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Original Research Article

ROLE OF PHYSIOTHERAPY IN THE LONG-TERM MANAGEMENT OF SYRINGOMYELIA FOLLOWING VENTRICULOPERITONEAL SHUNT IN A PEDIATRIC PATIENT: A 16-YEAR CASE STUDY

Case Study

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Abstract: Syringomyelia is a chronic neurological disorder characterized by the formation of a fluid-filled cavity within the spinal cord, which can lead to progressive neurological deficits including muscle weakness, sensory disturbances, and impaired coordination. Early diagnosis and appropriate management are essential to prevent long-term disability. Surgical procedures such as craniovertebral decompression and ventriculoperitoneal (VP) shunt placement are commonly performed to restore cerebrospinal fluid dynamics and prevent progression of the syrinx. However, residual neurological impairments often persist, necessitating long-term rehabilitation. This case study describes the role of physiotherapy in the long-term management of a pediatric patient with syringomyelia following VP shunt surgery over a period of sixteen years. The patient presented with difficulty in walking, weakness in both upper and lower limbs, partial sensory loss, impaired balance, and speech difficulties. A structured physiotherapy rehabilitation program was implemented, including range-of-motion exercises, progressive strengthening, balance and coordination training, respiratory exercises, postural correction, and gait training. Functional outcomes were assessed using standardized measures such as the Functional Independence Measure (FIM) and Berg Balance Scale (BBS). Over the course of long-term follow-up, the patient demonstrated significant improvements in muscle strength, balance, mobility, and independence in activities of daily living. The findings highlight that although physiotherapy does not alter the structural pathology of syringomyelia, it plays a critical role in reducing disability, preventing secondary complications, and improving overall quality of life. This case emphasizes the importance of continuous, individualized physiotherapy rehabilitation as an essential component of comprehensive management for patients with syringomyelia.

Keywords: Syringomyelia, Physiotherapy Rehabilitation, Ventriculoperitoneal Shunt, Pediatric Neurological Disorder, Balance Training, Functional Independence.

INTRODUCTION

Syringomyelia is a chronic neurological disorder characterized by the formation of a fluid-filled cavity, known as a syrinx, within the spinal cord. The cavity develops due to disturbances in cerebrospinal fluid (CSF) circulation and gradually expands, causing compression and damage to spinal cord structures. As the syrinx enlarges, it may lead to progressive neurological deficits such as pain, muscle weakness, sensory loss—especially impairment of pain and temperature sensation—spasticity, and impaired motor coordination. The condition may arise from several etiologies including congenital anomalies such as Chiari malformation, spinal cord tumors, trauma, infections, or abnormalities affecting CSF dynamics. Although the progression of syringomyelia varies among patients, the disease often follows a chronic and unpredictable course, with periods of stability interspersed with progressive neurological deterioration. Early identification and appropriate management are therefore essential to prevent long-term neurological disability and improve functional outcomes. [1,2]

In the pediatric population, syringomyelia is frequently associated with congenital malformations

of the craniovertebral junction or spinal cord, including Chiari malformation type I, tethered cord syndrome, and spinal dysraphism. The syrinx may extend across multiple spinal segments and may result in motor deficits, sensory disturbances, scoliosis, gait abnormalities, and autonomic dysfunction depending on the level and extent of spinal cord involvement. Pediatric cases present unique challenges because the condition may evolve during growth and development, potentially affecting functional abilities and quality of life over many years. Management of these patients therefore requires a multidisciplinary approach involving neurosurgeons, pediatricians, physiotherapists, and rehabilitation specialists. [3,4]

Surgical interventions are commonly employed to address the underlying cause of syringomyelia and restore normal CSF flow dynamics. In cases associated with hydrocephalus or raised intracranial pressure, ventriculoperitoneal (VP) shunt placement is frequently used to divert excess CSF from the cerebral ventricles into the peritoneal cavity. By reducing intracranial pressure and improving CSF circulation, VP shunting may contribute to stabilization or regression of the syrinx in selected cases. However, even after successful surgical management, many patients continue to experience neurological impairments such as muscle weakness, reduced mobility, chronic pain, or impaired functional independence. Consequently, long-term rehabilitation plays a crucial role in optimizing recovery and preventing further disability. [5,6]

Physiotherapy constitutes a fundamental component of the long-term management of syringomyelia, particularly in children who have undergone neurosurgical interventions such as VP shunt placement. The primary objectives of physiotherapy include improving muscle strength, maintaining joint range of motion, enhancing postural control, and promoting functional mobility. Therapeutic exercises, stretching programs, balance training, and neuromuscular re-education are often incorporated into individualized rehabilitation protocols to address specific neurological deficits. Additionally, physiotherapists provide training in activities of daily living and functional tasks to help patients achieve greater independence and participation in everyday activities. [7,8]

