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SURGICAL MANAGEMENT OF LUMBAR INTERVERTEBRAL DISC PROLAPSE BY ENDOSCOPIC DISCECTOMY A STUDY OF 20 CASES

DISSERTATION SUBMITTED FOR

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MADURAI.

CERTIFICATE

This is to certify that the dissertation entitled ***"SURGICAL MANAGEMENT OF LUMBAR INTERVERTEBRAL DISC PROLAPSE BY ENDOSCOPIC DISCECTOMY A STUDY OF 20 CASES"*** is a bonafide record of work done by ***Dr. A.SIVASENTHIL*** in the Department of Orthopaedics, Government Rajaji Hospital, Madurai Medical College, Madurai, under the direct guidance of **Prof. Dr.A.RAJAMANI,** M.S. Ortho., D.Ortho., Professor of spine Surgery and overall guidance of me.

Prof. M. CHIDAMBARAM, M.S.ORTHO., D. ORTHO.,
Professor and Head of the Department,
Department of Orthopaedics & Traumatology
Madurai Medical College and
Government Rajaji Hospital,
Madurai.

DECLARATION

I **Dr.A.SIVASENTHIL**, solemnly declare that the dissertation entitled ***"SURGICAL MANAGEMENT OF LUMBAR INTERVERTEBRAL DISC PROLAPSE BY ENDOSCOPIC DISCECTOMY A STUDY OF 20 CASES"*** has been prepared by me under the able guidance and supervision of my guide **Prof. Dr.A. RAJAMANI,** M.S.Ortho., D. Ortho., Professor of Spine Surgery, Department of Orthopaedics and Traumatology, Madurai Medical College, Madurai, in partial fulfillment of the regulation for the award of M.S. (ORTHOPAEDICS) degree examination of The Tamilnadu Dr. M.G.R. Medical University, Chennai to be held in March 2008.

This work has not formed the basis for the award of any other degree or diploma to me previously from any other university.

Place: Madurai

Date:

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CONTENTS

INTRODUCTION

Back pain has plagued humans for many thousands of years. Low back pain is amongst the commonest human disabilities – a price man pays for the erect posture and every human being on the earth will experience back pain one time or the other in their life time.

The increasing incidence is probably due to the present day hectic lifestyle due to rapid growth of industralisation, supplemented with poor posture as a occupational hazard especially in computer profession, wrong dietary habits leading to obesity and lack of regular exercises.

It is commonly acknowledged today that derangements of intervertebral disc represents the great majority of cases of low back pain and sciatica.

Intelligent treatment of lumbar disc prolapse must be predicted on a through knowledge of the natural history of this disorder. Many times surgical treatment fails because of inaccurate diagnosis and selection of wrong patients.

Most of the studies showed that conservative treatment is the mainstay of treatment to start with and surgical treatment is indicated only when conservative treatment fails or in some other exceptional cases.

AIM OF THE STUDY

The purpose of this study is to analyse the efficacy of endoscope in the treatment of lumbar intervertebral disc prolapse as one of the armamentorium of minimally invasive spine surgery with special emphasis on surgical exposure, blood loss, post operative pain, Radicular pain relief, Return to Daily activities, work and neurological recovery after surgery.

HISTORICAL REVIEW

Description of lumbago and sciatica are found in the Bible and in the writings of Hippocrate.

1828 The first successful laminectomy performed by ALBAN GILPIN SMITH of America to treat traumatic paraplegia secondary to spinal fracture.

1857 First clinical description of disc pathology by VIRCHOW, who identified a fractured disc at autopsy.

1881 Lasegue's sign or SLRT described by FORST but attributed to LASEGUE his teacher.

1896 KOCHER isolated a traumatic rupture of the disc at L_1-L_2 during autopsy.

1911 GEORGE MIDDLETON and JOHN TEACHER diagnosed first case of disc extrusion, clinically resulting in paraplegia and urinary tract dysfunction. Autopsy showed disc extrusion at L_1 with spinal cord compression.

1911 GOLDTHWAITE showed the clinical association between disc rupture and back pain. He also analyzed the direct influence of posterior disc displacement in paraplegia.

1921 SICCARD observed that lumbar nerve root could be compressed by ruptured discs and give rise to sciatica confirmed by the presence of disc by lumbar myelography using poppy seed oil.

1927 PUTTI conducted laminectomy and facetectomy for decompression of L_5S_1 nerve roots.

1929 WALTER DANDY determined that nodules of disc material could produce sciatica and their removal relieved the pain. However, he incorrectly diagnosed these nodules as tumours.

1933 BARR removed a mass of tissue in a patient with LBA and sciatica. The histopathological report came as chordoma but he proved it as disc material later, the displacement of which was the cause of symptoms.

1934 MIXTER and BARR in their classical paper delineated the intervertebral disc as the etiological agent in the production of LBA and sciatica.

1954 HULT reported successful anterolateral decompression of a lumbar disc herniation by percutaneous discectomy.

1978 ROBERT WILLIAMS was the first to advocate microsurgical discectomy.

1984 WEBER compared disc herniations on which operations were performed with those in which no surgery was done. The prognosis in disc herniation was found to be good regardless of treatment. Operated patients improved more rapidly during the first year than non-operated patients but in 4-5 years, the statistical difference between the groups was negligible.

1987 CHOY DSJ, introduced laser disc surgery.

1993 SHERK H.H. controlled studies on the efficacy of laser discectomy were inconclusive and further studies were needed.

1993 MAYER and BROCK described percutaneous endoscopic discectomy with a medium size, straight, rigid endoscope, at L4 – L5 and above.

ANATOMY OF INTERVERTEBRAL DISC

Normally 23 intervertebral discs exist, being absent only at atlantoaxial articulations. The intervertebral discs together form approximately 25% of the length of the vertebral column above the sacrum.

We can consider each vertebra as having three functional components. The vertebral body designed to bear weight; the neural arch designed to protect neural elements; and the bony processes designed to increase the efficiency of muscle action.

Each disc consists of three major elements, the cartilaginous end plates, the annulus fibrosus and the nucleus pulposus, which together form the partially mobile articulating joints considered as amphiarthroses between the individual vertebral bodies. They allow greater motion between the vertebral bodies than if they were in direct opposition. More importantly they distribute the weight over a large surface area of the vertebral body during bending motions, weight that would otherwise be centralized on the edge towards which the spine is bent. They also serve, shock absorbing function during direct vertical loading.

The vertebral bodies are connected together by the intervertebral discs and the neural arches are joined by the zygoapophyseal joints. The discal surface of an adult vertebral body demonstrates on its periphery a ring of cortical bone. This ring, the epiphyseal ring, acts as a growth zone in the young and in adults acts as an anchoring ring for the attachment of the fibres of the annulus. The hyaline cartilage plate lies within the confines of the ring.

ANNULUS FIBROSUS

The fibres of the annulus can be divided into three main groups. The outermost fibres attaching the vertebral bodies to the under surface of the epiphyseal ring. The middle fibres passing from the epiphyseal ring of one vertebral body to the epiphyeal ring of the vertebral body below and the innermost fibres passing from one cartilage plate to the other. The fibres are parallel to each other but diagonally oriented at an angle to the spinal axis and lie in opposite directions in adjacent lamellae. This criss-cross arrangements is essential for the bio-mechanical properties of the disc. The adjacent lamellae are separated by a proteoglycan rich gel which transmits the applied pressure from the nucleus pulposus and is analogous to break fluid in a car.

The anterior fibres are strengthened by the powerful anterior longitudinal ligament. The posterior longitudinal ligament affords only weak reinforcement to the posterior fibres. The fibres are more numerous anteriorly and laterally but are deficient posteriorly.

NUCLEUS PULPOSUS

It is essentially a set of proteoglycan enveloped by collagen fibrils which are randomly arranged. The young nucleus is a gelatinous fluid and transmits the pressure from the applied loads equally in all directions to the annulus. The cells of the nucleus pulposus lie in pericellular laminae which are rich in proteoglycans and surrounded by an outer fibrillar ring of collagen, identical to those of cartilage cells.

RELATIONSHIP

The relationship of the neural elements to the body skeleton and the intervertebral disc is important in the lumbar region. The spinal cord terminates at L_1 vertebra. The lumbar rootlets together with the conus medullaris and its continuation the filum terminale, comprise the cauda equina. The roots leave the anterior dura one vertebral segment above their foramina of exit. Then they pursue their oblique and downward course crossing the postero-lateral aspects of the discs below and continue

across the upper and postero lateral aspects of the bodies below the disc. Finally, they swing laterally beneath the pedicle and enter the intervertebral foramina. The intervertebral foramina provide the routes of exit for the nerve roots. Their anterior boundaries are formed by the posterior and lateral aspects of the vertebral bodies and the intervertebral discs. At its point of emergence from the foramen the nerve root is once again in intimate contact with the posterolateral aspects of the disc. The nerve root therefore is vulnerable to compression by pathological changes occurring at several points during its course down the spinal canal.

In analyzing the movements between two vertebrae, some structures permit movement and others limit the motion. The motion segment consists of all the structures that move between two vertebrae. These comprise the posterior articular joints and their capsules and ligamentous apparatus, the anterior and posterior longitudinal ligaments, the ligamentum flavum, the interspinous ligament, the extensor muscles of the back crossing at the level of the intervertebral disc. All these structures comprise the motor segment units.

The nerve supply of the soft tissue elements of the motor units and the relation of the nerve roots to the IVD explain the location and pattern

of the pain observed in the lumbar disc disease. In general the soft tissue components of the motor units are innervated by sinovertebral nerves and posterior primary divisions of the lumbar nerve roots.

The sinovertebral nerve takes origin near the spinal ganglion, one or two segments above the foramen it enters the spinal canal. It divides into ascending and descending branches which proceed towards the disc above and below and supply the peripheral layers of the annulus fibrosus. It also supplies the durameter, the vascular elements, the posterior longitudinal ligament and the periosteum, and when these nerves are irritated they produce deep local pain and muscle spasm. The pain may radiate to the hip, the sacroiliac joint and the posterior aspect of the thigh. This type of pain is diffuse and poorly localised by the patient and it is called discogenic pain in contrast to the neurogenic pain which is caused by direct irritation of the nerve root. The reflex muscle spasm is responsible for obliteration of lumbar lordosis and sciatic scoliosis in a patient with acute lumbar disc lesion.

The posterior rami supply the stem and muscles of the lumbar region and also sensory fibres to fasciae, ligaments, the periosteum and the IV joints.

The discs have a blood supply upto the age of 8, but thereafter they are dependent for their nutrition upon diffusion of tissue fluids. Fluid transfer is bidirectional from vertebral body to the disc and from the disc to the vertebral body.

ANATOMY OF THE NERVE ROOTS

The anterior and posterior nerve roots are formed by the convergence of nerve rootlets exiting from the anterior and posterior aspects of the spinal cord respectively. The lumbo sacral nerve roots travel for a considerable distance in the intrathecal space before entering the appropriate root sleeve within the dural sac. These structures are approximately referred to as anterior and posterior roots. Once they enter the root sleeves, they become spinal nerves as they contain both sensory and motor fibres and they remain as spinal nerves until they pass through the foramen where they branch into anterior and posterior rami.

Although the intrinsic capillary bed runs throughout the entire length of the root, the fact that the main feeder arteries decrease in size as the area of anastomosis is approached results in an area of relative hypovascualrity for a variable distance near the mid region of the root.

A final anatomical feature of major important relates to the lymphatic drainage of nerve roots. The intrinsic microvascualr blood flow to the nerve roots is extensive but lymphatic drainage is poor. In the absence of good lymphatic drainage an inflammatory response that has gained access to the endoneural space is cleared with great difficulty predisposing the nerve to invasion by fibroblasts and the development of intraneural fibrosis.

BIOMECHANICS OF THE SPINE

The flexion and extension motion range increases from L_1 to L_5. The lumbo sacral joint offers more saggital plane motion than other lumbar joints. For lateral bending each level shows the same range except L_5-L_1 which has little motion. The situation is same for axial rotation except for $L_5 - S_1$ which in these cases shows a greater range. Added to these movements that are several coupling pattern have been observed in the lumbar spine.

The nucleus pulposus acts like a ball bearing and in flexion and extension, the vertebral bodies roll over the incompressible gel, while the posterior joints glide and steady the movements.

The annulus acts like a coiled spring pulling the vertebral bodies together against the elastic resistance of the nucleus pulposus. The disc has the ability to convert a vertical pressure to a horizontal thrust, extending its energy on the annulus fibrosus. The fluid behavior of the nucleus pulposes is essential in distribution of this vertical thrust. The annulus extends with ease along the vertical axis allowing motion. While its resistance against horizontal displacement provides stability during vertical loading there is much greater amount of energy absorbed by the disc than during flexion or lateral bending.

Among the many forces acting on the disc like compression, bending or torsion, the bending and torsional forces and not the compression force, are the most damaging to the disc. Fatigue tolerance of the disc is low as the biological capacity for repair and regeneration of the disc is also low.

ROOT MECHANICS

The axis of rotation of spine during flexion and extension is located anterior to the spinal canal which means that spinal canal lengthens in forward flexion and shortens in extension. Change in length in adult is 7

cm in average. The neural tissues do not slide in the canal during spinal motion but rather adopt to length changes by passive deformation. Although the IV foramen represents a point of relative fixation of the nerve, peripheral nerve distal to the foramen becomes progressively more elastic stretching in the nerve reached the IV foramen only when the leg is elevated 20° – 30° and little movement is seen thereafter. The amount is dependent upon patients age and the presence of adhesions. The pain associated with sciatica must not be purely mechanical phenomenon, pain resulting from SLR must be at least partially a physiologic response triggered by tensile forces developing in an inflamed partially ischemic but still conducting nerve distal to IV foramen and not a simple direct reflection of compression of a spinal nerve on the proximal side of foramen.

PATHOLOGY

As noted, the lumbar spine must support the weight of the entire spinal column. In addition, significant motion occurs between lumbar vertebrae, particularly at the lower two lumbar discs. These two factors result in pathological processes that lead to lumbar disc degeneration and herniation and to spondylotic changes that may result in lumbar or lateral recess stenosis.

