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Case Report

Medulloblastoma with Metastasis in the Right Temporoparietal Region: A Case Report and Literature Review

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Abstract

Medulloblastoma (MB) is a malignant neoplasm that is relatively common in children but rare in young adults, accounting for less than 1% of all intracranial tumors. This study reports a rare case of MB metastasis to the right temporoparietal region in a 42-year-old woman, presenting with focal neurological symptoms such as weakness in the left arm and leg, speech disturbances, and impaired coordination. The patient had a history of cerebellar MB and underwent surgical resection, radiation therapy, and chemotherapy. Despite treatment, metastasis occurred, highlighting the diagnostic and therapeutic challenges in adult MB cases. The article also reviews the literature on MB in young adults, emphasizing the importance of dynamic neuroclinical monitoring and timely instrumental diagnosis for early detection and management of MB metastases.

Introduction

Medulloblastoma (MB) is one of the most common central nervous system (CNS) tumors of embryonal origin.[1] MB is a malignant neoplasm that occurs relatively frequently in pediatric patients but represents only a small fraction of brain tumors in young adults. The incidence of adult MB is less than 1% of all intracranial tumors in adults.[2] The peak age of diagnosis in children is between three and six years, and only about 25% of cases occur in patients aged 15 to 44 years.[3] Advances in molecular profiling have revealed significant heterogeneity among MBs, leading to the identification of four distinct subgroups, which represent separate disease entities both biologically and clinically.[4] MB rarely metastasizes outside the CNS but almost exclusively spreads to the spinal and intracranial leptomeninges, with dissemination occurring directly through cerebrospinal fluid. However, there is also an alternative route of MB metastasis through the bloodstream, then spreading to the leptomeningeal membrane.[5]

Over the past ten years, approximately 4,000 publications related to MB have been identified, including a limited number of retrospective case reports on adult MB, disease recurrence, and studies focused on molecular, genetic, radiological, and etiopathogenetic characteristics, along with reviews of modern MB classifications.[6] Reports of MB in adults remain relatively limited, which may reflect both its low prevalence and potentially insufficient diagnosis due to the non-specific clinical presentation in adults.

A search for MB cases in young patients in Russia revealed only two clinical reports of adult MB, in patients aged 27 and 29 years, respectively.[7,8] In adult patients, the Sonic Hedgehog subtype is the most common, followed by the Wingless subtype and Group 4.[1] The five-year overall survival rate ranges from 60% to 80%, depending on the MB subtype.[6] Treatment resistance remains a significant challenge. Moreover, the lack of prospective randomized controlled trials in adult patients creates an important research gap regarding therapeutic efficacy. MB predominantly spreads through cerebrospinal fluid pathways, producing leptomeningeal and drop metastases along the spinal axis. Parenchymal and ventricular seeding is less common but well-documented. Extraneural metastases to bones, bone marrow, lungs, or lymph nodes are rare. In adults, recurrent MB most often presents in metastatic

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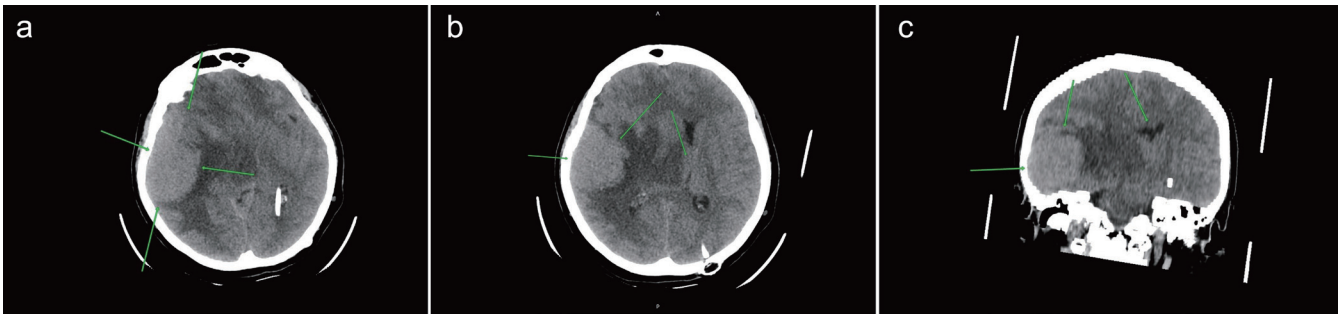

