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# Clinical and plain x-ray findings of spinal metastases: a retrospective study of pathologically-confirmed cases



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## ABSTRACT

**Background:** Malignancy of breast, prostate, and lung contribute to metastatic bone disease, and the metastases are mostly located in the spine. Spinal metastases may involve the spinal cord, leptomeninges, epidural space and also the bone itself. Therefore, proper imaging is needed in early detection and diagnosis of spinal metastasis. This study aimed to perform the clinical and plain x-ray findings in patients with spinal metastasis.

**Method:** A retrospective study was conducted on 28 spine pathological fracture patients with neurologic deficits who underwent surgical intervention in Sanglah General Hospital during a year. We evaluated the present symptoms, neurological status (Frankel score), pathological reports by plain x-ray findings, metastases cell type by histological assessment, and extension of mass expansion on MRI. A total of 20 cases that met the inclusion

criteria were evaluated.

**Result:** Most patients suffer from pathologic fracture on thoracic spine level, followed by lumbosacral level and none on cervical spine level. The compressive fracture was a major finding on plain x-ray. The extradural lesions account for most of the MRI findings, followed by intradural/extramedullary and intramedullary lesion. Primary tumours that lead to bone metastases in this serial-cases are prostate, breast, cervix, kidney and lung cancer, respectively.

**Conclusion:** Thoracic spine is the most common spinal metastases manifestation. Conventional plain x-ray is the most initial modality to evaluate systemic neoplasia patients with spinal pain, although it is not a sensitive indicator to identify the presence and extent of metastatic involvement.

**Keywords:** junior age; candidates for master of sports; track and field athletics; aggregation; platelets

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## INTRODUCTION

Metastases is the formation of tumour after seeding of cancer cells from certain organ through a process that involves loss of intercellular cohesion, cell migration, angiogenesis, access to the systemic circulation, survival in circulation, evasion of local immune responses and growth at distant organs.<sup>1</sup> Bone is the third most prevalent site for metastatic disease. Bone metastases are considerably more common than the primary bone cancers, especially in adults. Bone metastases are a substantial cause for morbidity, characterized by severe pain, pathological fractures, impaired mobility, spinal cord compression, bone marrow aplasia, and hypercalcemia.<sup>2</sup>

Skeletal metastases are the most common malignancy in bone. Approximately, 10% of skeletal metastases are symptomatic.<sup>3</sup> Particular types of malignancy, such as breast, prostate, thyroid, lung, kidney and pancreas cancer are likely to contribute to more than 80% cases of metastatic bone disease, which are mostly located in the spine.<sup>4,5</sup> More than 50% of patients with systemic neoplasia will have

spinal metastases. Spinal metastases may involve the spinal cord, leptomeninges, epidural space and also the bone itself. The involvement of spinal metastases is detected considerably associated with the type of primary tumour.<sup>3</sup> Nearly 95% of spinal lesions are dominated by extradural lesions, which can be divided into pure epidural lesions and those embarking from the vertebra expanding to the epidural space, and lunging on the thecal sac.<sup>6</sup> The thoracic spine is the most common spinal metastases manifestation. Intradural/extramedullary and intramedullary are less commonly involved in the dissemination of spinal metastases.<sup>7</sup>

The diagnosis of spinal metastases has a major impact on the overall treatment strategy. It is a vital role in the illness course and the quality of life. Modality of imaging is needed to detect the spinal metastases early. Different imaging modalities are often used in combination to identify the metastases optimally. Proper imaging would be useful for not only an accurate diagnosis of spinal metastases but also the identification of the primary cancer origin, which is critical to affecting the treatment

plan. Plain radiographs provide a useful screening test for spinal metastases.<sup>8</sup> Study of Heindel suggest that plain x-ray is still helpful for the immediate investigation of symptomatic bone pain and for the assessment of stability.<sup>9</sup> Therefore, the purpose of this study is to perform the clinical and plain x-ray findings in patients with spinal metastasis.

