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Case report

# Third ventricle glioblastoma. Case report and review of literature

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**Abstract**

A glioblastoma presenting as a solitary third ventricle mass is exceptional.
*Case description* : We report the case of a 29-year-old woman who lost consciousness, was taken to hospital and referred a previous history of depression and diabetes insipidus. Magnetic resonance imaging study revealed a heterogeneous anterior third ventricle mass with ring enhancement after contrast administration. It was approached and subtotally resected by a transcortical-transventricular route and histological diagnosis proved it to be a glioblastoma. There are only two other similar well-described cases and another nine have been previously reported in surgical series of high grade gliomas and glioblastomas. The possible origin of this lesion is discussed.


*Keywords:* Glioblastoma; Third ventricle; Tumor origin hypothesis

## 1. Introduction

Although glioblastomas are the most frequent brain tumor, accounting for approximately 12–15% of all intracranial neoplasms and 50–60% of all astrocytic tumours [1], the presence of this tumor in the third ventricle can be considered exceptional. An exhaustive revision of both well described cases as well as cases cited in large third ventricle tumour or brain gliomas series yielded only eleven cases [2–7]. We present a case of a heterogeneous mass with ring enhancement located at the third ventricle that was approached and subtotally resected by a transcortical-transventricular route. The clinical and pathological findings are reviewed and the possible origin of this lesion is discussed.

## 2. Case report

The patient was a 29-year-old woman who was evaluated at the emergency room after losing consciousness. She referred a previous 8 years' history of depression together with polydipsia and polyuria. Her admission neurological examination score was thirteen points on the Glasgow Coma Scale (eye: three, verbal: four and motor: six) and she was disoriented as to time and place, but without any neurological deficit. The physical examination was unremarkable except for marked obesity.

Computed tomography (CT), performed on admission, revealed an obstructive hydrocephalus due to a block of Monro's foramina from an isodense third ventricular mass. She was operated immediately and a ventriculoperitoneal shunt was inserted. The patient did well and the following day a magnetic resonance imaging (MRI) study confirmed the presence of a heterogeneous anterior third ventricle lesion of two centimetres in diameter. The tumor was predominantly hypointense on T1-weighted and hyperintense on T2-weighted images, with ring enhancement after Gadolonium-DTPA administration (Fig. 1).

After a right frontal craniotomy, the tumor was approached by a transcortical-transventricular route following the ventricular catheter. A soft and vascular greyish tumoural mass was seen through the right foramen of Monro and it occupied the third ventricle cavity (Fig. 2). It was subtotally removed, leaving a laminar portion with inaccurate margins in the anterior left basal part of the third ventricle (Fig. 3).

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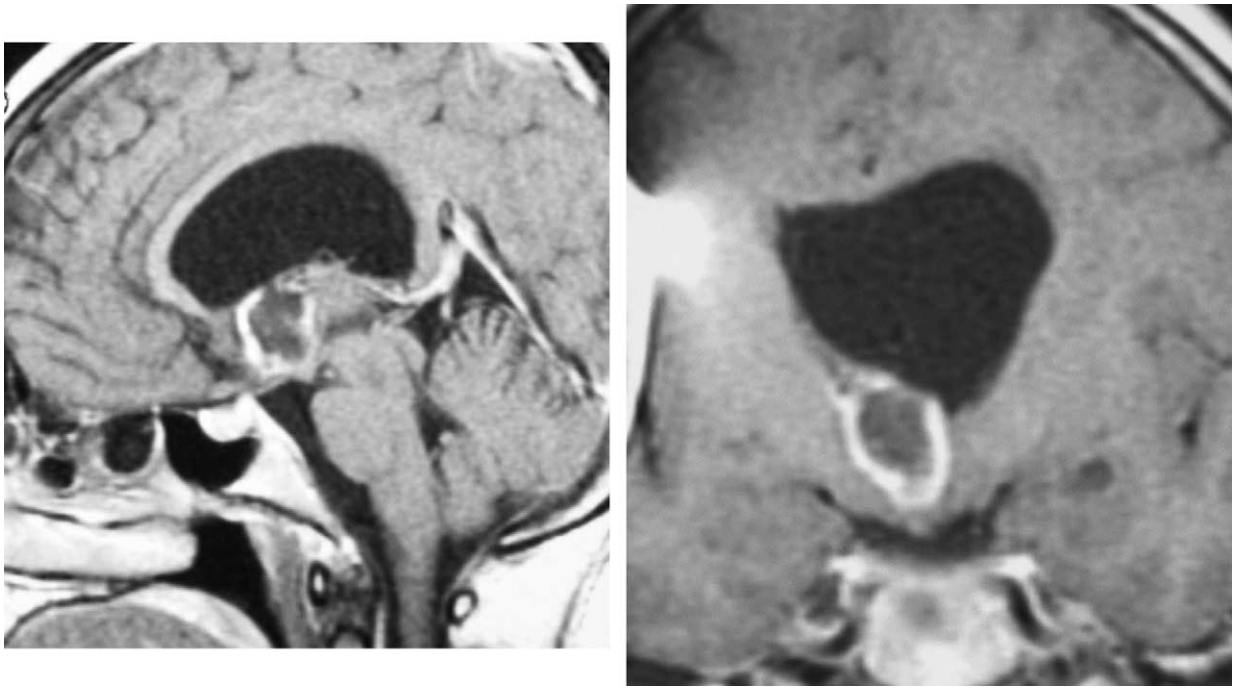