Fig. 1. Space-occupying lesion in the right temporal lobe parenchyma. On a series of non-contrast brain computed tomography scans, a homogeneous hyperdense lesion with well-defined margins is visualized within the right temporal lobe parenchyma (a), surrounded peripherally by a hypodense zone representing brain tissue edema (February 2, 2022). There is displacement of midline structures to the left (b), along with compression and deformation of the ventricular system (c).

form and is associated with poor prognosis.[4] Given the rarity of MB metastasis in adults in the Russian literature, this study aims to contribute a clinical case of an adult patient with CNS metastasis of MB in Russia and to summarize reported cases of MB in young adults worldwide over the past ten years.

Case presentation

A 42-year-old female patient was admitted to the neurosurgical department of the State Budgetary Institution of Healthcare of the Republic of Bashkortostan, City Clinical Hospital No. 21 in Ufa (Russia) on February 2, 2022, in critical condition, and was transferred to the neurosurgical intensive care unit. Upon admission, the patient complained of severe headaches, weakness in the left arm and leg, speech disturbances, impaired coordination, and generalized weakness. She was examined by both a neurosurgeon and a neurologist.

According to the medical history, headaches and dizziness first appeared in 2020. Brain magnetic resonance imaging (MRI) revealed a cerebellar neoplasm and signs of hydrocephalus. The patient underwent ventriculoperitoneal shunt surgery. The patient was then regularly monitored by a neurosurgeon, oncologist, and neurologist at her local outpatient clinic. On March 2, 2021, due to negative dynamics, clinical picture, and instrumental data, she underwent surgical intervention—posterior cranial fossa craniotomy with subtotal resection of a cerebellar MB. Histological examination (No. 760k21.1.-7) confirmed MB with necrosis and desmoplastic foci, Grade IV. From April 16 to May 31, 2021, the patient received external beam radiation therapy according to a radical protocol for craniospinal irradiation, delivered with an Elekta-Infinity (Sweden) apparatus (6–10 MeV). The fraction dose was 2 Gy per day, five fractions per week. The total focal dose was 22 Gy for the spinal cord and 54 Gy for the cerebellar tumor bed over seven weeks.

Her past medical history included duodenal ulcer disease in remission. Allergological history was negative. Gynecological history: menarche at age 13, menstruation lasting three to five days with a cycle of 27–28 days; the last menstrual period occurred in 2019. Tests for hepatitis B surface antigen and human immunodeficiency virus antigens were negative, as was the rapid plasma reagin (anticardiolipin) test. She had previously contracted COVID-19 caused by SARS-CoV-2, which resulted in 15% lung parenchyma involvement.

On admission, her neurological status was as follows: palpebral fissures equal (D=S), pupils equal (OD=OS) with preserved light reaction, normal ocular movements without nystagmus or diplopia; slightly asymmetrical nasolabial folds; tongue deviated to the left; moderate dysarthria and reduced pharyngeal reflex. Tendon reflexes were hyperactive on the left in both upper and lower extremities, while abdominal reflexes were diminished. Muscle tone was normal, with muscle strength of 3/5 on the left (upper and lower limbs) and 5/5 on the right. Pathological reflexes included positive Babinski and Rossolimo signs on the left. No sensory disturbances were noted, and meningeal signs were questionable. Coordination testing revealed an intention tremor on the left; the Romberg test was not performed due to moderate central hemiparesis. Clinical scales: Visual Analog Scale, 70 mm; Rivermead Mobility Index, 1 point; modified Rankin Scale, 4 points. Laboratory findings: leukocytosis and elevated erythrocyte sedimentation rate. Complete blood count showed erythrocytes 4.1×10^{12}/L, leukocytes 14.9 $\times$ 10^9/L, platelets 388×10^3/L, hemoglobin 121 g/L, erythrocyte sedimentation rate 31 mm/h. Coagulation profile indicated hypocoagulability (international normalized ratio 1.5, activated partial thromboplastin time 37.4 sec, soluble fibrin-monomer complexes 9.0 mg/%). Blood type: 0(I) Rh(+). Urinalysis was unremarkable. Biochemical analysis revealed hypoproteinemia (61 g/L). Electrocardiography demonstrated a sinus rhythm with a heart rate of 70 bpm. A computed tomography (CT) scan of the brain revealed a space-occupying lesion in the right temporal region with a hemorrhagic component in adjacent areas. Lateral displacement of midline structures to the left was noted. The patient was in a postoperative state following craniectomy with occipital bone trephination. (Fig. 1).

