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Prospective Study of Clinical and Functional Outcome of Laminectomy in a Case of Lumbar Canal Stenosis in Adults

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Abstract: ***Objective: This is prospective study to analyse the surgical management of patients with lumbar canal stenosis. Study focuses on-To assess the neurological and functional outcome of Laminectomy procedure done. Methods: Inclusion Criteria: Adult patient with back pain, sciatica, neurogenic claudication-Fresh MRI finding suggestive of lumbar canal stenosis-absolute stenosis (mid sagittal diameter of the canal < 10mm)-Relative stenosis (mid sagittal diameter of the canal 10mm-13mm)-Patient willing to participate and co-operate. Exclusion Criteria: Congenital lumbar canal stenosis.-MRI suggestive of Lumbar Canal stenosis but patient symptomatically normal.-Patient not willing.-Psychiatric patient.-Patient with traumatic lumbar canal stenosis.-Patient with bowel and bladder involvement.-Patient with neurological Disorders like parkinsonism, Alzheimer's, CVA, cerebral disorders. Patients satisfying inclusion criteria were included in the study after obtaining written informed consent.30 patients with lumbar canal stenosis were recruited and underwent surgical intervention. Postoperative Protocol: Neurological charting was done after 2 weeks of surgery along JOA score and VAS score. Patients were followed-up regularly every month during the first 3 months and thereafter every 3 months upto 12 months. RESULTS: The long-term outcomes of decompressive surgery on reliefof pain and disability in degenerative lumbar canal stenosis are unclear. Thirty patients of degenerative lumbar canal stenosis managed surgically were included in this study. We excluded patients with congenital lumbar canal stenosis, traumatic LCS, patient with neurological disorders. Mean age of the patients in our study was 51.9 years. There was slight male preponderance with male 16 (53%) and female 14 (47%). Decompressive Laminectomy without instrumentation was performed using standard posterior midline approach. JOA scoring system for low backache was used to assess the patients. The recovery rate was calculated as described by Hirabayashi et al. (1981). Surgical outcome was assessed based on the recovery rate and was classified using a four- grade scale: Excellent, improvement of >75%; good, 50- 75% improvement; fair, 25-50% improvement; and poor, below 25% improvement. At 1-year followup 46.6% patients showed excellent outcome, 46% showed good outcome, and 7.4% showed fair outcome. No patient had poor outcome. Outcome of the patients improved as the time after surgery increased till 1 year and was sustained thereafter till the last follow-up. Conclusion: This study was carried out in 30 patients to observe the efficiency of Decompressive Laminectomy in management of Lumbar canal stenosis. Surgical management of lumbar canal stenosis gives an excellent relief of symptoms and good functional outcome All patients had improved claudication distance post-operatively All patients had drastic improvement in straight leg raising post-operatively No correlation was found between gender and functional outcome No correlation was found between outcome and Obesity of patient. All patients had improved mobility decreasing their family burden. Operative treatment in patients of degenerative lumbar canal stenosis yields excellent results as observed on the basis of JOA scoring system. No patient got recurrence of symptoms of nerve compression.***

Keywords: Laminectomy, Lumbar Canal Stenosis, Midline Decompression, Low Back Pain, Degenerative Spine Disease

1. Introduction

Low back pain is extremely prevalent and is the second most common for people to seek medical attention. LBP accounts for the most of the sick leave from work and is the most common cause of disability of persons less than 45 years of age. As life expectancy continue to increase, prevalence of symptomatic spinal stenosis will increase. Although lumbar stenosis is not life threatening it can cause chronic and sustained pain and can limit activity severely. Early, accurate diagnosis and treatment of lumbar stenosis is important in preserving activity in elderly population Lumbar spinal canal stenosis is a most common orthopedic condition, it is a clinical syndrome of back or leg pain with characteristic provocative and palliative features, which occurs due to narrowing of spinal canal and the intervertebral foramen. Lumbar spinal canal stenosis has been regarded as "the forgotten spinal disease". This neglect occurred because of the association between herniated intervertebral discs and sciatica received most of the attention after it was discovered by Mixter and Barr in 1934. Verbiest was the first in 1954 to described the classic finding of this syndrome. One of the classic symptoms of spinal stenosis, intermittant claudication of the spine, is called Verbiest's Syndrome. It usually found in middle aged and older adults presenting with back pain and lower extremity pain precipitated by standing and walking and aggravated by hyperextension and relieved by forward flexion, sitting and recumbency. The basic pathology behind degenerative lumbar spinal canal stenosis is due to thickening of interspinous ligament, ligamentum flavum and facet joint hypertrophy. Although acute disc herniation and neoplasm can both cause narrowing of the canal with radiculopathy or pseudoclaudication, these diagnoses are often referred to separately. Narrowing of the spine can occur in the central canal, lateral recess or foramen leading to compression of the neural elements in those locations. The symptoms produced depends upon the location of the neural compression. Patient who are symptomatic describes low back pain radiating into bilateral legs typically associated with heaviness and weakness in their legs that worsens with movements. . Usually, patients with central canal stenosis complain of neurogenic claudication whereas patients with lateral recess and foraminal stenosis complains of radicular pain. Even though nonoperative treatment is the main stay of treatment, surgery is indicated in patients who have progressive neurological decline or when non-operative

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manoeuvres have failed adequately to address the symptoms. At present, various surgical options are available. The Gold standard is by midline decompression by laminectomy, different kinds of unilateral and bilateral fenestrations and partial or full hemilaminectomies. Since the patients suffering from degenerative lumbar spinal canal stenosis are elderly patients and its incidence increases considerably. And the elderly patients have associated co-morbid conditions compared to younger generation, problems regarding various surgical procedures need to be addressed. Such choices of procedure are important because greater invasiveness associated with higher mortality, greater complications but generally similar clinical benefits. So, risk versus benefit ratio carefully weighed before choosing surgical procedure. The mainstay of surgical treatment of lumbar spinal stenosis is decompression laminectomy. Patients with concomitant spondylolisthesis or instability, spinal deformity or concerns for iatrogenic postoperative instability should be considered for decompression with fusion.

2. Methodology

Aim of the Study: This is prospective study to analyse the surgical management of patients with lumbar canal stenosis. Study focuses on-To assess the neurological and functional outcome of Laminectomy procedure done.

Study Design: Prospective analytical study.

Materials and Methods: Patients satisfying inclusion criteria were included in the study after obtaining written informed consent.30 patients with lumbar canal stenosis were recruited and underwent surgical intervention.

