OPEN ACCESS ISSN: 2837-3642
Granaroli P, et al. (2024): 188
Doi: 10.47991/2837-3642/100128

Case Report

Annals of Clinical Reviews & Case Reports

Management of Posterior Fossa Ependymoma with Spinal Metastasis in an Adult Patient: Surgical Treatment Involving Extensive Thoracic Laminectomy and Postoperative Radiotherapy

Pierluigi Granaroli[1], Giuseppina Bevacqua[1*], Elisa Coassin[2], Maurizio Mascarin[2], Valentina Grespi[3] and Carlo Conti[1]

[1]Unit of Neurosurgery, Azienda Ospedaliera S. Maria, 05100 Terni, Italy.
[2]AYA Oncology and Pediatric Radiotherapy Unit, CRO Aviano, National Cancer Institute, Istituto di Ricovero e Cura a Carattere Scientifico, IRCCS, 33081 Aviano, Italy.
[3]Stem Cell Laboratory, Cell Factory and Biobank, Azienda Ospedaliera S. Maria, 05100 Terni, Italy.

[*]**Correspondence:** Giuseppina Bevacqua, Unit of Neurosurgery, Azienda Ospedaliera S. Maria, 05100 Terni. Italy. Email: giuseppina.bevacqua@aospterni.it

Citation: Granaroli P, Bevacqua G, Coassin E, Mascarin M, Grespi V, et al. (2024) Management of Posterior Fossa Ependymoma with Spinal Metastasis in an Adult Patient: Surgical Treatment Involving Extensive Thoracic Laminectomy and Postoperative Radiotherapy. Anna Clin Rev Cas Rep: ACRCR-128.

Received Date: 02 July, 2024; **Accepted Date:** 09 July, 2024; **Published Date:** 15 July, 2024

Abstract

Ependymomas are primary central nervous system (CNS) tumors that arise from the ependymal cells lining the ventricular system and the central canal of the spinal cord. This report explores an extremely rare manifestation of a primary posterior fossa ependymoma with spinal metastasis in a 31-year-old female, a phenomenon not previously documented in contemporary literature post the 2021 update of CNS tumor classification. This complicated case highlights the challenges and complexities associates with the diagnosis and management of rare CNS tumors, and adds significantly to the existing knowledge on the management of ependymomas

Keywords: *Ependymoma, radiotherapy, spinal metastasis, AYAs brain, spine tumors.*

Introduction

Ependymomas are primary central nervous system (CNS) tumors arising from the ependymal cells lining the ventricular system and the central canal of the spinal cord [1]. The 2021 revision of the World Health Organization (WHO) classification of CNS tumors defines ten ependymomas typed based on anatomical localization and molecular features. The ten subgroups were divided among the three major compartments of the CNS: the supratentorial (ST) space, the infratentorial (IT) space, and the spinal cord (SP) compartment [1]. In particular, posterior fossa (PF) ependymomas comprise three distinct molecular subgroups, defined by gene expression and genome-wide DNA methylation, termed PF-A, PF-B, and PF-SE (subependymoma) [2,3]. Treatment typically involves surgical removal of the tumor when possible, because the degree of surgical resection is considered as the most consistent prognostic factor. The success of surgical intervention depends on the tumor's size, location, and the involvement of critical structures. In tumors localized in the brain, likewise in tumors with CNS metastasis, adjuvant radiotherapy is generally accepted, even when macroscopic complete resection is achieved. In some cases, additional treatments with chemotherapy may be recommended.

We report a rare case of primary PF ependymoma with spinal metastasis in a young woman, a rare phenomenon not described in the literature so far at least since the 2021 tumor classification system update.

Case Presentation

In 2023, a 31-year-old female patient presented to our Neurosurgery Department (Santa Maria Hospital, Terni, Italy) complaining of lumbar and cervical pain refractory to analgesics treatment for two months. The patient's past medical history included Henoch-Schonlein purpura (immune complex-mediated vasculitis), FVIII and FII deficiencies, and colon polypectomy. Neurological examination revealed visual disturbances with dissociation of straight lines and lower extremity paresthesias. Magnetic resonance imaging (MRI) showed a mass involving the fourth ventricle and the cisterna magna up to C2-C3 with initial ventricular dilatation (Figure 1).