The characteristics of prolapses vary with the physical qualities of the affected disc tissue. Knowledge of the varying relationships which prolapsed disc may bear to the neural contents of the spinal canal is essential to the understanding of varied clinical pictures which may present.

In young persons, discrete, small rounded firm, fluctuant protrusions are found with the stretched but intact annulus and when incised at operation, only a small quantity of disc tissue may escape and be removed.

Extrusion of variable quantities of disc tissue into the spinal canal may be seen when gross degerative changes have occurred in the disc as a

whole. This is called “sequestrated disc fragments”. The components of such fragments may include nuclear, annular and end plate material.

Between these two extremes, a variety of pathological changes are noted. Incomplete sequestration may be associated with marked perineural fibrosis. Calcified nuclear tissue may herniate or calcification may occur in prolapsed tissue leading occasionally to erosion of the dural sac.

Sequestrated fragment may migrate to another level from the disc of its origin. In a subrhizal prolapse, the disc fragment lies anterior to the affected nerve root and this usually causes severe pain with objective sensory and motor signs.

Prolapses situated between the dural sac and the nerve root sheath, axillary prolapses or those lying outside the nerve root sheath, pararhizal prolapses may produce severe sciatica without abnormal objective physical signs.

Centrally placed prolapses or large migrating sequestrated fragments in the spinal canal may give rise to physical signs including bowel or bladder dysfunction and neurological sign and symptoms which vary from day to day in one leg or the other.

NATURAL HISTORY OF DISC DISEASE

Kirkaldy - Willis has postulated a theory of spinal degeneration as the natural process of spinal aging. The degenerative process has been divided into three separate stages.

The first stage is the stage of dysfunction. This stage is found in the age group of 15-45 years. This is characterised by circumferential and radial tears in the disc annulus and localised synovitis of facet joints.

The second stage is instability found in 30-70 years old patients. This is characterised by internal disruption of the disc, progressive disc resorption, degeneration of facet joints with capsular laxity-subluxation and joint erosion.

The final stage that is stage of stabilization is present in patients older than 60 years. In this stage, progressive development of hypertrophic bone around the discs and facet joints leads to segmental stiffening or frank ankylosis.

Disc herniation occurs during the stage of dysfunction and instability. Spinal stenosis occurs as a result of degenerative arthritis of facet joints.

CLINICAL FEATURES

SYMPTOMS

The patient gives a history of attacks of low back pain. A relatively minor degree of trauma is followed by acute severe low back pain and leg pain. Often, the back pain disappears with the onset of leg pain. The pain is made worse by forward bending, coughing and by sneezing. It is relieved by rest with the patient recumbent and the knee flexed. In the case of a small mid line protrusion, no leg pain may be present. Occasionally, the patient complains of muscle weakness when this is of marked degree. Still more rarely there may be complaints of bladder and bowel dysfunction.

Radicular pain and referred pain must be distinguished which is important in arriving at a clinical diagnosis.

Referred pain	Radicular pain
Symptoms Deep, boring, ill-defined, poorly localized	Sharp, well localized, electricity like
Radiation Radiates upto calf, rarely to foot	Follows nerve distribution up to the foot.

Sensory alteration Rare	Frequent, dermatomal distribution
Motor Weakness May have subjective weakness	Frequent objective weakness
Reflex deficit Rare	Frequent
Tension signs Absent	Frequent, sciatic nerve tenderness, popliteal, peroneal nerve tenderness
Provocative / analgesic testing Needle placement in a trigger point or injection of a posterior joint or intervertebral disc frequently replaces pain which is abolished by local anaesthetic	Selective nerve root injection used to isolate a symptomatic level

PHYSICAL EXAMINATION

The patient may have obliteration of normal lumbar lordosis with sciatic scoliosis. When the disc herniation is lateral to the nerve root, the patient will have scoliosis to the opposite side of the nerve root. When the herniation is in an axillary position, medial to the nerve root, the patient will have scoliosis towards the side of lesion in an effort to decompress the nerve root.

Limitation of motion is usually noted during the symptomatic presentation of the disc disease. Marked limitation of forward flexion is noted. Reversal of normal spinal rhythm on attempting to regain the erect posture after forward flexion is characteristic. The patient will usually tuck his pelvis under his spine to regain the erect position by slightly flexing the hip and knee.

Tenderness may be present over the spinous process or just lateral to it at the level of disc involved.

STRAIGHT LEG RAISING TEST

This is the single most important test in the diagnosis of a herniated disc. This test is done by raising the leg slowly with keeping the knee in

extension. This maneuvre cause stretching of the root involved and produces radicular pain. The pain produced during the test by nerve root stretch and not by other lesion such as hamstring spasm and is confirmed by three tests.

a. Dorsiflexion of the ankle at the limit of straight leg raising (Lasegue's sign).
b. Compression of the common peroneal nerve (bow string test).
c. Flexion of the cervical spine.

Aggravation of pain by these tests add more significant to the finding of limitation of SLR.

WELL LEG RAISING TEST

Raising the controlateral leg reproduces pain on the affected side. This usually indicates a very large extruded disc or a disc fragment in the axilla of the nerve root.

FEMORAL STRETCH TEST

Patient will have pain in the anterior thigh on extension of the hip in prone position. This indicates upper disc herniation producing stretching of femoral nerve during the test.

WADDELL NON-ORGANIC PHYSICAL SIGN

Non-organic causes of low back pain can be detected by following physical signs.

a. Pain and tenderness of bizarre degree and distribution
b. Pain on performing impressive but non-stressful manouvres such as pressing vertically on the spine or passively rotating the entire spine.
c. Variations in response to tests such as SLRT while distracting the patients attention.
d. Sensory deficit affecting the entire lower limb.
e. Over – determined behaviour during physical examination accompanied by loud groaning and exclamation of discomfort.

These overt patients are unlikely to respond to surgery.

NEUROLOGICAL EXAMINATION

A meticulous neurological examination will yield objective evidence of nerve root compression and suggest the level of disc herniation.

The motor weakness, changes in sensory appreciation or alteration in the deep tendon reflexes should be carefully noted.

Mc Culloch's criteria of diagnosis of prolapsed intervertebral disc are-

1. Unilateral leg pain in a typical sciatic nerve distribution including discomfort below the knee.
2. Specific neurological symptoms indicating a single nerve.
3. Limitation of straight leg raising by at least 50% of normal.
4. At least two neurological changes of muscle wasting, muscle weakness, sensory change or hyporeflexia.
5. MRI or CT scan evidence of a disc protrusion.

INVESTIGATIONS

RADIOLOGICAL EXAMINATION:

All the patients were investigated with plain x-ray, MRI and CT.

PLAIN X-RAY

Even though of limited value, it helps to find out narrowing of disc space, sciatic scoliosis, degenerative changes, loss of lumbar lordosis, listhesis and translational vertebra.

Narrowing of the disc space may be considered as an indication of degenerative disc disease, but not diagnostic of herniated disc.

Plain x-ray is useful to exclude other conditions producing low back pain such as spondylolisthesis, fracture, tumours, infections, congenital anamolies, ankylosing spondylitis and paget's disease.

Plain x-ray plays an important role in the assessment of the anamolies of the spine like sacralization of L5 or lumbarisation.

MYELOGRAPHY

Myelography is indicated only if surgical intervention is indicated. Water soluble contrast like metrizamide and non-ionic contrast iohexol

are used. Myelogram will localize the level of disc disease with an overall accuracy rate of 85% in detecting prolapsed disc.

Posterolateral herniation is identified by-

a. Incomplete filling
b. Elevation of spinal nerve sleeve
c. Lateral indentation of dural sac
d. Double density of the dural sac on lateral view.

Central herniation shows-

a. Complete myelographic block
b. AP view shows irregular saw toothed or paint brush appearance.
c. However, when interpreting the results of myelography, the false positive and false negative results should be kept in mind.

It has disadvantage of being invasive, chance of toxicity, other side effects and being less accurate at L5 S1 level due to large epidural space. It is also inaccurate for extreme lateral disc herniation than for more central herniations because lumbar nerve root sheath terminates near dorsal root ganglion.

CT SCAN

CT scan has revolutionized the diagnosis of spinal disease. The CT appearance of a herniated disc is a soft-tissue density extending in an angular manner from the posterior disc margins into the spinal canal. The mass both replaces the fat that is normally found centrally or laterally in the spinal canal and quite frequently compresses or displaces a nerve root and / or dural sac. When the disc herniation is contained the interface between the disc material and the dural sac is quite sharp and the nuclear material is contoured into a rounded mass by the posterior supporting structures. Conversely, an indistinct, polypoid or serpiginous margin of a disc herniation suggests free fragment. Extruded disc material may remain contained by an intact PLL, yet quite frequently the herniation may extend both upwards or downwards, these have ovoid configuration.

It has been particularly valuable in the diagnosis of extreme lateral or foraminal disc herniation. CT scan neither demonstrate intra-spinal tumour, arachnoiditis nor differentiate scar from new disc hernitation.

MRI SCAN

Lumbar disc herniation is better depicted by MRI than by other conventional modalities. The outer annulus and the posterior complex can

be seen as an area of decreased intensity in contrast to inner annulus – nucleus pulposus area, which helps characterize the type of herniation. The criteria for diagnosis of bulging or herniated disc on MRI are similar to those for CT scans. Although degeneration may be seen without herniation, most herniated discs are degenerated. Noted exceptions to this are uncommon juvenile disc herniation and the appearance of an acute disc herniation, such as may be noted with spinal trauma.

Mcnab and co-workers classify an abnormal disc as an annular bulge or herniated (protruded, extruded, or free fragment). An annular bulge is a result of disc degeneration usually recognized as a generalised extension of disc margin with intact lax annulus beyond the margins of adjacent vertebral end plates. Annular tears are considered as intermediate between disc bulge and herniation and they can be concentric, radial or transverse tears. Protruded discs represents herniation of disc material through a defect in the annulus, producing a focal or broad based extension of disc margin.

Extrusion and sequestration refer to herniations that are no longer contained by overlying annulus and ligament. An extruded disc represents herniation of nuclear material that results in an anterior

extradural mass and remains attached to nucleus of origin. Sequestrated disc refers to disc material external to annulus fibrosus and no longer contigous with parent nucleus. Differential diagnosis for MRI finding of sequestrated discs include epidural abscess, extradural neoplasm such as neurofibroma, post operative epidural fibrosis or fluid collection.

MRI is the imaging modality of choice in the evaluation of patients with recurrent clinical symptoms after disc surgery owing to its superiority in distinguishing the nerve roots at the surgical site, MRI was found to be superior than CT. But despite the use of gadolinium-DTPA, MRI studies obtained in the initial postoperative period are difficult to interpret, because of the normal sequence of changes. Consequently, the clinical picture still remains the major indicator for recurrent surgery.

The advantage of this technique includes the ability to demonstrate intra-spinal tumours, examine the entire spine, disc space infection, recurrent herniated disc and fibrosis.

Other investigations like discography, epidural venography nerve root infiltration, nerve conduction test, EmG are rarely performed.

CONSERVATIVE MANAGEMENT

Armstrong simplified the sequence of pathological changes in lumbar disc disease into three stages. Nuclear degeneration, nuclear displacement and fibrosis. The principle of conservative treatment is to protect the abnormal disc from strains and to put the part at rest to encourage healing. Even sequestrated fragments may respond to this treatment because they may dessicate in time.

BED REST

Bed rest or controlled physical activity is a main stay of therapy in conservative management.

The bio-mechanical rationale for bed rest is that the lowest intradiscal pressure are recorded in the supine position. Semifowler position with knees and hips flexed is even more helpful in reducing the symptoms.

Patient with severe symptoms is treated with absolute bed rest on a firm mattress and with necessary analgesics. Two days of bed rest followed by mobilization is as beneficial as a more prolonged period of rest.

The patient with mild or moderate symptoms of either low back pain and sciatica may respond to decrease in general activity, avoidance of lifting, bending and twisting, the use of a firm mattress and use of lumbosacral corset.

TRACTION

The basic premise of traction is that unloading the component of the spine by stretching muscles, ligaments and functional spinal units will decrease intra-discal pressure thereby relieveing the symptoms. When correctly applied it can cause distraction or separation of vertebral bodies and widening of the intervertebral foramen. It augments the effect of bed rest and ensures that the patient cannot leave his bed.

There are many forms of spinal traction:

1. Continuous traction uses light weight applied for several hours at a time.
2. Sustained (Static) traction uses a steady amount of weight for a period upto 30 minutes heavier weights are tolerated for this short period of time.
3. Intermittent traction applies and releases traction every few seconds.

4. Manual traction – Manual traction in the form of steady pull for a few seconds or a quick thrust.

MEDICINES

Medicines usually prescribed in disc prolapse are analgesics – anti-inflammatory muscle relaxants and tranquilizers singly or in combination. They give symptomatic relief and do not alter the course of the disease.

COLD PACK AND HEAT

Severe acute pain responds to ice pack application locally at the site of pain. Moderately severe pain responds to heat therapy.

LUMBOSACRAL SUPPORTS

The efficacy of lumbosacral supports in immobilizing the joint is greatly doubtful but the corset helps to raise the intra abdominal pressure and there by reduce by something approaching one-third, the load sustained by the lumbar discs.

EXERCISES

Most authors found the spinal exercises are very valuable in regaining mobility, make the back strong and in preventing attacks.

Strong muscles prevent strains on the spine from harmful or unusual activities.

There are equally strong views as regards to the type of exercise the patient should do. Some authorities believe that extension exercises are more helpful to strengthen the para spinal muscles. But others advocate strengthening of abdominal muscles and maintaining the intra-abdominal pressure to an optimum as advised by Williams.

SURGICAL TREATMENT

1. OPEN SURGERY

a) Standard laminectomy / discectomy

b) Fenestration discectomy

c) Microscopic discectomy

d) Endoscopic discectomy

2. CLOSED SURGERY

a) Chemonuleolysis

b) Automated percutaneous discectomy

c) Percutaneous manual discectomy

Before surgery the following criteria must be fulfilled.

