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A Case of Lateral Ventricular Subependymoma with Intratumoral Hemorrhage via Neuroendoscopic Surgery

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Abstract

Subependymoma (SE) is a rare, usually asymptomatic, brain tumor predominantly affecting older adults and occurring in the fourth and lateral ventricles. We report a rare case of SE with intratumoral hemorrhage that could be removed by neuroendoscopy. The 81-year-old patient had been followed as an outpatient for 10 years due to an intraventricular tumor. It did not grow over the patient's lengthy follow-up. The patient was transferred to our hospital after he fainted near his home; at the time of admission, he had mild consciousness disturbance, and his Glasgow Coma Scale score was 10 points (E3V3M4). Computed tomography showed intratumoral hemorrhage and slight ventricular enlargement. Magnetic resonance (MR) imaging showed a 4 cm-sized tumor in the anterior horn of the right lateral ventricle. The lesion appeared as a mixed-intensity solid tumor and showed irregular enhancement with gadolinium. The patient underwent neuroendoscopic tumor resection on the 30th day of the patient's hospital stay. A histopathological examination revealed small tumor cells with round nuclei scattered in the glial fibrillary background. Immunostaining was positive for glial fibrillary acidic protein; these findings are consistent with an SE diagnosis. The patient in this study had hypertension and used anticoagulants, risk factors for intratumoral hemorrhage. For intraventricular tumors with bleeding—particularly in older or more physically frail patients—minimally invasive neuroendoscopic surgery should be considered an option for tumor resection.

Keywords: subependymoma, lateral ventricle, intratumoral hemorrhage, neuroendoscope

Introduction

Subependymoma (SE) is a relatively rare tumor that most frequently occurs in older adults' fourth and lateral ventricles and accounts for 0.2%-0.7% of brain tumors. Most of these slow-growing tumors are benign and asymptomatic, and bleeding is extremely rare due to the tumors' low vascularity.[1)] This is the case of a hypertensive patient who underwent long-term anticoagulant treatment and developed SE with intratumoral hemorrhage. The tumor was successfully removed neuroendoscopically, and this case is contextualized through a review of the literature on SE cases.

Case Report

We report the case of an 81-year-old male on an oral antihypertensive and anticoagulant regimen due to hypertension and paroxysmal atrial fibrillation. He had been taking benidipine hydrochloride 8 mg/day and telmisartan 80 mg/day as antihypertensive medications for 10 years. He had been taking warfarin 3 mg/day as an anticoagulant for 8 years.

This patient had been followed as an outpatient at our department for 10 years because of an asymptomatic intraventricular tumor. His annual neurological imaging showed no tumor growth or bleeding tendency throughout the course of outpatient treatment. He had no microbleeds or cavernous angioma that could cause bleeding. Although the patient took medication for hypertension, his blood

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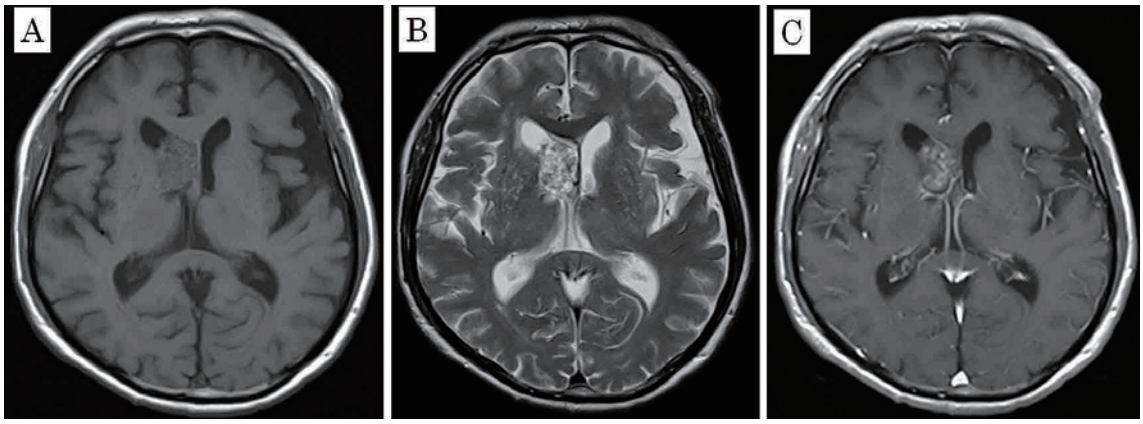

Fig. 1 MRI 3 months before admission. Axial T1- (A) and T2-weighted (B) magnetic resonance (MR) images show a mixed-intensity tumor. Axial T1-weighted (C) MRI with gadolinium revealing partial enhancement of the tumor.