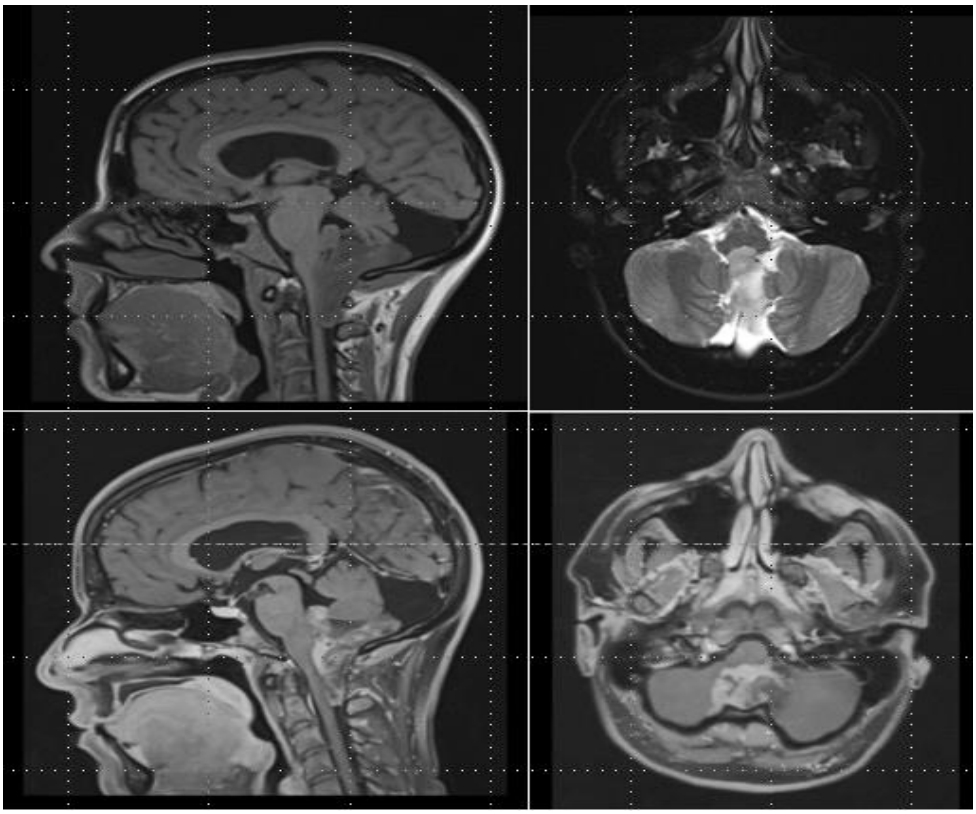

Figure 1: Preoperative enhanced MRI of brain and cervical spine (left, sagittal; right, axial) showing, in the posterior fossa, of a voluminous median lesion involving the fourth ventricle and the cisterna magna up to C2-C3 with initial ventricular dilatation.

A craniotomy was performed via a suboccipital approach. A gross total resection was performed to remove the tumor with complete C1 arch resection and C2 partial laminectomy. The surgery was successful and the follow-up Computed Tomography (CT) scan confirmed that the tumor was completely resected (Figure 2). Histological examination verified a PF-EPN-B, classified as a WHO grade III tumor.

