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Positive effects of neuro-rehabilitation in a patient of cervical myelopathy with lower limb weakness: A case report

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ABSTRACT

Introduction: Cervical myelopathy is a disease that causes the compression of the spinal cord. Cervical myelopathy occurs basically because of force applied to the anterior spinal cord with ischemia as a result of the distortion of the cord by anterior herniated discs, spondylotic spurs, and an ossified posterior longitudinal ligament, or spinal stenosis. **Case presentation:** A 55-year-old male who came with a chief complaint of weakness in both the lower limbs for approximately since 1 year. He was diagnosed previously with C₅-C₆-C₇ cervical myelopathy and was surgically operated on with cervical discectomy in June 2010. In September 2021 he again started experiencing the bilateral lower limb weakness and in March 2022 he visited the tertiary rural hospital where he was diagnosed with C₇-D₁myelopathy. He underwent various interventions like MRI and EMG (Electromyography), and NCV (Nerve Conduction Velocity). He was then diagnosed with mid-left median motor axonal. The disease-specific outcome measures for cervical myelopathy are the Nurick grading scale and JOACMEQ. **Conclusion:** The physiotherapeutic intervention that was modulated was according to the condition of the patient which improved his quality of life and independence. Therefore, it helps in gaining patients' confidence in their prognosis in the patient diagnosed with cervical myelopathy.

Keywords: Cervical myelopathy, Herniated discs, Spondylitic spurs, cervical discectomy, Physiotherapeutic intervention.

1. INTRODUCTION

Cervical myelopathy is a disorder that causes spasticity (continuous muscular contractions), hyperreflexia, pathologic reflexes, digit/hand clumsiness, and gait disruption due to compression of the spinal cord at the cervical level of the spinal column. It usually starts slowly and progresses gradually, with a functional decrease (Donnally et al., 2022). Due to a congenitally narrowed cervical canal, certain patients are more inclined to myelopathy. Myelopathy at this level is more prone to develop when stenosis or a cervical disc herniation progress. Because of the higher mobility allowed at these levels,

degenerative alterations are most common at C₅-C₆ or C₆-C₇ (Jackson, 2017). Cervical myelopathy commonly manifests in the upper extremities, however, it is rare for cervical myelopathy to present without symptoms in the upper extremities (Houten et al., 2019).

Static mechanical forces give rise to narrowing of the spinal canal and compression of the spinal cord. The intervertebral discs dry out with age, resulting in disc height reduction. The articular cartilage of the vertebrae and their corresponding end plates are put under more stress as a result of this process. The borders of these end plates generate osteophytic spurs. Osteophytes help to support neighbouring vertebrae that are hypermobile due to disc degeneration (Young, 2000). As it is well accepted that surgical intervention improves the prognosis of Cervical Myelopathy, the decision strategy for choosing the best surgical method is complicated. In reality, the decision to choose a ventral or dorsal approach is influenced by several criteria, including the site of the main compression (dorsal vs. ventral) and cervical spine alliance (lordosis vs. kyphosis), as well as the patient's spinal biomechanics (Mattei et al., 2011). Cervical Myelopathy has a complicated aetiology and its chronic character is liable to trigger compensatory mechanisms within the cord. Protruding spinal discs, distorted vertebral bodies, facet joint hypertrophy, osteosteolytic lesions, hypertrophic ligamentum flavum, and ossified posterior longitudinal ligament are all anatomical threats to the cord. These degenerative processes can cause static compression, as well as aggravate compression during dynamic motions in the spinal cord. Finally, axonal stretch injuries, spinal cord ischemia from vascular compression, and venous congestion may lead to static and dynamic compression (Bakhsheshian et al., 2017).

The estimated frequency of surgically treated cervical spondylotic myelopathy is 1.6 per 100,000 people. Even though the population's adherence to surgical technique is quite consistent and referral patterns are well-known, this estimate will be too low for a variety of reasons. At best, this figure represents the minimum prevalence of surgically treated cervical myelopathy. Other studies are needed to determine the actual incidence or prevalence of cervical myelopathy in general, as well as the requirement for surgical therapy (Boogaarts & Bartels, 2015).

