Evaluation of Degenerative Lumbar Disc Surgeries

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Abstract

Background: Back pain has been known since the start of written history, probably the first report of back pain and sciatica can be found in an ancient text, the so-called Edwin Smith Surgical Papyrus presumably written around 1550 B.C.[1] Although backache (with or without sciatica) is a benign often self -limiting condition (Macnab). [2] The cost of both time lost from work (with loss of productivity) and medical care, as well as the cost of litigation and disability claims, make back pain an industry unto itself.

Purpose: The main purpose of this study was to evaluate the clinical, radiological outcome of the lumbar disc patients managed surgically and to compare the results of different surgeries performed.

Methods: This study was prospective, non-randomized, cohort study it was carried out in the Department of Orthopaedics, Acharya Vinoba Bhave Rural Hospital, Wardha, between August 2013 – 2015. Patients with more than 18 years were included with persistent bothersome sciatic pain, despite conservative management for a period of 6-12 weeks. All the patients with progressive neurological involvement during a period of conservative treatment. All the patients with cauda equina syndrome or impending cauda equina syndrome.

Results: Out of total 67 patients the mean age was 49.85±8.75 years ranging from 40 to 72 years. Male gender was predominantly forming 66% of the sample size whereas 34% of females. All the patients had radicular pain, 26 out of 67 patients had left sided radiculopathy and right-sided radiculopathy was observed in 21 patients whereas 20 patients had bilateral radiculopathy. After MRI 34 patients had extrusion of disc, whereas 17 patients showed sequestrated disc, protrusion of disc was observed in 12 patients, whereas disc bulge was observed in 4 patients. 42% of patients were operated by laminectomy, 33 % patients were operated by microscopic discectomy and minimum 25% of patients were operated with microendoscopic discectomy. L4-L5 level was the most common level to get involved. Mean Pre-operative VAS score for male patients was 6.64 and female patients was 6.78, which was reduced to 3.14 and 3.48 respectively after 6 months of operative management. Mean Pre-operative Oswestery score for male patients was observed to be 44.05 and female patients was 44.87, which was reduced to 24.95 and 27.83 respectively after 6 months of operative management. Complications in all three surgeries were observed.

Conclusion: Minimally invasive techniques in all areas of surgery have gained momentum in recent years. Spinal surgery has been no exception. Unfortunately, minimally invasive techniques have often been equated with minimally effective procedures. We understand that the micro endoscopic discectomy and microscopic discectomy techniques are superior to the standard discectomy technique for the treatment of single level lumbar disc herniation's with regard to pain relief, clinical outcome and functional outcome, volume of blood loss, systemic repercussions, and duration of hospital stay. However, technical expertise and learning curve of the technique could be the limitation. Minimally invasive surgeries are cost-effective treatment for lumbar herniated discs. Results and complications were comparable with those associated with standard discectomy techniques. Patient satisfaction was high, and a cost savings was realized.

Keywords: Degenerative, Lumbar Spine, Disc Surgeries, Microscopic Discectomy, Laminectomy, Decompression

Access this article online	
Quick Response Code:	Website: www.innovativepublication.com
	DOI: 10.5958/2395-1362.2016.00009.8

Introduction

The first published report of lumbar disc herniation with radiculopathy was written by Mixter and Barr in 1934. Surgical treatment was not widespread until the 1950s. Today, lumbar discectomy is one of the most commonly performed elective operations. Lumbar disc disease accounts for a large amount of lost productivity in the workforce in the Indian population. Although most people experience back pain during their lifetime, only a fraction experience lumbar radiculopathy or sciatica as a consequence of root compression or irritation. Almost 5% of males and 2.5% of females experience sciatica at some time in their lifetime.

In the industrialized countries, back pain today is the second most common reason for seeking medical care.[3] Everybody belonging to this group of 'BACKPAIN' wants an answer to their sufferings and in process the Governments health care budget's share for backache goes up to billions per year and increasing year after year. The economic burden of spinal disorders includes:

1) Direct - concern medical expenditure

2) Indirect - consist of lost work output attributable to a reduced capacity for activity, and result from lost productivity.
3) Intangible costs are the most difficult to estimate. Intangible costs include psychosocial burdens resulting in reduced quality of life, such as job stress, economic stress, family stress, and suffering. The direct and indirect costs are considerable and their management utilizes a significant part of the gross national product of many countries. However, back pain has a severe impact on the individual, families, and society. [4]

When a fragment of nucleus herniates, it irritates and/or compresses the adjacent nerve root. This can cause the pain syndrome known as sciatica and, in severe cases, dysfunction of the nerve.

Most lumbar disc herniation's (lumbar disc diseases) are preceded by bouts of varying degrees and duration of back pain. In many cases, an inciting event cannot be identified. Pain eventually radiates into the leg. It may be characterized as achy, burning, or similar to an electrical shock and is often described as a shooting or stabbing pain. The distribution of the leg pain is somewhat dependent on the level of nerve root irritation.

On examination, patients may be neurologically normal, may have a profound radiculopathy, or may even demonstrate a cauda-equina syndrome. A positive straight-leg raising sign is almost always present. However, a crossed straight-leg raising sign may be even more predictive of a lumbar disc herniation (lumbar disc disease). A disc herniation (lumbar disc disease) most frequently irritates the displaced nerve root.

Aim & Objective

The aim of the study was to evaluate clinical, functional and radiological outcome of lumbar disc surgeries and to compare the results of different surgeries performed for lumbar disc.

