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# Medulloblastoma in Adults: Surgical Outcomes and Survival - A Single Center Analysis of 16 Patients

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## ABSTRACT

**AIM:** To look into the clinicopathological characteristics, surgical outcomes, and survival rates of adult patients with medulloblastoma.

**MATERIAL and METHODS:** Adult patients (age>17 years) who had surgery in our clinic with the diagnosis of cerebellar mass between 2009 and 2015 and whose pathological diagnosis was medulloblastoma were examined. The study was carried out retrospectively by analyzing the clinicopathological data, surgical outcomes, and complications of the patients. In the postoperative and follow-up periods, contrast-enhanced cranial magnetic resonance imaging (MRI) was used to assess the presence of recurrence or residual disease. Moreover, the overall 5-year survival rates of the patients were evaluated.

**RESULTS:** A total of 16 patients were diagnosed with medulloblastoma, with a mean age of 32.25 years old (age range 18–57 years). The tumor was found in the vermis in eight (50%) patients and the cerebellar hemispheres in the rest (50%) of them. Total excision was performed on 14 (87.5%) patients, near-total excision on 1 (6.25%) patient, and subtotal excision on 1 (6.25%) patient. The histopathological results were consistent with desmoplastic type medulloblastoma in nine (56.25%) patients, classical type in six (37.5%) patients, and anaplastic medulloblastoma in one (6.25%) patient. All patients received posterior fossa boost dose + craniospinal radiotherapy after the surgery. Recurrent lesions were found in six (40%) of the patients. A total of ten (62.5%) patients were still alive, and mortality rate was found to be 25% (4 patients) at 5 years.

**CONCLUSION:** After 5 years, 10 of the 16 patients in our study were still alive. Lateral localization of the tumor, desmoplastic histologic variant, and total excision were all good prognostic indicators. Total excision is difficult in patients with brainstem invasion, and even if total excision is performed, the prognosis is poor.

**KEYWORDS:** Medulloblastoma, Adult, Desmoplastic, Adjuvant radiotherapy

## INTRODUCTION

Medulloblastomas are the most common type of malignant brain tumor in children. They are extremely rare in adults, accounting for less than 1% of all adult brain tumors. Due to the rarity of medulloblastoma in adults, adult medulloblastoma series usually contain fewer than 20 patients. Further, pediatric cases are generally reported to have a poor prognosis, with metastasis through the CSF and midline localization, whereas adult series, although few in number, report a higher percentage of hemispheric localization and a better prognosis (2,3,7).

The purpose of this study was to look into the clinicopathological characteristics, surgical outcomes, and survival rates of adult patients who diagnosed and treated with medulloblastoma.

## MATERIAL and METHODS

Patients who had surgery at our clinic between 2009 and 2015 and had pathology results consistent with medulloblastoma were investigated. The study was carried out retrospectively by analyzing the clinicopathological data of the patients. In the postoperative period and during follow-up, cranial MR with contrast was used to assess the presence of recurrence or residual disease. Each patient with a pathology diagnosis was evaluated by an oncologist, and adjuvant treatments were administered as needed.

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The study was approved by the University of Health Sciences Izmir Bozyaka Education and Research Hospital clinical investigation ethics committee (21.10.2020/13). All procedures in human participant studies were carried out in accordance with the ethical standards of the institutional and/or national research committee, as well as the 1964 Helsinki Declaration and its subsequent amendments or comparable ethical standards. Written informed consent was obtained from all individual participants included in the study.

### Statistical Analysis

All statistical analyses were performed using the Statistical Package for the Social Sciences (SPSS), version 22.0. In all tables, continuous variables were expressed as mean SPSS values.

