

Spinal Fusion and Decompression Surgery Role in Metastatic Spine Disease at Dr. Zainoel Abidin General Hospital

Azharuddin^{a*}, Gauda Granthana^b, Reno Keumalazia Kamarlis^c

^a azharspbo_kspine@yahoo.com

^aSpine Consultant Orthopaedics and Traumatology, Medical Faculty, Syiah Kuala University, Dr. Zainoel Abidin General Hospital, Banda Aceh, 23111, Indonesia

^bResident Orthopaedics and Traumatology, Medical faculty, University of Sumatera Utara, Haji Adam Malik General Hospital, Medan, 20136, Indonesia

^cConsultant Anatomy Pathology, Medical faculty, Syah Kuala University, Dr. Zainoel Abidin General Hospital, Banda Aceh, 23111, Indonesia

Abstract

Skeletal metastasis is one of the most common metastasis second to liver and lung metastasis. The most common affected skeletal region is on the vertebral column (metastatic spine disease/MSD). Patients with MSD usually came with chief complain of backpain and neurological deficit. The modalities of treatment including chemotherapy, radiotherapy and surgery. The goal of MSD treatment is to improve the quality of life by relieving the pain, providing stability and even in some cases neurological deficit improved. Three patients in Dr. Zainoel Abidin General Hospital that diagnosed with MSD from different primary tumor and different level of vertebral involvement. We performed spinal decompression and spinal fusion to release the spinal cord entrapment and did follow up to evaluate the outcome. MSD is a common issue faced by a spine surgeons. We believe with multidisciplinary approach and right decision making and timing, surgical treatment to treat spine instability and compression can lead to patient's better quality of life despite of the type and prognosis of the primary tumor.

Keywords: Metastatic Spine Disease; MSD; Posterior Spinal Fusion; Spinal Decompression Spine Metastatic Palliative Care

1. Introduction

Skeletal metastasis is one of the most common metastasis second to liver and lung metastasis. The most common affected skeletal region is on the vertebral column where the primary tumor comes from prostate (84%), breast (72%), thyroid (50%), kidney (37%), pancreas (33%), lung (31%), etc. The diagnosis of metastatic spine disease (MSD) itself usually accomplished with spine MRI (Elmesallamy and Taha, 2020).

Patients with MSD usually came or referred to spine surgeon with chief complain of back pain (90%) and accompanied with neurological deficit and sometimes progressive deformities which affecting patients quality of life. Therefore the the goal of MSD treatment is to improve the quality of life by relieving the pain, providing stability and even in some cases neurological deficit improved (Alpantaki et al., 2020).

Treatment of MSD required multidisciplinary effort from spine surgeon, radiologist to rehabilitation specialist and many more. The modalities of treatment including chemotherapy, radiotherapy and surgery.

There are several literatures, guidelines or even scoring system that help to decide to do or do not operate MSD patients. The most common and popular one are Tomita Score and Spinal Instability Neoplastic Score (SINS). Tomita score help to predicting survival rate and decide the surgical strategy based on the progressiveness of the primary tumor, treatability of the metastasis and number of metastasis to the bone. This scoring system offer tumor resection, tumor debulking, palliative decompression or supportive care only based on severity of the score for treatment options (table 1).SINS provide scoring system to evaluate the stability of the spine. This scoring system assesst the location of the lesion, pain, type of lesion, spinal alignment, vertebral body collapse and posterolateral involvement of the spine (table 2)

Despite of wide range MSD assessing tools and treatment options, there is still variety opinion and outcome in MSD surgery treatment. In this study we evaluate 3 patients in Dr. Zainoel Abidin General Hospital that diagnosed with MSD from different primary tumor and different level of vertebral involvement. These 3 patients came with chief complaint of pain and neurological deficit. We performed spinal decompression and spinal fusion to release the spinal cord entrapment and follow up to evaluate the outcome. Samples also taken during the operation of all patients to confirm the metastasis to the spine.

Table 1. Tomita Score. Total score 2-4 treatment option: En bloc resection, 4-6: Debulking, 6-8:Palliative decompression, 8-10: Supportive care

Characteristic	Score
Primary Site	
Slow (breast, prostate, thyroid)	1
Moderate (kidney, uterus)	2
Rapid (lung, liver, stomach, colon)	4
Visceral metastasis	
None	0
Treatable	2
Non Treatable	4
Bone Metastasis	
Solitary	1
Multiple	2

Table 2. Spinal Instability Neoplastic Score (SINS). Total score 1-6 suggest stable spine, 7-12 suggest potentially unstable, 13-18 suggest unstable spine.

