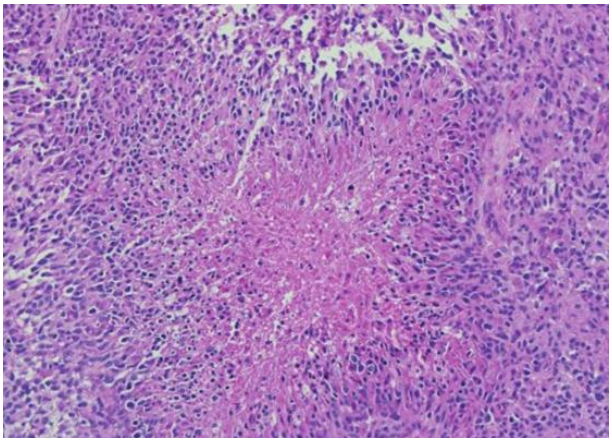
Several aspects of intracranial ependymoma treatment have been explored with chemotherapy, with the best responses observed in children following initial resection. In randomized phase II trials, platinum-based agents, including cisplatin and carboplatin, have shown some efficacy in treating ependymomas. However, randomized chemotherapy trials have not demonstrated a significant improvement in event-free survival. Despite this, chemotherapy has been utilized to delay radiotherapy. According to the UKCCSG/SIOP CNS 9204 study, children under the age of three may be able to avoid or postpone radio-

Figure 2. Histopathology of anaplastic ependymoma. The cells are medium-sized, and the nuclei are round and ovoid with lumpy chromatin. The cytoplasm is poorly visualized. The intercellular matrix is formed by a dense fibrillary network of cellular processes. Neoplastic cells sometimes form perivascular pseudorosettes. Pathological proliferation of blood vessels is observed, and foci of developing necrosis and calcifications are found. In hypercellular areas, mitotic activity increases. Results are consistent with anaplastic ependymoma, WHO grade 3.



therapy [11, 12]. On MRI, ependymomas of the posterior cranial fossa tend to be homogeneous with good delimitation, with some hemorrhages or calcifications as in our case, which show contrast-enhanced features and necrosis with cyst formations. Ependymomas can be located in the fourth ventricle with a lateral expansion from the foramina of Luschka and Magendie [13].

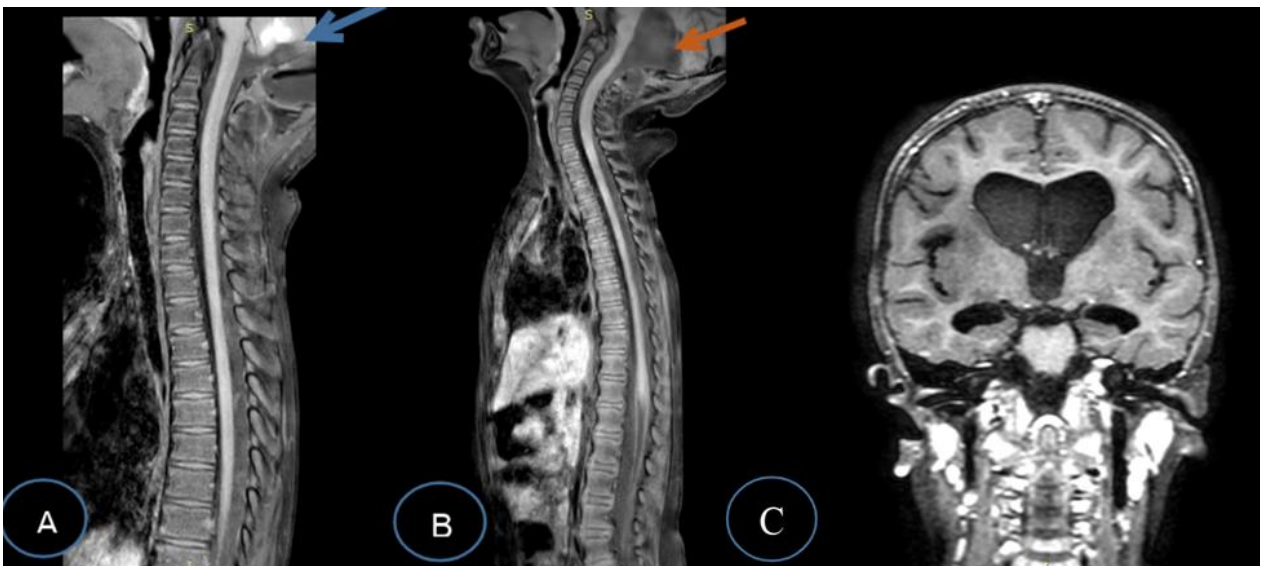
Figure 3. Histopathology examination revealed a hypercellular tumor with extensive necrosis, partially covered by ependyma. The neoplastic cells are medium to large, with round and ovoid basophilic nuclei. The cytoplasm is pale; its quantity varies from insignificant to medium. The tumor cells form numerous perivascular pseudorosettes. Mitotic activity is exceptionally high: in a field of view with a magnification of ×400, there may be up to 5–6 mitoses. It is concluded that it is a malignant neoplasm of the cerebral ventricle, possibly anaplastic ependymoma. The results were consistent with a malignant neoplasm of primary location, anaplastic ependymoma, WHO grade 4.