## RESULTS

Between January 2009 and December 2015, a total of 16 adult patients were diagnosed with medulloblastoma, with 9 (56.2%) males and 7 (43.7%) females, with a mean age of 32.25 years and a range of 18–57 years. At presentation, the most common symptoms were headache (15 patients, 93.75%), dizziness (12 patients, 75%), imbalance or inability to walk (6 patients, 37.5%), nausea or vomiting (4 patients, 25%), and extremity paresis (3 patients, 18.75%). In seven (43.7%) patients, the neurological examination was normal. Moreover, pathological findings on neurological examination included a positive Romberg sign or dysmetria in four (25%) patients, monoparesis in two (12.5%) patients, hemiparesis in one (6.25%) patient, and deteriorating general condition, decreased consciousness, and respiratory distress in two (12.5%) patients. Further, imaging showed that the tumor was found in the vermis in eight (50%) patients and the cerebellar hemispheres in eight (50%) patients. Ventricular enlargement consistent with hydrocephalus was present in seven (43.7%) patients, tumor calcification in six (37.5%) patients, and brainstem involvement in two (12.5%) patients (Table I). In addition, one (6.25%) patient had spinal metastasis, but none of our patients had extraneural metastasis.

Patients with midline tumors had surgery in a sitting position in eight cases, while patients with cerebellar hemisphere tumors had surgery in a prone position in four cases, sitting position in two cases, and lateral decubitus position in two cases. Severe complications associated with venous air embolism, such as a decline in partial oxygen pressure or blood pressure, were not observed in our patients as a result of their sitting position. Total excision was performed in 14 (87.5%) patients, near-total excision in 1 (6.25%) patient, and subtotal excision in 1 (6.25%) patient (Table II). Regardless of whether or not the patients developed hydrocephalus, all were placed in an external ventricular drain (EVD). After 3 days of drainage, the drain was removed or converted into a ventriculoperitoneal shunt, depending on ventricular enlargement and EVD closure. In one patient with postoperative ventricular hemorrhage,

**Table I:** Demographic Characteristics, Imaging Findings, Pathological Types, and 5-Year Survival of Patients with Adult Medulloblastoma Who Had Undergone Surgery

| Patient no. | Age | Sex | Loc | Met | HDS | Pathology | Final situation |
|---|---|---|---|---|---|---|---|
| 1 | 20 | M | Vermis | - | + | Classical | Ex (Recurrence) |
| 2 | 24 | F | Lateral | - | - | Desmoplastic | Alive |
| 3 | 40 | M | Lateral | - | - | Desmoplastic | Alive |
| 4 | 42 | F | Vermis | - | + | Classical | Alive- Recurrence |
| 5 | 21 | M | Vermis | - | + | Classical | Alive- Recurrence |
| 6 | 30 | F | Vermis | - | - | Desmoplastic | Ex (Recurrence) |
| 7 | 30 | M | Lateral | - | + | Desmoplastic | Alive |
| 8 | 57 | F | Lateral | - | - | Desmoplastic | Alive |
| 9 | 23 | F | Vermis | - | + | Desmoplastic | Ex |
| 10 | 38 | F | Lateral | - | - | Classical | Alive- Recurrence |
| 11 | 25 | M | Vermis | - | - | Desmoplastic | Alive |
| 12 | 36 | F | Lateral | - | - | Desmoplastic | Alive |
| 13 | 43 | M | Vermis | + | + | Classical | Alive |
| 14 | 47 | M | Lateral | - | - | Desmoplastic | Ex (Recurrence) |
| 15 | 18 | M | Vermis | - | - | Anaplastic | Alive |
| 16 | 22 | M | Lateral | - | - | Classical | Alive |

***Loc:*** *Localization,* ***Met:*** *Metastasis,* ***HDS:*** *Hydrocephalus.*

**Table II:** Extent of Resection and 5-Year Follow-Up of Patients with Adult Medulloblastoma

| Extent of Resection | Number (%) |
|---|---|
| Total | 14 (87.5) |
| Near total | 1 (6.25) |
| Subtotal | 1 (6.25) |
| **Five-year follow-up** | |
| Alive | 10 (62.5) |
| Dead | 4 (25) |
| Lost to follow-up | 2 (12.5) |

the drainage catheter was kept longer, and the EVD was converted into a ventriculoperitoneal shunt in six (37.5%) patients, including this patient.

Due to postoperative early period hemorrhage at the surgical area and bleeding inside the fourth ventricle as a postoperative complication, two (12.5%) patients had repeat surgery. One of these patients died in the early period. After 1.5 months of intensive care stay, the second patient was discharged with cerebellar mutism. In three (18.7%) patients, there was wound discharge and development of meningitis. Their condition improved as a result of dual antibiotherapy and wound site monitoring. One (6.25%) patient had newly developed cranial nerve deficit. Moreover, hemiparesis and imbalance were also newly developed in one (6.25%) patient after surgery. During follow-up, one patient required repeat surgery for dura repair due to the development of a pseudomeningocele at the surgical area. In addition, the rate of postoperative mortality was 6.25%.

