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Effect of pre-surgical physiotherapy rehabilitation of a traumatic D-11 vertebral compression fracture: A case study

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ABSTRACT

Vertebral compression fractures are usually the fractures of thoraco-lumbar region in which the vertebrae collapse into it and becomes squashed into a wedge shape. The most common cause of this is the presence of osteoporosis or high velocity trauma. These fractures occur as a result of flexion type of injuries. These fractures cause substantial pain and impairment, limiting everyday activities and lowering quality of life. When evaluated, these patients have no aberrant findings, but they do have kyphosis and discomfort in the spinal region. Movements involving flexion of the spine exacerbate the pain. Management includes conservative management and surgical management. Surgically, fractures are managed by vertebroplasty and kyphoplasty. Physiotherapy is suggested to help with the symptoms occurring due to the condition as well as due to the surgery. Rehabilitation starts post operatively and includes pain management, strengthening exercise program, flexibility exercises and return to daily activities. The therapist also incorporates the use of brace to prevent flexion of the spinal column which exacerbates the condition. This has proven to have successful results; however, early initiation of the process can help the patient overall in terms of pain, strength, disability, kinesiophobia and reduced length of hospital stay after a spinal surgery. In case of vertebral fracture with cord compression, physiotherapy intervention pre-op and post-op has been proven to be quite useful in early recovery of the patient along with reduced hospital stay.

Keywords: Vertebral fracture, cord compression, physiotherapy, rehabilitation

1. INTRODUCTION

Vertebral compression fractures are most commonly due to the presence of osteoporosis or high energy trauma like road traffic accidents (Inose et al., 2021). These types of fractures are seen mostly in post-menopausal women. These fractures cause significant pain and disability which hamper the

activities of daily living and affect the quality of life (McCarthy and Davis, 2016). Cord compression can be seen in such fractures due to retropulsion of bony fragments. It presents as pain in the lower extremities, paraesthesia, urinary incontinence and weakness (Lukert, 1994). These patients present with no abnormal findings when examined, however they show signs of kyphosis and tenderness over spinal region (Rushton et al., 2018). The compression fractures are classified as wedge, crush and concave. The anterior border of the wedge fracture is collapsed, whereas the posterior border is intact or almost whole. The overall vertebra breaks when a crush fracture occurs. Concave fracture has intact borders-anterior and posterior and there is damage to the central portion of the vertebral body (Wu et al., 2003). These fractures can occur at any level of the spine; most common are the thoracic and lumbar fractures.

Fractures at the lumbar level have a better prognosis than the thoracic fractures (Cockerill, 2000). The type of fracture also affects the intensity of pain and the quality of life. There is also evidence of kyphosis in thoracic compression fractures; the reason being an increase in intramuscular back muscle pressure and fatigue (Silverman, 1992). Flexion exercises increases thoracic kyphosis by increasing the compression force (Gaitanis et al., 2005). Patients with a previous vertebral fracture have a poor prognosis, lower quality of life and disability (Nagae et al., 1989). These patients have an increased risk of incidental fractures and worsening disability (Koenders et al., 2019). A study showed that previous fractures pose as a negative factor for disability, daily activities and eventually the quality of life the patient leads (Suzuki et al., 2010).

Vertebral compression fractures managed by spinal fusion along with decompression have proven to be successful when followed by a rehabilitation programme (Greenwood et al., 2015). Rehabilitation process which starts immediately after the surgery is not usually incorporated but has shown better results in terms of pain management, functional impairment and the degree of disability the patient undergoes as a result of spinal surgery (Wu et al., 2003). In this particular case, we attempted to reduce the complications of spinal surgery by providing the patient with a protocol including pre-op and post-op interventions. The programme includes various factors such as education, pain management, flexibility and mobility, strengthening programme, functional re-training.

2. PATIENT INFORMATION

The patient is a 13-year old male with a right handed dominance from Kothari in Nanded district. The child presented with difficulty in walking without support since the last 3 months. He also complains of difficulty initiating micturition since the last 3 months. Upon asking, the father mentions a trauma on the spine 2 years back. The child had a slip and he fell on a desk hitting his back during school hours. The child had severe paresthesia in bilateral lower limbs immediately after the incident. The paresthesia was resolved over time. The child had difficulty in walking after the incident. The patient complains of urinary hesistancy since 1 year.

