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Metastatic Spinal Tumors: Diagnostic Methods, Management and Prognosis at the Yaounde Central Hospital and Yaounde General Hospital

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Abstract

Introduction: Metastatic spinal tumors (MST) refer to secondary involvement of the vertebral column by hematogenously-disseminated metastatic cells. They could affect either the bony structures or the spinal cords. Mechanical instability and neurologic deficits resulting from spinal cord compression are the most common manifestations. Surgical intervention remains the most effective treatment for about 20% of patients who present with spinal cord compression. The prognosis is relatively poor. This work has as objectives to describe: the diagnostic tools, the different modalities of management and the prognostic elements of spine metastasis. Methodology: We conducted an ambispective cross-sectional descriptive study; with retrospective data collection from January 2015 to December 2021 and prospective collection from January to April 2022 in the "Neurosurgery" unit of the Yaounde Central Hospital and the "Oncology and Neurosurgery" units of Yaounde General Hospital. Result: We included 101 patients. The M/F sex ratio was 1.66. The average age of the participants was 56.44 years (±14.19 SD) with a median of 58 years. Metastatic spinal tumors were discovered in 61.39% of patients with a previously known primary tumor and 21.78% of patients had newly discovered tumors. The neurologic examination revealed a vertebral syndrome in 79.21% of cases, radicular syndrome in 60.40% and sub-lesional syndrome in 59.89%. Sensory disorders accounted for 39.60% and sphincter disorders accounted for 34.65%. According to the degree of severity, the lesions were classified as

Frankel E (37.62%) followed by Frankel D (21.78%). Metastatic lesions were mostly found at the thoracic vertebrae (68.25%) and lumbar vertebrae (22.22%). The most represented primary tumors were: prostate tumors (41.58%) and breast tumors (23.76%); followed by malignant hemopathies (15.84%). Computed-tomography scan (CT-scan) was the most frequent diagnostic imaging technique used (71.28%). Analgesic treatment mostly involved level II analgesia (64.36%). High dose steroid therapy (greater than 80mg/24h) was used in more than half of the patients. Radiation therapy was performed in 24.75% of the patients, chemotherapy in 55.44% and specific surgical interventions performed in 20.79%. The most frequent surgical indication was complete motor deficit according to the Frankel classification (47.21%). One patient in four (23.76%) experienced improvement in functional prognosis with increased muscle strength after a period of 2 weeks to 5 months of treatment. About 1 in 10 patients (8.8%) rather had worsening of their neurologic status. We observed that there was a correlation between spine surgery and improvement in muscle strength (P-value less than 0.05). Patients (12) who had better recovery or preserved gait were those with partial compression (P-value = 0.0143). Four out of five patients (81.18%) of our series had an estimated survival of less than one year according to the Tokuhashi score. Conclusion: MSTs are frequent in our context. Most patients sought consultation late after the first symptoms appeared (principally back pain). The clinical examination revealed a high proportion of patients with spinal cord compression syndrome. Medical treatment was first-line for the management of pain and most patients who underwent surgical treatment had complete neurologic deficits. The functional prognosis was found to be improved by surgery and the vital prognosis depended on the Tokuhashi score, with better accuracy when the prediction is more than 12 months.

Keywords

Metastases, Spinal Tumors, Diagnosis, Prognosis, Spinal Cord Compression

1. Introduction

Metastatic spinal tumors (MSTs) represent secondary involvement of the vertebral column by hematogenously-disseminated metastatic cells. MSTs are frequent manifestations in 10% to 40% of patients with primary cancers. They are the most common type of malignant lesions of the spine [1] [2] [3]. Mechanical instability and neurologic deficits resulting from spinal cord compression are the forefront signs [4]. Magnetic Resonance Imaging (MRI) is the gold standard diagnostic tool in tumoral spinal pathologies [5]. MRI in combination with other imaging tests such as X-rays, and CT (computed tomography) scans can provide detailed information about the location, size, and characteristics of the tumor. A biopsy may also be performed to determine the type of tumor and guide treatment decisions. The treatment depends on several factors, including the type of

