

Intramedullary Subependymoma of the Thoracic Spinal Cord

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An Intramedullary subependymoma of the spinal cord is a rare tumor with only 43 reported cases in the literature. Most of them are reported to be localized within the cervical spinal cord. We report a rare case of a thoracic spine intramedullary subependymoma in a 37-year-old female who presented with back pain and radiating leg pain. Subtotal resection and postoperative radiotherapy were performed. Subependymomas developing in the spinal cord are benign with a low proliferative potential. Complete resection of the tumor appears to be the optimal method for a complete cure. However aggressive surgery may cause severe neurological deficit. Therefore, if severe neurological deficits are expected after complete removal, a partial removal and postoperative radiation therapy is an alternative method for treatment in selected cases. A large-scale randomized study is mandatory to clarify the effectiveness of radiotherapy and to establish the recurrence rate and prognosis with respect to the surgical removal of these tumors.

KEY WORDS : Intramedullary · Subependymoma · Spinal cord.

Introduction

Subependymomas, first described by Scheinker in 1945^{5,13}, are slow-growing and non-invasive benign tumors, accounting for 0.2~0.7% of all intracranial tumor¹³. They frequently occur in the lateral recess of the fourth ventricle or in the lateral ventricles but rarely in the spinal cord^{1,7}. Only 44 cases of spinal subependymomas (including our case) have been described in the literature^{2,7}. Most of the intraventricular subependymomas are subclinical and found incidentally with a frequency of 0.13~0.4% on autopsy³, whereas spinal tumors are inevitably accompanied by spinal cord symptoms, such as motor, sensory, urinary and sexual dysfunction¹³. Most of these tumors are intramedullary lesions occurring in cervical segments of the spine and only eight cases are reported at the thoracic level^{12,13}. We describe a rare case of thoracic intramedullary subependymoma in a 37-year-old female.

Case Report

A 37-year-old female patient presented with a 6-month history of lower back pain radiating to the right leg and

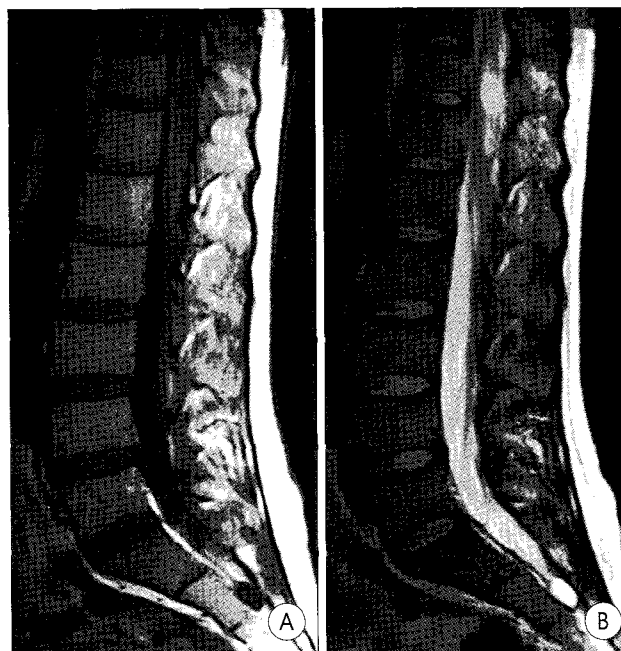


Fig. 1. Preoperative magnetic resonance images. (A) T1 weighted sagittal image showing diffuse enlargement of the spinal cord extending from T11 to T12 (B) T2 weighted sagittal image showing a fusiform, hyperintense mass lesion.

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numbness, the symptoms were gradually increasing in intensity.

