Original Article

Posterior endoscopic discectomy: Results in 300 patients

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Abstract

Background: Posterior endoscopic discectomy is an established method for treatment of lumbar disc herniation. Many studies have not been reported in literature for lumbar discectomy by Destandau Endospine System. We report a series of 300 patients operated for lumbar dissectomy by Destandau Endospine system.

Materials and Methods: A total of 300 patients suffering from lumbar disc herniations were operated between January 2002 and December 2008. All patients were operated as day care procedure. Technique comprised localization of symptomatic level followed by insertion of an endospine system devise through a 15 mm skin and fascial incision. Endoscopic discectomy is then carried out by conventional micro disc surgery instruments by minimal invasive route. The results were evaluated by Macnab's criteria after a minimum followup of 12 months and maximum up to 24 months.

Results: Based on modified Macnab's criteria, 90% patients had excellent to good, 8% had fair, and 2% had poor results. The complications observed were discitis and dural tear in five patients each and nerve root injury in two patients. 90% patients were able to return to light and sedentary work with an average delay of 3 weeks and normal physical activities after 2 months.

Conclusion: Edoscopic discectomy provides a safe and minimal access corridor for lumbar discectomy. The technique also allows early postoperative mobilization and faster return to work.

Key words: Endoscope, endoscopic discectomy, endospine, facetectomy, laminotomy, radiculopathy

Introduction

The advantages of use of minimal invasive spinal surgical techniques in treatment of lumbar disc herniation is small incision, limited tissue disruption, enhanced visualization due to better magnification and illumination, shorter hospital stay, and faster recovery time.[1-3] Among many posterior spinal endoscopic systems used for disc surgery, Destandau Endospine system and Foley and Smith's Metrx system are seen as viable alternatives to open disc surgery.[4-6] The aim of this study was to present results in 300 patients operated by Edoscopic discectomy and to discuss technical points to shorten the learning curve.

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Materials and Methods

A total of 475 patients suffering from different type and level of lumbar disc herniation with radiculopathy and degenerative lumbar canal stenosis were operated between January 2002 and December 2008. 300 patients who met following inclusion criteria were evaluated. The inclusion criteria were patients having lumbar disc prolapse with unilateral radiculopathy, on clinical evaluation, positive straight leg raise or femoral stretch test, and identification of a single nerve root lesion on MRI. First 50 patients were not included in the study in view of learning curve. Patients with bilateral symptoms, double root involvement, cauda equina syndrome and whose clinical symptoms did not match MRI picture were excluded from present study. All these patients had fair trial of conservative treatment in the form of rest, medication (NSAID), activity modification, and physiotherapy (minimum 6 weeks) before they were advised to undergo surgery. However, in present study, none of the patients opted for surgery at 6 weeks after completion of conservative treatment. There were 206 males and 94 females aged between 18 to 72 years (mean, 38.4 years). Onset of symptoms to surgery was between 3 months to 12 years. Levels operated upon included L1-L2 (n=3), L2-L3 (n=2), L3-L4 (n=6), L4-L5 (n=205), and L5-S1 (n=84). 220 patients had radiculopathy on right side and 80 on left side. There were 235 extruded, 20 contained, 15 foraminal, and 30 sequestrated

herniations. 125 patients were operated under general anesthesia while 175 under spinal anesthesia. Results were evaluated as poor, fair, and good or excellent using modified Macnab's criteria. Modified Macnab's grading was as follows: Excellent - no pain/restriction of activity and being able to do all activities; good - occasional pain with relief of presenting symptoms and returning to work with some modification; fair - some improved functional capacity but still handicapped or unemployed; and poor results - having objective symptoms of root involvement or repeat surgery at the index level. The clinical material included preoperative history, physical examination, plain X-rays and MRI studies of lumbosacral spine, laboratory tests, and intraoperative video documentation. Postoperative follow-up was carried out on third day, 2 weeks, 6 weeks, 3, 6, 12, and 24 months. All these patients were operated by single surgeon.

We used Destandau endospine system. It consists of endospine tube, trocar, and working insert [Figure 1a and b]. The working insert comprises four ports. One port for 0 degree endoscope, second for suction cannula, third port (biggest) for working instrument, and fourth port for dural and nerve root retractor. The procedure of discectomy can be carried out under general, spinal, epidural, or local anesthesia. The operative technique consists of knee chest positioning after administration of anesthesia followed by level localization by localization devise [Figure 1c]. At marked point, 15 mm skin incision is made aponeurosis is incised using mayo's scissors; 1.5 cm wide periosteal elevator is used to elevate paravertebral muscles subperiostealy, thus exposing the interlaminar window and part of the affected side facet.

