

## Case Report

# Supratentorial atypical ectopic ependymoma in a child: a case report

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**Abstract:** The aim of this study is to report a rare case of supratentorial ectopic ependymoma in a child with atypical radiologic and pathologic characteristics. A 14-month-old male infant suffered a short spell of sudden unconsciousness and convulsion of the right limbs, accompanying with vomiting and salivating. A computed tomography (CT) scan revealed a huge slightly low density solid mass locating in the left temporo-parietal junction, within slightly high density component. Magnetic resonance imaging (MRI) scan demonstrated a solid mass, approximately 78×58×58 mm, in the left temporo-parietal region, which had equal intensity on T1 Weighted Image (WI) and slightly higher signal intensity on T2 WI. Tumor had no attachment to the dura mater and no continuity with the ventricular system. The clinical symptom, sign and assistant examination pointed to the diagnosis of the left temporal and parietal low-grade gliomas. The patient underwent transtemporo-parietal craniotomy. The tumor was fish-meat like appearance, pink color, approximately 80×70×60 mm, soft texture, a large welldefined lesion, adherent to lateral ventricle but having no attachment to it. The tumor was completely dissected free of the surrounding brain tissue damage. On histological examination, the tumor cell nuclei was round or oval in shape and mitotic activity was seen, without perivascular pseudorosettes. Immunohistochemically, the tumor cells expressed glial fibrillary acidic protein (GFAP), S100, vimentin and epithelial membrane antigen (EMA). 67.5 percent of the tumor cell nuclei showed a positive anti-Ki67 reaction. The diagnosis of ependymoma (WHO II) was made according to the immunohistochemical studies. Supratentorial atypical ectopic ependymoma in children is rare and difficult for preoperative diagnosis. Safe total surgical resection is the best choice for treatment with infrequent recurrence.

**Keywords:** Supratentorial ependymoma, ectopic ependymoma

### Introduction

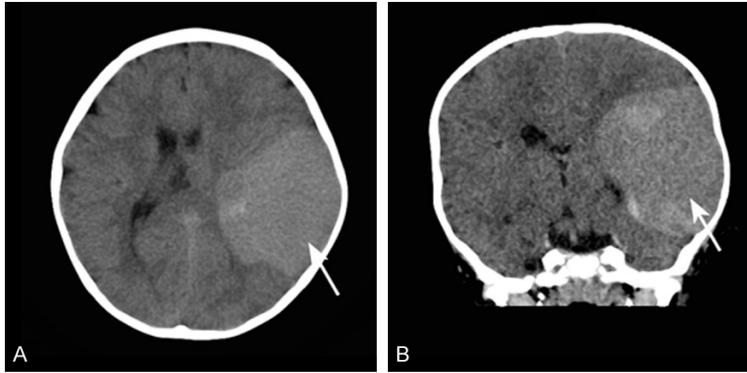
Ependymoma, as the third most common pediatric central nervous system tumor, behind only astrocytoma and medulloblastoma, is a central nervous system malignancy originating from the walls of the ventricular system. Rare ependymoma is originating from brain parenchyma that had no connections to the dura or to the ventricle, called ectopic ependymoma [1]. Supratentorial ectopic ependymoma have few radiologic and pathologic characteristics, and thus do not provide accurate preoperative diagnosis and only depend on the clinical history, especially in children [2, 3]. In this study, we present a child who was diagnosed with supratentorial atypical ectopic ependymoma, which have rarely been described in the literature. The clinical manifestations, neuroimaging

findings, pathologic characteristics, treatment methods, and therapeutic results were retrospectively reviewed.

### Case report

Twelve hours before admission to our hospital, a 14-month-old male infant suffered a short spell of sudden unconsciousness and convulsion of the right limbs, accompanying with vomiting and salivating. When the patient was transferred to emergency department, he was found to be in somnolence state and three-fifths strength of the right limbs, but otherwise was in normal limits. A computed tomography (CT) scan was obtained immediately, and this revealed a huge slightly low density solid mass locating in the left temporo-parietal junction, within slightly high density component

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**Figure 1.** Preoperative head CT scan imaging findings. A: A huge slightly low density solid mass locating in the left temporo-parietal junction, in axial CT scan imaging (white arrow). B: A huge slightly low density solid mass locating in the left temporo-parietal junction, within slightly high density component, in coronal CT scan imaging (white arrow).

