Original Article

Radiotherapy treatment of spinal metastases in Ibadan: A 9-year review

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Abstract

Background: Metastatic spinal tumors signify disease progression and result in poor quality of life of patients. We are likely to see an increasing burden of spinal metastases due to the global trend of increasing cancer survival.

Objective: The objective of this study was to review the pattern of presentation and radiotherapy of metastatic spinal tumors in the Radiation Oncology Department, University College Hospital, Ibadan, Nigeria.

Materials and Methods: The radiation therapy records of all patients who received spinal irradiation between January 2007 and December 2015 were retrieved. The extracted data are patients' sociodemographic, clinicopathologic, and treatment factors which include the radiation dose given and retreatment dose.

Results: Majority (91.7%) of the patients who had radiotherapy to the spine had metastatic spinal tumors. Male patients accounted for 69.1% of the cases and females accounted for 30.1% resulting in a male–female ratio of 2.23:1. Close to half (45.8%) of the patients were elderly. Prostate cancer (57.3%) and breast cancer (18.8%) were the most common primary sites. The most common involved spinal site was the thoracic region. In all age groups, fewer patients received a short radiotherapy treatment course (totaling 15 Gy or less and within a duration of 1 week) versus long radiotherapy treatment course (other radiation schedules not meeting criteria for short).

Conclusion: A high index of suspicion of metastatic spinal cancer is required, particularly for breast and prostate cancers. The authors recommend that more elderly patients should be treated with short-course radiotherapy.

Keywords: Oncology, radiation oncology, spinal metastases

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INTRODUCTION

Metastatic spinal tumors have a unique implication in an oncological practice. Not only do they signify disease progression, but also they have grave implications on the management of the patients. This is due to the fact that metastatic spinal tumors can lead to mechanical instability of the spine and neurological deficits.[1] These can affect the performance status and quality of life of the patient.

In Nigeria, the cancers with the highest prevalence are breast cancer, cervical cancer, and prostate cancer, with age-standardized prevalence rates of 185, 75.3, and 64.8 per 100,000, respectively.[2] These cancers, excluding

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cervical cancer, are known to be the most frequent types of cancer that metastasize to the bones, spine inclusive.[1] Autopsy studies have shown that over 30% of all patients with cancer will have spinal metastases[3,4] with or without clinical manifestation. Furthermore, in up to 10% of patients, spinal metastases are the first manifestation of cancer.[5-7] We are likely to see an increasing burden of spinal metastases in our practice. This is due to the global trend of increasing cancer survival with the advent of modern treatment modalities such as immunotherapy, targeted therapy, and stereotactic radiosurgery.[1,8]

Metastatic spinal cord tumors typically present with back pain radiating to the lower limbs. The pain sometimes has a band/belt-like dermatomal pattern. Other symptoms may include progressive neurological deficits, ranging from weakness to absolute inability to move the limb(s). Somatosensory symptoms such as paresthesia, hyperalgesia, and sensory loss are also seen. Bladder and fecal incontinence are usually late clinical features. As a result, spinal metastases are treated as oncological emergencies to halt progression and prevent the development of these symptoms.

This article presents a 9-year review of patients treated for secondary spinal malignancies in our radiation treatment center located at a large and regionally important teaching hospital in Ibadan, the largest city in South Western Nigeria.

MATERIALS AND METHODS

The study was carried out in the Radiation Oncology Department, University College Hospital (UCH), Ibadan, Nigeria. The UCH is a large regional teaching hospital in South Western Nigeria. It was the first teaching hospital in the country and has the second, of the eight, radiation treatment center with megavoltage equipment in the country.

The records of all patients who received spinal irradiation for primary or secondary malignancies in our department between January 2007 and December 2015 were retrieved. A data extraction form was used to retrieve data from the records. The extracted data are patients' sociodemographic parameters such as age, sex, and state of residence; clinicopathologic features such as the tumor type and site of metastases; and treatment factors which include the radiation dose given and retreatment dose.

Data analysis

The data were analyzed with IBM Statistical Package for Social Sciences, Version 21.0. IBM Corp. Released 2012. Armonk, NY, USA. Means and standard deviations were determined. Age was grouped into 15–39, 40–65, and ≥65 years. Frequency distributions of age group, gender, and state of residence were carried out. Frequency tables were also generated to display the distribution of cancer-type, origin (metastatic or primary spinal), irradiated dose, spinal site involved, presence or absence of further treatment, and the dose of further treatment irradiated. An appropriate test of significance (likelihood ratio) was done. The level of significance was set at 0.05.

RESULTS

A total of 97 patients had radiation treatment to the spine during the study period. One of the patients was excluded from our analysis because he did not complete the prescribed treatment. Male patients accounted for 69.1% of the cases and females accounted for 30.1% resulting in a male–female ratio of 2.23:1. Majority of the patients, i.e., 45.8%, were elderly, aged 65 years and above. The mean age was 59.7 ± 15.3 years, and the range was 17–87 years [Figure 1].