Fig. 1. Preoperative T1-weighted magnetic resonance imaging after gadolinium-DTPA administration. Left: sagittal section showing a solitary anterior third ventricle mass with ring enhancement. Right: coronal section in the same area showing a ring enhanced mass surround by intact hypothalamus nuclei.

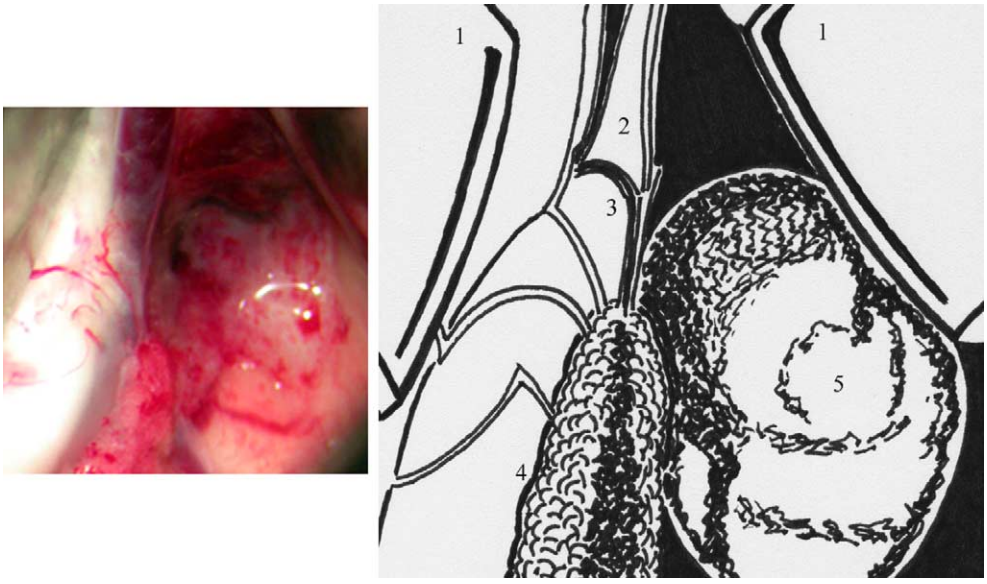


Fig. 2. Photograph (left) and schematic drawing (right) of the operative field showing a soft greyish vascularized tumoural mass through the right foramen of Monro. (1) Retractor; (2) fornix; (3) septal vein; (4) choroid plexus of lateral ventricle; (5) tumour.

Histological examination of the excised tissue diagnosed glioblastoma (Fig. 4).

Postoperatively, the patient did well and her diabetes insipidus symptoms disappeared in the following five days. Endocrinological evaluation showed hypothyroidism parameters and consequently, hormonal replacement treatment was initiated. MRI taken two months after the operation evidenced tumor progression (Fig. 5).