Anaplasia in ependymoma

There are randomized studies that show anaplastic histology as a major risk marker, since many authors have described this pathology as a cause or factor of negative clinical results, which led to its incorporation as a stratified marker of very high risk or poor prognosis. Some prospective studies were the basis for clinical care studies. When molecular phenotyping and the division of ependymoma into some biological or compartmental type groups were introduced, leaving anaplasia alone as a risk factor [14].

Figure 4. A. A preoperative sagittal craniocervical fat-attenuated MRI depicts a 10 × 27 × 15 mm hyperdense cerebellar lesion with irregular borders. (blue arrow). **B.** A postoperative sagittal craniocervical MRI shows minor postoperative changes, including fluid accumulation with minimal hemorrhagic content in the operative area (orange arrow). **C.** A Postoperative coronal FLAIR MRI depicts lateral ventricular dilation.



Effect of tumor volume, surgery, and radiotherapy

Tumor volume and longitudinal VAL scores were associated with an effect of -0.0729 pts/mL/year; P = 0.0222. Although there was no relationship between surgical procedures or surgical resection prior to irradiation. In the extent of preoperative resection, once gross total resection and subtotal resection was achieved, an association was seen between the two left hippocampal medians and longitudinal scores of IQ (0.0558 pts/Gy/year; P = 0.0305) and VAL (-0.0517 pts/Gy/year; P = 0.0063). Another relationship was seen between the mean dose to the right hippocampus and VAL scores, of 0.0683 pts/Gy/year; P = 0.0024 [6, 7, 15].

Surgical approach

Needle electrodes were placed in the superior oblique muscle (OS), the orbicularis oris muscle on both sides, an intubation tube with recording electrodes and the thenar and peroneal muscles on both sides. Arch-shaped incision in the frontal region on the right in the projection of the Kocher point. A reaming hole has been placed. The dura mater is coagulated punctually. Ventriculopuncture at 5 cm depth. Through the counter-opening, the drain in the right parietal region is removed and connected to a cerebrospinal fluid collection bottle. The head is fixed in a Mayfield holder. Sitting position on the operating table. Incision in the cervicoccipital region. The occipital bone and the first cervical vertebra are skeletonized. A trephine hole was made below the external occipital protuberance using a pneumatic drill. A bone flap is formed and temporarily removed from the wound. The Brainlab intraoperative navigation system is installed. A surgical microscope is installed. The dura mater is opened in a Y-shape. Under the intraoperative navigation system, the cerebellar hemispheres were separated, access to the tumor was achieved, and the grayish tumor tissue was visualized. Upon removal of the tumor, it was found to be poorly vascularized. It was removed en bloc using bipolar forceps and an aspirator. After tumor removal, the lower part of the fourth ventricle and the Sylvian aqueduct were visualized, and satisfactory cerebrospinal fluid pulsation was obtained. During tumor removal, MEP was obtained from both sides. The nuclei of cranial nerve pairs VI, VII, and IX were mapped. Hemostasis by coagulation and application of Surgicel. The dura mater is firmly sutured. The bone is placed in place and fixed with bone sutures. Sutures are layered over the wound. Operation outcome: The tumor was removed from the posterior cranial fossa.

Our case study was based on the symptoms of the anaplastic tumor, due to its space-occupying lesion in the fourth ventricle, its composition, and its influence on the anatomical structures of the posterior cranial fossa, such as the cerebellum, creating ataxia and related sensory and motor issues. This study sought to improve motor or physical functionality after surgical decompression, including adjuvant therapy, radiotherapy, and chemotherapy.

CONCLUSION

This study sought to improve motor or physical functionality after surgical decompression, including adjuvant therapy, radiotherapy, and chemotherapy. Postoperative radiotherapy should be considered a standard component of postoperative management in patients with anaplastic ependymoma. If hydrocephalus develops after surgery, the placement of a ventriculoperitoneal shunt is a viable option and should not be delayed. Although intratumoral bleeding and calcifications may indicate a poor prognosis, achieving gross total resection can lead to a favorable outcome. Use of cisplatin and carboplatin is recommended but does not notably improve the survival rate but shows an interesting efficacy against ependymomas. Gross total resection shows a good prognosis if it is achieved with radiochemotherapy.

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Methodology: D.A.E.S., G.S.
Software: D.A.E.S. and G.C.
Validation: G.C. and B.C.
Formal analysis: G.S. and G.F.
Investigation: D.E.E.S.
Resources: B.C. and E.S.
Data curation: writing – original draft preparation: D.A.E.S.
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