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CASE REPORT

# Non-surgical approach to a paediatric pilocytic astrocytoma with MRI follow-up. Case report and brief literature review

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**Introduction**: Pilocytic astrocytoma is a common tumour in paediatric patients. A low-grade glioma, it is most commonly treated by surgery, with various post-surgical side effects. New methods of treatment and follow-up are constantly evolving to offer alternative options to paediatric patients whose nerve structures are developing. **Case presentation**: A 9-year-old patient diagnosed with a pilocytic astrocytoma by MRI and histopathological examination underwent a biopsy and evacuation procedure of the cystic component after which the patient's condition improved significantly. The 'wait-and-see' approach using MRI instead of total surgical excision of the tumour was preferred, and the patient had favourable results on control imaging. **Conclusions**: Paediatric patients suffering from pilocytic astrocytoma with favourable imaging and histopathological features may consider MRI follow-up instead of surgical excision until the character of the tumour changes or until the brain has reached full development.

**Keywords**: pilocytic astrocytoma, magnetic resonance imaging, low-grade glioma, paediatric brain tumour

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## Introduction

Pilocytic astrocytoma is one of the most common tumours in paediatric patients. This type of tumour has relatively benign characteristics. It tends to occur predominantly in the structures of the posterior cranial fossa, mainly in the cerebellum, followed by the cerebral hemispheres, optic tracts, and brainstem [1,2]. Despite good prognosis, the long-term results are not favourable for the patient, mainly due to post-surgical side effects, tumour recurrence, and the side effects of radiation or chemotherapy [3]. The symptomatology is most often produced by the compressive effect of the cystic component on the surrounding hemispheric structures. The character of the tumour after complete or partial resection remains unpredictable. The most common treatment option is surgery; however, due to the many early and late postoperative complications and the relatively benign nature of the tumour, a 'wait-and-see' approach has recently been proposed whereby the patient is examined at 3-6 months to monitor the imaging features of the tumour [4-6]. The most common postoperative complications are postoperative haematoma, intracranial hypertension, subdural hygroma, and neurological deficits with moderate-to-severe impairment [7]. The imaging investigation of choice for diagnosis and follow-up of this type of tumour is nuclear magnetic resonance imaging (MRI). The lesion occurs most frequently with a cystic component and a hypointense solid component in T1 sequence, hyperintense in T2 sequence, with contrast enhancement seen predominantly in the solid component, and slight diffusion restriction [8].

The aim of this article is to present the case of a pilocytic astrocytoma that developed in the right cerebellar hemisphere in a 9-year-old child where a watch-and-wait approach with MRI follow-up was chosen over the classical surgical approach, the first imaging investigation being carried out at the time of diagnosis and the second one 3 months later.

## Case presentation

We present the case of a 9-year-old male diagnosed with pilocytic astrocytoma. The patient did not present a medical history relevant to the current pathology, and no grade 1 or 2 relatives had suffered from brain tumours. Prior to hospitalisation, the patient complained of vague neurological symptoms, especially sporadic headaches, loss of balance, and infrequent convulsions. The patient was first consulted in an otolaryngology service where he was diagnosed with otitis media for which he received treatment at home. He returned to the hospital after approximately 1 month due to persistence of symptoms and was hospitalised in the neurology department. During clinical examination, the patient mainly complained of severe balance disorders, and we decided to perform an MRI for evaluation (Figure 1). MRI revealed the presence of a tumour mass in the right cerebellar hemisphere with a double cystic component and

