Original Article

LUMBAR MICRODISCECTOMY

Yash Gulati

From the Department of Orthopaedics Surgery, Indraprastha Apollo Hospitals, New Delhi, India.

Correspondence to: Dr.Yash Gulati, Sr.Consultant, Division of Spine Surgery, B-1/43 ,Azad Apartments, Sri Aurbindo Marg , New Delhi-110016, India.
Email: yashgulati@vsnl.net

Disc Prolapse is a common problem encountered in clinical practice. Surgery may be indicated in 10% of cases. Various types of procedures ranging from large Laminectomy to Percutaneous Discectomy under Local Anesthesia are being practiced even today. Ever since the introduction of Microdiscectomy, patients have experienced quick recovery and early return to work [1]. Lumbar Microdiscectomy has become the "Gold Standard" for treating lumbar disc herniation when surgery is indicated 151 cases of single level Microdiscectomy for Lumber Intervertebral Disc Prolapse were followed up for a minimum period of 1 year. Indications, surgical technique and results have been critically evaluated.

DISC prolapse is seen in 1 in 10,000 in general population and 10% patients may require surgical intervention. Historically, Laminectomy was performed to remove the offending disc material. This was associated with significant morbidity and delayed rehabilitation. Less invasive techniques were introduced over last 2 decades.

Microdiscectomy has been reported to have resulted in early recovery of patients and quick return to work. It has indeed become the "gold standard" for treating disc prolapse when surgery is indicated, especially as it can now be performed as an day care procedure [2-5].

The indications of microdiscectomy, its execution and the postoperative tasks have been discussed in various reports [6-7]. Indications include unilateral radicular symptoms with leg pain more severe than back pain, positive straight leg raise test, other signs of root dysfunction, and failure to improve after a minimum of 6 weeks of conservative medical therapy. An abnormal EMG corresponding to the level of the abnormal disc provides additional support for performing this proce-dure. Recently, the microsurgical technique is increasingly being used for the treatment of recurrent herniated discs, far lateral discs and foraminal stenoses [8,9]. The potential benefits of micro-invasive disc surgery have been described variously as reduced surgical trauma to the tissue, increased safety due to good visualization of the operative field under the microscope and, consequently, reduced postoperative morbidity, and shorter hospitalization [3,10-11]. Careful selection of patients, meticulous analysis of radiographic findings and proper surgical technique yield good results which allow most patients to lead a pain-free existence [7]. Presented here is my experience of 151 followed up cases (out of a total of 159 operated patients) of virgin lumbar disc prolapse treated with microlumbar discectomy, over a 7-year period from 1995 to 2002. In addition, the indications for microdiscectomy, its execution and post-operative protocol have also been reviewed [6].

Materials and Methods

A total of hundred and fifty nine patients presenting with symptoms of radiculopathy were operated by the microsurgical technique described below, after satisfying the inclusion criteria. There were 101 males and 58 females with a mean age of 45 years (range 23 to 62 years). These included among others 2 airline pilots and 8 doctors (3 surgeons). All were operated at a single level. Of the 159 patients, 8 were lost to follow up (on an average, after 9 months), and were not included in our results. The remaining 151 patients were followed for an average period of 2 ½ years (range 1 year to 6 years). In our study, 88 patients had a L4-L5 level disc prolapse, 51 had L5 S1 disc prolapse, there were 11 cases of L3- L4 prolapse, and 1 patient had a high lumbar disc (L2-L3) prolapse. Clinically, 8 patients had presented with cauda equina syndrome.

We employed a strict set of criteria for inclusion in this study, which included the following: a single intra-canalicular lumbar disc herniation, with associated radiculopathy; failure to respond to non-operative measures; more pain in the lower extremities than in the back; the presence of positive tension signs with or without an accompanying neurological deficit; a dermatomal distribution of pain in the lower extremities matching that seen on imaging studies and specific nerve-root involvement; and no previous operation on the low back. Patients excluded from our study were those with central or lateral stenosis of the spinal canal; severe degenerative narrowing of the intervertebral disc space at the index level; global bulging of the intervertebral disc associated with central or lateral stenosis; drug dependency, and known psychological disorders.

Surgical technique

Under general anesthesia, the patient was placed prone on a Wilson frame. The appropriate level was first confirmed under image intensifier.

After infiltration of the skin and subcutaneous tissue with saline-adrenaline (1:100000), a small skin incision measuring about 2 cm was made over the site, subperiosteal dissection of the adjacent laminae performed using periosteal dissectors. An Asculesp microdiscectomy retractor was placed and the operating microscope brought into the field. Inferior part of lamina above was thinned using high-speed drill. Thinned part of lamina was removed using No. 2 & 3 Karrison rongeours.