Method and Material

The present study was carried out in the Department of Orthopaedics, Acharya Vinoba Bhave Rural Hospital, Wardha, between August 2013 – 2015. The study design was prospective, non-randomized, cohort study.

Patients with more than 18 years were included with persistent bothersome sciatic pain, despite conservative management for a period of 6-12 weeks. All the patients with progressive neurological involvement during a period of conservative treatment. All the patients with cauda equina syndrome or impending cauda equina syndrome.

Patients with disc prolapse at more than one level, operated earlier for the disc pathology, who required spinal fusion surgeries and patients with associated vertebral fracture, infective, or neoplastic disease of the spine were excluded

Observation & Results

Out of total 67 patients the mean age was 49.85±8.75 years ranging from 40 to 72 years. The distribution curve was bell shaped with rounded peak at fourth decade and tapering ends at extremes of age. Maximum patients were from fourth decade of life. The proportion of patients in different age group was analyzed using chi-square test. Male gender was predominantly forming 66% of the sample size whereas 34% of females.

The mean age for male patients was found to be 49.84±8.58 years, which was nearly same for the female patients, mean age 49.87±9.25 years. Minimum age for female was 40 years and maximum 70 years and minimum age for male was 40 and maximum 72 years. All the patients had radicular pain, 26 out of 67 patients had left sided radiculopathy and right-sided radiculopathy was observed in 21 patients whereas 20 patients had bilateral radiculopathy.

MRI findings of the patients in the study were observed, 34 patients had extrusion of disc, whereas 17 patients showed sequestrated disc, protrusion of disc was observed in 12 patients, whereas disc bulge was observed in 4 patients. Changes in MRI of the patients were observed, 39 patients had ligamentum flavum hypertrophy, whereas 38 patients had facetal hypertrophy, modic changes were observed in 25 patients and 9 patients showed pars defect without listhesis.

Maximum 42% of patients were operated by laminectomy, 33% patients were operated by microscopic discectomy and minimum 25% of patients were operated with microendoscopic discectomy. The Proportion of number of surgeries to type of surgery was found to be significant.(Chi-square test $p=0.001 <0.05$).

Most of the surgeries were done in the patients of age group of fourth decade. 50% of all type of surgeries was done in fourth decade. Microscopic group had patients with minimum age of 40 and maximum age of 70. Whereas, microendoscopicscopic group had youngest patient of age 40 years and eldest 61years. However the distribution of number of surgeries in different age group was statistically significant. (chi square test $p=0.0001(p<0.05)$.

Laminectomy group patients had higher mean age 54.25±9.656 years as compared to microscopic and micro endoscopic surgery group 46.5±6.940 and 46.95±6.088 years respectively. The mean age of three groups was compared and the difference was found to be statistically significant.(Analysis of variance $p=0.01(p<0.05)$.

When comparison between time period of symptoms and type of surgery was done it was found that the patients who had undergone microendoscopic

discectomy had less time between onset of symptoms and surgery which was 13.94±6.28 months as compared to microscopic discectomy which was 19.36±12.11 months and for standard laminectomy it was 24.14±12.80 months. The difference was found to be significant. (one way ANOVA test p=0.016 p<0.05).

L4-L5 level was the most common level to get involved and accounted for 72% of total single level surgeries. L5-S1 accounted for 25% of total surgeries whereas L3-L4 level surgeries accounted for only 3% of total patients. However, the distribution was found to be significant. (chi- square test p=0.025; p<0.05).

The mean VAS scores of pre-operative, post-operative and 6 months follow up VAS scores were compared, there was significant reduction in the postoperative VAS scores in all three surgeries and the reduction in mean VAS score was maximum in microendoscopic discectomy by 4.18, followed by microscopic discectomy by 3.37 and laminectomy by 3.04. However, the difference was found significant. (One way ANOVA test p=0.0001(p<0.05).

The mean oswestery scores for pre-operative, post-operative and 6 months follow up were compared. Maximum reduction in mean Oswestery score was found in microendoscopic discectomy by 22.71, for microscopic discectomy score reduced by 17.45 and minimum reduction in mean Oswestery score was found in standard laminectomy by 16.50. However, the difference was found significant in all the thre surgeries. (one way ANOVA p=0.0001 p<0.05).

The mean hospital stay for microendoscopic discectomy was 1.82±0.72 days, for laminectomy group patients was 6.46±2.15 days, whereas for microscopic discectomy hospital stay was 4.23±0.75 days. The mean hospital stay in all three surgeries was compared. The difference was statistically significant (one way ANOVA test p=0.016 (p<0.05).

A Complications in all three surgeries were observed, laminectomy had maximum number of complications, 6 patients did not had pain relief, dural tear was observed in 3 patients, however 3 patients had superficial surgical site infections, discitis was observed in 2 patients, however 1 patient had reherniation. Whereas, only 2 patients did not have pain relief after microscopic surgery, superficial infection was observed in 1 patient, however 1 patient had discitis and reherniation was observed in 1 patient. However, only 1 patient did not relieve of pain after microendoscopic discectomy.