Inclusion Criteria: Adult patient with back pain, sciatica, neurogenic claudication-Fresh MRI finding suggestive of lumbar canal stenosis-absolute stenosis (mid sagittal diameter of the canal < 10mm)-Relative stenosis (mid sagittal diameter of the canal 10mm-13mm)-Patient willing to participate and co-operate

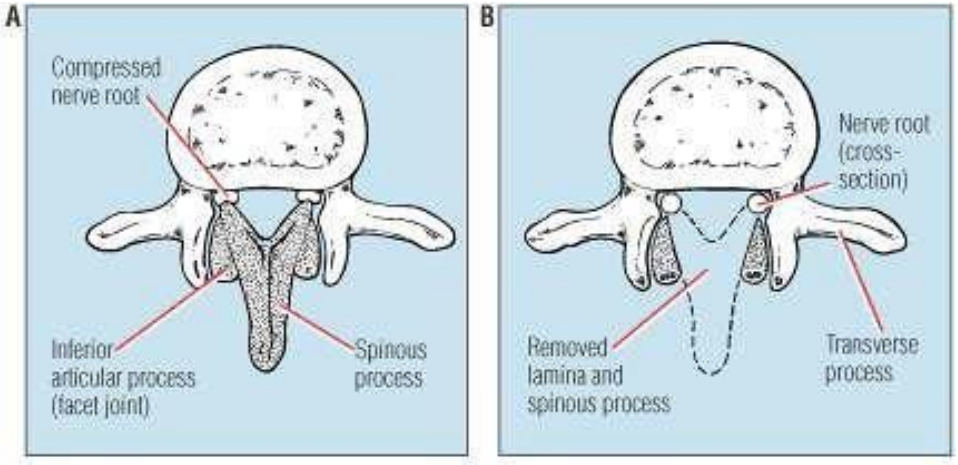
Exclusion Criteria: Congenital lumbar canal stenosis.-MRI suggestive of Lumbar Canal stenosis but patient symptomatically normal.-Patient not willing.-Psychiatric patient.-Patient with traumatic lumbar canal stenosis.-Patient with bowel and bladder involvement.-Patient with neurological Disorders like parkinsonism, Alzheimer's, CVA, cerebral disorders.

Preoperative Evaluation: Patient history and neurological examination.-Preoperative clinical evaluation of the patients was made by-Japanese Orthopaedic Association (JOA) score-Visual analogue score for back and neurogenic Claudication (VAS).

Radiography of the Lumbosacral Spine: MRI of lumbosacral spine.

Surgical Technique: For all the procedure, patient under Endotracheal tube General Anaesthesiain prone position. Through standard Posterior Midline Approach

Posterior Midline Approach: Skin incision centring the stenotic area given in standard posterior midline approach, length of the incision varies with the level involved.-Skin, subcutaneous tissue, para vertebrae facia incised.-Para spinal muscles were elevated sub-periosteally from the spinous process and lamina.-Spinous Process, transverse process, facet joint identified.-Decompression achieved by removal of lamina, ligamentum flavum done-Removal of the lamina up to medial border of the pedicle done-Adequacy of the decompression assessed.-Discectomy done.-Paraspinal muscles closed in layers with absorbable sutures and the subcutaneous tissue and skin were closed.



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Post-operative MRI after decompressive Laminectomy

Intra Operative Assessment

- Operative time
- Blood loss and transfusion
- Through inspection of neural elements.

Postoperative Protocol

Immediately after extubation neurological assessment done.

- Patients were kept on suction drain and was removed after 2 days.
- Patients were kept on lumbosacral belt.
- Patients were encouraged to walk as soon as is comfortable.
- Sutures were removed after 12th day of surgery.
- Neurological charting was done after 2 weeks of surgery along JOA score and VAS score.
- Patients were followed-up regularly every month during the first 3 months and thereafter every 3 months upto 12 months.

Case Illustrations

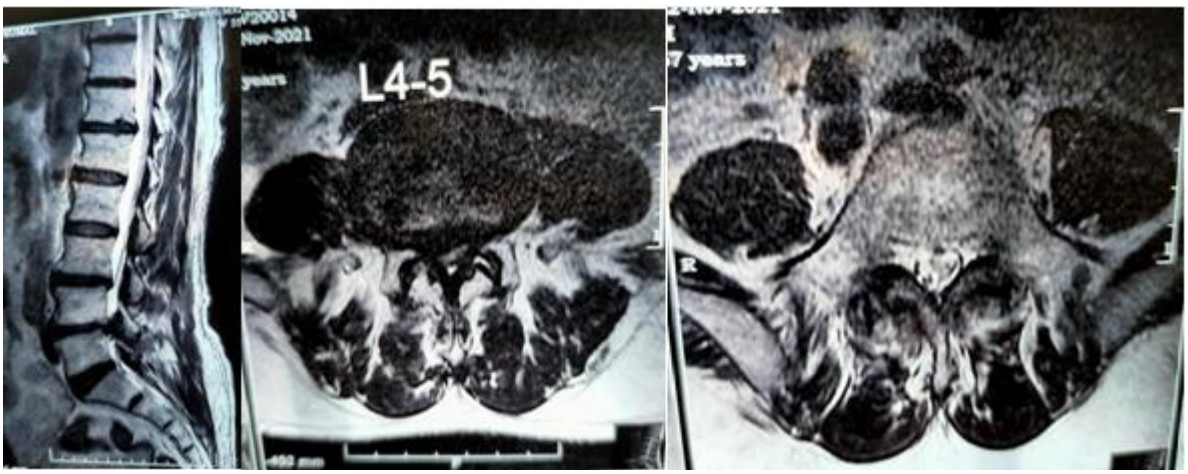
Case 1

Mr P 50/M, C/O Low Back Pain for 3 yrs with neurogenic claudication for 4 months.

Diagnosis: L4, L5, S1 Central stenosis.

Procedure done: Decompression with Conventional Laminectomy.