tumor, its location, and the individuals overall health. Treatment options may include surgery, radiation therapy, chemotherapy, or a combination of these approaches. The goals of the treatment are to remove or shrink the tumor, alleviate symptoms, preserve neurological function, and improve the quality of life. The specific treatment plan is determined on a case-by-case basis and often involves a multidisciplinary team of healthcare professionals, including neurosurgeons, oncologists, and radiation therapists. Surgical intervention remains the reference treatment for about 20% of patients who present with spinal cord compression syndrome. Other indications for surgery include intractable pain, and the need for stabilization of impending pathological fractures. In addition, surgery should be considered for patients with an expected survival time greater than 12 weeks. However, chemotherapy, external beam radiotherapy, and external orthosis may precede surgery [2]. The prognosis is generally poor with a median survival of 2.9 to 14.1 months [6]. The outcome is often determined by the nature of the primary cancer, the number of lesions, the presence of distant nonskeletal metastases, and the presence and/or severity of spinal cord compression [2]. The aim of this work is to describe the diagnostic tools, management modalities and prognostic elements of vertebro-medullary metastases.

2. Patients and Method

We conducted an ambispective cross-sectional descriptive study with retrospective data collection from January 2015 to December 2021 and prospective collection from January to April 2022 in the "Neurosurgery" unit of the Yaounde Central Hospital and the "Oncology and Neurosurgery" unit of the Yaounde General hospital. Data was collected via data entry sheets adapted to meet the need of this research. The medical files of patients included were those who presented with metastatic spinal tumors (with or without symptoms), who had radiologic imaging and histologic diagnosis. A simple consecutive sampling was done where all patient medical booklets with histological evidence of MST during the study period were included. Therefore, no formal sample size calculation was performed. The variables collected were the socio-demographic parameters, clinical features (patient complaints, patient history such as existence of a known malignancy or primary tumor, the neurological status and general state), radiologic signs and investigations (CT, MRI, spine X-ray), histologic classification of the primary tumors, treatment modalities (analgesics, corticotherapy, radiotherapy, chemotherapy, surgery, physiotherapy) and the prognostic elements (evolution of motor function and pain, survival rate according to the Tokuhashi score). The data collected were entered and analysed using the statistical software SPSS version 20. Our study was carried out in strict compliance with the principles of ethics in medical research.

3. Results

We included 101 patients in this study. The male to female ratio was 1.66. The

mean age was 56.4 years (±14.19 SD) with a median of 58 years. Retired people (25.74%) were most represented, followed by housewives (17%) (Table 1). In our series, the primary tumors were known in 61.39% of cases while 21.78% of patients had newly discovered tumors. More than three-quarters of MSTs (78.12%) were discovered within the first 6 months following the emergence of symptoms. Back pain was the most common symptom (76.23%) followed by motor deficits (17.82%) (Table 2).

The neurologic examination revealed a vertebral syndrome in 79.21% of cases, radicular syndrome in 60.4% and a sub-lesional syndrome in 59.89%. Sensory deficits were present in 39.6% and bladder/rectal dysfunction in 34.65% (Table 3).

According to the degree of severity, the lesions were classified as Frankel E (37.62%) followed by Frankel D (21.78%). Lesions were predominantly located at the thoracic spine (68.25%) followed by the lumbar spine (22.22%). About half

Table 1. Distribution of socio-demographic characteristics.

Variable	Frequency/Value	Percentage (%)
Sex ratio (male to female)	1.66	
Mean age	56.4 years (+/− 14.19SD)	
Median age	58 years	
Profession:		
Retired people	26	25.74%
Housewives	17	16.83%

Table 2. Distribution of symptoms in MSTs.

Symptoms	Frequency	Percentage (%)
Back pain	77	76.23
Motor deficit	18	17.82
Bone pain	1	0.99

Table 3. Distribution of neurological status.

