

Functional outcome after surgical decompression of lumbar canal stenosis

Ravikumar Biradar* and Mohammed Ateeq

Department of Orthopaedics, Al Ameen Medical College and Hospital, Athani Road, Vijayapura-586108 Karnataka, India

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Abstract: *Background:* Low back pain with or without leg pain, sometimes associated with paraesthesia is a common occurrence in the community. Apart from lumbago, spondylosis and herniated disc, which usually cause low back pain, associated leg pain and paraesthesia. Also the stenosis of lumbar canal with degenerative changes is very commonly found in Middle and old aged individuals, responsible for considerable disability. It is said that decompression of stenosed canal gives relief to a great extent. Hence to know the outcome of pain relief, problems associated with procedure and the patient's satisfaction post surgically. *Aims and Objectives:* To evaluate outcome of the procedure and to understand the problems related to the procedure. *Methods and Observations:* 20 patients of Lumbar spinal stenosis who visited Al-Ameen Medical College Hospital, Vijayapura out of which 8 patients with primary canal stenosis, 8 others with secondary canal stenosis and 4 patients with degenerative listhesis with stenosis were subjected for laminectomy, after the meticulous preoperative examination and MRI imaging. Postoperative observations with reference to Low back pain, leg pain, and claudication, walking distance, neurological status and Activities of daily living were drawn. 85% of them had combined Low back pain and Leg pain, severity scale was high in mixed stenosis than pure canal stenosis. Neurological claudication was found to be a hallmark presentation. Restoration of walking ability is one of the most diagnostic functional parameter. Neurological recovery was good to the extent of relieving paraesthesia. *Results:* 80% of the study rated as excellent with the mean Swiss spinal stenosis score being 12.22%; 20% rated as good with mean score being 21.19%. The mean age of presentation 49.4% and mean duration of symptoms was 11.7 months. *Conclusion:* Surgical decompression addresses dramatically the morbid symptoms like neurological claudication and radicular pain and improved the walking ability. The problems and complications are the least, insignificant and inconsequential.

Keywords: Lumbar spinal stenosis (LSS), Claudication, Laminectomy.

Introduction

Majority of individuals will experience some degree of low back pain during their lives. The condition is fortunately self-limiting. For those patients, who continue to suffer chronic low back pain, a plethora of potential treatments exist[1]. The contemporary management of chronic low back pain focuses primarily on non-operative modalities such as physiotherapy, NSAIDs. But surgical intervention may be warranted in selective cases.

Though low back pain may be caused by wide spectrum of conditions, a specific etiology cannot be firmly established in the majority of patients. Our understanding of pathophysiology and current level of diagnostic sophistication are

sufficient to determine convincingly the pathoanatomic etiology in most cases of low back pain. Apart from wide spectrum of conditions, where rest, physiotherapy and NSAIDs will suffice. But the conditions where surgical intervention is warranted are intervertebral disc prolapse, spinal canal stenosis and spondylolisthesis etc. Lumbar spinal canal stenosis is defined as narrowing of spinal canal producing symptoms of Low back pain, radiculopathy or claudication. It is a common finding in ageing or degenerative spine[2-3].

Dutch Surgeon Henk Verbiest first described the clinical syndrome of spinal stenosis in a classic article in 1954. This article contains

clear description of intermittent claudication of spine in seven patients. Spinal canal stenosis was demonstrated in these cases with myelography[4].

Clinical Evaluation [1-2]: Spinal stenosis refers to morphology not symptoms. Neurogenic claudication also known as pseudoclaudication, a clinical syndrome with symptoms of leg pain that are associated with walking. It should be distinguished from vascular claudication which has a different etiology with clinical features.

Table-1: Neurogenic claudication Vs Vascular Claudication			
Sl. No.		Neurogenic claudication	Vascular claudication
1	Walking distance	Fixed	Variable
2	Palliative factors	Forward bending	Standing at rest
3	Provocative factors	Walking/standing	Walking
4	Walking uphill	Painless	Painful
5	Bicycle test (Van Galdren)	Comfortable	Painful
6	Pulses	Present	Absent/ Feeble
7	Skin	Normal	Pigmented, atrophic
8	Weakness	Present with Paraesthesia	Rare
9	Back pain	Present	Not present
10	Back motion	Limited extension	Normal

Pain in either low back or leg pain unilateral or bilateral is present in 94% of cases with numbness (63%) and weakness (43%). Bilateral involvement is common. Patients with neurogenic claudication may present with either radicular pain or diffuse vague pain in lower back buttocks and posterior part of thigh. Radicular pain is typically in dermatomal distribution and is often unilateral. It is often seen with lateral recess stenosis, foraminal stenosis or with concomitant disc herniation. The presence of disc herniation in a patient with narrowed spinal canal is not uncommon. Symptoms are typically produced by standing or walking.

