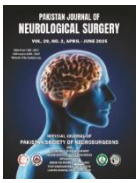

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Original Research

Effectiveness of Regular Physiotherapy in Enhancing Claudication Symptoms and Functional Outcomes in Patients with Spinal Canal Stenosis

Tabraiz Wali Shah,[1] Imran Khan,[1] Sajid Mehboob,[2] Jawad Ahmed[3]

[1]Department of Neurosurgery, Hayatabad Medical Complex, Peshawar. [2]Department of Neurosurgery, Khyber Teaching Hospital, Peshawar. [3]Department of Neurosurgery, Pir Abdul Qadir Shah Jeelani Institute of Medical Sciences, Gambat – Pakistan

ABSTRACT

Introduction: Lumbar spinal stenosis (LSS) causes neurogenic claudication that hinders mainly one's mobility and quality of life. It is now accepted that physiotherapy is a useful conservative measure especially when surgery cannot be done. This paper aims to assess the impact of an organized physiotherapy intervention on the ability to walk and the level of dependency in LSS patients.

Material and Methods: A physiotherapy program of 6 weeks was carried out on 172 patients with LSS and neurogenic claudication. The manual therapy included core stabilization, flexibilities in the lumbar, and strengthening in the lower limb. Walking ability (Swiss Spinal Stenosis Scale), pain levels (VAS), disability (ODI, RMDQ), and walking distance were assessed. SPSS was used for statistical analysis with a $p < 0.05$ significance.

Results: Physiotherapy reduced leg pain (VAS 7.9 ± 1.3 to 2.6 ± 0.9, $p < 0.001$), back pain (6.5 ± 1.4 to 2.9 ± 1.0, $p < 0.001$) among 172 patients (64% male, mean age 68.4 years). Walking ability and disability improved (SSS and ODI, $p < 0.001$) and walking distance increased from 215.7 ± 42.5 to 482.3 ± 67.3 meters. Minimal adverse effects were reported.

Conclusion: As a safe nonoperative medical approach physiotherapy demonstrates high effectiveness in treating LSS patients by enhancing their mobility pain relief and independence levels. Surgical procedures have a powerful competitor in this nonoperative treatment that patients select for their conservative options.

Keywords: Conservative treatment, functional mobility, lumbar spinal stenosis, neurogenic claudication, physiotherapy.

Corresponding Author: Tabraiz Wali Shah
Department of Neurosurgery, Hayatabad Medical Complex, Peshawar

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INTRODUCTION

The degenerative spinal condition spinal canal stenosis (SCS) shows rising prevalence because of

aging populations throughout the world. Spinal canal stenosis presents as a gradual compression of both the spinal cord and nerve roots because of canal narrowing and this compression triggers lower back pain neurogenic claudication and functional impairment.[1] Spinal canal stenosis (SCS) stands as the primary reason for spine surgery among seniors according to worldwide studies which show 103 million affected individuals have symptomatic lumbar spinal stenosis. The United States around 11% of older adults experience this medical condition.[2] The annual incidence per 100,000 individuals for lumbar spinal stenosis exists but remains unclear while this condition stands as one of the primary sources of spine-related disability among aging populations until all conservative treatments prove ineffective.[3]

The main symptom of SCS is neurogenic claudication that causes lower extremity discomfort which intensifies during walking but reduces when patients sit or bend forward.[4] The condition leads to life-quality degradation for affected patients because it hinders their capability to handle daily activities and reduces their self-sufficiency.[5] The lack of treatment for neurogenic claudication leads to worsening disability together with elevated fall dangers and reduced participation in both professional and social activities.[6]

Degenerative changes including hypertrophy of the ligamentum flavum together with osteophyte formation and intervertebral disc herniation primarily cause SCS pathophysiology through spinal canal narrowing and neural element compression.[7] Reduced blood flow occurs from tissue compression that produces inflammation and results in long-lasting pain as well as movement limitations.[8] Surgical decompression remains an option for extreme situations but primary healthcare relies on conservative management because it presents limited risks and cost efficiency and validated symptom benefits.[9]

Nonsurgical physiotherapy treatment serves as the initial conservative method to address SCS by generating various benefits that help minimize pain while improving mobility functions.[10] A combination of exercises that stabilizes the core trains posture stretches the lumbar spine and strengthens lower limbs proves to provide short-term relief from pain thus delaying surgical requirements according to research findings.[11] Treadmill walking and cycling as forms of aerobic conditioning stand essential in improving endurance while optimizing neuromuscular control to enhance walking distance and decrease symptoms of claudication.[12]