The histopathology result was consistent with desmoplastic-type medulloblastoma in nine (56.25%) patients, classical-type medulloblastoma in six (37.5%) patients, and anaplastic medulloblastoma in one (6.25%) patient (Table I). Furthermore, 11 cases were p53 immunonegative, while 5 cases were p53 immunopositive. Also, cytoplasmic B-catenin immunostaining was observed in 12 cases. In this study, most medulloblastomas were classified as sonic hedgehog tumors (6/16, 75%), followed by wingless (WNT) tumors (5/16) and group 3–4 tumors (5/16).

On the recommendation of the radiation oncologist or medical oncologist, all discharged patients received craniospinal radiotherapy + posterior fossa boost dose radiotherapy. Those who were at high risk during follow-up (any metastasis, T3b/T4 disease, postoperative residual tumor larger than 1.5 $cm^2$, recurrence in the imaging prior to RT) received adjuvant chemotherapy after radiotherapy. During follow-up,6 of the 15 (40%) patients had a recurrent lesion, all of which were in the posterior fossa. All of the recurrent lesions were less than 1.5 $cm^2$ in size and did not require repeat surgery. In addition, chemotherapy was added to the treatment of these patients. Furthermore, one patient with cerebellar mutism and one with hemiparesis were discharged after 5 years of follow-up, and one patient with chemotherapy added to the treatment due to recurrence died. The 5-year mortality rate was 25% (four patients). At the 5-year follow-up, ten (62.5%) patients were still alive. There were two patients who discontinued follow-up after no recurrence within the first 3 years (Table II).

The figures show examples of cases with bleeding into the surgical area (Figure 1), total excision (Figures 2 and 3), recurrence or residual disease (Figure 4), and complication development (Figure 5).

## DISCUSSION

Cerebellar medulloblastomas are the most common embryonic neoplasm of the pediatric age group, accounting for 25% of all primary central nervous system tumors in children. However, adult medulloblastomas are rare, accounting for less than 1% of all adult brain tumors. They are more common in adults aged 20–34 or 55–64 years and are twice as common in males (9,11,15). Our series also revealed male dominance, with a mean age of 30 years.

Classical medulloblastomas are typically found in the cerebellar vermis, but they show hemispheric localization and desmoblastic variants in adult patients. In our study, the desmoblastic variant was also prevalent (nine patients, 56.25%). Adult medulloblastomas have a better prognosis and are located laterally in 50% of cases (1,12). In our study, the rates of lateral and midline localization were the same. On the other hand, in pediatric patients, this rate is only 10% or less. Adult medulloblastomas, as opposed to pediatric cases, are thus more amenable to surgical resection and near-total resection. As adult medulloblastomas are much more commonly located laterally, the rate of hydrocephalus is also lower than in pediatric cases. Hydrocephalus was detected in the preoperative images seven (43.7%) patients in our series, and six of them were converted to a permanent V-P shunt.

The first and most important step of medulloblastoma treatment is surgery, with the goal of removing the maximum amount of tumor tissue without leaving a residual disease. One of the most important prognostic factors is the amount of postoperative residual disease (4,5,14). Furthermore, two patients in our series had brainstem infiltration and a midline mass, as well as fourth ventricular floor infiltration, and total excision was not possible. The postoperative outcomes of these patients were poor. Although no definitive conclusion was reached in the publications, patients with standard risk (no metastasis, postoperative residual tumor smaller than 1.5 $cm^2$ on craniospinal MR and CSF sample, no recurrence on imaging prior to RT) were recommended to undergo craniospinal RT + administration of boost dose RT to the posterior fossa. Patients at high risk (presence of any metastasis, T3b/T4 disease, postoperative residual tumor larger than 1.5 $cm^2$, recurrence on imaging prior to RT) were recommended to receive chemotherapy in addition to the previous treatment (8,10,13).