Table 1: Age description

Statistics	
Age	
Number of patients	67
Mean	49.85
Std. Error of Mean	1.069
Std. Deviation	8.751
Variance	76.583
Range	32
Minimum	40
Maximum	72

Graph 1: shows distribution of age

Table 2: Shows Gender Wise Distribution According to Mean Age

Group Statistics						p value
	Gender	**Number of patients**	**Mean**	**Std. Deviation**	**Std. Error Mean**	
Age	Male	44	49.84	8.586	1.294	.990 (p>0.05)
	Female	23	49.87	9.255	1.930	

Graph 2: Shows Distribution of Radicular Symptoms

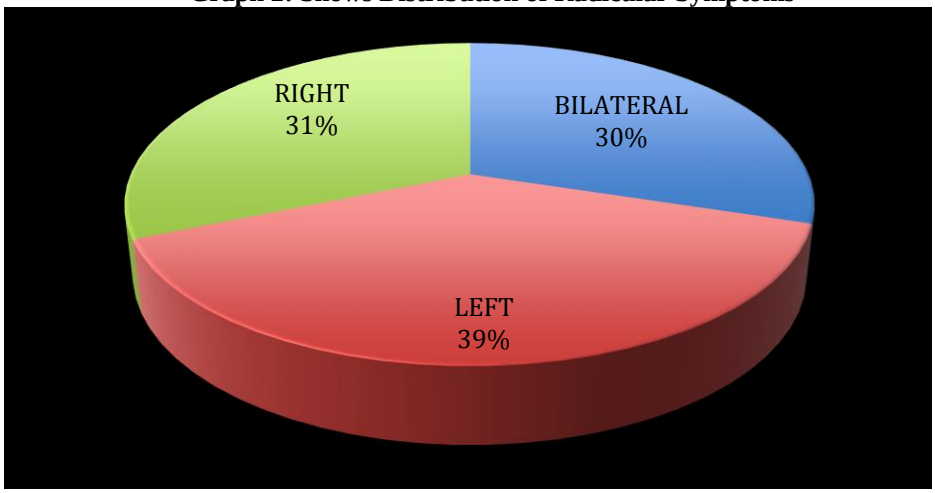


Table 3: Distribution of patients according to stages of herniated disc

Herniated Disc		
	Frequency	**Percent**
Disc Bulge	4	6
Protrusion of Disc	12	18
Extrusion of Disc	34	51
Sequestrated Disc	17	25
Total	67	100

Graph 3: Changes in MRI

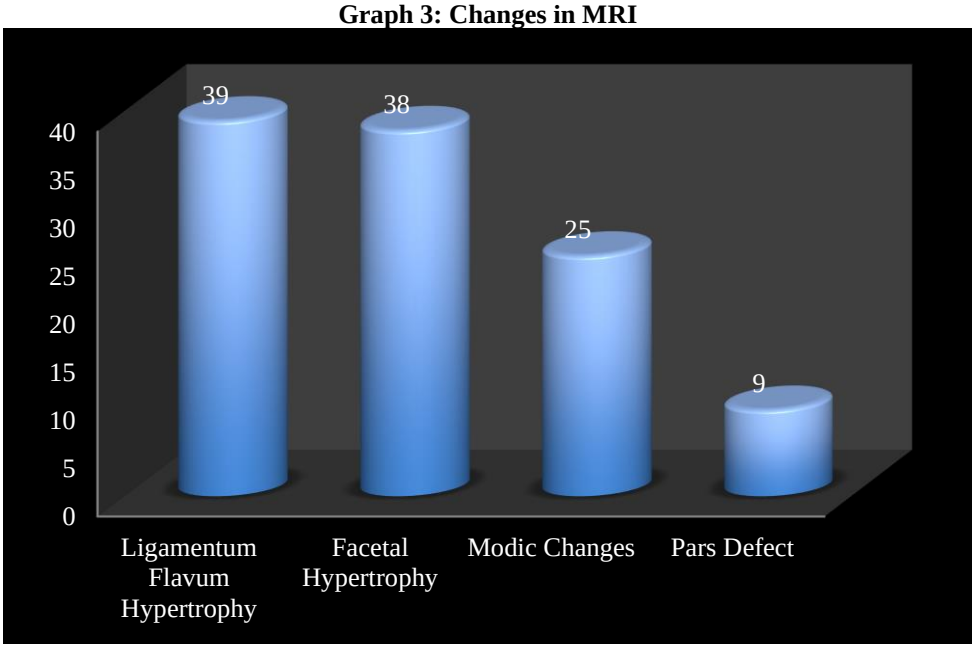


Table 4: Distribution of patients according to types of surgeries

Type of Surgery	Number of patients	Percentage
Laminectomy	28	42
Microendoscopic discectomy	17	25
Microscopic discectomy	22	33
Total	67	100

Table 5: Correlation between different age group with type of surgeries

Age group	Laminectomy	Microendoscopic discectomy	Microscopic Discectomy	Total	p value
31-40	1	3	3	7	0.0001
41-50	14	9	16	39	
51-60	5	4	2	11	
61-70	7	1	1	9	
71-80	1	0	0	1	
Total	28	17	22	67	