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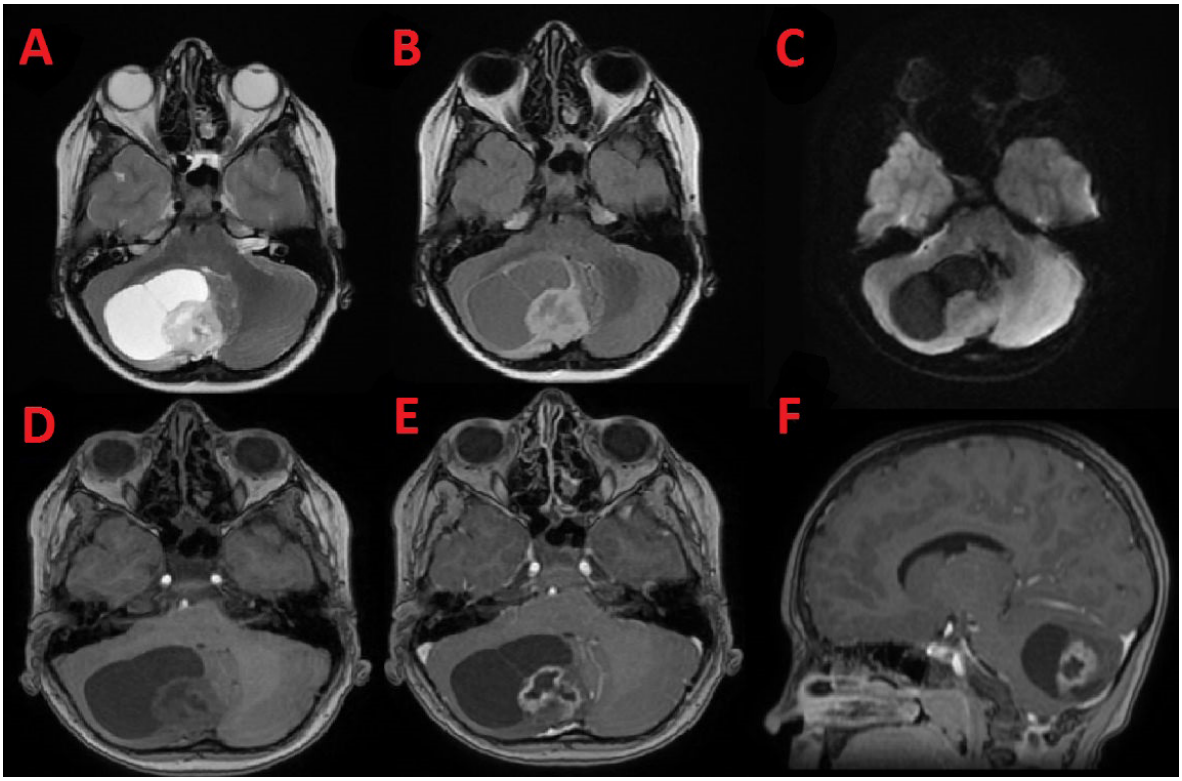


**Fig. 1. Head MRI. A: Axial T2; B: Axial T2 FLAIR; C: Diffusion weighted imaging; D: Axial T1; E: Axial T1+Contrast; F: Sagittal T1+Contrast**

a solid parenchymal component, hyperintense on T2 and T2 FLAIR, hypointense on T1, with a small central necrotic component, and with contrast enhancement only at the level of the parenchymal components. The cystic component did not exhibit contrast loading, and the tumour formation exhibited diffusion restriction. The cystic component represented approximately two-thirds of the tumour volume, measuring 34/40/41 mm (CC/AP/LL). The solid component had dimensions of 29/29/28 mm (CC/AP/LL). The tumour simultaneously caused a compression effect on the contralateral cerebellar hemisphere without infiltrating the surrounding tissues, and it did not exhibit a mass effect on the IV ventricle, intracranial hypertension, or herniation of the cerebellar amygdala. The MRI features of this lesion were representative of a pilocytic astrocytoma located in the posterior cerebellar fossa; therefore, a biopsy was performed for definite diagnosis and grading of the lesion approximately 1 week after the first MRI evaluation, certifying the diagnosis of pilocytic astrocytoma.

During the biopsy procedure, much of the cystic component of the tumour was vacuumed in an attempt to improve the patient's symptoms caused by the compressive effects. After 48 hours, we decided to perform a control MRI to re-evaluate the appearance of the tumour after the intervention. This examination revealed a remarkable reduction in the size of the cystic component, measuring 14/20/21 mm (CC/AP/LL), with a reduction in the mass effect on the contralateral cerebellar hemisphere (Figure 2 A,B,C). No changes were observed in the dimensions of the solid component or in its imaging characteristics. Clinical evaluation of the patient revealed significant improvement in symptoms, with complete improvement before discharge.

The tumour tissue had relatively high cellularity and was composed of tumour cells with round-oval, hyperchromatic nuclei with reduced pleomorphism and thin eosinophilic extensions, which formed a loose matrix with focal microcystic areas. In some places, fibrillar eosinophilic structures with the appearance of Rosenthal fibres and eosinophilic granular bodies were observed. Microscopic foci of haemorrhage were also observed, without the presence of necrotic areas. No mitotic figures were identified. The tumour did not have an infiltrative character, an aspect further highlighted immunohistochemically by its reaction with neurofilament (Figure 2 D,E,F).

The patient's relatives decided to postpone the surgery and monitor the lesion closely by MRI at intervals of about 3 months to avoid possible postoperative complications and the risk of permanent neurological damage during a period of incomplete brain development.