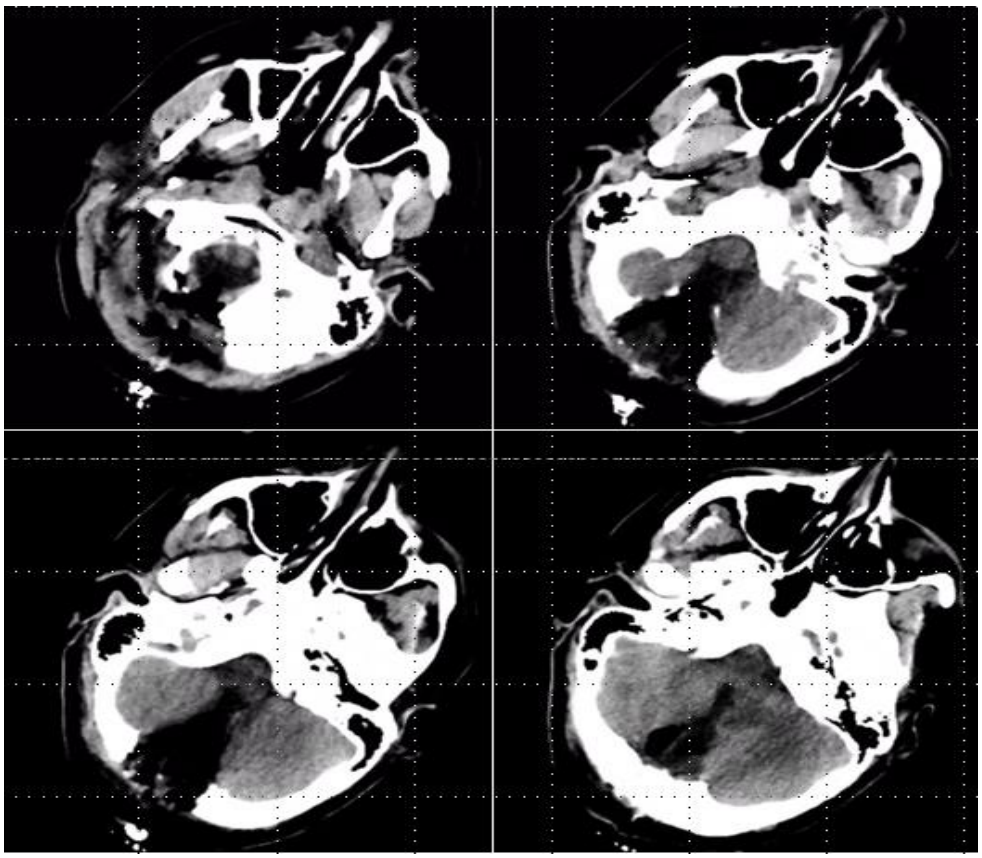

Figure 2: Postoperative Brain CT showed a total resection of the tumor.

The patient was discharged 7 days after surgery presenting in good general conditions. Given that the patient suffered from low back pain and that spinal metastasis is one of the features of PF-EPN, a complete spinal cord MRI was performed. Multiple extra-axial intradural metastases were found from C5 to the bottom of the dural sac area, located mostly posterior to the spinal cord (Figure 3). The main one, extending from D1 to D8, caused compression of the spinal cord. Given the patient's symptoms and the radiological findings, surgical excision of the tumor was deemed necessary. A D1-D11 laminectomy and a total excision of the tumor was performed. Histology was in keeping with the spinal location of a grade III ependymoma.