There were 29 patients aged 18 years or older in the adult medulloblastoma series of De B et al., with 19 patients

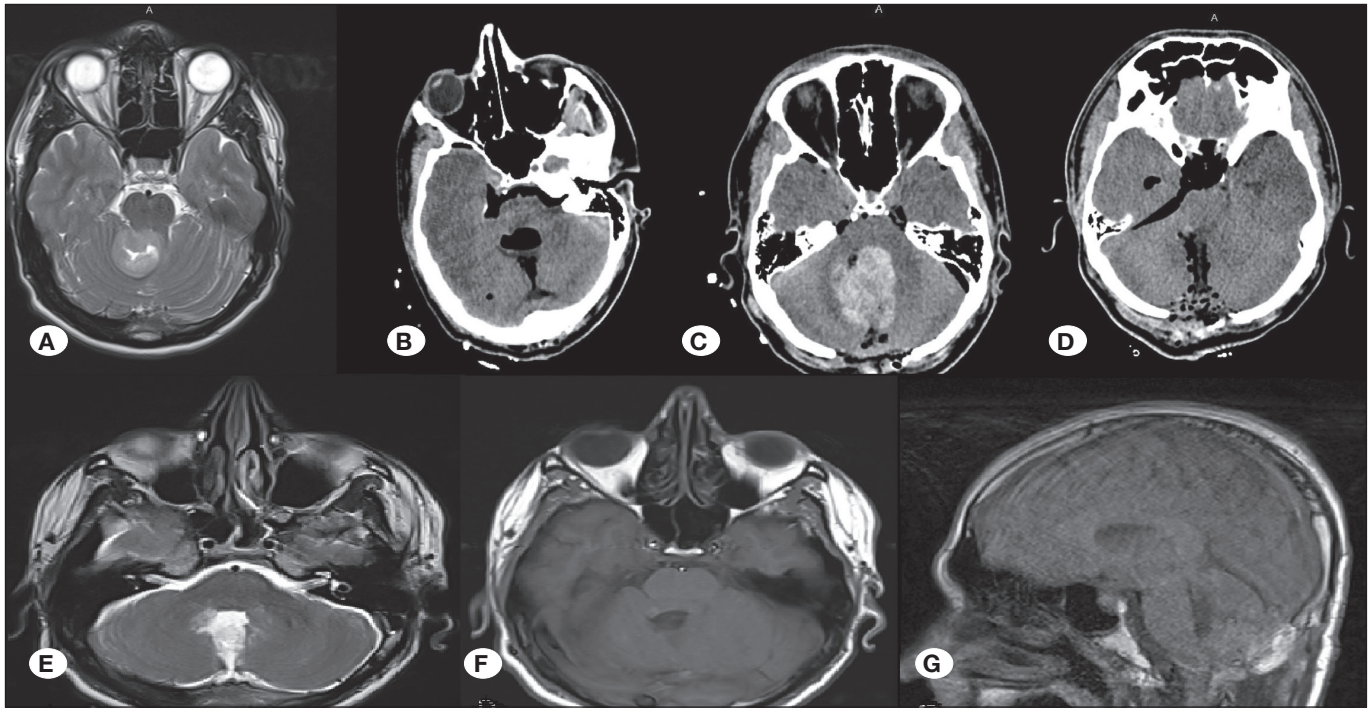


**Figure 1: A)** The axial section of the cranial T2W magnetic resonance imaging (MRI) shows a midline cerebellar mass with brainstem invasion. **B)** A postoperative early-stage cranial computed tomography (CT) reveals that the mass has been totally excised. **C)** The second CT scan after the seizure showing intraventricular hemorrhage. **D)** A follow-up CT scan of the patient who had undergone repeat surgery. A follow-up cranial MRI scan performed 1 month after surgery reveals that the mass has been totally excised (**E:** axial T2W, **F:** axial T1W contrast enhanced, **G:** sagittal T1W contrast enhanced).