Neurologic Syndrome	Frequency	Percentage (%)
Vertebral syndrome	80	79.21
Radicular syndrome	61	60.40
Complete sub-lesional syndrome	28	27.22
Partial sub-lesional syndrome	33	32.67
Cauda equina syndrome	1	0.99
Conus medullaris syndrome	1	0.99

of the participants had an average general state (54.45%). The most common associated clinical presentations were: tumoral syndrome (20.79%), bone pain (18.81%) and anemia (16.63%). The primary tumor was still present in about three fifths of cases (59.41%) while 15.84% had a past history of total or partial tumor resection. The most common primary tumors identified were: prostate tumors (41.58%), breasts tumors (23.76%) and malignant hemopathies (15.84%) (Figure 1).

Computed-tomography scan (CT-scan) was the most frequent diagnostic imaging technique used (71.28%) followed by Magnetic Resonance Imaging (MRI) and Spine X-ray with respective percentages: 26.73% and 23.76%. The metastatic lesions were osteolytic in 39.6%.

Symptomatic management was started soon after the diagnosis of MSTs was made for nearly all patients (98.2%). Level II analgesics were the most administered for pain management (64.3%), followed by level III analgesics (19.8%). This treatment was associated with neuropathic pain medications (pregabaline) in 19.8% of cases. High-dose steroid therapy (methylprednisolone higher than 80 mg/24 h) was used in more than half of the patients.

Radiotherapy was performed in 24.75% of cases. The most used protocol was that involving 30 grays (68.96%) split into 10 fractions of 3 grays each. The indication for radiotherapy was made for 30.16% of patients with spinal cord compression but only 20.81% actually received it.

Chemotherapy was done for 55.44% of patients (20.79% with breast cancer and 10.89% with prostate cancer). Specific therapy with Sorafenib was used for 1.98% of patients principally for poorly differenciated adenocarcinoma and hepatocellular carcinoma.

Specific surgical treatment was proposed for 22.77% of cases but only 20.79% of patients had surgery due to financial constraints. Laminectomy was done in 19.80% of cases with/without osteosynthesis (Roy Camilles plates, transpedicle

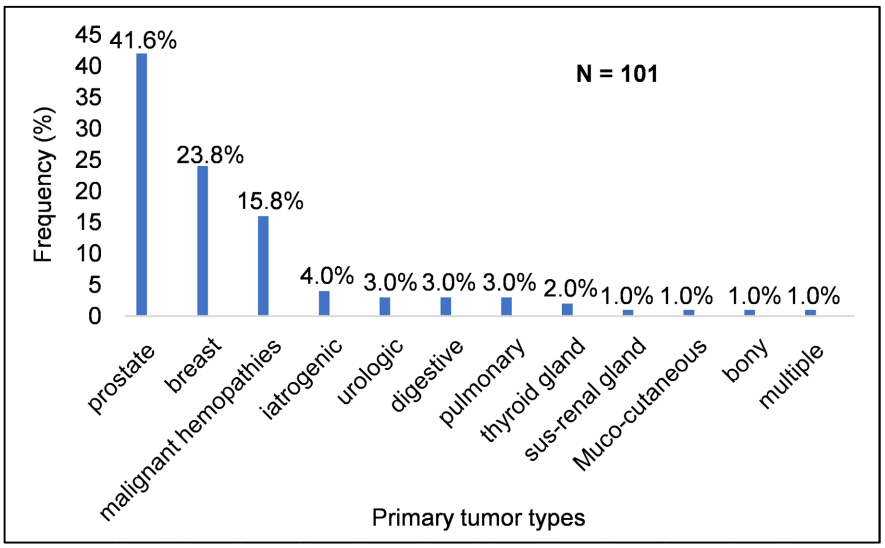

Figure 1. Representation of primary tumor sites.

screws), biopsy or tumor resection. Corpectomy or vertebrectomy associated with osteosynthesis (bilateral implant) was done for one patient. The posterior approach (16.83%) was the most used approach followed by the anterior approach (3.97%). About a fifth (21.78%) of patients had had previous surgery removing the primary tumor and 19.80% had had surgical castration for prostatic adenocarcinoma. For the 21 operated patients, the surgical indications were mainly: complete motor deficit according to Frankel classification (47.21%) followed by incomplete motor deficit (42.86%). Nine point five two percent of them had no motor deficit. Physiotherapy was done for approximately one-quarter of patients (24.75%).