1) No operation on a psycho-social problem.
2) No falling into a trap and missing another potential cause of low back pain and sciatica.
3) An accurate diagnosis as to the anatomical location of the lesion which is based on a perfect fit between the neurological examination and the structural lesion seen on imaging.
4) Unequivocal definition of the lesion on imaging
5) The patient has the indications for surgery

INDICATIONS FOR SURGERY

1. **Absolute indication:**
    a) The acute massive disc herniation that cause bladder and bowel paralysis.
    b) Increasing neurological deficit with significant straight leg raising reduction.
2. **Relative Indication**
    a) Failure of conservative treatment: Conservative treatment must be at least 6 weeks and not more than 3 months.
    b) Recurrent episode of sciatica.

OPERATIVE TECHNICAL CONSIDERATION

MICROSCOPIC DISCECTOMY

Posterior lumbar disc surgery with the use of microscope through a small incision.

ADVANTAGES

1) Small incision, good wound healing less fibrosis and less scarring, there fore less postoperative morbidity, early return to activity.

2) Good magnification and good light in the operative field
3) Muscle damage less therefore less blood loss, less rate of transfusion.
4) Structure and function of the spine preserved.

DISADVANTAGES

1. Limited field of vision
2. Limited field of work.
3. Wrong level
4. Missed pathology
5. Dural injury
6. Infection
7. Obstruction of view by instruments in the field

ENDOSCOPIC DISCECTOMY

These technique generally are variations of the micro discectomy technique using an endoscope, rather than the microscope and different types of retractors. The basic principles remain the same as with microscopic discectomy.

ADVANTAGES

1. Illumination and magnification are more therefore disc fragments are easily localized.
2. Provides wide field of vision of whole canal and we can see the opposite side also, which is useful for the removal of disc from the opposite side.
3. Because of its special design, the surgeon can permanently see the ends of the surgical instruments and the different anatomical structures.
4. We can tilt the scope on both sides.
5. Because of small incision muscular trauma minimized which leads to less post operative pain, consequently faster rehabilitation.
6. Postoperative spondylodiscitis less common because the instruments which enter the herniated disc never touches the skin.
7. Multiple level disc can be operated with single incision.
8. Also useful for lumbar canal and root canal stenosis decompression.

MATERIALS AND METHODS

This study has been made with prospective analysis of 20 cases of lumbar intervertebral disc prolapse treated by endoscopic discectomy during the period from January 2007 to June 2007.

In our study we used KARL STORZ endoscope designed by Dr. DESTANDAU, Neurosurgeon, Bordeaux, France.

Prior to surgery the diagnosis was confirmed by CT/MRI and correlated by clinical, peroperative findings.

All the patients were followed up from the time of presentations till the end of the study regularly from January 2007 to January 2008 and the average period of follow up was 8 months and one patient lost for follow up.

Back pain, radiating leg pains, functional endurance and neurological features were the main aspects analysed since these were the main complaints of the patients.

An objective evaluation regarding spinal movements, local tenderness, spasm, sciatic scoliosis, SLR and neurological signs also recorded in order to make it a comprehensive evaluation.

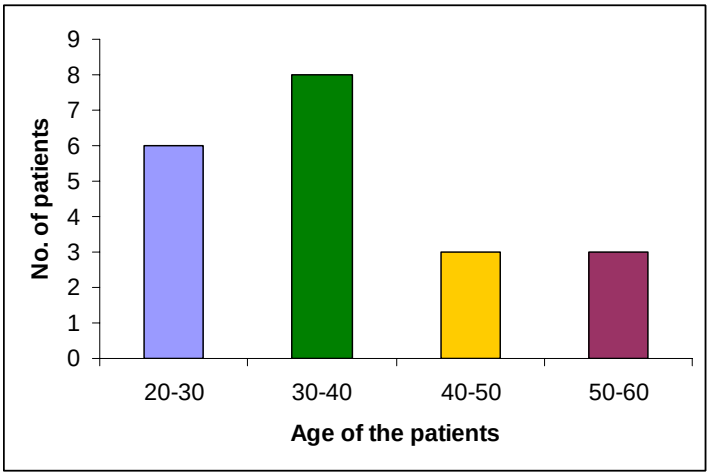
The results of the treatments were grouped into four excellent, good, fair and poor according to relief of pain, working ability and clinical signs.

Excellent	Complete relief of pain, full spinal movement, negative SLR, no work restrictions, no need for further treatment.
Good	Complete or near complete relief of pain, minimal restrictions of work, require intermittent treatment.
Fair	Moderate pain relief, moderate work restrictions, need further evaluation.
Poor	No relief of pain, unable to work, requires further investigation and treatment.

DISTRIBUTION OF THE PATIENTS

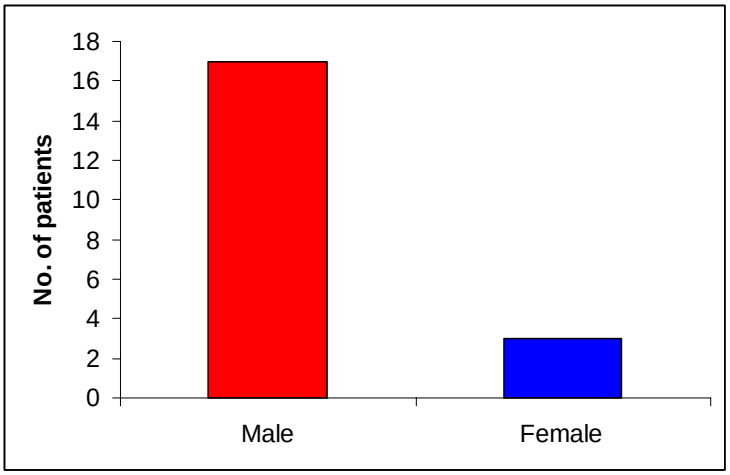
a) AGE

Age of patients in this study ranges from 21 to 60. Mean age is 33 years.



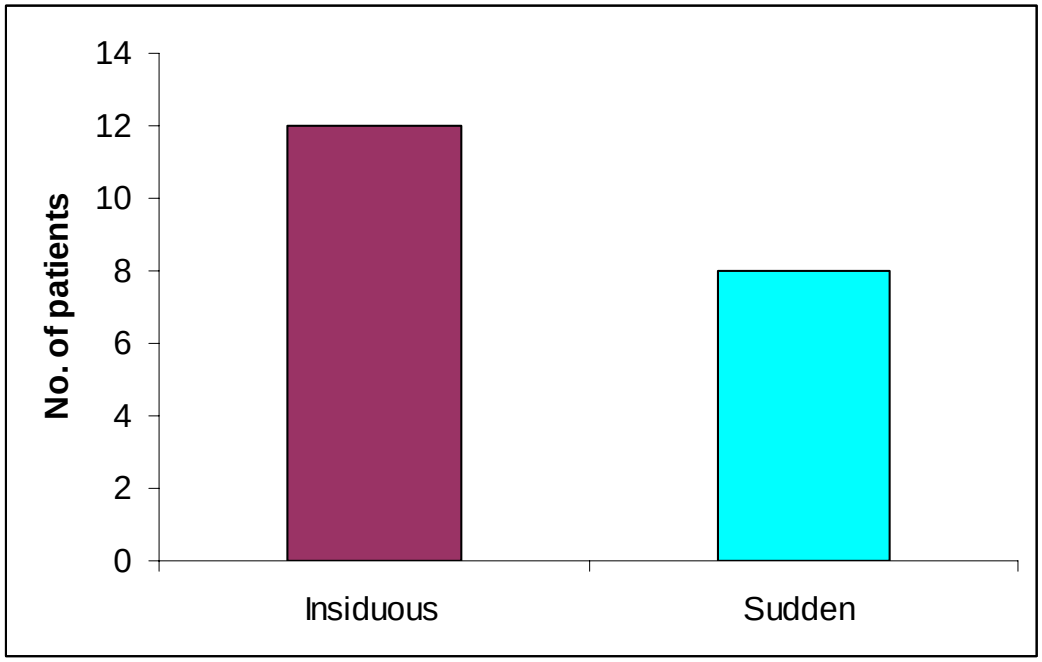
b) SEX

Out of the total 20 patients males were 17 in number and female 3 in number.



ONSET OF SYMPTOMS

Nature of onset	Number of patients	Percentage
Insiduous	12	60%
Sudden	8	40%



Out of the 20 patients onset of symptoms were insidious in 12 patients sudden in 8 patients.

DURATION OF SYMPTOMS

Duration of clinical symptoms varies from few months to several years. Mean duration was 6 months.

Duration	Number of patients	Percentage
≤ 6 months	4	20%
6 months – 1 year	6	30%
1 year – 2 year	5	25%
≥ 2 year	5	25%

SYMPTOMS

a. Main complaint of the majority of the patients was low back pain radiating down to lower limbs.

   15 patients were having low back pain radiating to lower limbs. 5 patients had only leg pain.

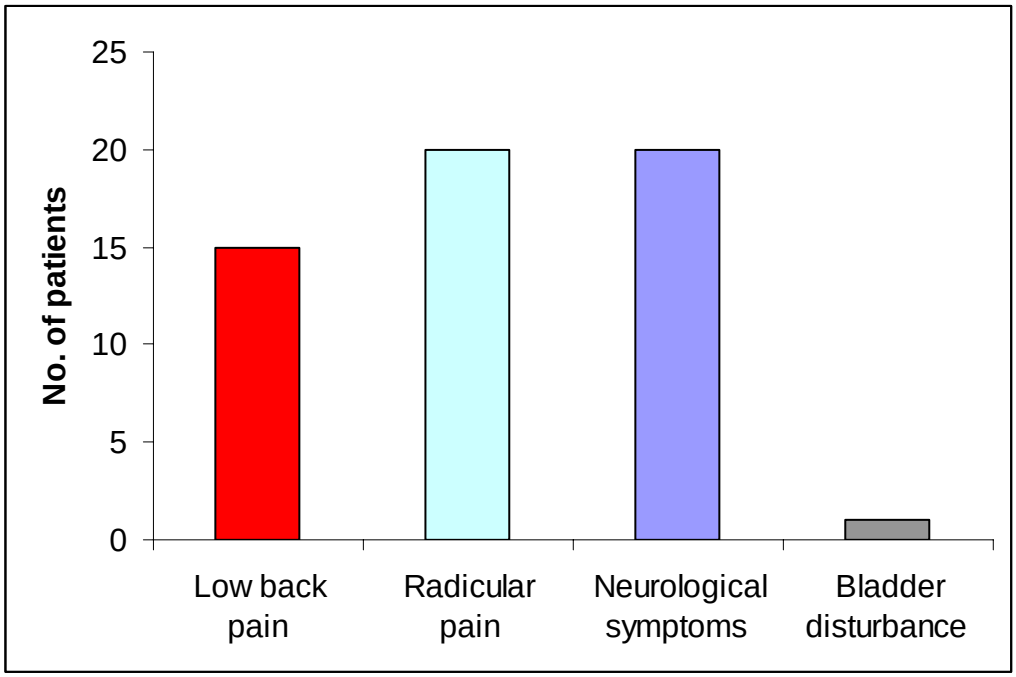
b. Next major symptom was difficult in bending. Almost all patients had difficulty in bending but the severity varied.

c. Neurological symptoms like sensory disturbance or motor weakness were noted in all 20 patients. Sensory disturbance presented as numbness, parasthesia, burning, weakness usually were objective findings.

d. Bladder disturbance was found in one case.

SYMPTOMATOLOGY

Symptoms	Number of patients	Percentage
Low back pain	15	75%
Radiating leg pain Unilateral Bilateral	 16 4	 80% 20%
Neurological symptoms	20	100%
Bladder disturbance	1	5%



OBJECTIVE EXAMINATION

a) SCIATIC SCOLIOSIS

This was the frequent finding in acute cases. The direction of sciatic scoliosis is well correlated with the situation of the disc prolapse i.e. disc herniation lateral to the nerve root presented with scoliosis to the opposite side and disc herniation medial to the nerve root presented with scoliosis on the same side.

11 patients had sciatic scoliosis.

b) DECREASED LORDOSIS

Majority of the patients had some amount of loss of lordosis. 16 patients had decreased lordosis.

c) SLR

SLR was positive in the range of 0-50 in 14 patients. SLR in the range of 50-90 was noted in 6 patients.

d) WELL LEG RAISING TEST

Well leg raising test was pathagnomonic of disc prolapse and was noted in 6 patients.

e) NEUROLOGICAL SIGNS

Only sensory deficit was present in 3 patients. Only motor deficit was noted in 6 patients. Only reflect deficit was noted in 1 patient. A combined deficit was noted in 10 patients.

F) LIMITATION OF SPINAL MOVEMENTS

This was most frequently positive objective finding. Spinal flexion and lateral bending were characteristically limited in this study.

OBJECTIVE EXAMINATION

Signs	Number of patients	Percentage
Scatic scoliosis	11	55%
Decreased lumbar lordosis	16	80%
SLR +ve	20	100%
Well leg raising test	6	30%
Neurological signs	20	100%
Limitation of spinal movements	18	90%

OPERATIVE TECHNIQUE

ANAESTHESIA

General anaesthesia

POSITION

Patient is then changed to modified knee chest position after the induction of anaesthesia with the bladder on catheter. Eyes are protected with cotton pads. Arms are kept by the side of the body.

IMAGE INTENSIFIER

They are used for the localization of disc space preoperatively and confirmation of level per operatively.

TUMESCENT INJECTION

Adrenaline	-	1ml (1:1000)
Sodium bicarbonate	-	10ml (7.5% w/v)
Hyalase	-	1 ampoule
Lignocaine (2%)	-	25ml
Normal saline	-	450 ml

Solution is prepared from these drugs and about 50ml is injected down to the level of lamina to minimize the bleeding.

MARKING THE ENTRY POINT

A special localization device with two arms is used with the fluoroscopic image intensifier for determination of the point of the skin incision. The target disc is centered on the monitor screen of the image intensifier. The localization device is placed in position and its position modified until the two arms are projected onto the disc.

