Epidemiological Characteristics of the Spine Tumors in a Single Tertiary Centre of Nepal

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ABSTRACT

Background

Spine tumors can be primary or secondary, depending on their origin. Metastasis compromises the majority of spine tumors. Primary tumors of the spine are rare and mostly asymptomatic; consequently, their real incidence cannot be investigated. Primary malignancies of the spine are even rarer. Most epidemiological data for spine tumors comes from registries in developed countries.

Objective

To provide epidemiological data on spine tumors in a single tertiary hospital in Nepal.

Method

This is a descriptive cross-sectional study done at the department of orthopaedics at Dhulikhel Hospital. The study was done using retrospective hospital records from January 2010 to December 2024. The data related to all the spine tumors admitted under the department of orthopedics during the study's duration were included. Records without complete, relevant information were excluded. We took data from 135 patients admitted for spine tumors. The information related to the demography, site of tumors, types of tumors, and histological diagnosis was entered in Google Sheets and exported for descriptive analysis in Statistical Package for Social Sciences (SPSS) version 20.

Result

Among the 135 patients, the most common site of spine tumor was thoracic (42.22%). Primary benign neoplasms were the most common (n=68), and among the 61 malignancies, 36 were secondary and 25 were primary malignancies. Schwannomas were the most common benign tumors in the spine (n=23). The most common site for secondaries in the spine was the lungs (n=11).

Conclusion

This study's results represent data on the epidemiology of spinal tumors from a single institute. Although this data is far too small to represent the whole country, in the absence of registries or other large multicentric databases, it can shed some light on the less studied spine tumors in Nepal.

KEY WORDS

Epidemiology, Metastasis, Spine tumors

INTRODUCTION

Spine tumors can either be primary or secondary, depending on the origin of the tumor. The good vascularization and ties with local venous and lymphatic drainage make the spine vulnerable to metastasis.[1] Hence, metastasis compromises the majority of spine tumors. Carcinomas arising in the lungs, breast, prostate, kidney, gastrointestinal tract, and thyroid are known to metastasize to the spine.[2] Metastasis mostly occurs in the thoracic and lumbar vertebrae, followed by the sacral and cervical spine.[3] Primary tumors of the spine are rare and mostly asymptomatic; their real incidence cannot be investigated. Primary malignancies of the spine are even rarer.[4]

An epidemiological study not only provides knowledge on the burden of the disease but also directs resource allocation. Most epidemiological data for spine tumors comes from registries in developed countries. As per our knowledge, there are very few studies on spine tumors in Nepal. The study aimed to provide epidemiological data on spine tumors in Nepal.

METHODS

This is a descriptive cross-sectional study done at the department of orthopaedics at Dhulikhel Hospital. The study was done using retrospective hospital records from January 2010 to December 2024. The data related to all the spine tumors admitted under the department of orthopedics during the study's duration were included. Records without complete, relevant information were excluded. We took data from 135 patients admitted for spine tumors.

The information related to the demography, site of tumors, types of tumors, and histological diagnosis was entered in Google Sheets and exported for descriptive analysis in Statistical Package for Social Sciences (SPSS) version 20.

RESULTS

The average age of the 135 patients was 44.02 ± 16.59 years, [7 - 85 years]. The male-to-female ratio was 1.25:1. The most common site of spine tumors was thoracic (42.22%), followed by lumbar (31.67%), sacral (16.67%), and cervical (9.44%).

The average age for benign primary tumors of the spine was 42.03 ± 15.70 years, while locally aggressive tumors appeared early with an average age of 37.17 ± 16.24 years. The average age for metastatic tumors of the spine was 48.86 ± 17.41 years, and primary malignancy, including hematological tumors, was 45.76 ± 15.80 years.

Benign tumors and locally aggressive tumors were almost identically distributed among both sexes, while malignancy was seen more in males.