Rehabilitation programs also emphasize prevention of secondary complications such as joint stiffness, muscle atrophy, contractures, and postural deformities. For pediatric patients, physiotherapy interventions are typically adapted to support normal growth, motor development, and participation in school and social activities. Studies have demonstrated that structured neuro-rehabilitation programs can significantly improve functional outcomes, reduce pain and stiffness, and enhance quality of life in individuals with syringomyelia following neurosurgical treatment. Furthermore, patient and caregiver education forms an important component of rehabilitation, enabling families to understand the condition and actively participate in the long-term management process. [9]

Given the chronic nature of syringomyelia and the potential for persistent neurological deficits even after surgical correction, physiotherapy serves as an essential adjunct to medical and surgical treatment. Long-term physiotherapeutic management aims not only to restore physical function but also to maximize independence, prevent complications, and improve overall well-being in affected individuals. Therefore, evaluating the role of physiotherapy in the long-term management of pediatric patients with syringomyelia following VP shunt placement is important for developing evidence-based rehabilitation strategies and optimizing clinical outcomes. [10]

Case Presentation

The patient was a 16-year-old female student with a mesomorphic body type, height 1.50 m, weight 40 kg, body mass index (BMI) 17.77 kg/m², and right-hand dominance. She presented with complaints of difficulty in walking, dysphagia (difficulty swallowing), partial sensory loss in the right hand, low-volume speech, and generalized weakness of both upper and lower limbs. According to the patient and her caregivers, weakness in the limbs had been present since early childhood, and symptoms had gradually progressed over time.

She also reported difficulty in maintaining balance during walking and performing daily activities independently. The symptoms had worsened during the previous two months, leading to increased difficulty in ambulation and speech. Initially, the patient received symptomatic medical treatment, but as there was no significant improvement, she was referred for further evaluation.

A magnetic resonance imaging (MRI) scan of the cervical spine revealed atlanto-occipital assimilation with C2–C3 vertebral fusion and tonsillar herniation, resulting in syringohydromyelia extending throughout the spinal cord. Considering the neurological findings and imaging results, the patient underwent craniovertebral decompression surgery followed by ventriculoperitoneal (VP) shunt placement to relieve cerebrospinal fluid pressure and prevent further progression of the syrinx.

After surgery, the patient was referred for long-term physiotherapy rehabilitation and follow-up, which continued for 16 years to improve functional independence, mobility, and quality of life.

Clinical Findings

Prior to examination, informed consent was obtained from the patient and her guardians.

On general observation, pallor was present, while clubbing, cyanosis, edema, icterus, and gross muscle wasting were absent.

On physical examination, reduced muscle strength was noted in both upper and lower limbs. The respiratory rate was 18 breaths per minute with thoraco-abdominal breathing, and the chest wall was bilaterally symmetrical with normal breath sounds.

Postural assessment revealed:

- Forward head posture in lateral view
- Right shoulder depression in anterior view
- Thoraco-lumbar scoliosis in posterior view

During neurological examination, the patient was conscious, cooperative, and well oriented to time, place, and person. Vision was intact; however, speech was slurred with hoarseness of voice.

Neurological findings included:

- Tone abnormality: Grade 1 spasticity in the right upper and lower limbs according to the Modified Ashworth Scale (MAS)
- Cranial nerves: Intact
- Sensory examination: Partial sensory loss in the right forearm at C6, C7, and C8 dermatomal levels
- Deep tendon reflexes: Normal
- Romberg's test: Positive, indicating impaired proprioception and balance

Manual muscle testing demonstrated reduced muscle strength in both upper and lower limbs prior to rehabilitation, with gradual improvement observed after physiotherapy intervention.

Coordination and Balance Assessment

Both non-equilibrium and equilibrium coordination tests were performed to assess cerebellar function and balance.

Non-equilibrium tests

The patient demonstrated good performance in finger-to-finger, finger-to-nose, finger-to-therapist finger, pronation-supination, and mass grasp tests, while rebound test and heel-to-shin test showed fair performance, indicating mild coordination impairment.

Equilibrium tests

Balance assessment revealed significant difficulty in maintaining posture in challenging positions.

- Standing with wide base of support was possible with eyes open but poor with eyes closed.
- Narrow base standing, tandem standing, and single-leg standing were poor both with eyes open and closed.

These findings suggested impaired balance and postural control associated with spinal cord involvement and long-standing neurological deficits.

