COMPARATIVE EVALUATION OF ENDOSCOPIC DISCECTOMY AND LUMBAR LAMINECTOMY IN LUMBAR DISC DISEASES

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Abstract

Lumbar disc disease accounts for a large amount of lost productivity in the workforce. Accurate diagnosis can be difficult and often requires interpretation. Treatment is controversial. Treatment failures are not uncommon, are often related to posttraumatic or work-related injuries, and may result in litigation.

The present study was planned in Department of Neurosurgery, SKMCH, Muzaffarpur, Bihar, India. In the present study 50 Patients Suffered from Lumbar disc diseases were enrolled and divided based different surgery procedure. In the present study 25 cases of the patients undergoing Endoscopic Discectomy and 25 cases of patients undergoing Lumbar Laminectomy surgery were enrolled.

The experience gained from the patients operated upon for lumbar disc herniation by endoscopic technique and conventional laminectomy with discectomy in the present study was presented herewith. All patients had virgin lumbar radiculopathy with positive clinical findings and MRI evidence of herniation. The endoscopic approach meant a shorter operating time, less bleeding during surgery, immediate mobilization of patients and shorter post-operative stay in the hospital and return to work in 7 days which is less than half the usual time in laminectomy with discectomy. In endoscopic technique fewer incidence of wound infections, Catheterization in endoscopic while urinary infection along with catheterization was very low. No patients developed pulmonary embolism, deep vein thrombosis, and increase in neurological deficit or nerve root injury. Thus endoscopic approach to discectomy for herniated lumbar disc remains the procedure of choice for majority of patients requiring surgery and it continues to be the Gold standard against which all procedures must be measured.

Keywords: Endoscopic Discectomy, Lumbar Laminectomy, Lumbar disc diseases, etc.

Introduction

Lumbar disc disease accounts for a large amount of lost productivity in the workforce. Accurate diagnosis can be difficult and often requires interpretation. Treatment is controversial. Treatment failures are not uncommon, are often related to posttraumatic or work-related injuries, and may result in litigation. As a consequence, this disease can generate distrust of physicians on the part of patients and vice versa. Surgical treatment was not widespread until the 1950s. Today, lumbar discectomy is one of the most commonly performed elective operations in the United States. [1, 2, 3, 4, 5, 6]

Lumbar disc disease is a rather encompassing term. For example, some physicians include back pain alone as a symptom of disc disease. Others make the diagnosis without evidence of disc disease on MRI. The discussion of this article is limited to well-defined lumbar disc herniation. The pathophysiology, clinical presentation, radiographic diagnosis, treatment, and outcome are discussed.

A disc herniation (lumbar disc disease) most frequently irritates the displaced nerve root. One of the more difficult concepts for beginning medical students to grasp is the anatomic relationship of the fifth lumbar (L5) nerve root to the L4-5 disc herniation. Equally important to understand is the concept of the far lateral or foraminal disc herniation in which the root above the disc herniation is irritated.

With very large herniations, the entire cauda equina can be compressed and functionally compromised. [7] This causes saddle anesthesia and can cause urinary retention and incontinence.

A herniated disc fragment comes from the nucleus pulposus of the disc (a remnant of the embryonic notochord). In the normal condition, this nucleus is in the disc center securely contained by the annulus fibrosus. 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. 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. [8]

MRI is by far the most commonly ordered test to evaluate patients with sciatica. Often, MRI is performed prior to plain radiographs. MRI is very sensitive in delineating lumbar disc herniations. Far lateral discs are best evaluated with this test. In reoperations, MRI can delineate the full extent of scar tissue and, with moderate reliability, differentiate it from recurrent disc herniation. [2, 3, 9, 10, 11, 6]

Lumbar discectomy is the most common operation performed in the United States for lumbar-related symptoms. Almost all patients with sciatica and disc herniations deserve a trial of medical therapy. The one obvious exception is a patient presenting with cauda equina syndrome or profound motor deficits. A large multicenter trial found that surgical and nonsurgical outcomes at 2 years were similar, but that the surgical group experienced faster pain relief. [12, 13] The limitations of this study are outlined in an editorial. [14]