## 3. Discussion

Diagnosis of a glioblastoma multiforme presenting as a unique mass entirely restricted to within the third ventricle cavity can be considered exceptional. With the exception of colloid cysts, low-grade gliomas constitute the majority of pathological lesions affecting primarily the third ventricle [8]. In most series of third ventricle tumours, the reported

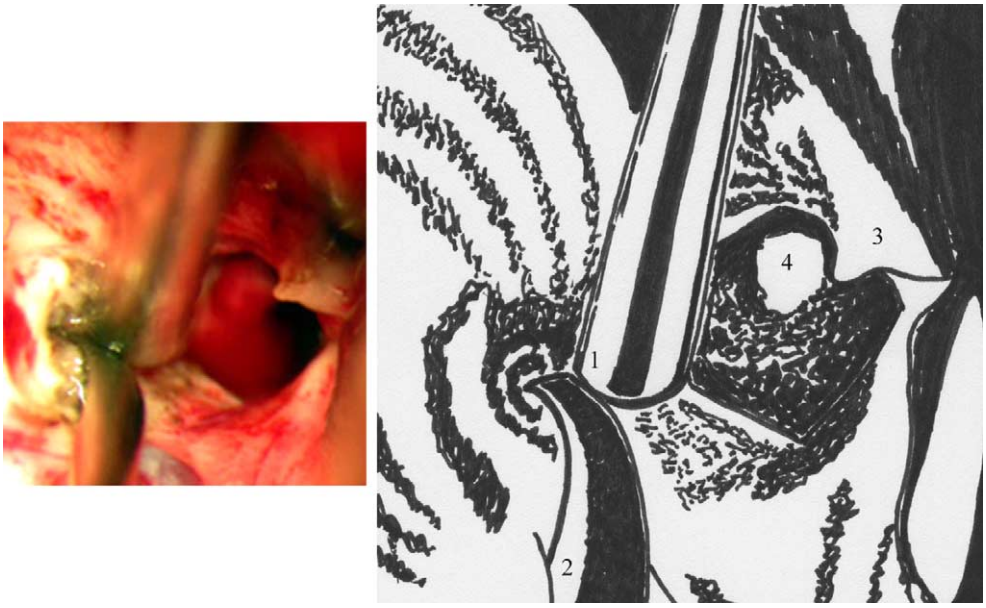


Fig. 3. Photograph (left) and schematic drawing (right) of the operative field after subtotal surgical excision of the mass. (1) Sucker; (2) retractor; (3) foramen of Monro; (4) third ventricle.

incidence of low-grade astrocytomas varies from 25% to 50% yet glioblastoma being not mentioned in almost none of them [5,9–13]. To our knowledge only one well-described case of third ventricle glioblastoma [4] and another case of anaplastic astrocytoma [3] have been reported previously in the literature. An extensive review of surgical series of the third ventricle tumours and brain gliomas could garner only nine additional cases, of either histology, glioblastoma and high grade astrocytoma [2,5–7] (Table 1). Specially significant is the absence of third ventricle glioblastoma in the extensive review of 987 glioblastoma neoplasms, performed by Kleihues et al., that remark the extreme rarity of this location [1].

### 3.1. Tumour origin hypotheses

Depending on their origin, glioblastomas have been classified as either primary tumours, which are the most frequent, or as secondary neoplasms that develop from a previous low-grade glioma [1]. Concerning the glioblastomas located at the third ventricle, some of these cases represent a tumoral extension from a periventricular structure, like the corpus callosum, the thalamus or the caudate nucleus [14,15]; however, these cases should not be considered as true third ventricle glioblastomas. To our knowledge, only the present case and another previous one [4] correspond to glioblastomas with an exclusive location in the third ventricle without any periventricular infiltrated structure identifiable on MRI studies. The most probable origin of a third ventricle glioma should be located at any of the structures that surround this cavity, mainly hypothalamic and thalamic nuclei, septum pellucidum, fornices and septal nuclei. Since all these structures were intact on the preoperative MRI studies of the two above mentioned cases, it could be speculated that the initial tumoral cells would have developed at the subependymal level, breaking early in their growth through the ependymal layer towards the third ventricle cavity. Nevertheless, the possibility of a cell tumoral seeding, via cerebrospinal fluid, from a glioblastoma primarily located at another brain area cannot be excluded [16–18]. The possibility of a secondary glioblastoma development from a low-grade glioma, placed at the third ventricle floor, must be taken into account. Indeed, considering our case and due to the eight-year history of diabetes insipidus, in the present case, it is the most likely hypothesis.