Graph 4: shows correlation between type of surgery and mean age

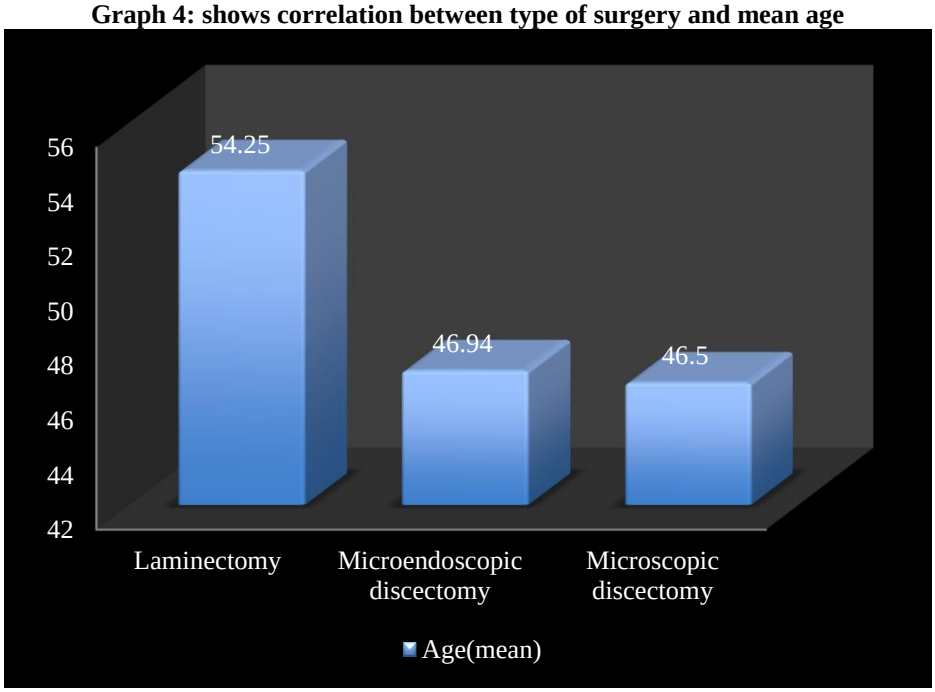


Table 5: Distribution of Level of operation among total number of patients

Level of operation	Number of patients	Percentage
L3-L4	2	3
L4-L5	48	72
L5-S1	17	25
Total	67	100

Table 6: Correlation between type of surgery and pre-operative, post-operative and 6 months follow up VAS Score

Descriptives		Number of patients	Mean	Std. Deviation	p value
Pre-operative VAS	Laminectomy	28	7.36	.678	.000
	Microendoscopic discectomy	17	6.18	.728	.000
	Microscopic discectomy	22	6.23	.612	.000
Post-operative VAS	Laminectomy	28	6.57	.959	.000
	Microendoscopic discectomy	17	4.65	1.272	.000
	Microscopic discectomy	22	5.18	.795	.000
6 months follow up VAS	Laminectomy	28	4.32	1.090	.000
	Microendoscopic discectomy	17	2.00	1.173	.000
	Microscopic discectomy	22	2.86	1.082	.000

Graph 5: shows correlation between type of surgery and mean pre-operative, post-operative and 6 months follow up VAS Scores

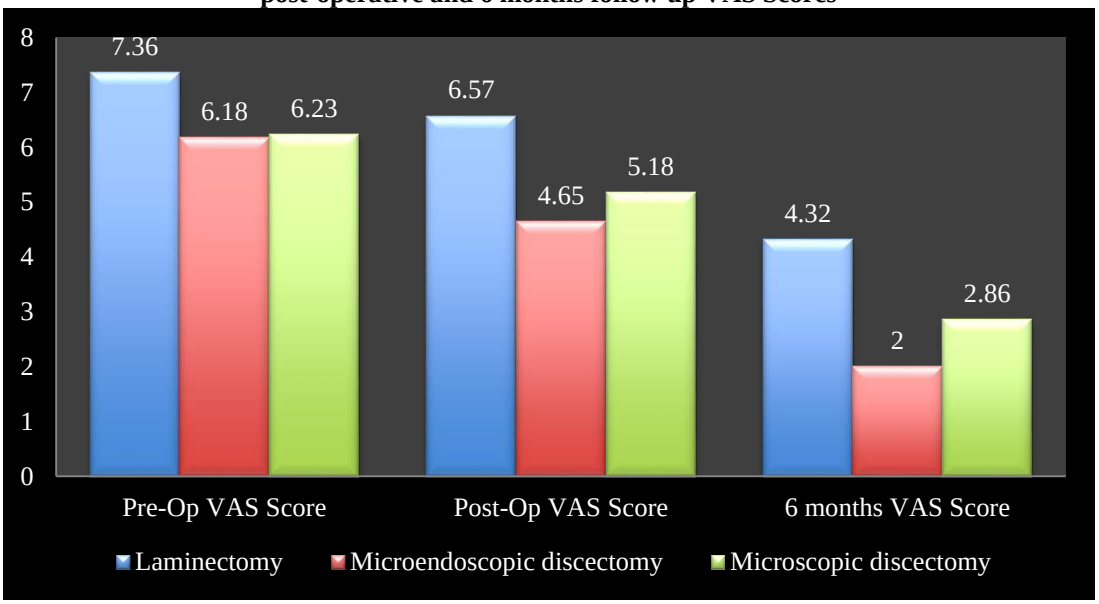
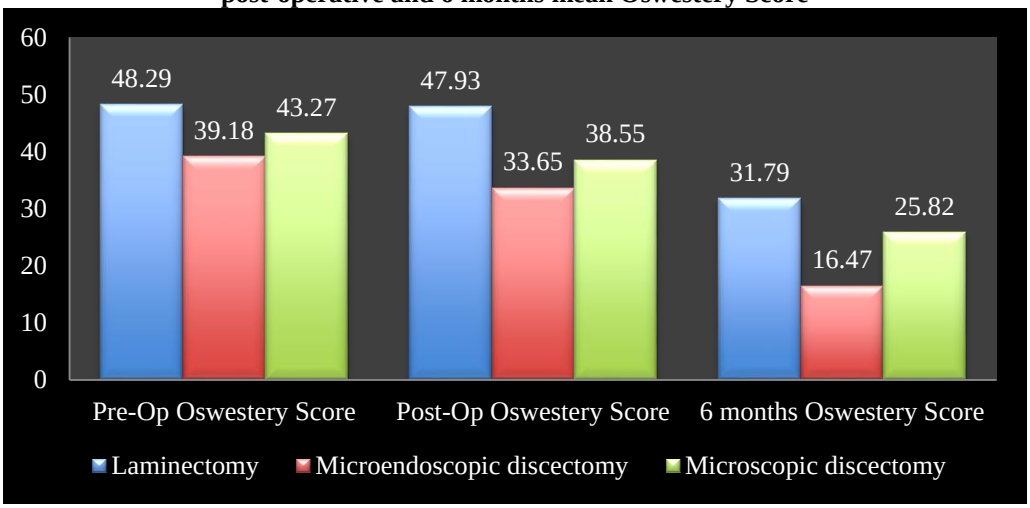