The lifetime prevalence of low back pain is 80%, with disc disorders being the most common cause of adult low back pain. The most consistent risk factor for degeneration is increasing age. [15]

Correlations have been found with the following [15] :

- Body mass index, mechanical loading, and genetic predisposition.
- Genes coding for collagen, aggrecan, vitamin D receptors, matrix metalloproteinase, cartilage intermediate layer protein, and interleukins.
- Smoking and increased rates of disc degeneration, with animal models showing increased proinflammatory markers, alterations to annular structure, vasoconstriction, and altered nutrient distribution to the disc.

The prevalence of a symptomatic herniated lumbar disc is about 1 to 3% in Finland and Italy, depending on age and sex. The highest prevalence is in persons 30 to 50 years of age, with a male-to-female ratio of 2:1. In persons 25 to 55 years of age, about 95% cases of herniated disc occur at the lower lumbar spine (L4–5 level); disc herniation above this level is more common in persons older than 55 years. [16] Almost 5% of males and 2.5% of females experience sciatica at some time in their lifetime. [8]

Most lumbar disc herniations (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 may radiate into the leg. It may be characterized as less 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. Higher herniations (third or fourth lumbar levels) can radiate into the groin or anterior thigh. Lower radiculopathies (first sacral level) cause pain in the calf and bottom of the foot.

Fifth lumbar radiculopathy, which occurs most commonly, causes lateral and anterior thigh and leg pain. Often, accompanying numbness or tingling occurs with a distribution similar to the pain. Accompanying muscle weakness may be unrecognized if the pain is incapacitating. The pain usually improves when the patient is in the supine position with the legs slightly elevated. Patients are more comfortable when changing positions. Short walks can bring relief. Long walks or extended sitting (especially driving) can aggravate the pain.

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). The back may appear scoliotic. Gait is often abnormal. Muscle weakness may be revealed particularly when testing walking on heels and toes.

The indications for surgical treatment of symptomatic lumbar disc disease are not clearly delineated. Nevertheless, situations exist in which most spine surgeons would probably agree on operative intervention. These situations include the following:

- A patient with cauda equina syndrome
- A patient demonstrating progressive neurologic deficit during a period of observation
- A patient with persistent bothersome sciatic pain, despite conservative management, for a period of 6-12 weeks (a time period that varies from surgeon to surgeon)

Notably missing from this list is a patient presenting with a profound motor deficit of varying duration. In the absence of pain, whether such patients benefit from surgery is unclear. No consensus has been reached concerning how urgent surgery is for a patient who presents with a clinical picture of painful disc herniation. Unfortunately, the decision to operate emergently is often based on fear of legal repercussions rather than on scientific evidence of actual patient benefit.

Any claim of absolute contraindications for lumbar disc disease would invariably be challenged. Most spine surgeons adhere to some guidelines, including the following:

- A patient with unrelenting back pain: Patients who have back pain after a bout of sciatica has resolved are not good candidates for operative treatment. Often, these patients are the most insistent and difficult to manage.

Occasionally, these are patients whose back pain improved after discectomy for a large central disc herniation.

- A patient with an incomplete workup: When diagnosis is uncertain, postpone surgery. Disc herniations are so ubiquitous that being cavalier in diagnosis is easy. Ensure the completeness of the workup prior to proceeding with the operation. All surgeons can recall several cases in which a diabetic plexopathy or an epidural metastasis was missed.
- A patient not provided adequate conservative treatment: Spine surgeons rarely commit a patient with a short period of sciatica and without bedrest and a steroid trial to an operation that will permanently alter the patient's back mechanics and strength.