2. PATIENT INFORMATION

The presented case is of a 55-year-old patient who was an officer in the coal mines, residing in Wardha. The patient came with the chief complaint of weakness in both the lower limbs for approximately since 1 year. The patient noticed the weakness 12 years ago when he slowly and gradually started realizing that there is a bilateral lower limb and upper limb weakness (left leg more than right leg). Then he visited the neuro physician at Patna where MRI was done and the impression revealed compression at C₅-C₆-C₇. There, the physician advised him of the cervical collar but the situation started worsening. Therefore, he underwent an operation in Bangalore on 12 June 2010. After he was operated on with cervical discectomy there was no movement of the body for at least 72 hours, but then his family members noticed a flickering of movement in the great toe of the right side. After 8 days under observation, the patient was shifted to the general ward, and then after a week, he was discharged. There he was diagnosed with an accidental oesophageal tear and was operated on with an anterior fixation plate to oesophagus. The patient was then referred for physiotherapy, and after a few months was able to walk with the stick. Recently, from September 2021 the patient was experiencing the same problem that is weakness in both the lower limbs and the patient was unable to do his daily living activities independently. Therefore, the patient visited AVBRH on 05/03/2022, again the MRI was done and which revealed cervical myelopathy of C₇-D₁, and was referred for physiotherapy on 01/04/2022. He is a known case of hypertension and urges incontinence for 6 years. His socioeconomic status was revealed as Upper middle class on the Modified Kuppaswamy scale.

3. CLINICAL FINDINGS

The patient was assessed in a supine lying position on the couch with a pillow under the cervical spine for support. The vital signs like heart rate were increased to 109 beats/min; respiratory rate was increased to 29 breaths/min. On observation, the patient had an endomorphic build. The attitude of limbs for the upper extremity was placed by the sides of the body and the palm was placed in pronation. In bilateral lower limbs, his hips were extended, adducted, and externally rotated with the knee in extension ankle in slight plantar flexion. There was the use of accessory muscles of respiration with the thoracoabdominal type of breathing due to weakness of the diaphragm and muscles of respiration. There was no evidence of edema or pressure sores. On Palpation, there were no noteworthy findings in the context of warmth, tenderness, and swelling. On examination, the higher mental functions were normal i.e. the cognition of the patient was not impaired as the score was 28/30 on the Mini-mental scale examination (MMSE). His short- and long-term memory was intact. In special senses, V (Motor part) VII (Motor part), IX (motor part), X, XI & XII (motor part) cranial nerves were intact, and VIII (sensory) cranial is impaired. In the sensory examination, the superficial, deep, and cortical sensations were intact bilaterally over the upper and lower limbs along with the trunk. In cranial nerve examination, Rinne's and Weber's tests are positive. In the motor examination, there was weakness of both the lower limbs with trunk instability. On Manual

muscle testing, his upper limbs had a grade of 4 and his lower limbs had a grade of 3. His deep tendon reflexes grading is given in Table 1.

Table 1 Grading of Deep Tendon Reflexes

DEEP TENDON REFLEX GRADING	
Jaw jerk	2+ (Brisker or more reflexive than normal)
Biceps jerk	2+
Supinator jerk	2+ (Normal)
Triceps jerk	2+
Knee jerk	1+ (Low normal, diminished)
Ankle jerk	0 (Absent, no response)

Timeline

January 2010: cervical spine MRI was done and diagnosed with cervical myelopathy of C5-C6-C7. 11 June 2010: the patient was operated on with spinal fusion of C5-C6. In December 2010: a radiogram of the oesophagus by barium swallow study was done. September 2021: cervical spine MRI, Ultrasound of abdomen + pelvis revealed prostatomegaly with 87cc of post-void residual urine and MRI of Brain suggested bilateral mastoiditis. 5 March 2022 MRI of the cervical spine revealed cervical myelopathy of C7-D1. 2 April 2022: EMG and NCV study revealed that there is mid left median motor axonal neuropathy.

