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Case report

Adult pilomyxoid astrocytoma presenting in the temporal lobe

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ABSTRACT

Pilomyxoid astrocytoma (PMA) is a rare variant of astrocytoma that is usually present in the hypothalamic and chiasmatic areas in the paediatric population. PMA shares many similar histopathological features to Pilocytic astrocytoma (PA), with some notable differences in its radiological and histopathological findings. On the contrary, PMA has been reported to behave more aggressively in its clinical progression than PA. Here, we describe a rare case of PMA in a 25-year-old female involving the temporal lobe, presenting with recurrent partial seizures. To our knowledge, this is the first reported case of PMA presenting in the temporal lobe in an adult female with an atypical location of the tumour, uncommon age group, and unusual radiological features being unique in this case report.

1. Introduction

Pilomyxoid astrocytoma (PMA) is a rare primary central nervous system tumour and a rare variant of Pilocytic Astrocytoma (PA) with unique histological features [1]. PMA was previously graded as World Health Organization (WHO) grade II; however, in 2021, the WHO classification was updated, whereby PMA was integrated into PA with no formal grade allocated to PMA [2]. PMA has been reported to have a more aggressive clinical course with an increased risk of cerebrospinal fluid (CSF) dissemination compared to PA [3, 4]. Although it is primarily considered a paediatric tumour involving the hypothalamic and chiasmatic areas, there have been several case reports of PMA in adults. Upon reviewing the literature on PMA within the adult population, we report the third case of PMA in the temporal lobe, which has a different clinical presentation compared to the previous two cases.

1.1. Case report

A 25-year-old South African-born, right-handed patient, presented with temporal lobe epilepsy. She was being treated with Carbamazepine and Levetiracetam by her neurologist. She reported having focal impaired awareness seizure (FIAS) (motionless staring with conscious impairment, without automatism) since 2016. She was subsequently referred to a neurologist due to the increased frequency of seizure episodes towards the end of 2020 and was then started on antiepileptic medications. This patient did not have any other relevant past medical or family history. There were no neurological deficits and no signs of increased intracranial pressure on clinical examination.

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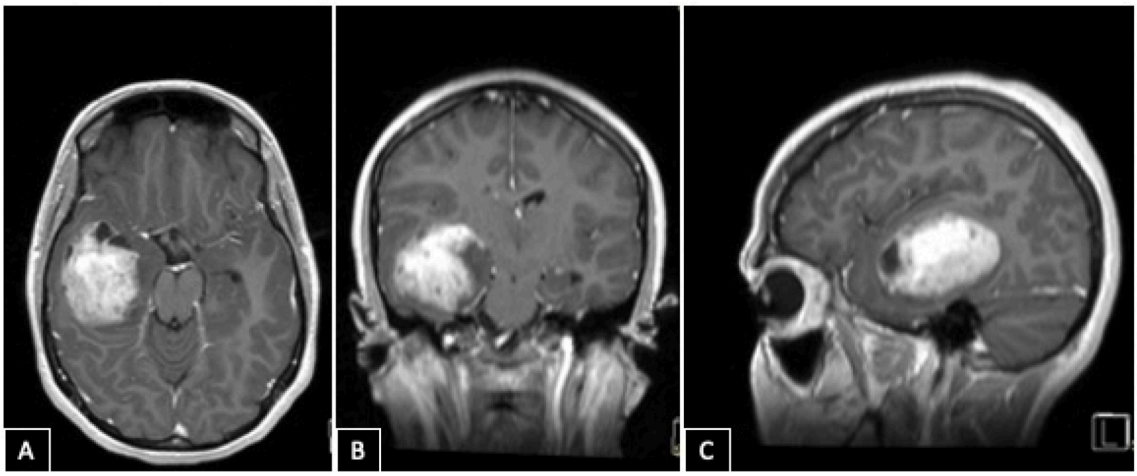

Fig. 1. Pre-operative MRI Brain with gadolinium contrast in T1WI (A) axial, (B) coronal and (C) sagittal sections showing large heterogeneously enhancing right temporal lobe lesion with multiple cysts of variable size.