The Intervertebral Disc has a complex structure. The nucleus pulposus has an organized matrix, which is laid down by relatively few cells. The central gelatinous nucleus is contained around the periphery by the collagenous annulus, the cartilaginous annulus and the cartilage and plates cephalad and caudad. The outer annulus fibrosus consists of densely packed layers of type I collagen, giving it form and tensile strength. The layered fibres are oriented at about 30 degrees to the horizontal, the direction alternating with each layer, enabling the disc to resist both distractive and shear forces. Collagen fibres continue from the annulus to the surrounding tissues, tying into the vertebral body along its rim, and into the anterior and posterior longitudinal ligaments and the hyaline cartilage end plates superiorly and inferiorly. The cartilage end plates are secured into the osseous end plates by the calcified cartilage. The annulus has a lamellar structure with interconnections between adjacent layers of collagen fibrils. Nucleus is made up of type II collagen in a mucoprotein gel rich in polysaccharides and a proteoglycan matrix, that gives it visco – elasticity, stiffness and resistance to compression through its interaction with water.

The disc can be divided into two regions, outer third and inner two third. In the outer third the disc is anchored to the vertebra on either side by Sharpe's fibres forming a ring apophysis. The layers of the inner two thirds curve into and form the cartilaginous component of the vertebral end plate. The end plate consists of hyaline cartilage in children and young adults and calcified cartilage and bone in elderly. The end plate has no fibrillar connection with the collagen of the vertebral subchondral bone, making it susceptible to horizontal shear forces. Apart from type I & II collagen V, VI, IX, XI, XII are also present. The normal adult disc has a large amount of extra cellular matrix and a few cells that account for about 1% by volume. These cells are of two phenotypes, annulus cells and nucleus cells. The annulus cells are elongated and appear more like fibroblasts, whereas nucleus cells are oval and resemble chondrocytes. These two cells behave differently and may

be able to sense mechanical stresses. The annulus cells produce predominantly type I collagen. Nucleus cells synthesize type II collagen. Embryological development of the vertebral column and discs occurs at 4 weeks of gestation. The notochord (derived from endothelial germ layer) forms the nucleus pulposus.

The discs become larger caudally. In the cervical region, the discs are thicker in their anterior portion, contributing to the lordosis. Thoracic discs are uniform in height and thicken caudally. Lumbar discs are again thicker anteriorly maximally at L5/S1. The largest disc is at the level of L4/5, this is also the most avascular disc. In normal children, who usually learn to walk unaided before the age of two, the resultant change from a primary to secondary lumbar curvature is accompanied by a change in the relative position of the nucleus pulposus within the intervertebral disc, from a predominantly posterior situation to a central situation. During the third and fourth years of life, an increase in the rate of vertical growth of the L 4-5 "total disc", as measured at its centre, is associated with the gradual change from convexity to concavity in the shape of the bony vertebral end surfaces bounding the disc. It is suggested that while vertical growth of the central region of lumbar vertebral bodies may be genetically determined and independent of mechanical factors, vertical growth of lumbar intervertebral discs and anteroposterior growth of lumbar vertebral bodies and discs are dependent on the activity associated with weight-bearing in the erect posture.

The aim of the present study was:

- To study the types and levels of disc prolapse.
- To understand mechanics of disc prolapse and subsequent nerve root compression.
- Clinical sign and symptoms produced by involved nerve root.
- Clinical, operative correlation of disc prolapse.
- Indication and advantages of microlumbar discectomy over conventional standard laminectomy.

Methodology:

The present study was planned in Department of Neurosurgery, SKMCH, Muzaffarpur, Bihar, India. In the present study 50 Patients Suffered from Lumbar disc diseases were enrolled and divided based on different surgical procedure. In the present study 25 cases of the patients undergoing Endoscopic Discectomy and 25 cases of patients undergoing Lumbar Laminectomy surgery were enrolled.