With the availability of noninvasive techniques like MRI and CT-Myelo lumbar spinal stenosis is increasingly recognized as a cause of low back pain and radiculopathy in elderly patients. The other modalities which help in the diagnosis of canal stenosis are CT scan, CT with myelography, gadolinium enhanced MRI. The main goals of surgical treatment of LSS is decompression of canal and relieving pressure on cauda equina, nerve roots, laminectomy is the gold standard procedure adopted for this condition, with or without fusion[2,5-6]. Hence this study is a prospective clinical study of Lumbar spinal stenosis managed by decompression with laminectomy.

Historical Background: Portal of France seems to be the first to have studied spinal stenosis in 1803. When he analyzed the size of vertebral canal as related to the cause of spinal stenosis, he noted abnormal curvature of spine might produce this deformity with severe cord compression with paraplegia [1, 3]. In 1864, Jacourd discussed Portal's reports concluding that it is due to narrow canal than the abnormal curvature.

During the later part of nineteenth century, a few authors have written about a strange conditions of Low back pain with leg pain seemed to respond to opening of back and exposing dura. One of the earliest report was by Arbuthnot Lane in 1893. He had a patient with degenerative spondylolisis thesis producing cauda equina compression. He decompressed the lesion and relieved this patient. In 1896 Sottac coined the term intermittent claudication of spinal cord for the first time. In the year 1900, Sachs and Frankel wrote on progressive ankylotic rigidity of spine. They recorded the case of one patient with sacral and lumbar pain, relieved by laminectomy in which the lamina was markedly thickened.

In 1911 Bailey and Cassamajor referred one patient with pain and weakness in the leg relieved by laminectomy. They thought that thickening of laminae, ligamentaflava and bony exostosis could cause compression of nerve roots in the cauda equine [7]. In 1947, Sharpener of Istanbul, Turkey was the first to

describe “congenital” narrowing of spinal canal as responsible for cauda equina compression[7]. In 1954, H Verbiest of Utrecht described the symptoms of intermittent claudication due to cauda equina compression. In 11 of 13 cases, there was complete block. He thought that narrowing was developmental in origin, but disc protrusion and degenerative changes could aggravate the condition. In 1974, W.H. Kirkaldy Willis KWE Paine and Jean Cauchox et al has given definition and classification of lumbar spinal canal stenosis[3].

In 1987 degenerative stenosis of lumbar spine was elaborated by Dan M Spangler of Nashville [8]. In 2003 lumbar spinal stenosis treatment strategies and indications for surgery by Dilip K Sengupta and Harry Herkowitz, USA [9]. Initially all patients with degenerative LSS should be treated conservatively. Rapid deterioration is unlikely for central spinal stenosis, without significant grade I listhesis or deformity, decompression is the surgical treatment of choice.

Material and Methods

Materials: Twenty (20) patients of lumbar spinal canal stenosis who visited Al-Ameen Medical College Hospital, Vijayapura during the year 2019 to 2021 have been take up for the study. We have followed the *inclusion criteria* of:

- Intractable low back pain with leg pain.
- Low back pain with spinal canal diameter 10mm and less with failed conservative management.
- Lumbar spinal canal of 10 mm or less with motor and sensory deficits.

We carefully excluded patients:

- With isolated disc herniation
- Previous lumbar surgeries, and
- Space occupying lesions, deformities and infections.
- Also patient with co-morbidity.

Method: All 20 patients were clinically evaluated for signs and symptoms of Lumbar spinal stenosis for the parameters such as low back pain, leg pain, neurogenic claudication, claudication distance etc. based on proper history taking the neurogenic claudication was differentiated from vascular claudication and vascular causes ruled out. Pre operative and post operative assessment

of activities of daily living was done by standard Swiss spinal stenosis questionnaire and scoring of the patients done based in the same. These were asked to patients for subjective and objective assessment to the patients.

Each patients thoroughly examined for sensations at different dermatomes for increased or decreased or altered sensations at any level in bilateral lower limbs. Motor function assessed by looking for power, tone, reflexes etc in all muscles of lower limbs. All the patients were radiologically evaluated with plain radiography and MRI for actual measurements of mid sagittal diameter of spinal canal, ligamentum hypertrophy, facet joint arthropathy and pedicular abnormalities etc., in relation to associated central canal stenosis. Lateral recess stenosis, foraminal stenosis and far out stenosis. Routine investigations were done to rule out infection and other pathological conditions. All patients were counseled for surgery, merits and limitations. The patients were evaluated post operatively by regular follow up; upto 1 year.