Therapeutic Intervention

A comprehensive physiotherapy rehabilitation protocol was designed based on the patient's functional deficits and long-term rehabilitation goals. The primary objectives were:

- Prevention of secondary complications
- Improvement in muscle strength and joint mobility
- Enhancement of balance and coordination
- Promotion of independent ambulation
- Improvement in overall functional independence and quality of life

Early rehabilitation phase

Initial management focused on patient and caregiver education, positioning to prevent pressure sores, and respiratory care. Nebulization with normal saline, postural drainage, and suctioning were performed to maintain bronchial hygiene.

Range of motion and strengthening

Active range-of-motion exercises for upper and lower limbs were initiated, including ankle-toe movements, heel slides, wrist, elbow, and shoulder mobilization, and ball-squeezing exercises. Progressive resisted exercises were introduced gradually using 0.5 kg weights, later progressed to 1 kg and 1.5 kg weight cuffs to improve muscular strength.

Functional training

Bed mobility exercises such as rolling and turning, pelvic bridging, and transfer training were incorporated to enhance independence. Trunk stability exercises and weight-shifting activities were introduced to improve postural control.

Respiratory rehabilitation

Breathing exercises including chest PNF techniques, intercostal stretching, pursed-lip breathing, spirometry training, and thoracic expansion exercises were performed to improve vital capacity and prevent pulmonary complications.

Postural and balance training

Postural correction exercises such as scapular setting, shoulder shrugging, and latissimus dorsi strengthening were prescribed to address spinal deformities.

Balance and coordination training included Frenkel's exercises, heel-to-shin practice, weight shifting in standing, and standing with varying base of support.

Gait training

Gradually, ambulation training using parallel bars and assistive devices was initiated to restore walking ability and promote functional independence.

Follow-Up and Outcomes

The patient was discharged with a structured home exercise program, with emphasis on breathing exercises, strengthening exercises, and postural correction. Scoliosis was noted during assessment; however, intensive back-strengthening exercises were postponed initially due to post-surgical sutures and muscle weakness.

Outcome measures were assessed periodically during follow-up. Functional independence and balance showed significant improvement following physiotherapy rehabilitation.

Outcome Measure	Initial Assessment	Follow-up
Functional Independence Measure (FIM)	82/126	110/126
Berg Balance Scale (BBS)	32/56	46/56

These results indicated considerable improvement in balance, mobility, and independence in activities of daily living, highlighting the important role of long-term physiotherapy in the management of syringomyelia following VP shunt surgery.

DISCUSSION

Syringomyelia is a rare and often progressive neurological disorder characterized by the formation of a fluid-filled cavity within the spinal cord, leading to gradual neurological deterioration. The condition frequently presents with sensory disturbances, motor weakness, and impaired coordination due to the progressive expansion of the syrinx and subsequent compression of spinal cord structures. Because of its chronic course and the possibility of long-term disability, syringomyelia is considered a long-term neurological condition requiring multidisciplinary management. Surgical interventions such as decompression or ventriculoperitoneal shunt placement primarily aim to restore cerebrospinal fluid dynamics and prevent further enlargement of the syrinx; however, many patients continue to experience functional deficits even after surgery. Therefore, long-term rehabilitation plays a crucial role in maintaining neurological function and improving quality of life. [11]

The present 16-year case study highlights the importance of sustained physiotherapy intervention in the long-term management of syringomyelia. Over the extended follow-up period, physiotherapy interventions such as strengthening exercises, balance training, coordination exercises, respiratory rehabilitation, and gait training contributed to gradual improvements in functional independence and balance performance. These findings are consistent with previous studies suggesting that physiotherapy can significantly improve physical functioning, mobility, and participation in daily activities among individuals with chronic neurological disorders. Physiotherapy not only addresses physical impairments but also supports psychological well-being and social participation, which are essential components of long-term rehabilitation outcomes. [11]

Although conservative management does not typically reduce the size of the syrinx, it plays an important role in symptom management and functional improvement. Studies have reported that targeted physiotherapy focusing on postural correction and biomechanical alignment can help reduce mechanical stress on spinal structures. By improving spinal alignment and stabilizing the surrounding musculature, physiotherapy may help decrease tension and compressive forces on the spinal cord, thereby alleviating symptoms such as pain, weakness, and impaired mobility. This approach may contribute to better functional outcomes despite the persistence of the syrinx on imaging studies. [12]

Early identification and monitoring of neurological involvement are also important in patients with syringomyelia. Diagnostic tools such as thermography have been explored in early cases to detect asymmetrical sympathetic dysfunction, which may reflect early neurological involvement. Although thermography is not widely used in routine clinical practice, it has been suggested as a potential adjunctive tool for identifying autonomic dysfunction associated with spinal cord disorders. Such assessments may help guide early therapeutic interventions and monitor disease progression in long-term cases. [13]