The endospine tube with trocar is pushed through the incision in the direction of posterior arch over interlaminar window followed by withdrawal of trocar. The working insert is then fitted over endospine tube [Figure 1d]. The video camera is connected to 0 degree endoscope under sterile conditions. The endoscope and suction tube are introduced into their respective ports. Any soft tissue bulging in the mouth of tube is removed till boundaries of interlaminar window such as superior and inferior lamina, facet joint are clearly visualized [Figure 1e]. This follows part resection of inferior margin of the superior lamina followed by excision of ligamentum flavum leading to exposure of the dural sac and nerve root under endoscopic vision. Once the nerve root has been accurately identified, it is retracted using a nerve root retractor. The epidural veins are coagulated if necessary. Dural and nerve root retraction can be further aided by cottonoids. It also helps to keep the field dry. Depending on local findings, discectomy involving the extraction of the nucleus pulposus is then carried out [Figure 2]. Hemostasis of the muscle layers is achieved under video-endoscopic control. Once satisfactory nerve root decompression is achieved, endospine tube along with working insert is withdrawn. Aponeurosis is sutured using vicryl fine suture followed by closure of the skin in a

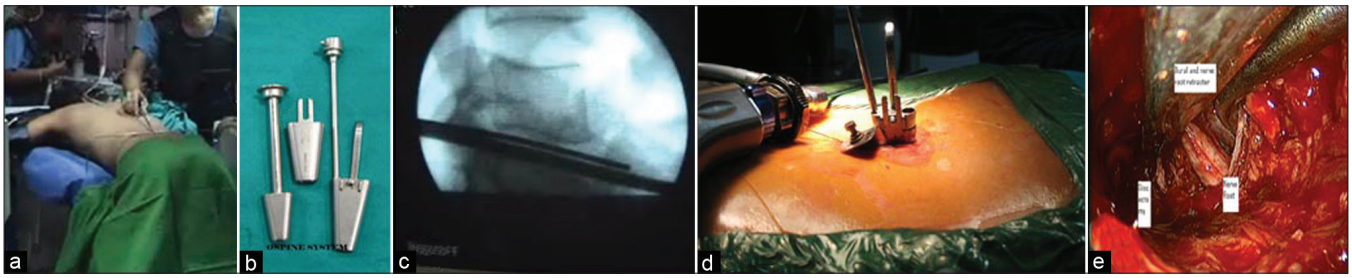

Figure 1: (a) Clinical photograph showing patient positioning and level marking (b) Destandau endospine system (c) IITV picture of marked level (d) Position of endospine tube (e) Endoscopic view of decompressed nerve root

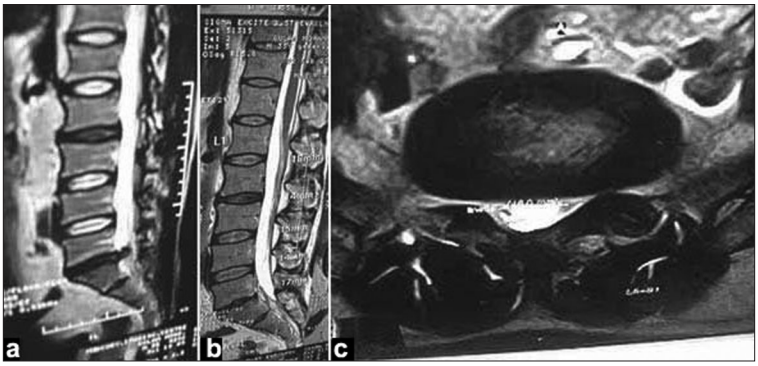

Figure 2: (a) Preoperative sagittal T2WI MRI of prolapsed L5-S1 disc (b) Postoperative sagittal T2WI MRI of L5-S1 disc after endoscopic discectomy at 2 years follow up (c) Axial T2WI MRI section at L5-S1 disc after endoscopic discectomy at 2 years follow up shows no compression

subcuticular fashion. A water-impermeable dressing is then applied over incision.

These patients were followed up on third day, 2 weeks, 6 weeks, 3, 6, 12, and 24 months. Patients were followed up for minimum of one year and maximum of 2-year duration. On second visit on third day, wound was inspected for any drainage or evidence of infection. Complains about fever, backache, and leg discomfort were enquired. SLR was tested on every visit. On subsequent visits, all these parameters were evaluated.