Pre Op JOA Score-10, VAS Score-7 Post Op JOA Score-13, VAS Score-1



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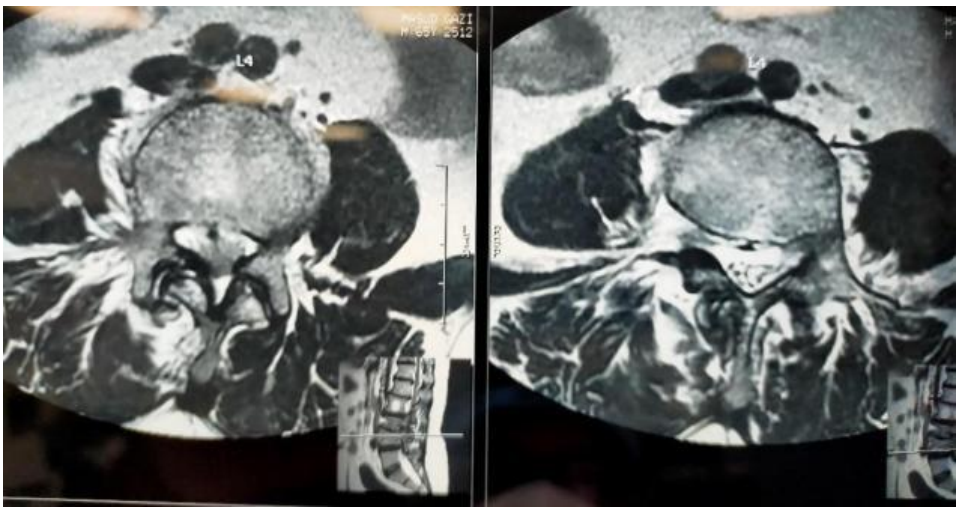
3 Months Follow Up

Case 2

Mrs G 63/F, C/O Low Back Pain for 3 yrs with neurogenic claudication for 6 months.
Diagnosis: L3, L4, L5, S1 Stenosis.
Procedure done: Decompression with Conventional Laminectomy.
Pre Op JOA Score-7, VAS Score-8
Post Op JOA Score-17, VAS Score-1



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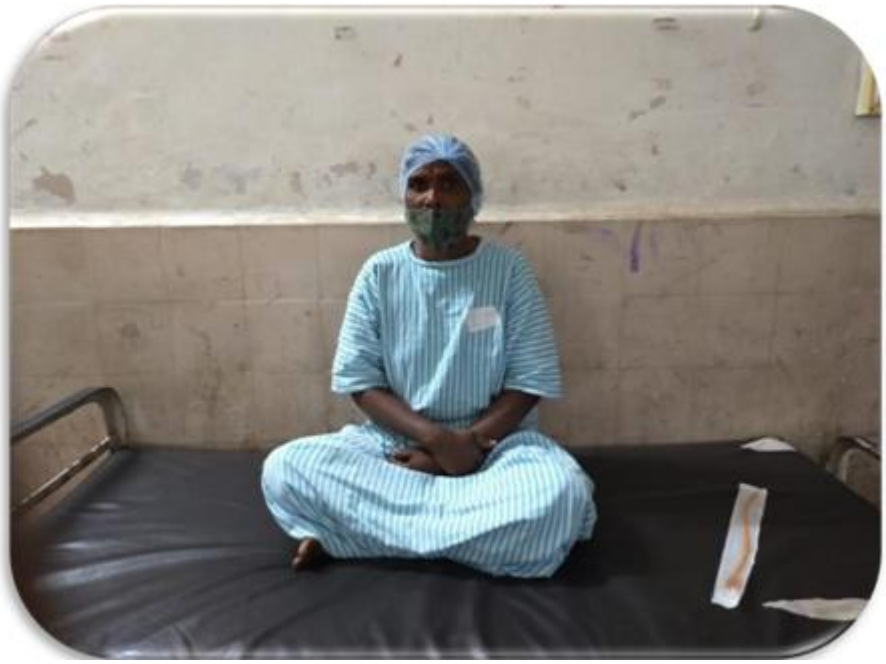
Follow-up after 3 Months



Case 3

Mr S 53/M, C/O Low Back Pain for 3 yrs with EHL 4/5 Diagnosis: L3, L4, L5, S1 Stenosis.
Procedure done: Decompression with Conventional Laminectomy.
Pre Op JOA Score-7, VAS Score-8
Post Op JOA Score-17, VAS Score-1

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Follow up after 6 months

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3. Observation and Results

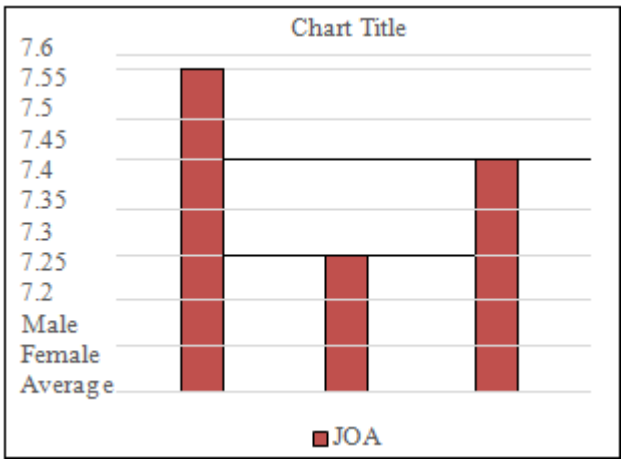
Demographics
Study sample size was 30.

Functional Evaluation

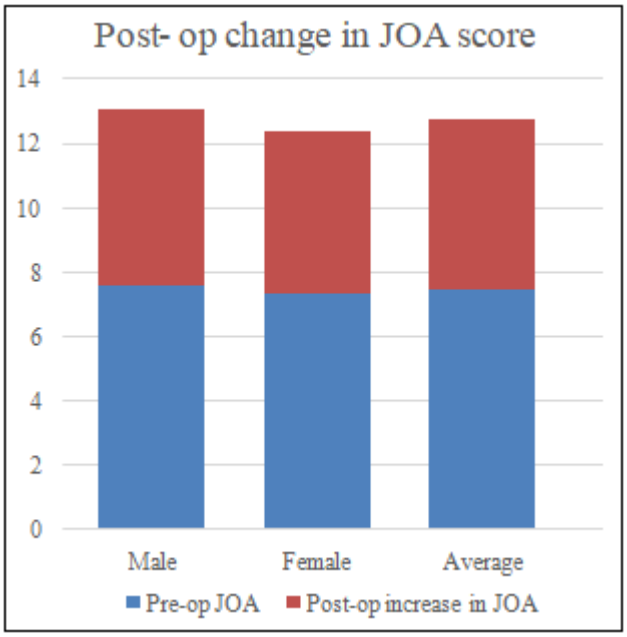
Modified Japanese Orthopaedic Association score

Excellent outcome	14	46.6%
Good outcome	14	46.6%
Fair outcome	2	6.6%
Poor outcome	-	-