The point of incision is marked on the skin and the direction of the operating light is adjusted to the direction of the approach i.e. to the orientation plane of the disc. This direction is a line of reference throughout the operation.

The surgeon takes up a position on the side of the hernia. To his left is the instrument table on which the video camera and cold light cables are resting.

SURGICAL STEPS

Make a posterior midline incision from the spinous process of the upper vertebra to the spinous process of the lower vertebra at the involved disc level. This is usually 1.5-2 cm long. Deep fascia incised, go between the paraspinal muscles and are pushed on to one side.

According to the type of disc herniation two approaches used.

a) Inter laminar window – For central and lateral disc herniation.
b) Inter transverse window – Far lateral or extra foraminal disc herniation.

Then trocar with operating tube is introduced opposite to inter laminar window. Now remove the trocar and remove whatever soft tissues or muscles coming in the way of operating tube.

Now the Endospine working tube is introduced in to the operating tube. Ligamentum flavum removed, If necessary some of the superior lamina can be removed with kerrison Rongeurs. Nerve Root, Dura identified and retracted. Bulging disc exposed and removed with disc punch. The disc cavity may be inspected by inserting the Hopkins telescope.

Then disc cavity is irrigated with isotonic solution under controlled inflow pressure. Antibiotic solution injected in to the disc space. Before removing the endospine check hemostasis and look for cord pulsation. Then muscles, subcutaneous tissue sutured with absorbable sutures. For skin subcuticular sutures applied.

RESULTS

In majority of the patients level of disc herniation is L4 L5, left side involvement is more common than right, protrusion is more common than other types.

SKIN INCISION

Size of the incision	No of patients	Percentage
1.5 cm	4	20%
2.0 cm	10	50%
2.5 cm	6	30%

In majority of patients the size of the skin incision was 2cm.

BLOOD LOSS

Amount of blood loss	No of patients	Percentage
15-25 ml	13	65%
26-35 ml	6	30%
36-45 ml	Nil	-
> 45 ml	1	5%

The blood loss was calculated from the suction apparatus and also from mop pads. Average blood loss in our series was about 25ml.

All patients were followed up for an average period of 8 months and the results were analysed.

Clinically by alleviation of post operative pain, radicular pain, return to daily activity, work and neurological recovery.

POST OPERATIVE PAIN

Post operative pain lasts for	No of patients	Percentage
< 2days	17	85%
3-7 days	3	15%
> 7 days	Nil	-

In majority of the patients i.e. 17 patients post operative pain lasts for less than 2 days.

RADICULAR PAIN

Radicular pain last for	No of patients	Percentage
< 3 days	4	20%
4-7 days	11	55%
> 7 days	5	25%

Out of 20 patients the radicular pain disappears within 4 to 7 days in 11 patients. According to oswestry scale the relief was excellent in 13 patients, good in 4 patients, fair in 3 patients, there is no worsening of original radicular pain.

DURATION OF HOSPITAL STAY

Duration Of Hospital Stay	No of patients	Percentage
One day	10	50%
2 days	7	35%
3 days	3	15%

Out of 20 patients 17 patients discharged to home on the 2nd day, Remaining 3 patients on the 3rd day.

RETURN TO DAILY ACTIVITIES

Return to daily activities	No of patients	Percentage
1- 2 days	14	70%
3-4 days	5	25%
> 4 days	1	5%

Out of 20 patients 14 patients return to daily activities in 1-2 days. One patient lost for follow up.

RETURN TO WORK

Return to work	No of patients	Percentage
< 4 wks	12	60%
4-8 wks	6	30%
> 8 wks	2	10%

Out of 20 patients 12 patients return to their work within 4 weeks, 6 patients between 4-8 weeks, 2 patients more than 8 weeks.

NEUROLOGICAL RECOVERY

Neurological recovery	No of patients	Percentage
< 8 wks	11	55%
8-12 wks	5	25%
> 12 wks	3	15%

Complete neurological recovery was seen in 13 patients, neurological improvement seen in 7 patients one patient lost for follow up, there was no worsening of neurology.

Out of 20 patients recovery was noted in less than 8wks in 11 patients, between 8-12 wks in 5 patients, more than 12 wks in 3 patients. One patient lost for follow up.

COMPLICATION

Complication	No of patients	Percentage
Superficial infection	1	5%
Epidural bleed	1	5%

Superficial infection and epidural bleed each is seen in one patient. In our series we encountered wrong level in 3 cases but correct level was identified with the help of image intensifier two to three times peroperatively.

Our functional results were analysed using the oswestry scale.

OSWESTRY SCALE

Oswestry scale	No of patients	Percentage
Excellent	13	65%
Good	4	20%
Fair	3	15%
Poor	Nil	-

DISCUSSION

Before going to the detailed discussion of the final evaluation, the limitations of the study should be taken into account.

This is regarding the criteria for evaluation. Even though symptoms are the major assessment criteria, in this study equal importance has been given to the symptoms as well as signs. So, there may be minor differences between the subjective relief and overall evaluation.

AGE AND SEX

In this study, majority of the patients come under 20 - 40 years Males are more commonly affected than females.

SYMPTOMATOLOGY

In majority of patients the onset of symptoms in this study was insidious. Repeated stress or occupational stress was found to be the main cause. In 40% of patients, there was definite history such as lifting heavy weight and bending and twisting. Forward bending with twisting was found to be the major culprit.

87% of patients presented with low back pain and sciatica. The sciatic pain was characteristically below knee upto ankle. In nearly 15%

of patients, there were subjective sensory alterations in the form of numbness or paraesthesia. In the remaining patients, it was only objective finding.

The commonest level of disc herniation in this study was L4-5 being 75%. Next common is L5 S1 15%, double level lesion in 10% of cases.

The commonest site of disc herniation in this study was posterolateral subrhizal followed by axillary type and central disc.

A careful history, nature of patients pain, its quality, locations and distributions and careful physical examinations were sufficient to diagnose the disc herniation. Sciatic tension signs have high correlations with disc herniation. These diagnostic signs of sciatic stretch can be reliable guides to start aggressive modes of evaluation. No correlation was found between specific SLRT and locations of disc herniation.

INVESTIGATIONS

The majority of the patients in this series, diagnosis has been made mainly by history and physical findings. The diagnosis was confirmed by CT / MRI. The investigations were useful to find out level, locations and type of lesions.

MRI is the standard investigation for disc disease. Interpreting radiologically detected disc protrusion is vital. Since, there are frequent asymptomatic disc prolapse. Correlation between clinical finding and radiological finding should be made before contemplating surgery. In this series, in 3 cases the MRI findings were multiple disc but with single root compressions. In these cases, only symptomatic disc was moved.

METHODS

We have choosen KARL STORZ – DESTANDAU endoscope for the following reasons.

The magnification and illumination provided by this instrument was far superior than other minimally invasive procedures (microscope, foraminoscope).

Because of its special design we can tilt the endoscope, which provides wider field of vision, which was not possible with other Techniques (microscope, foraminoscope), which provides only tubular vision you cannot deviate on sides. So only one portion of the canal is visible, particularly straight structures.

The angle between the working channel and the one used by the telescope measures 12°. So the surgeon can permanently see the ends of

the surgical instruments and the different anatomical structures with out any obstruction which was not possible with microscope, where the tip of the instrument come in the way while operating so you do not know which structure you are holding and removing.

In Endoscopic discectomy not only disc material is removed but nerve root also decompressed fully but in case of other minimally invasive procedures (microscope, foraminoscope) nerve root is not decompressed fully.

Compared to microscopic discectomy the amount of bone removed in Endoscopic discectomy was very minimal, normal anatomy is not disturbed.

Because of its minimal incision and less tissue trauma blood loss was very minimal, post operative pain, healing, fibrosis, scarring, tethering of the nerve root, venous stasis, chronic nerve root edema and stiffness of back all are very less. Therefore the patient needs less rate of blood transfusion, reduced analgesic medication dose and duration which reduce the cost spent by the patient.

Rapid relief of radicular pain, early return to daily activities and their work, reduces the duration of hospital stay and the cost spent by the patient and also by the government.

Because of faster rehabilitation patient will return to their work early therefore the time lost from work was greatly reduced which reduces the financial burden on the patient.

Compared to microscope in endoscope all the instruments can be managed by one hand no need for assistants.

Compared to microscope and foraminoscope, endoscope is not limited to any type of disc herniation, any story or zone.

Wrong level is one of the disadvantage like any other disc surgery and particularly in endoscope because of the slope of the lamina and the direction of endoscope which was taken as an advantage in multiple level disc prolapse which usually need a separate incision with microscopic technique.

It is also useful for Laminectomy, Lumbar canal, root canal stenosis decompression and for the removal of opposite side disc.

It is a very good educational tool because of open TV monitor not only for the surgeon and assistants but also to other post graduates,

Residents, staff nurses which was not possible with microscope, the information stored in the computer will be useful for data management, documentation and analysis of results.

Since the surgeon looks straight when utilizing the endoscope, Neck pain in the surgeon may be minimized but not in case of microscope.

Main disadvantages of endoscope is cost, but in most of the orthopaedic institute the arthroscope was available which includes light source and camera. So for Endoscopic spine surgery only Endospine operating tube, special spine instruments are required which does not cost too much. Second it is a demanding technique, so the surgeon must be familiar with this technique and must have acquired proper training in its use. Therefore do not operate without specific training otherwise he may land up in life threatening complications.

OVERALL OUT COME

In 50% of the patients size of skin incision was 2cm, in 20% patients it was 1.5cm.

In 65% of the patients average blood loss was about 15-25ml

In 85% of the patients post operative pain lasts for only less than 2 days, 3 to 7 days in 15% cases.

About 85% of the patients discharged to home on the 2nd day.

In 55% of the patients radicular pain disappear within 4-7 days.

70% of the patients return to daily activities with in two days.

60% patients return to work in four weeks.

In 55% of the patients neurological recovery was noted in less than 8 weeks.

Compared to chronic cases radicular pain relief, return to daily activity, work and neurological recovery was earlier in acute cases, but it takes much longer time in chronic cases.

CONCLUSION

The financial pressures on the health care system and the push to reduce hospital stays have provided a strong impetus toward minimally invasive procedures in all surgical specialties including spine surgery. These procedures frequently are associated with decreased perioperative morbidity, decreased duration of hospital stay, and reduced costs.

However, these types of procedures frequently required highly specialized equipment and training. Additionally, these procedures are often associated with unique and sometimes catastrophic complication.

Among the armamentarium of minimally invasive spine surgery, ENDOSPINE designed by Dr. DESTANDAU is a very good instrument for discectomy for the following reasons.

1. Greater magnification and illumination compared to other minimally invasive procedures (microscope, foraminoscope).
2. Because of it is special design we can tilt the scope both sides, which provides wider field of vision, there is no obstruction of view in the field while using instruments which is not possible in microscope.

3. Because of minimal incision and less tissue trauma – post operative pain less. Return to daily activity and work much early which reduces the analgesic dose, Hospital stay and cost spent by the patient and government.
4. Endoscope is not limited to any particular type of disc herniation. It is also useful for removing the disc from other side, multiple level disc prolapse in single incision, lumbar canal and root canal stenosis decompression, which is not possible in case of microscope.
5. In the future use of endoscope extended to following surgeries.
    - Posterior spinal instrumentation
    - Kyphoplasty

The disadvantages are cost of the equipment and it is a demanding technique which requires special training.

Finally the success of surgery depends on careful patient selection and meticulous surgery.

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SPINE PROFOMA

NAME: AGE: SEX:

OCCUPATION: ADDRESS:

IP-NO: D.O.A: D.O.S

D.O.D: DURATION OF STAY:

SYMPTOMS: PAIN: Site; Duration;

Mode of onset; Nature of pain;

Radiating pain; Reffered pain;

Rest pain; Aggravating factors;

Relieving factors; Remissions / Exagerbations;

History of previous episodes of pain.

Neurogenic claudication; Progression;

STIFFNESS OF BACK: Onset; Duration;

Progression; Site;

DEFORMITY OF BACK: Onset; Duration;

Progression; Site;

NUMBNESS/PARAESTHESIA: Onset; Duration;

Progression; Site;

WEAKNESS: Onset Duration;

Progression; Site;

URINARY RETENTION /INCONTINENCE:

OTHER SYMPTOMS:

PAST HISTORY:

HISTORY OF TRAUMA

INAPPROPRIATE LIFTING OF WEIGHT

NO OF EPISODES

TREATMENT HISTORY:

CONSERVATIVE: Bed rest /Traction /Others

LOCAL EXAMINATION:

Paraspinal muscle spasm

Local spinal tenderness

Spinal movements – flexion /extension/lateral flexion / rotation

Right

Left

SLRT

LASEGUE'S TEST

FEMORAL NERVE STRETCH TEST

BOWSTRING SIGN

CROSSED SCIATIC TENSION

SENSATION

TONE

POWER

- EHL / EDL
- FHL / FDL

ANKLE

- DORSIFLEXOR
- PLANTAR FLEXOR

KNEE

- FLEXION
- EXTENSION

HIP

- FLEXION
- EXTENSION
- ABDUCTION
- ADDUCTION

REFLEXES

ANKLE JERK

KNEE JERK

PLANTAR RESPONSE

PULSES

SACRO ILIAC JOINT

BLADDER / BOWEL

INVESTIGATIONS

X-RAY

CT – SCAN

MRI – SCAN

DIAGNOSIS

OPERATIVE PROCEDURE – POSITION, ANAESTHESIA.

FINDINGS: DISC PROLAPASE / EXTRUDED / MIGRATED

FACET JOINTS OPENED / NOT /PARTIAL MEDIAL

FACETOMY

OPERATIVE COMPLICATIONS:

IMMEDIATE – BLEEDING /DURAL TEAR / WRONG LEVEL

OTHERS

LATE - WOUND INFECTION / WOUND GAPING

POST OPERATIVE PAIN DISAPPEARS ------ DAYS AFTER SURGERY.