Most of the patients resided in Oyo State (36.5%) and Lagos State (19.8%). An overwhelming majority (91.7%) of the cases had metastatic spinal malignancies. Prostate (57.3%) and breast (18.8%) cancers accounted for the majority of the cases [Table 1]. The sarcomas seen were fibrosarcoma, chondrosarcoma, malignant peripheral nerve sheath tumor, alveolar rhabdomyosarcoma, and osteosarcoma.

Site of metastases and treatment

Most of the patients presented with spinal diseases in multiple regions and received treatment that spans different spinal regions. Of the 88 patients with metastatic spinal diseases, only 21.6% presented with diseases limited to one spinal region with 13.6% and 8% in both the lumbar and the thoracic regions, respectively. The remaining were affected in multiple spinal regions mostly involving the thoracic region. Only 2.3% of the patients had the entire spine irradiated.

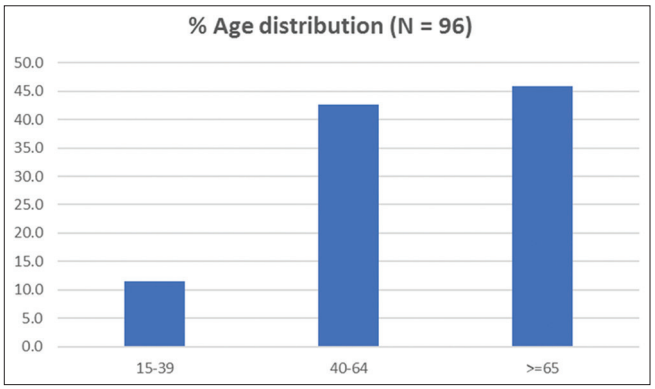

Figure 1: Age distribution of the patients

The lumbar and thoracic regions again accounted for most of the primary spinal tumors treated with radiotherapy with 3 of the 8 cases (37.5%) and 1 (12.5%) in the lumbar and thoracic spine, respectively. The remainders were in the thoracolumbar (37.5%) and cervicothoracic regions (12.5%) [Tables 2 and 3].

Treatment doses

Majority of the patients (90.62%) were treated using multiple fractions including 10 Gy in 2 fractions, 12 Gy in 2 fractions, 15 Gy in 3 fractions, 20 Gy in 5 fractions, 24 Gy in 6 fractions, 25 Gy in 6 fractions, and 30 Gy in 10 fractions. Nine patients (9.38%) had single-fraction treatments of either 6 Gy or 8 Gy [Table 4].

Most of the breast cancer patients (61.1%) and 83.6% of the prostate cancer patients had radiotherapy to the thoracic spine. Of the nine patients who had single-fraction treatments, five were aged 40–64 years. Most of the patients (93.2%) aged 65 years and above had multiple fraction treatments. A second wave of treatment to improve symptomatic response was administered to 13 patients (13.5%). These patients were predominantly treated with 10 Gy in multiple fractions. Only 11.1% of the breast cancer and 10.9% of prostate cancer patients had repeat treatment for persistent symptoms.

In terms of the course of radiation treatment, short course being patients who received treatment 15 Gy or less and within a week and long course being other radiation schedules not meeting the criteria for short course. Majority of the patients, i.e., 58.3%, received long-course treatment. In addition, more patients in each age grouping received long-course than short-course treatment. Within the respective age groups, more patients (47.7%) aged 65 years and above received short-course treatment compared to the other age groups. The association between age and radiation treatment course was, however, not significant ($P = 0.414$) [Table 5].

DISCUSSION

The spine is an important part of the human body. It is the main skeletal support for the entire trunk and serves as an important conduit and protection for the spinal cord. The spine is composed of the bony cage formed at different levels by different types of vertebrae, blood vessels, and nerve trunks that pass through it.

The spine is frequently a site of metastatic involvement in advanced malignancies, occurring in 5%–30% of all cancer patients.[9,10] The spine is the third most common site for cancer cells to metastasize, following the lung and the liver. This amounts to 70% of all osseous metastases.

Table 1: Distribution of study population by cancer type

Cancer	*n* (%)
Breast	18 (18.8)
Bronchogenic	3 (3.1)
Ependymoma	1 (1.0)
Multiple myeloma	4 (4.2)
Non-Hodgkin's lymphoma	1 (1.0)
Prostate	55 (57.3)
Renal	3 (3.1)
Sarcoma	5 (5.2)
Unknown primary	3 (3.1)
Others	3 (3.1)
Total	96 (100.0)

Table 2: Distribution by site treated in those with metastatic disease

Site	Frequency, *n* (%)
Cervicothoracic	1 (1.1)
Cervicothoracolumbar	6 (6.8)
Lumbar	12 (13.6)
Lumbosacral	8 (9.1)
Thoracic	7 (8.0)
Thoracolumbar	43 (48.9)
Thoracolumbosacral	9 (10.2)
Whole	2 (2.3)
Total	88 (100.0)

Table 3: Frequency of spinal site involvement in patients with primary spinal disease

Site	Frequency, *n* (%)
Cervicothoracic	1 (12.5)
Lumbar	3 (37.5)
Thoracic	1 (12.5)
Thoracolumbar	3 (37.5)
Total	8 (100.0)

