Spinal intradural, extramedullary anaplastic ependymoma with an extradural component: Case report and review of the literature

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Abstract

Background: There have been 18 reported cases of primary spinal intradural, extramedullary ependymomas reported in the literature. One of the 18 cases had an extradural component and was benign. Our case is the second spinal intradural, extramedullary ependymoma with an extradural component and the first with its initial presentation as an anaplastic ependymoma.

Case Description: A 50-year-old male presented with bilateral upper thigh weakness and thoracic numbness. His exam showed the pin-prick level at T5. Magnetic resonance imaging (MRI) of the thoracic spine showed an enhancing lesion at T5–6 with severe compression of the spinal cord with a dumbbell shape extension of the tumor through the right T5–6 neural foramen. The patient had a laminectomy at T4–T6 with the resection of the tumor. Postoperatively, the patient regained full strength in his lower extremities. Intraoperatively, the tumor was found to be intradural, extramedullary with an extradural component. The tumor was found to be an anaplastic ependymoma.

Conclusions: Even though spinal intradural extramedullary ependymomas are very rare, surgeons must be aware that on MRI, they can be mistaken for meningiomas or nerve sheath tumors especially if there is an extradural component. Our case report is the first intradural, extramedullary ependymoma that is anaplastic and has an extradural component. A review of the literature provides little information on the treatment and prognosis for these tumors especially if they are anaplastic. We propose that the treatment, as done in our case, should be complete resection of the tumor with spinal radiotherapy to the tumor level.

Key Words: Anaplastic ependymoma, extradural, extramedullary, intradural, spinal cord

INTRODUCTION

Ependymomas, although representing only 4–6% of all primary central nervous system tumors, are the most common tumors of glial origin found in the spinal cord.¹⁶ They account for 60% of all intramedullary tumors¹¹ with 50% of them arising from the filum terminale.⁶,²² There, however, have been only 18 reported cases of primary spinal ependymomas²,⁴,⁶,¹₁,¹₂,¹₅,¹₈,₂₁,₂₃,₂₄ located intradural and extramedullary, with one of these cases
having an additional extradural component.[7] The aim of this report is to present the second case of an intradural, extramedullary primary spinal ependymoma with an extradural component, but the first case with its initial presentation as an anaplastic ependymoma.

CASE REPORT

A 50-year-old male who had no significant past medical history was noted to have progressive weakness of his lower extremities over a 2-week period. He had numbness starting in his mid-abdominal area and radiating down both legs to the top of both feet. He had no lower back or thoracic pain and no urinary or bowel incontinence. There was normal strength in the upper and lower extremities with no difficulty walking on heels and toes; however, he had difficulty in standing from a squat position. Sensory examination revealed decreased pin-prick and temperature sensation from just below the umbilicus down into the feet. There were normal deep tendon reflexes for his upper and lower extremities except for hyper-reflexia of the right knee. He also had bilaterally down-going toes with no clonus.

Magnetic resonance imaging (MRI) of the thoracic spine revealed a well-circumscribed isotense T1/bright T2 homogeneously enhancing intradural, extramedullary mass centered at the T5–6 level eccentric to the right [Figure 1a and b]. A dural tail appeared posteriorly with the displacement of the cord to the left, with approximately 80% canal compromise. A portion of this mass in the form of a dumbbell shape extended through the right T5–6 neural foramen [Figure 1b], which was otherwise normal in dimension. MRI of the brain, cervical, and lumbar spine was normal.

The patient underwent laminectomy at T4–T6. An extradural component of the tumor was seen on the right T5–6 foramen [Figure 2a]. Opening the dura showed an intradural and extramedullary mass with a clearly identifiable cleavage caudal and cephalad of the tumor without attachment to the dura [Figure 2b]. The tumor was easily removed off the spinal cord except for the central portion that was attached to the pia and vasculature of the spinal cord, but did not invade the spinal cord. By microdissection, the entire tumor was removed. The tumor extended through the right T5–6 foramen and was easily dissected off the nerve root.

Sections of the tumor microscopically showed a moderately cellular ependymoma characterized by perivascular pseudorosette formation evidenced by round to irregular nuclei with fibrillar processes extending to and surrounding a central blood vessel. Mild nuclear pleomorphism with a mitotic activity was identified. Focal endothelial proliferation and a few foci of necrosis were seen. Several areas of the ependymoma displayed tanycytic features in which the cells were arranged in fascicles of variable density.

