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The frequency of various spinal cord tumors (SCTs) in surgically treated patients at Shiraz Shahid Chamran Hospital from 2012 to 2022

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Abstract

Aim The incidence of spinal cord tumors (SCTs) in a population considering sex, age, histopathology, and emplacement position of tumors is different between various regions. Therefore, the present study aimed to evaluate the frequency of various SCTs in surgically treated patients in a reference spinal surgery center in Shiraz, Iran.

Method Documented information related to 109 SCT patients surgically treated was collected from the archive of Shahid Chamran Hospital (the reference center of spinal cord surgery in the south of Iran) in Shiraz from 2012 to 2022. This information includes demographics, medical history, histology, and position of SCTs within the spinal cord.

Result The population of patients included 65 men and 44 women, with a mean age of 44.7 years old. Most patients (26 cases) were in the age group of 50–59 years. Neurological function in most patients (51 cases) was equivalent to level D of the ASIA impairment scale (AIS), and the most common complaints of patients (83 cases) were related to pain. Finally, anatomic and histologic evaluations indicated that intradural and schwannoma tumors were the most common types of tumors, with 64 and 25 cases, respectively.

Conclusions In the present study, most of the findings are consistent with the previous reports. Schwannoma and ependymoma tumors were the most common types of SCTs and the most common types of intramedullary tumors, respectively. The sixth decade of life was the most common age of incidence. Neurological function in most patients with SCT was equivalent to levels of D and E of AIS. However, regarding the factor of gender, our results are similar to those of the Asian population. More comprehensive studies in the future likely reveal the probable role of environmental, genetic, and hormonal factors in the etiology of SCTs.

Keywords Frequency, Spinal cord, Tumor, Incidence, Surgery

Introduction

Spinal cord tumors are relatively uncommon, accounting for 4–16% of all central nervous system (CNS) tumors [1, 2]. In addition, the spine is one of the most frequent

sites for bone metastases [3], which means around 70% of cancer patients experience spine metastasis, and over 10% experience metastatic spinal cord compression [4]. Despite many reports on the epidemiology of tumors in the whole CNS, there are few reports on the epidemiology of purely spinal cord tumors (SCTs). Furthermore, available reports on the prevalence of SCTs vary greatly due to differences in sample size, tumor classification, and race of the studied population. In different racial and geographical groups, it has been noted that the incidence of SCTs varies according to age, sex, the histology

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of tumors, and the position of tumors along the spine [5–10]. A strategy for prognosis and understanding of the etiology of SCTs may be established by assessing the incidence rate of SCTs across various geographic areas. To our knowledge, no report in the English-language literature analyzes the epidemiology of SCTs in Iran. Therefore, the goal of the current study was to evaluate the incidence rate of SCTs by age, sex, histology, and position of tumors along the spine in patients surgically treated in Shahid Chamran Hospital (the reference center of spinal cord surgery in the south of Iran) to determine the epidemiology of SCTs in the population of the south of Iran.

Methods

A retrospective cross-sectional study was carried out in Shahid Chamran Hospital, affiliated with the Shiraz University of Medical Sciences. The patients data were retrospectively extracted from their medical records. The inclusion criteria were the patients with surgically treated SCTs at Shahid Chamran Hospital. In the case of incomplete information, the patient was excluded from the study. All SCT patients who underwent surgical treatment from 2012 to 2022 were selected, and their medical records were investigated using a census form. The demographic information, such as age, sex, and past medical history, such as initial symptoms leading to the diagnosis of SCT, as well as the level of neurological function based on the ASIA impairment scale (AIS), were extracted from medical records. The laboratory and observational findings, including the histology of various tumors and the location of tumors within the spinal cord, were also recorded for each patient. All information was kept private. The study was approved by the Ethics Committee of the Shiraz University of Medical Sciences. Written informed consent was obtained from all participants. The study was approved by the Ethics Committee of the Shiraz University of Medical Sciences (reference number: IR.SUMS.REC.1392.62.83). Written consent to participate was obtained from all participants. All data were entered into SPSS version 20 software (IBM Corp., Armonk, NY, USA) and analyzed by two trained individuals (to reduce data entry error). The absolute frequency and percentage were used to report the extracted data.

Results

We identified 130 SCT patients who had undergone surgery at Shiraz Shahid Chamran Hospital from 2012 to 2022. Twenty-one patients were excluded from the study due to incomplete demographic information or unavailable pathology reports. Consequently, 109 patients were included.