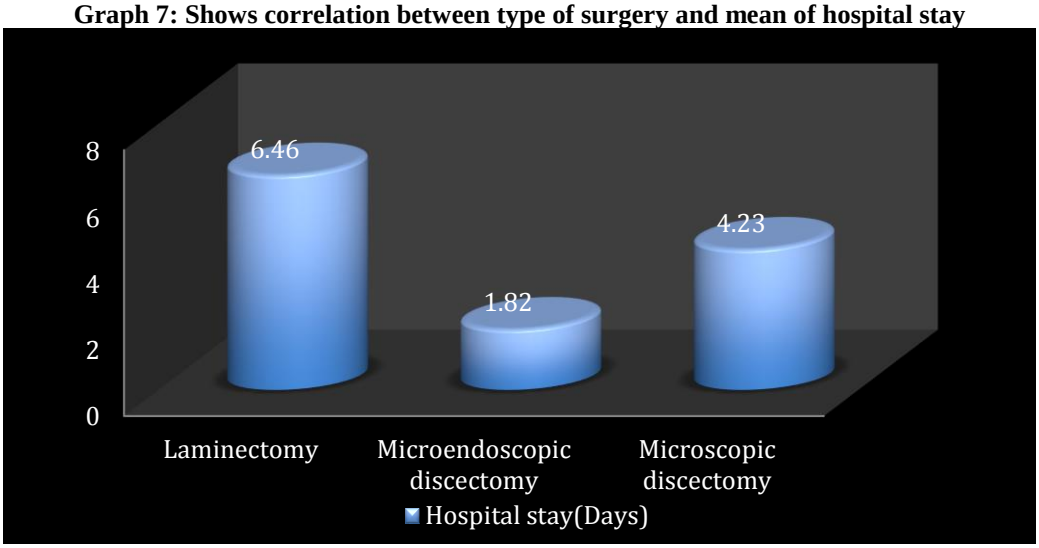
Table 7: Correlation between type of surgery and pre-operative, post-operative and 6 months Oswestery Score Score

		Number of patients	Mean	Std. Deviation	p value
pre operative oswestery score	Laminectomy	28	48.29	4.545	0.0001
	Microendoscopic discectomy	17	39.18	4.004	0.0001
	Microscopic discectomy	22	43.27	3.120	0.0001
post operative oswestery score	Laminectomy	28	47.93	10.059	0.0001
	Microendoscopic discectomy	17	33.65	5.623	0.0001
	Microscopic discectomy	22	38.55	3.912	0.0001
6 months oswestery score	Laminectomy	28	31.79	11.396	0.0001
	Microendoscopic discectomy	17	16.47	7.922	0.0001
	Microscopic discectomy	22	25.82	7.195	0.0001

Graph 6: Shows correlation between type of surgery and pre-operative, post-operative and 6 months mean Oswestery Score



Graph 7: Shows correlation between type of surgery and mean of hospital stay



Graph 8: Shows correlation between mean pre-operative and mean 6 months values of VAS and Oswestery scores