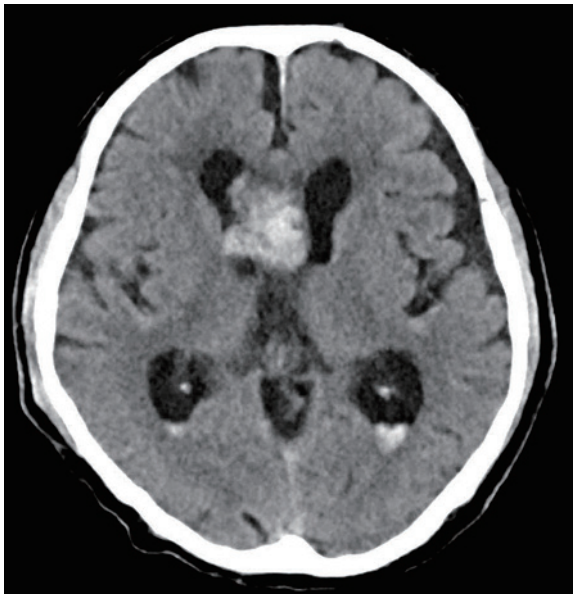

Fig. 2 Computed tomography on admission, showing intratumoral hemorrhage and intraventricular hemorrhage.

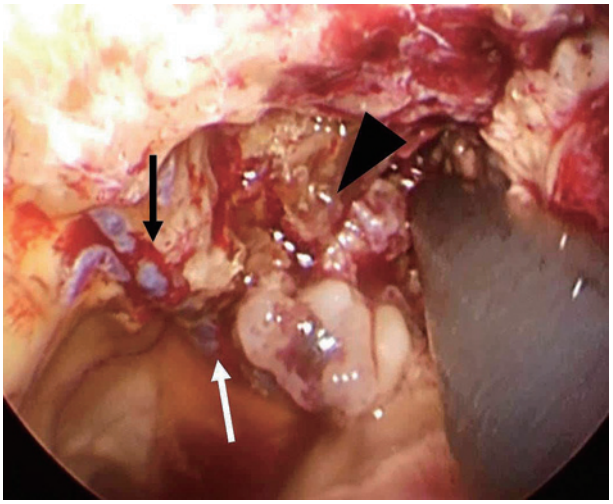

Fig. 3 Intraoperative photo: Arrowhead: tumor, Arrow: anterior septal vein, White arrow: thalamostriate vein.

pressure remained poorly controlled, with a frequent systolic reading of 140-150 mm Hg. Cranial magnetic resonance imaging (MRI) 3 months prior showed a 4 cm tumor in the anterior horn of the right lateral ventricle. T_1- and T_2-weighted imaging revealed a mixed-intensity solid tumor, which was irregular upon enhanced gadolinium administration (Fig. 1). The patient fainted near his home early one morning and was subsequently transferred to our hospital. The patient's level of consciousness was Glasgow Coma Scale (GCS) of 10 points (E3V3M4), with no motor palsy or other neurological deficits. The patient's blood pressure was 160/100 mm Hg, and blood tests showed a prothrombin time/international normalized ratio (PT/INR) of 2.0, which was over-extended in the elderly.

Computed tomography (CT) revealed intratumoral hemorrhage with intraventricular hemorrhage in the anterior horn of the right ventricle (Fig. 2). After admission, the patient developed DVT and was treated with Edoxaban. In addition, the patient also developed aspiration pneumonia and was treated for this complication as well. His advanced age and general condition were deteriorating due to the effects of bed rest that caused the DVT treatment and aspiration pneumonia, so we chose an endoscopic approach to minimally invasive surgery.