Demographic information of the patients has been presented in Table 1. It was observed that 65 patients

Table 1 Demographic information of surgically treated patients with spinal cord tumors in Shiraz Shahid Chamran Hospital

Variable	Number (% of total)
<i>Age</i>	
0–9	0
10–19	3 (2.75)
20–29	16 (14.6)
30–39	25 (22.93)
40–49	21 (19.2)
50–59	26 (23.85)
60–69	10 (9.17)
70–79	7 (6.42)
80–89	1 (0.91)
<i>Sex</i>	
Male	65 (59.63)
Female	44 (40.36)
<i>Initial symptoms</i>	
Pain	83 (76.14)
Motor deficits	31 (28.44)
Sensory deficits	11 (10.09)
Sphingter problems	1 (0.9)
dna	14 (12.84)
<i>ASIA classification</i>	
Grade A	0
Grade B	7(6.42)
Grade C	6 (5.5)
Grade D	51 (46.78)
Grade E	44 (40.36)
dna	1 (0.9)

dna: data not available

(59.63%) were men and 44 patients (40.36%) were women. The youngest and oldest patients were 16 years old and 82 years old, respectively, and the mean age of the patients was 44.7 years old. The age group of 50–59 years old, with 26 patients (23.85%), included most cases, followed by the age groups of 30–39 and 40–49 years old, with 25 (22.93%) and 21 (19.26%) cases, respectively. Nineteen patients (17.43%) were younger than 30 years old, and 18 patients (16.51%) were older than 60 years old. Assessment of neurological function before surgery was found for 108 patients. According to AIS, none of the patients were at level A and levels B and C were only observed in 7 (6.42%) and 6 (5.5%) patients, respectively. The majority of patients (51 cases, 46.78%) indicated level D of AIS, and completely preserved neurological function (level E of AIS) was observed in 44 (40.36%) patients. Neurological function assessments of one patient were not available. Among all the initial symptoms recorded from 95 patients, most complaints (83 cases, or 76.14%) were related to pain, followed by motor disorders with

31 cases (28.44%), sensory disorders with 11 cases (10.09%), and sphincter problems with 1 case (0.9%) (Table 1). Evaluation of the position of tumors along the spine demonstrated that the most common types of SCTs were intradural (ID) tumors with 64 cases (58.71%), including extramedullary intradural (EMID) tumors and intramedullary intradural (IMID) tumors with 40 cases (36.69%) and 24 cases (22.01%) respectively. Extradural (ED) tumors were observed in 45 patients (41.28%), and a combined intradural & extradural tumor was diagnosed in only 1 case (0.91%) (Table 2). Regarding histology, schwannoma tumors, with 25 cases (25.93%), were the most frequent tumors, followed by ependymoma tumors, with 15 cases (13.76%). In addition, metastatic carcinoma, metastasis, and neurofibroma were diagnosed in 14 (12.84%), 10 (9.17%), and 8 (7.33%) patients, respectively. Large cell tumors, meningioma, and myxopapillary ependymoma were each found in 3 cases (2.75%), and other types of tumors were collectively observed in 24 patients, with less than 3 cases for each type (Table 3).

Surgical interventions for IDEM and ED tumors included laminectomy and tumor resection. For IDIM tumors, laminectomy, myelotomy, and tumor resection were performed. The operation time ranged from 2 to 6 h (mean: 4 h), depending on the location and size of the tumor. Also, the measure of blood loss varied from

1560 to 2845 ml, and the mean blood loss was 2305 ml. The duration of hospitalization was 4–6 days. Scar infection occurred in 2 patients (1.83%), CSF leakage occurred in 6 patients (5.5%), and a worsening or new incidence of neurological deficits, including motor and sphincter problems, occurred in 12 patients (11%), of which 8% were transient and resolved within 2 months and the remaining 3% resolved after 1 year. In Fig. 1, we presented a 17-year-old woman with a meningioma tumor in the T12 region of the spine. The MRI scans indicated complete removal of the tumor following laminectomy surgery and tumor resection. The patient experienced no later complications and after 4 days discharged from the hospital in good general condition.

