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# Functional evaluation of lumbar spinal stenosis treated with conservative treatment retrospective study



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## ABSTRACT

**Background:** Approximately 75% men have low-back pain, and most of them come to get treated for acute low-back pain and cure without operation. Conservative treatment procedures, including surgery, have never been evaluated carefully.

**Objectives:** To assess the efficacy of conservative treatment in Lumbar Spinal Stenosis (LSS) and how to choose the patient for conservative treatment. **Material and Methods:** As many as 30 patients (9 men and 21 women) who were undergoing treatment between January and December 2014 in Orthopaedic and Traumatology Department, Faculty of Medicine, Airlangga University—dr. Soetomo General Hospital, Orthopaedic and Traumatology Hospital (RSOT) Surabaya were recruited for the study. The mean of age of the participants was 51.9 years

(diagnostic with plain radiography and MRI) without indicated operation and they were treated conservatively with TENS, WSD, and ultrasonography and NSAIDs for 6–12 weeks. We evaluate VAS and ODI and assigned scores to predict the efficacy of conservative treatment.

**Results:** VAS decreased significantly in patients with mild and moderate VAS prior to conservative treatment 68.1% ( $p < 0.001$ ). ODI improved significantly in a patient with a mild and moderate disability prior to conservative treatment 87.5% ( $p < 0.000$ ). On the basis of scores assigned to predict the efficacy of conservative treatment, we fixed sensitivity and specificity at cut point  $\leq 3.50$ .

**Conclusions:** Conservative treatment can be effective in some LSS patients if the indications are correctly presented.

**Keywords:** Lumbar Spinal Stenosis, Conservative treatment, TENS, ODI

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## INTRODUCTION

Approximately 75% men have low-back pain. Low-back pain is a major problem in the United States and most of the affected individual's affected report experiencing acute low-back pain and want recovery without operation. In low-back pain patients, about 2–3% have herniated disc, and 1–2% have nerve root compression. Older men come to clinic presenting chronic or recurrent degenerative spine,<sup>1</sup> which is usually seen in the 5th decade.

Degenerative disc, facet joint osteoarthritis, or osteophyte are often seen in men aged more than 64 years. Disc degeneration, facet joints osteoarthritis, or osteophytes were found in 90–100% of the subjects aged over 64 years.<sup>2–5</sup> Typically in those aged 65 years and above, myelography shows that 1.7–6% present with spinal stenosis of the lumbar.<sup>6</sup> It has been found that up to 80% of the subjects aged over 70 years have increased stenosis. However, there is little correlation between radiologically found stenosis and symptoms. Up to 21% of the subjects aged over 60 years had stenosis without any symptoms on the MRI. A study conducted in Sweden found that the annual incidence of stenosis of the lumbar is 5 per 100,000 persons. Another research found that in patients who came to the general practitioner or specialist doctor to get examined for

the back pain symptoms, about 3–14% presented with spinal stenosis. It was reported that annually 3–11.5 individuals per 100000 underwent spinal stenosis. With the increase in life expectancy and the specifically the percentage of individuals aged over 65 years (expected to be 20% in the year of 2026), there is a clear possibility that the incidence of spinal stenosis will be on a rise.<sup>2,3,7</sup>

The fundamental aim of treatment of spinal stenosis is to treat symptoms and prevent the neurological sequelae. Conservative approaches such as pharmacology therapy and physical therapy decrease the symptoms for only a limited time, but the conclusive solution or treatment option is decompression surgery only. The non-operative treatment aims at controlling the symptoms: analgesics and anti-inflammatory and anti-spasmodic drugs are used for treating the symptoms during the acute phase.<sup>1,4,8</sup> The algorithm is the generally accepted treatment for lumbar spinal stenosis; the treatment begins with anti-inflammatory steroids and narcotics, physical therapy, and pain management modalities such as epidural steroid injections. At the end of this phase of treatment, as much as 15% of patients experience improvement (i.e., with non-operative modalities), and about 70% continue

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**Table 1** Predictive scores