The patient was clinically diagnosed with a bulky mass in the right temporal lobe of the brain (suspected metastasis), with moderate left-sided central hemiparesis and mild dysarthria. She had previously undergone trepanation of the posterior cranial fossa and ventriculoperitoneal shunting. Complications included dislocation syndrome and occlusive internal hydrocephalus.

On February 5, 2022, a team of neurosurgeons performed trepanation of the right temporal region with removal of the brain tumor. The biopsy material was sent for histological examination. According to the histological results (No. 763k22.1-10), connective tissue proliferation and blood vessels of various calibers were present. Collagen and reticulin fibers were closely associated with the vascular walls and the pia mater. In some areas, the fibers were loosely arranged, surrounding individual clusters of tumor cells; in other regions, they formed large septa, giving the tumor a lobulated architecture. A significant number of "pale islands" were observed—rounded clusters of cells with optically clear cytoplasm.

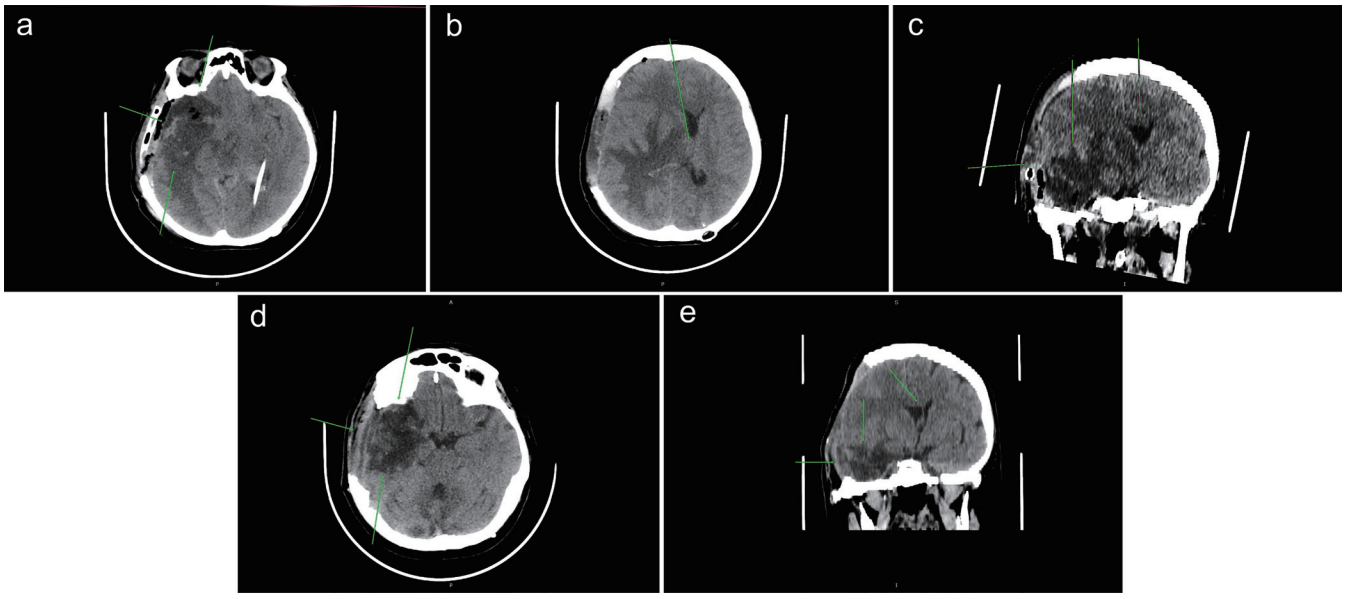

Fig. 2. Postoperative state after decompressive craniectomy in the right temporal region and removal of a space-occupying lesion in the right temporal lobe parenchyma (a) (February 6, 2022). Displacement of midline structures to the left (b), compression (c), and deformation (d) of the ventricular system are observed (e).