One in four patients (23.76%) experienced an improvement in their muscle strength after a period of 2 weeks to 5 months of treatment. Approximately 1 in 10 patients (8.8%) rather had worsened neurologic states. We observed a reduction of the spinal pain in about 43.56%. Amongst the 62.3% of patients with a motor deficit, 68.4% of the 19 operated patients had an improvement of their muscle strength. We found a correlation between spinal surgery and improvement in motor function (P-value < 0.05). The patients (12) who had good recovery or conserved gait were those with incomplete spinal cord compression (P-value = 0.0143). Four in five patients (81.18%) in our series had a survival rate of less than 1 year according to Tokuhashi score. During our study period, one quarter of patients (24.75%) was lost to follow up and 18 patients (17.80%) were alive. Amongst the excluded lost to follow-up patients, the Tokuhashi score (with a better precision) was 62.5% in patients with a predicted survival rate greater than 12 months (Table 4 and Table 5).

Table 4. Predicted survival rates with Tokuhashi score.

Tokuhashi score	Frequency	Percentage (%)
0 - 8 (less than 6 months)	41	40.59
9 - 11 (6 to 12 months)	41	40.59
12 - 15 (greater than 6 months)	19	18.81

Table 5. Real survival rates of patients.

Situation	Frequency	Percentage (%)
12 - 24 months	14	13.86
Less than 6 months	21	20.79
6 - 12 months	16	15.84
Loss to follow up	25	24.75
Greater than 24 months	7	6.93
Alive	18	17.82

4. Discussion

Older persons have higher chances of developing cancer and eventually metastases. In this study, the mean age was 56.44 ± 14.19 years with a median of 58 years. This result is similar to that obtained in by Elaji et al and Rahhali *et al.* [7] [8]. MSTs have a male predominance with M/F sex-ratio of 1.66. A male predominance has been replicated in several series involving studies on bone metastasis and spinal metastases with or without spinal cord compression [3] [7] [9]. This male predominance can be attributed to the relatively high prevalence of prostate cancer and its greater tendency to metastasize to the spine (41.6% of MSTs in our series). It is therefore appropriate to search for or rule out prostate cancer first in men with a metastatic spinal tumor. Retired people were the most affected by MSTs. This is in accordance with the mean age in our series and with the greater incidence of cancers in the elderly. The incidence of MSTs in other groups like housewives and traders could be explained by late diagnosis of primary tumors and inaccessible treatments due to high cost.

In our series, the mode of revelation of MSTs was essentially from vertebromedullary abnormalities/dysfunctions. This is in accordance with what was found by Boussios *et al.*, (95%) [10]; but differs from the findings of Marie V. *et al.* in Tunisia [11].

It was difficult to estimate the delay between occurrence of first symptoms and consultation because this information was absent in one out of every 5 files studied (21.88%). Nevertheless, about a fifth (21.88%) of patients consulted more than 6 months after the onset of symptoms; 4.17% of patients after 5 months and 3.13% within the first 24 hours. Rahhali *et al.,* had a mean delay of 1 month and Elaji *et al.* 4.1 months with extremes being 0.3 to 13 months [7] [8]. This delay prior to consultation can explain the delay in the diagnosis of MSTs. Delay in diagnosis equally delays the onset of specific treatment thereby, reducing the likelihood of functional restoration even after treatment. The primary tumor was known in 61.39% of the patients in our series. This is similar to what was found in Morocco (63.4%) but lower than the result published by Bouissios *et al.* This difference can be attributed to the diagnostic delay in African countries, in comparison to western countries [8] [10] [12].

Vertebral pain revealed metastases in more than three quarters of cases (76.23%). This result is similar to both African and Western series confirming that vertebral pain is the commonest manifestation of MSTs. Motor deficits (18.75%) were the second most common revealing sign similar to what was found by Domiguez *et al.* (10%) [13].