Table 1. Demography and Tumor Characteristics

Location	Benign	Locally aggressive	Malignant	Total
Cervical	11	2	4	17(9.44%)
Thoracic	43	3	30	76(42.22%)
Lumbar	28	0	29	57(31.67%)
Sacral	7	1	22	30(16.67%)
*The same patient can have multiple tumors or tumors can span multiple segments.				
Age (years)	42.03±15.70	32.17±16.24	45.76 ± 15.80 (primary)	
			48.86±17.41(metastasis)	
Sex				
Male	34	4	37	21
Female	34	2	24	15
Type				
Primary	68	6	25	
Secondary			36	
Tumor location within the vertebra				
Osseous	10	6	57	73
Extradural	9	0	2	11
Facetal	2	0	0	2
Intradural	47	0	1	48
Para spinal	0	0	1	1

Table 2. Origin of the secondaries to the spine

Origin	Frequency
Bladder	1
Breast	1
GI	2
Lungs	11
Not known	11
Ovary	1
Prostate	3
Renal	3
Thyroid	3

Benign primary tumors were the most common (n=68), and among the 61 malignancies, 36 were secondary and 25 were primary malignancies.

Most of the benign tumors were intradural (n=47), and most of the malignancies were in the vertebral bones (n=57). Most intradural tumors were extramedullary (n=43), and five were intramedullary. One of the intradural tumors was malignant.

The most common primary site for secondaries from the spine was the lungs (n=11), and in 11 cases, the primary site could not be identified while the patients were in our hospital.

Schwannomas were the most common benign tumors in the spine (n=23), followed by meningiomas (n=9) and hemangiomas (n=8). Five giant cell tumors and an aneurysmal bone cyst were classified as locally aggressive.

Table 3. Primary benign tumors

Benign tumors	Frequency
Aneurysmal bone cyst	1
Arachnoid cyst	5
Astrocytoma	2
Benign cyst	4
Benign spindle cell neoplasm	1
Dermoid cyst	2
Desmoplastic fibroma	1
Ependymoma	3
Giant cell tumor	5
Hemangioblastoma	1
Hemangioma	8
Langerhans cell histiocytosis	1
Meningioma	9
Neurofibroma	2
Osteoblastoma	1
Osteoid osteoma	1
Schwannoma	23
Synovial cyst	1
Tarlov cyst	3
Total	74

Among the primary malignancies of the spine, plasma cell tumors, including multiple myeloma and plasmacytoma (n=9), were the most common tumors, followed by sacral chordoma (n=4).

DISCUSSIONS

As substantial geographic and socioeconomic variation is seen in spinal tumors, understanding the burden of spinal tumors becomes more important in addressing resource allocation for such tumors.[5]

Primary tumors of the spine can originate from bone, adipose tissue, fibrous tissue, neural tissues, neural membranes, or neighboring paravertebral soft tissues and vessels. Additionally, distant malignant lesion foci might enter the spine via hematogenous or lymphatic pathways.[6] Primary spine tumors are known to occur rarely compared to metastatic tumors.[7]

Intradural extramedullary tumors account for the bulk of all tumors of the spine and spinal cord (40-45%).[8-12] Schwannomas, neurofibromas, and meningiomas are the most common types among these tumors, accounting for around 60 percent of extramedullary tumors.[8,13-15] Ependymomas make up the other majority, and the rest are rare neoplasms and space-occupying lesions that are non-neoplastic, like arachnoid cysts.[8,16,17]

The majority of our extramedullary tumors (n=45) were schwannomas (n=23), followed by meningiomas (n=9), ependymomas (n=2), neurofibromas (n=2), arachnoid cysts (n=5), and tarlov cysts (n=3).

Table 4. Primary malignant tumors

Malignant tumors	Frequency
Chordoma	4
Ewings Sarcoma	2
Glioblastoma	1
Leiomyosarcoma	1
Liposarcoma	1
Malignant peripheral nerve sheath tumor	1
Malignant spindle cell tumor	1
Plasma cell tumor/ multiple myeloma	9
Non-hodgkin lymphoma	2
Small blue round cell tumor	1
Teratoma	2

Intradural intramedullary neoplasms are a small portion of central nervous system tumors.[8] The vast majority of these neoplasms are gliomas (80%), and astrocytomas and ependymomas are the commonest of these.[9,18] We had just six intramedullary neoplasms with one primary malignancy: two cases of astrocytoma, a case each of ependymoma, dermoid cyst, hemangioblastoma, and grade IV glioblastoma.