Figure 1: (a) Sagittal and (b) axial T1-weighted MR images with the contrast of thoracic spine showing an intradural, extramedullary enhancing mass at T5–T6

Figure 2: (a) Intraoperative view of the extradural component of the tumor and (b) view of the intradural tumor
Immunohistochemical analysis showed a strong diffuse immunoreactivity for glial fibrillary acidic protein (GFAP), strong membrane immunoreactivity for CD56, and strong nuclear and cytoplasmic immunoreactivity for S100. The perinuclear dot-like immunoreactivity for the epithelial membrane antigen (EMA) was equivocal as the patchy staining noted was not of a greater intensity as that seen on the negative control study. The neoplastic cells were nonreactive for CD34 and neurofilament. The Ki-67 labeling index was variable with foci of the greatest labeling estimated at 5–15%. The final pathologic diagnosis was an anaplastic ependymoma, WHO grade 3.

Following surgery, the patient received external beam radiation between T3 and T8 with a total dose of 5000 cGy delivered using a three-field arrangement with daily doses of 200 cGy. The patient with 6-month follow-up had no recurrent tumor with normal MRI of the brain, cervical, and lumbar spine. He was neurologically intact except for poor proprioception in lower extremities which was unchanged from the time before initiation of surgery.

**DISCUSSION**

A review of the 18 reported cases of primary intradural, extramedullary ependymomas of the spinal cord [Table 1] shows ages ranging from 24 to 69 years with a female predominance. Earlier case reports (1951–2005) had shown the tumors occurring predominantly in women[5,10,12,14,21,23,24] with only one male[13] reported. A hormonal theory was proposed by Duffau et al.[8] in 2000 but was not confirmed by any cytogenic or molecular study and now with four recent cases[2,4,12,14] as well our case report identifying at total of six male patients, we believe that theory cannot be substantiated.

The location of the tumor often determines the clinical presentation. Mild to severe limb weakness, urinary disturbance and gait abnormalities mainly due to posterior column compression have been common clinical presentations. In almost all cases, these symptoms were reversed after surgery. The thoracic spine has been the most common location with five cases occurring in the cervical spine,[2,12,14,21] and three cases in the lumbar spine.[12,15,21] There were two cases[12,21] in which tumors occurred at multiple spinal levels on initial presentation [Table 1].

MRI imaging shows well-delineated intradural, extramedullary masses that homogeneously enhanced after gadolinium administration. One exception was the case of Graça et al.[10] in which the lesion appeared hyperintense on T2-weighted and isointense on T1-weighted images without any enhancement and with an appearance typical of an arachnoid cyst. In general, intradural, extramedullary ependymomas are often mistaken for meningiomas or nerve sheath tumors and this has been further strengthened when there is an extradural component as seen in the case by De Bonis et al.[7] in which a dumbbell-shaped tumor extended in the left paravertebral space through the vertebral foramen. Our case was the second such case in which an extradural component was seen [Figure 2a].

Intraoperative findings of these tumors have shown well-circumscribed encapsulated tumors with no dural attachment which can be easily removed from the surface of the spinal cord. We have found five exceptions,[5,10,12,14,20] Cheng et al.[5] and Krisman et al.[14] both described a thin stalk between the tumor and the spinal cord that was easily amputated. Graça et al.[10] and Iunes et al.[12] both described the tumor infiltrating the arachnoid membrane requiring sharp dissection at the tumor–spinal cord interface. Robles et al.[20] described a highly vascular lesion with infiltration into the pia requiring microvascular dissection. This was similar to our case. Both cases were Grade 3 indicating greater infiltration into the pia. In all these cases, there was no evidence of invasion into the cord intraoperatively or on MRI imaging and hence were all considered extramedullary.

Table 1 lists the actual description of the pathology of these tumors as they appear in these 18 papers. Almost all tumors were benign on initial presentation except for five[6,13,14,18,21] which were described as anaplastic or Grade 3. Our case was also an anaplastic ependymoma on initial presentation. Recurrence at the same level occurred in two cases,[2,4] and at a different level in one case.[20] All recurrent tumors were anaplastic. Two patients had cerebral metastasis from their spinal tumors.[2,21]