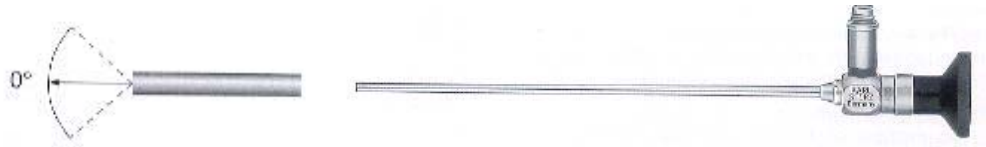
ORIGINAL DISC PAIN DISAPPEARS -------- DAYS AFTER SURGERY

SENSORY LOSS / MUSCLE WEAKNESS / REFLEXES – RETURNS TO NORMAL – DAYS AFTER SURGERY

RETURN TO NORMAL DAILY ACTIVITIES ---- AFTER SURGERY

RETURN TO WORK ---------- DAYS AFTER SURGERY.

SURGICAL INSTRUMENTS



HOPKINS **Straight Forward Telescope** 0°, diameter 4mm, length 18cm, **autoclavable,** Fiberoptic light transmission incorporated

ENDOSPINE Operating Tube, oval, with obsturator for use with working insert

ENDOSPINE Working Insert, with positioning detent, for use with operating tube, with working channel, diameter 8mm and irrigation channel for use with **HOPKINS** telescope with adjustable nerve root retractor

Localization Device for fluoroscopic determination of the point of incision for insertion of the ENDOSPINE operating tube

Bone Punch, 90°, 45° **upbiting,** not through-cutting, 3mm, working length 17cm,18cm respectively.

Trephine, diameter 3.5mm, working length 22cm

Rongeur, with oval-cupped jaws, working length 15cm

Chisel, flat, 10mm, with handle, length 19cm

Take-apart MANHES **Bipolar Coagulating Forceps,** width of jaws 1mm, diameter 5mm, working length 20cm

Elevator, spatula slightly curved, 5mm, working length 13cm

Palpation Hook, blunt, hook angled 90°, hook length 5.5cm, working length 13cm.

FERGUSON **Suction Tube,** with cut-off hole, 11Fr., angled, working length 11cm.

Surgical Handle, for use with blades 11,15.

KARL STORZ Endovision TELECAM, one-chip camera, with integrated Parfocal Zoom Lens, f = 14mm – 28mm, (2x); with 2 freely programmable buttons, camera head **autoclavable**

TELECAM SL II Camera Control Unit, with integrated Image Processing Module; power supply : 100-240 VAC, 50/60 Hz.

Cold Light Fountain XENON NOVA 175, Power supply : 100-125 VAC/ 220-240 VAC, 50/60 Hz.

TV MONITOR

NEUROLOGICAL EXAMINATION

L1,L2 –ILIOPSOAS

L3-QUADRICEPS

L4-TIBIALIS ANTERIOR

L5

EHL

EDL

GLUTEUS MEDIUS

S1

PL, PB

GASTROSOLEUS

GLUTEUS MAXIMUS

REFLEX

L4

L4

L5

L5

S1

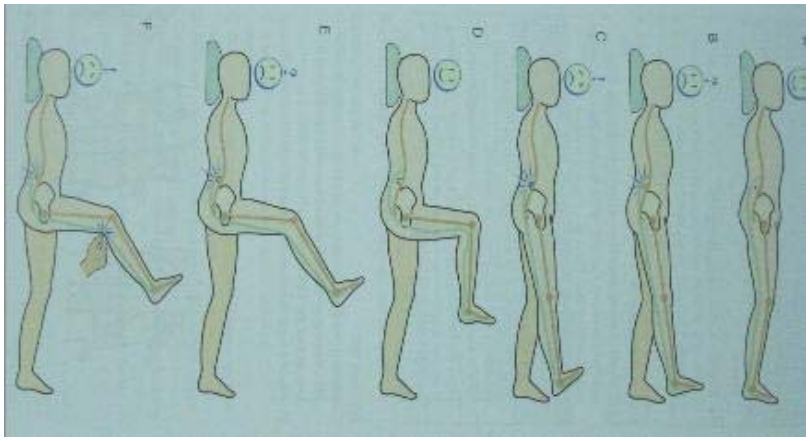
S1

CLINICAL TEST

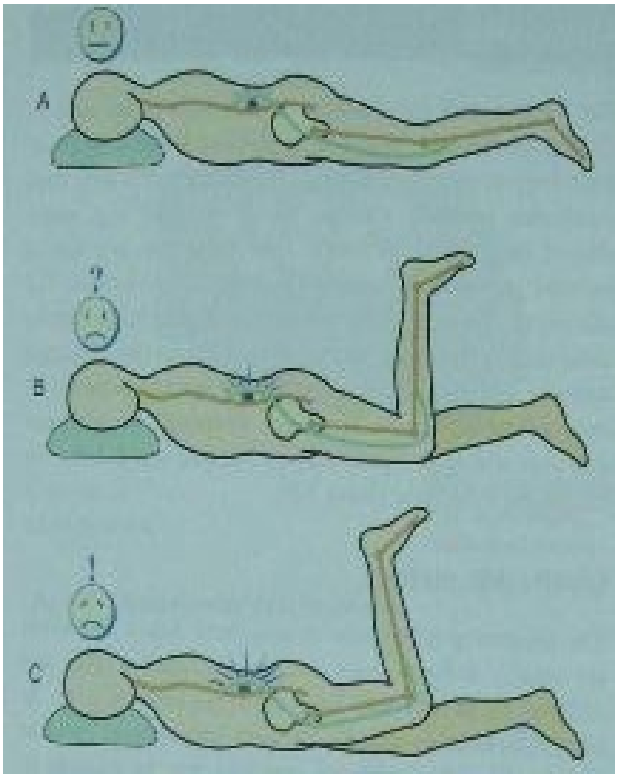
SLR

LASEGUE'S TEST

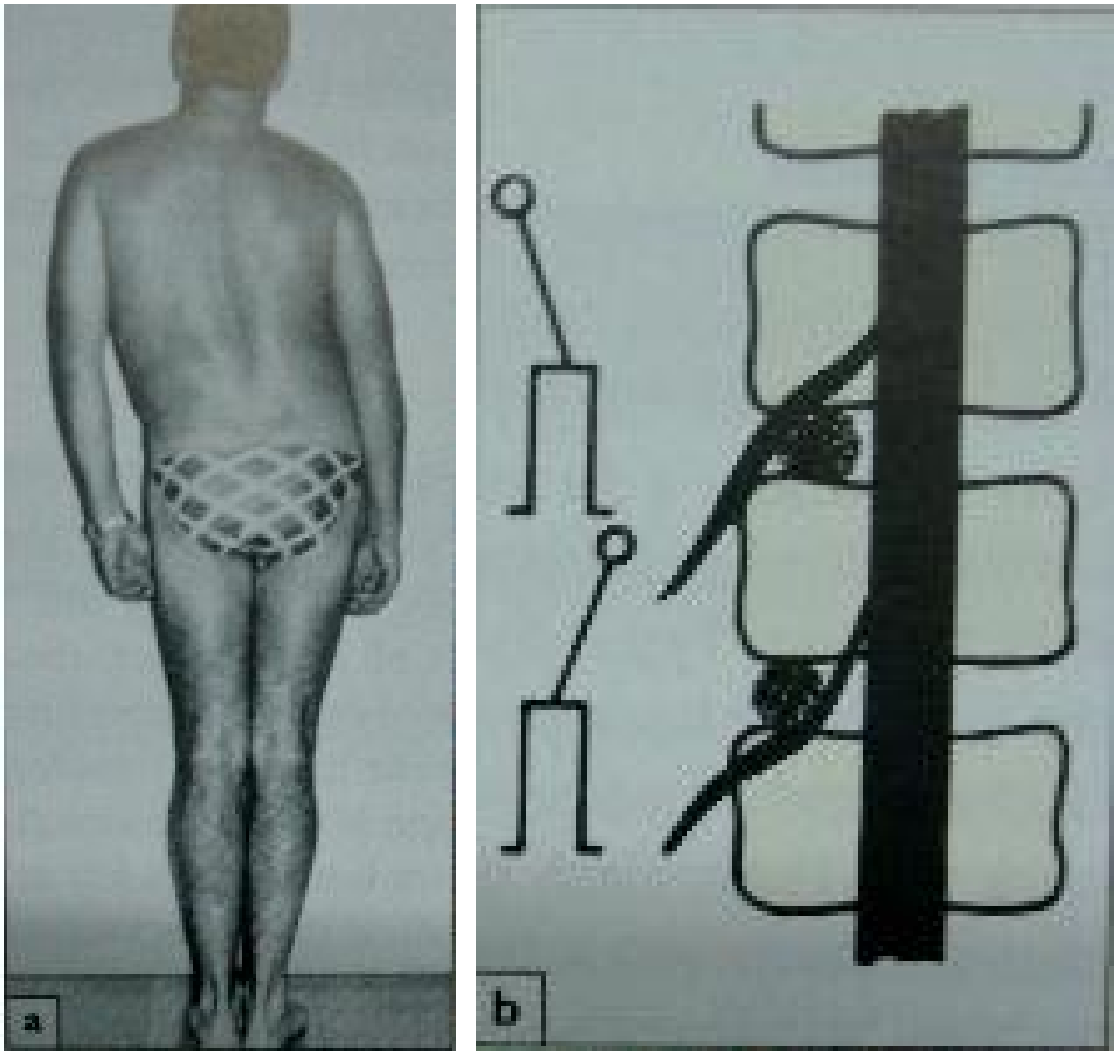
BOWSTRING SIGN



FEMORAL NERVE STRETCH TEST

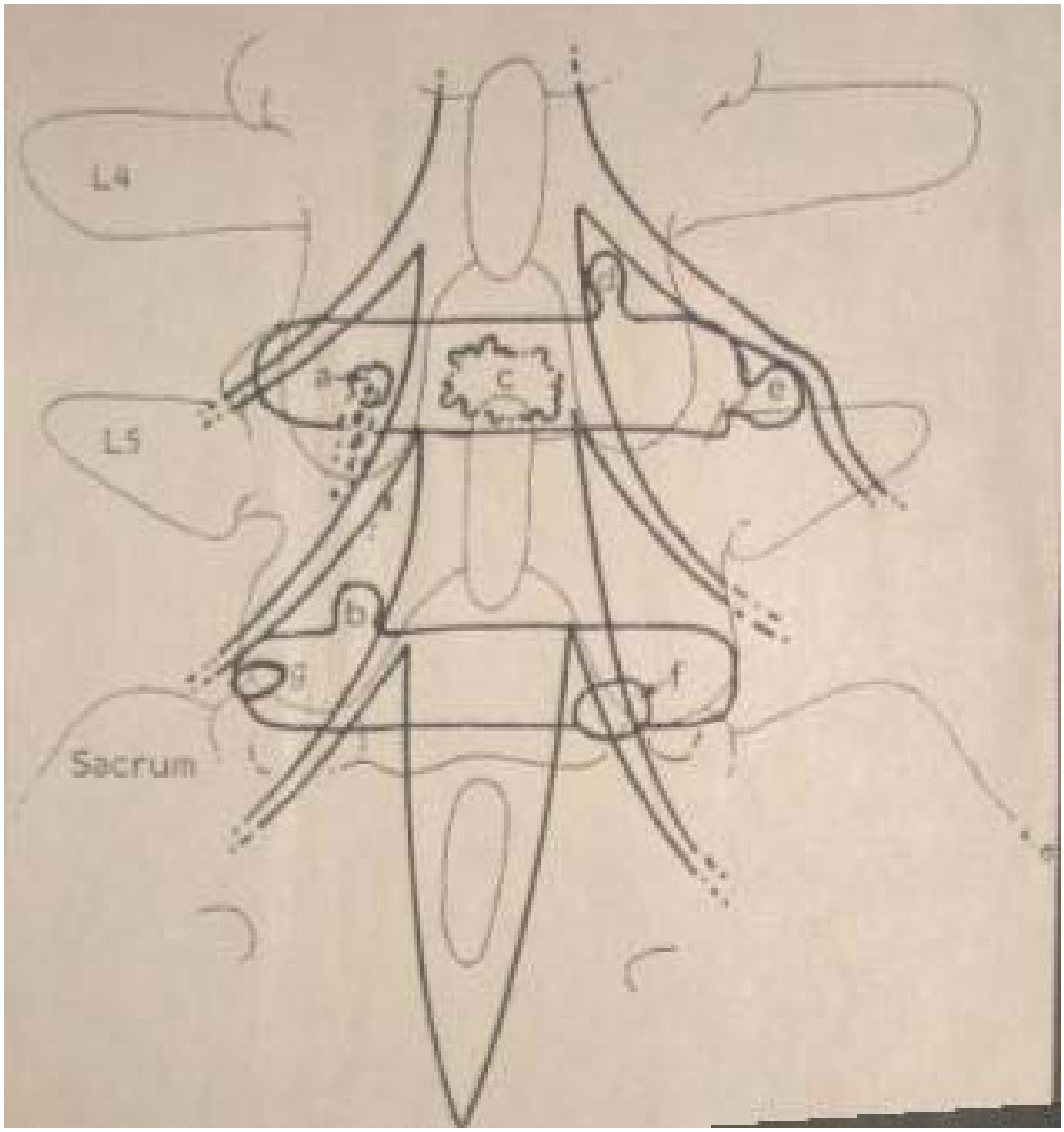


SCIATIC SCOLIOSIS



Lumbar disc – signs : (a) The patient has a sideways list or tile. (b) If the disc protrudes medial to the nerve root the tilt is towards the painful side, with a lateral prolapse the tilt is away from the painful side