Category	Classification	Score
Sex	Male	0
	Female	1
Age	<45 years	0
	≥45 years	1
VAS	Mild pain (0–3)	0
	Moderate pain (4–6)	1
	Severe pain (7–10)	2
ODI	Minimal disability (0–20%)	0
	Moderate disability (21–40%)	1
	Severe disability (41–60%)	2
	Paralyzed (61–80%)	3
	Ambulatory (81–100%)	4
Minimal		0
Maximal		8

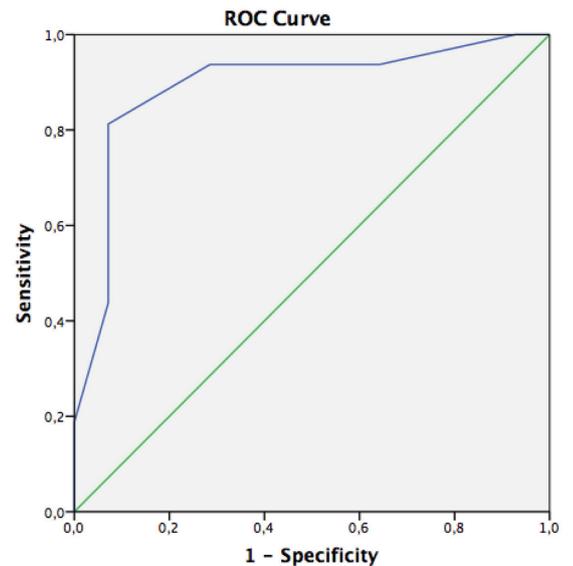
**Table 2** Coordinates of the curve

Test result variable(s): Total score		
Positive if less than or equal to <sup>a</sup>	Sensitivity	1 – Specificity
–1,00	0.000	0.000
0.50	0.063	0.000
1.50	0.188	0.000
2.50	0.438	0.071
3.50	0.813	0.071
4.50	0.938	0.286
5.50	0.938	0.643
6.50	1.000	0.929
8.00	1.000	1.000

**Table 3** Area under the ROC curve

Test result variable(s): Skor total				
Area	Standard Error <sup>a</sup>	Asymptotic Significance <sup>b</sup>	Asymptotic 95% confidence interval	
			Lower bound	Upper bound
0.893	0.066	0.000	0.764	1.000

to experience neurogenic claudication. Thus, over time, most patients with lumbar spinal stenosis continue to go through further surgery for definitive treatment.<sup>3</sup> There weren't enough studies on conservative treatment or surgical procedures.<sup>1</sup> All the research literature available in this area reports only about conservative treatment coupled with surgical procedures where required. In a study

**Figure 1** ROC curve based on ROC coordinate

conducted in Indonesia, it was found that among 98 patients with canal stenosis, 58 were women (59.2%) and 40 (40.8%) men. Most people in Indonesia do canal stenosis operative action use laminotomy or laminectomy.

## MATERIAL AND METHODS

During the period January–December 2014, 30 patients (9 men and 21 women) with a mean age of 51.9 years who suffered canal stenosis therapy were given non-operative physiotherapy and pharmacotherapy in the Orthopedics and Traumatology Hospital and the Hospital Dr. Soetomo; the inclusion criteria are subjects aged between 30 and 60 years with neurological claudication as diagnosed by MRI and subjects did not go through operative and non-operative therapy for at least 12 weeks prior to the study, and the exclusion criteria is progressive neurological deficit or equine cauda syndrome in subjects.

## Clinical Assessment

The clinical outcome scores were assessed using the Visual Analogue Scale (VAS) and Oswestry Questionnaire Disability Index (ODI).

## Statistical

Data were analyzed with SPSS 21. Independent test and paired samples *t*-test for parametric VAS and ODI were conducted. The correlation was investigated using regression analysis, where the significance was determined as  $p < 0.05$ . The predictive score was determined by using the test result variable and ROC.

## RESULT

No significant improvement in VAS and ODI scores was found in patients who experienced an improvement ( $p < 0.05$ ). The average VAS score after treatment had decreased by 0.94 before conservative measures were arrived at. ODI after conservative measures decreased by 3.47%.

### Predictive scores

Some risk factors are given scores to determine the predictive score, that is, gender, age, initial VAS and ODI and these are presented in Table 1.