Mean Modified JOA score preoperative was 7.46
Mean Modified JOA score preoperative for men was 7.56
Mean Modified JOA score preoperative for women was 7.35



Mean JOA post-operatively-12.73
Mean JOA post-operatively in men-13.06
Mean JOA Post-operatively in women-12.357



Preoperative Parameters

S. No	Contents	
1	No of Patients	30
2	Avg Age	54.2
3	Male: Female	08:07
4	Average duration of follow-up	12 Months

The study was conducted in 30 patients in tertiary care centre, most patients are farmer or labourer by occupation. With average age of 54.2 years and in a ratio of 8: 7 (male: female)

Intraoperative Parameters

Sr No.	Parameter	
1	Average duration of surgery	2 hours
2	Average blood loss	150ml
3	Number of transfusions	1
4	Dural tear	3
5	Iatrogenic neurologic deficit	2

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Surgery was performed by senior surgeon. All procedures performed under general anaesthesia. Mean duration of surgery was 120 mins. Only patient required transfusion. Accidental Dural tear was observed in 3 cases which was immediately sutured.

Post-operative Parameters

S. No.	Parameter	
1	Wound Infections	1 (superficial)
2	Instability	Nil
3	Urinary Tract Infection	Nil
4	Lower Respiratory Tract infection	Nil

Wound complication was observed in one patient in 28 days postoperative. It was managed by thorough wound wash and antibiotics. Surgical site after which went on to heal uneventfully. No other postoperative complication observed in any of our patients.

Dural tear: 3
Managed by Dura repair and Tablet Acetazolamide 500mg bd.

Infection: 1
Managed by wound debridement and wash

Neurological deficit: 2
Two patient who had undergone Decompression encountered iatrogenic nerve injury recovered by Physiotherapy in 3 months.

Modified Japanese Orthopaedic Association Score
In our study population the Pre op modified JOA score was 7.46 it improved to12.73 in the last follow up. Demographically Male gender group had mean Pre-op JOA of 7.56 with mean improvement of 13.06in the last follow-up. Male group had the mean recovery rate of 73.46%

In female group had mean pre-op modified JOA of 7.35 with mean improvement of 12.35 in the last follow up. Recovery rate observed in female group was 65.94%

Statistical analysis with T test

t-Test: Paired Two Sample for Means		
	Pre-op JOA	*Post-op JOA*
Mean	7.466666667	12.73333333
Variance	1.636781609	1.167816092
Observations	30	30
Pearson Correlation	0.417351394	
Hypothesized Mean Difference	0	
Df	29	
t Stat	-22.45323211	
P (T<=t) one-tail	3.48974E-20	
t Critical one-tail	1.699127027	
P (T<=t) two-tail	6.97948E-20	
t Critical two-tail	2.045229642	

So, P < 0.005

So the change in the JOA score pre and Post operatively showed statistically significant results.

Visual Analogue Scale
In our series of 30 patients mean Pre-op VAS was 7.8 and it reduced to mean post op VAS of 1.87.

Demographically Male group had Pre-op VAS of 7.62 and it reduced to 1.9 in the last follow up.

In female group Pre-op VAS was 8 and it reduced to 1.8 in the last follow up.

4. Discussion

This study was done in the Government run tertiary level hospital in Maharashtra with 30 participants, 16 male and 14 female, in a ratio of 1.14: 1.

Age distribution.
Verbiest et al (1949) in his study of 7 patients with lumbar canal stenosis age distribution 37 to 67 years, with a mean of 51.2 years

Deen HG Jr et al (1995) conducted a retrospective study of patients who were referred to their institution between 1990 and 1993 because their symptoms were unchanged or worsened after lumbar decompressive laminectomy**.** For the 45 study patients (25 women and 20 men; mean age,) the mean age of the patients was 70.8 years **Hanakita J et al (1999)** conducted study on 164 patients with lumbar canal stenosis were aged from 19 to 84 years old, peaking in the 60s.

Patients 65 years of age or over accounted for about 40% of all patients.

Iguchi et al (2000) in their study mean age was found to be 60.9 years

Kawaguchi Y et al (2001) carried out study in 37 patients 56-86 years old; mean age 69.6 years

HirotakaHaro et al (**2008)** Mean age in their study was 66.1years ranging from 33 to 88 years at the time of surgery

R Nath et al (2012) Mean age in their study was 45.1years

In **present study** mean age was 51.9 years. Mean age among male patients was 49.8 years while in female patients was 54.2 years. Males are more prone for lumbar canal stenosis at an younger age probable reasons may be due to strenuous work environment speeding the degenerative process.

Sex
Verbiest et al 1949 Presented his finding of lumbar canal stenosis in 7 patients, all were male patients.

Auquier L, et al (1970) presented a series of 29 patients all male of athletic build they noted following common in them a frequently insidious onset, uncertain root distribution,

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athletic habitus, pain upon stretching of the rachis and relief by the opposite position

Pennal GF, Schatzker J. et al8 (1971) in their series they operated on 20 patients with lumbar canal stenosis, of which 14 patients were male and 6 females, all had gratifying relief of symptoms postop.

Louis R et al (1992) in their study conductedbetween 1974 and 1989 350 patients 216 male and 134 female were submitted to surgery for the treatment of stenosis of the lumbar canal.

Iguchi et al (**2000)** In their study distribution of sex was 19 male and 18 females

Kawaguchi Y et al (2001) carried out study in 37 patients of which 31 were men and 6 women; 56-86 years old; mean age 69.6 years

HirotakaHaro et al (2008) In their study distribution of sex was 20 male and 22 females

R Nath et al (2012) In their study distribution of sex was 22 males and 10 females

In **present study** of sample size of 30, 16 patients were males while 14 were females in a ratio of 1.14: 1. Our study had slight male predominance of 53 % and female making up rest 47 %. Many studies had male predominance this may be due to strenuous work usually done by male population.

Presenting complaints-

Verbiest H et al (1949) In their study they observed that the symptoms were characteristic. On walking and standing these patients presented signs of disturbance of the cauda equina; bilateral radicular pains, disturbances of sensation and impairment of motor power in the legs. When the patient was recumbent the symptoms immediately disappeared and neurological examination during rest revealed nothing abnormal

GATHIER JC et al (1959) gave a case report on lumbar canal stenosis in a thirty-year-old soldier who showed the typical clinical picture of stenosis of the lumbar vertebral canal. The patient had suffered from a numb feeling in both legs ascending from the feet to the groins when walking, for the previous three years. On prolonged walking: the legs became powerless and painful, and the patient's gait became unsteady,

Louis R et al (1992) conducted his study in 350 patients**.** In 67% of the cases neurogenic claudication was present; in 57% there was monolateral radiculopathy, in 43% bilateral radiculopathy.