Diagnostic assessment

The patient underwent an investigation of cervical spine MRI in 2010 which revealed that there is cervical myelopathy and myelomalacia of C5-C6 levels. Then he underwent further investigations like CBC that revealed increased RBC count-5.45 mil/mL, ESR, Urine Analysis, Lipid profile test, Kidney function test, Kidney basic screening that revealed an elevated level of uric acid- 6.0 mg/dL, Random glucose, Immunology, Serology for Hbs Ag, HIV, Rapid plasma reagin, LFT (Liver Function Test). In December 2010: a radiogram of the esophagus by barium swallow study was done which revealed there is an accidental tear in the anterior esophagus. In September 2021 cervical spine MRI revealed post-op changes with a susceptible artifact from graft at C5-C7 vertebral bodies with a fusion of C5-C7 vertebral bodies and non-visualization of the intervertebral disc, Ultrasound of abdomen + pelvis revealed prostatomegaly with 87cc of post-void residual urine and MRI Brain suggested bilateral mastoiditis (figure 1). On 5 March 2022 he underwent a few more investigations of MRI cervical spine revealed cervical myelopathy of C7-D1. 2 April 2022: EMG and NCV study revealed that there is mid left median motor axonal neuropathy (figure 2).

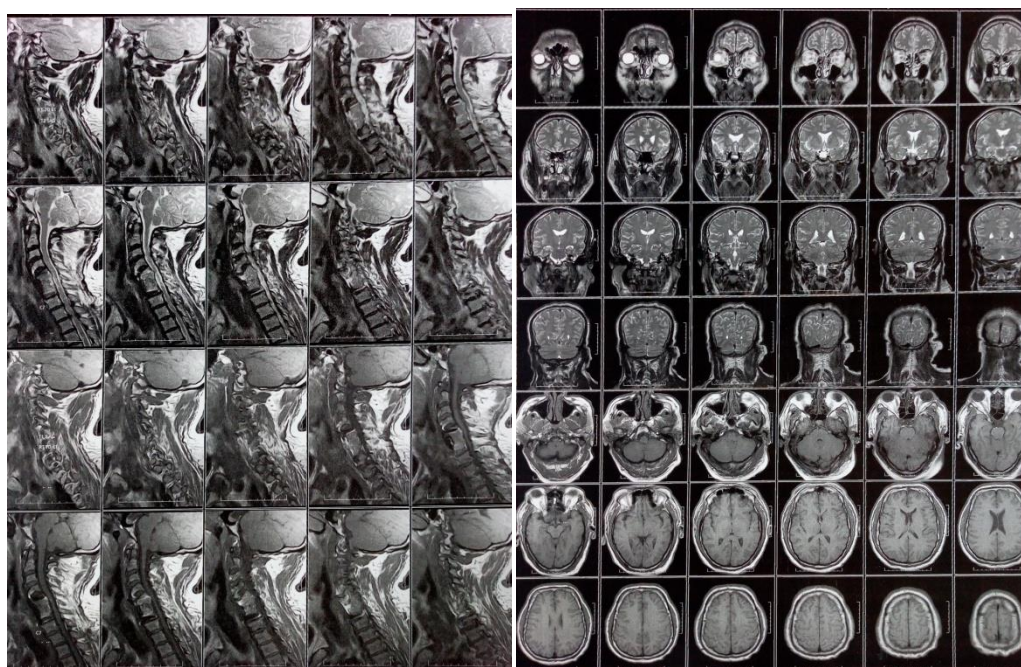


Figure 1 [A] MRI of the cervical spine and [B] MRI of the Brain

Diagnostic challenges

As cervical myelopathy is considered an elementary differential diagnosis to sort out when the patient complains about symptoms of the upper limb, specifically a combination of neck, shoulder, and arm pain with hand weakness. But, when the patient visits only with lower limb weakness it makes it obvious to analyze as lumbar pathology and proceed with the clinical investigation this is the diagnostic challenge faced.

Physiotherapeutic interventions

Knowing the complexity of the patient’s condition the patient was well educated about the physiotherapy benefits and the protocol was briefly described to the patient. The patient was visually shown and verbally instructed about how to perform the following exercises which are shown in table 1.