Neurological examination showed decreased response to pin prick and light touch and numbness between the L4 and S1 dermatome on her right leg. No obvious motor impairment

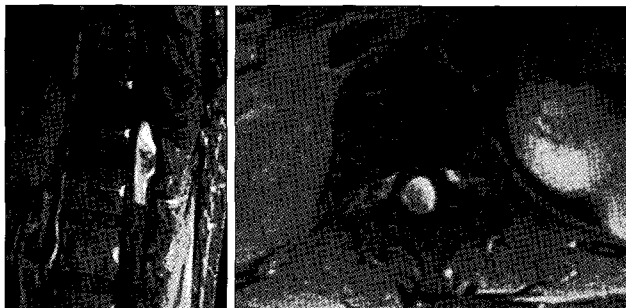


Fig. 2. After gadolinium administration, heterogeneous enhancement of the tumor is found on T1 weighted image.



Fig. 3. Intraoperative picture shows a dark-brown color mass containing soft mucinous liquid.

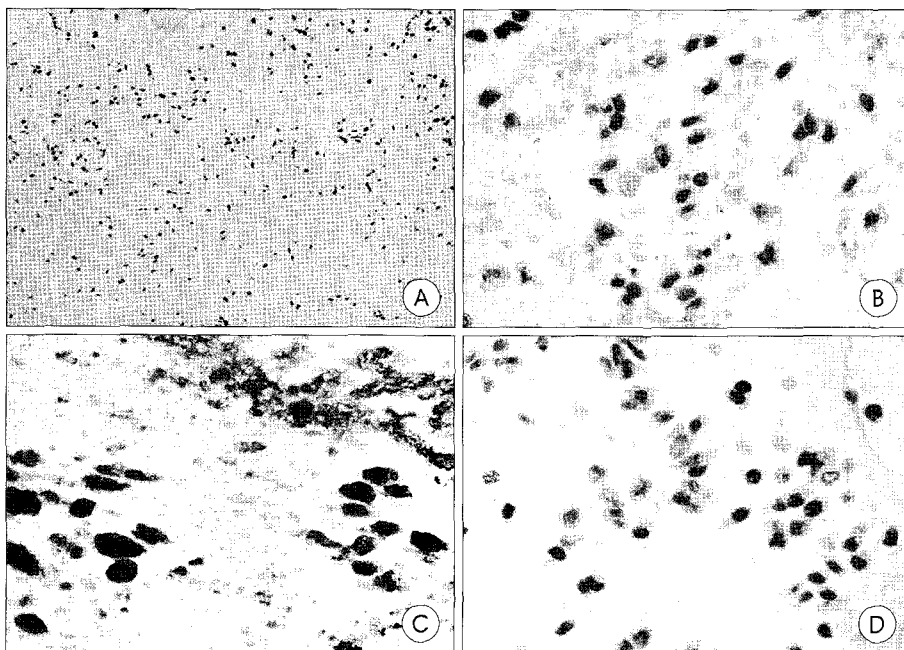


Fig. 4. Photomicrograph of the tumor specimen showing low to moderately cellular tumor in clusters. And relatively uniform nuclei surrounded by eosinophilic cytoplasm(A, H&E, x 100). Immunohistochemical staining reveals that glial fibrillary acidic protein is weakly positive and S-100 is strong positive. However, the epithelial membrane antigen is negative (B,C,D).

was observed. Bilateral lower extremity reflexes were hyperpositive at 3+, however the Babinski sign and ankle clonus were not present. Plain radiographs of the thoracic spine were normal. Magnetic resonance imaging(MRI) revealed a fusiform intramedullary mass at the level of the 11th and 12th thoracic vertebra. T1-weighted MRI images demonstrated a hypointense mass with no clear cut demarcation between the spinal cord and tumor. T2-weighted images showed a hyperintense and heterogeneous enhancement were noted with gadolinium administration(Fig. 1, 2). The mass extended along the right posterolateral surface of the cord. Imaging findings were considered to favor an intramedullary lesion and hence the differential diagnosis of ependymoma and astrocytoma were considered.

With the patient prone, a T11-12 total laminectomy was performed. After opening the dura, the cord was enlarged and a subpial eccentric tumor mass was encountered. The tumor was dark-brown in color and had a cystic texture. The midline longitudinal myelotomy disclosed a dark-brown colored, avascular soft mass lesion. Because the surrounding tissue was friable and the tumor was poorly demarcated, it was not easy to distinguish and to dissect from the surrounding spinal cord. This ill-defined tumor was resected piece by piece and a subtotal resection was performed (Fig. 3).