Duong et al. reported that among 11,712 patients with primary spinal cord, spinal meninges, and cauda equina tumors in the USA, meningiomas were the most frequent (3820), followed by tumors of spinal nerves (3125) and ependymoma (2478).[12]

Bhat et al. reported a total of 537 cases of spinal cord tumors in the northern valley of Kashmir, India. The most common type of tumor was intradural extramedullary (68.73%), followed by intradural intramedullary (14.87%). Schwannomas (38.90%) were the most common tumors, followed by meningiomas (24.10%) and neurofibromas (18.90%).[19]

Hirano et al. in their review of 678 surgically treated patients with primary spinal cord tumors in Japan, reported 54.7% intradural extramedullary tumors and 18.3% intramedullary tumors. They reported that of all cases, 57.2% were schwannomas, followed by 11.7% meningioma, 8% ependymoma.[20]

Schellinger, in their study of 3226 primary spinal cord tumors, reported that most of the tumors originated from the spinal cord (70%), followed by spinal meninges (26%) and cauda equina (4%). Of these tumors, 31% were malignant, and 69% were non-malignant. The most common histological diagnosis was meningioma (29%), followed by nerve sheath tumors (24%), and ependymoma (23%).[21]

Arora et al. reported in their study of 111 consecutive patients in northern India an almost equal incidence of intradural intramedullary (36.9%) and intradural extramedullary tumors (36.1%). They reasoned that their centre's being a tertiary referral centre might be the cause of this difference from the majority of the literature.[9]

Tumors affecting the osseous structure of the spine are the most diverse category. Many studies have shown that primary vertebral tumors account for less than 5% of the total vertebral tumors. Most of these primary tumors are known to be benign.[8,22] Because many benign tumors are less likely to cause symptoms, they are less likely to be diagnosed and are usually incidental findings.[8]

In contrast, secondary neoplasms are likely to occur 40 times more often.[8,23] After the lungs and the liver, the spinal column has the third-highest prevalence of metastasis.[24,25] Spinal metastases alone account for more than half of the skeletal metastases.[24] DiCaprio et al reported that the breast, prostate, and lungs have the highest incidence of metastasis to the bone in the US.[25]

Our study shows that among 135 cases, primary benign neoplasms were the most common (n=68), and among the 61 malignancies, 36 were secondary and 25 were primary malignancies. The most common benign tumor was schwannoma, followed by meningioma, hemangioma, and ependymoma. The most common primary malignancies were plasma cell neoplasms, followed by chordomas. The lung was the most common site of origin for the metastasis at the spine. As our centre does not have a dedicated oncology department, most malignancies are referred to cancer hospitals for radiotherapy or chemotherapy. Only those patients who had their first symptoms due to spinal lesions are managed at our centre, which might have caused a lower number of spinal metastasis cases. Most hemangiomas are asymptomatic and are incidental findings, which we do not record among the cases, and the number of hemangiomas that are symptomatic due to fractures or aggressive ones compressing the cord and causing symptoms is only reported. Hence, the number of hemangiomas is also lower. However, similar to much of the literature, intradural extramedullary tumors make up the bulk of our tumors.

Zaborovsky et al. have reported that among 2023 spine tumor patients who underwent orthopedic surgery, 59% had metastatic tumors and 32.8% had primary tumors.[6] The most common sites of origin of the metastatic tumors were the breast (43.6%), kidneys (18%), lungs (10.7%), gastrointestinal tract (8.9%), and prostate (4.6%).[6] The majority of primary tumors were benign, with hemangiomas making up 93.8% of those. Plasma cell neoplasms (68.8%) were the most common primary malignancy, followed by chordomas (13.7%). Giant cell tumors and aneurysmal bone cysts classified as intermediate primary (locally aggressive) tumors of the spine were less frequent, accounting for 3.9% of all tumors.[6]

Dang et al. studied 438 patients with primary tumors of the spine and reported 347 benign and 91 malignant cases.[26] Giant cell tumors were the most frequent benign tumors, followed by schwannomas, eosinophilic granulomas, and hemangiomas. Among the malignant primary tumors, chordomas were the most common, followed by chondrosarcomas, malignant peripheral nerve sheath tumors, and primitive neuroectodermal tumors.[26]