The parents took the child to the local hospital with the complaint that the child had difficulty walking. He was referred to the physiotherapy department for the same. The physiotherapist suggested strengthening exercises and the use of a splint to the patient. The patient wore the splint for 6 months but the gait difficulties did not improve and the parents stopped the use of the splint. After that, the parents made the child run every day for a year. Later on, the child had severe weakness in his lower limbs especially the ankle. So, the parents brought him to AVBRH, Sawangi for further management. Here an MRI was done which revealed the presence of D-11 fracture with cord compression. The patient was referred to neuro-surgery department for laminectomy and spinal fusion.

3. CLINICAL FINDINGS

A proper written consent was taken from the patient. The patient was explained about physical examination and intervention. On general examination patient was conscious, well oriented with time, place, person and cooperative. He had a GCS score of 15/15. Patient was hemodynamically stable, afebrile with BP-128/78 mm Hg, pulse rate was 84 beats/ min, and respiratory rate was 18 breaths per min. On observation, the patient was in supine lying position. There was visible equinovarus deformity in his right foot. The left foot also showed initial signs of developing an inversion deformity (fig.1).

On examination, both superficial and deep sensations were intact in his upper as well as lower limbs. Reflex examination showed mute reflexes all over (table 1). Range of motion on the day of assessment is as mentioned in table 2. Motor examination revealed that he had 4/5 grade in his upper limbs on the MMT grading scale whereas the grading was relatively less in his lower extremities i.e. hip and knee flexors and extensors bilaterally was 3+. The patient was unable to perform ankle movements and his grade on MMT scale was 0/5 (table 3). He also had bed sores on the right gluteal region (grade 1).

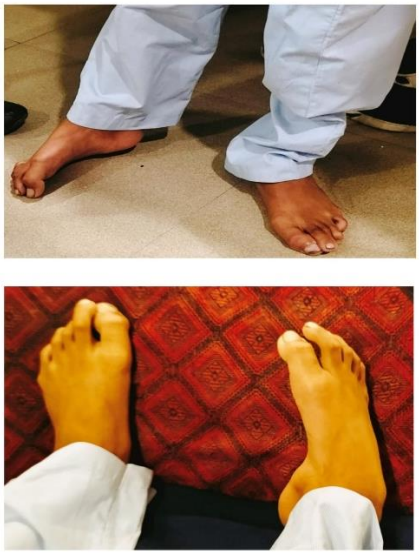

Figure 1 Foot deformity in supine and standing

On investigation, complete blood count report was within normal range. X-ray and MRI were done. MRI report revealed anterior wedge compression of grade 3 of D-11 vertebrae causing spinal canal stenosis, cord impingement and oedema (fig. 2). Also, HRCT scan of thorax showed burst compression fracture of D-11 vertebrae with retropulsion of fracture fragment causing focal kyphosis and spinal canal narrowing. The tone of the patient was normal all over.

Table 1 reflexes on the day of assessment

	Right	Left
Deep – Biceps	0	0
Triceps	0	0
Supinator	0	0
Knee	0	0
Ankle	0	0
Superficial – Abdominal	1+	1+
Plantar	0	0

Table 2 range of motion on the day of assessment

Joints	Right	Left
Shoulder – flexion	0-175 °	0-175 °
Extension	0-20 °	0-20 °
Abduction	0-160 °	0-160 °
Elbow – flexion	0-140 °	0-140 °
Extension	140-0	140-0
Wrist – flexion	0-85	0-85
Extension	0-25	0-25
Hip- flexion	0-175	0-175
Extension	0-15	0-15
Adduction	0-5	0-5
Abduction	0-40	0-40
Knee – flexion	0-135	0-137
Extension	135-0	137-0
Ankle – dorsiflexion	-	-

Plantar flexion	-	-

MMT: All upper extremity muscles were graded as 4/5 on MMT scale.

Table 3 muscle strength on day of assessment

Lower extremity	Right	Left
Hip- flexors	3+	3+
Extensors	3+	3+
Adductors	3+	3+
Abductors	3+	3+
Knee – flexors	3	3
Extensors	3	3
Ankle – dorsiflexors	0	0
Plantar flexors	0	0