Preoperative diffusion tensor imaging was used to confirm the white matter tracts so that they would not be affected during sheath insertion. A round retractor 21 mm (ViewSite, Vycor Medical, Boca Raton, Florida, USA) was placed toward the anterior horn of the right lateral ventricle from Kocher's point using a neuronavigation system. Tumor and anterior septal veins were confirmed through a flexible scope (OLYMPUS VEF TYPE V, Olympus Medical Systems Corp, Hachioji, Tokyo, Japan). Tumor removal was

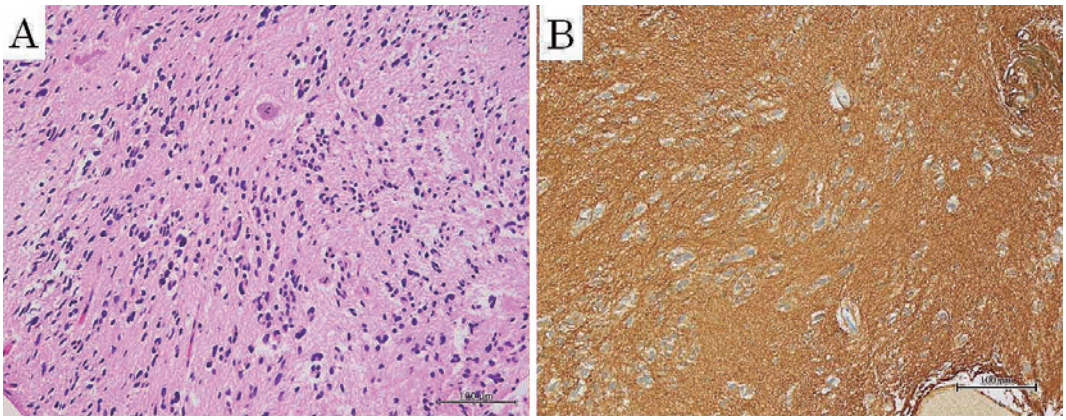

Fig. 4 A: Photograph showing microcystic degeneration (H&E stain).
B: Immunohistochemical staining revealed a positive reaction for glial fibrillary acidic protein.

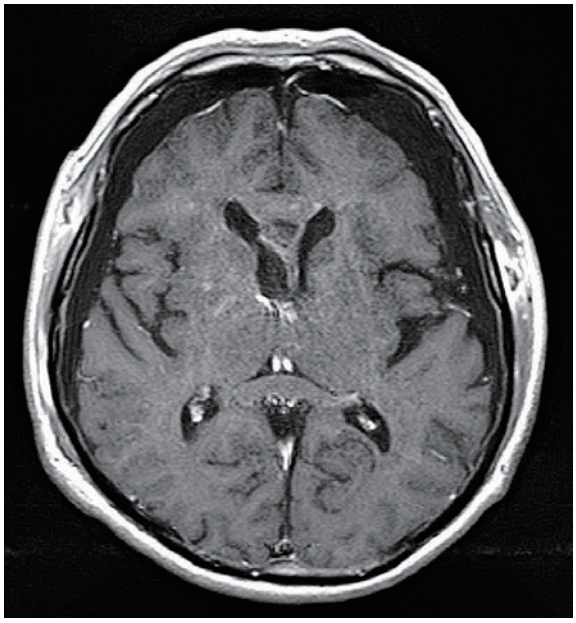

Fig. 5 Postoperative MRI with gadolinium showing total removal of the intraventricular tumor.

performed using a rigid scope (A81000A, Olympus Medical Systems Corp, Hachioji, Tokyo, Japan) and ultrasonic aspirator system (SONOPET UST-2001α, Stryker, Kalamazoo, MI, USA) in a dry field. There was an old hematoma inside the tumor. No bleeding from the tumor was visible, and a monopolar coagulator (RAF fiber electrode, Aims, Osaka, Japan) was sufficient to stop the bleeding. Subsequently, the thalamostriate vein was also confirmed. The tumor, anterior septal vein, and thalamic vein were carefully dissected and removed because of adhesions (Fig. 3). Histopathological findings via Hematoxylin and Eosin (H&E) staining showed small cells scattered in the glial substrate, with sparse cell density and microcystic degeneration (Fig. 4A). Vascularity within the tumor was relatively low. Immunohistochemical staining showed glial fibrillary acidic protein (+) (Fig. 4B), epithelial membrane antigen (–), Olg-2(–), and Ki-67(<1%). The tumor was pathologically diagnosed as SE (World Health Organization grade I). Postoperative MRI showed total removal of the tumor (Fig. 5).