Within the prominent connective tissue component, these "pale islands" represented aggregates of tumor cells. The histological findings confirmed metastasis of desmoplastic MB. Postoperatively, the patient's neurological status showed mild central hemiparesis, right-sided oculomotor nerve neuropathy, and regression of mild dysarthria.

A dynamic CT scan of the brain performed after surgery revealed bone resection trepanation of the right temporoparietal skull region and removal of the bulky mass. Hypodense zones were noted in the parenchyma of the right frontal, temporal, and occipital lobes (secondary ischemia and cerebral edema), along with pneumocephaly. There was a displacement of midline structures to the left. Findings also included the postoperative state after bone resection trepanation in the left occipital region, with a bone defect measuring 43 × 25 mm, and postoperative changes after ventricular bypass surgery (Fig. 2). An MRI scan of the brain performed on March 5, 2022, demonstrated postoperative changes following tumor resection in the right temporal lobe and cerebellum (2022), as well as the previously placed ventriculoperitoneal shunt (2020) (Fig. 3).

On June 23, 2022, the patient was discharged for outpatient follow-up under the care of a neurosurgeon, oncologist, and neurologist with the following clinical diagnosis: space-occupying lesion of the right temporal lobe of the brain (metastasis), accompanied by mild left-sided central hemiparesis, right-sided oculomotor nerve neuropathy, and cerebellar ataxia. At discharge, the patient scored 20 mm on the Visual Analog Scale, 12 points on the Rivermead Mobility Index, and 2 points on the modified Rankin Scale.

In April 2022, the patient underwent a palliative course of external beam radiation therapy. Volumetric modulated arc therapy was delivered with an individual thermoplastic mask for fixation. A single fraction dose of 2.0 Gy was prescribed, in a 5-fraction regimen, three times per week. In June 2022, she received one cycle of antitumor chemotherapy according to the following regimen: SH1110—cisplatin 25 mg/m^2 on days 1–4 and etoposide 80 mg/m^2 on days 1–4, repeated every 21 days, calculated based on her height of 164 cm and weight of 81 kg.

On July 4, 2022, the patient presented to the clinic's therapist with complaints of deteriorating health, general weakness, and fever up to 37.5°C. She was diagnosed with an acute upper respiratory tract infection and received treatment recommendations. However, her condition rapidly worsened, and she developed acute respiratory failure. The patient unfortunately passed away on July 5, 2022.

Discussion

In adult MB patients, guidelines for diagnosis and treatment are based on pediatric practice as well as retrospective data analysis, highlighting the lack of a unified registry for adult MB cases.[9] Despite the recent establishment of a 934-patient MB database by Wang *et al*.,[10] the scarcity of adult-onset cases underscores the continued importance of reporting individual cases.

According to a literature search on adult MB, we summarized new cases from the last 10 years worldwide (2016–2025) in Tables 1 and 2.[7,8,11–18] When analyzing the cases, it was noted that symptoms in young adults developed over one to five months, with an average of two to three months, and that metastases appeared on average after 2.5 years. Symptoms such as headache, nausea, vomiting, and dizziness were common complaints at the initial doctor visit, as in our case. The main complaint of young patients with MB was headache of varying intensity, along with dizziness and loss of balance, which is reflected in Table 1. Metastases in the brain and spine were detected one to five years after diagnosis, with an average of two to three years. MB in adults is mainly represented by classical and desmoplastic histological subtypes (Table 2). According to Table 1, in desmoplastic MB, tumor metastases were detected in the brain parenchyma, lymph nodes, spine, and flat bones.

