

Management of a Case with Cervical Myelopathy through Clinical Reasoning Process

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Abstract

Clinical reasoning is a thinking and decision-making process that occurs in clinical practice. Cervical myelopathy is a clinical syndrome of spinal cord compression that leads to disability. As a clinician, reducing this disability with proper diagnosis and treatment is imperative. A case-based study through pattern recognition, three-track reasoning, as well as narrative reasoning. This study aims to explore the physiotherapy management of cervical myelopathy patients through clinical reasoning. As the patient came with a myelopathy diagnosis to the clinician so used pattern recognition. The client was female and had professional work and household activities. So, need to support her family; that's why the clinician used three-track reasoning and narrative reasoning. While analyzing the clinical reasoning process, it was difficult to stick to a single clinical reasoning process, so the clinician went through different clinical reasoning processes to fulfill the client's requirement. The patient responded well after treatment, as pain was decreased from 7 to 2 on the numerical pain rating scale. ROM was increased, which was measured by a goniometer. Improved muscle strength was measured by manual muscle testing, as well as improved functional activity measured by NDI. The model of clinical reasoning is related to understanding, organization, and application of new knowledge into clinical practice. Clinicians with effective clinical reasoning have a positive effect on patient outcomes.

Keywords: Disability, clinical competence, problem solving, pattern recognition, narrative reasoning.

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1. Introduction

Clinical reasoning is a process of thinking and decision-making that is used in clinical practice. According to Higgs and Jones (2008), Clinical Reasoning is a process by which the therapist interacts with her patient and other significant members, such as the patient's family members and other healthcare team members, and enables the patient to build up goals and health management strategies based on clinical cues, patient choice, professional judgment and knowledge.

Reasoning is a cognitive process by which a person can think about ideas and interpret phenomena.

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Reasoning is an umbrella term that includes all aspects of thinking from simple perception to complex abstract construction as well as many forms of inquiry and interpretation (Fleming, M.H 1991). Cognition is a process that involves the lateral prefrontal cortex and accumulates episodic, contextual, and sensory control to initiate a motor response.

1.1 Pattern Recognition

According to Groen and Patel (1985), in non-problematic situations, expert clinical reasoning becomes like pattern recognition, which is the direct retrieval of information from well-structured knowledge. In pattern recognition, similarities of new cases are recognized in relation to previous experience about signs, symptoms, treatment options, outcome, and context. Pattern recognition is precious. Swift, feasible, prevailing strategy of clinical reasoning.

1.2 Hypothetico-Deductive Reasoning

Rahman et al. 2016 stated that novices, as well as expert practitioners, would like to go through hypothetico-deductive reasoning during an unfamiliar condition. There are four stages: cue acquisition, hypothesis formation, cue interpretation, and hypothesis evaluation. Cue acquisition is an initial process that involves the collection of information during the process of clinical reasoning.

1.3 Three-track Reasoning

Fleming (1991) stated that therapists need different modes of thinking for different purposes or to solve different features of clinical problems. This study uses at least four types of clinical reasoning to solve a problem. By using three-track reasoning, therapists use a dual search between problem identification and treatment selection.

1.4 Procedural Reasoning

According to Fleming (1991), procedural reasoning is a process by which a therapist can think about the patient's physical ailments and which procedure would be most appropriate to alleviate the physical ailment. So, the therapist needs to know about the disease and condition. This reasoning is similar to hypothetico-deductive reasoning and includes problem identification, goal setting, and intervention planning.

1.5 Interactive Reasoning

The therapist interacts with the patient to achieve the best possible outcome by using the interactive reasoning process. Interactive reasoning is a process by which the therapist engages in face-to-face interaction with the patient to understand the patient as an individual (Fleming, 1991). Interactive reasoning helps the therapist to understand disability from the patient's point of view and engage the patient to involve different ways in patient treatment.