Vertebral pain was present in 79.21% of patients. This is greater than what was found by Rahhali *et al.* in 2009 (30%) [8]. About 62.38% of our participants presented signs of compression of neural elements or neurologic deficit. Spinal cord compression (60.40%) was most predominant. Although vertebral pain is not considered, in itself, to be a predictor of spinal cord compression, many clinicians believe that the onset of new pain or change in intensity or characteris-

tics of existing pain should raise the possibility of spinal cord compression. In addition, various studies have shown that vertebral pain often precedes the onset of neurological damage by several weeks or even a few months. One of the most dramatic consequences of spinal cord compression due to metastases and even primary tumors is the development of a motor or sensory neurological deficit. More so, the motor neurological state and the speed of onset of motor deficit at the time of treatment are important predictive factors of motor function after treatment [14]. These findings highlight the importance of not only making an early diagnosis, but above all quickly suspecting the presence of a motor impairment. In our study, motor deficits were present in about 3 patients out of every 5 (60.40%), sensory deficit in 36.60%, and anal/bladder sphincter dysfunction in 34.65% of participants. These results are in conformity with those derived in other series [15] [16]. The presence of these clinical signs in favour of spinal cord compression constitutes an oncological emergency and requires immediate treatment.

The motor deficit was complete in 39.60% of patients and partial in 20.79%. This can be explained by the long delay before consultation and raises the problem of early screening for MSTs, especially in patients with a known primary cancer and also the need to do regular follow up imaging for asymptomatic patients or those with minimal symptoms. Up to 68.25% of MSTs were located on the thoracic spine while 22.22% were located on the lumbar spine. Metastatic spine tumors have been shown to have a predilection for the thoracic spine in several studies [10] [14] [17] [18].

In both asymptomatic and symptomatic patients, imaging of the spine has a primary role in the detection of MSTs and is important for subsequent patient management. MRI is the exam of choice in the topographic diagnosis of spinal cord compressions [19]. This non-invasive imaging test makes it possible to detect subclinical syndrome very early, that is to say the beginning of compression of the thecal sac without clear clinical symptoms. It also makes it possible to specify the segmental levels reached and the nature of the compression and to exclude other potential diagnoses. The entire spine and cord are explored in sagittal, axial and sometimes coronal sequences weighted in T1 and T2. MRI makes it possible to map the lesion process by determining the site of the lesion in height (cervical, thoracic, lumbar); the location in a spinal space (extradural, intradural extramedullary or intramedullary); the number, extent and dimensions of the lesion; the relationship with neighbouring structures; the semiological characteristics of the lesion; the impact on the spinal cord [20]. In our study 71.28% of patients were diagnosed with computed tomography (CT) scans, 26.73% with MRI and 23.76% with standard spine radiographies.

CT scan is more affordable and available than MRI explaining the high frequency of CT scan use in the diagnosis of MST in our setting. Even though CT examination is less sensitive and less informative than magnetic resonance, it is effective in assessing the extent of bone metastatic disease and makes it possible

to identify sites of invasion, especially if they originate in bone. A simple X-ray is of relatively limited use; it can reveal bone lysis or vertebral collapse, which would support the diagnostic hypothesis. It is worth noting that, a negative result does not exclude the presence of bone invasion or compression.

Compared to osteocondensing lesions, osteolytic bone lesions were more predominant both on standard radiographs and CT scans. MSTs are predominantly extradural [3] [19]. In our study, 87.13% of patients presented extradural lesions while intradural extramedullary lesions accounted for 26.73% of cases. Intramedullary invasions were rare (less than 1%). The intramedullary location of tumors rather appears to be dominated by primary tumors [3] [7]. In the attempt to measure the evolution of primary tumors using biological markers; PSA was found elevated in 37 patients and CA-15.3 (for breast cancer follow up) elevated in 13 patients. In other words, prostate carcinoma and breast carcinoma were the most frequent solid tumors encountered. This is consistent with results obtained in multiple studies in that domain [3] [21]. Malignant hemopathies and lung cancers together represented the 3rd cause of MST. The rarity of patients with lung cancer is certainly due to selection bias.