All cases except two patients, were performed under local anaesthesia with conscious sedation. Patient was positioned prone on a radiolucent table. The entry point was 10-11 cm lateral from the midline. A metal rod or 18 no. spinal needle was placed over the back in AP view in c-

arm to locate the respective disc space. Then the metal rod was placed transversely across the centre of the target disc in lateral view. Once the entry point was determined, the skin window was infiltrated with 1% plain lidocaine. A 6 inch long 18 gauge needle was inserted from the skin window at 60-65° angle to the parasagittal plane, anteromedially towards the anatomic disc centre. The subcutaneous tissue and trajectory was infiltrated with lidocaine as the needle is advanced. Then the c-arm was moved to lateral projection and position of needle tip in annular window in foramen was confirmed. The annulus was infiltrated with lidocaine. The stylet was removed and 1mm guide wire was inserted through the spinal needle. An incision about 5mm was made around the spinal needle at the entry point. The guide wire was advanced about 1-2cm into the disc and the spinal needle was removed. Now sequentially dilators were inserted over the guide wire. The scope sheath was inserted over the last dilator. Once its position was confirmed in c-arm in both AP and Lateral view, the obturator (dilator) was removed and the scope was inserted. Continuous saline irrigation was done. If there was bleeding, cautery was used. The prolapsed disc material was removed using 3mm forceps and grasper was inserted through the working channel of the endoscope, under direct endoscopic visualisation

All the patients were informed consents. The aim and the objective of the present study were conveyed to them. Approval of the institutional ethical committee was taken prior to conduct of this study.

Following was the inclusion and exclusion criteria for the present study.

Inclusion criteria: Patients with following criteria were included in the study. • Radiating leg pain that was more severe than axial back pain. • Positive straight leg raising test. • Pain not relieved after conservative (non-surgical) treatment for minimum of 8 weeks. • MRI scan of L-s spine confirming contained disc prolapsed.

Exclusion criteria: Patients with following criteria were not included in the study

Results & Discussion:

Patients having lesions of lumbo sacral region causing low backache with sciatica are commonly encountered in orthopaedics practice. [17] The pain is said to be due to the irritation of the dura covering of nerve root by the protruded part of inter vertebral disc. [18] When the nucleus of a lumbar intervertebral disc extrudes through the enveloping annulus fibrosus capsule the adjacent nerve roots may be compressed. [19] The recent advances in computed tomography (CT) and MRI and a better understanding of the causes of the leg pain make consistently accurate diagnosis of the patient's symptom producing disorders. The surgical management of prolapse

of a lumbar disc has been practiced since mixter and barr [20] discovered the link between sciatica and herniation of a lumbar disc in 1934. They started operations upon the patient via extensive laminectomy. Shortly afterwards hemilaminectomy became the favourite procedure in cases with unilateral symptoms.

Surgery for lumbar disc prolapse can be classified into two broad categories. Open versus minimally invasive. First open laminectomy and discectomy was done by Oppenheim and Fedre Krause in 1906, though the first publication was done by Mixter and Barr in 1934. Since then laminectomy, hemilaminectomy and fenestration were introduced and are still being practiced all over the world. Open surgical procedures are associated with iatrogenic morbidity such as dural tear, destabilization of spine due to resection of posterior elements, epidural fibrosis and it takes time to recover from surgical trauma to paraspinal structures. It therefore became more common for spine surgeon to consider minimally invasive procedures for these patients. With the introduction of microscope, Casper and Yasergill refined the open laminectomy into open microdiscectomy. Currently open microdiscectomy is the most widely performed procedure for disc prolapse and is considered gold standard. The concept of minimally invasive surgery for lumbar disc herniation is to provide surgical options that optimally address the disc pathology without producing the iatrogenic morbidity associated with the open surgical procedures. Percutaneous endoscopic surgery has several advantages over open surgery, including clear visualization and targeted fragmentectomy.