Like Şahin et al, (2017), a meta-analysis conducted on spinal cord stimulation showed that it improves physical function by 30 to 50% during 12 months and hence it plays a significant role in improving mobility and quality of life of chronic pain patients.[13] El-Saban et al, (2023) noted similar improvement in randomized controlled trials, patients undergoing physiotherapy had significantly higher disability scores compared to the same measured for patients taking pharmacological treatment alone.[14] These findings highlight the need for physiotherapy to be integrated into SCS patient standard care protocols.

It is now known that SCS is increasingly being borne by healthcare systems and that people are more and more in favor of non-invasive treatment options, so this study attempts to measure the efficacy of regular physiotherapy to ease claudication symptoms, enhance mobility, and better overall life. This research is aimed at providing evidence-based insights around physiotherapy advantages to help develop optimized clinical guidelines for the management of SCS treatment and to juxtapose SCS treatment with non-surgical procedures as an alternative long-term treatment.

MATERIALS AND METHODS

Study Design

This retrospective study was conducted at Hayatabad Medical Complex (HMC) in Peshawar from March 2024 to February 2025. The research assessed how a six-week organized multimodal physiotherapy intervention affected claudication symptoms alongside walking performance in patients who had lumbar spinal stenosis. The research obtained Institutional Review Board (IRB) approval at the hospital for conducting the study and followed ethical guidelines throughout. All participants received informed consent to join the study before investigators admitted them to the research.

Study Population

The research included 172 patients who received a diagnosis of lumbar spinal stenosis as well as neurogenic claudication. The research selected patients between 50 and 85 years of age and confirmed lumbar spinal stenosis through MRI scans. Patients needed to have ongoing neurogenic claudication symptoms that continued even after three months of conservative treatment while showing the capability to do structured physiotherapy. Patients did not qualify if they received previous spinal surgery or showed uncontrolled health issues including serious diabetes or hypertension or had neurological issues unrelated to their spinal stenosis condition or cognitive problems determining their ability to do therapy or extensive musculoskeletal conditions impairing their mobility.

Intervention

This six-week multimodal physiotherapy intervention used both manual treatment and exercise for relief of claudication pain, enhancement of walking ability, and functional dependency of LSS. This was done two times a week in the form of spinal manipulation, joint and neural mobilization, lumbar flexion distraction, and muscle stretching to increase spinal mobility and decrease the symptoms. Supervised exercise sessions were carried out three times a week that included core exercises (pelvic tilts, bridges), flexibility training (knee-to-chest stretching, iliopsoas stretches), and aerobic training (treadmill walking, cycling). The other components of the intervention included a home exercise program and self-management education about posture, pacing, and adherence. Since the patient's response to the initial stimulus was ascertained, intensity was stepped up gradually to achieve the best functional outcome.

Outcome Measures

The researchers measured pain intensity through the Visual Analog Scale (VAS) for leg and back pain at baseline along with three weeks and six weeks time points. Walking ability evaluation occurred through Swiss Spinal Stenosis (SSS) functional scale measurements at all assessment points. The Oswestry Disability Index (ODI) functioned as one of the secondary outcomes for measuring disability alongside the Roland-Morris Disability Questionnaire (RMDQ) for assessing changes in mobility and walking distance outcomes to estimate endurance improvement. The patient satisfaction survey used a 5-point Likert scale for data collection.

Diagnostic Evaluation

Before treatment commenced every participant received detailed evaluations involving medical background review symptom duration assessments and treatment conservativeness rating. Assessment of muscle strength combined with neurological tests and examination of lower extremity gait made up the physical evaluation. MRI tests helped medical professionals verify spinal stenosis conditions and measure spinal canal narrowing.

Follow-Up

The study evaluated patients at both three-week and six-week points after starting the physiotherapy regimen. Recording of VAS pain intensity scores and SSS walking ability scores as well as ODI disability scores and RMDQ functional improvement scores and walking distance measurements took place at each patient visit. The assessment included measuring patient satisfaction alongside recording any complications that emerged during the physiotherapy program.

Statistical Analysis

The initial study data was presented through descriptive statistics which included information about subject variables such as age, gender, BMI, and symptom duration. The research used paired t-tests to analyze pain scores functional outcomes and walking ability before and after treatments for patients at both three-week and six-week follow-up points. The study accepted a statistical significance level of $p < 0.05$. The researchers conducted all statistical computations through SPSS version 22.