Immunohistochemical analysis is necessary to determine specific parameters of MB. These may include a positive reaction to synaptophysin, membrane and cytoplasmic reactions, a lack of re-

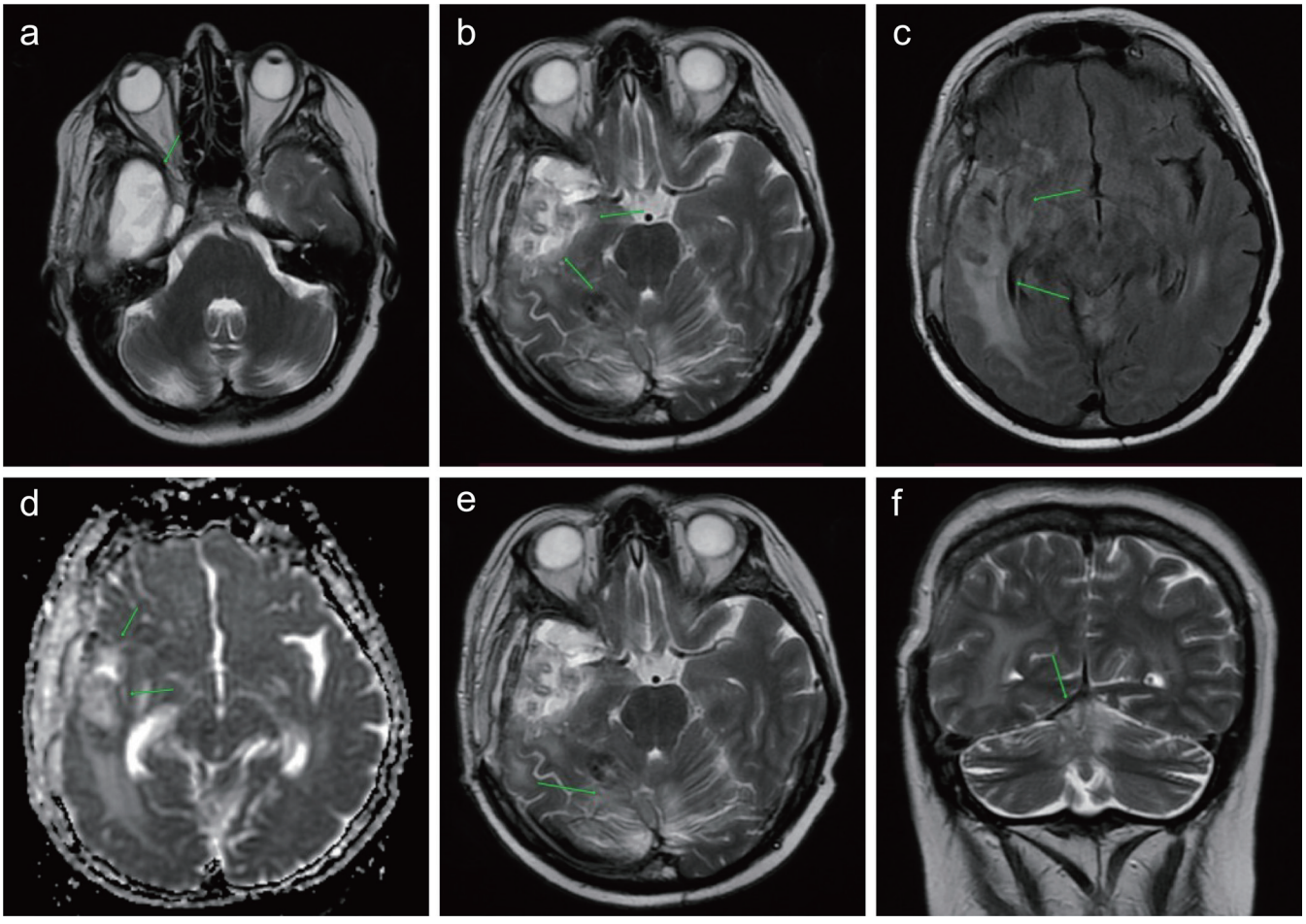

Fig. 3. Postoperative state after tumor resection in the right temporal lobe (March 5, 2022). In the right temporal lobe, a pathological zone with unclear margins is identified, including a cyst (a), residual tumor (b), and a gliosis-affected area visible on T2-weighted image (T2WI) and fluid attenuated inversion recovery (FLAIR) sequences with surrounding perifocal edema (c) and signs of restricted diffusion on diffusion-weighted imaging (DWI) (d). In the region of the cerebellar vermis and right cerebellar hemisphere, a zone of cystic-gliotic changes is identified (e, f). Displacement of midline structures is also observed (f).