Table 1: Demographic Detail

Type of Surgery	Discectomy	Laminectomy
Total Cases	25	25
Age	46 – 60 years	47 – 59 years
Sex:		
Males	12	15
Females	13	10
Chief Complaints:		
Backache	24	24
Sciatica	25	25
Sensory symptoms	18	15
Motor symptoms	13	10
Urinary Complaints	2	1
Levels of Disc Prolapse:		
L1	1	0
L3	0	0
L4	4	8
L5	10	10
S1	9	
T	1	
Duration of Symptoms:		
Acute	4	6
Subacute	10	9
Chronic	11	10
Total	25	25
Occupation:		
Employed	19	20
Unemployed	6	5
Total	25	25

Table 2:

Type of Surgery	Discectomy	Laminectomy
Total Cases	25	25
Side of Disc Prolapse:		
Right	11	10
Left	9	11
Bilateral	5	4
Complications:		
Urinary retention &	1	2
Catheterisation	1	1
Wound Infection	0	0
Discitis	1	1
Dual Tear, CSF leak	1	1
Intestinal Ileus	0	1
Reherniation	21	19
No Complication		
Post Operative Pain		
Relief:	22	20
Excellent	2	4
Good	1	1
Fair		

Manoj Kumar et al, stated that there is improvement in functional outcome after lumbar discectomy, and patients were benefited from surgery. The ODI questionnaire pertaining to tolerance of pain, well-being, walking, standing, sitting, personal life, social life, lifting, travelling and sleeping was compared in the preoperative and post-operative stages which indicated a significant change with reference to nearly all variables among post-operative patients. They also reported that there was a significant improvement in the quality of life in the post-operative stage indicated by the patients with reference to walking, standing, social, personal care and sleeping. [21]

Weber in 1983 expressed that, disc herniation is a collective term, to describe a process with rupture of annulus fibrosus and subsequent displacement of the central mass of the disc into the intervertebral space, 9 common to the dorsal or laterodorsal aspect of the disc. [22]

Loupasis G.A. in 1999 conducted a retrospective study evaluating seven to twenty year outcome of lumbar discectomy by a mailed self report questionnaire. Subjective disability was assessed by the Oswestry questionnaire. They found that the long term results of 11 standard lumbar discectomy were not very satisfying. [23]

Herron L, Turner J in 1996 performed a prospective study regarding patient selection for lumbar discectomy with a revised objective rating system based on the severity of findings in each of 4 categories (neurologic signs, root tension signs, imaging findings, psychosocial environment). They found that the objective rating score was highly predictive of patient outcome at follow up with 12 more than 80% of the patients having good results. [24]

Prolapsed intervertebral disc occurs in about 5-10% of all backache patients and is a common cause of sciatica. Even

a small herniated disc in the presence of a narrow spinal canal can be responsible for the compression of cauda equine and its roots. The standard treatment of lumbar disc prolapsed has been surgical excision of the disc, though the methods of discectomy vary. The traditional view has been that wide laminectomy produces increased morbidity compared to less extensive procedures.

Endoscopic Lumbar microdiscectomy is one of the well established and frequently performed spinal procedures in neurosurgical practice. [25-26] 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% [27] prospective studies are less sanguine with statistics in the 70-80% range. [28] There is no doubt that, Minimal invasive procedures are cost effective and allow earlier resumption of activities, work and sports. The endoscopic 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 endoscopic approach means a shorter duration of operation, less bleeding during surgery, less intra-operative myoligamentous trauma, less postoperative wound pain, and return to work within half the usual time. Also prevented is the postoperative development of venous stasis and chronic nerve-root edema.

Conclusion:

The experience gained from the patients operated upon for lumbar disc herniation by endoscopic technique and conventional laminectomy with discectomy in the present study was presented herewith. All patients had virgin lumbar radiculopathy with positive clinical findings and MRI evidence of herniation. The endoscopic approach meant a shorter operating time, less bleeding during surgery, immediate mobilization of patients and shorter post-operative stay in the hospital and return to work in 7 days which is less than half the usual time in laminectomy with discectomy. In endoscopic technique fewer incidence of wound infections, Catheterization in endoscopic while urinary infection along with catheterization was very low. No patients developed pulmonary embolism, deep vein thrombosis, and increase in neurological deficit or nerve root injury. Thus endoscopic approach to discectomy for herniated lumbar disc remains the procedure of choice for majority of patients requiring surgery and it continues to be the Gold standard against which all procedures must be measured.

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