1.6 Conditional Reasoning

Conditional reasoning is a multidimensional process which involve in three different ways. First, the therapist thought about the whole condition, such as the person, illness, meaning of illness, family, physical and social context in which the person lives. Secondly, the therapist thought about how the condition could change, whether it might be achieved or not. Thirdly, success or failure mainly depended on the person's participation. This participation not only affected therapeutic activities but also structured a future outcome.

1.7 Narrative Reasoning

Narrative reasoning is one form of reasoning that the therapist employs to make an appreciation of the feeling of illness and experience of disability from the patient's viewpoint. According to Higg's and Titchen (1995), storytelling helps the creation of knowledge and facilitates the construction process. Narrative makes sense of reality by linking the outward world of action and event to the inner world of human intention and motivation (Edward, 2002).

1.8 Cervical Myelopathy

Cervical myelopathy is a clinical syndrome characterized by spinal cord dysfunction, such as diminished balance, dexterity, paralysis, and incontinence. Some etiological factors for cervical myelopathy include spondylosis, ossification of the posterior longitudinal ligament, trauma, and tumor (Edward et al., 2003).

Normally, the cervical region has adequate space in the neural canal for neural elements such as meninges, ligament, and epidural fat. The diameter of the cervical canal from C3-C7 is 17-18 mm. When this diameter is decreased in the sagittal plane, then cervical myelopathy occurs. Cervical canal stenosis can occur due to degenerative changes, ossification of posterior longitudinal ligaments, disc prolapse, or congenital causes (Edward et al., 2003).

Patients with cervical myelopathy may present with several signs & symptoms or might be asymptomatic; it depends on the severity of cervical cord compression. Early signs and symptoms might be diminished dexterity and subtle changes in balance and gait, incoordination during manipulating small objects. When the severity of compression is large, then bowel bladder dysfunction might occur.

The Japanese Orthopedic Association has developed a scale to assess the severity of cervical myelopathy based on four areas of physical findings. These four areas are motor dysfunction of upper and lower extremities, sensory deficit, and sphincter dysfunction. The total evaluation score was 17. A score of <7 indicates severe myelopathy, 8 to 10 indicates moderate, and > 13 indicates mild myelopathy (Rumi & Yoon, 2003).

Clinical reasoning is a specific concentration of thinking and practice of various tasks of clinical practice of physiotherapy. There is a close relationship between clinicians' skill in clinical reasoning and their personal aspect of health and disability. Cervical myelopathy is a condition that has a chance of disability. Early diagnosis and proper treatment have a significant chance to avoid complications (Jones et al. 2002).

Appropriate organization of knowledge is required to integrate the critical and reflective clinical reasoning process into success in applying new knowledge and changing practical thinking and behavior.

This study explicit the application of pattern recognition, three-tract reasoning, and narrative reasoning to treat the case of cervical myelopathy of a software engineer.

1.9 Justification of the Study

Cervical myelopathy, often caused by spinal cord compression from cervical spondylotic changes, is a progressive condition that can lead to severe neurological impairments. Given its potential impact on motor, sensory, and autonomic functions, early diagnosis and effective management are essential to prevent deterioration and improve quality of life. A structured clinical reasoning approach enables healthcare professionals to systematically assess the patient's condition, identify impairments, and make informed decisions about interventions. This process helps address the complex, multifaceted presentations of cervical myelopathy, ensuring a tailored, patient-centered approach to treatment that can improve outcomes and minimize complications. A clinical reasoning approach integrates the latest evidence-based practices with patient-centered care principles, allowing treatment to be customized to the patient's unique clinical presentation and personal goals. For instance, exercise and manual therapy have shown promise in alleviating symptoms and enhancing functional abilities in cervical myelopathy. However, clinical reasoning is necessary to determine the appropriate type, intensity, and frequency of interventions, especially because overloading the spine may exacerbate symptoms.