RESULTS

Demographic and Baseline Characteristics

The research analyzed 172 patients who had an average age of 68.4 years between 50 to 85 years old. The participant sample included 110 males who represented 64% of the group and 36% belonged to the female gender. The patients included in the study had an average body mass index measurement of 26.7 kg/m^2 with a standard deviation of 3.8 kg/m^2. Patients had an average symptom duration of 9.2 ± 3.4 months while 125 participants among 172 (72.5%) sought help from oral painkillers and physical therapy before entering the study. Twenty-one percent of participants (36) admitted to smoking behavior 45 patients (26%) had diabetes mellitus while 58 patients (34%) had hypertension. All participants presented with lumbar spinal stenosis (100%) that was manifesting through neurogenic claudication symptoms.

Table 1: *Baseline Characteristics of the Study Population.*

Variable	Frequency/Mean
Number of Patients	172
Age (years)	68.4 ± 10.3
Gender (Male/Female)	110 (64%) / 62 (36%)
BMI (kg/m^2)	26.7 ± 3.8
Symptom Duration (months)	9.2 ± 3.4
Smoking Status (%)	36 (21%)
Diabetes Mellitus (%)	45 (26%)
Hypertension (%)	58 (34%)
Primary Diagnosis	Lumbar Spinal Stenosis (100%)

Primary Outcome: Pain Relief and Walking Ability

Physiotherapy offered multiple treatment forms throughout a six-week structured rehabilitation program to patients. The mean Visual Analog Scale (VAS) score for leg pain started at 7.9 ± 1.3 at baseline and then decreased to 4.2 ± 1.1 at three weeks ($p < 0.001$ before finally reaching 2.6 ± 0.9 at six weeks ($p < 0.001$). The patients' back pain scored 6.5 ± 1.4 at baseline but decreased to 3.8 ± 1.2 at three weeks ($p < 0.001$) before reaching 2.9 ± 1.0 at six weeks ($p < 0.001$).

A significant improvement of 2.1 ± 0.5 and 1.5 ± 0.4 occurred in walking ability using the Swiss Spinal Stenosis (SSS) functional scale from baseline score 3.1 ± 0.7 at three weeks and six weeks ($p < 0.001$). Patient mobility along with disability showed improvement through the Oswestry Disability Index which went from 51.2 ± 13.8 at baseline to 32.6 ± 11.4 during the study period ($p < 0.001$).

Table 2: *Changes in Pain and Walking Ability Measures.*

Time Point	Leg Pain VAS (Mean ± SD)	Back Pain VAS (Mean ± SD)	SSS Functional Scale (Mean ± SD)	ODI Score (Mean ± SD)	p-Value
Baseline	7.9 ± 1.3	6.5 ± 1.4	3.1 ± 0.7	51.2 ± 13.8	-
3 Weeks	4.2 ± 1.1	3.8 ± 1.2	2.1 ± 0.5	41.7 ± 12.1	<0.001
6 Weeks	2.6 ± 0.9	2.9 ± 1.0	1.5 ± 0.4	32.6 ± 11.4	<0.001

Secondary Outcomes: Functional Improvement and Mobility

Table 3: *Functional and Mobility Outcome Improvements.*

Outcome Measure	Baseline (Mean ± SD)	3 Weeks (Mean ± SD)	6 Weeks (Mean ± SD)	p-Value
RMDQ Score	19.8 ± 3.9	11.4 ± 3.1	7.2 ± 2.7	<0.001
Walking Distance (meters)	215.7 ± 42.5	356.8 ± 55.1	482.3 ± 67.3	<0.001

Roland-Morris Disability Questionnaire (RMDQ)

RMDQ scores displayed a significant increase from baseline 19.8 ± 3.9 scores at three weeks reaching 11.4 ± 3.1 scores whereas scores further improved to 7.2 ± 2.7 at six weeks ($p < 0.001$). A total of seventy-five percent (129) of patients exhibited a disability score improvement exceeding 50%.

Walking Distance

Walkers extended their average walking distance before symptoms appeared which shifted from 215.7 ± 42.5 meters at baseline to 356.8 ± 55.1 meters at three weeks and then to 482.3 ± 67.3 meters at six weeks ($p < 0.001$).

