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Functional outcome of microscopic lumbar discectomy for the treatment of lumbar disc prolapse

Ansari Ishtyaque Abdul Aziz[1], Ansari Muqtadeer Abdul Aziz[2]*

[1]Associate Professor and Incharge, Department of Neurosurgery, MGM Medical College, Aurangabad, Maharashtra, India
[2]Head of Unit and Associate Professor, Department of Orthopaedics, Government Medical College, Aurangabad, Maharashtra, India

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***Correspondence:**
Dr. Ansari Muqtadeer Abdul Aziz,
E-mail: mukkuortho@gmail.com

ABSTRACT

Background: Back pain constitutes significant proportion of orthopaedic practitioner OPD. Lumbar disc prolapse constitutes important cause of back pain with radiculopathic leg pain. Different techniques have evolved to treat this disorder non-operatively and operatively. Operative techniques vary a lot in the field of spine surgery depending on the surgeon, institute, infrastructure and cost. We present simple, cost effective, cosmetic, operative technique with scientific basis which gives better visualization for decompression of nerve root in this paper called microscopic lumbar discectomy (MLD).
Methods: On the basis of inclusion and exclusion criteria 26 patients were operated by microscopic lumbar discectomy (MLD) technique. All the patients were followed up at the interval of 1 month, 3 months and 6 months and assessment was done of subjective and objective findings with Japanese orthopaedic association (JOA) score and rate of improvement (RI) was calculated. Out of 26 patients 18 were men and 8 were women. Age ranges from 28 years to 72 years. Mean age being 47.8 years.
Results: Out of 26 patients at the time of discharge, 20 patients (87.5%) could walk independently without any aid and without any radicular pain. In most of the patients 19 (73.07%) sciatica improved immediately. The pre-operative mean±SD (SE) JOA score was 8.346±0.85 (0.169) which improved to 11.807±0.694 (0.136) after 1 month and 13.19±0.895 (0.175) after 6 months.
Conclusions: Excellent to good results and improvement can be achieved surgically, economically and cosmetically by microscopic lumbar discectomy technique in the spine lumbar disc prolapse patients at many spine centre with cosmesis, good results and rehabilitation of the patient.

Keywords: Prolapse, Microscopic, Lumbar, Spine

INTRODUCTION

Lumbar disc prolapse is the most common cause of back pain seen in majority of the patients attending the orthopaedic or neurosurgical outpatient department.[1] It can lead to a wide range of clinical spectrum right from plain simple back pain to leg pain due to nerve root irritation called radiculopathy.[2] Severe compression depending on the grade of lumbar disc prolapse can lead to numbness, paraesthesias, weakness, foot drop and in severe cases cauda equina syndrome which is a emergency requiring urgent decompression surgery.[3,4] Surgery when required has evolved from wide extensive laminectomy to hemilaminectomy to interlaminar fenestration described by Loew to the present day conservative dissection techniques which advocate minimally invasive procedures and also consist of a very wide range, like chemonucleolysis, percutaneous systems

and endoscopic systems of different surgeons like Yeung.[5-13] Mishra et al stated superiority of fenestration over laminectomy results in early postoperative mobilization, early return to work and low incidence of postoperative backache as it is less extensive.[14] Operating microscope was first used by Williams who emphasised better visualisation of the dural structures and nerve roots and called it a conservative approach.[10] These microscopic decompression techniques were further modified and simplified by Caspar and Yasargill.[15,16] Discectomy performed open or with an operating microscope remains the standard surgical management.[17-20] Here in our study we used a operating microscope for better visualization and better decompression. It is very safe, effective and reliable surgical technique for treating properly selected patients with herniated disc.[21] The potential benefits of this technique include less muscle and local damage, better cosmesis, decreased pain and operative time and faster recovery after surgery.[22-24] On the other hand, open surgery includes extensive retraction and dissection of paraspinal muscles, longer operative time, longer incisions and bone resection.[25] Endoscopic techniques (Yeung system) need expensive equipments and have high learning curve.[26]

METHODS

Study area and study population

26 patients were included in this prospective study, conducted in the department of neurosurgery and department of orthopaedics at each of the authors working places, between august 2016 to march 2018 after getting approval from local ethics committee. Patients were considered for the study if they fulfilled following criteria.