Microscopic examination revealed low to moderately cellular tumor arranged clusters. The tumor cells had relatively uniform nuclei surrounded by eosinophilic cytoplasm with bipolar or multi-polar cytoplasmic processes (Fig. 4). No pleomorphism,

mitosis, calcification or necrosis was seen. No ependymal rosettes or perivascular pseudorosettes were noted. Immunohistochemical stain showed weak immunoreactivity to glial fibrillary acidic protein(GFAP) and was strongly positive to S-100. Epithelial membrane antigen(EMA) immunostains showed no positive reaction (Fig. 5). Based on the above features, a histological diagnosis of subependymoma was made.

Postoperatively the patient developed transient monoparesis in her right leg and dysesthesia below the L3 dermatome. The motor power subsequently improved but the sensory impairment did not. The patient was discharged 2 weeks after the operation with normal motor function of both extremities but mild sensory impairment. Adjuvant ex-

ternal beam radiotherapy with a total dose of 45Gy was given to treat the residual mass. On MRI obtained 3 months after surgery, showed a remnant mass. At the 6 month follow-up, numbness in the right saddle area was remained.

Discussion

Spinal subependymomas are much less frequent than intracranial subependymoma. But they are generally identified because they become symptomatic quite early³. They are inevitably accompanied by myelopathy and are often diagnosed clinically as ependymoma or astrocytoma. Spinal cord subependymomas were first reported by Boykin et al. in 1954. Since then, only 44 cases (including our own) have been reported in the literature. The reports include 28 males and 16 females, showing a male predominance. The mean age of reported cases at presentation was 43.8 years (range 6~76 years). The typical patient is a male in the fifth to sixth decade¹². All tumors except for five were intramedullary. Most of the tumors were localized at the cervical (19 cases) or cervicothoracic segments (14 cases) of the spine. In the other 11 cases, the locations were four at lower thoracic, four at the thoracolumbar, two at lumbar and one holocord subependymoma. Most symptoms at presentation were motor and sensory deficits of the extremities with or without sphincter problems and neurogenic pain¹². The symptoms were present for a substantial period of time ranging from 3 months to 17 years (median 4 years)¹³.

Spinal subependymomas are difficult to distinguish from other intramedullary spinal tumors based on neuroradiological findings. Computed tomography either shows no abnormalities or only slight abnormalities in some reports of spinal subependymomas¹⁰. MRI findings revealed segmental fusiform dilatation of the cord with low T1-weighted and high T2-weighted signal intensities^{10,12,13}. The findings on MRI without contrast enhancement of spinal subependymomas are similar to those of ependymomas. With Contrast enhancement findings are more characteristic for an ependymoma, either well-circumscribed areas of homogeneous signal enhancement or multiple nodular enhancement, however commonly these findings are absent or very subtle^{7,10}. The location of the spinal subependymomas is eccentric within the spinal cord compared to the central location of the ependyoma^{5,12}.

Spinal subependymomas are not different histologically from intracranial subependymomas¹⁰. Spinal subependymomas have a distinct histological appearance characterized by sparse cellularity, clustering of nuclei distributed over a thick fibrillary background formed by cell processes, and occasionally contain microcytes^{3,9,11}. The nuclei are round to slightly oval and resemble those of ependymal cells⁹. There are occasional

perivascular arrangements similar to the ependymal pseudorosette⁹. The main characteristics that distinguish the subependymoma from the astrocytoma and ependyoma are the variable proportions between ependymal cells, astrocytes and transitional cells. Immunohistochemical phenotypes are identical to those of the astrocytoma : GFAP and S-100 protein are diffusely positive¹³. In contrast to ependymomas, subependymomas have been reported to be negative for EMA, probably because of poor development of ependymal-type rosettes¹³. The absence of a positive response to EMA supports the hypothesis that subependymoma is an entity separate from other ependymomas.