action to β-catenin, and a high proliferative activity index, among others. This is important because MB may resemble other embryonic tumors on histological examination, such as neuroblastoma, atypical teratoid–rhabdoid tumor, primitive neuroectodermal tumor, or ganglioneuroblastoma.[19,20]

Molecular genetic analysis determines not only the amplification of MYCN or MYC but also the clustering of gene expression characteristic of MB. Vo *et al*.[11] reported a case of a 21-year-old woman with MB in which DNA methylation and gene expression clustering provided inconclusive classification. However, they identified a heterozygous somatic loss-of-function mutation in the E3 ligase BIRC2, another E3 ubiquitin ligase that interacts with TRAF2. This finding makes the case unique and provides opportunities for further study of MB biopsy sites and for expanding the research panel, as summarized in Table 2. Molecular-genetic identification of MB subtypes can aid in risk stratification, prediction of disease progression, assessment of treatment sensitivity, and guidance of adjuvant therapy.[21]

MB is a heterogeneous brain tumor that occurs very rarely in adults, particularly in those over 40 years of age, accounting for less than 1% of all primary brain tumors in adults.[2] Its clinical presentation is diverse and depends on localization. The management of MB in pediatric patients differs significantly from that in adults, encompassing not only molecular characteristics but also therapeutic response, tolerability, and resistance to treatment. These distinctions underscore the need for more tailored approaches to adult MB care. In our case, the patient developed focal neurological symptoms, initially raising suspicion for an acute cerebrovascular event. A thorough history suggested two possible diagnoses: MB metastasis or tumor recurrence. The definitive diagnosis was established by histological examination of a surgical biopsy, which confirmed MB metastasis.

MB metastases most commonly occur in the spinal cord and its coverings, and less frequently in the cerebral hemispheres and ventricular system, due to cerebrospinal fluid pathways.[5] There are relatively few publications in both international and domestic literature regarding metastatic MB in adults; such reports are either presented as individual clinical cases or combined with analyses of pediatric MB metastases.[12] In this case, molecular-genetic subtyping was not feasible due to the unavailability of such testing in the hospital laboratory. A significant factor in survival analysis is the patient's age at diagnosis.[13] The nonspecific neurological symptoms of MB in adults can delay instrumental investigations and targeted treatment, constituting an unfavora-

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Table 1. Literature review of medulloblastoma cases in young adults over the past ten years (2016–2025)