(**Figure 1A, 1B**). The patient was taken promptly to neurosurgery department for further treatment, and accepted on anticonvulsant medication. Magnetic resonance imaging (MRI) scan was followed, and it demonstrated a solid mass, approximately 78×58×58 mm, in the left temporo-parietal region, which had equal intensity on T1 Weighted Image (WI) and slightly higher signal intensity on T2 WI. Tumor had no attachment to the dura mater and no continuity with the ventricular system. On MRI, the solid lesion was patchy enhancement peripherally following intravenous administration of gadolinium acid, with sick ventriculi being pressed and basal ganglia region moving (**Figure 2A-D**). The tumor did not show any anatomical connection with the wall of the left lateral ventricle. Magnetic resonance angiography (MRA) confirmed the left middle cerebral artery (LMCA) being pressed and moving, and branches of LMCA supplying the tumor. The clinical symptom, sign and assistant examination pointed to the diagnosis of the left temporal and parietal low-grade gliomas. On 3rd admission day, the patient underwent transtemporo-parietal craniotomy, and the extent of the lesion was visualized absolutely. The tumor was fish-meat like appearance, pink color, approximately 80×70×60 mm, soft texture, a large well-defined lesion, adherent to lateral ventricle but having no attachment to it (**Figure 3A, 3B**). The tumor was completely dissected free of the surrounding brain tissue damage. The operative process and postoperative course was uneventful. On histological examination, the tu-

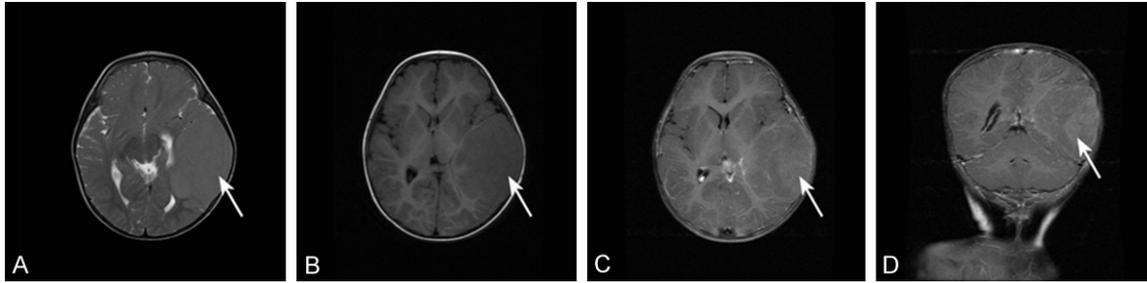
mor cells showed as sheets. The tumor cell nuclei was round or oval in shape and mitotic activity was seen, with up to four mitotic figures seen per high-power field, 3-5/10 hpf. Immunohistochemically, the tumor cells expressed glial fibrillary acidic protein (GFAP), S100, vimentin and epithelial membrane antigen (EMA). 67.5 percent of the tumor cell nuclei showed a positive anti-Ki67 reaction (**Figure 4A-D**). The diagnosis of ependymoma (WHO II) was made according to the immunohistochemical studies. On the 7th postoperative day, he resumed to four-fifths strength of the right limbs, and got out of bed and started living again. The postoperative CT scan confirmed the total removal of tumor and the patient discharged with no apparent injury from our hospital (**Figure 5**). No recurrences or metastases were found at 3 years of follow-up.

We also summarize other cases reported atypical ectopic ependymoma and their findings in a table (**Table 1**).