Sohn et al. reported the overall incidence rate for malignant spine tumors to be 0.70 per 100,000 people during 2009-2011 in the Korean population and also reported that the primary malignant tumor incidence rate increased with age.[27] These primary malignant tumors tend to most frequently involve the spinal cord, followed by the vertebral column, pelvis, sacrum, coccyx, and spinal meninges.[27]

Primary osseous spinal tumors occur rarely. Kerr et al. in their study, had a total of 1011 patients, with most of them being chordoma (377), followed by Ewing sarcoma (278), chondrosarcoma (223), and osteosarcoma (133).[28]

Sohn et al. in their study of the Korean population, described 1600 primary spinal tumors diagnosed from 2009 to 2012, 76.7% of which were benign and 23.3% malignant.[27] The most frequent type of primary spinal tumor was neoplasm of the spinal cord in both primary malignant and primary benign tumors. They also reported the incidence rate of metastatic spine tumors to be 35.13 per 100,000 people during the study period. The most common primary sites of the metastasized tumors were the lungs (28.1%), liver/biliary (12.9%), breast (10.2%), prostate (9.1%), colon (9.1%), stomach (8.9%), and rectum (4.4%).[29]

Wang et al. in their study of 1196 patients with spinal metastasis in China from 2007 to 2019, reported the most common site of primary tumors to be the lung (36.54%), followed by unknown origin (16.22%), kidney (6.52%), breast (6.35%), liver/biliary (6.27%), gastro-intestinal (4.43%), myeloma (4.43%), prostate (4.43%), and thyroid (3.09%).[30]

Wright et al. in their study on metastatic spine tumor across two decades and three continents (Europe, Asia, and North America), reported the most common origin to be breast (18.5%), followed by prostate (14.8%), lungs (13.9%), renal (12.0%), and myeloma (5.9%).[31]

Zhou et al. in their study of 1209 tumors of the osseous spine reported 64.5% benign cases and 35.5% malignant cases.[32] The most common benign tumor was hemangioma (28.1%), followed by giant cell tumor (15.7%), osteoblastoma (4.4%), and aneurysmal bone cyst (2.9%). Among the primary malignancies, chordoma was most common (9.8%), followed by plasma cell neoplasms (8.5%), chondrosarcoma (5.2%), and malignant lymphoma (4.5%).[32]

Wang et al. in their study of 1385 primary sacral tumors, reported 51.7% malignancy and 48.3% benign tumors.[33]

Chordoma (22.8%) was the most common type of malignancy, followed by chondrosarcoma (5.3%), myeloma (3.8%), and malignant peripheral nerve sheath tumor (3.4%). Giant cell tumor (14.8%) was the most common benign tumor, followed by neurofibroma (11.2%) and schwannoma (8.6%).[33]

Our study had a total of 30 sacral tumors, of which 22 were malignant, one was locally aggressive, and seven were benign. Primary malignancies of the sacrum were four chordomas and two teratomas; other malignancies were metastases from the lungs, thyroid, prostate, ovary, kidney, and those with unknown origin. There was one case each of giant cell tumor, schwannoma, desmoplastic fibroma, benign cystic lesion, ependymoma, neurofibromatosis, and three cases of tarlov cyst.

The most common site of spinal tumors was thoracic, accounting for 42.2% of all tumors, followed by lumbar and sacral. The cervical spine had the lowest number of spine tumors. Both malignant and benign neoplasms of the spine occurred most commonly at the thoracic spine.

Zhou et al. reported that the thoracic spine had the most benign osseous tumors of the spine and also the most malignancies.[32] However, they reported the second most common site of malignancy as the sacrum.[32] Wang et al. also reported the highest numbers of spinal metastases in the thoracic spine, followed by lumbar vertebrae.[30] Hirano et al also reported the highest number of cases of primary spinal cord tumors at thoracic vertebrae.[20] Bhat et al. also reported that more than half of the cases of spinal tumors (spinal cord, nerve roots, meninges) occurred at the thoracic level.[19] Arora et al. described thoracic vertebrae as the most common site of spinal tumors.[9] Thoracic level was also the most common site of spine tumors (57.5%) in the study by Zabarovsky et al.[6]

CONCLUSION

This study's results represent data on the epidemiology of spinal tumors from a single institute. Although this data is far too small to represent the whole country, in the absence of registries or other large multicentric data, it can shed some light on less studied spine tumors in Nepal.

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