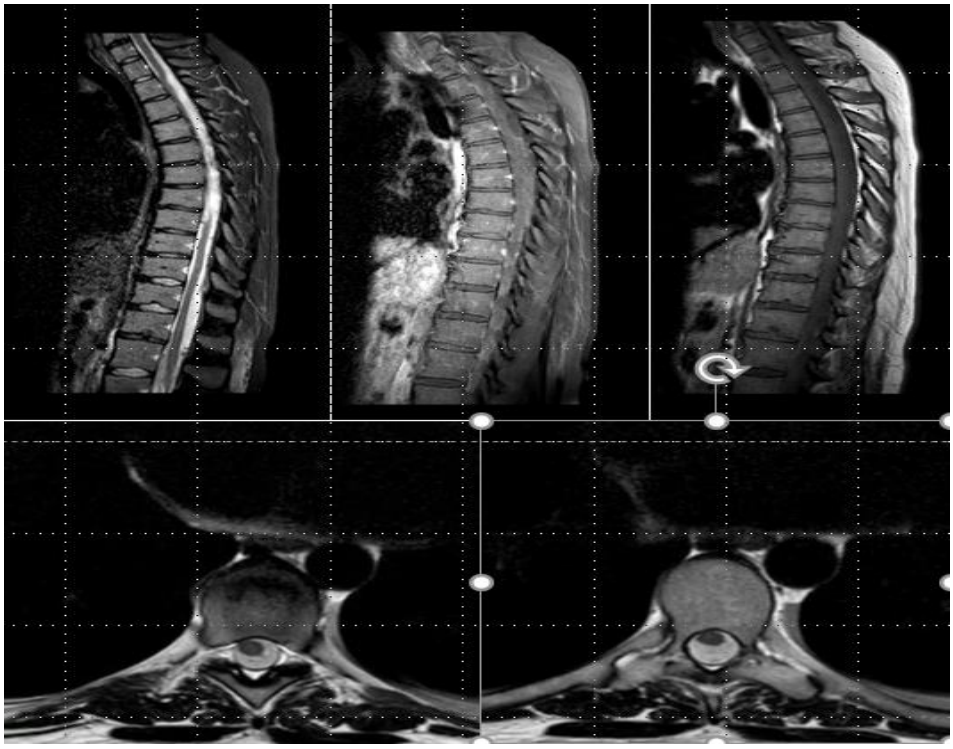

Figure 3: Spine MRI. From C5 to conus medullaris, multiple extra-axial intradural images are observed, mostly posterior to the cord, slightly hyperintense in T2, iso-ipointense in T1. The largest mass is located between D1 and D8, compressing the cord posteriorly and from the left.

The surgery was successful and the follow-up MRI confirmed that the tumor had been completely resected (Figure 4), there were no intraoperative or immediate postoperative complications and no new neurological deficits were observed.

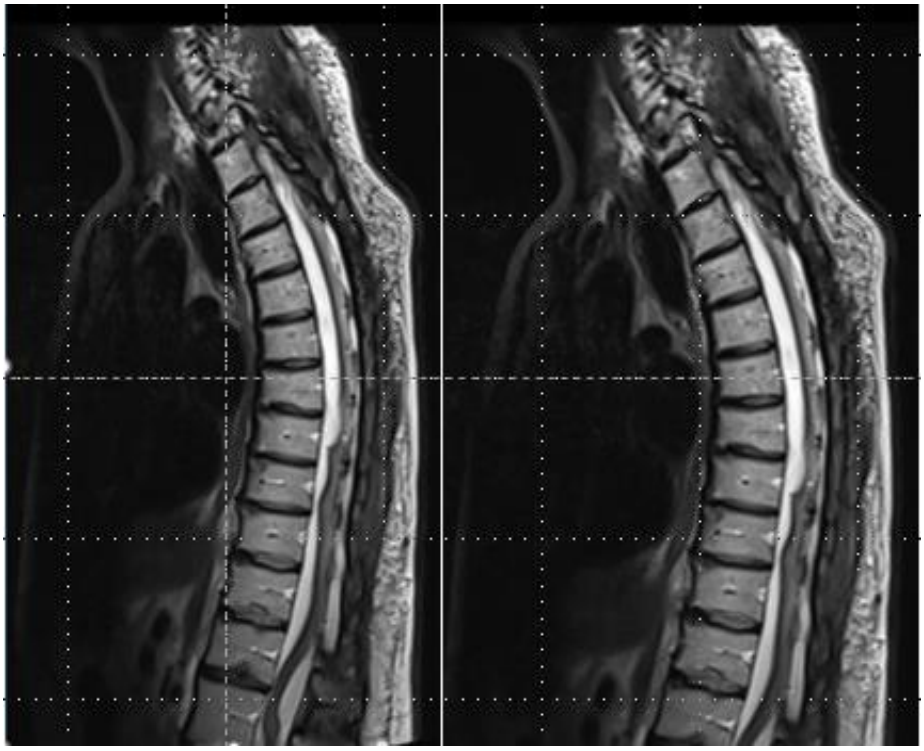

Figure 4: Postoperative Spine MRI after the operation. (left, 2 months; right, 9 months).