Kawaguchi Y et al (2001) carried out study in 37 patients All of them had neurogenic intermittent claudication (IMC) caused by cauda equina syndrome. Subjective urinary complaints were associated in 29 cases.

R Nath et al (2012) In his study most common complaint patient presented was posture related severe leg pain (87.5%, n=28/32)

Iguchi et al (**2000)** In their study Ten patients had symptoms primarily of intermittent claudication with bilateral leg numbness and pain. Eighteen patients reported unilateral leg pain, and another 9 patients had combined symptoms. Prolonged low back pain continuing for more than 1 month was found in 18 (48.6%) patients, and 35 (94.6%) patients had persistent leg pain.

Oh JY et al36 (2015) presented a case report of A 63-year-old gentleman with a one-year duration of progressive neurogenic claudication. However, unlike most patients who presents with leg symptoms, his pain was felt in his scrotal and perianal region. This was exacerbated with walking and standing, but he had immediate relief with sitting.

In **present study** most common complaint patient presented with was Intermittent claudication on walking. In all patients their walking distance was less than 100 meters which severely hampered their day-to-day activities.

Level involvement.

Louis R et al (1992) in their case series of 350 patientsThe lesions extended from L4 to S1 in 39.2% of the cases, L3 to S1 in 36.3%, L5 to S1 in 8.5%, L2 to S1 in 7.2%, L4 to L5 in 4.6%, and L3 to L4 in 2.1%.

R Nath et al[32] (2012) In their study most common level involvement was L4-L5 (81.82% patients, *n*=27) followed by L5-S1 (54.55% patients, *n*=18).

Iguchi et al[46] (2000) In their study most common level involvement was L4 18 patients as single level stenosis, and multilevel L4-L5 stenosis in 6 patients

In **present study** most common level of involvement was L4-L5 in 16 patients and L5-S1 in 7 patients this is due to higher mobility of the segments compared to others leading to more wear and
tear.

Intraoperative blood loss.

Iguchi et al (**2000)** In their study total intraoperative blood loss was 115 g

Weinstein et al[45] (2008) in their study conducted mean blood loss was 314 ml

Kanbara et al[57] (2015) in their study total blood loss for conventional laminectomy was 29.5 ml pel level

Sangwan SS et al (2014) in their study the average blood loss during the surgery was 150 mL (range, 120-200 mL) and none of their patients required a blood transfusion

In **present study** average blood loss was found to be 150 ml
Levels decompressed

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Gunzburg R et al (2003) conducted study in 36 patients who underwent decompression laminectomy One-level decompression was performed in 10 subjects, two-level decompression in 16, three-level decompression in 5, four-level in 1 and five-level decompression in 4 subjects.

Sangwan SS et al (2014) conducted a prospective study for evaluation of the clinico-radiological outcome and complications of limited laminectomy of 40 patients available in follow-up. The distribution of the site of the involved segments and level of decompression was as follows: L4-L5 (n=20), L3-L4 and L4-L5 (n=10), L4-L5 and L5-S1 (n=6), L5-S1 (n=2) and L3-L4 (n=2).

Antoniadis A et al (2017) conducted a retrospective study, 121 patients Decompression was performed at 1 level in 46 cases, at two levels in 55 cases, at three levels in 18 cases, at four levels in one case and at five levels in one case. In total, decompression at level L1-L2 was performed in two cases, at level L2-L3 in 25 cases, at level L3-L4 in 67 cases, at level L4-L5 in 103 cases and at level L5-S1 in 22 cases.

In present study of the 30 cases, 26 patients had 2 level laminectomy, 1 patient had 1 level and another 1 patient had 3 level laminectomy

Operative time

Iguchi et al[46] (2000) In their study total operative time was found to be 105 mins.

Weinstein et al[45] (2008) In their study mean total operative time was 120 mins

Kanbara et al[57] (2015) In their study total operative time for conventional laminectomy was 22.7 minutes per level

Gunzburg R et al (2003) conducted study in 36 patients who underwent decompression laminectomyThe average duration of the operation was 68±33 min (ranging from 30 to 150 min).

Sangwan SS et al (2014) conducted a prospective study for evaluation of the clinico-radiological outcome and complications of limited laminectomy of 40 patients available in follow-up. The average operation time was 108 minutes (range, 90-120 minutes).

In **present study** total operative time was found to be 120 mins. Operative time was especially dependent on number of levels decompressed and degree of ligamentum hypertrophy.

JOA recovery

R Nath et al[32] (2012) reported 64% patients with excellent and 28% showed good outcome at one year follow up in series of 32 patient.

Iguchi et al[46] (2000) reported 35.1% patients with excellent and 21.6% showed good outcome at ten year follow up in series of 37 patient

Haro H et al (2008) The overall JOA scores as well as the subscores for subjective symptoms, clinical signs with the exception of urinary dysfunction, and restriction of ADLs were all significantly improved 24 months postoperatively when compared with the corresponding preoperative scores

Sangwan SS et al (2014) conducted a prospective study for evaluation of the clinico-radiological outcome and complications of limited laminectomy of 40 patients available in follow-up. The mean±SD for the preoperative JOA score was 13.3±4.1 which improved to 22.9±3.2. Improvement in the JOA scores was significant by the paired Student's *t*-
test.

In **present study** 46.6% patients with excellent and 46.6% showed good outcome at one year follow up in series of 30 patient which is statistically significant as measured by paired T Test with P value <0.05.

JOA recovery	Iguchi et al	R Nath etal	Our study
Excellent	35.1	64	46.6
Good	21.6	36	46.6
Fair	21.6	-	6.6
Poor	21.6	-	-

Post-op relief of symptoms

Verbiest H et al10 (1977) in their study conducted between 1948 and 1975 147 patients were treated surgically for developmental stenosis of the lumbar vertebral canal, ninety-two of these patients were followed up for periods varying between one and twenty 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 latter being the most frequent persisting symptom

Yukawa Y et al21 (2002) conducted a study on Sixty-two patients with lumbar spinal stenosis and neurogenic claudication were prospectively enrolled in the study. Preoperatively fifty-eight (94%) of the patients had a positive result (provocation of symptoms) on the treadmill test and twenty-seven (44%) had a positive result on the bicycle test, whereas postoperatively six and twelve, respectively, had positive results. The mean preoperative scores on the Oswestry Disability Index and visual analog pain scale were 58.4 and 7.1, respectively. Postoperatively, these scores decreased to 21.1 and 2.3, respectively, and both decreases were significant.