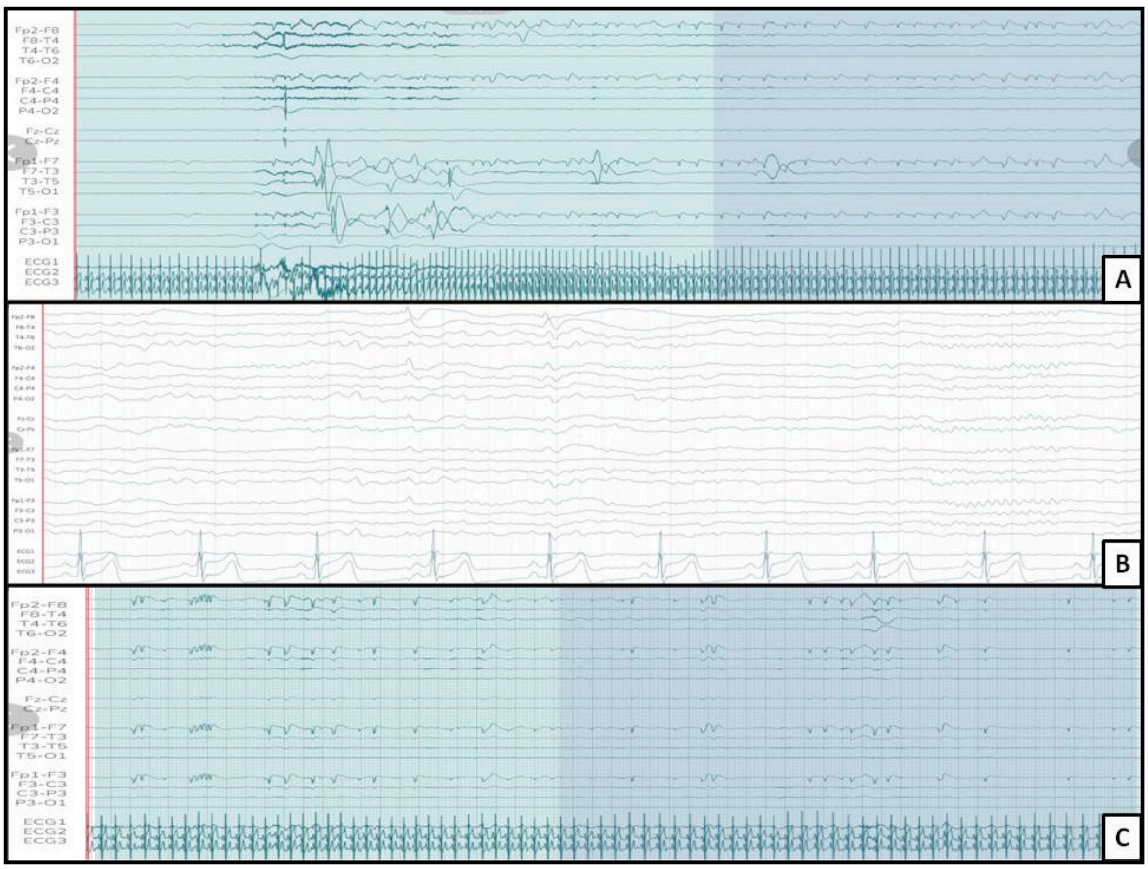

Fig. 2. Pre-operative and Post-operative EEGs (A) Pre-operative EEG demonstrating right-sided delta slowing and centro-posterior slowing, which leads to a period of repetitive sharp wave activity over the right frontal regions. There is irregular periodic discharge from bilateral frontal poles. Right frontotemporal theta activity is seen, which then slows and generalises over the right side, (B) Exemplar region identified in the pre-operative EEG demonstrating interictal abnormalities, showing right frontal waves, (C) Post-operative EEG shows 5Hz theta activity develop over the right hemisphere, maximal in the temporal leads, gradually evolving and subsiding.