Table 4: Radiation treatment doses given

Dose (Gy)	*n* (%)
6.0	1 (1.0)
8.0	3 (3.1)
10.0	5 (5.2)
12.0	1 (1.0)
15.0	30 (31.3)
18.0	6 (6.3)
20.0	4 (4.2)
24.0	1 (1.0)
25.0	34 (35.4)
26.0	1 (1.0)
30.0	10 (10.4)
Total	96 (100.0)

Table 5: Distribution of radiation treatment course by age group

Variable	Radiation treatment course		*P*
	Short course, *n* (%)	Long course, *n* (%)	
Age range (*n*)	40	56	0.414*
15–39 years	3 (27.3)	8 (72.7)	
40–64 years	16 (39.0)	25 (61.0)	
≥65 years	21 (47.7)	23 (52.3)	

*Likelihood ratio value reported

Spinal metastases may end up with irreversible neurological sequelae if not expeditiously managed. It is, therefore, important that the clinicians have a high index of suspicion, actively search for the presence of spinal metastases, and treat it expeditiously to prevent permanent motor and sensory loss.

Our results showed a male preponderance of 69% similar to the findings by others including Boström *et al*.[11] The median age of all patients treated was 59.7 ± 15.3 years, and the range was 17–87 years. The median age is higher than that documented in the study cited above,[11] but this could be due to the preponderance of metastatic tumors (91.7%) in our study as compared to that study in which metastatic tumors accounted for only 11.4% as it was a study specifically done on intramedullary spinal tumors who had surgery. The patients in their study were expected to be younger (to be considered fit for surgery), and intramedullary tumors are more often than not primary tumors than metastatic.

Metastatic breast and prostate cancers were the most common in our study. This is in keeping with many studies where the highest incidence of metastatic spinal disease was from these organs.[12-18] The high incidence of prostate cancer in our series may be due to the higher incidence of males seen during the period.

Metastatic cancer to the spine of unknown origin or primary has been documented to account for 3%–20% of metastatic spinal cord compression (MSCC).[5,12-14,19] This study reported an incidence of 3 (3.4%) of MSCC whose primary sites were unknown.

About 10% of all bone and soft-tissue sarcomas occur primarily in the spine.[15] The spine is the most common site of bony metastases from soft-tissue sarcomas in other parts of the body. Sarcomas with a higher incidence of bone metastases are alveolar soft part sarcoma, dedifferentiated liposarcoma, angiosarcoma, and rhabdomyosarcoma.[20,21] In our study, there were five cases of sarcomas, in which three were primary spinal tumors with malignant peripheral nerve sheath tumor, alveolar rhabdomyosarcoma, and fibrosarcoma as their histologies. The metastatic sarcomas in our review were chondrosarcoma and osteosarcoma.

The site of metastases is proportional to the volume or mass of bone in each region. Several authors have documented about 60%–70% of spinal metastases occurring in the thoracic spine which has a smaller ratio of spinal cord canal diameter than the other spinal segments. The lumbar spine is involved in 20%, multiple contiguous levels 10%–38%, and cervical spine in 10%.[14,19] In our study for both primary and metastatic diseases together, the thoracic spine was involved either alone or in combination with other spinal segments in majority of the cases (76.1%). This corresponds with other studies.[14,15,19,22]

Patients with metastatic prostate cancer also had majority of spinal metastases involving the thoracic spine. This differs from a similar study in Nigeria where majority of metastatic spinal cord diseases from prostate cancer occurred in the lumbar vertebrae (75%).[23]

The spine is the most common site of bony metastases from the breast.[24,25] In our study, majority of the patients with metastatic breast cancer had thoracic spine involvement which differs from that seen by Adewuyi *et al*. in Asian patients in which the lumbar spine was the most common site of spinal metastases.[24]

Primary tumors of the spine are rare and most are asymptomatic; thus, their real incidence is unknown. The most common primary tumors of the spine are hemangioma and enostoses. Except for osteoblastomas and chordomas, tumors which originate from the skeleton are not seen in the spine frequently. Primary malignant tumors of the spine are the rarest type of spinal tumors.[15] There is a slight female predilection for primary spinal tumors.[26] In our study, multiple myeloma accounted for 4 (4.1%) of all cases, half of the primary tumors. Sarcomas accounted for 3 (37.5%) and ependymoma for 1 (12.5%) of the primary spinal tumors. There was an equal sex distribution in our study even when multiple myeloma was excluded.

CONCLUSION

This study has highlighted the varying causes of spinal tumors necessitating radiation treatment at the UCH, Ibadan, Nigeria. Due to the increasing incidence of spinal metastasis and its debilitating natural history, health workers managing malignancies, particularly breast and prostate cancers, need to have a high diagnostic index for spinal metastases. Although most of our patients received long-course treatment, shorter courses should be evaluated because of the load on our treatment facilities and the few number of such facilities in the country. This should shorten the waiting time for patients who may require this treatment to prevent the development of motor deficits.

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Conflicts of interest
There are no conflicts of interest.

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