The patient was discharged 14 days after surgery and was subsequently referred for adjuvant radiotherapy at the Radiation Oncology Department, IRCCS Centro di Riferimento Oncologico, Aviano, Italy. A tailor-made treatment plan was developed: 36 Gy craniospinal irradiation (CSI) was delivered in 20 fractions, 9 Gy boost on PF and whole-spinal cord in 5 fractions, 9 Gy boost on tumor bed with infraforaminal extension in 5 fractions, 5.4 Gy boost on tumor bed in 3 fractions without infraforaminal extension (Figure 5).

Based on personal and family medical history, tumor tissue was analysed for a panel of genes responsible for genetic predisposition. There were no targetable mutations and germline NF1 and NF2 mutations, but CDK4 gene amplification was detected.

The patient is alive in good clinical conditions, twelve months after the end of radiotherapy, without radiological evidence of active disease.

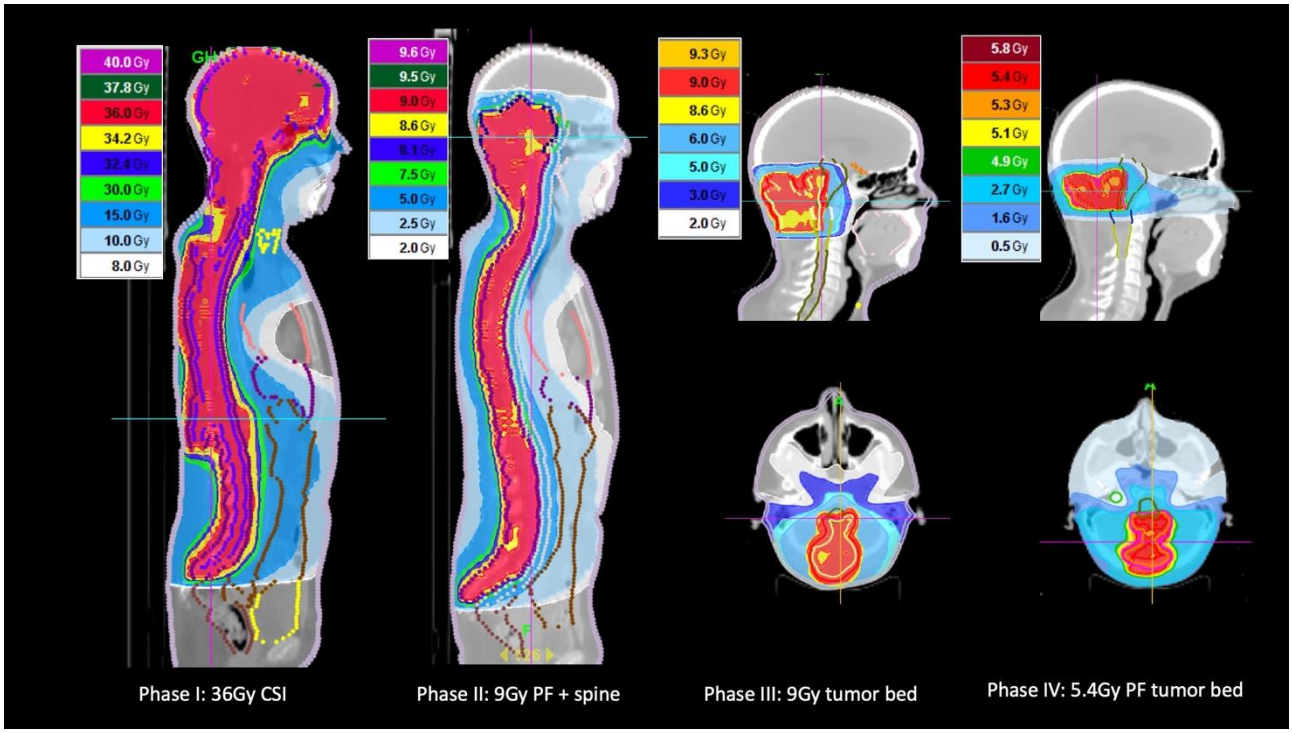

Figure 5: Radiotherapy treatment delivered with Helical Tomotherapy, using 6 MV photons, was divided into four treatment phases: Phase I: 36 Gy CSI (the radiotherapy volume to the spinal cord, included the post-surgical soft tissue alterations in the C7-D12 tract); Phase II 9 Gy boost to PF and spine (total dose 45Gy); Phase III 9 Gy boost to tumor bed, up to C2-C3 cervical cord extension (total dose 54 Gy); Phase IV 5.4 Gy boost to tumor bed, excluding the extension to the cervical cord (total dose 59.4Gy)

Discussion

Ependymomas, while constituting a predominant subset of intramedullary spinal tumors in adults, represent a minor fraction of all primary central nervous system (CNS) neoplasms, accounting for merely 2-3% [4]. These tumors, originating from ependymal cells lining the CNS's ventricular system and spinal canal, present considerable diagnostic and therapeutic challenges due to their intricate location and the critical neurological structures involved.

The 2021 revision of the World Health Organization (WHO) classification system for CNS tumors has significantly advanced our understanding by categorizing ependymomas into ten distinct types based on anatomical localization and molecular features. The ten subgroups were divided into the three major compartments of the CNS: the supratentorial (ST) space, the infratentorial (IT) space and the spinal (SP) compartment. The IT compartment contained the subgroups PF-A, PF-B and PF-SE, of which, PFA has a strong preponderance in the pediatric population.

The diagnostic process in this case was compounded by the tumor's aggressive behavior and precarious positioning, necessitating the use of advanced magnetic resonance imaging (MRI) techniques and a detailed neurosurgical assessment to ascertain the full extent of the disease.