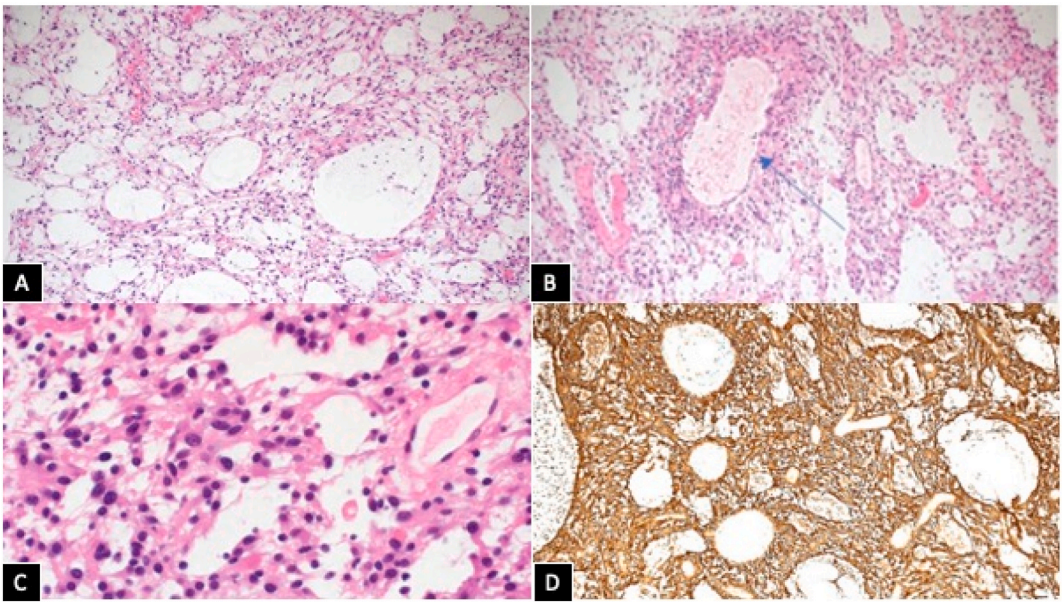

Fig. 3. Histopathological slides of the tumour post resection, (A) showing Pilomyxoid astrocytoma, composed of monomorphous piloid cells separated by multiple microcystic spaces, (B) showing typical angiocentric arrangement (arrowed), (C) showing monomorphous bipolar tumour cells embedded in myxomatous stroma, (D) showing positive stain when tested with S100 stain.

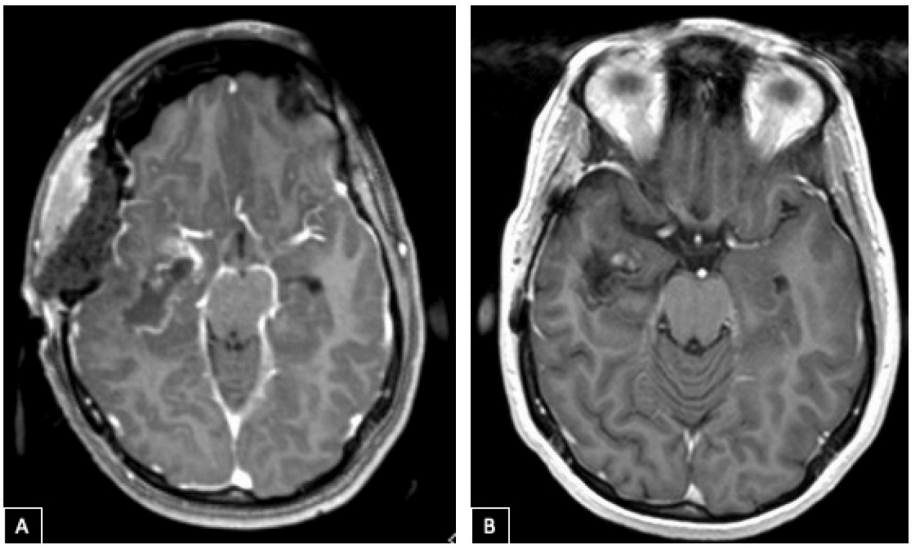

Fig. 4. Comparison of intraoperative and follow up MRI findings with, (A) Intra-operative iMRI Brain with gadolinium contrast in T1WI axial section post tumour excision showing possible residual tumour in the superior medial aspect of the resection cavity on retrospective examination. (B) 3-month follow up MRI Brain with gadolinium contrast in T1WI axial section showing stable appearance of the residual tumour in the same location.

