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Case Report

Outcome following cervicothoracic junction fusion in T1 pathological fracture of breast cancer spinal metastases: a case report

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ABSTRACT

The cervicothoracic junction (CTJ) is defined as the area extending from vertebral segment C7 to T2. Spinal metastases of CTJ are rare, range from 10% to less than 20%. A 47-year-old woman complained sensory and motor disturbance since 3 weeks prior to admission. History of lump on the left breast was confirmed. Neurological deficit was confirmed as ASIA C at the time of diagnosis. MRI finding suggest fracture of T1 vertebral body with kypothic angle 28° that causing anterior compression of spinal cord. The patient underwent decompression and posterior fusion from C4 to T4. A biopsy sample was also collected from the spine and left breast to confirm the diagnosis. Patient evaluation was done during discharge and at certain points of follow-up for improvement on its neurological, pain, and functional status. An MRI evaluation was performed to evaluate spinal stability and fusion. Significant improvements were observed in patient ambulatory and pain status. Cervicothoracic junction fusion procedure is a considerable choice for the management of pathological vertebral fractures with cervicothoracic junction involvement caused by spinal metastases of breast cancer.

Keywords: Cervicothoracic junction, Posterior approach, Spinal metastases, Spinal surgeon

INTRODUCTION

The cervicothoracic junction is defined as the area extending from vertebral segments C7 to T2. It represents a change in spinal alignment from a mobile, cervical lordosis to a rigid, thoracic kyphosis.[1-3] It is an area susceptible to injuries because of the weight transfer from the posterior aspect to the anterior aspect of the spinal column and the vertebral index that decreases from C6 to T1 vertebrae.[1,2] Further, those characteristics and biomechanical result in inherent instability.

Metastases to the CTJ are quite rare, accounts for approximately 10%-15% of all spinal metastases.[2,4-6] Tumor involvement of the cervicothoracic junction can be problematic due to the small canal size and rigidity of the thoracic spine in the setting of a highly mobile cervical spine.[7] Neurological involvement causing instability can be as high as 80%. Progressive instability of this area ultimately leads to kyphosis and spinal cord compression.[3] Breast cancer has a particular affinity for the spine, accounting for approximately two thirds of the osseous metastases discovered. Although breast cancer carrying the most favourable prognosis, about one-third become symptomatic, causing intractable pain, neurological deficits, mechanical instability, and ultimately disability and a severe deterioration in quality of life.[8] With its median life expectancy of 1 to 2 years, the goals of treatment are for symptom palliation, to maintain or restore spinal stability, reduce pain, and improve or prevent neurologic deterioration.

Cervicothoracic junction (T1-T3) is the site where anterior spinal reconstruction is technically demanding.[9] Overall, surgical approaches to the cervicothoracic junction will be guided by the tumor's location, extent of involvement, and histological features, as well as the surgeon's familiarity with the approach.[3]

Few studies in the literature on surgical treatment for spinal metastases are focusing on this special area.[4] We aimed to present a surgical approach and evaluation of clinical outcome in patient with T1 Pathological Fracture of Breast cancer spinal metastases.

CASE REPORT

A 47-year-old woman present with complained of sensory and motor disturbance since 3 weeks prior to admission. Deterioration of motor function, resulting limitation in ambulatory status of previously active patient. Along with marked pain, its further decrease patients quality of life. We performed a series of physical and neurological evaluation. Muscle strength was graded 3 out of 5 according to Medical Research Council Scale, with hypoesthesia below the level of T1. No sign of upper motor neuron lesion was noted on evaluation. A lump on the left breast suspected as tumor was also noted during physical examination. The lump was only known lately, and no further evaluation was done previously to confirmed diagnosis.

Figure 1: Preoperative cervical MRI, a compression of T1 vertebral body and marro replacement on C7-T2 vertebral body was noted. Kypotic angle measured to be 28°.

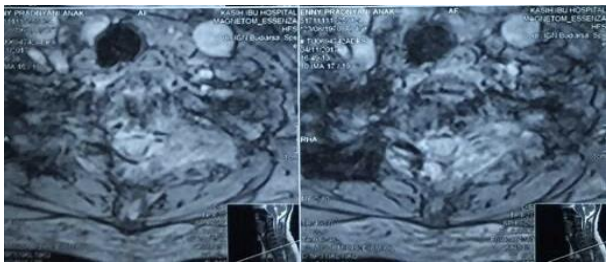

Figure 2: An axial view section at level T1 showing tumor involvement on posterior complex.