Ligamentum flavum was incised with No. 11 blade and excised. If necessary undercutting medial facetectomy was done. Nerve root was identified and retracted medially. Extruded disc fragment was removed. Loose fragments of disc were removed from the disc space with the help of straight and angled pituitary rongeurs. Thorough search was made for any separated, left over disc fragment in epidural space and nerve root was completely freed. At the end of the procedure local epidural steroid (80 mg methylprednisolone) was sprayed over the dura and nerve root. Bupivacaine was infiltrated into the paraspinous muscles and subcutaneous tissue prior to closure to relieve postoperative pain.

Post operative protocol

Patient was made to stand the evening of surgery and made to walk next morning. Dressing was changed in the morning. Patient was discharged on the evening of 1st post op day unless there was any problem.

Intravenous antibiotics and analgesics were continued till the time of discharge, which was usually the day after surgery, with oral antibiotics and analgesics for an average of four days.

Follow-up visits were scheduled at 5 days, 12 days, three months, six months, one year, and two years postoperatively. Patients were put on a lumbosacral corset for a period of 6 weeks and allowed ambulation. At six weeks following surgery, a graduated physiotherapy program was initiated, and continued till complete pain relief, for an average period of three months. Analysis of the outcome of the procedures was based on the patient's self-evaluation before and after the operation, the preoperative and postoperative clinical findings, and the patient's ability to return to a functional status.

The outcome was considered excellent if the radicular symptoms had ceased, the tension signs had become negative, the patient had returned to his or her previous occupation or to normal activity, and the patient expressed satisfaction with the result of the operative procedure; good if the criteria just mentioned were met but the patient had residual back pain and had to modify his or her occupation; and failed if the patient had persistent radicular symptoms or needed an additional operative procedure. An excellent or good result was considered a successful outcome. Patients were classified as failures or successes at the 12-month follow up according to the overall clinical score.

Results

Intra-operatively, we found an extruded disc in 71.4% of our cases, a sequestrated fragment in 19.8%, and a large bulge in 8.7%. Of the 151 patients who followed-up, on a 10 point Visual Analog Scale, the average preoperative back pain was rated 4.1 and leg pain 7.8. Preoperative numbness was rated 4.2 and weakness 2.9. The median time off work preoperatively was 8.4 weeks. The mean hospitalization was 2.2 days, and a postoperative median of 3 weeks elapsed before they returned to work. Average follow-up was 30 months (range, 24 to 84 months). Post-operatively, mean back pain was 2.1, with 80.1% having no back pain at last follow-up. Mean leg pain at last follow-up was 0.7, with 96% having no leg pain. Numbness was rated 1.8, with 92% having none at last follow-up. Weakness was rated 0.6, with 96% having none at last follow-up (average 2½ years).

Our complications included two cases of disciitis, diagnosed clinically, supplemented with serially elevated CRP, ESR and WBC counts [14]. Diagnosis was confirmed with post-op MRI, and treated conservatively; with an eventual satisfactory outcome. Neither of them required repeat surgery. Three others had dural puncture during the procedure. These were managed intra-operatively with a single 6-0 prolene stitch, supplemented with overlying crushed muscle graft. These patients were then treated routinely post-operatively, without any untoward post-operativeincident. Four patients had superficial wound infection, controlled with post-discharge continuation of oral antibiotics for ten days. Ten patients had low grade intermittent non-radiating back pain persisting beyond six weeks after surgery. Eight of these were more than 50 years old, suggesting the possibility of underlying facetal arthrosis. The pain was rated 1-2 on the visual analog scale by all, and hence managed non-operatively by analgesics and physiotherapy. One patient complained of pain in the opposite leg arising immediately postoperatively. The pain was of a mild, continuous type, the etiology of which was not determined as there was no plausible justification. He was treated conservatively with analgesics. At last follow-up about twelve months postoperatively, his pain had disappeared.

Overall 85% of the patients showed excellent results. All but eight have returned to their original work.

Discussion

Outcomes for lumbar discectomy for disc herniation

depend on patient selection. Short-term results of discectomy are excellent when there is agreement between the clinical presentation and imaging studies. A review of the literature reveals success rates for lumbar discectomy ranging from 80-96%.

Lumbar microdiscectomy is one of the well established and frequently performed spinal procedures in neurosurgical practice [1-2,6,11,15-16]. However, its widespread use is still not prevalent amongst orthopedic spinal surgeons. To add to the dilemma, little consensus exists in the literature regarding its efficacy and advantage over routine discectomy. Whereas retrospective reports boast success rates as high as 90-98% [15,17] prospective studies are less sanguine with statistics in the 70-80% range [18-19].