## METHOD

A retrospective study was conducted on the pathologic reports and clinical records of 28 consecutive patients admitted to Sanglah General Hospital for treatment of spine pathological fracture that undergoing surgery or decompression-stabilization-spinal fusion-biopsy within one year between March 2016 and March 2017. Patients were included in the study if they had been evaluated in accordance with all of following investigation parameters: (1) standard history and physical examination, (2) plain film of the affected spinal level, (3) an MRI of the spine at least showing the affected region, and (4) a biopsy at the affected vertebral level. Overall, spinal metastatic lesions in 20 patients were included in our case series study. The recorded parameters were: general demographic data, symptoms at the time of presentation, neurological status, plain x-ray findings, number of the spinal vertebra affected by metastasis, the region of the spine that involved with metastasis, the presence or absence of other skeletal metastases type, visceral metastases, known or unknown primary sites of metastasis, metastases cell type by histological assessments, and extension of mass expansion on MRI. All participants gave their informed written consent before the interventions. The procedure was approved by the Sanglah General Hospital and Universitas Udayana Bioethics committee.

## RESULTS

Twenty patients were met the criteria for our case series, where 13 patients were female (70%). All patients had complaints of weakness below the level of spine lesion, along with pain and sensory deficit at the time of presentation (Table 1). Eleven patient motoric status are classified as Frankel C with strength grade less than 3, and 6 patients completely loss motoric function below the affected level. Two patient has sphincters dysfunction, both associated with primary prostate cancer.

The compressive fracture was a major finding on plain x-ray, either with or without pedicle destruction, followed by missing pedicle (“winking owl” sign) and paraspinous shadow. Most patients suffered from a pathologic fracture on thoracic spine level, followed by lumbosacral level and none on the cervical spine level, as seen in Table 2.

In our study, 75% (n=15) patients have 1 level of spine involvement, three patients involve 2 spine level, and two patients has more than 3 levels of spine involvement which one of it was a skip lesion. Most of the spinal metastases are found in the thoracic region, and the rest are in the lumbar region, 11 patients and 9 patients, respectively. None were found in the cervical region. Extra spinal musculoskeletal metastases were found in 50% of patients. It mostly found in skull, ramus pubic, humerus, femur and ribs, most frequent respectively. Four patients had lung involvement; other data on visceral metastases were not available in our series. Further evaluation by MRI, found most patients suffered from an extradural lesion, followed by an intradural-extramedullary lesion and only 2 out of 20 patients have intramedullary lesions (Table 2).

Out of 20 spinal metastases showed 6 cases have a primary tumour in breast, 3 cases from lung, followed by prostate, cervix, kidney, neuroendocrine, nasopharynx, osteosarcoma, respectively and one case has an unknown primary tumour with round cell type (Table 3).

## DISCUSSION

This series provides descriptive data of spine metastases patients in Sanglah General Hospital that not yet available. We obtained 28 patients that met our inclusion criteria, but 8 patients were excluded due to incomplete data required in this series. A higher incidence in women is parallel to the higher rate of breast cancer included in this series. This corresponds to study which analyzed 1477 cases, concluded that 16.5% of spinal metastases with epidural involvement came from the breast cancer, 15.6% from the lung cancer, 9.2%

**Table 1. Characteristic of demographic data and clinical findings**

Variable	n (=20)	%
Gender		
Male	7	30.0
Female	13	70.0
Symptoms		
Local neck/back pain	18	31.0
Weakness	20	34.0
Sensory deficit	19	32.0
Sphincter dysfunction	2	3.0
Neurological involvement (Frankel scale)		
A (Complete paraplegia)	3	15.0
B	3	15.0
C	11	55.0
D	3	15.0
E (Normal)	0	0

**Table 2. Imaging findings of spinal metastases**

Findings	n	%
Plain X-Ray Findings		
Winking owl	8	25.0
Paraspinal shadow	6	19.0
Compressive fracture	18	56.0
Pathologic Dislocation	0	0
Number of spinal metastases		
1 level	15	75.0
2 levels	3	15.0
≥3 levels	2	10.0
Affected spinal region		
Cervical	0	0
Thoracic	10	50.0
Thoracolumbal	1	5.0
Lumbar	9	45.0
Number of extraspinal skeletal metastases		
0	10	50.0
1	4	20.0
2	1	5.0
≥ 3	5	25.0
Number of visceral metastases	4	20.0
MRI findings		
Extradural	12	60.0
Intradural extramedullary	6	30.0
Intradural Intramedullary	2	10.0