The patient's consciousness level improved to a GCS of 13 points (E4V4M5) following this interventional procedure, and the patient transferred to a rehabilitation facility 48 days after the operation.

Discussion

SE is a rare benign tumor first reported by Scheinker in 1945.[2] It occurs near the ventricles, with the fourth ventricle being the most common location (50%-60%), followed by the lateral ventricle (30%-40%).[2] SEs exhibit iso or hypodensity on CT, and often have no enhancement with contrast medium.[3] MRI shows the low or high signal at T1-weighted imaging and high signal at T2-weighted imaging, and cerebral angiography shows avascular tumors.[1]

In general, SE is asymptomatic and is mostly discovered incidentally at autopsy.[4] Although symptoms depend on the site of tumor development, the initial symptom of symptomatic SE is often intracranial hypertension due to obstruction of cerebrospinal fluid flow; in such cases, SE typically presents with headache, nausea, and impaired consciousness. When a tumor develops in the supratentorial space, it often causes motor paralysis due to impaired pyramidal tract, a mental disorder due to impaired septum pellucidum, and impaired memory. SEs reportedly cause cranial nerve paralysis when they occur in the fourth ventricle.[2,3] This case was an extremely rare SE that developed due to impaired consciousness due to intratumoral hemorrhage.

Typically, bleeding occurs in approximately 0.9%-11% of brain tumors. Malignant tumors, such as glioblastoma, and metastatic brain tumors are the most likely brain tumors to cause bleeding due to their abundant intratumoral blood vessels.[5] In meningiomas, which are representative

Table 1 Series of subependymomas with intratumoral hemorrhage

	Author (year)	Gender/ Age	Initial Symptoms	Predisposing Factor	Location	Size (cm)	Hemorrhage	Treatment	Out-come
1	Scheithauer (1978)	F/81	-	-	LV	large	ITH	not operative	died
2	Changaris (1981)	M/16	HA/blurred vision	no	LV	7	SAH	POTG/total	survived
3	Seiki (1984)	F/33	HA/AC	no	LV	-	IVH/SAH	POTG/subtotal	survived
4	Yamasaki (1990)	F/21	HA	no	LV	large	ITH	TC/total	survived
5		F/54	HA	no	SP	-	ITH	TC/total	survived
6	Marra (1991)	F/42	HA	-	LV	2.5	IVH/SAH	TC/total	survived
7	DiLorenzo (1991)	M/46	HA	HT	LV	4	IVH/SAH	TC/total	survived
8	Lindboe (1992)	M/63	MD/DO	no	SP	5	ITH	TC/partial	died
9	Viale (1994)	M/52	HA/AC	-	LV	3	ITH	-/total	survived
10	Furie (1995)	M/46	HA	-	LV	2	ITH	-	-
11	Nishio (2003)	M/20	HA/Nausea	-	LV	-	IVH	-	-
12	Sharma (2009)	M/25	HA/impaired vision	no	LV	6	ITH	Endoscopy/subtotal	survived
13	Carrasco (2010)	M/71	AC	anticoagulant	LV	3	IVH/ITH	TC/total	survived
14	Akamatsu (2010)	M/32	HA/AC	no	LV	2	IVH	TC/total	survived
15	Landriel (2013)	M/33	HA/cervical pain	no	4th.V	3	SAH/IGM	SOVT/total	survived
16	Kawahara (2015)	M/60	disorientation	HT	SP	5	ITH	TC/total	survived
17	Zhang (2018)	F/35	HA/HH	no	OL	-	ITH	Transcortical	survived
18		F/61	HA	no	OV	-	ITH	Transcortical	survived
19		M/23	HA/impaired vision	no	OL	-	ITH	Transcortical	survived
20		F/43	HA/impaired vision	no	TL	-	ITH	Transcortical	survived
21	Present case	M/81	AC	HT/anticoagulant	LV	4	ITH	Endoscopy/subtotal	survived