TYPES OF DISC HERNIATION



A) Sequestrated disc originating from L4-5 interspace

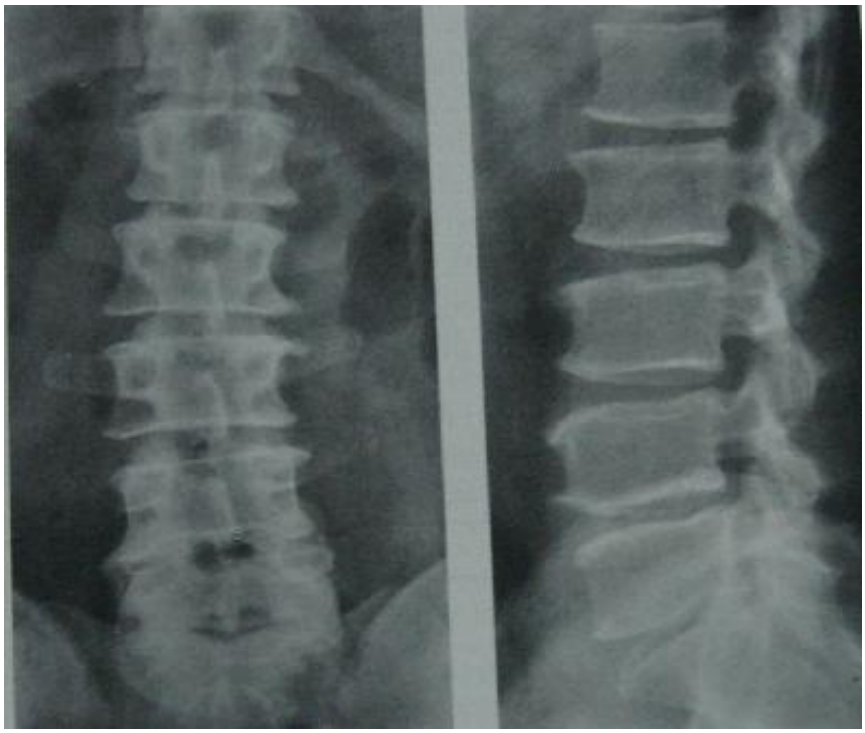
B) Shoulder type; C) Central disc prolapse D) Axillary type

E) Extraforaminal prolapse F) Subrhizal prolapse

G) Intra-foraminal prolapse

INVESTIGATIONS
X-RAY

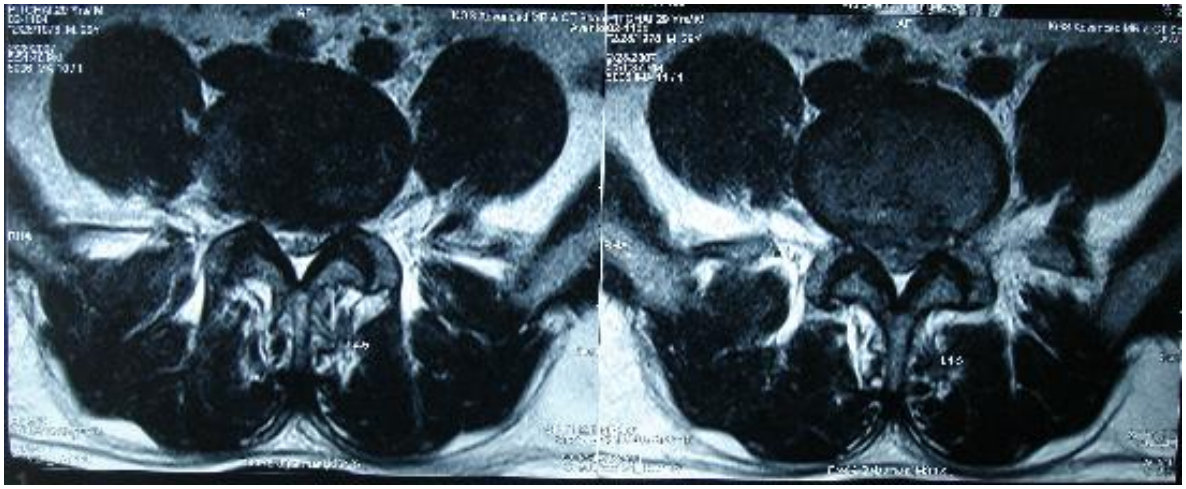
Disc space narrowing, osteophytes, end-plate change at L4-L5



loss of lumbar lordosis, sciatic scoliosis, narrowing of disc space with osteophyte formation

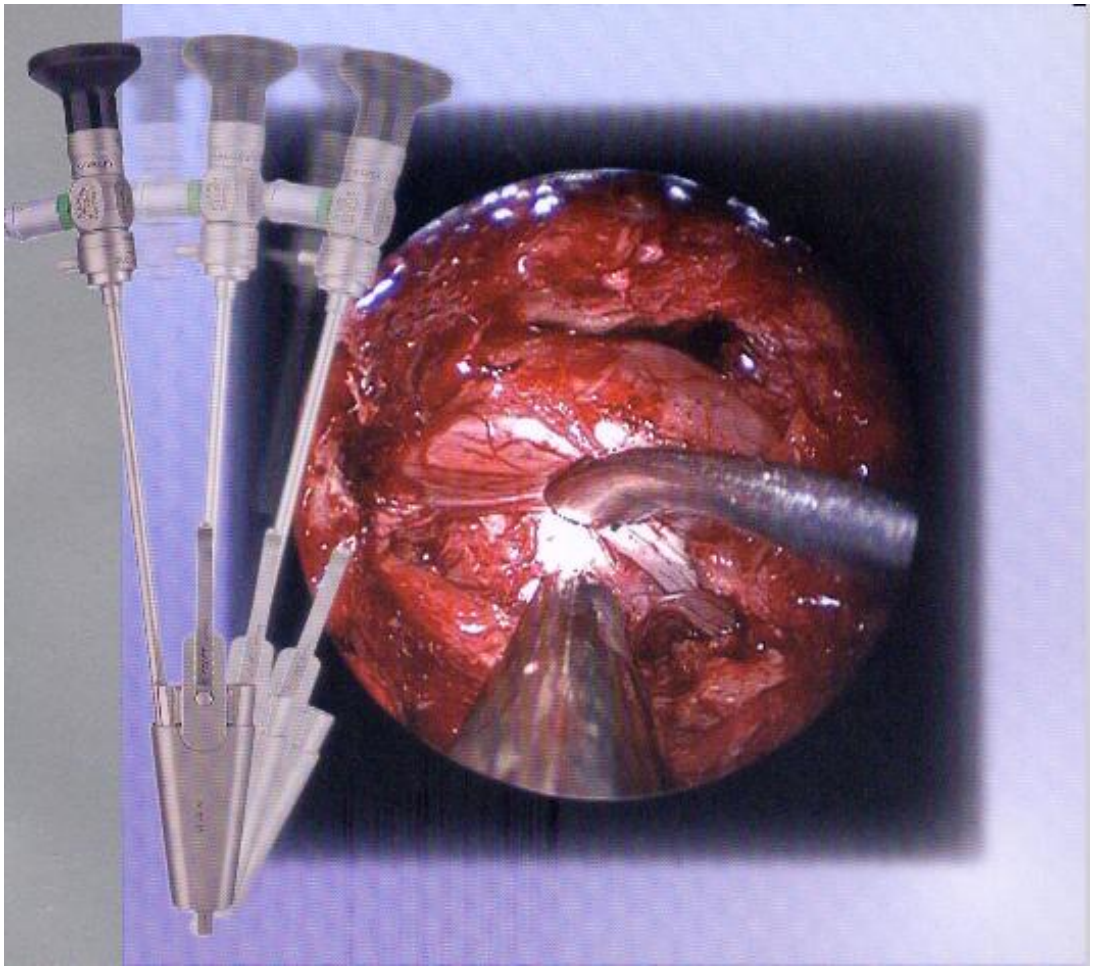
INVESTIGATIONS

MRI

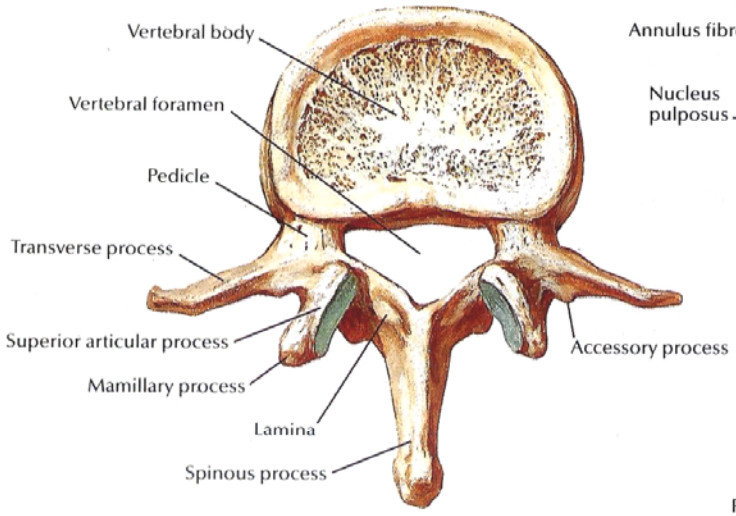


Paracentral disc prolapse with sequestration L4-L5, R> L

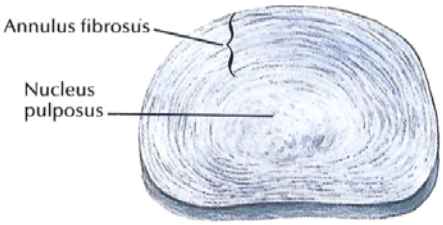
ENDOSCOPIC DISCECTOMY



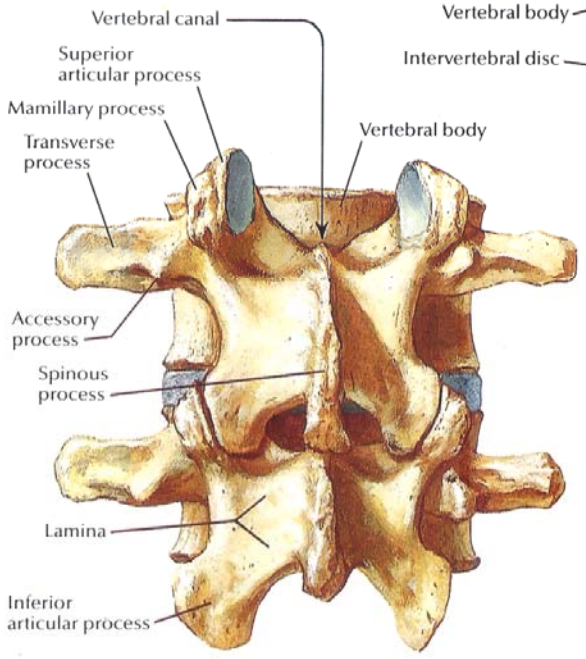
ANATOMY OF THE INTERVERTEBRAL DISC



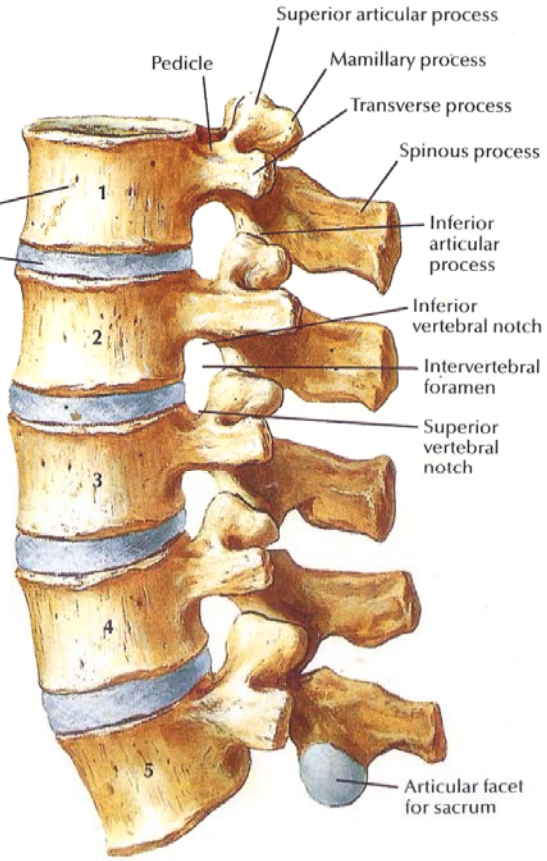
2nd lumbar vertebra: superior view



Intervertebral disc

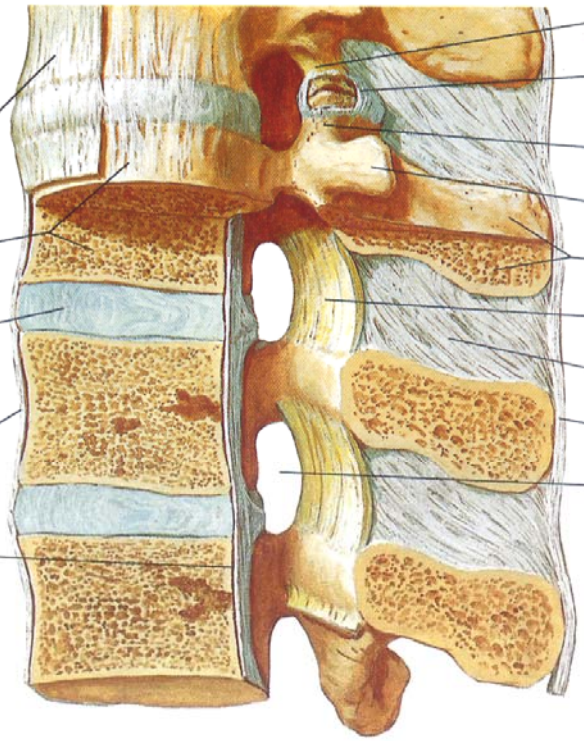


3rd and 4th lumbar vertebrae: posterior view



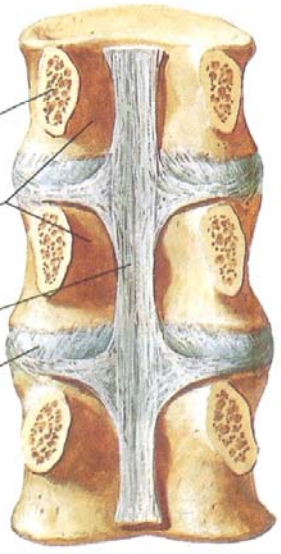
Lumbar vertebrae, assembled: left lateral view