In conclusion, treating cervical myelopathy using a clinical reasoning process offers a comprehensive, patient-specific strategy that is crucial for handling the complicated, frequently progressing character of this illness. In addition to reducing symptoms, this approach gives patients the information and resources they need for long-term care, enhancing their capacity to live autonomous and satisfying lives.

1.10 Aim

To use an organized, evidence-based, customized clinical reasoning method to evaluate functional independence, lessen neurological symptoms, and enhance overall quality of life in a patient with cervical myelopathy

1.10.1 Objectives

- a. To assess the severity of cervical myelopathy signs by examining motor, sensory, and autonomic functions relative to the symptoms that the client is experiencing.
- b. To identify the specific biomechanical and neurological deficits associated with the deformity through a comprehensive physical examination and pertinent diagnostic imaging, to formulate an effective intervention strategy.
- c. To develop an appropriate treatment plan that integrates therapeutic exercises and

manual therapy techniques to relieve the client's signs and symptoms, improve range of motion and muscle strength, and restore the joint's physiological function.

- d. To evaluate the client's progress and modification of the treatment plan to meet the client's needs periodically during the intervention process to manage the condition effectively and dynamically.

2. Materials and Method

This case study followed the CARE (Case Report) Checklist guidelines to ensure comprehensive and accurate reporting of the patient's diagnosis, treatment, and outcome. CARE checklist.

2.1 Patient Information

The patient was a 35-year-old female, a software engineer, with a history of neck pain exacerbated six months before her visit. The patient's work involved sitting most of the time, which probably aggravated the condition. The patient complained of pain on the right side of the neck, which was rated as 7/10 on a numeric pain rating scale. She also reported occasional headaches over the temporal region, dizziness, and nausea. The patient further stated that the pain was provoked by such activities as coughing, sneezing, lying on the right side, bending, and sitting for a prolonged period of time. The discomfort was relieved on resting and taking analgesics.

a. Clinical Findings

Initial Examination

The patient complained of pain radiating from the neck to the upper limbs, affecting the medial aspect of the arm, forearm, and little finger. Upon a detailed physical examination, the following signs were documented:

- Positive Dural Signs
- Exaggerated Reflexes
- Positive Clonus and Hoffman's Sign,
- Positive Spurling Test

Suggestive of cervical myelopathy diagnosed by a clinical examination of the studies of Edward et al. (2003) and Glaser et al., (2001).

b. Diagnostic Assessment

- Consultation with a neurosurgeon in the instance of cervical myelopathy was advised. An MRI scan demonstrated spinal cord compression at C3-4, C4-5, and C5-6 levels, confirming the diagnosis of spinal cord injury (cervical myelopathy).
- MRI Findings: MRI showed low signal intensity on T1-weighted images, which is an indication of a poor prognosis of cervical myelopathy according to the study

of Morio et al., (2001).

Figure 1

MRI Image of the Patient (Disc protrusion at C3-C4, C4-C5, C6-C7 with stenosis)



2.2 Case Summary

The case involved a 35-year-old female who had been working at a software firm for about eight years and was diagnosed with chronic mild cervical myelopathy. Initially, she ignored her pain and continued her job activities and family responsibilities while maintaining a prolonged slouched sitting position and forward bending. Gradually, she began experiencing severe neck pain and difficulty with computer typing and lifting heavy objects. She consulted a neurosurgeon, who advised her to undergo an MRI. The MRI revealed a small rounded focus of abnormal signal intensity on T2 images at the C3-C4, C4-C5, and C5-C6 levels. The surgeon recommended surgery; however, being highly educated and well aware of the services at CRP, she opted to seek treatment at the CRP Savar outdoor musculoskeletal unit. She was managed using diverse specialized concepts and was referred back to the neurosurgeon at CRP, who advised surgery if physiotherapy did not yield positive results.

2.3 Treatment Timeline and Outcome Measures

The patient participated in physiotherapy three times per week and completed a total of 27 sessions. Outcome measures include resting pain (VAS), Pain during activity, Cervical flexion, Cervical Extension, Cervical right-side flexion, Cervical left-side flexion, Cervical right-side rotation, Cervical left-side rotation, and Manual muscle testing

(MMT) in the upper limb and lower limb.