Nath et al[32] (2012) in their series with 62.5% had no pain, 37.5% had occasional mild pain, 96.87% had no leg pain.

Herron et al (1991) concluded similar results with average improvement of leg pain in 82% and improvement of back pain in 71%.

In **present study** Preoperatively 88% had continuous severe back pain, 8% had occasional severe low back pain and 4% had mild low back pain. With 24% patients have associated stress paraesthesia. At one year of follow-up 30% had low back pain on heavy work (VAS =2), 53.3% has occasionally

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mild low back pain on extremes of heavy work (VAS =1) and 16.6% had no pain. No patient in our series had occasional severe or continuous severe low back pain. Postoperatively 83.3% patient have improved paraesthesia at 1 year follow up.

Post operatively all our patients had complete relief of neurogenic claudication. At the end of one-year patients had significant improvement in pain scores

Complications

No surgical procedure in history is without any set of complications. The same holds true in case of Decompressive laminectomy.

Weinstein et al[45] (2008) conducted study in which 13 out of 152 random cohort (8%) and 23 out of 238 (10%) observational cohort had duraltears. managed by immediate dural repair

Hanakita J et al (1999) conducted study on 164 patients with lumbar canal stenosis There were four patients with dural laceration, all of which underwent microsurgical repair. No difference in functional outcome was observed.

Sangwan SS et al (2014) in their study dural tears occurred in 2 patients; the tears were repaired and needed no additional treatment.

Ulrich NH et al38 (2016) conducted a propective multicentre study to assess whether incidental durotomy during first-time lumbar spinal stenosis decompression surgery without fusion has an impact on longtermoutcome. Fifteen (9%) of those patients had an incidental durotomy.

All patients improved over time. Incidental durotomy in patients with DLSS undergoing first-time decompression surgery without fusion did not have negative effect on long-term outcome and quality of life.

Antoniadis A et al (2017) conducted a retrospective study in 121 patients. A lesion of the dura mater was reported intraoperatively in five patients. One of the lesions required a wound revision and a secondary suture of the dura 10 days after the primary procedure. The remaining four patients did not show any complications related to the dura lesion and were released from the hospital with proper wound healing conditions.

In **present study** 3 out of 30 patients had dural tears (10%)

It was managed by head low position and tab acetazolamide. No difference in outcome was observed at final follow-up compared to other patients without dural tears.

Weinstein et al[45] (2000) In his study 3 out of 152 random cohort (8%) and 5 out of 238 (10%) observational cohort had Wound infection

Antoniadis A et al (2017) conducted a retrospective study in 121 patients undergoing decompression for LCS in which Three patients developed wound healing disorders that required treatment by wound revision (in mean 20 days postop.) and antibiotic therapy. In two of these patients, a pathogenic agent (Staph. aureus) could be cultivated from intraoperative probes and thus are formally reported as wound infections

In **present study** only 1 patient out of 30 had superficial wound infection It was managed by immediate wound wash and
antibiotics.

Pennal GF, Schatzker J. et al (1971) in their series they operated on 20 patients with lumbar canal stenosis, Recurrence of symptoms 20 months after initial one-level laminectomy was followed by three-level laminectomy, complicated by gross epidural hematoma and profound paraparesis, which gradually recovered almost completely except for persisting bilateral leg discomfort and paresthesias.

Verbiest H et al10 (1977) in their study conducted between 1948 and 1975 147 patients 78 male and 69 females were treated surgically for developmental stenosis of the lumbar vertebral canal, A permanent neural deficit as a result of the surgical procedure was noted in two cases

In present study 6.6% (n=2) had iatrogenic nerve injury diagnosed in immediate post-op which was managed by physiotherapy and vitamin B 12 supplements, completely recovered after a period of 3 to 6 months

Comorbidities.

Burgstaller JM et al[37] (**2016**) In their study it was found that Obese patients can expect clinical improvement after lumbar decompression for DLSS, but the percentage of patients with a meaningful improvement is lower than in the group of patients with underweight, normal weight, and preobese weight at 6 and 12 months.

Gunzburg R et al22 (2003) conducted study which evaluated shortterm psychometric and functional outcomes after conservative decompressive surgery for lumbar canal stenosis. Forty patients had a lumbar laminectomy procedure, of which 36 were available for follow up Fifty percent of the patients reported no co-morbidities, three patients reported diabetes, two rheumatoid arthritis, four cardiac disease, one gout, and six reported various conditions. Calcification of the aorta, identified from CT scan, was noted in 50% of the patients (18/36). There were ten active smokers in the series (four women and six men).

Antoniadis A et al (2017) conducted a retrospective study, 121 patients over the age of 80 (mean age: 82.7 years SD: 2.4 years) with the diagnosis of central spinal canal stenosis The majority of their patients presented with other comorbidities including 35 patients suffering from coronary heart disease, seven from heart valve disease, 63 from arterial hypertension, 15 from diabetes mellitus, eight from chronic obstructive lung disease, 16 from renal insufficiency and two after a cerebrovascular insult. Additionally, 45 patients reported the current use of anticoagulant medication.

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In **present study** out of 30 patients 4 (13%) patients were hypertensive controlled by medication, 4 (13%) had diabetes, 1 (3.3%) had both DM and HTN, 3 (10%) patients had obesity (BMI >30).

Claudication distance

R Nath et al[32] (2012) In the Study conducted by All patients had preoperative claudication distance less than 100 m, but 93.75% patients (*n*=30) had normal gait with walking distance more than 500 m and no claudication symptoms postoperatively.

Sangwan SS et al (2014) in their study the mean±SD for the preoperative claudication distance was 95.2±62.5 m which improved to 582±147.7 m after surgery

Antoniadis A et al (2017) conducted a retrospective study, 121 patients over the age of 80, In their study mean walking distance prior to surgery was reported to be 147 meters (SD± 110 m) with 24 patients reporting a walking distance of less than 50 m. The walking distance improved from 147 to 340 m (SD ±170 m) at follow up time, showing a statistically significant improvement (p <.001)

In **present study** all patients had claudication distance of less than 100 m and post operatively all patients had improved claudication distance with walking distance more than 500m and no claudication

Straight leg raising test

R Nath et al[32] (2012) In their study 93.74% patients (*n*=30) had abnormal straight leg raising test [46.87% patients (*n*=15) had straight leg raising positive below 30° and 46.87% patients (*n*=15) had between 30° and 70°], but postoperatively all patients had normal straight leg raising test.