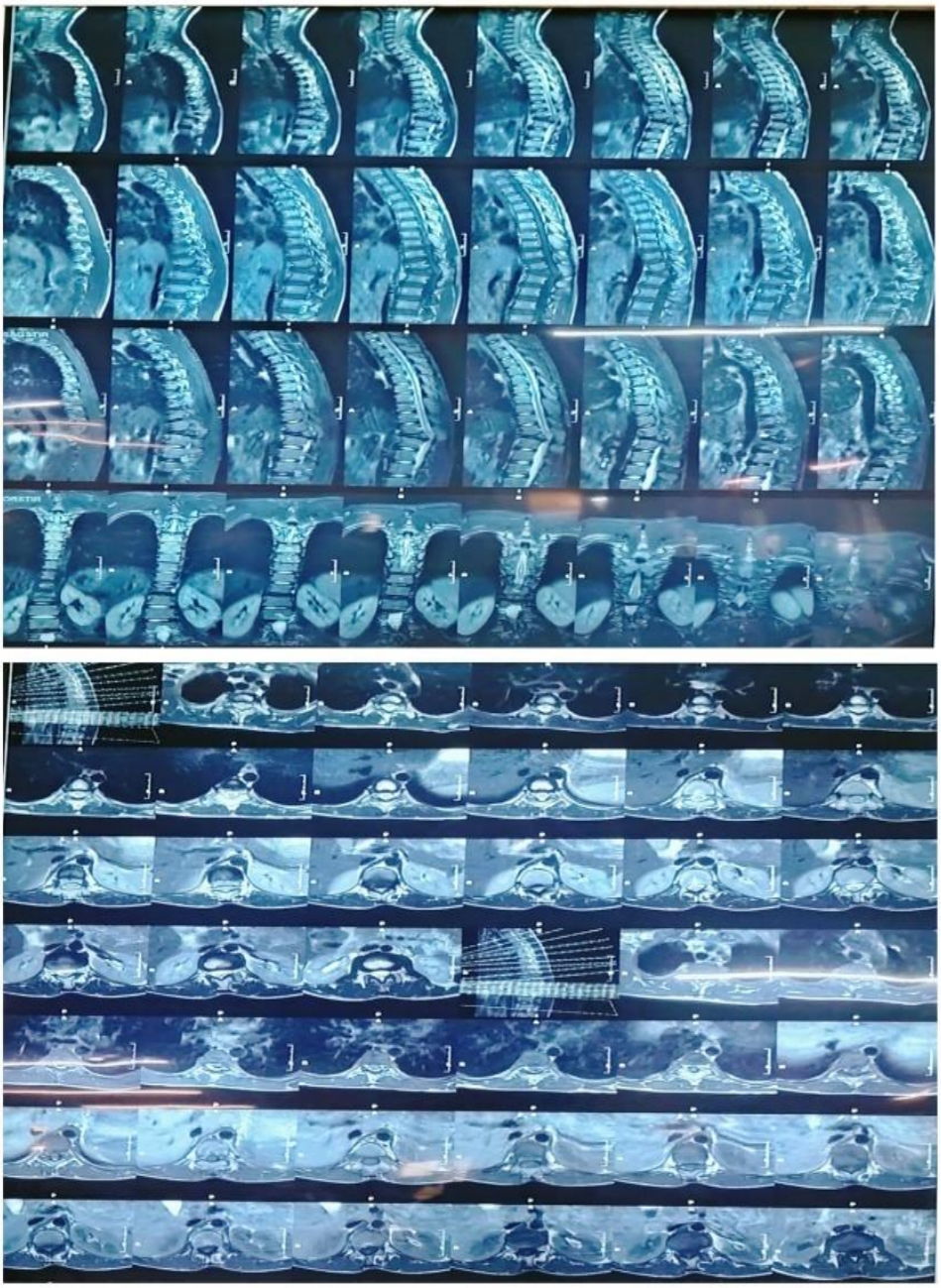

Figure 2 MRI (pre-op)

Diagnosis

The patient was diagnosed as a case of D11 vertebral fracture with cord compression. He underwent spinal fusion surgery of D10 and D11 with laminectomy of D11 with decompression of spinal canal.

Treatment protocol

The goals of this treatment program were to educate the parents and the patient about the condition, to teach bed mobility, to reduce spasm, to improve the strength of the patient, improve balance and prevent further deformity of the foot. The long-term goals were to maintain the muscle strength, provide balance and gait training, educate and teach orthotic use, prevent the deformity in the left foot and providing a better quality of life.

Intervention

Week 1

The goals in the first week were to educate the patient, teach bed mobility, relieve spasm and stop further deterioration of the foot deformity. For this, parent education and counselling, bed mobility such as rolling, supine to sit, sit to stand, heating to the paraspinal musculature to relieve spasm, correct use of foot orthosis, positioning of foot while in bed to prevent further inversion, stretching of tight musculatures, strengthening of upper limb; static isometrics to lower limb and back, functional electrical stimulation to ankle muscles to move from grade 0 to grade 1 on MMT scale were done (table 4).