Discussion

The results of the present study revealed that the incidence of tumors in men was about 20% higher than in women. Similar to our current results, some previous studies have reported a higher prevalence of SCTs in men than in women [11, 12]. However, despite our findings, some publications indicate a higher frequency in women [6, 13]. An overview of previous studies [2, 6–14] demonstrates that the male-to-female incidence rate ratio of SCT is variable from North America to Asia, and the highest incidence rate in women has been reported in the USA (40% male/ 60% female) [6], while the lowest incidence rate in women has been recorded in China (60.3% male/39.7% female) [2]. Thus, it can be inferred that in the western regions, the incidence rate of SCTs in women is higher than in men, and as we get closer to the eastern regions, the incidence rate in men increases. In China, one of the nations in the Far East, the incidence rate of SCTs is predominant in men rather than women. Furthermore, we discovered that the sixth decade of life was the most common age of occurrence of SCTs, followed by the fourth and fifth decades. In parallel with our findings, previous studies have mentioned the fourth, fifth, and sixth decades of life as the most common ages of incidence [11–13, 15]. However, we did not find a certain trend of incidence by age in different regions. In the current study, we observed that neurological function in

Table 2 Frequency of spinal cord tumors in surgically treated patients in Shiraz Shahid Chamran Hospital, regarding tumor histology

Tumor histology	Total no. (%)	Male no. (%)	Female no. (%)
Schwannoma	25 (22/93)	11 (44)	14 (56)
Ependymoma	15 (13/76)	13 (86/66)	2 (13/33)
Metastatic carcinom	14 (12/84)	3 (21/42)	11(78/57)
Metastasis	10 (9/17)	10 (100)	0
Neurofibroma	8 (7/33)	7 (87/5)	1 (12/5)
Giant cell	3 (2/75)	1 (33/33)	2 (66/66)
Meningioma	3 (2/75)	1 (33/33)	2 (66/66)
Myxopapillary ependymoma	3 (2/75)	1 (33/33)	2 (66/66)
Others (< 2%)	25 (22/018)	17 (68)	9 (36)

Table 3 Frequency of spinal cord tumors in surgically treated patients in Shiraz Shahid Chamran Hospital, based on their position along the spine

Number of patients (%)		Locality of tumors							
		ED	IMID	EMID	EDID				
Total (%)		45 (41.28)	24 (22.01)	40 (36/69)	1 (0/91)				
Males (%)	Females (%)	26/60	17/43	13/76	7/33	19/26	14/67	0	0/91

ED Extradural, IMID Intramedullary intradural, EMID Extramedullary intradural, EDID Combine of intradural and extradural