Table 1 Representing the Goals, Intervention, Rationale, and Dosage

Goals	Interventions	Rationale	Dosage
Phase- I (0-2 weeks)			
To increase the range of motion and lengthen the muscle.	Stretching to Gastrocnemius-Soleus, Hamstrings, Adductors, and rectus femoris [Proprioceptive neuromuscular facilitation (hold- relax technique)].	Increase range of motion. Improve ability to do daily living activities.	3 repetitions of 15 seconds hold (2 sets).
To improve pelvic stability.	Proprioceptive neuromuscular facilitation (slow reversal technique).	Activates the pelvic girdle muscles. Increase stability which enhances mobility.	3 repetitions of 15-second hold (5 sets).
To improve bladder control.	Kegels exercise	Strengthen the pelvic floor muscles. To prevent involuntary micturition.	10 repetitions of 10-second hold (1 set).
Phase-II(2-4weeks)			
To increase the range of motion and lengthen the muscle.	Stretching to Gastrocnemius-Soleus, Hamstrings, Adductors, and rectus femoris.	Increase range of motion. Improve ability to do daily living activities.	3 repetitions of 30 seconds hold (2 sets).
To improve pelvic stability.	Proprioceptive neuromuscular facilitation (slow reversal technique).	Activates the pelvic girdle muscles. Increase stability which enhances mobility.	3 repetitions of 30-second hold (10 sets).
To improve bladder control.	Kegels exercise	Strengthen the pelvic floor muscles. To prevent involuntary micturition.	20 repetitions of 10 second hold (1 set).
To strengthen the quadriceps muscle.	Dynamic squats with 1kg weight. Wall squatting Sit to stand	To increase the strength of quadriceps muscle. Improve stability of knee joint.	Initial 1 st week [10 repetitions of 5-second hold (1 set)]. Progression in 2 nd week [15 repetitions of 10-second holds (1 set)].
To increase mobility.	Parallel bar training exercises Spot marching	Increase strength in lower limbs. Improves static and	Initial first week with support 7 rounds, progression in 2 nd without support on the

	Swiss ball perturbation and balance training.	dynamic balance. Increases independence.	parallel bar. Spot marching initial 1 st week 10 repetitions and progression in 2 nd week to 20 repetitions. Swiss ball perturbation for 10-15 minutes.
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Figure 2 patient treatments in Neuro-Rehab

The outcome of intervention

Nurick grading scale: this scale assesses the employability of the person. This scale is arranged in descending manner that is it scores from 0 (normal function) to 5 (unable to attempt function). It is shown in Figure 3. Japanese Orthopaedic Association Cervical Myelopathy Evaluation Questionnaire (JOACMEQ): This Questionnaire establishes criteria of mild, moderate, and severe impairment in patients with cervical myelopathy (figure 4).