Study period: August 2016 to March 2018.

Inclusion criteria

Inclusion criteria were patient aged 18 years and above; single level or two level lumbar disc prolapse; failure to respond to non-operative treatment.

Exclusion criteria

Exclusion criteria were patients below the age of 18 years; multiple level disc herniation; vertebral fractures; disc prolapse with bowel and bladder symptoms (cauda equina syndrome); patient with scoliosis or kyphosis; patients with spinal infection.

Sampling

With the incidence rate of lumbar disc prolapse cases undergoing surgery 0.07% [70/100000] at 95% confidence interval and ±1 margin of error the sample size is n=26.

$$n = \frac{(Z_{\alpha})^2 \times p \times q}{d^2}$$

Hence a minimum number of 26 patients were included in this study.

A detailed history was obtained at the time of admission and all the patients were subjected to thorough clinical examination. All patients were subjected MRI. The findings obtained therein were noted in a standard proforma.

All the cases were assessed preoperatively and postoperatively with the Japanese Orthopaedic Association low back ache score. The results of surgery are evaluated using Mac Nab's criteria.

After detailed clinical evaluation, the patients had undergone relevant investigations like:

1. X-ray lumbo-sacral spine both anteroposterior (AP)/lateral views, lateral flexion and extension views
2. MRI whole spine.
3. Blood routine– Hb%, BT, CT, FBS, PPBS, Blood urea, sr. creatinine.
4. Chest X-ray.
5. ECG for fitness for anaesthesia.
6. Consent of the patient for the surgery.

Technique of surgery

All the patients were operated in prone position in knee chest position on bolsters. The surgical procedure carried out was conventional standard discectomy by fenestration technique using a standard operating ENT microscope. Only fenestration through ligamentum flavum was required in patients with disc prolapse at L5-S1 spaces (9 patients). A small amount of inferior lamina was removed in patients with L4-5 level prolapse to approach the disc. In patients with disc herniation at two levels L4-5 and L5-S1, simultaneous fenestration and discectomy was done at two levels. In all cases only prolapsed or extruded disc was removed and no disc space curettage was done. Nerve root was cleared of compression in all cases. Average duration of surgery: 75 min with a range of 45-100 min.

Average loss of blood: 200 ml with a range of 70 ml – 350 ml.

Blood transfusion was required in 7 patients, of these 2 patients had double level intervertebral disc prolapse who required two level fenestration simultaneously. One patient with dural tear required suturing of dura with absorbable suture (No. 4.0 vicryl) and a fat graft. Epidural bleeding was controlled by bipolar cautery and packing. 1 case of superficial wound infection required wound dressing and 3 days of antibiotics.

All patients were catherised for 24 hrs postsurgery. Fortunately none of the above complications affected the final outcome.

Post-operative management

Post-operative intravenous antibiotics for 48 hours and analgesia either intravenous or orally for 48-72 hours depending on pain was administered. Neurological function was monitored. Turning in bed was allowed on the operative day. Patients were allowed to sit up on 2nd post-operative day. Lower limb strengthening exercises were started on 2nd post-operative day. Back strengthening exercises were started on 14th post-operative day. Patients were mobilized with brace on 2nd post-operative day. Sutures were removed on 12th post-operative day. Stooping and flexing the spine excessively were avoided by patients on advice. At discharge patient were advised not to strain the back or lift weights. Patients were instructed to minimize sitting and riding in a vehicle 6 months post-operatively.

Japanese orthopaedic association (JOA) rating scale was used to determine the outcome apart from Macnabs's criteria. The total score represents the sum of subjective symptoms and objective findings.[27]

Statistical analysis

Chi- Square Test or Mc Nemers Chi- Square Test. Paired 'T' test or suitable non parametric test in case of skewed data (if necessary).

Table 1: Japanese orthopaedic association's low back ache score.