After 3 months, in which the patient did not follow any treatment at home, he returned to our hospital for a follow-up MRI (Figure 3). Further reduction in the size of the cystic component of the tumour was observed, measuring 11/6.5/5.6 mm (CC/AP/LL). The solid component showed no imaging changes compared to the first MRI evaluation and no change in size. There was no mass effect or infiltrative effects on the brain and cerebellar structures adjacent to the lesion. The patient reported significant improvement of symptoms, with the occasional presence of dizziness or mild headache, being decided to continue the watch-and-wait approach until future symptomatic or imaging changes of the tumour are observed on the 3-month follow-up.

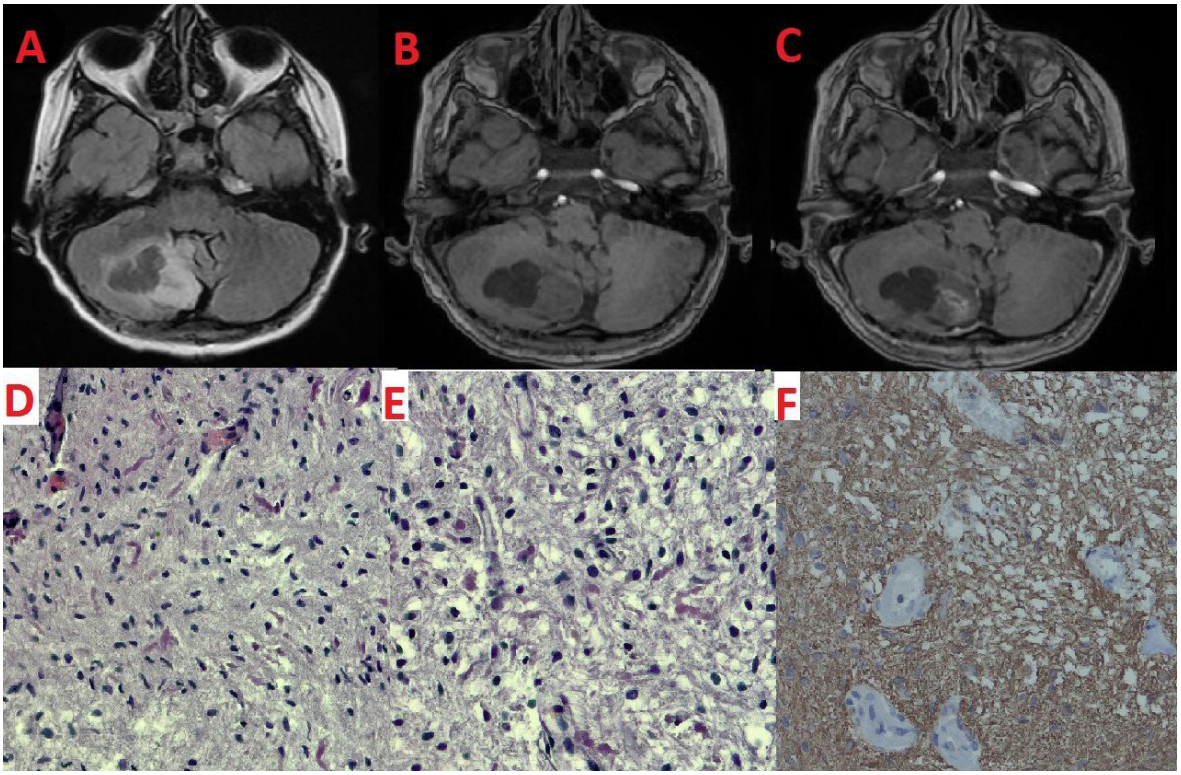


Fig. 2. Head MRI. A: Axial T2 FLAIR; B: Axial T1; C: Axial T1+C; D: Histological examination,hematoxylin eosin, Ob20x; E-hematoxylin eosin,Ob40x;F-GFAP,Ob20x

## Discussion

There are numerous clinical challenges in the management of patients with pilocytic astrocytoma. Due to the long-term survival of the majority of patients, pilocytic astrocytoma is seen as a chronic disease by many paediatric neurooncologists [9]. Therefore, treatment approaches should aim to be effective not only in controlling tumour growth, but also in managing acute and long-term tumour-related