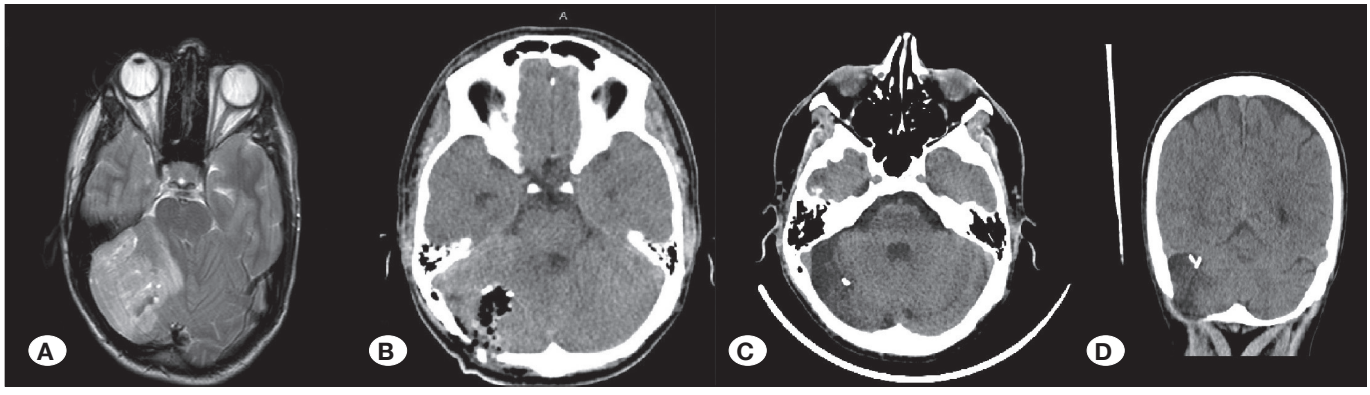


**Figure 2: A)** The axial section of the cranial T2W magnetic resonance imaging (MRI) shows a lateral cerebellar mass with brainstem invasion. **B)** A postoperative computed tomography (CT) scan reveals that the mass has been totally excised. The sixth year follow-up axial **(C)** and coronal **(D)** CT scan show no recurrence or residual disease.

undergoing gross total excision. During the 9-year follow-up, 23 (79.3%) patients who received craniospinal RT within 39 days were alive with no signs of disease. Another patient was alive and receiving treatment, while five others died (twopatients after progression of the disease and three patients due to complications of treatment, such as seizure, sepsis, lobar pneumonia, and leukopenia). Despite the fact that De et al. reported a fewer desmoblastic variants and fewer cases of total excision, the 9-year survival rate was quite high (6). Moreover, we had a 62.5% 5-year survival rate.

The limitation of the study were that its retrospective nature, and it only included a small number of patients. In addition, rather than being accompanied by molecular genetic results, we evaluated the survival in terms of neurosurgical outcomes.

## CONCLUSION

The number of series on adult medulloblastomas is small, as is the number of patients in each series. Although the treatment guidelines are unclear due to the small number of patients, all patients must undergo maximum mass removal