Table 4 Pre-op management

Goals:	Strategies:
Education	Explanation and reassurance
Bed mobility	Rolling in bed, supine to sit, sit to supine
Reduce spasm and maintain flexibility	Hydrocollator packs to paraspinal muscles Stretching to TA, hamstrings, spinal extension exercises
Strength training	Active resisted exercises to upper limb Active assisted exercises to lower limb
Prevent deformity	Walking with brace

Week 2

The goals in this week are to maintain flexibility and improve strength. For this, Hydrocollator packs to paraspinal muscles, spinal extension exercises, stretching of tight musculatures, active resisted exercises to the upper limb, Active assisted exercises to the lower limb, Functional electrical stimulation to ankle muscles to move from grade 1 to grade 2 on MMT scale were done.

Week 3

The goals of this week are to improve strength and improve balance. Active resisted exercises to the upper limb, Active assisted exercises to the lower limb, Functional electrical stimulation to ankle muscles, static balance exercises were incorporated in this week.

Post-op week 1

The goals of this week include alleviating pain, bed mobility, maintaining flexibility and strength. These included Active resisted exercises to the upper limb, Active exercises to the lower limb, Bedside sitting, Reach-outs in sitting and Trunk rotations (table 5).

Table 5 Post-op management

Goals:	Strategies:
Bed mobility	Rolling in bed, supine to sit, sit to supine, sit to stand
Maintain flexibility and strength	Stretching of tight musculatures Active-assisted to active to active-

	resistive exercises
Orthotic use and prevention of further deformity	Teaching the parent regarding the correct method of using the orthosis
Balance and gait training	Walking with the splint, in parallel bars, on various surfaces

Post-op week 2

The goals of this week include improving strength and initiate mobilisation. These consisted of Active exercises to the lower limb initially, Active exercises to lower limb with minimum resistance and Functional electrical stimulation to ankle dorsiflexors and plantar flexors. The improvement was monitored using outcome measures (table 6).

Table 6 Outcome measures showing progression of the patient.

Outcome measure	Pre-op day 1	Pre-op day 8	Post-op day1	Post-op day 8
VAS	2	1	9	6
Self-efficacy for exercise	47	56	10	52
Tampa scale for kinesiophobia	31	35	20	32
Oswestry disability index	10 (mild)	8	21 (moderate)	11 (mild)

4. DISCUSSION

Vertebral compression fractures managed by spinal fusion along with decompression have proven to be successful when followed by a rehabilitation programme (Greenwood et al., 2015). Rehabilitation process which starts immediately after the surgery is not usually incorporated but has shown better results in terms of pain management, functional impairment and the degree of disability the patient undergoes as a result of spinal surgery (Wu et al., 2003). A study done by Tegner et al., (2020), suggests the same i.e. early post-surgical rehabilitation of the patient when done helps in pain intensity, disability and kinesiophobia. They included graded activity and pain education with conventional physiotherapy treatment over a period of 10 weeks post operatively.

A study by Wu et al., (2003) states that at the time, rehabilitation of vertebral compression fractures included use of spinal brace, walking aids, and an exercise program of strengthening and mobility exercises to help with the symptoms besides the pharmaceutical management. In this particular case, we attempted to reduce the complications of spinal surgery by providing the patient with a protocol including pre-op and post-op interventions. The programme includes various factors such as education, pain management, flexibility and mobility, strengthening programme, functional re-training.

5. CONCLUSION

Pre-operative rehabilitation included educating the patient and his family about the condition and bed mobility training along with strengthening and preventing further deformity of the foot. Post-operative rehabilitation included further strengthening with balance and gait training and re-training of his activities of daily living. We also incorporated intervention to improve his kinesiophobia as a result of post-operative pain and advised use of orthotic for the deformity. As a result, we found that rehabilitation done before and after the spinal surgery helped in the early recovery and reduced hospital stay of the patient.

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Author Contributions

All authors mentioned have put their efforts in managing the patient, along with the data collection and preparation of this manuscript.

Informed consent

Written & Oral informed consent was obtained from all individual participants included in the study. Additional informed consent was obtained from all individual participants for whom identifying information is included in this manuscript.

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Conflicts of interest

The authors declare that there are no conflicts of interests.

Data and materials availability

All data associated with this study are present in the paper.

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