### 3.2. Topographical diagnosis

Tumours located exclusively in the third ventricle need an accurate topographical preoperative diagnosis in order to select the appropriate surgical approach. MRI provides some useful signs like patency of the chiasmatic cistern and absence of sellar or pituitary stalk abnormalities, in both the sagittal and coronal slices, that can allow us to suspect this rare topography. However, MRI can preoperatively identify neither the integrity nor the exact relationships of the anatomical third ventricle boundaries in most cases. As well, this tool cannot determine the degree of tumoral adherence to the surrounding anatomy. Differential diagnosis of high grade gliomas located in the third ventricle is extremely difficult due to the rarity of these tumours and the fact that their heterogeneous signal patterns on both T1 and T2 weighted MRI can be very similar to other intra and/or extra-axial lesions, like cystic craniopharyngiomas, chiasmatic and hypothalamic benign astrocytomas, germinomas and lymphomas. However, the presence of necrosis and ring enhancement on MRI, are suggestive signs of glioblastoma [19].

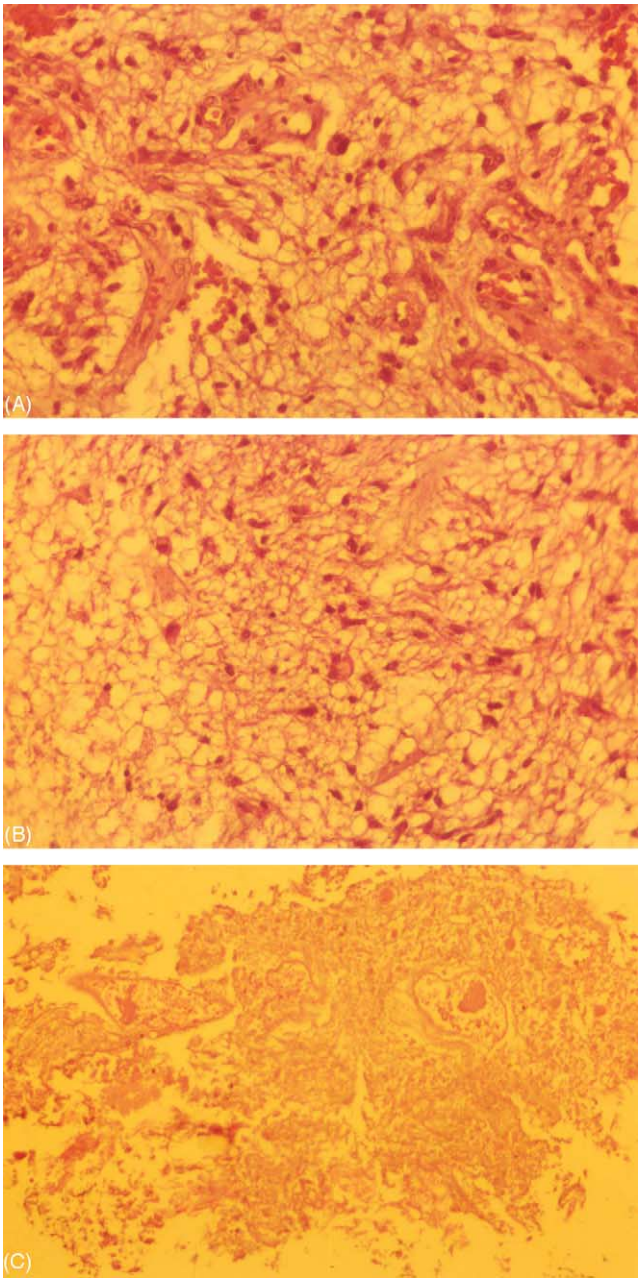


Fig. 4. Histological sections (hematoxylin and eosin stain). (A) Neovascularization with endothelial proliferation; (B) cellular pleomorphism; (C) areas of necrosis.