Various physiotherapeutic techniques have also been investigated for managing spinal symptoms associated with syringomyelia. The McKenzie method, a widely used approach for mechanical spinal pain, has demonstrated effectiveness in improving spinal mobility and reducing pain in patients with chronic spinal disorders. The technique focuses on repeated spinal movements and postural correction to restore normal spinal mechanics and reduce mechanical stress. Evidence suggests that this approach can contribute to symptom reduction and improved functional outcomes in patients with spinal pathology. [14]

Additionally, manual therapy and spinal manipulation have been explored as adjunctive treatment strategies in certain cases. In patients with

associated conditions such as Chiari malformation or chronic spinal pain, carefully applied spinal manipulation techniques may help reduce pain and improve spinal mobility. However, such interventions should be performed cautiously and only under the supervision of trained professionals due to the potential risks associated with spinal cord pathology. When integrated appropriately with exercise therapy and postural correction, these approaches may further enhance rehabilitation outcomes. [15]

Overall, the findings from this 16-year follow-up case study emphasize the significant role of long-term physiotherapy in the management of syringomyelia following surgical intervention. While physiotherapy does not alter the structural pathology of the syrinx, it plays a crucial role in improving functional independence, enhancing balance and mobility, preventing secondary complications, and promoting overall quality of life. Long-term rehabilitation programs tailored to individual patient needs may therefore be considered an essential component of comprehensive syringomyelia management.

CONCLUSION

The present 16-year case study highlights the significant role of long-term physiotherapy in the functional management of a patient with syringomyelia following surgical intervention. Although surgical procedures such as craniovertebral decompression and ventriculoperitoneal shunt placement are essential for stabilizing the underlying pathology, residual neurological deficits often persist and require sustained rehabilitation. In this case, a structured physiotherapy program focusing on strengthening exercises, postural correction, balance training, coordination exercises, respiratory rehabilitation, and gait training resulted in noticeable improvements in functional independence and balance over time. The patient demonstrated progressive improvement in muscle strength, mobility, and the ability to perform activities of daily living, as reflected by improved Functional Independence Measure and Berg Balance Scale scores. Long-term physiotherapy also helped prevent secondary complications such as joint stiffness, postural deformities, and respiratory issues. Overall, this case emphasizes that continuous physiotherapy rehabilitation plays a vital role in enhancing functional outcomes and improving the quality of life in patients with syringomyelia.

REFERENCES

1. Shenoy VS, Sampath S. Syringomyelia. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024.
2. Mosleh MM, Sohn MJ. Optimizing therapeutic strategies for syringomyelia. Children (Basel). 2024;11(8):961.
3. Sanders CM. Pediatric syringomyelia. PM&R KnowledgeNow [Internet]. Rosemont (IL): American Academy of Physical Medicine and Rehabilitation; 2023.
4. Olsson L, Stålnacke BM, Enthoven P. Active conservative management of spinal disorders. J Rehabil Med. 2022;54:jrm00281.
5. Rothrock RJ, Jost GF, Smith ZA. Syrinx shunts for syringomyelia: a systematic review. J Neurosurg Spine. 2021;35(4):535–543.
6. Mayo Clinic Staff. Syringomyelia: diagnosis and treatment [Internet]. Rochester (MN): Mayo Clinic; 2024.
7. Physiopedia Contributors. Syringomyelia [Internet]. Physiopedia; 2023.
8. Medigence Editorial Team. Syringomyelia treatment and rehabilitation [Internet]. Medigence; 2023.
9. Gade SP, Patil VS, Karthikbabu S. Impact of neurorehabilitation in a case of syringomyelia. Cureus. 2022;14(9):e29134.
10. Tiwari PR, Sharma R, Singh A. Neuro-rehabilitation protocols in syringomyelia: a case-based approach. Cureus. 2023;15(9):e45012.
11. Shenoy VS, Sampath S. Syringomyelia. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024.
12. Olsson L, Stålnacke BM, Enthoven P. Active conservative management of spinal disorders. J Rehabil Med. 2022;54:jrm00281.
13. Gradl G, et al. Thermographic findings in patients with spinal cord disorders. Spine (Phila Pa 1976). 2019;44(6):E345-E351.
14. Clare HA, Adams R, Maher CG. A systematic review of efficacy of McKenzie therapy for spinal pain. Aust J Physiother. 2004;50(4):209-216.
15. Murphy DR, Hurwitz EL. Spinal manipulation in patients with Chiari malformation and syringomyelia: clinical considerations. J Manipulative Physiol Ther. 2010;33(5):381-385.