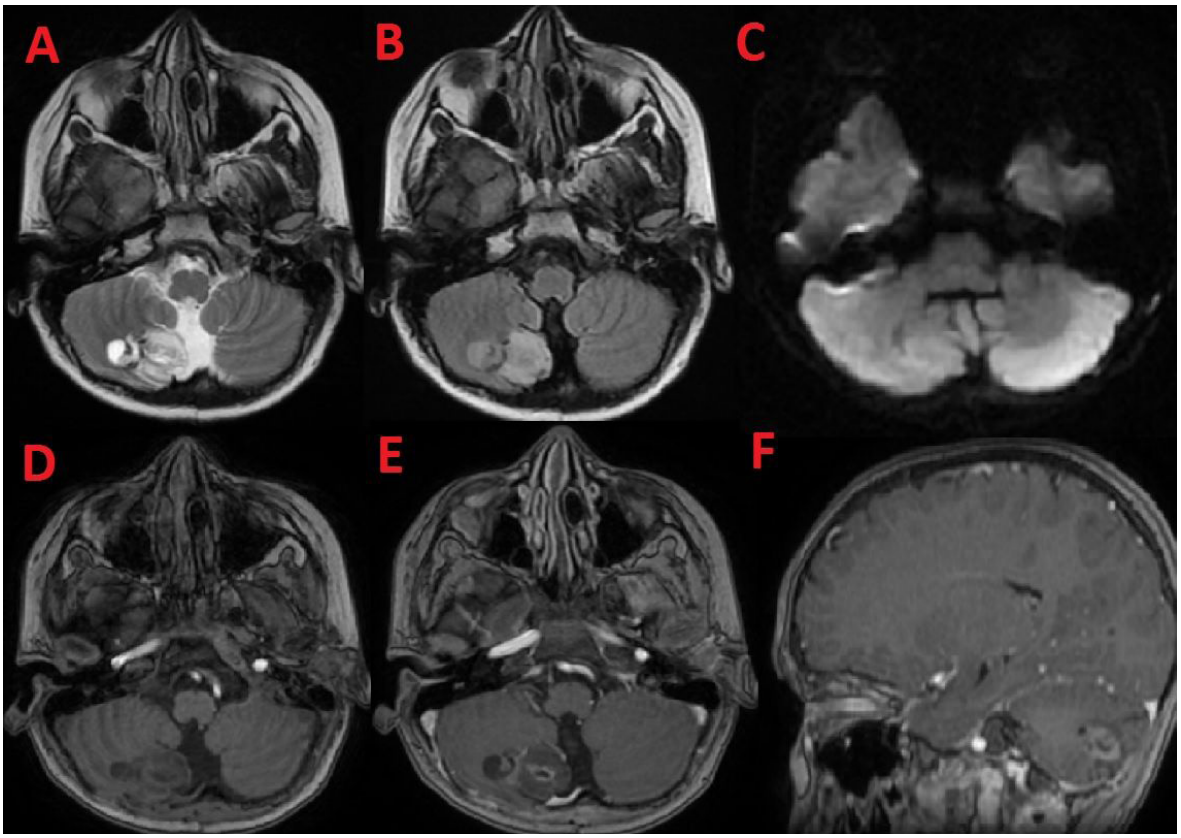


Fig. 3. Head MRI. A: Axial T2; B: Axial T2 FLAIR; C: Diffusion weighted imaging; D: Axial T1; E: Axial T1+Contrast; F: Sagittal T1+Contrast

toxicity, treatment, and quality of life. Although the results after surgery are generally favourable, complete surgical resection can only be achieved in about one-half of cases, when the tumour is in a surgically accessible location [10]. If the tumour involves the optic tract, the hypothalamic or thalamic regions, or a large part of the cerebellum, complete removal is impossible in most patients. In case of tumour progression, non-surgical treatment strategies are usually implemented, including chemotherapy and radiation therapy [11]. Older children usually receive local radiation therapy if the tumour progresses [12]. Conventional strategies in neuro-oncology consist of surgery, radiotherapy, and chemotherapy. However, in the case of low-grade gliomas, due to the availability of MRI imaging, a wait-and-see approach may be appropriate because many injuries cause few symptoms for many years. This is especially the case for incidentally discovered lesions and cases with convulsive disorders that are well controlled with anticonvulsants [12,13]. If the patient's only symptom is a convulsive disorder or headache, they can generally be controlled to a varying degree with monovalent or polyvalent symptomatic anticonvulsant therapy. If the lesion enlarges, changes radiologically, or if symptoms or signs progress, then some form of intervention is usually required [14]. The median time to disease progression or recurrence in benign cerebellar astrocytoma ranges from 3 months to 45 years. A study by Benesch M. and Eder H. on a group of 289 patients reported that most patients with recurrent or residual low-grade glioma located in the cerebellum had a benign and non-progressive clinical course [15]. To prevent over-treatment of children with benign disease and possible late and early treatment-related effects, the wait-and-see approach is warranted in patients with non-progressive or residual pilocytic astrocytoma, as was the case with our patient.