Based on the scores obtained, coordinates' correspond curves are presented in Table 2. In Table 2, it was found that the cut points of sensitivity and specificity were highest in value  $\leq 3.50$ , which is demonstrated by the ROC curve on figure 1. The overall picture obtained ROC curve's area under the curve, which is shown in Table 3. According to Table 3, the size of the area under the ROC curve was 89.3%.

## DISCUSSION

The result showed 30 patients who had lumbar spinal stenosis between January and December 2014 at the Hospital of Orthopedics and Traumatology and at the Hospital Dr. Soetomo were treated conservatively, where 9 patients (35%) were male and 21 patients (65%) female; evidently the number of females was more than twice that of males. These findings are similar to those of a previous study by Tjahjadi (2010), which reported a larger difference between the number of male and female subjects, the number of female subjects was 1.5 times greater than the number of male subjects.

Distribution of patients after conservative therapy showed that 6 out of 9 male patients (66.7%) did not improve and 3 out of 9 male patients (33.3%) experienced improvement. As many as 11 of the 21 patients were female (52.4%) and were treated conservatively, but they showed no improvement, and 10 out of 21 patients were female (47.6%), and they showed improvement. Previous research mentioned improvements in conservative therapy, despite operative therapy is superior to conservative therapy depends on the severity.<sup>9</sup>

Distribution of patients with lumbar spinal stenosis between January and December 2014 at the Hospital of Orthopedics and Traumatology and the Hospital Dr. Soetomo were treated conservatively; 11 patients (30%) were aged <45 years and 19 patients (70%) aged  $\geq 45$  years. This is consistent with research that says that the highest prevalence is seen in patients aged above 50 years of, particularly for those in the age range between

30 and 60 years.<sup>1</sup> With LSS patients after conservative therapy, 7 out of 11 patients (63.6%) were aged <45 years experienced repairing and 4 out of 11 patients (36.4%) who were aged <45 years did not improve. Meanwhile, 9 out of 19 patients (47.4%) aged  $\geq 45$  years experienced repairing and 10 out of 19 patients (52.6%) aged  $\geq 45$  years did not improve. This finding is consistent with research that states that in LSS patients aged above 65 years there was a higher likelihood of pre-operative diagnosis predicting the need for spinal surgery.<sup>1</sup>

Based on the VAS (Visual Analogue Score) prior to conservative therapy, it was found that 2 patients (5%) were with mild VAS (0–3), 20 patients (70%) with moderate VAS (4–6), and 8 patients (25%) with severe VAS ( $\geq 8$ ). After conservative treatment, all patients (100%) with mild VAS (0–3) improved, 13 out of 20 patients (65%) with moderate VAS (4–6) improved, and 7 out of 20 patients (35%) with moderate VAS moderate (4–6) had not improved, whereas 1 out of 8 patients (12.5%) with severe VAS ( $\geq 8$ ) improved and 7 out of the 8 patients (88.5%) with severe VAS ( $\geq 8$ ) no improvement. Based on the data obtained we noticed a significant decrease of VAS before and after conservative treatment with Paired samples test ( $p = 0.001$ ) in 16 patients especially in mild and moderate VAS. On the other hand, in those with severe VAS, a significant decrease could not be seen.

Based on ODI (Oswestry Disability Index) prior to conservative therapy, it was found that 11 patients (3%) had minimal disabilities, 5 patients (25%) had moderate disabilities, 12 patients (35%) were severe disability, 1 patient (5%) was crippled which mean that back pain impinges on all aspects of the patient's life and 1 (5%) was non-ambulatory which mean that this patient are either bed-bound or exaggerating their symptoms. After conservative treatment, it was found that 10 out of the 11 patients (90.9%) with minimal disability showed improvement and 1 out of those 11 patients (9.1%) did not recover; 4 out of 5 patients (80%) with moderate disabilities improved, 1 out of 5 patients (20%) with moderate disabilities did not recover, 2 out of 12 patients (16.7%) with severe disabilities improved, and 10 out of 12 patients (83.3%) with severe disabilities did not improve. All crippled patients (100%) and all non-ambulatory patients (100%) did not show any improvement. Study results showed that there was a significant functional improvement in patients with minimal and moderate disabilities, but this wasn't the case with patients with severe disabilities, specifically those who were crippled and non-ambulatory. Some of the previous research works in this area reported that in some cases even though surgery was a superior choice it still wasn't the first-line choice.<sup>9</sup>

Of the total 30 patients who were treated conservatively for LSS, it was found that 16 patients experienced clinical improvement (positive) and 14 patients did not experience clinical improvement (negative). Based on the findings of the paired samples test, it was found that for the subjects who experienced clinical improvement (about 16 subjects) the value of significance obtained was 0.000 ( $<0.005$ ), which means there are significant differences between the scores before and after conservative measures in patients who showed clinical improvement.

