Intraparenchymal schwannomas are extremely rare intracranial tumors. Although their occurrence has been reported in various age groups, they are most frequently seen in individuals under 30 years of age. A 65-year-old woman was brought to the emergency department with impaired consciousness due to spontaneous intracerebral hemorrhage in the right basal ganglia (BG). Approximately 3 months later, the patient was taken to another hospital due to decreased consciousness, and a subsequent brain computed tomography scan showed a mass-like lesion in the right BG. The tumor was removed, and the biopsy result revealed an intraparenchymal schwannoma with no involvement of the ventricular ependymal lining. An immunohistochemical analysis revealed a high Ki-67 labeling index, indicating rapid growth without malignancy.

Keywords: Intraparenchymal schwannoma; Ki-67 labeling index; Intratumoral hemorrhage

A rapidly growing intraparenchymal schwannoma in a geriatric patient: a case report and literature review

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Introduction

Intracranial schwannomas account for approximately 5% to 8% of primary intracranial tumors and most commonly originates from the 8th cranial nerve [1]. In fact, intracranial intraparenchymal schwannoma (IS) that are not derived from CN VIII have rarely been reported. Since the initial report by Gibson et al. in 1966, only approximately 150 cases have been reported [2]. This type of schwannoma is slow growing and typically observed in young people under the age of 30; however, symptoms can manifest quickly in old age [3].

Case Report

A 65-year-old woman presented to the emergency department with impaired consciousness and underwent an emergency burr hole procedure for management of spontaneous intracerebral hemorrhage (ICH) with intraventricular hemorrhage in the right basal ganglia (BG) (Fig. 1). The ICH biopsy revealed a hematoma, not specific. The patient received treatment for hypertensive ICH and was transferred to another hospital. Approximately 3 months later, she was brought to another hospital due to decreased consciousness, and a subsequent brain computed tomography scan showed a mass-like lesion in the right BG. The tumor was removed, and the biopsy result revealed an intraparenchymal schwannoma with no involvement of the ventricular ependymal lining. An immunohistochemical analysis revealed a high Ki-67 labeling index, indicating rapid growth without malignancy.

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ed, marginated mass (4.5 × 5 × 4 cm) was accessed using the transcortical approach (Fig. 3). It was then removed using a cavitron ultrasonic surgical aspirator since there was no involvement of the ependymal lining of the ventricles. Further, no sign of necrosis along with vascular proliferation was observed by analysis of the frozen biopsy sample, leading to a suspicion of glioma.

Upon histopathological examination, the cellular lesions consisted of a bundle of spindle cells arranged in a storiform pattern with palisading arrangement; however, no nuclear pleomorphism was seen. In addition, mild infiltration was of the mass into the brain parenchyma surrounding the tumor cells was observed, indicating the presence of a neurogenic tumor due to ovoid to spindle and partially wavy or buckled shaped cells. Immunohistochemical staining showed strong expression of both S-100 and glial fibrillary acidic protein (GFAP), while Ki-67 labeling index was 39.9% and the mitotic count was 3–4/10 high-power field (Fig. 4).

Fig. 1. (A) Initial computed tomography (CT) scan showed intracerebral hematoma in the right basal ganglia. (B) The brain CT after 3 weeks revealed hematoma resolution and no mass like lesion. (C, D) Three months later brain CT revealed a large mass at right basal ganglia with rim enhancement. Written informed consent was obtained for publication of this case report and accompanying images.

Fig. 2. Brain magnetic resonance imaging revealed peritumoral edema and a heterogeneously hyperintense lesion on T2-weighted image (A) and slight hypointense to grey matter on T1-weighted image (T1WI) (B). On the contrast-enhanced T1WI showed ring enhancement of the mass (C). Written informed consent was obtained for publication of this case report and accompanying images.

Fig. 3. Intraoperatively, a mixed friable and hard, grayish mass (star) was confirmed. Written informed consent was obtained for publication of this case report and accompanying images.
Discussion

IS is an extremely rare intracranial tumor. Despite being prevalent in various age groups, from the youngest case being of a patient aged 6 months to the oldest case one being 84 year-old, it frequently occurs in individuals under 30 years of age (58.7%). Of these, 12.0% (18) of patients were over 60 years of age, which is unexpected. The incidence was higher in men in the age group under 30 years (male:female; 1.84:1); whereas, the pattern was reversed in the group above 60 years of age (male: female; 0.46:1) (Table 1) [4–8].

IS may originate anywhere in the intracranial region; however, appears to be more frequent in the supratentorial region during young age, whereas it is commonly located in the infratentorial region in individuals > 60 years of age [4]. Although the pathophysiology of IS has not yet been clearly identified, 2 hypotheses have been proposed: (1) developmental theory, (2) non-developmental theory. The developmental theory assumes that mesenchymal pial cells in the brain parenchyma transform into Schwann cells. Alternatively, the non-developmental theory assumes that Schwann cells originate from adjacent organs, such as the meningeal branch of the perivascular nerve plexus and anterior ethmoidal and trigeminal nerves, where Schwann cells usually exist [9]. At present, it is unclear which of these 2 hypotheses prevails.