MRI of cervicothoracic region were obtained to evaluate spinal cord compression and extent of pathology (Figure 1). MRI finding suggest fracture of T1 vertebral body with kypothic angle 28° that causing anterior compression of spinal cord. Destruction is also seen on T1 pars interarticularis, posterior column, transverse and spinous processes. Nerve compression over C8 and T1, along with marrow replacement on C7, T1, and T2 vertebral body and posterior complex (Figure 2) was also noted.

Based on the evaluation, neurological deficit was concluded as ASIA C. Limitation of physical activity giving an ECOG score 3 on patient fuctional status. VAS was assessed 6 out of 10, and needed combination of NSAID and light opioid. Spine instability was assessed as SINS score 18. Life expectancy of more than 1 year was concluded based on Tokuhashi Scoring System.

A decision to performed surgery through posterior approach was made to provide immediate direct circumferential decompression of the spinal cord and reconstruction of the spinal stability.[6] Fixation achieved by lateral mass screw on C4 to C6 and pedicle screw on T1 to T4(Figure 3). A screw fixation was unable to applied on C7 lateral mass. Connection achieved by rods of different caliber(dual diameter rod) and cross link to ensure stability. Pediculectomy of T1 left pedicle due to tumor involvement was performed, followed by posterior decompression. Fusion was also done on this patient. A biopsy sample was collected from the spine and left breast to confirm the diagnosis histopathologically. Fluoroscopy taken to ensure implant position (Figure 4).

Figure 3: Clinical picture after fixation.

Patient evaluation was done to assess their neurological, pain and functional status post operatively. Rapid acceleration was observed on patient recovery of neurological defect. Motoric function was regained. On the 3rd month, patient was able to walk in short distance without support.

Patient was able to carry out a light house work on the 5th month, presenting improvement on ECOG performance status. Tingling and numbness around the back was still persisting, otherwise no sensoric abnormality was found

on examination. Postoperative pain levels were significantly reduced from VAS of 6 to 1-2 out of 10 during activity. Stable construct was seen plain X Ray that obtained on first month (Figure 5) and fifth month (Figure 6) after the procedure. No progressive kyphosis was observed during follow-up. A further improvement is to be anticipated.

Figure 4: Fluoroscopy taken during surgery.

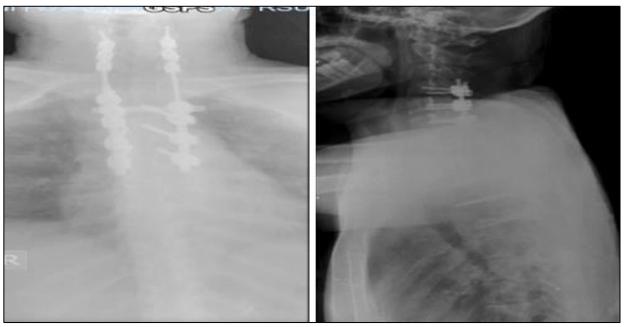

Figure 5: Plain X-ray taken on the first month follow-up showing stable construction.

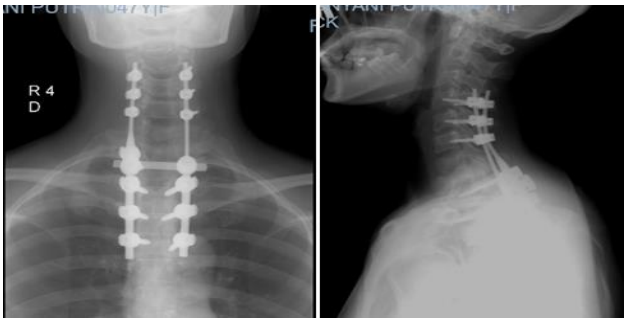

Figure 6: Cervical X-ray taken on the fifth month follow up showing fusion and no progression of kyphotic.