Evaluation of intervention for surgical decompression will include an assessment of patient’s life style and subjective complaints.

1. Intractable pain recalcitrant to non-operative measures.
2. Profound neurological deficit.
3. Impairment of patients life style.

Procedure: The surgeries were performed under general anaesthesia. The surgery performed by placing the patient in prone position. The prone position allows complete exposure of dorsal elements. The abdomen is kept free and hips slightly elevated during the process. Keeping the abdomen free prevents compression of blood vessels as well as epidural bleeding during surgery. Bending the hips helps provide a better assessment of the degree of neural compression from spinal stenosis.

After radiographic confirmation of the level, using the posterior midline approach, skin incision is made that is long enough to adequately expose the involved vertebra. After soft tissue dissection, the corresponding

spinous processes are dissected. The level of vertebra was visualized by direct vision as well as using fluoroscopy. Decompression is done by performing laminectomy with or without discectomy. The wound is flushed out with saline irrigation and then closure done ensuring water tight closure of thoracolumbar fascia. The subcutaneous and skin suturing done.

Results

We have observed in our study 9 patients (45%) had bilateral leg pain and 11 patients (55%) had unilateral pain. 17 patients (85%) had combined Low back pain and radicular pain, only 3 (15%) had pure low back pain.

Type	No. of cases	Percentage
Low back pain	3	15
Bilateral Leg pain	9	45
Unilateral Leg pain	11	55
Combined (LBP + LP)	17	85

We have observed in our study, 5 of the patients (25%) having mild to moderate pain, 15 of our patients (75%) had severe pain. Out of 20, about 16 patients (80%) had paraesthesia. This could be accounted to association of lateral recess stenosis and disc herniation. It was observed that 7 (35%) of patients had walking distance between 150 metres and 300metres. 11 (55%) patients had 15 to 150 metres and 2 (10%) patients were house bound.

Walking distance	No. of cases	Percentage
> 15metres	2	10
15 – 150metres	11	55
150 – 300metres	7	35

In our study we have noted 9 (45%) having motor deficits pre-operatively. Of them 6 patients had single root involvement of L5, 3 patients had S1 root involvement only. Only one patient (5%) had sensory deficit over L5 dermatome. In our study 11 (55%) patients had limitation of extension alone, 4 (20%) had all movements limited, 5 (25%) patients were normal. In our study 16 patients (80%) have got canal diameter less than

10 mm. 3 patients (15%) had spondylolisthesis and 10 patients (50%) had ligamentumflavum hypertrophy.

The subjective disability evaluation of entire study of 20 patients done during the year 2019-2021. With short period of follow up of one year. We have used Swiss spinal stenosis score subjective evaluation and score obtained from 0-20 is rated as excellent 21-40 as good, 41-60 poor and 61 and above as very poor. This score pattern ranged from 5.55% to 35.5% with mean score of 14.44%. 80% of the study rated as excellent with mean score of 12.22%. 20% of them as rated as good with mean score of 29.11%. The mean age of presentation of the patients in our study is 49.4 years with the mean duration of symptoms was 11.7 months.

No. of cases	Percentage (%)
Excellent	80
Good	20
Poor	0

The primary indications in our study include 8 (40%) primary bony canal stenosis. 8 (40%) secondary spinal canal stenosis, 4 (20%) patients belong to degenerative listhesis. Seven patients had ligamentumflavum, hypertrophy, 3 patients had associated degenerative disc herniation. Although primary spinal canal stenosis, present with a predominant low back pain than radicular pain we have observed 85% of them having radicular pain with low back pain, being 55% unilateral. This explains the possibility of mixed stenosis at other levels and at neural canal and also association of degenerative disc herniation usually co-existing with lumbar canal stenosis.

Pain severity scale was significantly observed in those patients with additional canal stenosis by degenerative pathology whereas pure canal stenosis remained to be moderately painful. Neurological claudication was found to be a hallmark presentation in lumbar spinal canal stenosis and we have found the same in all 20 patients. 65% of our patients were poor distant walkers.

Hence, restoration of walking ability is one of the prognostic functional parameter. Like in any other studies, we have noticed, 35% of nerve compression tests positive. This is possible because of association with significant number of lateral canal stenosis. Predominant motor deficit in our study extended from one root involvement to multiple root involvement. L5 root involvement is seen in almost 45% of patients. 42.08% of stenosed vertebrae belong to L4, 34.19% belong to L5 and 23.65% belong to L3 segments.

Absolute stenosis of less than 10 mm was found equally in all 3 segments and relative stenosis was only found in L4 and L5 segments. 42.08% of laminectomy is done at L4 level, 34.19% of laminectomy was done at L5 level. 23.6% of laminotomy were done at L3 level. 3 patients needed discectomy for herniation.

