CASE REPORT

A rare case of multifocal intramedullary germinoma in cervical spinal cord

R Wang¹, X Fan² and B Zhang³

Study design: Case report.

Objectives: We present for the first time a patient with multifocal intramedullary cervical spinal cord germ cell tumors with elevated serum alpha-fetoprotein (AFP).

Setting: Nanjing Drum Tower Hospital, The Affiliated Hospital of Nanjing University Medical School, Nanjing, China.

Methods: A 19-year-old girl experienced numbness in her right leg 10 months before diagnosis. The numbness gradually became severe and extended up to the thorax. Magnetic resonance imaging (MRI) visualized several intramedullary masses with intensive enhancement and extensive peritumoral edema in the spinal cord at the C3–T1 vertebral body levels. Administration of methylprednisolone caused no treatment effect. The largest mass, which was located at the T1 level inside the normal spinal cord and confirmed by naked eye observation, was completely extracted under a microscope. Postoperative pathological examination demonstrated the so-called ‘two-cell pattern,’ which is typical of germinoma with placental alkaline phosphatase expression. The serum level of AFP was 64.50 ng ml^{−1} (normal range: 0–5 ng ml^{−1}). The residual tumor was eliminated through radiation therapy (local 30 Gy) following surgery. Afterward, the patient’s neurological deficits were improved but not resolved.

Results: Six years after surgery, no recurrence was encountered and the patient remained stable.

Conclusion: Radiotherapy is the salvage therapy for spinal cord germinoma. Steroids were of no therapeutic value in the treatment of intramedullary spinal cord germinoma.

Spinal Cord (2014) 52, S19–S22; doi:10.1038/sc.2014.33

Keywords: germinoma; intramedullary tumor; radiotherapy; alpha-fetoprotein

INTRODUCTION

Germinoma of the central nervous system is rare, occurring only in 0.1 per 100 000 people annually. It is located mostly in the pineal area and is histologically the same as testicular germinoma and ovarian dysgerminoma. Spinal germinoma is usually reported as metastases from intracranial germinoma (10–20%), which usually exists in the perimedullary or extramedullary regions.¹ Only four metastatic intramedullary spinal cord germinomas exist. At least 21 cases involving primary intramedullary spinal cord germinomas have been reported (Table 1).²

CASE REPORT

A 19-year-old girl first experienced numbness in her right leg 10 months before diagnosis. The numbness gradually extended up to the thorax. She suffered from right leg weakness during the last 2 months. Although she did not feel pain, she had difficulty in walking and defecation.

Magnetic resonance imaging (MRI) showed swelling of the cervical spinal cord with edematous lesions and multiple enhanced intramedullary masses in the center of spinal cord at the C3–C4, C3–C6 and T1 vertebral body levels (Figure 1).

Steroids were administered using an intravenous methylprednisolone dose of 500 mg once daily for 3 days, followed by a lower intravenous dose of 80 mg once daily for 7 days. After 10 days, the patient noted a slight worsening of motor weakness and sensed numbness. Repeat MRI showed no significant change.

Surgery

Laminectomy of the T1–2 region and incision of the dura at the dorsal midline revealed a markedly widened thoracic spinal cord with shift of the posterior median sulcus to the left and a color-changed area in the right side dorsolateral of the spinal cord at the same level with the covered normal spinal cord nerve tissue. After performing a right-side dorsolateral myelotomy over the abnormal color area of the spinal cord, we encountered a wine-colored, gelatinous tumor encapsulated by a fragile membranous substance, which was completely removed under a microscope (Figure 2).

Histopathological features

Postoperative pathological examination demonstrated the so-called ‘two-cell pattern,’ which is typical of germinoma with placental alkaline phosphatase expression (Figure 2). Other immunohistologic results were as follows: CD117 (+ + +), CK (+), EMA (+ / −),

¹Department of Neurosurgery, Nanjing Drum Tower Hospital, The Affiliated Hospital of Nanjing University Medical School, Nanjing, China; ²Department of Pathology, Nanjing Drum Tower Hospital, The Affiliated Hospital of Nanjing University Medical School, Nanjing, China and ³Department of Radiology, Nanjing Drum Tower Hospital, The Affiliated Hospital of Nanjing University Medical School, Nanjing, China
Correspondence: Dr R Wang, Department of Neurosurgery, Nanjing Drum Tower Hospital, The Affiliated Hospital of Nanjing University Medical School, 321 Zhongshan Road, Nanjing 210008, China.
E-mail: wangr2007@126.com

Received 25 December 2013; revised 13 February 2014; accepted 18 February 2014

Table 1 Summary of previously reported cases of metastatic and primary intramedullary spinal cord germinomas