Magnetic resonance imaging (MRI) of the brain demonstrated a heterogeneously enhancing right temporal lobe lesion measuring 38× 55 × 32mm. The lesion had multiple cystic components with minimal vasogenic oedema [Fig. 1]. She subsequently underwent ambulatory electroencephalogram (EEG) monitoring, which demonstrated right-sided delta wave activity over the right frontal regions and right frontotemporal theta wave activity. Her pre-operative EEG also demonstrated right frontal waves in the interictal period. These changes were consistent with a focal seizure disorder originating from the right anterior quadrant, suggesting the tumour was the most likely epileptogenic focus [Fig. 2]. She was subsequently referred to neurosurgery and underwent iMRI guided right temporal craniotomy and resection of the tumour. Intraoperatively, no gross tumour invasion involving the uncus, hippocampus, or amygdala was noted. Postoperative MRI demonstrated a small contrast-enhancing region in the surgical bed suggestive of residual

tumour. Post operatively, the patient was well from a neuropsychological point of view and in terms of neurology, she did not have any neurological deficits prior to discharge.

Microscopic examination revealed a hypercellular tumour composed of monomorphous bipolar tumour cells in a myxoid background. These cells were organized in an angiocentric arrangement, whereby the tumour cells were arranged radially around vessels, with diffuse foci of microcystic formation present. There were neither eosinophilic granular bodies nor Rosenthal fibres seen. On immunohistochemistry, the tumour was diffusely positive for Glial Fibrillary Acid Protein (GFAP) and S100 protein with retained expression for ATRX. However, Epithelial Membrane Antigen (EMA) and NeuN were negative. IDHI and BRAF – V600E stains were negative. The MIB-1 (Ki-67) index was minimal at 2–3% [Fig. 3]. The patient did not receive any adjuvant therapy postoperatively. She was clinically well at her 3-month follow-up. She experienced two brief episodes of seizures; both were shorter than her previous episodes. Her Carbamazepine dose was increased from 100mg BD to 200mg BD by her neurologist in light of recurrent seizures. Repeat EEG following surgery demonstrated theta activity in the right hemisphere, mainly in the temporal region [Fig. 2]. However, the seizure frequency was much lesser than in the pre-operative period, and she denied any new neurological symptoms. The residual tumour also remained stable in size on follow-up MRI at three months [Fig. 4]. Due to the potential risk of CSF dissemination, MRI whole spine was performed, and it was unremarkable. Moving forward, a repeat MRI will be performed six months following surgery to monitor for any disease progression. She has not received any adjuvant therapy at this stage but may be considered for radiotherapy in the future, given the presence of the residual tumour.

2. Discussion

This case report is the first case of PMA in the temporal lobe of an adult female. There have been two previous case reports of PMA in the temporal lobe of male adults [5,6], which are different in terms of clinical presentation to this case.

Even though PMA is considered a variant of PA in the latest WHO classification in 2022, previous reports have suggested that PMA is associated with a higher risk of CSF metastasis and, overall, a worse prognosis than PA. There are insufficient studies on PMA in the adult population to draw a conclusion regarding the clinical course and management of PMA compared to PA in adults. PMA and PA have been reported in multiple studies to have notable differences. In the context of histological findings, PMA has a myxomatous background with a monomorphous population of piloid cells, while PA has a biphasic architecture. Moreover, PMA lacks the characteristic Rosenthal fibres and eosinophilic granular bodies present in PA [1,4]. Clinically, it has also been reported that PMA is more aggressive than PA. Komotar et al. reported higher rates of local recurrence and CSF dissemination in PMA than in PA [1,4]. The overall survival and progression-free survival rates are lower in PMA, with a mean of 63 and 26 months reported, respectively, compared to PA (213 and 147 months) [7]. Also, PMA has been known to occur in a younger age group in terms of the mean age of diagnosis (18 months) compared to PA (58 months) [1,8]. Radiologically, PMA is mainly located in the hypothalamic/chiasmatic region but can occur throughout the neuraxis [4]. PMA is usually isointense on T1-weighted MRI and hyperintense on T2-weighted MRI [3,4]. There are some differences reported between PA and PMA from gene expression microarray studies. However, the effect of these genes on the biological effect and clinical course of PMA is unclear, and this is mainly due to the rarity of PMA [8,9].

Currently, the management for both PMA and PA are similar, with the primary treatment modality for both being gross total resection of the tumour. However, gross total resection is usually only possible when the tumour is located in non-eloquent brain regions. There is also currently no standard of care in treating patients with PMA. Hence these patients are treated the same way as patients with PA. There is currently no clear evidence on the benefits of using adjuvant therapy, either chemotherapy or radiotherapy, to treat PA or PMA. Since previous studies have reported higher rates of local recurrence and CSF dissemination in PMA, more frequent postoperative monitoring may be required. In practice, PMA is currently being managed similarly to PA mainly due to the insufficient data on its long-term outcome, especially in the adult population.