1	Subjective symptoms	Score
A	**Low back pain (3 points)**	
a)	No low back pain	3
b)	Occasional mild low back	2
c)	Low back pain always present/severe low back pain occurs occasionally	1
d)	Severe low back pain always present	0
B	**Leg pain and/or tingling (3 points)**	
a)	No lower extremity pain or numbness	3
b)	Occasional mild lower extremity pain and numbness	2
c)	Lower extremities pain and numbness always present/severe lower extremities pain and numbness occur occasionally	1
d)	Severe lower extremities pain and numbness always present	0
C	**Ability to walk (3 points)**	
a)	Normal walking	3
b)	Walking at least 500 m is possible, but pain, numbness and weakness are felt	2
c)	In walking 500 m or less, pain, numbness and weakness occur, and walking becomes impossible.	1
d)	In walking at most 100 m, pain, numbness and weakness occur, and walking becomes impossible.	0
2	**Objective findings**	
A	**Straight leg raising test (SLRT)**	
a)	Normal	2
b)	30 degree –70 degree	1
c)	Less than 30 degree	0
B	**Sensory abnormality**	
a)	Normal	2
b)	Mild sensory disturbance (Hypoesthesia)	1
c)	Distinct sensory symptoms (Anesthesia)	0
C	**Motor abnormality**	
a)	Normal	2
b)	Slightly decreased muscle strength	1
c)	Markedly decreased muscle strength	0
	Total score	15

Rate of improvement= postoperative score – preoperative score×100; 15- preoperative score.

RESULTS

Total 26 patients were included in the study. All 26 patients were available for follow up by visits. All the patients were followed up at the interval of 1 month, 3 months and 6 months. At the end of 1 month and 6 months assessment was done of subjective and objective findings with Japanese orthopaedic association (JOA) score and rate of improvement (RI) was calculated. Out of 26 patients 18 were men and 8 were women. Age ranges from 28 years to 72 years. Mean age being 47.8 years. In male's age ranged from 28-72 years with mean

46.6 years. In females' age ranged between 35-70 years with a mean age of 50.5 years. All of the patients had both back pain and leg pain. In almost all the cases back pain preceded leg pain (sciatica) except in one case who had complained leg pain to start with. 9 patients had (Rt) sided radiculopathy and 13 patients had (Lt) sided radiculopathy. 4 patients had bilateral leg pain. 53.84% of patients had L4- L5 disc space involvement. 7 patients had sensory deficit with 5 having mild, 1 moderate and 1 severe. 17 patients had motor weakness, 11 having mild, 4 moderate, and 2 severe. 18 patients had epidural steroid prior to surgery and had relief for 3-4 months. Magnetic resonance imaging studies was done in all the patients. In the cases of lumbar disc prolapse maximum patients we had were from agriculture sector who were manually hard working farmers from rural Marathwada.

Table 2: Incidence of different level of disc.

Level of disk	No.	%
L3 L4	1	3.85
L4 L5	14	53.85
L4 L5, L5 S1	2	7.69
L5 S1	9	34.62

Table 3: Incidence of location/direction of disc herniation.

Location of herniation	Patients	%
Central	12	46.15
Lateral	1	3.85
Paracentral	8	30.77
Posterio lateral	5	19.23

Table 4: Incidence of clinical symptoms and signs.

Symptoms	No of cases (n=26)	Percentage (%)
Back pain	26	100
Radicular pain	26	100
Parasthesia	21	80.76
Muscular weakness	17	65.38
Sensory symptoms (hypoesthesia/ anaesthesia)	7	26.92
Visceral involvement (bowel/bladder)	0	0

Table 5: Immediate complications of surgery.

Complications	Frequency
Dural tear	1
CSF leak	0
Significant epidural bleeding	5
Wound infection	1
Discitis	0
Neural damage	0

All 26 patients had undergone conservative therapy in the form of bed rest, traction, analgesics or physiotherapy before undergoing our MLD procedure.

Surgical outcome

For analyzing the clinical outcome of MLD technique, we have used following criteria.

JOA score for pre-operative and post-operative objective and subjective symptoms and rate of improvement at 1 month and 6 months.

Mac Nab's criteria of outcome.