Patient no	Authors, year	Age	Sex	Duration of symptoms before admission (months)	HCG or β -HCG	AFP	Patients race	Tumor location (level)	Operation	Radiation therapy	Chemotherapy	Steroid therapy	Follow-up (months)
M1	Shibamoto <i>et al.</i> , 1994	27	M	— ^a 42	High	Normal		Pineal and suprasellar					
M2	Kuba <i>et al.</i> , 2000	25	M	72	High	Normal		Suprasellar					
M3	Shah <i>et al.</i> , 2005	30	F	6	High	Normal		Suprasellar					
M4	Hanakita <i>et al.</i> , 2012	28	M	180	Normal	Normal		Pineal					
1	Hisa <i>et al.</i> , 1985	5	M	1	High	—	Japanese	T8–L5	Amputation spinal cord(T7)	Yes	Yes	—	NED for 6
2	Nagasawa <i>et al.</i> , 1991	31	M	24	Normal	Normal	Japanese	Mid-cervical, multifocal	No	Yes	—	—	NED for 40
3	Matsuyama <i>et al.</i> , 1995	34	F	5	Normal	Normal	Japanese	T6–8	Partial	Yes	No	—	NED for 12
4	Itoh <i>et al.</i> , 1996	24	M	2	—	—	Japanese	T11–12	Total	Yes	—	—	NED for 13
5	Hata <i>et al.</i> , 2002	33	M	1	Normal	Normal	Japanese	T7–9	Partial	Yes	Yes	—	NED for 38
6	Sasaki <i>et al.</i> , 2002	32	F	2	High	Normal	Japanese	T3–4	No	Yes	Yes	No improvement	NED for 60
7	Zhu <i>et al.</i> , 2002	7	M	1	High	—	Chinese	T12–L1	Yes	No	No	—	—
8	Chute <i>et al.</i> , 2003	18	M	48	High	Normal	Hispanic	T6–T8	Biopsy	Yes	No	No improvement	NED for 6
9	Huang <i>et al.</i> , 2004	18	M	2	Normal	Normal	Caucasian	C3–C6	Partial	Yes	Yes	—	NED for 6
10	Watanabe <i>et al.</i> , 2005	34	F	48	Normal	Normal	Japanese	T1–3	Partial	Yes	Yes	—	—
11	Nakata <i>et al.</i> , 2006	35	M	56	High	—	Japanese	T6–T7	Total	Yes	Yes	—	NED for 48
12	Nakata <i>et al.</i> , 2006	27	M	16	High	—	Japanese	T7–T9	Partial	Yes	No	—	20 months later recurrence, 80 months later death
13	Takahashi <i>et al.</i> , 2006	22	F	3	High	—	Japanese	L1–L2	Partial	Yes	Yes	—	NED for 18
14	Aoyama <i>et al.</i> , 2007	16	F	5	High	—	Japanese	T9–T12 with dissemination	Partial	Yes	Yes	—	NED for 48
15	Aoyama <i>et al.</i> , 2007	34	F	3	High	—	Japanese	T8–T10	Biopsy	Yes	Yes	No improvement	NED for 36
16	Tubbs <i>et al.</i> , 2008	14	M	7	—	—	White male	L1 (conus)	Total	No	—	—	NED for 3
17	Yamagata <i>et al.</i> , 2009	33	M	24	—	—	Japanese	T9–11	Partial	Yes	Yes	Worsened	NED for 24
18	Yamagata <i>et al.</i> , 2009	24	F	2	High	—	Japanese	T6–7	Partial	Yes	Yes	Worsened	NED for 6
19	Yang <i>et al.</i> , 2009	39	F	7	High	—	Chinese	C2–T1	Biopsy	Yes	Yes	—	NED for 20
20	Rabo <i>et al.</i> , 2010	28	M	2	—	—	Japanese	L1–L2	Total	Yes	No	—	NED for 12
21	Kinoshita <i>et al.</i> , 2010	21	F	12	High	—	Japanese	Suprasellar region					
								T9–T11	Total of T9–T11 mass	Yes	Yes	—	NED for 36
22	Present case	19	F	10	Normal	High	Chinese	L2–L3	Total	Yes	No	Worsened	NED for 48
								C–T1					
								Multiple					

Abbreviations: AFP, alpha-fetoprotein; HCG, human chorionic gonadotropin; NED, no evidence of disease; —, not described. Patients M1–4 presented four metastatic intramedullary spinal cord germinomas, which all metastasized to cervical spinal cord.

Patients 1–22 presented four primary intramedullary spinal cord germinomas.

^aThe patient initially presented with an intramedullary spinal tumor and developed an intracranial germinoma 42 months later. The original spinal tumor without pathological confirmation was thought to be a metastasis from the intracranial germinoma, occur at that time.