Figure 2

International Classification of Functioning, Disability and Health (ICF) described for persons with Cervical Myelopathy

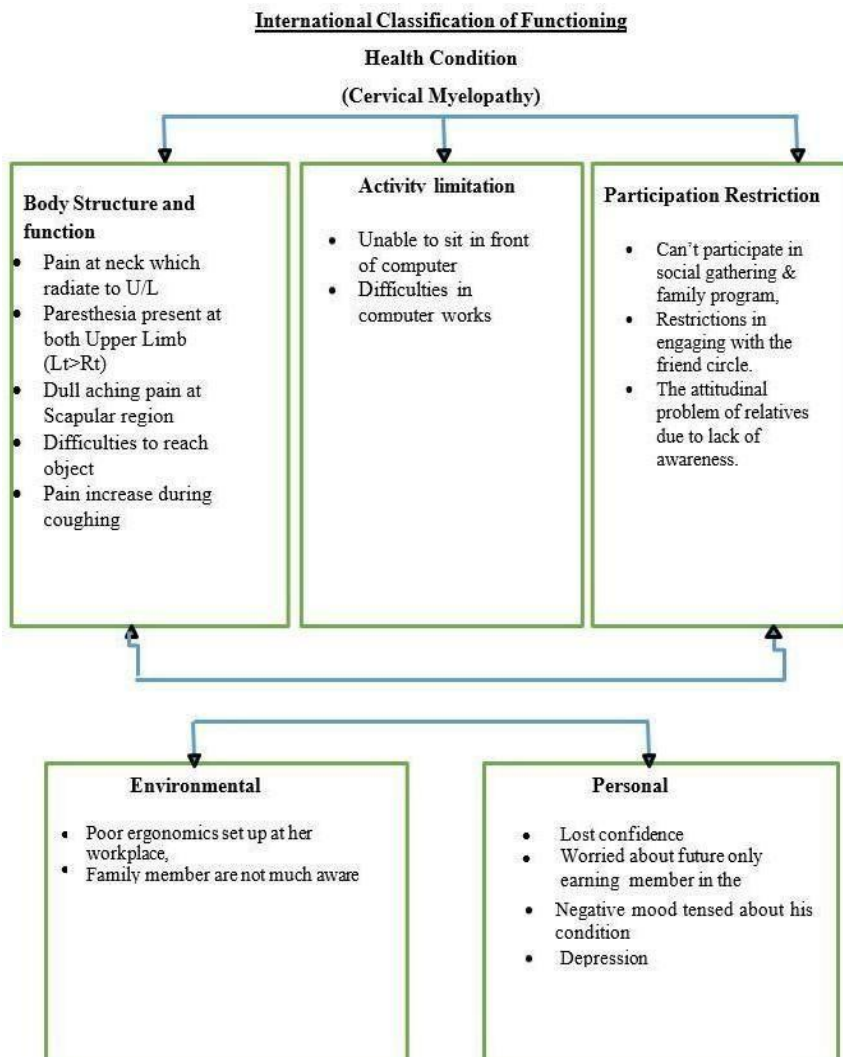


Table 1*Initial Assessment*

Variable	Initial Session
Resting pain (VAS)	7/10
Pain during activity	8/10
Cervical flexion	20 degrees
Cervical Extension	10 degrees
Cervical right-side flexion	5 degrees
Cervical left-side flexion	10 degrees
Cervical right-side rotation	10degrees
Cervical left-side rotation	20degrees
Manual muscle testing (MMT) in the upper limb and lower limb	For upper limb: 3/5 For lower limb: 4/5
Neck disability index out of 50	40
Participation in professional practice	Severe pain during activity

3. Data Analysis and Results**3.1 Therapeutic Intervention**

Initial Treatment: McKenzie method of treatment was initiated based on the patient's diagnosis of cervical myelopathy. Special attention was given to correcting her poor sitting posture, and treatment included:

- Soft Tissue Mobilization
- Extension Mobilization of Cervical and Thoracic Spine
- Manual Traction Therapy

Studies such as Browder et al. (2004) showed the effectiveness of cervical intermittent traction and thoracic manipulation in reducing pain and disability. The patient's pain improved from 7/10 to 3/10 on the NPRS after 27th sessions.