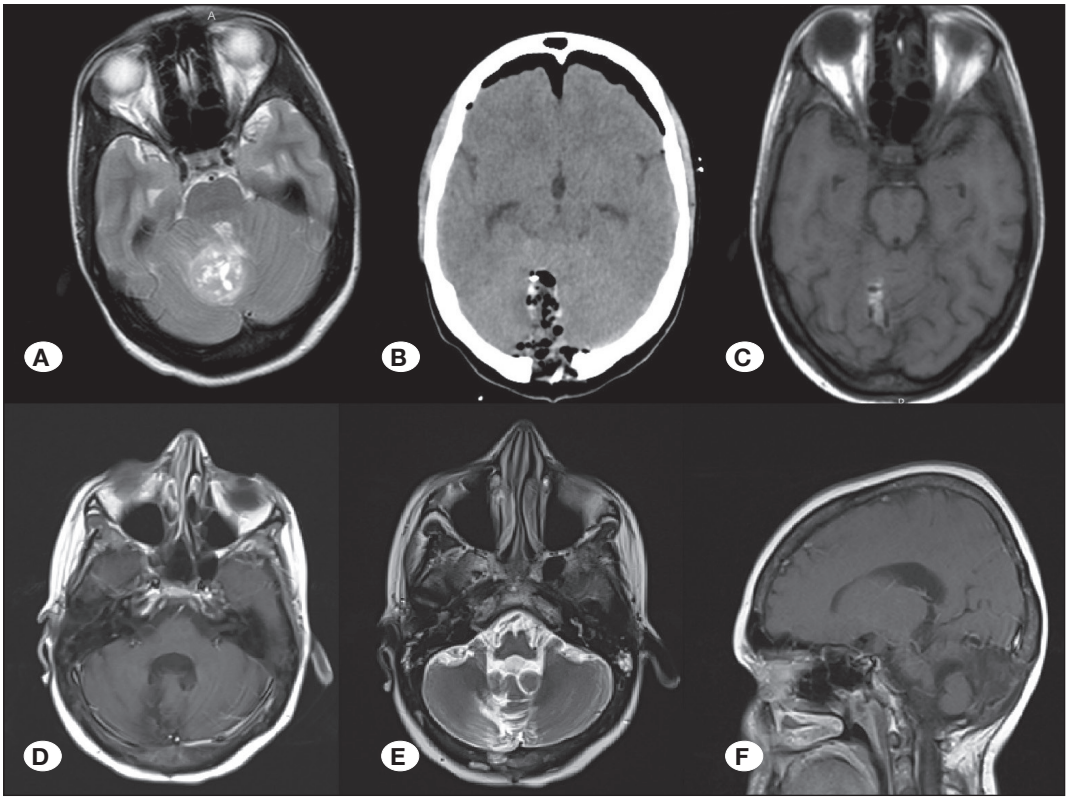


**Figure 3: A)** A midline cerebellar mass is visible in the axial section of T2W magnetic resonance imaging (MRI) scan. **B)** A postoperative axial computed tomography (CT) scan reveals that the mass has been totally excised. **C)** A postoperative first month follow-up axial T1W contrast enhanced MRI scan reveals that the mass has been totally excised. There is no recurrence or residual disease in the third year follow-up cranial MR scan (**D:** axial T1W contrast enhanced, **E:** axial T2W, **F:** sagittal T1W contrast enhanced).