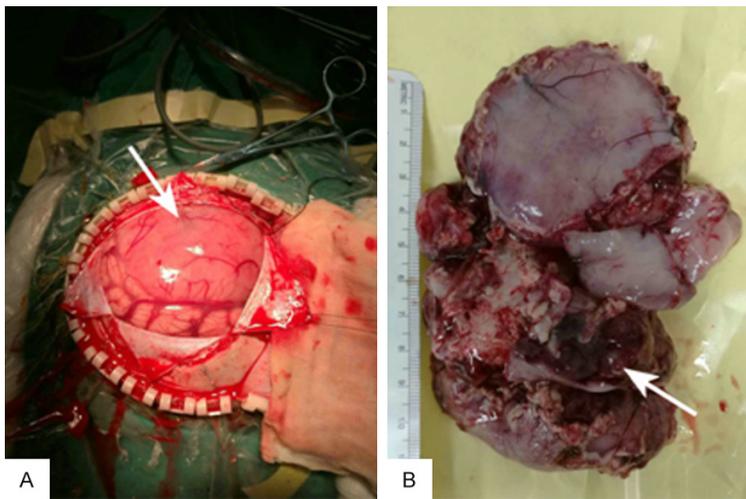
### Discussion

Ependymoma, the third most common pediatric brain tumor, compose approximately 6-12% of all pediatric intracranial tumors [4]. Ependymomas usually arise from the cells lining the ventricular system and the central canal of the spinal cord, rarely from the cerebral parenchyma. The supratentorial ependymoma compose one third of the pediatric ependymoma, and subtentorial ependymoma compose two thirds [5]. The mean age of onset is 7.8 in supratentorial ependymoma and 5 in subtentorial ependymoma. The male to female ratio of supratentorial ependymoma is 1.4:1, and the ratio is 0.7:1 in subtentorial ependymoma [6]. With the atypical imaging findings, the preoperative correct diagnosis of supratentorial ectopic ependymoma in children is difficult, and when the pathologic characteristics is atypical, the pathological diagnosis must depend on the immunohistochemical examination [4]. We discuss the clinical features, imaging findings and pathological aspects of supratentorial ectopic ependymoma.

## Supratentorial atypical ectopic ependymoma



**Figure 2.** Preoperative head MRI scan imaging findings. A: A solid mass, with equal intensity on T2WI, approximately 58×78×58 mm, in the left temporo-parietal region (white arrow). B: A solid mass with slightly higher signal intensity on T1WI (white arrow). C: The solid lesion was patchy enhancement peripherally (white arrow). D: A solid mass in coronal MRI scan imaging (white arrow).



**Figure 3.** Intraoperative findings and pathological specimen. A: The tumor was located in the left temporo-parietal junction, a large well-defined lesion, adherent to lateral ventricle but having no attachment to it (white arrow). B: The tumor was fish-meat like appearance, pink color, approximately 80×70×60 mm, soft texture (white arrow).

The aetiology of the ependymoma remains obscure, and no robust correlations with environmental or infectious aetiology is defined. Reuther et al. have confirmed that SV40 virus is capable of inducing brain tumours including ependymoma [7]. Neurofibromatosis type 2 (NF2) is the only known genetic defect with a predisposition to develop the ependymoma [8]. In the United States, 86% of all ependymomas occur in Caucasian patients, the tumor occurrence has surreptitious relationships with the ethnicity [9]. The case had no known history of infection and genetic factor.

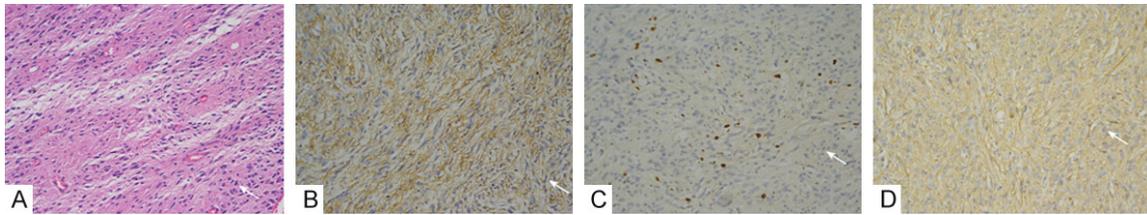
As with the other paediatric neurologic tumors, the most important factors affecting the presenting symptoms are the tumor location and