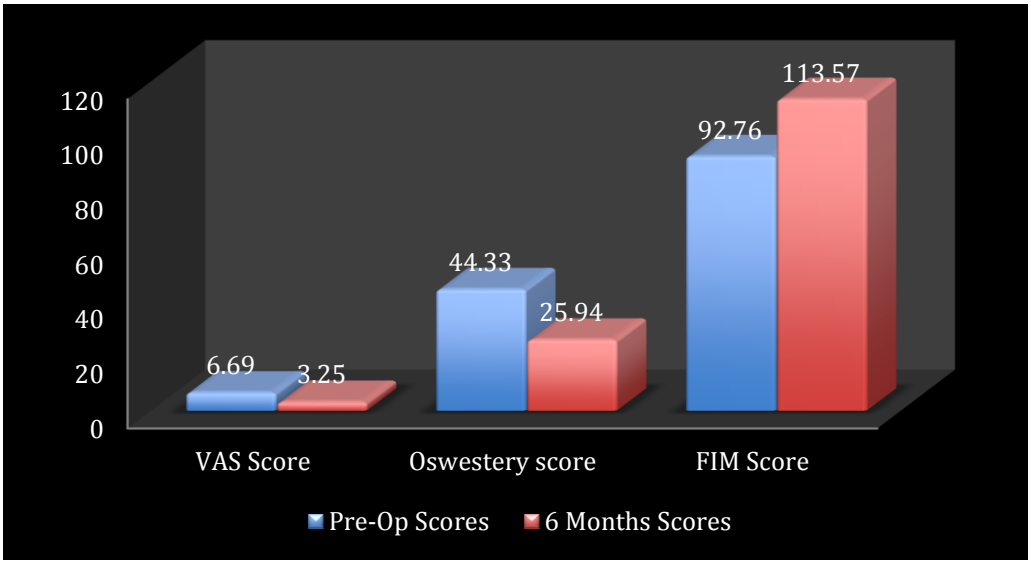
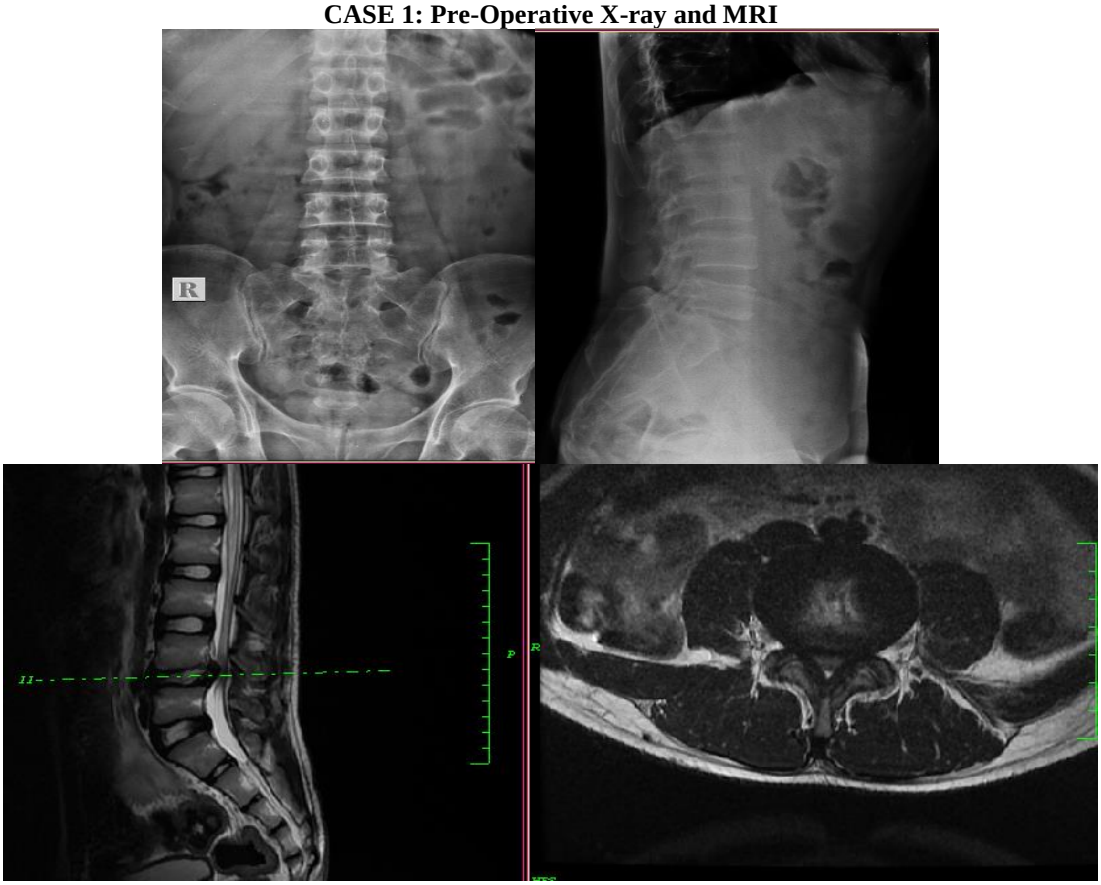


Table 8: Distribution of complications among three surgeries

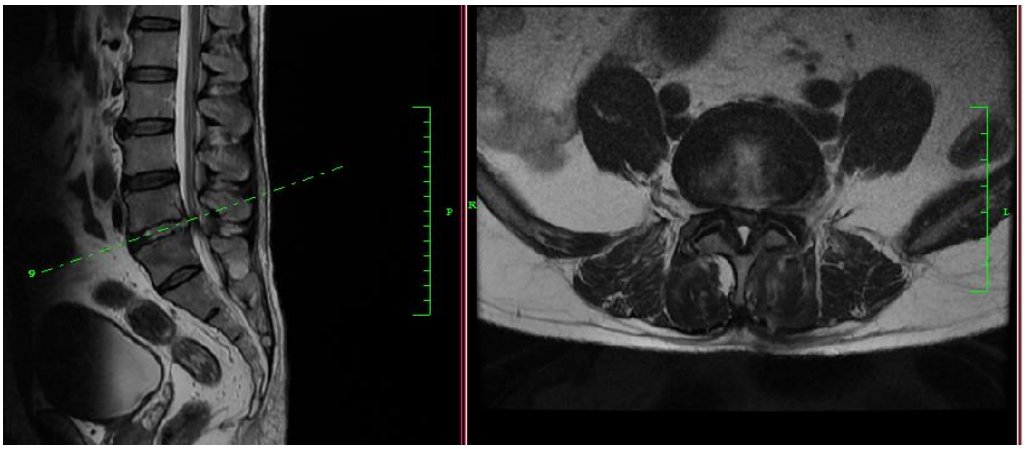
	Complications				
	Pain Not Relieved	**Dural Tear**	**Superficial Infection**	**Discitis**	**Reherniation**
Laminectomy	6	3	3	2	1
Microscopic Discectomy	2	0	1	1	1
Microendoscopic Discectomy	1	0	0	0	0