This case is an uncommon presentation of a rare primary central nervous system tumour. Our patient is a female adult with PMA located in the right temporal lobe. The presentation has some unique features compared to most of the PMA tumours reported. Firstly, the patient in this report is an adult (25 years old) and not in the usual paediatric age group. Secondly, the patient's tumour was in the temporal lobe, a rare presentation, especially in the adult population with PMA. To our knowledge, this is only the third case of PMA in the temporal lobe to be reported in an adult patient.

Two previous cases of PMA within the temporal lobes have been reported [5,6]. The first case reported by Gottfried et al. described a 24-year-old man with PMA in the right posterior temporal region. The patient presented with confusion, vomiting, headaches, and gait instability with radiological features of haemorrhage within the tumour. The patient was managed with gross total resection and showed no recurrence on MRI at a 6-month follow-up examination [5]. Karthigeyan et al. reported the second case, which described a 40-year-old man with PMA in the left temporal and parietal region. The patient presented with features of raised intracranial pressure with radiological features of haemorrhage. The patient was managed with near-total excision of the tumour, with a small portion of the tumour adherent to the choroid plexus left unexcised. This patient received adjuvant chemotherapy postoperatively and was well at a 3-month follow-up [6]. The presentation in our case differs in a few ways compared to the previous two case reports. Firstly, our patient presented with seizures and had no symptoms reported in the two previous cases. The pathogenesis of seizures in temporal lobe tumours is thought to be multifactorial and is not purely understood. Brain tumours in the temporal lobe can itself act as an epileptogenic source. Some studies have reported that astrocytomas with cortical involvement and tumour location close to functional areas have a higher risk of seizures. However, the fact that the two previous cases of PMA within the temporal lobe did not present with seizures reiterates that seizures in temporal lobe tumours are multifactorial [10,11]. Although our patient's tumour was located in the right temporal lobe, as demonstrated by the pre-operative MRI, periodic discharges were seen from bilateral frontal poles in the pre-operative ambulatory EEG. This could be due to epileptogenic zones in brain tumours being extensive, and there have been studies

Table 1
All reported cases of PMA in adults occurring outside the central neuroaxis.

Age (years), gender	Tumour location	Clinical presentation	Reference
24, M	Right posterior temporal	Confusion, vomiting, headache, gait instability	[5]
40, M	Left posterior temporal and parietal	Headache, vomiting	[6]
20, F	Left cerebellar hemisphere and vermis extending down to cervicomedullary junction	Headaches, nausea, vomiting for 2 months	[13]
72, M	Cerebellar vermis	Memory loss, gait disturbance, speech difficulty	[14]
22, F	Left frontal lobe	Seizures	[15]
28, M	Right Amygdala, Right uncus	Seizures	[16]

which have shown epileptic discharges from the contralateral side of brain tumours [12]. Secondly, the patient in our case did not have any radiological evidence of haemorrhage within the tumour or in the surrounding brain parenchyma.

Overall, very few reported cases of PMA in adults occur outside the central neuroaxis [Table 1]. There are currently no proven biological factors that would affect the age of onset or the location of PMA occurrence, especially outside the central neuroaxis.

3. Conclusion

This case reports an atypical site of PMA occurrence in an uncommon age group. It is crucial to differentiate PMA from PA, as the clinical course of PMA has been reported to be more aggressive than PA, especially in the paediatric population. However, this cannot be translated into the adult population because there are insufficient studies on PMA in adults to help consolidate clinical and radiological features to differentiate PMA from PA in adults [1,4]. In conclusion, increased recognition of PMA could affect the prognosis and treatment of these astrocytomas in adults as it would determine the need for adjuvant therapy or more intensive follow-up post-resection for patients with PMA.

The patient's informed consent was obtained prior to publishing this case report.

Author contribution statement

All authors listed have significantly contributed to the investigation, development and writing of this article.

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Data availability statement

Data will be made available on request.

Declaration of interest's statement

The authors declare no conflict of interest.

Abbreviations

PMA	Pilomyxoid Astrocytoma
PA	Pilocytic Astrocytoma
WHO	World Health Organization
CSF	cerebrospinal fluid
MRI	Magnetic resonance imaging
GFAP	Glial Fibrillary Acid Protein
EMA	Epithelial Membrane Antigen

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