Results

At final follow-up, 90% patients were relieved of sciatica and were satisfied with procedure. Average operative time was 50 minutes (range, 40-80 mins). Average blood loss was 45 ml (range, 30 —70 ml). 285 patients were operated as day care cases and were mobilized and discharged same evening from day care facility. Based on Modified Macnab's criteria 90% patients had excellent to good, 8% had fair, and 2% had poor results. Five patients who had interaoperative minor dural tears were hospitalized and were observed for any dural leak. Causative factor for dural tears in present study were as follows: Three patients had dural rent due to forceful retraction of dura and nerve root by dural and nerve root retractor. This was observed in patients in whom there was significant posterolateral herniation resulting in tenting of dura and nerve root at recess. In this situation, authors have found gentle mobilization of nerve root and dura by nerve root hook or approaching and debulking the offending disc through axilla before proceeding with retraction of nerve root and discectomy. Debulking ensures subsequent mobility and retraction of nerve root. Injury by Kerrison punch contributed to two cases of dural injury. This happened when Kerrison rongeur was used to open the tight recess resulting in dural tear and nerve root injury. These dural tears were managed by water tight closure of muscle, fascia, and skin and bed rest for duration of one week. Superficial delayed wound healing was observed in 20 patients, which healed in 21 days by regular dressings rest and administration of antibiotics. Post surgical discitis was observed in six patients. The diagnosis of postsurgical discitis was based on mainly clinical grounds and laboratory evidence of raised counts, ESR, and C-reactive proteins. Clinical criteria included recurrence of severe and unrelenting back pain within first week of surgery, keeping patient awake at night after initial recovery. All these patients developed these symptoms within first week. No biopsy of disc was resorted to; however, MRI of lumbosacral spine was ordered in all these patients which did not contribute much to the diagnosis. These patients were treated by intravenous antibiotics (Inj. Lizolid 600 mg/bd) for first week followed by oral antibiotics for 5 weeks. All these patients responded well to antibiotics and no further intervention of any kind was carried out. After initial back pain for 6 weeks, these patients had occasional residual backache which was treated by analgesics, activity modification, lumbar support, and rest during subsequent follow-up visits. Nerve root injuries (n=2) were encountered while trying to do a medial facetectomy to open the recess by a Kerrison rongeur causing severe laceration of nerve root. However, nerve root was in continuity. No attempt was made to repair the injured nerve root. Despite nerve root injury, patties were used for gentle retraction and procedure of discectomy was successfully completed endoscopically without resorting to open discectomy. 276 patients were able to return to sedentary work with an average delay of 2 weeks, except 24 patients who had complains of backache, occasional leg discomfort, discitis, and nerve root injuries. Medial facetectomy was resorted to in 59 patients to open the recess to decompress the nerve root in addition to discectomy.

Discussion

Mixter and Barr[7] discovered the pathophysiology of discogenic sciatica and suggested laminectomy and discectomy as operative treatment. The surgical technique was associated with high risk for developing approach-related morbidities. The overall results of standard discectomy range from 68 to 95% in different series.[8] The operative microscope and microsurgical techniques were developed in mid-1960's by Yasargil and Krayenbuhl[9,10] and These techniques revolutionized spine surgery leading to smaller incisions, less blood loss, increased visualization of site of pathology, decreased hospitalization, shorter postoperative recovery, and earlier return to activities compared with previous operative interventional techniques. The results of microdiscectomy also range from 85 to 98%.[11-13] Katayama *et al.*[14] compared the results of open *vs* gold standard microdiscectomy and observed no difference between the surgical outcomes in both the groups but microdiscectomy gave better lighting, magnification, and therefore decreased the length of incision and tissue invasion. Microdiscectomy also allowed the patients to return to early work with lesser use of narcotic medication. Microendoscopic dissectomy (MED) combines standard microsurgical technique with an endoscope, enabling the surgeons to address all types of disc herniations including decompression of nerve root and lateral recess. Chemonucleolysis was reported by Smith.[15] Nonetheless, based upon various randomized clinical trials, the efficacy of chemonucleolysis compared with more traditional and open procedures for the operative treatment of lumbar disc herniations remained speculative.[16] The use of percutaneous nucleotomy, laser discectomy, and intradiscal electrothermal

annuloplasty (IDET) compared with microdiscectomy remains unclear, and it is attributed to the lack of high-quality studies.[17] Conclusions about the efficacy of some of the aforementioned minimally invasive procedures (e.g., chemonucleolysis, APD, IDET) were questionable with regard to disc-related pathology.[18] Therefore, lumbar microdiscectomy remained the gold standard for addressing a herniated or sequestrated intervertebral disc; however, a movement toward more minimally invasive approaches that would yield superior outcomes, while minimizing excessive soft and bony tissue removal and minimizing soft tissue trauma, were sought. As such, an evolution in procedures toward smaller incisions, less tissue trauma, and quicker return to daily activities took center stage in spine surgery. The use of muscular retractor system was reported initially by Faubert and Caspar.[19,20] Perez-Curet and Fessler,[21] described for the first time a myriad of spine pathologies that could be addressed using tubeology. Though from our initial experience, endospine technique is minimal invasive, but limitation of study has been lack of comparison with gold standard microscopic discectomy technique. However, in a study by Shin *et al.*,[22] 15 cases each were compared of MED and Microscopic group (MD). The mean CPK-MM levels were lower for the MED group than for the MD group at both 3 (576.1±286.3 IU/l compared with 968.1±377.8 IU/l) and 5 days (348.1±231.0 IU/l compared with 721.7±463.2) postoperatively ($P<0.05$). The mean VAS scores for postoperative back pain were lower in the MED group than in the MD group, both at 1 (3.3±2.3 compared with 5.8±1.5) and 5 days (1.9±1.1 compared with 3.6±1.1) postoperatively ($P<0.01$). Aforementioned authors concluded that the MED procedure is less invasive than MD, and causes less muscle damage and backache.