DISCUSSION

Metastases of CTJ are susceptible to injuries because of the weight transfer from the anterior to the posterior column and the vertebral index that decreases from C6 to T1 vertebrae. Made it prone to compression and associated with poor ambulatory functional outcome. A favourable prognosis of metastases from breast cancer gives indication for palliative surgery. Early surgical intervention should be performed before ambulatory function begins to decline. The difficulty regarding the surgical technique resides in the cervicothoracic characteristics. An anterior approach brings consideration regarding its anatomical structures and major vasculars around it. While posterior approaches are disadvantageous because of a destabilization effect, inadequate visualization of the vertebral body pathology, and the need for a long posterior construct to restore stability.[1,2,4,9,10] More over outcomes following decompression are diverse in literature.

Previous surgeries at the cervicothoracic junction have been well known to destabilize the region. Several authors have reported increasing spinal deformity caused by a previous cervicothoracic junction laminectomy.[3] Posterior approach and instrumentation along with decompression and spinal fusion was choosen for this patient due to involvement of three spinal column with significant instability. Location of tumor on cervicothracic junction which further increasing the risk of progressive kyphosis was also directing for posterior stabilization rather than anterior.[11]

Kulkarni et al, indicated that posterior fixation is a gold standard for the treatment of cervicothoracic instability in spine tumors, considering anatomic and biomechanical goals.[6] In a recently published biomechanical study, posterior fixation in CTJ has been shown to provide sound stability in flexion-distraction, lateral bending, and axial rotation injuries, while complex lesions involving the anterior column require a combined anterior/posterior technique.[2,12] For T1 lesions, anterior stabilization alone, by cage and plate, showed no satisfactory results in all but one patient with C7 fracture type A3. Anterior C7-T2 fixation failed and required further posterior surgery.[2] Posterior fixation techniques have been demonstrated as ideal methods of stabilization for CTJ instability associated with spine tumors.[4] The similar results reported on study by Le et al, where a malignanat tumor involving the cervicothoracic junction have a favoured outcome after posterolateral approach for simultaneous decompression and stabilization.[3]

Bueff and co-worker's compared three different fixation devices at the cervicothoracic junction: an anterior plate, a posterior plate, and a posterior hook/rod system. They found that the hook/rod system provided up to six times the stiffness of the intact spine, whereas the anterior plate provided stiffness similar to the intact spine.[3] Pedicle screws fixation provides the stiffest fixation for stabilizing the cervicothoracic spine.[13]

The lower cervical laminae are thinner and weaker compared with upper thoracic vertebrae. Together with a narrow spinal canal, this often limits use of the hook/rod system for stabilization at the cervicothoracic junction. Use of lateral mass screws should take into consideration the location of the vertebral artery and the spinal nerves. The pedicles at T-1 and T-2 are large enough for screw

fixation and should be incorporated into the fusion construct if possible.[3]

A study by Placantonakis et al. involved 90 patients that underwent posterior instrumentation showed an excellent and safe stabilization of the cervicothoracic junction provide by LMSRS and PSS.[3,14,15] Recent study showed, due to inherently instability across the area, routine long construct was performed, at least three or four levels above and below the diseased area.[3,11] On biomechanical testing, there is no difference between the dual-diameter and solid domino connected rod.[16]

Eliminating motion by performing a fusion has been shown to increase the intradiscal pressure at the adjacent levels in biomechanical models. Eck et al simulated a fusion at C5-C6 and reported increases in the intradiscal pressures at both adjacent levels during flexion when compared with the perfusion values.[17] Spinal fusions ending at the cervicothoracic junction can also be a factor contributing to iatrogenic cervical instability. Progressive instability of this area ultimately leads to kyphosis and spinal cord compression.[3] Surgeons may consider ending constructs that cross the cervicothoracic junction in the upper thoracic spine rather than the mid to lower thoracic regions. In fact, the lowest combined pressures were measured at T2-T3.[17]

Overall, surgical approaches to the cervicothoracic junction will be guided by the tumor's location, extent of involvement, and histological features, as well as the surgeon's familiarity with the approach.[3]

CONCLUSION

This report presented a case of pathological vertebral fracture due to spinal metastasis of breast cancer that involved the cervicothoracic junction. Early decompression and fixation should be performed in order to improve functional status and relieving pain. Approach and instrumentation were depending on tumor involvement, biomechanics, and familiarity of the spinal surgeon. Cervicothoracic junction fusion procedure is a considerable choice for the management of pathological vertebral fractures with cervicothoracic junction involvement caused by spinal metastases of breast cancer.

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