The histogenesis of subependymoma is still controversial. Boykin et al. proposed that their origin is from subependymal astrocytes and therefore named these tumors "subependymal glomerate astrocytomas"^{10,12}. Based on the ultrastructural features, Scheinker proposed that these tumors were derived from the subependymal cell plate¹², whereas Fu et al. postulated that the subependymoma was a variant of ependymoma and the astrocytic component was a reactive component after a study using the electron microscope. Horstman et al. described their origin to be from tanycytes, which have an appearance both of astrocytes and ependymocytes and are located in the subependymal zone¹³. Because of their occasional association with heterotropic leptomeningeal glial tissue and occasional occurrence in identical twins, a hamartomatous or maldevelopmental origin has been proposed by Clarenbach P, Ho KL and Polivka B^{6,7,14}.

Subependymomas are biologically benign with a very low proliferation index^{10,12}. These tumors tend to be avascular, as compared to ependyomas. A majority of reported spinal subependymomas were sharply demarcated at surgery, permitting total removal in 34 of the 44 reported cases, but in about a quarter of cases, either no demarcation was noted or the tumor was infiltrating the surrounding cord¹². It is generally accepted that the best mode of treatment for these tumors is radical removal. Many authors recommend that every effort must be made to perform complete removal^{3,12} and functional improvement is generally better with total compared to partial removal of tumors. However, many of the reported patients suffered from marked motor weakness postoperatively. An accurate prognosis is difficult to establish because of the small number of reported cases.

According to the literature, complete surgical resection was achieved in 33 patients with 6 patients requiring two operations for complete resection while in 7 patients partial resection was performed. Six patients received postoperative radiotherapy. There were three immediate postoperative deaths. While 5 patients showed immediate postoperative improvement and 6 showed no change of status, postoperative worsening was

found in 18 patients; fourteen out of 18 patients had improved during follow up. In our case, partial removal was performed. In the immediate postoperative period the neurological status was worsened with transient monoparesis and hypesthesia. However, the neurological deficit was improved several days later. Therefore, when the subependymoma is well demarcated from the spinal cord, total removal should be tried and no recurrence would be expected. However, in patients with mild symptoms in whom there is poor delineation between the tumor and normal spinal cord tissue, the risk of neurological deficit should be considered before complete tumor removal is attempted. Partial removal and close follow-up could be another option. Regarding radiotherapy, there is no evidence of any efficacy. Several authors do not recommend radiotherapy as an adjunct therapy even after partial removal^{3,12}. Adjuvant radiation therapy should not be tried in cases of gross total removal, because of the potential complications of radiation therapy. In cases of intraventricular subependymoma, most authors do not advocate post-operative radiation therapy after complete surgical resection of pure subependymoma, because a good prognosis can be expected with surgery alone. Lombardi et al. reported follow-up data in 21 patients who underwent surgery for intraventricular subependymoma. Seven of 21 patients were treated with radiation therapy, and follow-up imaging demonstrated a greater radiographic response at doses of 5,000cGy or more. This finding support a justification for radiation therapy in patients with residual tumor or evidence of tumor progression⁹.

There have been just seven reported cases of intramedullary subependymoma including our own who received post-operative radiotherapy. Although there appears to be little justification for routine adjuvant radiotherapy following surgical resection, the use of radiotherapy after the subtotal removal of an intramedullary subependymoma might be considered as an option for another modality of treatment in selected cases. It is necessary to study more cases to establish an accurate recurrence rate and prognosis with respect to the surgical removal. The efficacy of radiotherapy in patients who have partial removal should be further studied.

Conclusion

For neurosurgeons who encounter an eccentric fusiform intramedullary mass, the possibility of subependymoma should be kept in mind and intensive microscopic and ultrastructural studies must be performed for its identification. Every effort must be made to perform complete removal. However, if there is a potential risk for severe neurological impairment after complete tumor removal, partial removal and postoperative radiation would be considered as another option.

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