№	Author/Year	Age/ Sex	Complaints	Neurological Status	Time interval from the onset of first symptoms to diagnosis (weeks)// metastasis (months)	Tumor localization/Metastasis	Surgical treatment	Radiation therapy/ Chemotherapy	Outcome
1	Faried *et al.*[12]/ Indonesia 2016	33/M	Periodic headache for 1 year, blurred vision in both eyes for 5 months	Visual acuity in both eyes was 3/60 without optic disc edema	20/–	Posterior cranial fossa/none	+	Unspecified/ Unspecified	Alive
2	Saad *et al.*[14]/USA 2017	41/M	Rapidly increasing headache, dizziness	Unspecified	4/–	Vermis and bilateral hemispheres, bilateral caudate nuclei, left temporal lobe/none	-	Unspecified/ Unspecified	Unspecified
3	Al Anazi *et al.*[15]/Saudi Arabia 2017	31/M	Headaches, nausea, visual impairment	Unspecified	4/–	The right lobe of the cerebellum/none	+	-/Unspecified	Unspecified
4	de Oliveira *et al.*[13]/ USA 2018	19/F	Headache, vomiting	Ataxia, dysmetria, and intentional tremor	8/–	The left hemisphere of the cerebellum/none	+	+/–	Unspecified
5	Kit *et al.*[7]/ Russia 2021	27/F	Weakness in the right arm, dizziness, pain in the bones	Unspecified	Unspecified/10	The right hemisphere of the cerebellum/multiple metastatic lesions of bones, intrathoracic, retroperitoneal, axillary lymph nodes, and the right ovary	+	+/Unspecified	Unspecified
6	Baranova *et al.*[8]/ Russia 2022	29/F	Headaches, tremors, weakness	Diplopia	12/–	The cerebellar worm/none	+	Unspecified/ Unspecified	Unspecified
7	Liserre *et al.*[16]/Italy 2023	26/M	Headache, vomiting, unstable posture	Cerebellar syndrome, nystagmus	4/–	The left hemisphere of the cerebellum/None	+	+/Unspecified	Alive
8	Vo *et al.*[11]/ USA 2024	21/F	Headache, dizziness accompanied by nausea, difficulty walking, unstable posture	Ataxia, emotional lability, mutism	3/–	Posterior cranial fossa/None	+	+/+	Alive
9	Zaresharifi *et al.*[17]/ Iran 2024	39/M	Dizziness, loss of balance, difficulty walking, nausea and vomiting	Cerebellar syndrome	Unspecified/84	Posterior cranial fossa/ Metastases to the spine, ribs, sternum, proximal bilateral humerus, pelvic bones, and proximal bilateral femurs	+	+/+	Alive
10	Maireche *et al.*[18]/ Algeria 2025	22/M	Headache,	Ataxia, Unsteady gait	3/–	The left place is the cerebellar angle/multiple metastases at various levels of the cervical, thoracic, and lumbar spine	+	Unspecified/ Unspecified	Unspecified
11	Yasinskaya *et al.*/Russia 2025	42/F	Headache, loss of coordination, weakness in the left arm and leg, speech impairment	Dysarthria, left-sided hemiparesis of the central type	8/11	Posterior cranial fossa/Metastasis of the right temporal lobe	+	Radiation therapy/ Chemotherapy	Fatal outcome

Table 2. Characteristics of medulloblastoma cases in young adults over the past ten years (2016–2025)

№	Author/Year	Age/Sex	Histological characteristics	Immunohistochemical diagnosis	Molecular study
1	Faried *et al.*[12]/ Indonesia 2016	33/M	Classic type	Positivity for synaptophysin, glial fibrillary acidic protein (GFAP), and smooth muscle actin	Unspecified
2	Saad *et al.*[14]/ USA 2017	41/M	Classic type	Synaptophysin +. INI-1 immunostaining was retained in the tumor cells. β-catenin immunostaining showed cytoplasmic positivity with no nuclear staining. The tumor cells showed nuclear and cytoplasmic positivity for YAP1 and strong cytoplasmic positivity for GAB1	Revealed monosomy of chromosome 14, loss on chromosome 11q21 (35Mb), gain on chromosome 19p13.3 [STK11 gene (602216), 7.5Mb] and loss of heterozygosity on chromosome 8p11p23 (40Mb). In addition, we found loss on chromosome 10p11.23 [MAP3K8 gene (191195)], 19q13.2 [PRX gene (605725)], and 13q34 [RASA3 gene (605182)]
3	Al Anazi *et al.*[15]/ Saudi Arabia 2017	31/M	Classic type	Ki67 Proliferative Activity Index: 80%	Unspecified
4	de Oliveira *et al.*[13]/USA 2018	19/F	Classic type	Conducted	No MYCN amplification or TP53 mutation was detected
5	Kit *et al.*[7]/ Russia 2021	27/F	Classic type	Synaptophysin+/−, GGAP-/+, S-100-/+, β-Catenin +/−, membrane-cytoplasmic reaction +, Ki67 proliferative activity index: 70%	Unspecified
6	Baranova *et al.*[8]/ Russia 2022	29/F	Classic type	Synaptophysin + , Membrane expression CD56, Ki67 Proliferative Activity Index: 90%	Unspecified
7	Liserre R. *et al.*[16]/Italy 2023	26/M	Classic type	IN-1 and ATRX expression is conserved, Cytoplasmic immunoreactivity for GFAP(Glial fibrillary acidic protein)), GAB 1, AP 1, β-Catenin -, Ki67 proliferative activity index: 30%	IN or MIC amplification and/or deletion of chromosome 9q (PTCH1). It was detected in both components, although in different allele fractions (26% vs. 12.4%; GFAP-enriched and GFAP-negative components of MB, respectively), the GNAS mutation was detected only in the GFAP-negative component of MB
8	Vo. *et al.*[11]/ USA 2024	21/F	Classic type	Synaptophysin, +, Membrane, immunoreactivity + on β-Catenin -, combined nuclear and cytoplasmic positivity for YAP1, spot-positive for p75-NGFR. The Ki67 proliferative activity index has increased	Inconclusive data in the classification of DNA methylation and clustering of gene expression, but a heterozygous somatic LOF mutation was found in E3 BIRC2 ligase, another E3 ubiquitin ligase that interacts with TRAF2
9	Zaresharifi *et al.*[17]/Iran 2024	39/M	Desmoplastic type	Synaptophysin +, GFAP(Glial fibrillary acidic protein)+, D2–40 +, ATRX +, β-catenin (cytoplasmic) +, Ki67: Ki67 Proliferative activity index: 50%	Unspecified
10	Maireche *et al.*[18]/ Algeria 2025	22/M	Unspecified	Unspecified	Unspecified
11	Yasinskaya A.S. *et al.*/Russia 2025	42/F	Desmoplastic type	Not carried out	Not carried out