size. Ependymomas usually arise from the cells lining the ventricular system and the central canal of the spinal cord. Supratentorial atypical ectopic ependymoma in a child is rare and from the cerebral parenchyma, most in frontal lobe [3]. Dogan et al. had reported ependymomas arising from the cells in the sacrococcygeal region [10]. The lesion was located in left temporo-parietal junction, and not in contact with the lateral ventricle. The medium diameter of the supratentorial atypical ectopic ependymoma was 6.6 cm [4], and the diameter of the tumor was 8.8, greater than the average, so the child had a serious symptom. The present-

ing symptoms of supratentorial parenchymal ependymomas in children can be divided into symptoms caused by intracranial hypertension and those attributable to compression of neural structures (e.g., motor weakness and seizure). But Haddadi had reported a case: a huge ependymoma of the cervical spinal cord with subtle atypical manifestations and hyperhidrosis [11]. Convulsion and hemiplegia was found to be the main clinical manifestation in our case.

A comprehensive history and physical exam concerning for ependymoma should be followed with MRI of the brain, though, in urgent situations, CT often is obtained first. A head CT will show an iso- to hypodense solid compo-

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**Figure 4.** Pathology of supratentorial atypical ectopic ependymoma. A: The supratentorial atypical ectopic ependymoma by hematoxylin and eosin (HE) staining,  $\times 200$ : The tumor cell nuclei was round or overall in shape and mitotic activity was seen, but it lacked perivascular pseudorosettes, belonging to atypical presentation (white arrow). B: The atypical ectopic ependymoma by GFAP staining,  $\times 200$ . C: The atypical ectopic ependymoma by Ki staining,  $\times 200$ . D: The atypical ectopic ependymoma by vimentin staining,  $\times 200$ .



**Figure 5.** Postoperative head CT imaging findings. The tumor was completely resected.

ment, commonly with cystic areas and coarse calcifications in supratentorial lesions [12]. It was difficult to diagnosis for which had atypia maging findings, slightly low density mass without cystic components and calcification. MRI evaluations should include brain and spine imaging with and without contrast. Ependymomas are generally iso- to hypointense on T1-WI and iso- to hyperintense on T2-WI and fluid-attenuate diversion recovery. With administration of gadolinium, the majority of ependymomas exhibit a heterogeneous enhancement [13, 14]. Supratentorial atypical ectopic ependymoma usually have the cystic areas and coarse calcifications on MRI images. On MRI, masses can be solid or have a “cyst and mural nodule” formation, resulting in a differential diagnosis of pilocytic astrocytoma, ganglioglioma, and pleomorphic xanthoastrocytoma. Comparison with MRI findings, the child had

rare common features, atypical presentation and It was absolutely not possible to give a accurate preoperative diagnosis.

The diagnosis of ependymoma depends on the pathological diagnosis, especially, when ependymoma have atypical pathological manifestations, it is necessary to use immunohistochemical technique, even genomics technology, for the diagnosis of ependymoma. Currently these tumours are classified into three grades by the World Health Organization (WHO) 2016, Grade I subependymomas and myxopapillary (MPE), Grade II (classic ependymomas) and Grade III asanaplastic type [15]. Grade II ependymomas most often have perivascular pseudorosettes, where the central structure surrounded by neoplastic cells is a blood vessel. True ependymal rosettes have a central empty lumen and the ependymal cell processes extending into the lumen produce an anuclear pale zone that stains brightly for GFAP. Grade II ependymomas can contain nuclear atypia and exhibit foci of calcification and necrosis. Pseudorosettes are not limited to ependymomas and can also be seen in glioblastoma, medulloblastoma, neurocytoma, and primitive neuroectodermal tumors. The case we have reported here presented mcroscopically without perivascular pseudorosettes, belonging to atypical presentation, and could not be diagnosed with ependymomas. Immunohistochemistry technique must followed for further examination. Immunohistochemically, vimentin and S-100 are strongly positive for the patients with ependymoma, but glial fibrillary acidic protein is strongly or weakly positive in most of the patients. An anti-EMA reaction showed dot-like staining of the microlumina. CD34 was only expressed in the endothelial cells. Thirty percent (30%) of the tumor cell nuclei showed a positive anti-

