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Original Article

Intraspinal tumors: Analysis of 184 patients treated surgically

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Abstract

Background: Intraspinal tumors are rare central nervous system neoplasms. The reported clinical features of intraspinal tumors have varied in previous studies. We present here the cases of 184 patients with intraspinal tumors treated surgically in our hospital and a review of the literature.
Methods: We conducted a retrospective review of 184 patients with intraspinal tumors who underwent surgical treatment in our institution between 2002 and 2013. Their age, sex, initial presentation, tumor location, level of affected vertebral column, histological diagnosis, and primary origin of the metastatic tumor were reviewed and analyzed.
Results: Of these 184 patients, 97 (52.7%) were men and 87 (47.3%) were women. The mean age was 56.3 years (range 7–83 years). A total of 102 (55.4%) had primary tumors, while 82 (44.6%) patients had developed metastatic tumors. The histological diagnosis of the primary tumors included 55 (53.9%) schwannomas, 16 (15.7%) meningiomas, six (5.9%) ependymomas, five (4.9%) neurofibromas, three (2.9%) hemangiomas, two (2.0%) hemagioblastomas, and 15 (14.7%) other tumor types. The most common primary sites of the metastatic tumors were the lung and breast.
Conclusion: Primary tumors were more numerous than metastastic tumors in our series of patients. For the primary tumors, our study showed a higher proportion of nerve sheath cell tumors (schwannomas and neurofibromas) and fewer meningiomas and neuroepithelial tumors compared with reports from non-Asian countries. In addition, the lung was the most common origin of the metastatic tumors and more than half of these tumors were located at the thoracic spine. Back pain and radicular pain were the most common presentations in patients with intraspinal tumors.

Keywords: central nervous system neoplasms; spinal cord neoplasms; spinal neoplasms

1. Introduction

Intraspinal tumors are a rare category of tumor in the central nervous system. Based on previous reports, the incidence and prevalence of different spinal tumors vary among countries and populations.[1–6] Although there have been many studies of the epidemiology of central nervous system tumors, there are few reports discussing the epidemiology of intraspinal tumors. In addition, the occurrence and distribution of intraspinal tumors by sex, age, and pathology are different among races and regions. In this study, we reviewed the cases of patients with spinal tumors treated surgically in our hospital. The patients' age at surgery, sex, the location of the tumor, and the pathological diagnosis are described.

2. Methods

We collected details of patients with intraspinal tumors treated surgically in the Department of Neurosurgery of our institution between January 2002 and October 2013. In each case, data about the patient's age at surgery, sex, initial presentation, location of the tumor, vertebral bodies affected,

Conflicts of interest: The authors declare that there are no conflicts of interest related to the subject matter or materials discussed in this article.

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histological diagnosis, and the primary origin of the metastatic tumor were obtained and analyzed. We also compared the results of our study with other studies performed elsewhere in the world.

3. Results

A total of 184 patients with spinal tumors had surgical treatment in our department between January 2002 and October 2013. Of these patients, 97 (52.7%) were men and 87 (47.3%) were women. Male predominance was noted in all tumors except meningiomas, for which the male/female ratio was 1:3.3. The mean age of the patients at surgery was 56.3 years (range 7–83 years). Eighty-two (44.6%) patients had metastatic tumors and 102 (55.4%) patients had primary tumors (Table 1).

Primary spinal tumors accounted for 102 cases. Table 1 shows that schwannoma was the most common tumor (55/102 patients; 53.9%), followed by meningioma (16/102; 15.7%). Six (5.9%) patients had intramedullary tumors, 62 (60.8%) patients had intradural extramedullary tumors, 14 (13.7%) patients had epidural tumors, and 20 (19.6%) patients had dumbbell tumors. Schwannomas occurred mainly at the lumbar spine (28/55 patients; 50.9%), whereas meningiomas occurred mainly at the thoracic spine (14/16 patients; 87.5%; Table 2). The peak age of patients with primary spinal tumors was 60–70 years (Fig. 1).

The most common clinical presentation of the primary spinal tumors was pain (58.8%). Most of the patients with nerve sheath cell tumors (schwannomas and neurofibromas) had symptoms of sensory disturbance and pain; schwannomas were found incidentally in eight patients. More than half of the patients with meningiomas had symptoms associated with cord compression (Table 3).

Of the 82 patients with metastatic tumors, the most common primary origin was the lung (22/82 patients; 26.8%), followed by the breast (11/82 patients; 13.4%), prostate (10/82 patients; 12.2%), liver (10/82 patients; 12.2%), gastrointestinal tract, lymphoma, ureter, pancreas, kidney, thyroid cancer, colon, larynx, multiple myeloma, and others (Table 4). The thoracic spine was affected in 61% of metastatic tumors (Table 2). The patient group aged 50–60 years had the largest number of patients with metastatic tumors (Fig. 2).