In **present study** all patients had abnormal straight leg raising test with 19 patients having less than 30^0 and 11 patients having between 30 to 70 degrees. Post operatively all patients had normal straight leg raising

Sensory disturbance

R Nath et al[32] (2012) In their study Sensations were diminished in L4 dermatome in 3 patients, L5 dermatome in 14 patients and S1 dermatome in 8 patients. More than one dermatome was involved in 5 patients. Overall, 20 patients (62.5%) had shown sensory disturbance preoperatively, but postoperatively 19 of these 20 patients recovered normal sensory function.

In **present study** Sensations were diminished in L4 dermatome in 5 patients, L5 dermatome in 12 patients and S1 dermatome in 3 patients. Overall, 20 patients (66.66%) had shown sensory disturbance preoperatively, but postoperatively 19 of these 20 patients recovered normal sensory function.

Postacchini *et al*.[55] (1992) noted bone regrowth in 88% of 40 patients who had laminectomy or laminotomy for spinal stenosis at an average of 8.6 years of follow up. Bone regrowth was noted in all patients with associated spondylolisthesis

In **present study** bone regrowth was not seen in any patients, possible reasons could be short duration of follow up (12months), and wide laminectomy with medial facetectomy as compared to narrow laminotomy in some cases of Postacchini *et al.*

Similarly, literature review by **Moon Soo Park et all (**2015), concluded that Decompressive surgery is the gold standard for the treatment of central or lumbar canal stenosis.

In **presentseries** all 30 patients after surgical intervention improved from leg pain neurogenic claudication, this could be attributed to the fact that all were operated after clinico-radiological correlation and 6 months trial of non-surgical management was given to every
patient.

Farzad Omidi-Kashani et all (2014) in their update review reported that fusion can stabilise the unstable lumbar vertebrae and also eradicate the source of pain originating from the diseased Intervertebral disc or facet joint

5. Summary

The long-term outcomes of decompressive surgery on relief of pain and disability in degenerative lumbar canal stenosis are unclear. The aim of our study was to evaluate the outcome of surgical management of secondary degenerative lumbar canal stenosis and to analyze the effect on outcome variables using Japanese Orthopaedic Association (JOA) score.

Thirty patients of degenerative lumbar canal stenosis managed surgically were included in this study. We excluded patients with congenital lumbar canal stenosis, traumatic LCS, patient with neurological disorders. Mean age of the patients in our study was 51.9 years. There was slight male preponderance with male 16 (53%) and female 14 (47%). Decompressive Laminectomy without instrumentation was performed using standard posterior midline approach. JOA scoring system for low backache was used to assess the patients. The recovery rate was calculated as described by Hirabayashi*et al*. (1981). Surgical outcome was assessed based on the recovery rate and was classified using a four-grade scale: Excellent, improvement of >75%; good, 50- 75% improvement; fair, 25-50% improvement; and poor, below 25% improvement.

At 1-year followup 46.6% patients showed excellent outcome, 46% showed good outcome, and 7.4% showed fair outcome. No patient had poor outcome. Outcome of the patients improved as the time after surgery increased till 1 year and was sustained thereafter till the last follow-up.

Operative treatment in patients of degenerative lumbar canal stenosis yields excellent results as observed on the basis of JOA scoring system.

No patient got recurrence of symptoms of nerve compression.

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6. Conclusion

- This study was carried out in 30 patients to observe the efficiency of Decompressive Laminectomy in management of Lumbar canal stenosis.
- Surgical management of lumbar canal stenosis gives an excellent relief of symptoms and good functional outcome
- All patients had improved claudication distance post-operatively
- All patients had drastic improvement in straight leg raising post-operatively
- No correlation was found between gender and functional outcome
- No correlation was found between outcome and Obesity of patient.
- All patients had improved mobility decreasing their family burden.