The radiologic features of IS include cyst formation, calcification, and peritumoral edema, and it is difficult to find distinct

Table 1. Radiological and immunohistochemical features of intraparenchymal schwannoma in geriatric patients above 60 years old

| No. | Study          | Year | Sex | Age (yr) | Location | S-100 | GFAP | EMA | Malignancy | Cystic | Calcification | Hemorrhage | Ki-67 (%) |
|-----|----------------|------|-----|----------|----------|-------|------|-----|------------|--------|--------------|------------|-----------|
| 1   | Ghatak et al.  | 1975 | Female | 63  | Parietal | n/a   | n/a  | n/a | ×          | n/a    | n/a          | ×          | ×         |
| 2   | Solomon et al. | 1987 | Male | 69  | Medulla  | Negative | n/a | n/a | ×        | ○      | ×            | ×          | ×         |
| 3   | Cervoni et al. | 1988 | Female | 61  | P-O      | n/a   | n/a  | n/a | ×        | n/a    | n/a          | ×          | ×         |
| 4   | Wilberger      | 1989 | Female | 62  | Pituitary | n/a   | n/a  | n/a | ×        | n/a    | n/a          | ×          | ×         |
| 5   | Tran-Dinh et al. | 1991 | Female | 64  | Cbll., brainstem | n/a   | n/a  | n/a | ×        | ○      | ×            | ×          | ×         |
| 6   | Casadei et al. [6] | 1993 | Female | 69  | Cbl.     | Positive | Positive | Positive | ×        | ○      | ×            | ×          | ×         |
| 7   | Casadei et al. [6] | 1993 | Female | 84  | Temporal | Positive | Positive | Positive | ×        | ○      | ×            | ×          | ×         |
| 8   | Singh et al.   | 1993 | Female | 61  | Cbl.     | Positive | Negative | n/a   | ×        | ○      | ×            | ×          | ×         |
| 9   | Weiner et al.  | 1993 | Male | 61  | Brainstem | n/a   | n/a  | n/a | ×        | ○      | ×            | ×          | ×         |
| 10  | Weiner et al.  | 1993 | Female | 78  | Brainstem | Positive | Negative | Negative | ×        | ○      | ×            | ×          | ×         |
| 11  | Ranjan et al.  | 1996 | Female | 65  | Cbl.     | Positive | Negative | Negative | ×        | ×      | ×            | ×          | ×         |
| 12  | Tanabe et al.  | 1996 | Female | 68  | Pons     | Positive | Negative | Negative | ×        | ○      | ×            | ×          | ×         |
| 13  | Muzzafar et al. [5] | 2010 | Male | 68  | Brainstem | n/a   | n/a  | n/a | ×        | ○      | ×            | ×          | ×         |
| 14  | Barnard et al. [8] | 2011 | Female | 75  | Frontal  | Positive | Negative | Negative | ○        | ○      | ×            | ×          | ×         |
| 15  | Khoo and Taki [7] | 2012 | Male | 60  | Frontal  | n/a   | Negative | Negative | ×        | ×      | ×            | ×          | × <1       |
| 16  | Luo et al.     | 2013 | Male | 72  | P-O      | Positive | Negative | n/a   | ×        | n/a    | n/a          | ×          | ×         |
| 17  | Luo et al.     | 2013 | Male | 64  | Cbl.     | Positive | Negative | n/a   | ×        | n/a    | n/a          | ×          | ×         |
| 18  | Arselmi et al. | 2021 | Male | 74  | Pons     | Positive | Negative | n/a   | ×        | ○      | ○            | ×          | ×         |
| 19  | Present case   | 2020 | Female | 65  | Basal ganglia | Positive | Positive | Positive | ×        | ×      | ×            | ○          | 39.9       |

GFAP, glial fibrillary acidic protein; EMA, epithelial membrane antigen; P-O, parieto-occipital; Cbll., cerebellum; n/a, not available.
differences from those of vestibular schwannomas \[5,10\]. However, only one similar case with intratumoral hemorrhage has reported so far, and even in vestibular schwannoma, the features shown in this case is known to be very rare, accounting for about 0.4% \[6,11\].

The diagnosis of intraparenchymal schwannoma by imaging is challenging, and is dependent on histopathological analysis and immunohistochemical findings. The histopathological appearance was characterized by Antoni A and B cells, while immunohistochemical staining showed positive expression of S-100 whereas epithelial membrane antigen and GFAP were absent in most cases \[4,7\].

Since intraparenchymal schwannoma presents with slow proliferation, Ki-67 labeling index is usually observed at less than 1% [1]. In this case, high Ki-67 labeling index was observed, indicating rapid growth, similar to a malignant intracerebral nerve sheath tumors (MINST). MINST is termed malignant peripheral nerve sheath tumors (MPNST) of brain parenchyma. MINST’s characteristics is similar to MPNST’s one except not associated of neurofibromatosis type I. In histologically, MINST has pleomorphic cells with irregular nuclei. And that tumor also showed poorly differentiated malignant spindle cell. MINST is extremely rare, only one case was reported in the age group above 60 years [8]. The malignancy rate was approximately 5% in the age group above 60 years, which was slightly lower compared to other age groups [4].

IS are mostly benign tumors and show a good prognosis after total resection [1]. It is crucial to set an accurate surgical goal in the early stages of IS treatment for better clinical outcomes; however, there are certain limitations in the diagnosis of IS since it is difficult to differentiate from GBM or high-grade gliomas based on the imaging findings. Thus, hematoxylin and eosin staining is the only feasible option for examination of intraoperative frozen biopsy [7].

**Conclusion**

IS is a benign lesion characterized by slow growth in most cases and presents a good prognosis when treated with total resection. To the best of our knowledge, this is the first case of IS characterized by a rapid growth rate without evidence of malignancy. Since it is difficult to rule out GBM in the early stages, gross total resection and short-term follow-up will be required for management of these tumors.

**Conflicts of interest**

No potential conflict of interest relevant to this article was reported.

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