The choice of therapeutic approach must take into account several elements, such as the ambulatory status of the patient, the histopathology of the primary tumor, the rapidity of the development of a neurological deficit, the systemic activity of the primary tumor (under control or not), age, performance status, number of levels of spinal cord compression at diagnosis and time between primary tumor diagnosis and spinal cord compression [14]. The various treatment modalities have as overall goal to improve neurological function, especially walking autonomy, to reduce pain and to preserve or improve quality of life [22]. In our study, the delay in the management was relatively short. Level II analgesics were mostly used according to WHO recommendations in pain management. This was associated with neuroleptic medications in 19.80%. This is similar to what was done by Yombi *et al.* in the management of patients with cancer. Short-term corticotherapy was used for 7/10 patients (68.31%). The association of corticotherapy and chemotherapy was used in 38.61% of cases followed by the association of corticotherapy and radiotherapy. The latter combination showed significantly good results and was equally the main treatment protocol used by Fadoukhair *et al.* [23]. Bisphosphate use corresponds to what was described by Polascik *et al.* [24]. Radiotherapy with analgesic and decompressive laminectomy were used with the objective of reducing pathologic pain. Only 1 patient out of 4 could afford radiotherapy (dosage used: 30 Gy in 10 fractions of 3 Gy). Djientchieu *et al.* attributed this to the limited availability of radiotherapy in our context [3]. Hormonal therapy was used as adjuvant treatment in 39.60% of patients with adenocarcinoma being the tumors with the greatest indications (85.71%). The first aim was medical and secondarily medico-surgical. Lebret *et al.,* suggest instead the use of LH-RH agonists [25]. Breast cancer was the second primary tumor and hormonotherapy was used in 16.67%. This can be

explained by the fact that this cancer affects younger populations. Chemotherapy was greatly used (55.4%) and was given to patients with susceptible tumors like breast adenocarcinoma (55.44%) and malignant hemopathies (100%). It could be done alone depending on the histopathology of the primary tumor/cancer according to data in litterature [22]. Spinal surgery was done to a lesser extend in our study (20.79%) than in series reported by Jibia *et al.* [21]. One out of 5 patients (19.80%) had laminectomy with/without osteosynthesis or spondylodesis with Roy Camille's plat and transpedicular screws, biopsy or tumoral ressection. These results are similar to those obtained in african and western countries [3] [13] [20] [22]. The aim of the laminectomy was greatly to reduce the pain, decompress and stabilise the spine and to collect sample for histologic diagnosis of the tumor. Posterior approach was mostly practiced (16.86%). The small percentage of surgical intervention could be explained by the socio-economic context and the neurological state of patients.

This study was limited by its retrospective nature where we used patient medical records not originally designed to collect data for research, thereby having some missing information. Another limitation came from the infrequent association of surgery and radiotherapy. Nevertheless, this series has shown that specific spinal surgery was statistically significant in the improvement of the motor deficit ($P = 0.0011$). In the same light, partial compression allowed a better recovery and preservation of mobility ($P = 0.0143$). This is in accordance with other series which ascertain the importance of surgical intervention in the neurological improvement [4] [21] [23]. Tokuhashi score was statistically significant with a precision of 80.9% in the Gakhar *et al.* series for patients with a score between 12 - 15 and a precision of 36.1% and 9.1% for those with scores between 0 - 8 and 9 - 11 respectively [26]. Zoccali *et al.* had a score with 77.21% precision for patients with an estimated survival of 12 months [27]. Our results are close to these because we had a precision of 62.50% for an estimated survival of 12 months; 42.42% for those with less than 6 months and 29.62% for those between 6 and 12 months.

5. Conclusion

MSTs are a frequent pathology in our context. The delay before consulting was long for most patients and backaches were the main symptom requiring patients to seek medical consultation. On clinical evaluation, spinal cord compression syndrome was present in the majority of patients. Medical treatment for pain management was the first line treatment and surgical interventions were indicated for most patients with a complete deficit. There was improvement in the motor deficit with surgery and Tokuhashi score had a greater precision when the survival rate was estimated at more than 12 months.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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