Component	Score
Location	
Junctional (occiput-C2, C7-T2, T11-L1, L5-S1)	3
Mobile spine (C3-C6, L2-L4)	2
Semirigid (T3-T10)	1
Rigid (S2-S5)	0
Pain	3

Yes	1
Occasional but not mechanical	0
Pain free lesion	
Bone lesion	2
Lytic	1
Mixed	0
Blastic	
Radiograph spinal alignment	4
Subluxation/translation	2
De'novo deformity	0
Normal alignment	
Vertebral body collapse	3
<50%	2
>50%	1
No collapse with >50% body involved	0
None	
Posterolateral involvement	3
Bilateral	1
Unilateral	0
None	

2. Case reports

2.1 Case 1

Female, 46 years old with history of breast tumor came with chief complain pain and weakness on both of her leg. She had no history of trauma previously. This condition keep progressing and now she unable to stand or even sit so she spent her days on the bed. She had history of breast cancer. T2 Weighted Image (T2WI) MRI Examination show hyperintense lesion suggesting metastasis T3-T5 level with T4 vertebral body collapse & protruding to spinal canal.

The Tomita Score in this patient was 5 and SINS 13 which suggesting an unstable spine with recommended option of debulking. So she underwent posterior spinal fusion T1-T7 and decompression.



Fig. 1. T2WI (right) showing hyperintense lesion on T3-T5 vertebral body with disruption of spinal canal and T1WI (left) T4 vertebral body protrusion to the spinal canal.

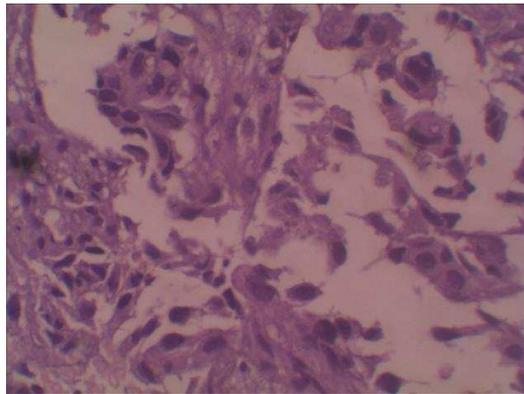


Fig. 2. Histopathologic examination showing some malignant glands structure in H&E magnification 400x..

The follow up did not show any neurological improvement yet but the pain complaint was subsided and now she able to sit and ambulate using wheel chair, which made her daily activity much easier. Some sample also taken during the operation and the macroscopic histopathologic study showing 2cc sample in volume with brown color and tender consistency. As the microscopic study showing groups of epithelial cell's with enlarged nucleus, coarse chromatin and loose eosinophilic cytoplasm between the fibromyxoid connective tissue's stroma. All evidence's suggesting adenocarcinoma metastasis.

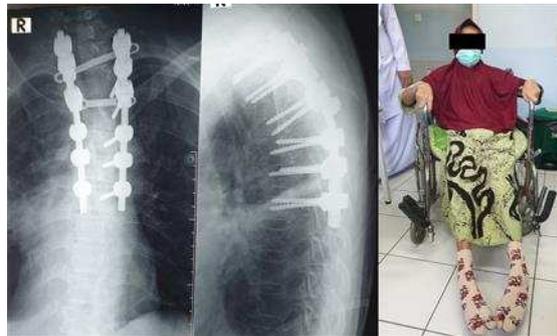


Fig. 3. Post T1-T7 spinal fusion and T4 decompression xray (left). On the follow up the patient now able to sit and ambulate using wheelchair (right).

2.2 Case 2

Male 51 years old with primary thyroid tumor came with chief complaint of mechanical back pain and weakness & numbness on both leg. He was diagnosed with thyroid tumor and underwent partial thyroidectomy 3 years prior to his spine symptoms. He had no history of previous trauma.



Fig. 4. T1WI MRI image (left) showing multilevel hypointense lesion from T5-S3 level. T2WI (right) showing spinal canal compression of T11 level.

On the day he came to Zainoel Abidin General Hospital, he still able to move his legs but unable to stand or walk by himself (Frankel C).

On the MRI examination, T1WI showing multilevel hypointense lesion from T5-S4, suggesting MSD causing lytic lesion with vertebral body collapse of T11. T2WI confirming protrusion and spinal canal compression on T11 level. The macroscopic histopathology examination showing 4cc sample in volume with grayish white color, tender consistency. Microscopic examination confirming the adenocarcinoma metastasis to the spine.

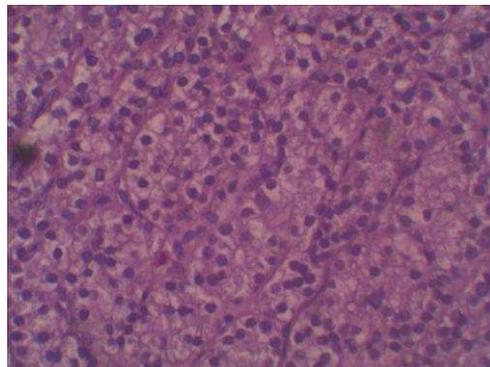


Fig. 4. Histopathologic finding shows clear cell carcinoma. H&E. Magnification 400x.