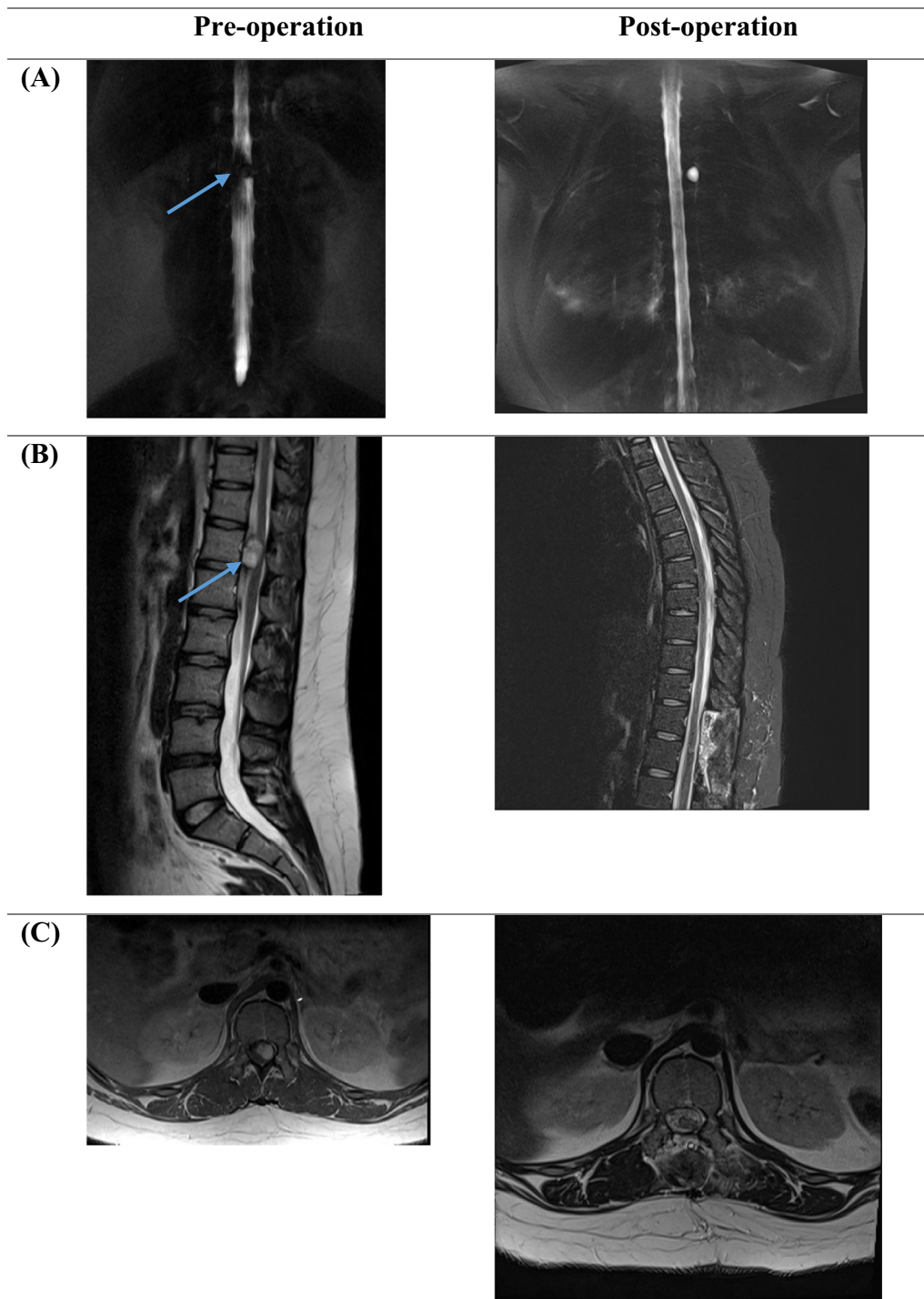


Fig. 1 Pre- and post-operation MRI scans of a 17-year-old girl with a meningioma tumor in the T12 region of the spine: **A** MRI myelogram view **B** Mid-sagittal T2-weighted MRI of the spine **C** Axial T1-weighted MRI of the T12 region of the spine. Postoperative MRI scans reveal complete removal of the tumor. Arrows show the location of the tumor

patients with SCTs has not been seriously impaired, and most patients presented mild deficits in neurological function. Similar to our findings, previous studies have

also declared that neurological function in most patients with SCT was equivalent to levels D and E of AIS [16, 17] representing partially preserved neurological function

in patients with tumor-related spinal cord injury (SCI). Tumor-related SCI typically displays a higher quality of motor function than traumatic SCI [18, 19]. Similar to previous reports [16, 20–22], we observed that pain was the most common initial symptom in patients, followed by movement disorders, sensory dysfunctions, and bladder sphincter problems. Regarding tumor anatomical position, it was detected that intradural tumors had the highest frequency, and extramedullary tumors were the most common type of intradural tumor. These findings were consistent with previous reports [11–13, 23]. Furthermore, similar to the previous studies [11, 12, 15, 22–24], we identified schwannoma tumors as the most common type of SCT and ependymoma tumors as the most common type of intramedullary tumor.

Conclusions

In the present study, most findings are consistent with the previous reports. Intradural tumors had the highest frequency, and extramedullary tumors were the most common type of intradural tumor. Schwannoma and ependymoma tumors were the most common types of SCTs and the most common types of intramedullary tumors, respectively. The sixth decade of life was the most common age of incidence. Neurological function in most patients with SCT was equivalent to levels of D and E of AIS. However, regarding the factor of gender, our results are similar to those of the Asian population. The male-to-female incidence rate ratio of SCT is variable from North America to Asia, and in Asian regions, the incidence rate in men is higher than in women. The current report, together with other epidemiological studies in this field, has the potential to reveal the probable role of environmental, genetic, and hormonal factors in the etiology of SCTs and may help find an approach for prognosis, prevention, or early identification of patients with SCTs. However, further, more comprehensive studies.

Abbreviations

SCT	Spinal cord tumor
CNS	Central nervous system
AIS	ASIA impairment scale
ID	Intradural
EMID	Extramedullary intradural
IMID	Intramedullary intradural
ED	Extradural

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Author contributions

FI: Data collection, data analysis, and interpretation, drafting the article, MRF: Conception or design of the work, Critical revision of the article, study supervision.

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Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author upon reasonable request. are needed to achieve this aim.

Declarations

Ethics approval and consent to participate

The study was approved by the Ethics Committee of the Shiraz University of Medical Sciences (reference number: IR.SUMS.REC.1393.283). Written consent to participate was obtained from all participants.

Consent for publication

Written consent to publish was obtained from all participants.

Competing interests

No author had any conflicts of interest and the authors have no personal financial or institutional interest in any of the drugs, materials, or devices described in this article.

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