Figure 1 Cervical spinal MRI using a 1.5-T scanner. (a) T₁-weighted sagittal imaging shows an enlargement of the spinal cord. (b) Gadolinium-enhanced sagittal imaging shows homogeneous enhancement of the mass at the C3–4, C5–6 and T1 level. (c) T₂-weighted sagittal imaging shows an isodensity intramedullary mass at T1 level with surrounding hyperintense signal at C3–7 and T2–4 level. Postoperative images reveal complete remission of the tumor with no intramedullary lesions and peritumoral edema at T₁-weighted sagittal imaging (d), Gadolinium-enhanced sagittal imaging (e) and T₂-weighted sagittal imaging (f).

Figure 2 (a) Left image is the intraoperative findings of a markedly widened spinal cord with shift of the posterior median sulcus to the left and a color-changed area (arrow) in the right-side dorsolateral of the spinal cord at the same level with the covered normal spinal cord nerve tissue. Right image is the appearance of the same spinal cord covered with oxidized absorbable cellulose after removal of the mass. (b) Microscopically, the tumor is composed of uniform cells arranged in sheets, which are divided by fine fibrous trabeculae associated with a lymphocytic infiltrate (hematoxylin and eosin stain, H&E, original magnification $\times 200$). A full color version of this figure is available at the *Spinal Cord* journal online.

Oct3/4 (+), S100 (+/-), Syn (-), alpha-fetoprotein (AFP, -), HMB45 (-), CEA (-), GFAP (-), ALK (-), CD3 (-), CD20 (-), CD30 (-) and CD15 (-).

Postoperative therapy and follow-up

The postoperative course was uneventful, and no new neurological deficits emerged. Serum levels of human chorionic gonadotropin- β subunit (HCG) and lactate dehydrogenase were normal, whereas that

of AFP was 64.50 ng ml^{-1} (normal level: $0\text{--}5 \text{ ng ml}^{-1}$) on day 10 after the operation. Abdominal ultrasonography including the ovary and abdominal/chest computed tomography (CT) were performed to identify any source of the spinal cord lesion. However, no other lesions were revealed. Radiation therapy (local 30 Gy) was initiated following the surgery at 20-day intervals. One week after the radiotherapy, MRI showed the disappearance of the enhanced residue masses in the center of cervical spinal cord (Figure 1). During the

6-year follow-up period, the patient's neurological deficits had improved but were not completely resolved. She refused further MRI check because of the lack of new symptoms.

DISCUSSION

This case deserved care for multifocal intramedullary spinal cord germinoma. A 19-year-old girl was operated on for an intramedullary cervical tumor that was eventually identified as a germinoma. Several cervical masses with similar MRI findings were detected in the vicinity, and no primary tumor was found elsewhere in the central nervous system or the body. Usually, one of the intramedullary spinal masses is the primary tumor and the others are metastases. Although never reported, multifocal primary intramedullary spinal cord germinomas could not be excluded in this case.³

Some patients have highly elevated serum β -HCG levels.⁴ The present case is the first of intramedullary spinal cord germinoma with a high serum level of AFP.

The management of spinal cord germinoma is based on the protocol for treating intracranial germinomas. Postoperative radiotherapy was considered in all the reported spinal cord germinoma cases because germinoma is extremely sensitive to radiation. Pure germinoma has an especially favorable prognosis and can be cured by radiation therapy alone, with a 5-year survival rate of nearly 100%.⁵

CONCLUSION

This case report aims to increase knowledge about the pathogenesis and treatment of intramedullary spinal cord germinoma. Irradiation of the tumor and surrounding margin is an effective therapy for intracranial germinomas even without operation. Meanwhile, steroid therapy is effective for intramedullary spinal cord germinomas.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

- 1 Jennings MT, Gelman R, Hochberg F. Intracranial germ-cell tumors: natural history and pathogenesis. *J Neurosurg* 1985; **63**: 155–167.
- 2 Hisa S, Morinaga S, Kobayashi Y, Ojima M, Chikaoka H, Sasano N. Intramedullary spinal cord germinoma producing HCG and precocious puberty in a boy. *Cancer* 1985; **55**: 2845–2849.
- 3 Rabo CS, Hashimoto N, Kagawa N, Fujita T, Hirayama R, Otsuki H *et al*. A rare case of a simultaneously detected suprasellar and intramedullary spinal cord germinoma. *Brain Tumor Pathol* 2010; **27**: 117–120.
- 4 Biswas A, Puri T, Goyal S, Gupta R, Eesa M, Julka PK *et al*. Spinal intradural primary germ cell tumour—review of literature and case report. *Acta Neurochir (Wien)* 2009; **151**: 277–284.
- 5 Kinoshita Y, Akatsuka K, Ohtake M, Kamitani H, Watanabe T. Primary intramedullary spinal cord germinoma. *Neurol Med Chir (Tokyo)* 2010; **50**: 592–594.