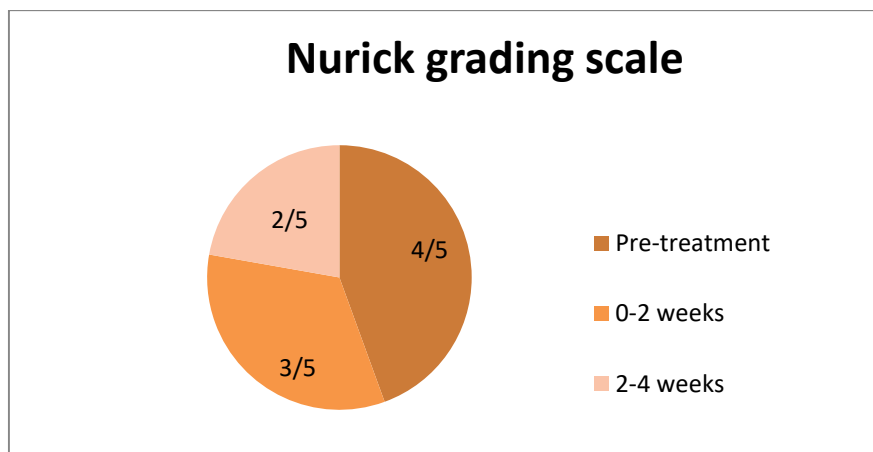


Figure 3 Nurick Grading Scale assesses the employability of the person

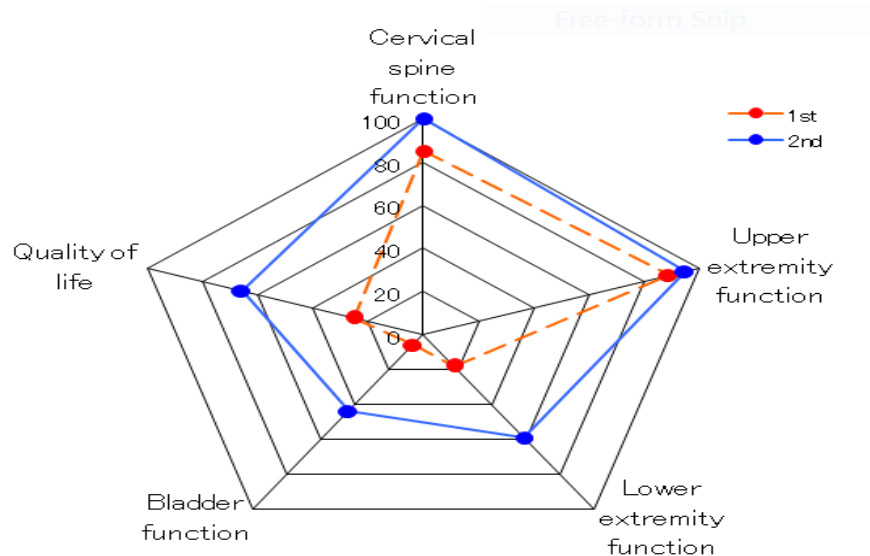


Figure 4 JOACMEQ evaluating the intensity of impairment in a patient with cervical myelopathy.

4. DISCUSSION

According to (Boerger et al., 2022) currently, all individuals are recommended to have surgical decompression to treat the cervical myelopathy but it is not necessarily all patients come to complete recovery or back to their quality of life after there is irreversible tissue damage in the spinal cord. As (Luo et al., 2020) told that in cervical myelopathy it is common to have upper limb and lower limb dysfunction or impairments and it is evident that there is more involvement of upper extremity weakness than lower extremities but the case presented by us is having lower extremities weakness and the upper extremities are absolutely towards normal. (Davies et al., 2018) suggested that spinal cord compression leads to the neurological deficit and affects a patient’s quality of life, when the patient underwent surgical process the prognosis of the patient gets stopped as the recovery strength of the spinal cord is finite and this can also lead to permanent damage. (Revanappa and Rajshekhar, 2011) revealed that the Nurick grading scale and JOACMEQ have good correlation after surgery as these are the disease-specific scales. The relation of the scales was found best in mild-moderate cervical myelopathy patients than in severe conditions.

As Cheng et al., (2020) incorporated the impairments with functional abilities and balance. However, the balance control of the patient is less stable in patients with cervical decompression as compared to normal same age-group people. Cheng et al., (2020) presented a study that aimed the effect 4-week of perturbation balance base balance training on the balance and functional abilities of the patient. But, the regimen made by us has concluded that the balance can be regained in 2 weeks of the balance training program.

5. CONCLUSION

Although the prognosis of cervical myelopathy patient depends on the neurologic condition of the patient which may vary in some cases remaining bedridden for years and the quality of life of the patient may drastically hamper, physiotherapy treatment that is individualized to the patient’s requirements and objectives and which focuses on managing symptoms, enhancing function and involvement helps persons with cervical myelopathy to live their lives with quality.

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Author’s Contributions

GSK and RD evaluated the case report, and RD & PH helped in the final drafting of the case report. GSK and RD assisted in the revision of the manuscript. All authors approved the final version of the manuscript.

Patient's Perspective

After 4 weeks of my physiotherapy treatment, I've started feeling much better, reduce my dyspnea significantly, and it also indulged a sense of motivation in me to be active as much as possible and taught me to always be willing for exercise sessions, which I was not able to do before physiotherapy management.

Authors' contributions

The design of this report was suggested by GSK and RD. The study was made and implemented with the help of GSK and RD. GSK wrote this report. The final report was analyzed and approved for publishing by RD.

Informed Consent

The patient was first briefed about the report followed by obtaining oral informed consent.

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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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