The Tomita Score and SINS in this patient was 5 and 14 and so this patient underwent T8-L4 posterior spinal

fusion and T11 decompression. A month outcome follow up showing great improvement. The pain was subsided almost entirely and the neurological deficit greatly improved that now he able to stand and walk without any help (Frankel E). He routinely came for control and also given Thoracolumbal Spine Orthoses (TLSO) brace.



Fig. 5. Post spinal fusion & decompression xray (left). A month follow up showing the patient able to stand and ambulate independently (right).

2.3 Case 3

Female 51 years old with breast tumor came with chief complain of back pain, weakness on her both leg and inability to sense or control micturition & defecation which was the most severe debilitating sequelae of MSD. Again, this patient had no history of trauma before. Six months prior to surgery, she started to feel pain on her back. Three months later the pain got worse and she was unable to move her legs due to weakness. She also complained of severe pain on her left hip. She was bedridden for a few months before treated.

On the examination, T2WI MRI showing hypointense lesion on the L4 level with anterior to middle column vertebral body destruction, protruding to the spinal canal which caused neurological symptoms in this patient. Plain hip X-ray showing pathological intertrochanteric fracture on the left femur, suggesting a metastatic bone disease.

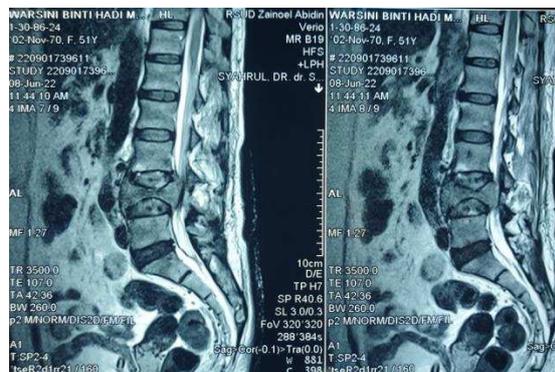


Fig. 6. T2WI showing hypointense lesion accompanied with vertebral body destruction that protrudes to the spinal canal on L4 level.

Tomita Score and SINS was 4 and 15 in this patient and she underwent posterior spinal fusion from L2-S1 and decompression on L4 level. The sample taken during the operation and macroscopic histopathologic study showing 4cc sample in volume with brown color and tender consistency that suggesting adenocarcinoma metastasis to the spine.

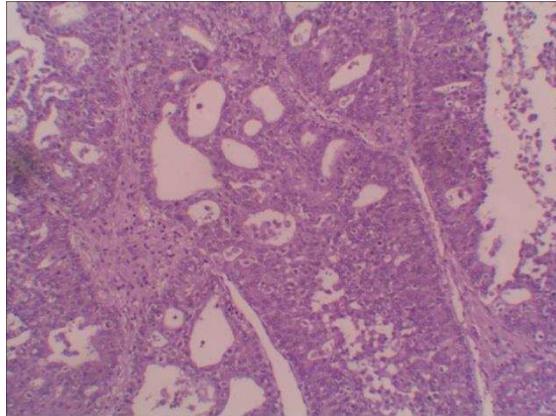


Fig. 7. Histopathologic examination shows malignant glandular cells with H&E. Magnification 100x.

Post operative follow up showing no improvement yet on the neurological deficit but the pain alleviated and now she able to sit and ambulate using wheelchair.



Fig. 8. Post L2-S1 Spinal fusion xray (left). The patient now ambulate using wheelchair but not able to stand yet due to proximal femur pathological fracture (right).

3. Discussion

Two females and one male cases with ages ranged from 46 to 51 years old above shown MSD with primary tumor on the thyroid and breast. All of the patients had chief complain of backpain with variety of neurological impairment.

All of the patients underwent posterior spinal fusion and decompression corresponding to the pathologic level. Post operative follow up showing neurological improvement on one patient but not yet on the other two.

On the other hand the pain symptom post operatively showing good improvement in all three cases. This allowed the bedridden patients to able to ambulate using wheelchair, a frankel C patient to walk independently again, which we believe had a big impact to persons quality of life despite of the primary tumor ongoing treatment and prognosis.

MSD are a common systemic disease in these days. The goals of treatment is quite varies from relieve pain, stabilize spinal structure, maintain neurologic function, preventing new onset, etc and all of it is for patient health related quality of life. Every spine surgeon may or may not able to achieve every goals depend on timing of the diagnosis, treatment selection, biology of the tumor and the severity of each cases (Elmesallamy and Taha, 2020).