There is no doubt that, Minimal invasive procedures are cost effective and allow earlier resumption of activities, work and sports. The microdiscectomy technique allows a smaller incision, less trauma to lumbar muscles and offers excellent illumination and magnification, better identification of neural structures allowing soft manipulation making the technique much safer. Perfect hemostasis can be secured.

Early post-operative mobilization is easy, Compared with the traditional operation, the microsurgical approach means a shorter duration of operation, less bleeding during surgery, less intra-operative myoligamentous trauma, less post-operative wound pain, and return to work within half the usual time [10-12]. Also prevented is the postoperative development of venous stasis and chronic nerve-root edema.

Short term and long term studies in the past have supported our results. In one study, six months after operation, 96% of the patients treated by the microsurgical technique were relieved of their root pain and 89% were free from low back pain.

The corresponding figures at follow-up 3.6 years post-operatively were 89% and 80% respectively [7].

Re-surgery following microdiscectomy has recently been extensively studied [8-9]. The overall incidence of second operation was found to be 7.5%8, significantly higher in teenagers than in patients in other age decades ($P < 0.01$), and also in patients with protrusion-type herniation than in those with extrusion- or sequestration-type ($P < 0.01$). To prevent the necessity for second operation, careful and thorough discectomy, especially deep to the posterior longitudinal ligament, and decompression at the lateral recess are useful [8-9].

A specific complication of lumbar microdiscectomy - the wrong level - can be minimized by preoperative planning. Other complications like dural lesions and excessive bleeding are less frequent with the microscope because of the better view.

A few reports indicate that no significant differences have been found between microsurgery and traditional surgery as regards peri-operative bleeding, complications, inpatient stay, time off work, or end result over the long term and the decision to use the operating microscope should be left to the surgeon [24-25]. However, we found microscope to be extremely useful.

A 4-week postoperative exercise program that concentrates on improving strength and endurance of the back and abdominal muscles and mobility of the spine and hips; with repetitive assessment of posture, hip and lumbar mobility, back muscle endurance capacity and electromyographic measures of back muscle fatigue can improve pain, disability, and spinal function in patients who undergo microdiscectomy, and should be made part of the protocol[26].

Alternative surgical procedures include Automated Percutaneous Lumbar Discectomy [27]; Chemonucleolysis [28]; Percutaneous Endoscopic Discectomy [22]; "same-day microsurgical arthroscopic lateral-approach laser-assisted fluoroscopic discectomies" [29]; Transforaminal Endoscopic Microdiscectomy[30]; Stereotactic Lumbar Micro-discectomy [31]; and Percutaneous Laser Discectomy [32], but these techniques have highly specific indications.

Although both macro-and micro-discectomy are simple and acceptable methods for the treatment of a symptom-producing disc herniation, present study strengthens the view that, for selected patients who meet specific criteria, microdiscectomy offers an excellent choice for operative treatment of lumbar disc herniation.

Conclusion

In conclusion, microsurgery has proven to be a safe, least traumatic procedure for removal of lumbar disc herniations, with very good long-term results [3-5,8-12,15-16,18]. It should be encouraged amongst orthopedic spinal surgeons, although there is a steep learning curve and the need for excellent hand-eye co-ordination and technical expertise.

The future holds in store the realms of Artificial Disc Replacement or Intervertebral Disc Transfer. Continued development of an experimental lumbar intervertebral disc transfer model may lead to the application of disc autografts or allografts for the treatment of lumbar disc pathology, but till then, microdiscectomy remains the "gold standard", and should be incorporated into the armamentarium of the orthopedic spine surgeon.

REFERENCES

1. Wilson DH, Harbaugh R. Microsurgical and standard removal of the protruded lumbar disc: A comparative study. Neurosurgery 8: 422-427, 1981.

2. Apostolides PJ, Jacobowitz R, Sonntag VK. Lumbar discectomy microdiscectomy: "the gold standard". Clin Neurosurg 1996; 43: 228-238.