Ependymomas are traditionally managed through maximal safe surgical resection, a principle that holds irrespective of the tumor grade [5]. Chemotherapy is typically reserved for patients with advanced or recurrent ependymomas that cannot be resected or irradiated [1], while postoperative radiotherapy is recommended for WHO grade III ependymomas regardless of the extent of resection, and for incompletely resected grade II ependymomas [6]. This case required not only the initial surgical removal of the primary tumor, classified as WHO grade III PF-EPN-B, but also subsequent interventions to address multiple spinal metastases detected postoperatively. The management strategy underscored the critical role of aggressive surgical approaches coupled with comprehensive postoperative radiotherapy, illustrating the complexities involved in treating high-grade ependymomas.

This report explores an exceedingly rare manifestation of a primary PF ependymoma with spinal metastasis in a 31-year-old female, a phenomenon not previously documented in contemporary literature post the 2021 update of CNS tumor classification.

The patient's initial presentation included nonspecific symptoms such as lumbar and cervical pain, which were refractory to conventional analgesic treatment, leading to further neurological evaluation and diagnostic imaging that revealed a mass extending from the fourth ventricle to the C2-C3 level of the spinal cord. PFB occurs in adolescents and adults, with a median age of 30 years and a slight predilection toward the female sex. PFB subgroup tumors are located medially within the PF [1], and mandatory criteria for the diagnosis of PF-B are localization in the PF and a methylation profile aligned with the methylation class PF-B [2].

In this case, radiotherapy was indispensable for managing residual disease and preventing recurrence, particularly given the high grade and metastatic nature of the tumor. A personalized radiotherapy regimen was devised, targeting both the primary and metastatic sites, which highlights the necessity for precise and targeted therapeutic approaches in such complex cases. The timing of radiotherapy, ideally within five weeks post-surgery, was crucial for maximizing treatment efficacy, although practical challenges such as surgical recovery and the scheduling of additional procedures can introduce delays.

The prognosis in ependymoma cases is influenced by a multitude of factors including the tumor grade, therapeutic regimens, Ki-67 index, gene type, location age and gender but radical removal of the lesion is the most significant among them [7]. Adults appear to have a better prognosis than children with a 5-year survival of 55-90% and 14-60%, respectively [8]. The detection of spinal metastases, although rare in PF-B ependymomas, indicated a potentially severe clinical course.