Treatment for the 18 cases varied and depended on the pathology seen on initial presentation or recurrence. Benign tumors were treated with complete surgical resections with no adjunctive treatment. This was similar to the treatment of benign intramedullary cord ependymomas reported by Brotchi et al.[3] who recommended gross total resection without adjunctive radiation therapy. For the five cases[6,13,14,18,21] of anaplastic ependymomas on initial presentation, the treatment varied. Katoh et al.[13] and Oliver et al.[18] did not give any radiation treatment postsurgery and had favorable outcomes but the follow-up period was short, 3–6 months. Schuurmans et al.[21] radiated the entire spinal cord with 20 sessions of 1.8 G with a boost to the cervical and lumbar levels, where the tumor occurred. Similarly, Cease et al.[8] advised his patient to have radiotherapy after the T5 anaplastic ependymoma was completely resected, but the patient refused. One year later with recurrence of the tumor, the patient had complete resection of the tumor with whole central nervous system radiotherapy. The patient died 1 month after treatment. Krisman et al.[14] treated his case with complete resection with adjunctive radiotherapy. The treatment in our case was complete resection of the tumor with neurospinal radiotherapy to T3–T8.
The hypothesis for the formation of these intradural, extramedullary ependymomas is that the heterotopic glial tissue is left in the intradural space as the neural tube closes. This most likely occurs at one region in the spinal cord. Schuurmans et al. hypothesized in their case that although cervical and lumbar tumors were found on initial presentation, one of the tumors must have been the primary tumor. They believed that the lumbar was most likely the primary ependymoma and it migrated via the cerebrospinal fluid (CSF) circulation to the cervical spine. This was even made more plausible when 2 years after the initial presentation the patient had a seizure and was found to have a large right temporal anaplastic ependymoma that was located in the sylvian fissure without any intracranial attachment. We believe that the process may be a combination of both and that the primary tumor most likely was ectopic and benign initially. If it was not detected early it may be transformed to a more malignant type and found as a new occurrence at a different level.

CONCLUSIONS

Primary spinal intradural, extramedullary ependymomas are very rare with only 18 reported cases. This tumor can be confused with meningiomas and nerve sheath tumors due to its similarity in MRI findings. Our case report is the first intradural, extramedullary ependymoma that is anaplastic and has an extradural component. The review of the literature provides little information on the treatment and prognosis for these tumors especially if they are anaplastic. We propose that the treatment, as done in our case, should be complete resection of the tumor with spinal radiotherapy to the tumor level.

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Table 1: Reported cases of primary spinal intradural, extramedullary ependymomas

| Reference | Authors       | Year | Age | Sex | Spine level | Location of the tumor | Pathology                  | Remarks                                |
|-----------|---------------|------|-----|-----|-------------|-----------------------|---------------------------|---------------------------------------|
| 6         | Cooper et al. | 1951 | 40  | F   | T2          | Intradural, extramedullary | Grade 1                   |                                       |
| 9         | Gonzales et al.| 1971 | 43  | F   | T7–T9       | Intradural, extramedullary | Grade 2                   |                                       |
| 18        | Oliver et al. | 1981 | 34  | M   | T5–T10      | Intradural, extramedullary | Grade 3                   |                                       |
| 23        | Wagle et al.  | 1988 | 41  | F   | T7          | Intradural, extramedullary | N/A                       |                                       |
| 15        | Li et al.     | 1992 | 63  | M   | Lumbar      | Intradural, extramedullary | N/A                       |                                       |
| 13        | Katoh et al.  | 1995 | 24  | F   | C4–T3       | Intradural, extramedullary | Grade 3                   |                                       |
| 5         | Cheng et al.  | 1996 | 47  | F   | T 4–T5      | Intradural, extramedullary | Myxopapillary ependynoma  |                                       |
| 24        | Wolfa et al.  | 1997 | 69  | F   | T10–T11     | Intradural, extramedullary | Ependynoma                |                                       |
| 19        | Payer et al.  | 1999 | 87  | F   | T6–T7       | Intradural, extramedullary | Grade 2                   |                                       |
| 8         | Daffau et al. | 1999 | 34  | F   | T1–T8       | Intradural, extramedullary | Grade 3                   |                                       |
| 20        | Robles et al. | 2005 | 47  | F   | T2          | Intradural, extramedullary | Grade 1                   |                                       |
| 4         | Cerase et al. | 2006 | 56  | M   | T5          | Intradural, extramedullary | Grade 3 anaplastic        | Recurrence same level                 |
| 10        | Graca et al.  | 2006 | 67  | F   | T6–T8       | Intradural, extramedullary | Grade 2                   |                                       |
| 21        | Schuurmans et al.| 2006 | 29  | F   | C3–C6       | Intradural, extramedullary | Anaplastic ependymoma/WHO grade III | Multilevels on initial presentation/seeded to brain |
| 2         | Benzagmount et al.| 2008 | 31  | M   | C1–C3       | Intradural, extramedullary | Benign ependymoma          | Metastasis to cerebellum              |
| 7         | De Bonis et al.| 2009 | 60  | F   | T9–10       | Extradural, intradural, extramedullary | Grade 2                   | Extradural ependymoma – left paravertebral space |
| 14        | Krisman et al.| 2011 | 53  | M   | C5–7        | Intradural, extramedullary | Anaplastic ependymoma     |                                       |
| 12        | Iunes et al.  | 2011 | 32  | M   | C2–3, T5–11, L-2, L-4, L-5, T5–T6 | Intradural, extramedullary | WHO grade II               | Multilevels on initial presentation   |
| Present study | Guppy et al. | 2010 | 50  | M   | T5–T6       | Extradural, intradural, extramedullary | Anaplastic ependymoma     | Extradural ependymoma – right T5–6 foramen |

initial presentation. Once surgery has occurred, the CSF is seeded and the recurrence can occur at another spinal level or in the brain. Of note, all the recurrences were found in a more advanced stage.
REFERENCES