3.2 Strengthening Exercises

Strengthening exercises for the neck and upper and lower limbs were introduced after the initial improvement. This phase was aimed at improving the patient's health-related quality of life, as supported by Salo et al.'s randomized controlled trial, which showed significant improvements in patients with chronic neck pain.

Visual Analog Scale (VAS) has assessed the case with McKenzie assessment generated

by the McKenzie Institute International and Neck Disability Index (NDI) scale for disability level and pain. McKenzie assessment is a valid and reliable tool for musculoskeletal assessment with pain behavior and pain response with repeated movement (Kilby et al., 1990). The Neck Disability Index (NDI) is one of the most commonly used outcome measures for individuals with neck pain (Macdermid, 2009).

Table 2

FITT Analysis for Cervical Myelopathy Treatment

The given FITT (Frequency, Intensity, Time, Type) analysis represents the phases of treatment and the set of exercises for the patient diagnosed with cervical myelopathy, which aim to reduce his pain, correct his deformity, and improve his quality of life.

Treatment Phase	Frequency	Intensity	Time	Type
Initial Treatment	2-3 sessions per week	Moderate	30-45 minutes per session	McKenzie Method, Soft Tissue Mobilization, Cervical and Thoracic Spine Extension, Manual Traction
Soft Tissue Mobilization	Performed each session	Gentle to moderate, targeting sore areas	5-10 minutes	Hands-on mobilization focusing on soft tissue release
Extension Mobilization	Performed each session	Moderate intensity, adjusted per tolerance	10-15 minutes	Mobilization of cervical and thoracic spine to correct posture and reduce nerve compression
Manual Traction Therapy	2-3 sessions per week	Light to moderate, based on patient's comfort	10-15 minutes	Cervical intermittent traction to alleviate compression and enhance cervical stability
Strengthening Exercises	3-4 sessions per week	Low to moderate, based on patient progress	30-45 minutes per session	Neck, upper, and lower limb exercises to enhance stability and mobility
Neck Strengthening	Each strengthening session	Low initially, progressing to moderate	10-15 minutes	Focus on isometric and resistance-based neck exercises
Upper & Lower Limb Exercises	Each strengthening session	Low initially, progressing to moderate	15-20 minutes	Combination of weight bearing and resistance exercises, targeting upper and lower limbs

3.3 Reasoning and Decision-Making

The clinician was able to apply a range of clinical reasoning methods to the complex nature of the patient's situation.

3.4 Pattern Recognition

- Initially used to identify the diagnosis of cervical myelopathy based on clinical signs, symptoms, MRI findings, and prior neurosurgeon referral.
- Helped the clinician quickly form a clinical hypothesis regarding spinal cord compression.

3.5 Three-Track Reasoning

- **Procedural Reasoning:** The physiotherapist focuses on recognizing the patient's medical issue (cervical myelopathy) and determining the best physiotherapy technique for it.
- **Interactive Reasoning:** The physiotherapist engages in a conversation with the patient and her family about the treatment options while considering the patient's expectations of returning to work.
- **Conditional Reasoning:** The physiotherapist thinks through the possible outcomes of the patient's condition, taking into account her profession as a software engineer and the resulting lifestyle.

3.6 Narrative Reasoning

- The physiotherapist uses narrative reasoning to understand the patient's concerns about the procedure's implications for her career and to reassure the patient and her husband that the physiotherapy course will be more effective than surgery in restoring her functionality.
- The physiotherapist shares stories of other patients who have successfully undergone physiotherapy to demonstrate its efficacy.