Table 1
Histological classification, incidence, and sex distribution in this study of patients with intraspinal tumors.

Type of tumor	*n* (%)	No. of men	No. of women
Metastatic	82 (44.6)	51	31
Schwannoma	55 (29.9)	31	24
Meningioma	16 (8.7)	4	12
Ependymoma	6 (3.3)	5	1
Neurofibroma	5 (2.7)	0	5
Hemangioma	3 (1.6)	0	3
Hemangioblastoma	2 (1.1)	2	0
Other	15 (8.1)	4	11

Table 2
Location of intraspinal tumors.

Type of tumor	Cervical spine	Thoracic spine	Lumbosacral spine	*n* (%)
Metastatic	18	50	14	82 (44.6)
Schwannoma	9	18	28	55 (29.9)
Meningioma	2	14	0	16 (8.7)
Ependymoma	2	0	4	6 (3.3)
Neurofibroma	3	0	2	5 (2.7)
Hemangioma	0	3	0	3 (1.6)
Hemangioblastoma	0	1	1	2 (1.1)
Other	2	3	10	15 (8.1)
n (%)	36 (19.6)	89 (48.4)	59 (32.0)	184 (100)

Data are presented as number of patients.

4. Discussion

The previously reported incidence of primary spinal tumors varies (Table 5).[1–6] There were evident differences in the prevalence of nerve sheath cell tumors (schwannomas and neurofibromas) and meningiomas, which were the most common primary spinal tumors. The nerve sheath cell tumors were found more frequently than meningiomas in Asian countries, including in this study (nerve sheath cell tumors 55.0%; meningiomas 15.7%),[2–4] and this trend was more obvious in eastern Asia. Hirano et al[3] reported that nerve sheath tumors accounted for 60.6% in their series of 678 cases of primary spinal tumor in Japan. By contrast, the frequency of meningiomas in Western countries was equal to or higher than that of nerve sheath tumors.[4–6] Neuroepithelial tumors occurred less frequently in Asian countries than in Western countries. The incidence of vascular tumors seems to vary less among the studies. There were significant differences in the prevalence of schwannomas, meningiomas, and neuroepithelial tumors between Asian countries and non-Asian countries.

Nerve sheath cell tumors (schwannomas and neurofibromas) were the most common primary spinal tumors in our series with no significant difference in prevalence between men and women (ratio of men to women 1.03). However, the preponderance for spinal meningiomas in women is universal; in our series of patients, the ratio of men to women for meningiomas was 0.33. In previous studies, the ratio of men to women for patients with primary spinal tumors varied among

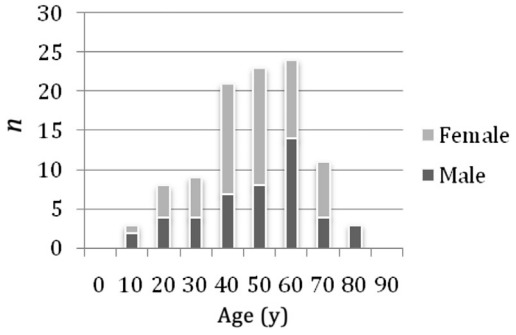

Fig. 1. Age at surgery of patients with primary spinal tumors.

Table 3
Clinical presentations of 92 primary spinal tumors.

Type of tumor	Pain	Sensory disturbance	Motor weakness	Sphincter dysfunction	Myelopathy	Incidentally found
Schwannoma	33	7	20	2	0	8
Meningioma	6	5	7	2	3	0
Ependymoma	4	0	2	1	1	0
Neurofibroma	2	1	2	0	0	0
Other	15	5	8	0	2	0
Total	60	18	39	5	6	8

Data are presented as number of patients.

Table 4
Primary sites of metastatic tumors.

Origin of primary tumor	*n* (%)
Lung	22 (26.8)
Breast	11 (13.4)
Prostate	10 (12.2)
Liver	10 (12.2)
Gastrointestinal tract	3 (3.7)
Lymphoma	3 (3.7)
Ureter	3 (3.7)
Pancreas	3 (3.7)
Kidney	3 (3.7)
Thyroid	2 (2.4)
Colon	2 (2.4)
Larynx	2 (2.4)
Multiple myeloma	2 (2.4)
Cervix	1 (1.2)
Brain	1 (1.2)
Tonsil	1 (1.2)
Unknown	3 (3.7)

countries. Engelhard et al[6] reported that a preponderance in women for meningiomas alone was enough to change the ratio of men to women for the entire spinal tumor series in non-Asian regions. There would be a slight male predominance for primary spinal tumors if meningiomas were not included.