AP 1, activator protein 1; ATRX, alpha-thalassemia/mental retardation X-linked; BIRC2, baculoviral IAP repeat-containing protein 2; CD56, NCAM1 (neural cell adhesion moecule 1, CD56); GAB, 1, growth-factor receptor-bound protein 2 associated Binder 1; GFAP, glial fibrillary acidic protein; GGAP, GTPase-activating protein and guanine nucleotide-binding; GNAS, Guanine nucleotide binding protein, alpha stimulating; IN-1, integrase interactor 1; LOF, loss-of-function; MB, medulloblastoma; MIC, minimum inhibitory concentration; MYCN, Myc proto-oncogene protein; NGFR, nerve growth factor receptor; TP53, tumor protein P53; TRAF2, tumor necrosis factor receptor-associated factor 2 ; YAP1, Yes-associated protein 1.

ble prognostic factor.

We present here a single clinical case without molecular or genetic profiling of the tumor, which limits our ability to stratify the patient's risk and predict treatment response with precision. Consequently, the findings cannot be generalized to the broader population.

Conclusions

The metastasis of MB to the CNS represents a serious clinical and diagnostic challenge. In our report, the development of focal neurological symptoms could indicate either an acute cerebrovascular accident or tumor recurrence, given the patient's medical history. It is important to note that the diagnosis and confirmation of MB in our case relied on neurological examination, CT, and MRI, and, most importantly, immunohistochemical analysis of the tumor. Despite radiation therapy, two years after diagnosis, neurological deterioration was observed, and metastasis of desmoplastic MB occurred in the temporal region. We propose that molecular genetic testing of the MB subtype could help guide further treatment strategies and provide a more accurate prognosis.

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Conflict of interest

The authors declare that they have no known competing financial interests or personal relationships that could have influenced the work reported in this article.

Author contributions

Conceptualization, methodology, investigation of this study, data curation (ASY), formal analysis (AYN), drafting and editing of the manuscript (ASY, SMM, UAS), image analysis and preparation (BMD, ARK), literature review and tables preparation (ASY, BMD, SMM, UAS), validation, resources, and supervision (ASY, ARK, SMM). All authors participated in the review and editing of the manuscript and approved the final version for publication.

Ethical statement

This study was conducted in accordance with the ethical standards of the Medical Ethics Committee of Bashkir State Medical University and the 2024 Helsinki Declaration and its subsequent amendments. Patient information is presented in an anonymized manner. Written informed consent was obtained from the patient for the publication of this case report and accompanying images on June 7, 2022.

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