The 90% excellent results in present study is comparable with other surgical procedures for herniated lumbar discs such as those of Destandau, Perez-Cruet *et al.,* and Ranjan.[23] These authors have reported success rate in range of 73 to over 90%. We compared our results with these aforementioned authors. Their average surgical time was 66 minutes, average blood loss was 22 ml, average hospital stay was 7.7 hours, complication rate was 5%, reoperation rate was 4%, and average return to work was 17 days with excellent result in 94% patients. We had 9 to 10 hours hospital stay. Average operative time was 50 minutes average blood loss was 45 ml (range, 30-70 ml). Complication rate was 5%. Return to work (21 days) and overall results (90%) which are comparable. In another prospective and randomized evaluation of surgical treatment for lumbar disc herniation by Hermantin *et al.*,[24] satisfactory results of 97% in endoscopic group ($n=30$) and 93% in open laminectomy group ($n=30$) were reported. However, in endoscopic group, these authors had excluded large central herniations and extra ligamentous herniations between L5 and first sacral vertebra. However, present endoscopic technique could be used for all levels and all type of herniations. In our current series, there was 5% discitis and 5% incidence of dural injury. Our reoperation rate was 5%. In series reported by Williams, Caspar and Ebling,[25,26] authors have reported reoperation rate of 5.5, 5.7, and 3%, respectively. Another measure of success is reflected by the patient's ability to return to previous employment. Our patients returned to previous employment on an average at 15 days with restriction to avoid heavy manual work for 2 months. Discectomy (MED) by endospine system has claimed even lesser tissue invasion than microdiscectomy with even smaller skin incision, lesser use of analgesics, and early return to work. Least tissue invasion is established by many reports comparing the postoperative MRI signal of paraspinal muscles,[27] intraoperative electromyographic findings establishing less invasion to nerve roots,[28] and by measuring serum levels of biochemical parameters reflective of a postoperative inflammatory reaction and damage to the paravertebral muscles.[29] Our personal opinion is similar, though this was not the parameter studied in our series.

Minimal invasive microendoscopic decompression technique has been used not only for paracentral disc herniations, but also for all types including far lateral, cephalad, caudal migrated, and central and recurrent disc herniations.[30-32] One of the driving forces behind the minimal invasive spine surgery is economics, shorter hospital stay, reduced postoperative morbidity, and quicker recovery times. In our series, 90% patients were operated as day care cases. Posterior paraspinous process endoscopic access to lumbar disc herniation requires creation of working space where no or little space existed before. Creation of such space is ably achieved by mobile endospine. Internal view of operating site is magnified and well illuminated. With advent of this system, discectomy can be done as day care procedure ensuring reduced postoperative morbidity, minimal or no hospitalization, less pain, and faster recovery. With proper patient selection, discectomy and adequate nerve root decompression by doing foraminotomy or opening a lateral recess stenosis by minimally invasive technique can be achieved with this system. However, the endospine system has been excellent modality to address discogenic radiculopathy and to decompress lumbar canal stenosis. Many surgeons are convinced of advantages of the system and have included this system as part of their inventry. However, due to difficulty in orientation with scope and two-dimensional vision, availability of less space, frustrating and steep learning curve, and inability to master hand eye coordination, majority of surgeons are not able to continue with the technique. The patience and persévérance to work through narrow confines and work closely with a surgeon who has mastered the technique is the key to learn. Second

step would be to become comfortable with 2 dimensional vision of endoscopic camera and to master orientation, triangulation. Depth perception in these techniques comes from experience rather than observation; hence, surgeon keen to learn these techniques must combine these procedures during early phase of learning with standard procedures he is doing in his clinical practice. Gradually, as surgeons master the learning curve, he will be able to use this as treatment method for his patients. There is also a need to establish cadaveric labs and dummy models on line of arthroscopic learning centers where surgeons can practice hands-on cadavers and models to improve triangulation, depth perception, and hand eye coordination.

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