### 3.3. Surgical treatment

The removal of any tumor, that is wholly located within the third ventricle cavity, obliges the surgeon to use an approach that invariably requires penetrating healthy nervous structures. Lesions located in the anterior and/or middle third ventricle chamber can be approached by a basal route, either subfrontal-interhemispheric or pterional, with the incision of the lamina terminalis, or by a superior route employing either a frontal-transcortical-transventricular approach or a transcallosal one. There is no general agreement as to which

Table 1
Summary of characteristics of third ventricle high grade gliomas and glioblastomas reported in the literature

| Case no. | Authors and reference | Number of cases | Age (year), sex | Clinical features | Neuroradiological features | Histology | Surgical approach and extent of excision |
|---|---|---|---|---|---|---|---|
| 1 | Hasso [3] | 1 | 56, M | Seizures 2 years previously. IICP | CT: obstructive hydrocephalus. MRI: 1 cm mass with mild enhancement in the anterior third ventricle and nodular enhancement in the splenium of the corpus callosum and the superior colliculus with dilatation of lateral ventricles | Anaplastic astrocytoma | ? |
| 2 | Lee [4] | 1 | 59, M | One-year history of depression, anxiety disorder and progressive urinary incontinence. Memory difficulty and episodes of disorientation. IICP | CT: obstructive hydrocephalus. MRI: third ventricle ring-enhanced lesion | Glioblastoma | Transcallosal, partial removal |
| 3–6 | Yasargil [7] | 4 out of 80 of TVT | ? | ? | Anterior portion of the third ventricle | Glioblastoma | Frontal interhemispheric |
| 7–8 | Albert [2] | 2 out of 55 of TVT | ? | ? | ? | Glioblastoma | ? |
| 9–10 | Lejeune [5] | 2 out of 262 of TVT | ? | ? | ? | Anaplastic astrocytoma and/or glioblastoma | Trasfrontal transventricular |
| 11 | Villani [6] | 1 out of 193 of TVT | ? | ? | ? | Glioblastoma | ? |
| 12 | Present report | 1 | 29, F | Eight-year history of polydipsia, polyuria and depression. IICP | CT: obstructive hydrocephalus. MRI: heterogeneous anterior third ventricle lesion with two centimetres in diameter with ring-enhancement | Glioblastoma | Frontal- transcortical-transventricular, subtotal removal |

TVT: third ventricle tumours; IICP: increased intracranial pressure; M: male; F: female; CT: computed tomography; MRI: magnetic resonance image; ?: data not provided.