Despite of medical accomplishment in the management of MSD, surgery, although high risk, remain crucial. Surgical treatment in MSD indicated in some patients and some helpful scoring system to determine MSD treatment such as Tomita and SINS was used in this study. But some other literature said that MSD cases the with neurological deficit, urgent surgical intervention is necessary despite of the type of tumor (Alpantaki et al., 2020).

Be noted complication after surgery for MSD also in another field of ongoing research and complications rates over 75% are reported when multiple type of adverse events are included. Analysis of 4.676 patients from New York State, USA, published in 2020 showed the complication rate of 18%, where pulmonary, urinal and renal complications were the most prevalent. Quarishiet al reported complication rate of 27% where chest complication and site infections were the most common. A systematic review from 2020 by Tarawneh et al included 19 studies with 2.088 patients. Surgical site infection was reported as the most common complication with an incidence of 6,5% (Corvino et al., 2022; Carrwik, 2021).

Other reported complications include approach-related morbidities, intraoperative hemorrhage, CSF leak, thromboembolism and wounds infection. All of his occurrence risk may be decreased with careful preoperative planning which considers the goal based on life expectancy and functional outcome (Corvino et al., 2022).

Patients with spinal mechanical instability typically require surgical stabilization. Since radiation or systemic treatment do not treat spinal instability, an unstable spine should be surgically stabilized to allow pain palliation and to prevent further neurologic compromise and spinal deformity progression. Especially patients with high SINS score tend to have a higher risk of radiotherapy failure and experience significant benefit from surgical stabilization leading to pain relief and functional improvement. Another clinical studies also shown that functional status of oncology patients correlates with survival, with ambulatory patients surviving longer than patients who have lost the ability to ambulate (Barzilai et al., 2019).

While many studies used to be focused on survival rate, quality of life gain interest started from early 2000. In 2008, Ibrahim et al concluded in an international multicenter studies of 223 patients that surgery was effective in improving quality of life, enabling patients to regain or maintain mobility. Similar conclusions were drawn in an other prospective single centre study from Quraishiet al, including 199 patients treated surgically on 2011-2013, with regular follow up visits until two years of surgery. An international retrospective cohort study by Dea et al, 2020 highlights the importance of quality of life by showing that even patients with a short expected survival time can benefit from surgery, given that surgery will improve someone quality of life status. The authors also suggest that baseline performance status rather than expected survival after surgery should be the key factor in the decision making process, challenging the established threshold of three months survival after surgery (Carrwik, 2021).

The potential benefit of surgery in MSD treatment may represent the difference between a patient being able to walk on their own and a patient being bedridden for the rest of their life. This also implicate for patient's ability to pursue activities of daily life, their functional independence, health-related quality of life and fitness to undergo systemic oncological treatment and eventually, patient survival (Meyer et al., 2022). But be mindful that not all MSD patients are capable candidates for surgery treatment. Early diagnosis and

evaluation, decision and timing of treatment, chance and risk of complication should be assessed carefully in every MSD patients.

4. Conclusions

MSD is a common issue faced by a spine surgeons. We believe with multidisciplinary approach and right decision making and timing, surgical treatment to treat spine instability and compression can lead to patient's better quality of life despite of the type and prognosis of the primary tumor.

Acknowledgements

None to acknowledge.

References

- Alpantaki, K. et al., 2020. Surgery for spinal metastatic tumors: Prognostication Systems in clinical practice (review), *Molecular and Clinical Oncology*, 12(5), p. 399–402. Available at: <https://doi.org/10.3892/mco.2020.2008>.
- Barzilai, O. et al., 2019. Essential Concepts for the management of metastatic spine disease: What the surgeon should know and Practice, *Global Spine Journal*, 9(1_suppl), p. 98s–107s. Available at: <https://doi.org/10.1177/2192568219830323>.
- Carwik C., 2021. Surgical treatment of spinal metastasis. *Digital Comprehensive Summaries of Uppsala Dissertations from The Faculty of Medicine*. Uppsala, 1792, p. 40.
- Corvino, S. et al., 2022. The role of surgery in spinal intradural metastases from renal cell carcinoma: A literature review, *Cancers*, 14(6), p. 1595. Available at: <https://doi.org/10.3390/cancers14061595>.
- Elmesallamy A.A, Taha M. Mahmoud., 2020. Surgical Management and Prognostic Factors of Spinal Metastatic Tumors. *Egyptian Journal of Neurosurgery*, 35(7).
- Meyer, H.S. et al., 2022. Surgery in acute metastatic spinal cord compression: Timing and functional outcome, *Cancers*, 14(9), p. 2249. Available at: <https://doi.org/10.3390/cancers14092249>.