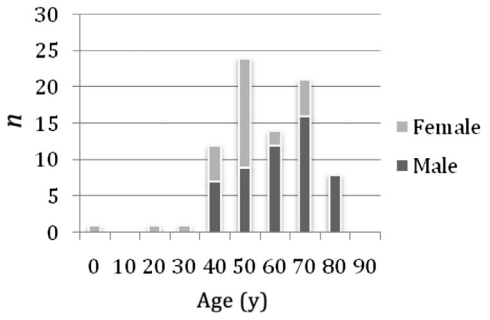

Fig. 2. Age at surgery of patients with metastatic tumors.

The most common clinical presentations of primary spinal tumors in our study were back pain and radicular pain (60/102 patients; 58.8%). Nerve sheath cell tumors usually cause paresthesia or a shooting pain and are sometimes found incidentally. Jinnai et al[7] collected data for 149 patients with spinal nerve sheath tumors and the symptoms at onset were motor weakness in 36 (24.2%) patients, pain in 55 (36.9%) patients, and paresthesia and/or numbness in 53 (35.6%) patients. The presenting symptoms of spinal meningiomas include back pain, motor disturbance, sensory disturbance, and sphincter dysfunction.[8,9] The initial presenting symptoms vary among patients because of the different levels and anatomic location of the tumor.

All 20 dumbbell tumors in our study were nerve sheath cell tumors and most were located at the cervical spine. According to a previous study, about 10–20% of nerve sheath cell tumors arise where the nerve root leaves the dural sac and display both intradural and intraforaminal involvement, with intraforaminal and paravertebral involvement; the so-called "dumbbell tumors".[10] Entirely extradural or intramedullar nerve sheath tumors are much less common. Nerve sheath cell tumors occur more commonly at the level of the lumbosacral region than in the cervical and thoracic region, but dumbbell tumors are mostly located at the level of the cervical spine.[7]

The multiple schwannomas present in a single patient were possibly associated with a medical syndrome, such as neurofibromatosis. However, several workers have reported patients with multiple schwannomas without any clinical evidence of vestibular schwannoma or neurofibromatosis as schwannomatosis. In our series, there were three patients with multiple spinal schwannomas who did not have the stigmata of type 1 or 2 neurofibromatosis. They all received surgical resection with good clinical outcomes and prognosis. Huang et al[11]

Table 5
Incidence of primary intraspinal tumors in different countries.

Country	Reference	Year	No. of cases	Nerve sheath cell tumors (%)	Meningioma (%)	Neuroepithelial tumors (%)
Taiwan	This study	2013	102	55.0	15.7	7.8
Taiwan	Su et al[2]	2007	64	51.6	21.9	10.9
Japan	Hirano et al[3]	2012	678	60.6	11.7	9.4
Korea	Suh et al[4]	2002	141	39.7	25.5	19.1
USA	Schellonger[5]	2008	3226	24.4	28.9	29.2
USA	Engelhard[6]	2010	430	22.6	24.2	39.3
Germany	Klekamp and Samii[1]	2006	1081	26.9	16.7	17.1

reported six patients with schwannomatosis in a series of 131 patients who underwent surgery at their institution for resection of spinal or peripheral nerve schwannomas. Surgery is indicated for symptomatic lesions, where asymptomatic tumors are followed regularly.[11–13]

There were more primary tumors than metastatic tumors in the patients in our study. In previous reports of intraspinal tumors, the incidence of metastatic tumors varied between different regions and countries.[1,4,14] Differences in case selection and study methodologies could be two of the reasons for this variation. The improved survival rate of many kinds of malignant disease has increased the occurrence rate of spinal metastases in recent years. This may also be attributed to advancements and improvements in the quality of non-invasive image techniques, especially the more easily available magnetic resonance imaging. The most common primary origin of metastatic tumors in our study was the lung (26.8%), followed by the breast, prostate, and liver; the thoracic spine (61.0%) was most commonly affected. The lung and breast have often been reported as the two most common primary sites of origin. Steinmetz et al[15] concluded that breast, lung, prostate, and renal carcinoma were the most common tumors that disseminated to the spine and that the thoracic spine was affected in 70% of symptomatic patients. In addition to surgical treatment, some patients with metastatic spinal tumors received only radiation therapy.[16–19] The characteristics of metastatic tumors may be misunderstood because we only obtained the data for patients treated surgically.

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