Radiological and Clinical Photograph

CASE 1: Pre-Operative X-ray and MRI



Case 2: Pre Operative X-ray and MRI



Discussion

The mean age of our study group was 49.85±8.75 years, which is comparable to other studies. Wang et al.[5], Righesso et al.[6] and Mariscalco et al.[7] observed comparable mean age in their study. The explanation to this can be that, the young- middle age group of population are the most productive age of the society and indulge in outdoor activities, which involve heavy strenuous work.

Age group and gender distribution were correlated and we observed that male had a mean age of 49.84±8.58 years and female patients had a mean age of 49.87±9.25 years. However the difference was statistically insignificant.

VAS score is one of the leading indicators for verifying the effects of interventions. However, low back pain (LBP) has multiple causes, while sciatica is a unique symptom of Lumbar disc herniation. So sciatica could always be relieved after the surgery. Thus, compared with LBP, the relief of sciatica (leg pain) would be a more appropriate choice to evaluate the effects of the surgery.

In present study microendoscopic discectomy shows maximum reduction of VAS score in comparison to microscopic and laminectomy surgery which is comparable to international literature. To support our study, Ryang et al.[8], Tulberg et al.[9], had similar findings for microendoscopic discectomies. Katayama et al.[10], Teli et al.[11] observed that patients VAS scores were as low as normal. Alistair et al.[12], Tulberg et al.[9] observed same results from microscopic discectomy. For laminectomy Alistair et al.[14], Fritzell et al.[13] observed comparable results with the present study. Righesso et al.[4] observed zero VAS score value in their both type of surgical patients.

Turner J A et al.[14] performed a study and observed that success rate in terms of Oswestry Disability Index of the microendoscopic discectomy was as high as 90%; excellent results were obtained in 80% patients in microscopic discectomy patients. However, in laminectomy patients, the success rate was 70% only. In a historical meta-analysis, the success rate was 64% only[15]. Our results in terms of Oswestry Disability Index were much better as compared with study done by Iguchi et al[16] on traditional open laminectomy, in which only 56.7% patients obtained good or excellent results.[17]

With MED, the bony destruction was limited at the interlaminar window and most of the facet joints are preserved. Our study confirmed that MED is a good surgical option to decompress the herniation while preserving the intrinsic stability. Ng et al [18] found a statistically significant increased risk of poor outcome for Oswestry Disability Index and Low Back Pain Outcome Score (but not for visual analog scale) if the duration of sciatica exceeded 12 months prior to surgery. In our study after 6 months Oswestery score is 16.47 which is comparable to international studies, Ulf S Nerland et al[19], John A et al[20].

In the present study the reduction of Oswestry score was significant for microscopic discectomy too. Bhavuk Garg et al[21] found 6 months follow up Oswestry score 14.05 which is comparable to our study 25.82±7.19. In microscopic discectomy small incision and less muscle injury and small fenestration window accounts for less instability and soft tissue damage with better healing and early mobilization when compared with open laminectomy.

Oswestery score for standard laminectomy has been studied in literature. Sun Zhuoran et al.[22] and Ulf S Nerland et al.[23] observed significant reduction in open Laminectomy, present study shows comparable results 31.79±11.40 with Sun Zhuoran et al.[22] and Ulf S Nerland et al.[23], Oswestery score after 6 months. However, Memduh et al.[24] observed after open laminectomy reduction of oswestery scores was average. Our results were comparable to Sun Zhuoran et al [22] and Ulf S Nerland et al[23].

In our study 72% of the patients had disc prolapsed at L4-L5 level which is comparable worldwide with other studies like Cao Peng et al.[9] shows(65%), Bhavuk Garg et al.[21] (75%) found single level pathology at L4-L5 level. L4-L5 level is most vulnerable for disc herniation. Pradeep K. Singh et al.[25] concludes that the common level for disc herniation involve L4-L5 of lumbar spine due to weak inherent property of annulus

fibrosus and posterior longitudinal ligament at L4-L5 level.

As a general rule duration of symptoms was directly proportional to outcome of surgery. The patients who had surgery within 12 months of symptomatology do better. A recent prospective study by Rihn et al.[26] in (Spine Patient Outcomes Research Trail [SPORT])[27] concludes that patient with symptoms duration of 6 months or less had better outcomes (with conservative or operative treatment) compared to patients with symptoms duration of more than 6 months. However, there were significant baseline differences in the two groups. These differences included the type of herniation of nucleus pulposus, the presence of neurological deficit, operative time, percentage of patients who reported depression, percentage of patients who perceived that the problem was getting worse and percentage of patients who had a preference for surgical treatment. Silverplats et al.[28] found duration of leg pain of <6 months and duration of sick leave of <2 months was related to better outcome. Hurme et al.[29] found long duration of preoperative sciatica (more than 2 months) was a predictor of poor results.