**Table 3. Distribution of spinal metastases and its origin of primary cancer**

Primary Tumor	Cervical	Thoracal (n=10)	Thoracolumbal (n=1)	Lumbar (n=9)	n (=20)	%
Known primary tumour						
Prostate	0	0	0	2	2	10.0
Breast	0	3	1	2	6	30.0
Uterine	0	0	0	1	1	5.0
Cervix	0	1	0	1	2	10.0
Lung	0	2	0	1	3	15.0
KNF	0	1	0	0	1	5.0
Kidney	0	1	0	1	2	10.0
Neuroendocrine	0	1	0	0	1	5.0
Osteosarcoma	0	1	0	0	1	5.0
Unknown primary tumour						
Round cell tumour	0	0	0	1	1	5.0

from prostate cancer, and 6.5% from kidney cancer. They also analyzed 1585 cases of symptomatic epidural metastases and reported that 70.3% had involvement of thoracic and thoracolumbar region, 21.6% of the lumbar and sacral region, and 8.1% of the cervical and cervical-thoracic region, concluding that although the lumbar region is more involved, the majority of patients with neurological dysfunction have thoracic lesions.<sup>8,11,12</sup> Compared with their result, ours were almost equal incidence in the thoracic and lumbar region (55% to 45% respectively).

Multiple levels of spine involvement were seen in 25% of our patients (5 patients), in 1 patient has a non-contiguous level of lesion. As in other studies, more than 50% of patients with spinal metastasis have multiple levels involved, and 10 to 38% of patients have multiple, noncontiguous segments involved. This may show the advance of the metastases process.<sup>4,13</sup>

Pain is the presenting symptom in 90% of our patients. Neurological compromise in the form of weakness, sensory loss, and sphincter disturbance was also found, that usually occur following pain. With 85% patient were non-ambulatory either due to pain or motor weakness, may be related to late presentation of the patient to the health centre. However, no complete data were recorded on symptom duration and progression to the time of diagnosis.<sup>10,14</sup>

Bone destruction, either as a compressive fracture or pedicle destruction, were observed in most of our patients. Although plain radiographs provide a useful screening test for spinal metastases, X-rays necessitate a 1 cm diameter mass and 50% bone mineral loss at minimum for detection. This also explains that up to 40% of lesions will be unidentified by X-rays, presenting false-negative results. An extraspinal musculoskeletal and visceral involvement found in this series may indicate a more advanced stage of the metastases.<sup>2,8,13</sup>

Cancers of the prostate, lung, and also breast constitute the most common culpable primaries, reflecting the tendency and prevalence for these malignancies to metastasize to bone. The level of the spine involves also related to the primary tumour that may explain its pathways of metastases.<sup>15</sup>

## CONCLUSION

Our finding is presenting a profile of spine metastases patients in Sanglah General Hospital. Although conventional plain X-rays are the most common initial means to evaluate patients with neoplastic disease spinal pain, they are not sensitive indicators of the presence and extent of metastatic involvement. Breast and prostate cancer are the

most prevalent primary tumour in cancer cases. A more thorough and careful evaluation should be obtained on those patients for related spine metastases. The late presentation of the patient to the health centre and failure to diagnose initially results in higher morbidity.

Several limitations of the present study are the small number of patients, that may not represent patient demography in general. Its retrospective method may cause an incomplete data collection that may alter the result of this study.

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### ETHICAL CLEARANCE

This study has obtained ethics approval from the Ethics Committee of Universitas Udayana prior to the study conducted.

### CONFLICT OF INTERESTS

The authors declare that there were no conflicts of interest in the process of this study.

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### AUTHOR CONTRIBUTION

All of the authors are equally contributed to the study from the study framework, data gathering, data analysis, until reporting the result of study.

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