TENS in conservative treatment can reduce pain through both peripheral and central mechanisms. Centrally, sites in the spinal cord and brainstem that utilize opioid, serotonin, and muscarinic receptors are activated by TENS. Peripherally, at the site of TENS application, opioid and  $\alpha$ -2 noradrenergic receptors are involved in TENS-induced analgesia. TENS inhibits primary hyperalgesia associated with inflammation in a time-dependent manner. TENS produced analgesia by activation of cutaneous afferent fibers at the site of application and mediated through activation of large diameter afferent fibers.<sup>10</sup> In a recent study that was done by Josimari et al., it was concluded that patients after walking a distance  $<100$  meters, were standing for  $<10$  minutes, or those who had a lumbar canal anteroposterior diameter  $<7$  mm required surgical intervention, while those who walked a distance  $>500$  meters and were standing for  $>30$  minutes could be treated conservatively. Neurological involvement at any stage warrants surgical intervention.<sup>10,11</sup> Some previous studies concluded that exercise with ultrasound therapy and exercise and sham ultrasound after 3 months could improve ODI, pain scores, and ambulation significantly (Level II Evidence). In some studies, it was reported that distraction manipulation and neural mobilization might be beneficial in the treatment of LSS (Level IV Evidence).<sup>12</sup> In another study, it was found that the use of a lumbosacral corset can increase walking distance before claudication and reduce pain in patients with lumbar spinal stenosis. There is no evidence that use of a brace has any lasting results once discontinued (Level III Evidence). In another study that evaluated 82 patients with LSS with medical/intervention (methylcobalt, education, activity modification, exercise, physical therapy, NSAIDS, analgesic), it was found that approximately 40% of patients treated medically/interventionally showed improvements in pain and physical functions (Level IV Evidence).<sup>12</sup> In this study, results showed that there were improvements in VAS and ODI in patients treated conservatively, even though not in all cases, which agrees with

previous research works, given the effect of TENS as an analgesia and the effect of NSAIDS as an anti-inflammation agent as we know in Kirkaldy Willis, which is used for treating the onset of degeneration in spinal cord that starts with dysfunction due to synovial reaction, meniscal and annulus tear, and cartilage destruction that causes the inflammation. In this study, it was found that cut points of sensitivity and specificity were of the highest value  $\geq 3.50$  with the best sensitivity and specificity, respectively, at 81% and 93%. The size of the area under the ROC curve was 89.3% (over 50%). The amount of area under the curve indicates that a scoring system can be applied to predict the development of conservative therapy given to patients with LSS in Orthopedics and Traumatology Hospital and the Hospital Dr. Soetomo.

## CONCLUSION

From the results of the retrospective evaluation of 30 patients who underwent conservative treatment for lumbar spinal stenosis in Orthopedics and Traumatology Hospital and the Hospital Dr. Soetomo between January and December 2014-2015, with females comprising majority of the study population, almost twice as much as men (specifically the number of females aged  $\geq 45$  years in the study was nearly two times greater than the number of males aged  $<45$ ), clinically significant improvement was seen in patients aged  $<45$  years.

Those individuals with lumbar spinal stenosis who seek treatment usually present with moderate VAS; however, significant improvements have been seen in patients with mild-to-moderate VAS, whereas those with severe VAS did not show any significant improvement. The significant functional improvement was seen in patients with minimal and moderate disabilities, but there was no significant functional improvement in patients with severe disability or those who were ambulatory. There was a clinical improvement in 16 patients who were treated conservatively.

In the cut point score system  $\leq 3.50$  was the best sensitivity and specificity value, respectively, by 81% and 93% and the area under the ROC arc area is 89.3% (over 50%), which means a scoring system can be applied.

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