1. Baleriaux D L. Spinal cord tumor. Eur Radiol 1999;9:1252-8.
2. Benzagmut M, Boujraf S, Oulali N, Chbani L, Amarti A, Chakour K, et al. Intradural extramedullary ependymoma: Is there constantly a hormonal relationship? Surg Neurol 2008;70:536-8.
3. Broth J, Fischer G. Spinal cord ependymomas. Neurosurg Focus 1998;4:e2.
4. Cerese A, Venturi C, Oliveri G, De Falco D, Miracco C. Intradural extramedullary spinal anaplastic ependymoma. Case illustration. J Neurosurg Spine 2006;5:476.
5. Cheng CH, Lee TC, Huang HY, Lui CC. Intradural extramedullary myxopapillary ependymoma: A case report of a rare tumor. Ann Acad Med Singapore 1996;25:869-72.
6. Cooper IS, Craig W. Tumors of the spinal cord: Primary extramedullary gliomas. Surg Gynecol Obstet 1951;92:183-90.
7. De Bonis P, Montano N, Cioni B, Colosimo C, Lauriola L, Papacci F, et al. Primary extramedullary extradural ependymoma of the thoracic spine mimicking a schwannoma. J Neurol Neurosurg Psychiatry 2009;80:579-81.
8. Duffau H, Gazzaz M, Kujas M, Fohanno D. Primary intradural extramedullary ependymoma: Case report and review of the literature. Spine 2000;25:1993-5.
9. González Feria L, Fernández Martín F, Ginovés Sierra M, Galera Davidson H. Giant dorsal extramedullary ependymoma. Arch Neurobiol (Madr) 1971;34:325-32.
10. Graça J, Gültasli N, D’Haene N, Brotchi J, Salmon I, Baleriaux D. Cystic extramedullary ependymoma. AJNR Am J Neuroradiol 2006;27:818-21.
11. Hanbali F, Fournet DR, Marmor E, Suki D, Rhines LD, Weinberg JS, et al. Spinal cord ependymoma: Radical surgical resection and outcome. Neurosurgery 2002;51:1162-72.
12. Iunes EA, Stávalle JN, de Cássia Caldas Pessoa R, Ansai R, Onishi FJ, de Paiva Neto MA, et al. Multifocal intradural extramedullary ependymoma. Case report. J Neurosurg Spine 2011;14:65-70.
13. Katoh S, Ikata T, Inoue A, Takahashi M. Intradural extramedullary ependymoma. Spine 1995;20:2036-8.
14. Kinsman MJ, Callahan JD, Hattab EM, Cohen-Gadol AA. Intradural extramedullary ependymoma: A diagnostic challenge and review of the literature. Clin Neurol Neurosurg 2011. [In press].
15. Li MH, Holsas S, Larsson EM. MR imaging of intradural extramedullary tumors. Acta Radiol 1992;33:207-12.
16. McCormick PC, Post KD, Stein BM. Intradural extramedullary tumors in adults. Neurosurg Clin N Am 1990;1:591-608.
17. Moser FG, Tiuva J, LaSalla P, Llana J. Ependymoma of the spinal nerve root-case report. Neurosurgery 1992;31:962-4.
18. Oliver B, De Castro A, Sarmiento MA, Arguello C, Blázquez MG. Dorsal extramedullary ependymoma. Arch Neurolol 1981;44:215-24.
19. Payer M, Yonekawa Y, Imhof HG. Solitary thoracic intradural extramedullary ependymoma. J Clin Neurosci 1999;6:344-5.
20. Robles SG, Saldana C, Boto GR, Martinez A, Zamarron AP, Jorquera M, et al. Intradural extramedullary spinal ependymoma: A benign pathology? Spine 2005;30:E251-4.
21. Schuurmans M, Vanneste JA, Verstegen MJ, van Furth WR. Spinal extramedullary anaplastic ependymoma with spinal and intracranial metastases. J Neurooncol 2006;79:57-9.
22. Sloof JL, Kernohan JW, MacCarty CS. Primary Intradmedullary Tumors of the Spinal Cord and Filum Terminale. Philadelphia: WB Saunders; 1964.
23. Wagle WA, Jaufman B, Mincy JE. Intradural extramedullary ependymoma: MR pathologic correlation. J Comput Assist Tomogr 1988;12:705-7.
24. Wolfs CE, Azzarelli B, Shah IV. Primary extramedullary ependymoma of the thoracic spine. Case illustration. J Neurosurg 1997;87:643.