The particularity of the presented case was the new approach regarding the strategy of treatment and follow-up of pilocytic astrocytoma (which, at the first MRI investigation, had a predominant cystic component) in a 9-year-old paediatric patient where periodic MRI follow-up of the lesion was preferred over a classic surgical approach. The patient presented favourable MRI characteristics and clinical symptoms during control visits due to the reduction of the cystic component and of the compression effect on the surrounding structures.

## Conclusions

In pilocytic astrocytomas with favourable imaging and histopathological characteristics like the case presented, careful follow-up by MRI until future changes in tumour character or until complete brain development may be an alternative choice to surgical resection, for its increased incidence necessitates the continuous development of new approach methods.

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The patient signed an informed consent for the publication of this manuscript.

## Authors' contribution

F.A.C (Conceptualization, Investigation, Methodology, Writing – original draft)
O.Z (Supervision, Validation, Resources)
F.E.F (Methodology, Data curation, Supervision)
G.I.G (Conceptualization, Investigation, Visualization)
Z.C.A (Data curation, Investigation, Visualization)
K.A (Conceptualization, Data curation, Investigation)

## Conflict of interest

The authors declare no competing interests.

## References

1. Whittle IR.The dilemma of low grade glioma. J Neurol Neurosurg Psychiatry. 2004 Jun;75 Suppl 2(Suppl 2):ii31-6.
2. Milde, Till et al.Reimagining pilocytic astrocytomas in the context of pediatric low-grade gliomas.Neuro-oncology vol.23,10 (2021):1634-1646.
3. Shaw, E. G., & Wisoff, J. H. (2003).Prospective clinical trials of intracranial low-grade glioma in adults and children.Neuro-oncology,5(3), 153–160.
4. Saunders, Dawn E et al.Surveillance imaging strategies following surgery and/or radiotherapy for childhood cerebellar low-grade astrocytoma. Journal of neurosurgery vol.102,2 Suppl (2005):172-8.
5. Collins, V Peter et al.Pilocytic astrocytoma: pathology, molecular mechanisms and markers.Acta neuropathologica vol.129,6 (2015):775-88.
6. Ogiwara,Hideki et al.Long-term follow-up of pediatric benign cerebellar astrocytomas. Neurosurgery vol.70,1 (2012):40-7.
7. Voronina, Natalia et al.The age of adult pilocytic astrocytoma cells. Oncogene vol.40,16 (2021):2830-2841.
8. Mackay, Alan et al.Integrated Molecular Meta-Analysis of 1,000 Pediatric High-Grade and Diffuse Intrinsic Pontine Glioma.Cancer cell vol.32,4(2017):520-53.
9. Smith HL, Wadhwani N, Horbinski C.Major Features of the 2021 WHO Classification of CNS Tumors.Neurotherapeutics. 2022 May 16. Epub ahead of print.
10. Perez A, Huse JT.The Evolving Classification of Diffuse Gliomas: World Health Organization Updates for 2021.Curr Neurol Neurosci Rep. 2021 Nov 24;21(12):67.
11. Dirven CM, Mooij JJ, Molenaar WM.Cerebellar pilocytic astrocytoma: a treatment protocol based upon analysis of 73 cases and a review of the literature.Childs Nerv Syst. 1997;13(1):17-23.
12. Palma L, Celli P, Mariottini A.Long-term follow-up of childhood cerebellar astrocytomas after incomplete resection with particular reference to arrested growth or spontaneous tumour regression.Acta Neurochir (Wien).2004;146(6):581-588.
13. Hojer C, Hildebrandt G, Lanfermann H, Schröder R, Haupt WF.Pilocytic astrocytomas of the posterior fossa.A follow-up study in 33 patients. Acta Neurochir (Wien).1994;129(3-4):131-139.
14. Pan HC, Wong TT, Guo WY, Lee LS.Pilocytic astrocytoma of the posterior fossa:a follow-up study in 15 patients.Zhonghua Yi Xue Za Zhi (Taipei).1999;62(5):278-284.
15. Benesch, Martin et al.Residual or recurrent cerebellar low-grade glioma in children after tumor resection:is re-treatment needed?A single center experience from 1983 to 2003.Pediatric neurosurgery vol. 42,3 (2006):159-64.