Metastases are important in predicting the clinical outcome and the cerebrospinal fluid (CSF) spread of tumor cells is a key factor in staging, prognosis and treatment [8]. For ependymoma, metastases are relatively common for the anaplastic type, subtentorial tumors and young patients [7,9-10]. PFB subgroup tumors are rarely invasive or metastatic and are unlikely to recur [1]. Despite that, also for PF ependymomas full spinal MRI is extremely important to rule out spinal cord metastases [7].

The present case clearly suggests that defining the extent of the disease pre-operatively and a gross total excision followed by radiotherapy should be the standard of care. This case shows a favorable outcome: the patient received two successful procedures with no obvious surgical-related complications. Undoubtedly, gross total tumorectomy should be regarded as the criterion standard, even with non-conservative surgical approaches [11-12].

Radiotherapy is an essential component of the treatment, especially for a WHO grade III intracranial tumor. Ideally, physicians aim to start post-operative radiotherapy within 5 weeks after surgery to maximize its effectiveness [4]. However, the postoperative recovery or the need for second look surgery can delay the initiation of adjuvant therapy [13]. For this reason, the laminoplasty is scheduled for a month after the end of the radiation therapy. We will aim to report the long-term follow-up of this rare and interesting case.

Conclusion

This intricate case of PF ependymoma with spinal metastasis underscores the challenges and complexities inherent in the diagnosis and management of rare CNS tumors. It also exemplifies the critical importance of a multidisciplinary treatment approach that integrates precise surgical techniques, advanced radiotherapy, and a nuanced understanding of the tumor's molecular and anatomical profile to achieve optimal outcomes. This case contributes significantly to the existing knowledge on the management of ependymomas, particularly those with unusual presentations and metastatic spread.

Acknowledgement: The authors acknowledge the contribution of the Pathology Unit, Azienda Ospedaliera Santa Maria di Terni, and the Medical Oncology and Cancer Prevention Unit, Centro di Riferimento Oncologico di Aviano (CRO)

Authors contribution to this paper: PG: Conceptualization, Writing – Original Draft; GB: Data Curation, Writing – Review & Editing; EC: Data Curation, Writing – Review & Editing; MM Data Curation, Writing – Review & Editing; VG Data Curation, Writing – Review & Editing; CC: Supervision, Writing – Review & Editing. All authors approved the final version of the manuscript

Consent for publication: Written informed consent for publication was obtained from the patient. His information has been deidentified to the best of our ability to protect his privacy.

Source of funding: This study was not funded

References

1. Larrew T.; Saway B.F.; Lowe S.R.; Olar A. Molecular Classification and Therapeutic Targets in Ependymoma. Cancers (Basel) 2021 Dec 10;13(24):6218. doi: 10.3390/cancers13246218.
2. Kresbach C.; Neyazi S.; Schüller U. Updates in the classification of ependymal neoplasms: The 2021 WHO Classification and beyond. Brain Pathol 2022 Jul;32(4): e13068. doi: 10.1111/bpa.13068.
3. Cavalli F.M.G.; Hübner J.M.; Sharma T.; Luu B.; Sill M.; Zapotocky M.; Mack S.C.; Witt H.; Lin T.; Shih D.J.H.; Ho B.; Santi M.; Emery L.; Hukin J.; Dunham C.; McLendon R.E.; Lipp E.S.; Gururangan S.; Grossbach A.; French P.; Kros J.M.; van Veelen M.C.; Rao A.A.N.; Giannini C.; Leary S.; Jung S.; Faria C.C.; Mora J.; Schüller U.; Alonso M.M.; Chan J.A.; Klekner A.; Chambless L.B.; Hwang E.I.; Massimino M.; Eberhart C.G.; Karajannis M.A.; Lu B.; Liau L.M.; Zollo M.; Ferrucci V.; Carlotti C.; Tirapelli D.P.C.; Tabori U.; Bouffet E.; Ryzhova M.; Ellison D.W.; Merchant T.E.; Gilbert M.R.; Armstrong T.S.; Korshunov A.; Pfister S.M.; Taylor M.D.; Aldape K.; Pajtler K.W.; Kool M., Ramaswamy V. Heterogeneity within the PF-EPN-B ependymoma subgroup. Acta Neuropathol 2018 Aug;136(2):227-237. doi: 10.1007/s00401-018-1888-x.
4. Kouhen F.; Mjabbar R.; Alami R.; El Gouach H., Cherkaoui Jaouad M.R.; Benslima N.; Mahdi Y.; El Khannoussi B.; Fliyou F.; Errafiy N.; El Azhari A.; Ismaili N. Unusual location of myxopapillary ependymoma in the sacrum: Case report and review of the literature. Radiol Case Rep 2024 Jan 20;19(4):1489-1495. doi: 10.1016/j.radcr.2023.12.010.