Although there was no randomization but we found in our present study that the patients who presented early in 13.94±6.28 months had undergone microscopic discectomy as compared to microscopic discectomy for which patients presented in 19.36±12.11 months and laminectomy for which patients presented in 24.14± 12.80 months.

Duration of hospital stay was primarily dependent on postoperative mobilization of the patients. We mobilized our patients as early as 1.82 days (mean) for the patients who had MED, which was comparable to many studies whereas for fenestration surgeries and standard laminectomy it was 4.23 and 6.46 respectively. Patients were discharged same day after post-op mobilization.

Data regarding hospital stay were available in eight studies including Ryang et al[8], Tulberg et al.[9], Katayama et al[10], Righesso et al[6], all reported a significant difference between the MED and laminectomy group. The length of hospital stay varies widely. In different reports the post-operative stay ranged from 1.1 to 8.5 days[30].

In our study we observed that ligamentum flavum hypertrophy was present in 58% of patients, facetal hypertrophy in 57%, modic changes in 37% and pars defect in 13% of patients. Brinjikji W et al.[31] concludes that MR imaging evidence of disc bulge, degeneration, extrusion, protrusion, Modic changes, and spondylolysis are more prevalent in adults 50 years of age or younger with back pain compared to asymptomatic individuals. Takatalo J et al.[32] concludes that herniation's were most likely in the subjects with recent onset or persistent (3-yr period) low back symptoms, when compared in subjects with no symptoms.

This is in keeping with the 1986 statement on the role of micro discectomy in relation to standard discectomy in which Hudgins wrote, "My concept of micro-lumbar discectomy is that it consists of the ability to do all the surgical maneuvers of standard partial hemi laminectomy that have stood the test of time, but through a much smaller incision." It is important that the complication rate associated with the microscopic lumbar discectomy is comparable with that in standard micro discectomy series. In our current series there was a 5.9% wound infection rate, a 4.4% discitis rate, and a 4.4% dural tear rate. These rates compared favorably with those reported by Williams et al.[33] (0, 0, and 0%, respectively), Ebling et al.[34] (3.3, 0.8, and 3.9%, respectively), Caspar, et al[35]. (0.7, 0.7, and 6.7%, respectively), and Pappas, et al [36],(7.2, 0.5, and 1%, respectively).

Our reoperation rate was 3%. This included one recurrence of disc prolapsed at the same level and same side, whereas one patient had herniation on contralateral side of same level and were managed conservatively. Whereas, one patient developed refractory backache and required fusion eventually. The aforementioned authors reported reoperation rates of 14, 5.5, 5.7, and 3%, respectively.

In our study success rate was very high for all three surgeries accounting for 92% in total. Whereas, Williams[33], Ebling, et al[34], Caspar, et al[35], and Findlay et al[37], have reported success rates ranging from 73 to 86%.

SUMMARY

The mean age was 49.85±8.75 years ranging from 40 to 72 years. Maximum patients were from fourth decade of life. Male gender was predominant. The mean age for male patients was found to be 49.84±8.58 years. All the patients had radicular pain, 26 out of 67 patients had left sided radiculopathy and right-sided radiculopathy was observed in 21 patients whereas 20 patients had bilateral radiculopathy. Most of the surgeries were done in the patients of age group of fourth decade.

Maximum 42% of patients were operated by laminectomy, 33 % patients were operated by microscopic discectomy and minimum 25% of patients were operated with microendoscopic discectomy. Laminectomy group patients had higher mean age 54.25±9.656 years as compared to microscopic and microendoscopic surgery group 46.5±6.940 and 46.95±6.088 years respectively. L4-L5 level was the most common level to get involved and accounted for 72% of total single level surgeries.

The mean VAS scores of pre-operative, post-operative and 6 months follow up significantly reduced. The mean oswestery scores for pre-operative, post-operative and 6 months follow up were compared and a significant change was observed. The mean hospital

stay for microendoscopic discectomy was less as compared to other methods.

Complications in all three surgeries were observed, laminectomy had maximum number of complications, 6 patients did not had pain relief, dural tear was observed in 3 patients, however 3 patients had superficial surgical site infections, discitis was observed in 2 patients, however 1 patient had reherniation. Whereas, only 2 patients did not have pain relief after microscopic surgery, superficial infection was observed in 1 patient, however 1 patient had discitis and 1 patient had reherniation. However, only 1 patient did not relieve of pain after micro endoscopic discectomy.

Conclusion

Minimally invasive techniques in all areas of surgery have gained momentum in recent years. Spinal surgery has been no exception. Unfortunately, minimally invasive techniques have often been equated with minimally effective procedures. The procedure involving tubular instrumentation and technique is an attempt to allow for a standard familiar microsurgical discectomy to be performed using standard microsurgical techniques via a minimally invasive approach.

We understand that the micro endoscopic discectomy and microscopic discectomy techniques are superior to the standard discectomy technique for the treatment of single level lumbar disc herniation's with regard to pain relief, clinical outcome and functional outcome, volume of blood loss, systemic repercussions, and duration of hospital stay. However, technical expertise and learning curve of the technique could be the limitation.

The advantages of MED over SD include small incision, better cosmesis, early ambulation, less postoperative back pain, less blood loss, short hospital stay, less analgesics, short time to return to work and thus less cost of treatment.

Conflict of Interest: None
Source of Support: Nil

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