All the patients (100%) showed disappearance of claudication pain, disappearance of leg pain. 85% of Patients had complete relief of low back pain postoperatively. 15% of the patients remained to be having mild low back pain persisting postoperatively. All the patients (100%) significant improvement in walking distance with the walking ability of 150 metres to 500metres. All the patients (100%) were restored to live normal activity of daily living like going to bathroom shops for purchase of groceries etc. Preoperative L5 root weakness of grade 3 and 4 in two patients have recovered completely. Another one patient showed an improvement to grade 4. Paraesthesia over the leg in all patients disappeared postoperatively.

Discussion

In 1975, results of surgical treatment of idiopathic developmental stenosis of lumbar vertebral canal, a review of twenty-seven years experience. 147 patients were treated surgically. Between 1948 and 1975, 147 patients were treated surgically for developmental stenosis of lumbar vertebral canal, measurement of mid-sagittal diameter in the whole area of stenosis being performed in 116 patients. 92 patients were followed for period varying between 1-20 years.

About two-thirds were completely relieved of symptoms and signs. Sciatica and intermittent claudication were more frequently cured than

radicular deficit and lumbago, the later being most frequent persistent symptoms. In our study, all the patients (100%) showed disappearance of claudication pain postoperatively.

In 1993 surgical treatment of central lumbar stenosis multiple laminotomy compared with total laminectomy by F. Postacchini et al [10]. 67 patients were assigned with central lumbar stenosis alternatively to either multiple laminotomy or total laminectomy. The patients were divided into three groups. 26 patients only for multiple laminotomy, group II 9 patients scheduled for laminotomy but later changed to total laminectomy. Group III 32 patients scheduled for only laminectomy. Lumbar spinal stenosis – clinical and radiological features – A clinical picture is demonstrated in 100 patients with symptomatic LSS.

The radiological changes were more extensive than expected from clinical picture. In our study, the radiological evaluation revealed that 42.08% of stenosed vertebra belonged to L4 level, 34.19% belong to L5 level and 23.65% belong to L3 level.

In 2000 Lumbar spinal stenosis – conservative or surgical management, a prospective 10 year study by Tom Amundsen and Henritacoveretc [11]. A cohort of 100 patients with symptomatic lumbar spinal stenosis. After a period of 3 months after surgery, relief of pain had occurred in most patients. Some had relief earlier and some later than one year. The outcome was most favourable for surgical treatment. In our study, in all the patients (100%) the claudication pain disappeared postoperatively and they showed significant improvement in walking distance.

Herron et al reported an average improvement of leg pain improvement of 82% and back pain improvement of 71% in surgically treated patient [12]. Our study shows that 85% of the patients had complete relief of low back pain postoperatively and 100% patients showed disappearance of leg pain.

In the study of K. W. E Paine et al, out of 150 patients treated surgically, 66 of the patients

showed excellent outcome, 47 patients showed good outcome and 34 showed poor outcome [6].

Similarly a study of J. N. katz et al among 88 surgically treated patients, 78 showed excellent outcome, 8 patients showed good outcome and 2 had poor outcome [13]. Rajendranath et al showed excellent outcome in 64% patients and a good outcome in 36% patients in a 1 year follow up study after surgery [14]. Our study shows excellent outcome in 80% patients a good outcome in 20% patients after follow up for 1 year after surgery.

The study of Chang et al included the follow up of 35 patients treated conservatively and 51 patients treated surgically. The follow up of 10years yielded the following result that surgery had better improvemet for radicular pain, functional status [15]. Atlas et al study with follow up for 1 year treated 67 patients conservatively and 81 patients were treated surgically. The outcome of the study showed surgery had better improvement for both radicular and back pain[16].

Johnson and associated compared two groups of patients who were treated surgically by

laminectomy without fusion. Results were assessed by a questionnaire and neurophysiologic testing that included measurements of motor conduction velocities. Subjective findings based on the questionnaire indicated that, in non-surgical group, 30% improved and 60% remained unchanged as compared with 60% improvement in laminectomy group.

Table-5: Comparative Results

Author	No. of cases	Excellent	Good	Poor
K. W. E. Paine [6]	150	66	47	37
J. N. Katz et al [13]	88	78	8	2
Present study	20	16	4	0

Conclusion

Surgical decompression addresses dramatically the morbid symptoms like neurological claudication and radicular pain and improved the walking ability. The problems and complications are the least, insignificant and inconsequential.

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*All correspondences to: Dr. Ravikumar Biradar, Associate Professor, Department of Orthopaedics, Al Ameen Medical College and Hospital, Athani Road, Vijayapura-586108 Karnataka, India. Email: drravi782003@yahoo.co.in