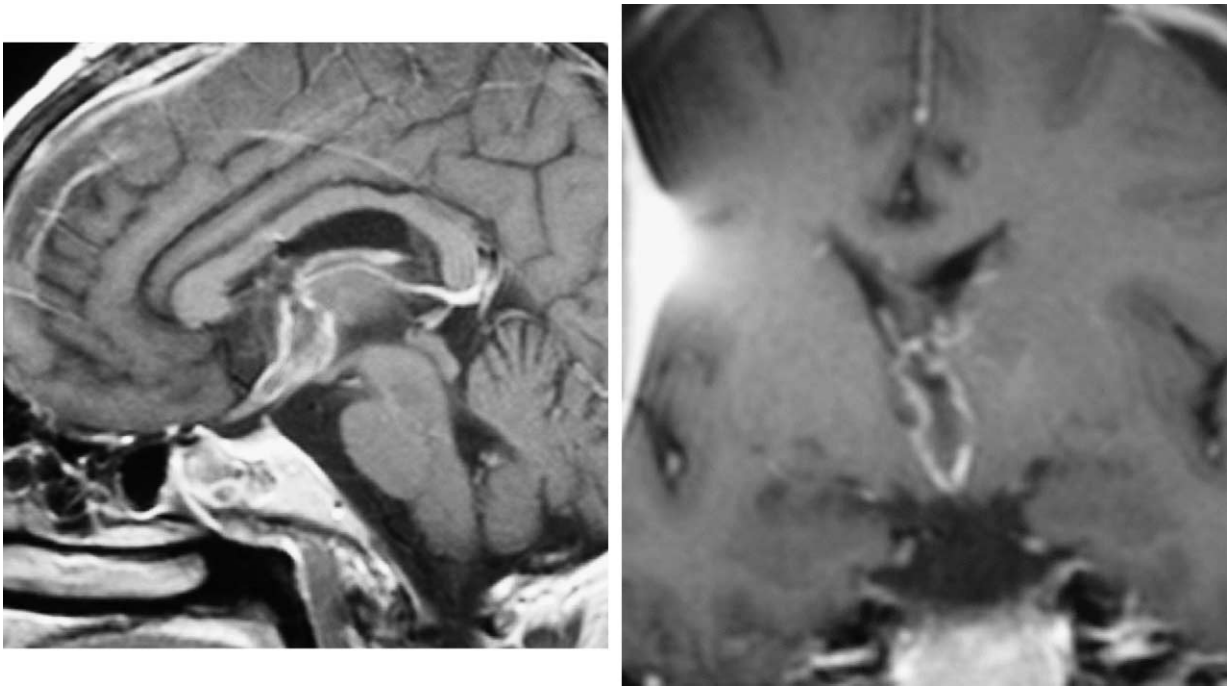

Fig. 5. Postoperative T1-weighted magnetic resonance imaging after gadolinium-DTPA administration, taken two months after the operation, shows that the antero-inferior region of the third ventricle cavity is increased in size and with ring enhancement. Left: sagittal section. Right: coronal section.

of these four possible approaches offers the best results in terms of grade of excision and outcome. The basal translamina terminalis approach allows an earlier and more direct visualization of any tumoral adherences to the floor and walls of the third ventricle, thereby, allowing a safer dissection and manipulation of neural structures. Due to the deep location of the third ventricle cavity, the transcortical-transforaminal and transcallosal approaches involve a greater distance before reaching the inferolateral tumoral areas where the tightest attachments are usually found. In the last decade, endoscopic approach to lesions confined to the ventricular spaces has undergone a rapid growth [10]. We believe that using an appropriate technique, the endoscopic resection of these kind of lesions is a valid choice. The approaches that need the opening of the foramen of Monro may cause memory deficits if damage to the columns of the fornix occurs. However, if both foramina of Monro have been enlarged by the tumoral mass thereby provoking an obstructive hydrocephalus, the risk of forniceal injury is significantly reduced. The wedding of computerized tomographic scanning or magnetic resonance scanning and sterotactic techniques has added a new dimension to the management of masses in the third ventricular chamber because low risk biopsy may be achieved. Management of malignant lesions, based on the information derived from stereotactic biopsy, would be radiochemotherapy.

The selection of an appropriate surgical procedure depends on the individual patient, surgeon and institution [20]. In comatose patients or if they present a very large ventricular dilatation an internal drainage may be implanted as an emergency.

In the present case, the patient required a ventricle-peritoneal shunt before tumour resection because she came to the emergency with low level of consciousness in relation with the hydrocephalus, and a transcortical-transforaminal approach was taken following the trajectory of the previous ventricular catheter.

The most challenging problem, when removing a tumor that is filling the third ventricle, is to dissect its external surface safely from the surrounding neural structures that limit the third ventricle cavity, avoiding any hypothalamic injury. Even with total macroscopic removal of a glioblastoma, we should assume microscopic remnants of the tumor will be left behind in the tumoral bed. Any attempt at aggressive dissection at tumoral areas of attachment should be avoided, specially if we suspect a bilateral hypothalamic infiltration.

## 4. Conclusions

Diagnosis of a glioblastoma presenting as a unique mass involving the third ventricle region is extremely rare but a heterogeneous mass with ring enhancement is the common finding on MRI. Differential diagnosis with other tumoral lesions of the region is difficult and, consequently, a histological specimen must be obtained. We believe that radical excisions of third ventricle glioblastomas should be avoided for two reasons: (i) the high risk of hypothalamic injury, and (ii) the outcome will not be improved. Although gross debulking as opposed to minimal resection has been shown to increase the length and quality of life of glioblastoma patients, it must be

taken into account the location of this tumour. Third ventricle location adds significant difficulties to the management of masses with this nature. Since all the periventricular structures of our patient were apparently intact in the preoperative studies, it could be speculated that the initial tumoral cells of this truly third ventricle glioblastoma had originated in the subependymal level and eventually broken through into the third ventricle cavity. Given the eight-year history of diabetes insipidus, the most likely possibility is that of a secondary glioblastoma having developed from a hypothalamic low grade glioma in this patient.

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