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**Table 1.** Clinical data of the patients with ectopic ependymoma in the literature

First author	Publication year	Country	Sex	Age (years)	Clinical symptoms	Location of lesion	Size of lesion	MRI findings	Treatment	Pathological diagnosis	Immunohistochemical findings	Outcome
Dogan	2016	Turkey	Female	9	Soft tissue mass	Sacrococcygeal region	5.3×2.5×2.4 cm	Well-defined, lobulated nonlipomatous mass with T1 and T2 prolongation	Surgical total resection	Myxopapillary ependymoma	Not given	Survived for more than 6 months
Kutlay	2011	Turkey	Female	11	Headache, vomiting, seizure, right emiparesis	Left frontoparietal region	4.5×4.0×3.5 cm	Left-sided unilocular cyst	Frontoparietal craniotomy, cranial radiotherapy	Anaplastic ependymoma	GFAP, S-100, EMA, Ki-67/MIB-1 (33%), p53	Not given
Haddadi	2016	Iran	Male	34	Cervical pain, hyperhidrosis	C1 to T2 intraspinal canal	Not given	Iso to hypointense in T1 WI and hyperintense in T2 WI	Surgical removal, cervical field radiotherapy	Grade II ependymoma	Not given	Survived for more than 1 year
Elsharkawy	2013	Germany	Male	25	Convulsion, numbness in left fingers	Right frontal lobe	Not given	Solid, well-demarcated homogeneous mass	Surgical total resection	Anaplastic ependymoma	GFAP, S100, and vimentin, Ki-67 (30%), p53, CD34	Survived for more than 6 months

WI: Weighted Image.

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Ki67 reaction [3]. In our case, the immunohistochemical findings was eligible for the diagnosis of ependymoma. So far, life scientists can surely make progress in both molecular biology and genomics. The neurofibromatosis type II (NF2) gene is located at chromosome 22q 12.2, and ependymomas in patients with NF2 are most commonly intramedullary spinal tumors with a predilection for the cervical region [16]. Ependymomas also rarely occur in Turcot Syndrome, characterized by the association of colonic polyps and central nervous system tumors caused by the mutation of MSH2 at chromosome 2p21, and MEN1 syndrome, characterized by clusters of endocrine neoplasms caused by the mutation of MEN1 at chromosome 11q 13.61 [17]. The global acetylation of lysine position 9 of histone 3 (H3K9Ac) is helpful for diagnosis of ependymoma and has some specificity [18]. Rajeshwari M et al. report that 1q gain is frequent in ependymomas in Indian patients, seen across all ages, sites and grades, and thus is likely an early event in pathogenesis. The prognostic value of 1q gain, remains uncertain, and multicentric pooling of data is required [19]. The epidermal growth factor receptor (EGFR) frequently overexpressed in ependymomas [20].

Current therapeutic strategy for paediatric ependymomas includes maximal safe surgical resection, followed by adjuvant therapy. This includes in radiation with or without chemotherapy. A safetotal resection is aimed with intent to remove macroscopical disease and to prevent recurrence. This could be challenging in eloquent areas of the brain. The transient or permanent neurologic morbidity associated with aggressive surgery has followed, especially in subtentorial ependymoma [21]. A partial resection is followed by radiation therapy, which is the main method for treatment, and have a better survival rate than only partial resection [22]. Chemotherapy has been extensively evaluated in paediatric ependymoma, but its role remains controversial though benefits have been suggested in limited studies [23]. In our present case, a safe total resection was completed with no neurological dysfunction. The child had complete normalization of the hemiparesis a week after operation. Radiotherapy was suggested for the child, but the parents had withdrawing treatment because of

economic reasons. No recurrences or metastases were found at 3 years of follow-up, and we are going to keep following the child.

### Conclusion

Supratentorial atypical ectopic ependymoma in children is rare and difficult for accurate pre-operative diagnosis. Safe total surgical resection is the best choice of treatment with infrequent recurrence.

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### Disclosure of conflict of interest

None.

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