Left lateral view
(*partially sectioned*)



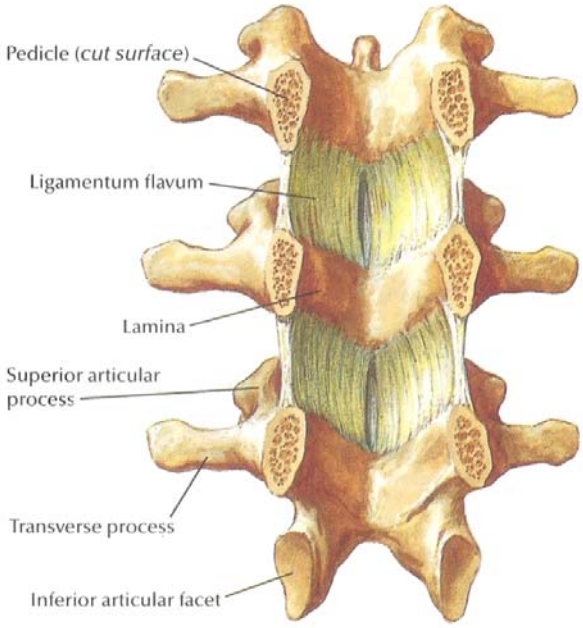
Anterior longitudinal ligament
Lumbar vertebral body
Intervertebral disc
Anterior longitudinal ligament
Posterior longitudinal ligament
Inferior articular process
Capsule of zygapophyseal joint (*partially opened*)
Superior articular process
Transverse process
Spinous process
Ligamentum flavum
Interspinous ligament
Supraspinous ligament
Intervertebral foramen

Anterior vertebral segments: posterior view
(*pedicles sectioned*)



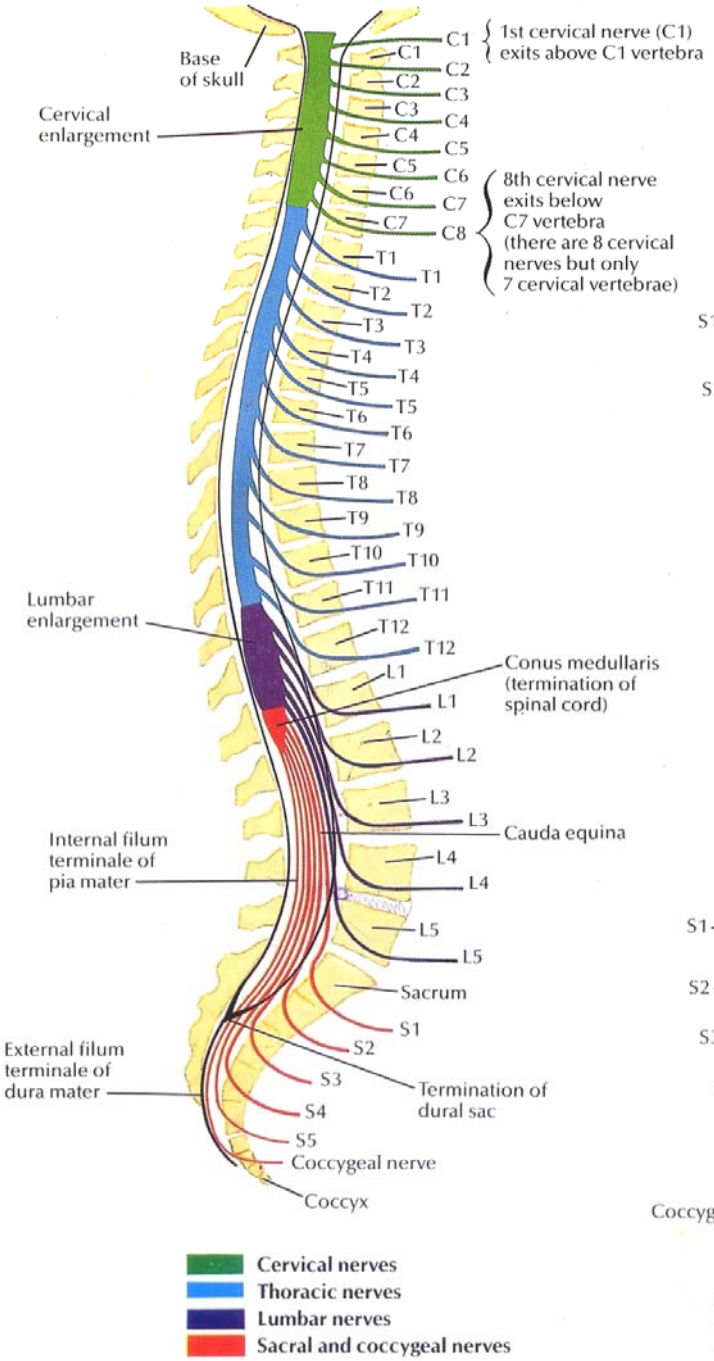
Pedicle (*cut surface*)
Posterior surface of vertebral bodies
Posterior longitudinal ligament
Intervertebral disc

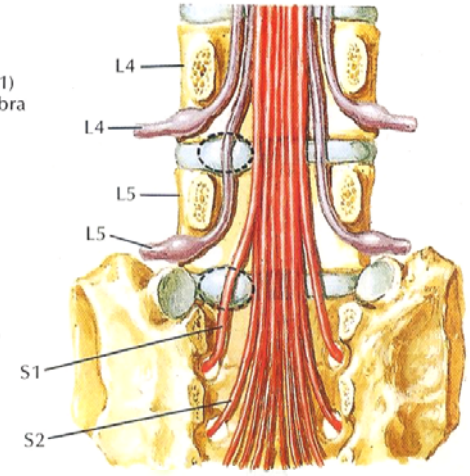
Posterior vertebral segments: anterior view



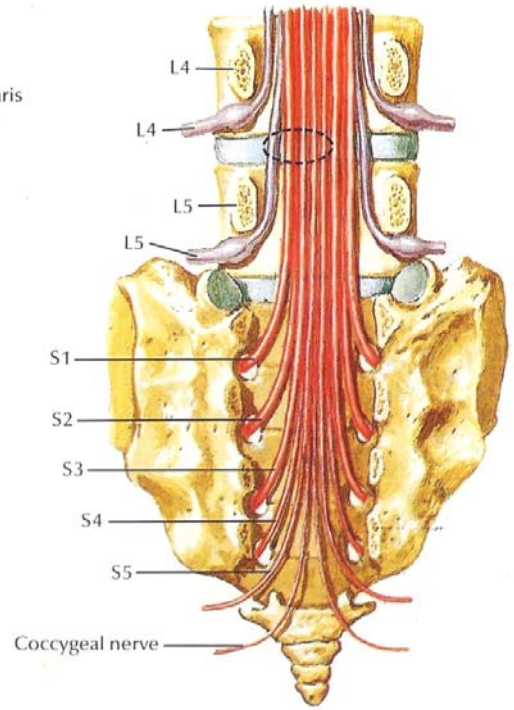
Pedicle (*cut surface*)
Ligamentum flavum
Lamina
Superior articular process
Transverse process
Inferior articular facet

ANATOMY OF THE NERVE ROOT





Lumbar disc protrusion does not usually affect nerve exiting above disc. Lateral protrusion at disc level L4–5 affects 5th lumbar nerve, not 4th lumbar nerve. Protrusion at disc level L5–S1 affects 1st sacral nerve, not 5th lumbar nerve

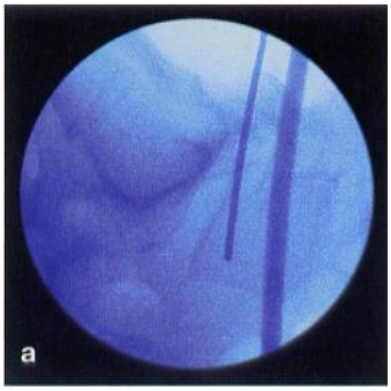


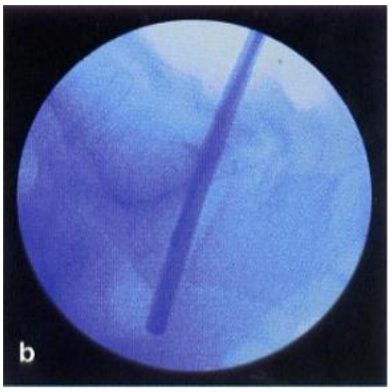
Medial protrusion at disc level L4–5 rarely affects 4th lumbar nerve but may affect 5th lumbar nerve and sometimes 1st–4th sacral nerves

SURGICAL TECHNIQUE

PATIENT POSITION

MARKING THE ENTRY POINT





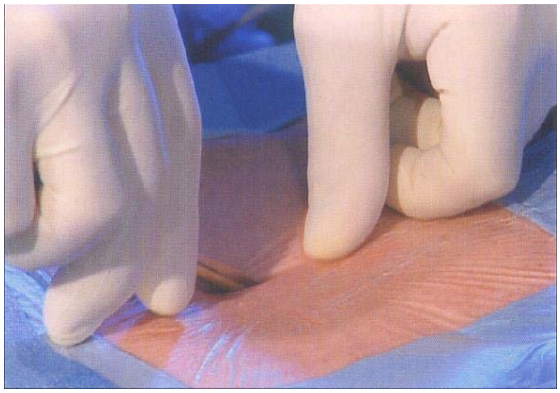
THE ARMS OF THE LOCALIZATION DEVICE HAVE TO BE IN LINE WITH THE INTERVERTEBRAL DISC SPACE

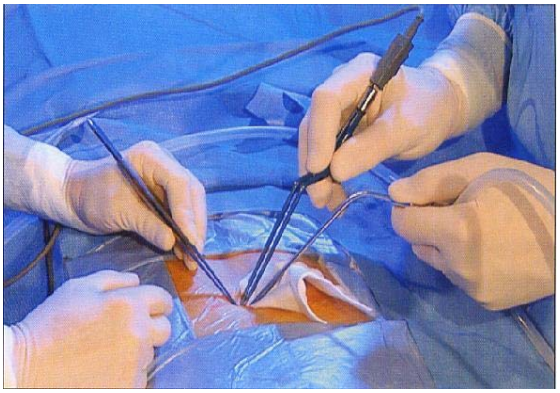
THEATRE SETUP

Finding the orientation plane of the disc by use of the inclination adjustment of the operating light

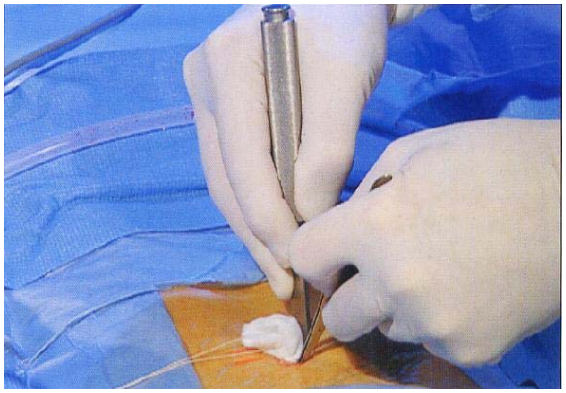
SURGICAL TECHNIQUE

SKIN INCISION

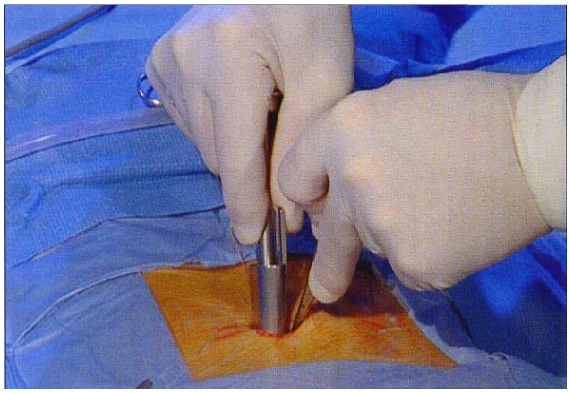




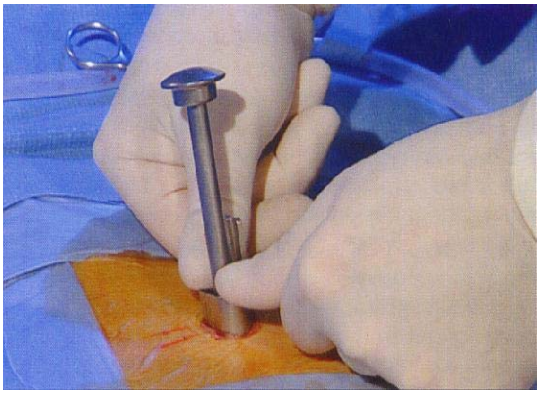
Hemostasis by use of bipolar coagulating forceps



Detachment of the muscles from the spinous process and lamina by use of a flat chisel.