References

[1] Verbiest H. A radicular syndrome from developmental spinal stenosis. J Bone Joint Surg [Br] 1954; 36: 230-7.
[2] GATHIER JC. A case of absolute stenosis of the lumbar vertebral canal in adults. Acta Neurochir (Wien).1959; 7: 344-9. doi: 10.1007/BF01407975. PMID: 13826847
[3] Epstein, J. A., Epstein, B. S., and Lavine, L. (1962). Nerve root compression associated with narrowing of the lumbar spinal canal. J. Neurol. Psychiat., 25, 165-176.
[4] Auquier L, Hirsch JF, Paolaggi JB, Rouques C, Ghozian R. Stenosis of the lumbar spinal canal and sciatic claudication. A study of 29 cases, thirteen of which were operated upon. Ann Rheum Dis.1970 Nov; 29 (6): 691-2. doi: 10.1136/ard.29.6.691-e. PMID: 5483304; PMCID: PMC1010621
[5] Teng, P., and Papatheodorou, C. (1963). Myelographic findings in spondylosis of the lumbar spine. Brit. J. Radiol., 36, 122-128.
[6] Highman, J. H. Complete myelographic block in lumbar degenerative disease. Clin. H, adiol., 16: 106-111, 1965.
[7] Auquier L, Hirsch JF, Paolaggi JB, Rouques C, Ghozian R. Stenosis of the lumbar spinal canal and sciatic claudication. A study of 29 cases, thirteen of which were operated upon. Ann Rheum Dis.1970 Nov; 29 (6): 691-2. doi: 10.1136/ard.29.6.691-e. PMID: 5483304; PMCID: PMC1010621.
[8] Pennal GF, Schatzker J. Stenosis of the lumbar spinal canal. Clin Neurosurg.1971; 18: 86-105. doi: 10.1093/neurosurgery/18. cn_suppl_1.86. PMID: 9015635.
[9] McKinley LM, Davis GL. The narrow lumbar spinal canal or lumbar spinal stenosis. Clin OrthopRelat Res.1976 Jan-Feb; (114): 319-25. PMID: 1261130
[10] Verbiest H. Results of surgical treatment of idiopathic developmental stenosis of the lumbar vertebral canal. A review of twenty-seven years' experience. J Bone Joint Surg Br.1977 May; 59 (2): 181-8. doi: 10.1302/0301-620X.59B2.141452. PMID: 141452
[11] Choudhury AR, Taylor JC. Occult lumbar spinal stenosis. J NeurolNeurosurg Psychiatry.1977 May; 40 (5): 506-10. doi: 10.1136/jnnp.40.5.506. PMID: 894321; PMCID: PMC492726.
[12] Kawai S, Hattori S, Oda H, Yamaguchi Y, Yoshida Y. Enlargement of the lumbar vertebral canal in lumbar canal stenosis. Spine (Phila Pa 1976).1981 Jul-Aug; 6 (4): 381-7. doi: 10.1097/00007632-198107000-00009. PMID: 7280827
[13] Gooding GA, Boggan JE, Weinstein PR. Intraoperative sonography during lumbar laminectomy: work in progress. AJNR Am J Neuroradiol.1984 Nov-Dec; 5 (6): 751-3. PMID: 6437177; PMCID: PMC8333652.
[14] Louis R, Nazarian S. Lumbar stenosis surgery: the experience of the orthopaedic surgeon. ChirOrgani Mov.1992 Jan-Mar; 77 (1): 23-9. English, Italian. PMID: 1587157.
[15] Deen HG Jr, Zimmerman RS, Lyons MK, Wharen RE Jr, Reimer R. Analysis of early failures after lumbar decompressive laminectomy for spinal stenosis. Mayo Clin Proc.1995 Jan; 70 (1): 33-6. doi: 10.1016/S0025-6196 (11) 64662-4. PMID: 7808047.
[16] Poletti CE. Central lumbar stenosis caused by ligamentum flavum: unilateral laminotomy for bilateral ligamentectomy: preliminary report of two cases. Neurosurgery.1995 Aug; 37 (2): 343-7. doi: 10.1227/00006123-199508000-00025. PMID: 7477792.
[17] Hanakita J, Suwa H, Mizuno M. Surgical treatment of lumbar canal stenosis in the elderly. Neurol Med Chir (Tokyo).1999 Jul; 39 (7): 519-22; discussion 522-3. doi: 10.2176/nmc.39.519. PMID: 10437380
[18] Kawaguchi Y, Kanamori M, Ishihara H, Ohmori K, Fujiuchi Y, Matsui H, Kimura T. Clinical symptoms and surgical outcome in lumbar spinal stenosis patients with neuropathic bladder. J Spinal Disord.2001 Oct; 14 (5): 404-10. doi: 10.1097/00002517-200110000-00006. PMID: 11586140.
[19] Matsumoto T, Yoshida M, Yamada H, Kurimoto K, Tamaki T. Lumbar canal stenosis caused by hypertrophy of the posterior longitudinal ligament: case report. Spine (Phila Pa 1976).2001 Dec 15; 26 (24): E576-9. doi: 10.1097/00007632-200112150-00028. PMID: 11740375
[20] Yücesoy K, Ozer E. Inverse laminoplasty for the treatment of lumbar spinal stenosis. Spine (Phila Pa 1976).2002 Jul 1; 27 (13): E316-20. doi: 10.1097/00007632-200207010-00021. PMID: 12131752.
[21] Yukawa Y, Lenke LG, Tenhula J, Bridwell KH, Riew KD, Blanke K. A comprehensive study of patients with surgically treated lumbar spinal stenosis with neurogenic claudication. J Bone Joint Surg Am.2002 Nov; 84 (11): 1954-9. doi: 10.2106/00004623-200211000-00008. PMID: 12429755
[22] Gunzburg R, Keller TS, Szpalski M, Vandeputte K, Spratt KF. Clinical and psychofunctional measures of conservative decompression surgery for lumbar spinal stenosis: a prospective cohort study. Eur Spine J.2003 Apr; 12 (2): 197-204. doi: 10.1007/s00586-002-0479-6. Epub 2002 Nov 30. PMID: 12709858; PMCID: PMC3784854.

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[23] Trouillier H, Birkenmaier C, Kluzik J, Kauschke T, Refior HJ. Operative treatment for degenerative lumbar spinal canal stenosis. Acta Orthop Belg.2004 Aug; 70 (4): 337-43. PMID: 15481418.
[24] Kawaguchi Y, Kanamori M, Ishihara H, Kikkawa T, Matsui H, Tsuji H, Kimura T. Clinical and radiographic results of expansive lumbar laminoplasty in patients with spinal stenosis. J Bone Joint Surg Am.2005 Sep; 87 Suppl 1 (Pt 2): 292-9. doi: 10.2106/JBJS. E.00211. PMID: 16140802.
[25] Zheng F, Farmer JC, Sandhu HS, O'Leary PF. A novel method for the quantitative evaluation of lumbar spinal stenosis. HSS J.2006 Sep; 2 (2): 136-40. doi: 10.1007/s11420-006-9006-3. PMID: 18751826; PMCID: PMC2488171.
[26] Weiner BK, Patel NM, Walker MA. Outcomes of decompression for lumbar spinal canal stenosis based upon preoperative radiographic severity. J OrthopSurg Res.2007 Mar 8; 2: 3. doi: 10.1186/1749-799X2-3. PMID: 17346339; PMCID: PMC1828049
[27] Haro H, Maekawa S, Hamada Y. Prospective analysis of clinical evaluation and self-assessment by patients after decompression surgery for degenerative lumbar canal stenosis. Spine J.2008 Mar-Apr; 8 (2): 380-4. doi: 10.1016/j. spinee.2007.01.010. Epub 2007 Mar 13. PMID: 17433781.
[28] Kleinstück FS, Grob D, Lattig F, Bartanusz V, Porchet F, Jeszenszky D, O'Riordan D, Mannion AF. The influence of preoperative back pain on the outcome of lumbar decompression surgery. Spine (Phila Pa 1976).2009 May 15; 34 (11): 1198-203. doi: 10.1097/BRS.0b013e31819fcf35. PMID: 19407677.
[29] Safak AA, Is M, Sevinc O, Barut C, Eryoruk N, Erdogmus B, Dosoglu M. The thickness of the ligamentum flavum in relation to age and gender. Clin Anat.2010 Jan; 23 (1): 79-83. doi: 10.1002/ca.20883. PMID: 19941359.
[30] Schulte TL, Schubert T, Winter C, Brandes M, Hackenberg L, Wassmann H, Liem D, Rosenbaum D, Bullmann V. Step activity monitoring in lumbar stenosis patients undergoing decompressive surgery. Eur Spine J.2010 Nov; 19 (11): 1855-64. doi: 10.1007/s00586-010-1324-y. Epub 2010 Feb 26. PMID: 20186442; PMCID: PMC2989265

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