Collectively, pattern recognition of the patient's neurological presentation allows the physiotherapist to priorities neurological screening and safety considerations before initiating functional rehabilitation, while interactive and conditional reasoning guided the selection and progression of interventions according to the patient's work-related goals and response to treatment.

Table 3*Final Result and Follow-up*

Variable	20 Sessions	27 Sessions
Resting pain (VAS)	4/10	2/10
Pain during activity	5/10	3/10
Cervical flexion	30 degrees	40 degrees
Cervical Extension	25 degrees	30 degrees
Cervical right-side flexion	20 degrees	30 degrees
Cervical left side flexion	30 degrees	45 degrees
Cervical right-side rotation	40 degrees	60 degrees
Cervical left side rotation	50degrees	70degrees
Manual muscle testing (MMT) in the upper limb and lower limb	For upper limb: 4/5 For lower limb: 5/5	For upper limb: 5/5 For lower limb: 5/5
Neck disability index out of 50	30	25
Participation in professional practice	Moderate pain during activity	Mild pain during prolonged activity

3.7 Key Findings

With 27 sessions of dedicated work, the patient started moving better, feeling stronger, and getting back to daily activities with more confidence. Her pain reduced to 3/10, and her cervical range of motion improved. Strengthening exercises continued, and her psychological status improved due to the collaborative approach between the clinician and her family.

4. Discussion

Clinical reasoning is the ability of a clinician to interpret the different clinical findings. It is difficult for every clinician to interpret the clinical findings by using only one clinical reasoning process. In this case study, after analyzing the decision-making process, it was very difficult to be strict with only a single clinical reasoning process. The clinician went through pattern recognition initially because the client was previously diagnosed by a neurosurgeon. The neurosurgeon advised her to undergo surgery. But the client did not do that. She came to CRP for physiotherapy. Clinicians also contrasted this case study

with three-track reasoning and the narrative reasoning process. However, in the earliest moment, the clinician went through pattern recognition after observing clinical signs & symptoms, investigation, and referral diagnosis. The client was female, and her future was bright, so the clinician used three-track reasoning and involved the client and her family in treatment planning. The clinician imagined her future job situation. The client's husband was depressed about her condition. So, the clinician used the narrative reasoning process because the narrative reasoning process makes a relationship between motive, action, and consequence of activity. Reassessed and adjusted the treatment plan as needed.

The clinical hypothesis of cervical myelopathy was supported by positive dural signs, reflex abnormalities, and MRI findings. Evidence-based studies such as Browder et al. (2004) and Salo et al. (2010) supported the treatment approach by emphasizing the role of manual therapy and strengthening exercises in managing cervical myelopathy and improving patient outcomes.

The treatment plan began with McKenzie diagnosis and treatment of the cervical spine. This included cervical spine retraction in lying position (10 repetitions every 2 hours), soft tissue mobilization and stretching of the muscles in an unloading position, and segmental extension mobilization of the central and transverse processes of the cervical spine. This protocol was followed for around 12 sessions. Then intermittent traction and thoracic manipulation were added to the previous protocol for around 20 sessions. Once the pain subsided, strengthening exercises of the neck muscle, upper limb and lower limb were initiated. Following that the clinician began the gait re-education, which continued for 27 sessions. The clinician utilized multiple forms of clinical reasoning: procedural, interactive, conditional, and narrative in diagnostic and treatment process. The use of procedural reasoning enabled the clinician to identify cervical myelopathy based on a positive Hoffman's sign, exaggerated reflexes, clonus and the Spurling test. These signs when coupled with MRI findings of spinal cord compression at C3-4, C4-5, and C5-6 confirmed the diagnosis. These systematic procedures highlight the importance of using both propositional and non-propositional knowledge to enhance the diagnostic accuracy as emphasized by Kuiper and Pesut (2003).