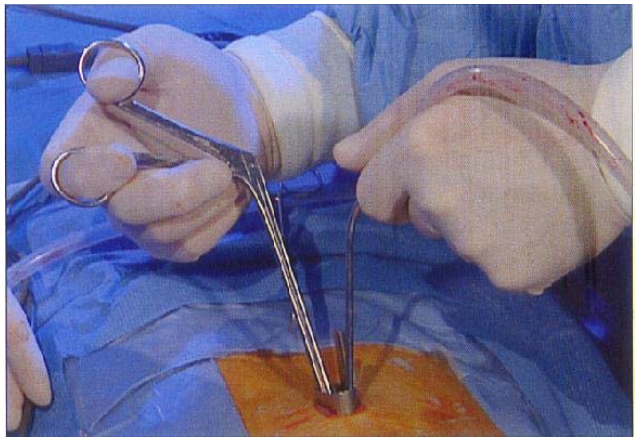


Introducing the operating tube is aided by the blunt Obturator

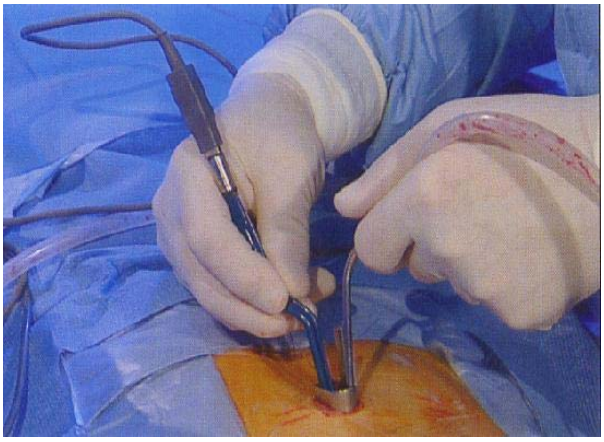


Withdrawing the Obturator

SURGICAL TECHNIQUE



WITHDRAWAL OF SOFT TISSUE THROUGH THE ENDOSPINE OPERATING TUBE USING A DISC RONGEUR



HEMOSTASIS BY USE OF BIPOLAR COAGULATING FORCEPS

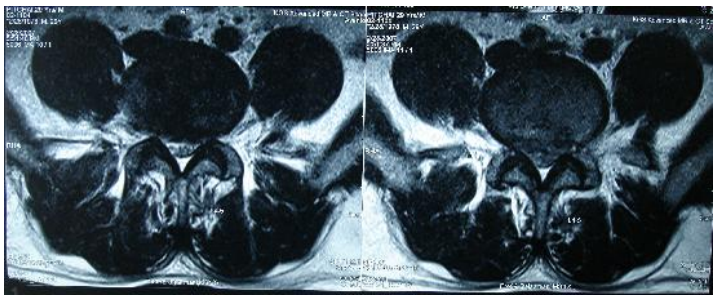
SUBCUTICULAR SKIN SUTURES

CLINICAL RESULTS

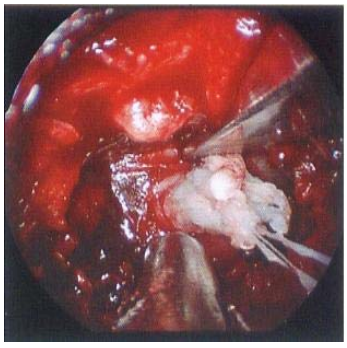
CASE I

(R) SCIATICA, EHL WEAKNESS, SENSATION DIMINISHED OVER 1ST DORSAL WEB SPACE (R)

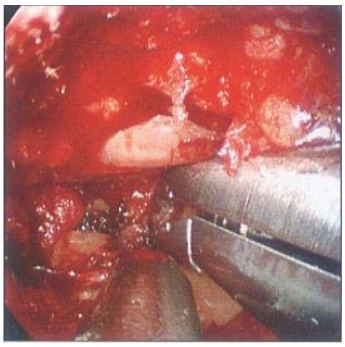
MRI



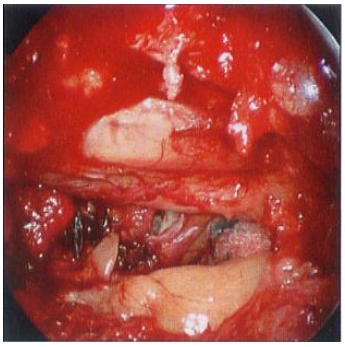
PARACENTRAL DISC PROLAPSE WITH SEQUESTRATION L4-L5, R> L



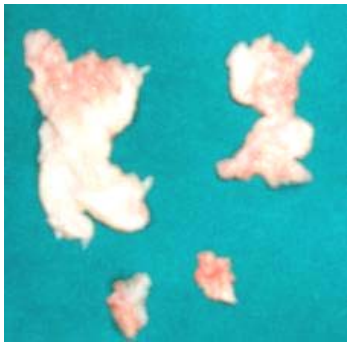
Endoscopic view of the herniated disc portion



Endoscopic view of the discectomy



Endoscopic view after nerve root decompression



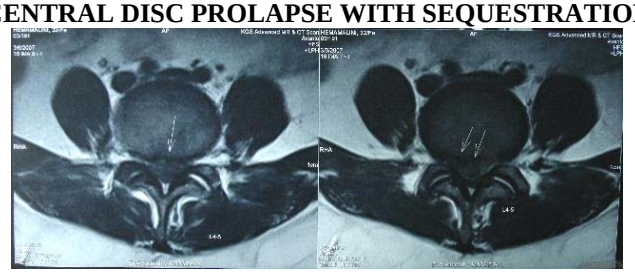
Removed Disc Material

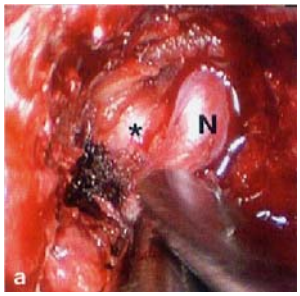
CLINICAL RESULTS

CASE II

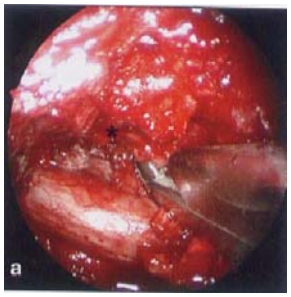
B/L SCIATICA MORE ON ® BLADDER BOWEL INCONTINENCE, B/L, EHL, GLUTEAL, HAMSTRINGS WEAKNESS, DECREASED KJ, AJ, EXTENSOR PLANTAR WITH CAUDA EQUINE SYNDROME

PARACENTRAL DISC PROLAPSE WITH SEQUESTRATION R > L





Endoscopic view of nerve root compression



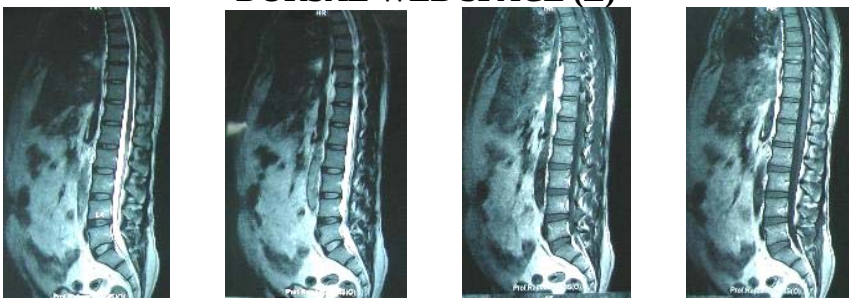
Endoscopic view of nerve root after decompression

Removed Disc Material

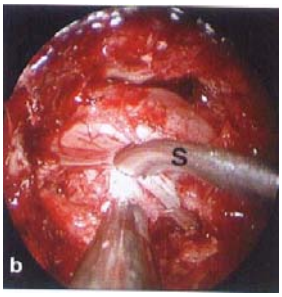
CLINICAL RESULTS

CASE III

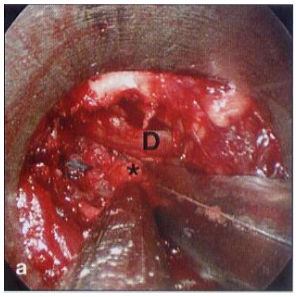
(L) SCIATICA, EHL WEAKNESS, SENSATION DIMINISHED OVER 1ST DORSAL WEB SPACE (L)



L4 – L5 disc prolapse (L)



Endoscopic view of prolapsed disc



Endoscopic view after decompression

Removed Disc Material

MASTER CHART

S.No	Name	Age / Sex	IP No	Mode of onset	Duration of symptoms	Clinical features	CT, MRI findings	Level	Size of incision	Blood loss	Postoperative pain disappears in	Duratin of hospital stay	Radicular pain disappears in	Return to daily activity on	Return to work in	Neurological recovery	Complications	Follow up	Results
1	Ganesan	47/M	8956	Insidious	8 yrs	LBP, (L) Sciatica, KJ, knee extension decreased (L)	Prolapse (L)	L2 L3	2.5 cm	15 ml	3 days	3	8 days	5th day	10 weeks	16 weeks	Epidural bleed	12 months	Fair
2	Vijayalakshmi	35/F	13232	Sudden	7 months	LBP, (L) Sciatica, FHL weakness , AJ decresed on (L)	Sequestration	L5 S1	2.5 cm	15 ml	1 day	1	4 days	2nd day	2 weeks	6 weeks	-	12 months	Excellent
3	Kubendran	40/M	17960		4 months	LBP, (L) Sciatica, weakness of foot eversion, AJ decreased on (L)	Extrusion	L5 S1	2.5 cm	20 ml	1 day	1	4 days	2nd day	2 weeks	5 weeks	-	12 months	Excellent
4	Manikandan	31/M	20451	Insidious	1 1/2 yrs	LBP, B/L sciatica more on (L), EHL weakness, decreased sensation over Ist dorsal web space (L)	Paracentral disc prolapse L > R	L4 L5	2 cm	15 ml	2 days	2	3 days	2nd day	4 weeks	10 weeks	Superficial infection	12 months	Excellent
5	Muniyasamy	60/M	21861	Insidious	6 months	LBP, (R) sciatica, AJ decreased (L)	Prolapse (R)	L5 S1	2 cm	20 ml	1 day	1	3 days	2nd day	2 weeks	6 weeks	-	11 months	Excellent
6	Jeeva	21/M	27538	Sudden	5 months	B/L sciatica more on (L), EHL , EDL weakness (L)	Paracentral disc prolapse L > R	L4 L5	2 cm	25 ml	1 day	1	4 days	2nd day	2 weeks	5 weeks	-	11 months	Excellent
7	Arumugam	32/M	33436	Insidious	2 yrs	LBP, (R) sciatica, EHL, FHL weakness, decreased AJ (R)	Extrusion (R)	L4 L5, L5 S1	2.5 cm	25 ml	2 days	2	9 days	3rd day	5 weeks	11 weeks	-	10 months	Good
8	Madankumar	21/M	28265	Sudden	4 months	LBP (R) sciatica, decreased sensation over Ist dorsal web space (R)	Prolapse (R)	L4 L5	2 cm	15 ml	1 day	1	3 days	2nd day	2 weeks	4 weeks	-	9 months	Excellent
9	Senthilkumar	22/M	39927	Sudden	7 months	LBP, B/L sciatica, EHL weakness (L)	Paracentral disc prolapse L > R	L4 L5	2 cm	20 ml	1 day	1	4 days	2nd day	2 weeks	5 weeks	-	9 months	Excellent
10	Saravanan	33/M	554636	Insidious	11 months	(L) Sciatica, decreased sensation over Ist dorsal web space (L)	Bulge (L)	L4 L5	2 cm	15 ml	2 days	2	5 days	2nd day	3 weeks	8 weeks	-	8 months	Excellent
11	Vellaisamy	30/M	57009	Insidious	14 months	LBP, (L) sciatica, EHL weakness (L)	Paracentral disc prolapse L > R	L4 L5	2 cm	30 ml	2 days	2	5 days	2nd day	3 weeks	8 weeks	-	8 months	Excellent
12	Jebaraj	44/M	66168	Insidious	2 1/2 yrs	LBP, (R) sciatica, EHL weakness (R)	Prolapse (R)	L4 L5	2 cm	30 ml	2 days	2	8 days	3rd day	6 weeks	12 weeks	-	7 months	Good
13	Lakshmi	55/F	68997	Insidious	1 1/2 yrs	LBP, (R) sciatica, sensation diminished over antrolateral aspect of leg, Ist dorsal web space (R)	Prolapse (R)	L4 L5	2 cm	30 ml	2 days	2	7 days	2nd day	5 weeks	10 weeks	-	7 months	Good
14	Gopal	29/M	70685	Sudden	9 months	(L) sciatica, EHL weakness (L)	Prolapse (L)	L4 L5	2 cm	30 ml	1 day	1	5 days	2nd day	4 weeks	8 weeks	-	6 months	Excellent

S.No	Name	Age / Sex	IP No	Mode of onset	Duration of symptoms	Clinical features	CT, MRI findings	Level	Size of incision	Blood loss	Postoperative pain disappears in	Duratin of hospital stay	Radicular pain disappears in	Return to daily activity on	Return to work in	Neurological recovery	Complications	Follow up	Results
15	Muthusamy	24/M	78274	Sudden	4 months	LBP, (L) sciatica, EHL weakness, sensation diminished over Ist dorsal web space (L)	Prolapse (L)	L4 L5	1.5 cm	35 ml	1 day	1	4 days	2nd day	2 weeks	4 weeks	-	6 months	Excellent
16	Arokiasamy	57/M	83712	Insidious	3 1/2 yrs	LBP, (L) sciatica, EHL weakness, sensation diminished over Ist dorsal web space (L)	Extrusion	L4 L5	1.5 cm	35 ml	2 days	2	8 days	4th day	7 weeks	14 weeks	-	5 months	Good
17	Sivanandham	31/M	87121	Sudden	6 1/2 yrs	LBP, (L) sciatica, EHL, FHL weakness (L)	Prolapse (L)	L4 L5, L5 S1	2.5 cm	25 ml	3 days	3	9 days	3rd day	8 weeks	16 weeks	-	10 months	Fair
18	Hemamalini	32/F	90821	Insidious	8 yrs	LBP, B/L sciatica more on (R) bladder bowel incontinence. B/L, EHL, gluteal, hamstrings weakness, decreased KJ, AJ, extensor plantar	Paracentral disc prolapse with sequestration R > L	L4 L5 with cauda equina syndrome	2.5 cm	50 ml	3 days	3	10 days	Lost for followup	-	-	-	-	-
19	Pitchai	29/M	92431	Insidious	6 months	(R) sciatica, EHL weakness, sensation diminished over Ist dorsal web space (R)	Paracentral disc prolapse with sequestration R > L	L4 L5	1.5 cm	20 ml	1 day	1	4 days	2nd day	2 weeks	5 weeks	-	10 months	Excellent
20	Manoharan	48/M	97618	Insidious	10 months	(L) sciatica, EHL weakness, sensation diminished over Ist dorsal web space (L)	Prolapse (L)	L4 L5	1.5 cm	20 ml	1 day	1	5 days	2nd day	2 weeks	7 weeks	-	11 months	Excellent