AC: Altered consciousness, HA: headache, MD: memory disturbance, DO: disorientation, LV: lateral ventricle, SP: septum pellucium, 4th.V: 4th ventricle, ITH: intratumoral hemorrhage, TL: temporal lobe, IVH: intraventricular hemorrhage, SAH: subarachnoid hemorrhage, IGM: intra cisterna magna, HT: hypertension, SOVT: suboccipital velotonsillar, TC: transcallosal, POTG: parietooccipital transcortical, HH: homonymous hemianopia, OV: occipital ventricle, OL: occipital lobe

of benign tumors, the incidence of bleeding is as low as 0.5%-2.4%.[6] Pressman et al. noted that risk factors for intratumoral hemorrhage in meningioma include age (younger than 30 years or older than 70 years), tumor location (intraventricular or convexity), histological findings (malignant, fibrous, angioblastic), and presence of hypertension, anticoagulation therapy, and/or traumatic brain injury.[6,7]

To our knowledge, only 21 cases of SE with bleeding have been reported (males = 13, females = 8; mean age = 45 years)[1-5,8-19] (Table 1). The mean age of hemorrhage cases was 45 years, which was not significantly different from the mean age of 49-51 years reported in studies of subependymoma in general.[20,21] The average tumor diameter in these reported cases was 3.9 cm, and tumors most often occurred in the lateral ventricle; other sites of occurrence were the septum pellucidum and the fourth ventricle.[1-5,8-19] The diameter of a typical subependymoma tumor was 1.7 cm, and hemorrhagic cases tended to have larger tumors.[20] The site of origin, the hemorrhagic cases tended

to be in the lateral ventricles, whereas the fourth ventricle generally occurred more frequently.[2] No neuroradiological differences were observed in hemorrhage cases compared to non-hemorrhage cases. In most of these cases, bleeding was caused by intratumoral hemorrhage and intraventricular hemorrhage, with some cases showing subarachnoid hemorrhage.[1-5,8-19]

The mechanism of bleeding in SE, which generally has poor vascularity, is unclear. Seiki et al. predicted that tumor growth extends the veins in the subependymal (i.e., venostasis), rupturing the venous wall.[10] Kawahara et al. noted hypertension, anticoagulant use, and abundant vascularity induce SE bleeding.[3] Three cases of hypertension and two cases of anticoagulant use were among the reported 21 cases of SE with intratumoral hemorrhage. In this case, the above two factors overlapped and may have had a considerable effect on the patient's subsequent intratumoral hemorrhage.

Eighteen of the reported 21 SEs with intratumoral hemorrhage were treated by surgery.[1-3,9-19] Of the 17 cases with reported surgical approaches, eight used a transcallosal approach, four used a transcortical approach, two used a parietooccipital transcortical approach, and one used a suboccipital velotonsillar approach. Only two cases, including this one, underwent endoscopic resection.

Conventionally, using a hemostatic technique has been considered to be more difficult in neuroendoscopic surgery than in craniotomy. However, craniotomy safety improved significantly due to the development of enhanced surgical devices and monitors, the increased visibility of surgical fields, and improved surgical techniques. In this case, the tumor had developed in the anterior horn of the right lateral ventricle, and hydrocephalus was also present, so neuroendoscopic surgery was suitable. In addition, neuroendoscopic surgery is one of the small craniotomy surgeries compared to conventional craniotomy with a transcallosal approach. Due to this patient's advanced age, less-invasive surgical techniques were required to maintain brain function and physical health; thus, neuroendoscopic surgery could remove the patient's SE with minimal invasiveness. For intraventricular tumors with bleeding, such as the case reported here, neuroendoscopic surgery should be considered.

Abbreviations

CT Computed tomography
GCS Glasgow Coma Scale
H&E Hematoxylin and Eosin
MR Magnetic resonance
MRI Magnetic resonance imaging

Declaration of Patient Consent

The authors certify that they have obtained all appropriate patient consent forms. The form specifies that the patient has given his consent for his images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Conflicts of Interest Disclosure

We have completed and submitted to the Japan Neurosurgical Society our COI self-report for the past 3 years. All authors have no conflict of interest.

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