3. Kelly A, Griffith H, Jamjoom A. Results of day-case surgery for lumbar disc prolapse. Br J Neurosurg 1994; 8(1): 47-49.
4. Bookwalter JW 3rd, Busch MD, Nicely D. Ambulatory surgery is safe and effective in radicular disc disease. Spine 1994 Mar 1; 19(5): 526-530.
5. Rogers LA. Outpatient microdiscectomy. Neurosurgery 1988; Jul; 23(1):128.
6. Williams RW. Lumbar disc disease. Microdiscectomy. Neurosurg Clin N Am 1993 Jan; 4(1): 101-108.
7. McCulloch JA. Focus issue on lumbar disc herniation: macro- and microdiscectomy. Spine 1996 Dec 15;21(24 Suppl):45S-56S.
8. Hirabayashi S, Kumano K, Ogawa Y, Aota Y, Maehiro S. Microdiscectomy and second operation for lumbar disc herniation. Spine 1993 Nov; 18(15): 2206-2211.
9. Haglund MM, Moore AJ, Marsh H, Uttley D. Outcome after repeat lumbar microdiscectomy. Br J Neurosurg 1995; 9(4): 487-489.
10. Lorish TR, Tanabe CT, Waller FT, London MR, Lansky DJ. Correlation between health outcome and length of hospital stay in lumbar microdiscectomy. Spine 1998 Oct 15; 23(20): 2195-2200.
11. Silvers HR. Microsurgical versus standard lumbar discectomy. Neurosurgery 1988 May; 22(5): 837-841.
12. Frizzell RT, Hadley MN. Lumbar microdiscectomy with medial facetectomy. Techniques and analysis of results. Neurosurg Clin N Am 1993 Jan; 4(1):109-115.
13. Rodgers LA. Experience with limited versus extensive disc removal in patients undergoing microsurgical operations for ruptured lumbar discs. Neurosurgery 1988; 22: 82-85.
14. Meyer B, Schaller K, Rohde V, Hassler W. The C-reactive protein for detection of early infections after lumbar microdiscectomy. Acta Neurochir (Wien) 1995;136(3-4): 145-150.
15. Gibson JN, Grant IC, Waddell G. Surgery for lumbar disc prolapse. Cochrane Database Syst Rev 2000;(3): CD001350.
16. Kotilainen E, Valtonen S, Carlson CA. Microsurgical treatment of lumbar disc herniation: follow-up of 237 patients. Acta Neurochir (Wien) 1993;120(3-4): 143-149.
17. Findlay GF, Hall BI, Musa BS, Oliveira MD, Fear SC. A 10-year follow-up of the outcome of lumbar microdiscectomy. Spine 1998 May 15; 23(10):1168-1171.
18. Asch HL, Lewis PJ, Moreland DB, Egnatchik JG, Yu YJ, Clabeaux DE, Hyland AH. Prospective multiple outcomes study of outpatient lumbar microdiscectomy: should 75 to 80% success rates be the norm? J Neurosurg 2002 Jan; 96(1 Suppl): 34-44.
19. Quigley MR, Bost J, Maroon JC, Elrifai A, Panahandeh M. Outcome after microdiscectomy: results of a prospective single institutional study. Surg Neurol 1998 Mar; 49(3): 263-267; discussion 267-268.
20. Song J, Park Y. Ligament-sparing lumbar microdiscectomy: technical note. Surg Neurol 2000 Jun;53(6): 592-596; discussion 596-597.
21. Fountas KN, Kapsalaki EZ, Johnston KW, Smisson HF 3rd, Vogel RL, Robinson JS Jr. Postoperative lumbar microdiscectomy pain. Minimalization by irrigation and cooling. Spine 1999 Sep 15; 24(18):1958-1960.
22. Kambin P, O'Brien E, Zhou L, Schaffer JL. Arthroscopic microdiscectomy and selective fragmentectomy. Clin Orthop 1998 Feb; (347): 150-167.
23. Kotilainen E. Long-term outcome of patients suffering from clinical instability after microsurgical treatment of lumbar disc herniation. Acta Neurochir (Wien) 1998;140(2):120-125.
24. Tullberg T, Isacson J, Weidenhielm L. Does microscopic removal of lumbar disc herniation lead to better results than the standard procedure? Results of a one-year randomized study. Spine 1993 Jan; 18(1).
25. Mulholland RC. Does microdiscectomy have any real advantage? Br J Hosp Med 1991 Apr;45(4):196, 199.
26. Dolan P, Greenfield K, Nelson RJ, Nelson IW. Can exercise therapy improve the outcome of microdiscectomy? Spine 2000 Jun 15; 25(12):1523-1532.
27. Davis GW, Onik G. Clinical experience with automated percutaneous lumbar discectomy. Clin Orthop 1989 Jan; (238):98-103.
28. Javid MJ, Nordby EJ. Lumbar chymopapain nucleolysis. Neurosurg Clin North Am1996; 7: 17-27.
30. Avitz MH. Same-day microsurgical arthroscopic lateral-approach laser-assisted (SMALL) fluoroscopic discectomy. J Neurosurg 1994; 80: 1039-1045.
31. Mathews HH. Transforaminal endoscopic microdiscectomy. Neurosurg Clin N Am 1996 Jan;7 (1): 59-63.
32. Koutrouvelis PG, Lang E. Stereotactic lumbar micro-discectomy. Neurosurg Clin North 1996; Am 7: 49-57.
33. Choy DSJ, Ascher PW, Saddekni S. Percutaneous laser disc decompression. Spine 1992; 17: 949-956.