5. Träger M.; Schweizer L.; Pérez E.; Schmid S.; Hain E.G.; Dittmayer C.; Onken J.; Fukuoka K.; Ichimura K.; Schüller U.; Dührsen L.; Müther M.; Paulus W.; Thomas C.; Gutt-Will M.; Schucht P.; Maragkou T.; Schittenhelm J.; Eckert F.; Niyazi M.; Fleischmann D.F.; Dorostkar M.M.; Feyer P.; May S.A.; Moskopp D.; Badakhshi H.; Radke C.; Walter J.; Ehret F.; Capper D.; Kaul D.
6. Rudà R.; Reifenberger G.; Frappaz D.; Pfister S.M.; Laprie A.; Santarius T.; Roth P.; Tonn J.C.; Soffietti R.; Weller M.; Moyal E.C. EANO guidelines for the diagnosis and treatment of ependymal tumors. Neuro Oncol. 2018 Mar 27;20(4):445-456. doi: 10.1093/neuonc/nox166.
7. Zhao C.; Wang C.; Zhang M.; Jiang T.; Liu W.; Li W. Primary cerebellopontine angle ependymoma with spinal metastasis in an adult patient: A case report. Oncol Lett 2015 Sep;10(3):1755-1758. doi: 10.3892/ol.2015.3409.
8. Ambekar S.; Ranjan M.; Prasad C.; Santosh V.; Somanna S. Fourth ventricular ependymoma with a distant intraventricular metastasis: Report of a rare case. J Neurosci Rural Pract 2013 Aug;4(Suppl 1): S121-4. doi: 10.4103/0976-3147.116444.
9. Chao M.M.; Packer R.J.; Myseros J.S.; Rood B.R. Isolated extracranial recurrence of anaplastic ependymoma. Pediatr Blood Cancer 2011 Feb;56(2):317-8. doi: 10.1002/pbc.22764.
10. Liu X.; Sun B.; Xu Q.; Che X.; Hu J.; Gu S.; Shou J. Outcomes in treatment for primary spinal anaplastic ependymomas: a retrospective series of 20 patients. J Neurosurg Spine 2013 Jul;19(1):3-11. doi: 10.3171/2013.3.SPINE12183.
11. Shen C.; Li T.; Qi Z.; Zhong J.; Shi Z.; Yang B. Ten-Segment Intramedullary Ependymoma and Whole Spinal Syringomyelia. World Neurosurg 2020 Jul:139:20-22. doi: 10.1016/j.wneu.2020.03.149.
12. Visocchi, Massimiliano, et al. "10 Levels thoracic no-intrumented laminectomy for huge spontaneous spinal subdural hematoma removal. Report of the first case and literature review." International Journal of Surgery Case Reports 15 (2015): 57-62.
13. Shah S.; Gates.; Mallory C.; Rubens M.; Maher O.M.; Niazi T.N.; Khatib Z.; Kotecha R.; Mehta M.P.; Hall M.D. Effect of Postoperative Radiation Therapy Timing on Survival in Pediatric and Young Adult Ependymoma. Adv Radiat Oncol 2021 Mar 26;6(4):100691. doi: 10.1016/j.adro.2021.100691.