A. *Excellent*- No pain; no restriction of mobility return to normal work & level of activity

B. *Good*- Occasional non-radicular pain relief of presenting symptoms; return to modified work

C. *Fair*- Some improved functional capacity still handicapped and unemployed

D. *Poor*- Continued objective symptoms of root involvement; additional operative intervention needed at the index level irrespective of length of postoperative follow-up.

Out of 26 patients at the time of discharge, 20 patients (87.5%) could walk independently without any aid and without any radicular pain. 6 patients with little radicular pain and with support.

In most of the patients 19 (73.07%) sciatica improved immediately.

The clinical outcome of 26 patients after a mean follow up of 6 months is as follows:

Table 6: JOA score and rate of improvement mean score.

JOA	Mean
Preoperative	8.346
After 1 month	11.807
After 6 month	13.19
Rate of IMP.1 M	51.635
Rate of IMP.6 M	72.191

Table 7: Mac Nab's criteria.

Mac Nab's criteria	Frequency	Percentage (%)
Excellent	10	38.46
Good	12	46.15
Fair	2	7.69

DISCUSSION

Results of this study, state that the lumbar discectomy performed with an operating microscope is a safe, effective and reliable method for treating selected patients with herniated lumbar discs. All patients recovered and rehabilitated very well after surgery. In majority of patients with excellent and good results, the preoperative radiculopathic symptoms improved within first three days after surgery. We observed 26 patients with follow up at 1 month, 3 months, and 6 months.

The pre-operative mean±SD (SE) JOA score was 8.346±0.85 (0.169) which improved to 11.807±0.694 (0.136) after 1 month and 13.19±0.895 (0.175) after 6 months. The 1 month mean±SD (SE) rate of improvement (RI) was 51.635±10.09 (1.797) and after 6 months was 72.191±12.8 (2.511). A Wilcoxon paired signed rank test showed that the above changes were statically significant ($p<0.0001$ HS). According to Mac Nab's criteria we had excellent outcome in 10 (38.46%) patients and good in 12 (46.15%) patients. In Sangwan et al based on modified Macnab criteria 17 patients had excellent, 6 good and 2 fair results with average age 38.22 years ranging from 25-50 years with 18 males and 8 females with left leg affection in 15 patients.[4] In Riaz et al the most common level of involvement was L4 -L5 (n=67) followed by L5-S1 (n=42).[28] Kelsey and White in 1980 reported that the risk of being hospitalized for a herniated disc or sciatica was lowest in professionals and highest in manual workers and motor vehicle drivers.[29] Techniques like chemonucleolysis, percutaneous lumbar discectomy, nucleoplasty and percutaneous laser-assisted discectomy cannot deal with disc fragment extrusions and associated bony and ligamentous compression and are minimally useful.[30-33] Open discectomy (OD) and microdiscectomy remain the current standard of surgical treatment. The technique of surgery thus chosen varies from place to place, institute to institute, set up, cost, economy, training of the surgeon and expertise. Whatever the procedure applied should give good outcome in terms of recovery of the patient as well as suit the patient to minimize future morbidity and accelerate rehabilitation as well as be cost effective particularly in many parts of India and appeal as a minimally invasive surgery for the patient in terms of cosmesis.

CONCLUSION

Interlaminar discectomy by fenestration technique with operating microscope called microscopic lumbar discectomy (MLD) is a safe and reliable method for treating patients with lumbar disc prolapse who have been closely scrutinized for surgery. It is more cosmetic with lesser muscle dissection, less blood loss, less tissue damage, short operative times, better visualization and decompression of neural structures. We have an excellent outcome in 10 (38.46%) patients and 12 (46.15%) patients had good outcome and this result can be credited to careful selection of candidates for surgery. It is a safe procedure compared to extensive laminectomy and discectomy, which destabilizes the spine. Change in the outcome score gives better idea of the recovery compared to preoperative state in addition to total postoperative JOA scale. Rate of improvement is a good indicator of post-operative improvement in subjective symptoms and objective findings. Standard parameters and documentation of recovery by use of JOA scale predicts better faster recovery of the patients.

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