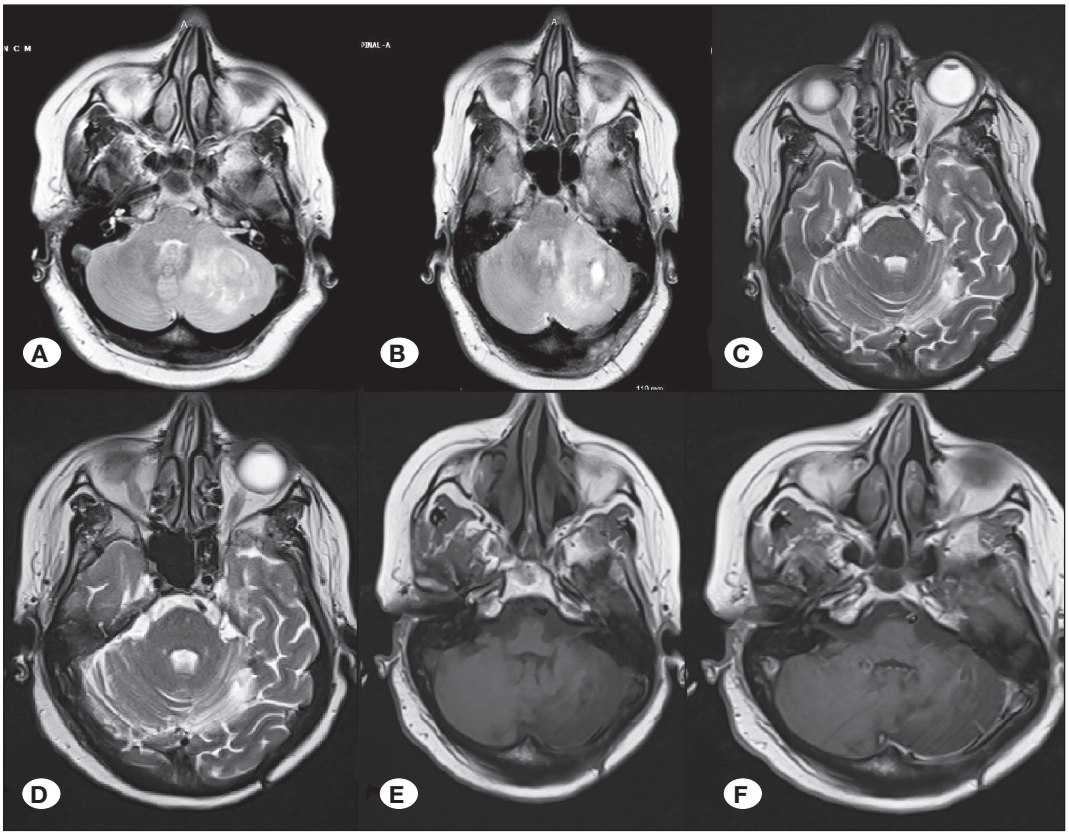


**Figure 4: A)** A lateral cerebellar mass is visible in the axial section of T2W magnetic resonance imaging (MRI) scan. **B–C)** Postoperative follow-up cranial axial T2W MRI scans show a residual mass less than 1.5 cm. No recurrence or residual disease is noted on the fifth year follow-up cranial MRI scans (**D:** axial T2W, **E and F:** axial T1W contrast enhanced).

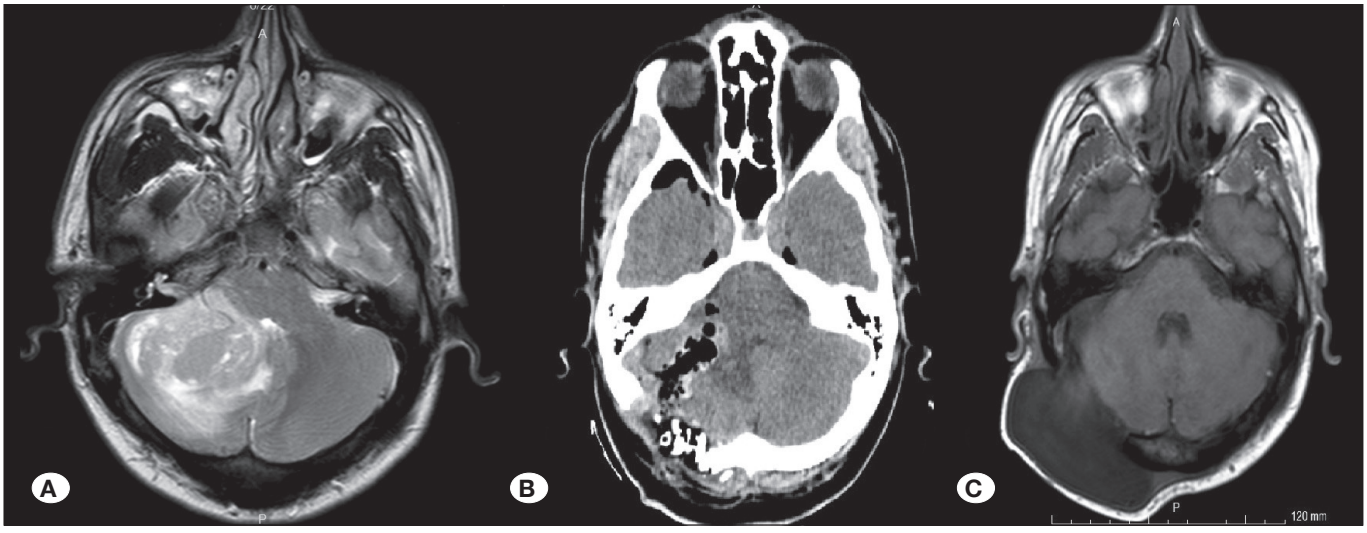


**Figure 5: A)** The axial section of the cranial T2W magnetic resonance imaging (MRI) sequence shows a cerebellar mass localized laterally but extending to the midline, with brainstem invasion. **B)** A postoperative axial computed tomography (CT) scan reveals that the mass has been totally excised. **C)** There is no recurrence or residual disease, but a pseudomeningocele appears at the surgical site in the postoperative first month (cranial axial T1W contrast enhanced MRI scan).

followed by craniospinal RT and boost dose RT in the posterior fossa, as well as simultaneous chemotherapy in high risk patients. Further, good prognostic indicators include a lateral localization, the desmoplastic histologic variant, and total excision. The presence of brainstem invasion and fourth ventricular floor invasion increases the risk of surgical complications, such as postoperative bleeding, and also indicates a poor prognosis. In both the previous series and our series, the rate of survival for 5 years or more was greater than 60%. Moreover, there were no severe complications as a result of the sitting position.

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