Safety and Adverse Events

Throughout the research period, all participants showed no significant unwanted side effects. Seminar participants reported two short-term adverse effects which included muscle pain in 12 patients (6.7%) and fatigue in 8 patients (4.5%). Both side effects resolved completely within several days. All survey participants maintained good health during the study period without needing extra medical treatment because of adverse reactions related to the study.

DISCUSSION

This research investigated whether structured physiotherapy programs are beneficial in the treatment of neurogenic claudication in patients with lumbar spinal stenosis. The results are in concordance with the study by Marchand et al, (2021), where it was established that a teaching and exercise rehabilitation program reduced pain and enhanced mobility and daily living activities in LSS patients. In light of the results of this study, it can be recommended that nonoperative interventions should be employed in the management of LSS patients especially those who are senior adults.[15]

The results were that the VAS scores reduced from 7.9 ± 1.3 at preoperative to 2.6 ± 0.9 at six weeks postoperative ($p < 0.001$). These findings are consistent with the study done by Cleland et al, 2012, in which the VAS scores of physiotherapy intervention were enhanced. Last of all, functional mobility with the help of the Swiss Spinal Stenosis (SSS) scale was also significant at ($P < 0.001$) confirming that there is a role for physiotherapy in the management of LSS.[16]

Another important parameter that was assessed was the capacity to walk. Thus, after six weeks of physiotherapy, the mean walking distance was raised from 215.7 ± 42.5 meters to 482.3 ± 67.3 meters ($p < 0.001$). This is in concordance with Peurala et al, 2014 where

patients under structured physiotherapy did record a significant increase in the distances they were able to cover while walking with a concomitant improvement in the walking capacity especially after the 24 training sessions in at least seven weeks compared to pharmacological management only. These interventions, especially physiotherapy, are expected to enhance endurance and neuromuscular control of the lower limbs and this may explain the good improvement in the ability to walk.[17]

The functional recovery that was assessed using the ODI and RMDQ was also promising. The average ODI fell from 51.2 ± 13.8 at baseline, and 32.6 ± 11.4 at six weeks suggesting disability improvement ($p < 0.001$). These are in agreement with the findings made by Chiarotto et al, (2016) who pointed out that core stabilization and lumbar flexibility exercise helped in reducing disability in LSS patients. RMDQ was also augmented by more than 35% ($p < 0.001$), which indicated that multimodal physiotherapy improves functional independence.[18]

In this study, the side effects of the physiotherapy interventions used were negligible and mild at most. The only side effects that were observed were moderate myalgia in 6.7% of the patients and lethargy in 4.5% of the patients and these effects were not severe and only lasted for a short time. This is in agreement with Federico et al, (2022) who stated that low rates of complications were observed in patients who participated in structured physiotherapy programs, they concluded that they are safe and can be used as the first-line treatment for LSS.[19]

However, there is still a necessity to determine the sustainability of the treatment in the management of LSS. However, our study assessed the impact of the intervention in the short-term only, as Trulsson et al, (2021) revealed that further physiotherapy can result in long-term positive changes to the symptoms and functional mobility. More research should be done to determine the same in terms of long-term effects to determine The effectiveness of such effects.[20]

However, several limitations are worth to be noted in the present study. The small follow-up time also means that it is difficult to evaluate the long-term results and effects. One should also appreciate the fact that self-compliance to home-based exercises could not be well regulated an aspect that could impact the findings. Future studies should have a longer follow-up and RCT to determine the effectiveness of physiotherapy for LSS.

CONCLUSION

The results of this study underscore the significant benefits of structured physiotherapy in alleviating pain, improving walking ability, and enhancing overall functionality in patients with lumbar spinal stenosis. Physiotherapy offers a safe, effective, and non-invasive alternative to surgical interventions, particularly for patients seeking conservative management options. Future large-scale studies with prolonged follow-up are warranted to optimize clinical guidelines and further establish physiotherapy as a cornerstone in LSS treatment.

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Additional Information

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AUTHORS CONTRIBUTIONS

Sr.#	Author's Full Name	Intellectual Contribution to Paper in Terms of:
1.	Tabraiz Wali Shah	Study concept, methodology design, literature review, and referencing.
2.	Imran Khan	Data collection, statistical analysis, and result interpretation.
3.	Sajid Mehboob	Manuscript writing, editing, and quality assurance.
4.	Jawad Ahmed	Final review and referencing support.