Moreover, the involvement of the multidisciplinary team and collaboration with the neurosurgeon further strengthened the clinical judgment. The use of MRI not only supported the clinical hypothesis but also reinforced the need to take a non-surgical approach as recommended by the neurosurgeon.

The therapeutic intervention was grounded in evidence-based practice. The evidence-based studies such as Browder et al. (2004) and Salo et al. (2010) supported the use of cervical traction, thoracic manipulation and strengthening exercises to reduce pain and improve functional outcome of the patients with cervical myelopathy and chronic neck pain. After nine sessions, the patient reported a significant reduction in pain from 7/10 to 3/10 on the Numeric Pain Rating Scale (NPRS), improved cervical range of motion and improved overall functional performance. This is a reflection of the effectiveness of combining manual therapy techniques and patient specific exercise protocols. The

McKenzie treatment method that focused on centralizing pain and improving posture proved to be effective for this patient. The approach helped to address the root causes of the patient's symptoms- the poor sitting posture that was associated with her job. By targeting the biomechanical aspects of her condition, the treatment reduced the symptoms during prolonged sitting and desk work. Long term management of cervical myelopathy often requires combination of continued physiotherapy, ergonomic modifications and self-management strategies. The use of narrative reasoning approach helped the patient to envision a future where her symptoms can be controlled and her functional status maintained. The clinician emphasized the importance of following the home advice such as use of cervical collar during commuting and maintaining the proper posture during desk work to prevent recurrence of the symptoms. This is in line with the findings of Mattingly (1991) who emphasized the importance of the narrative reasoning approach in helping the patient to visualize her recovery process and engage more actively in her treatment plans.

The outcome of this case suggests that even in the presence of significant spinal cord compression, non-surgical interventions can result in significant improvements in symptoms and functional outcome if the patient is compliant with treatment and self-management strategies. The use of strengthening exercises of the neck and upper limb as recommended by Salo et al. (2010) was instrumental in improving the patient's quality of life and preventing the relapse of the symptoms.

This case highlights the importance of an individualized, evidence-based approach to management of cervical myelopathy. The integration of clinical reasoning frameworks and an in-depth understanding of the patient's physical and psychological needs enabled the clinician to make the most appropriate treatment interventions. The positive outcome of the case further emphasizes the need for the clinicians to keep abreast of the current evidence to make informed decisions that align with the patient's unique context.

Furthermore, the success of this case also highlights the need for interdisciplinary collaboration in management of complex neurological conditions such as cervical myelopathy. The role of the neurosurgeon in confirming the diagnosis and the physiotherapist in implementing a conservative management plan demonstrate how multidisciplinary care can optimize patient outcomes.

5. Recommendation

This case was cervical myelopathy. Most of the patients with cervical myelopathy receive physiotherapy treatment after surgery procedure. Although the surgery is dependent on the amount of disc compression, the clinician believed that the client's prognosis would be better if the client received physiotherapy after the surgery. Considering the client's better prognosis, future studies could evaluate the outcomes of physiotherapy after surgery using a large sample.

This case highlights the importance of a comprehensive, multi-disciplinary approach to diagnosing and managing cervical myelopathy. The use of clinical reasoning, evidence-based practices, and patient-centered care was critical to the positive outcome of the

patient. The patient's condition significantly improved with non-surgical interventions, allowing her to manage the symptoms and continue her professional life.

6. Conclusion

Clinical reasoning is a thinking process by which clinicians can interpret the different clinical findings. An expert clinician must have critical thinking about any condition rather than ignoring any symptom or overemphasizing any symptom. Patient's knowledge, beliefs, and reasoning are also important parts of clinical reasoning. That's why clinicians need to give a proper explanation about the disease condition, prognosis, and intervention to the patient. If the clinician did not follow the clinical reasoning process for this case during diagnosis and treatment protocol, then it would be life-threatening and might result in some disability.

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