EVALUATION AND MANAGEMENT OF HERNIATED LUMBAR DISC

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INTRODUCTION

Headache and backache are both common symptoms known to human beings since the beginning of recorded history. Backache has been part of human experience. About 80% of general adult population will suffer from back pain at some point in their lives and about 35% will develop sciatica. The proportion is very small in children.

In any given year, about 25% of male are unable to work; approximately 93 million working days are lost yearly secondary to low backache. About 2% of population will consult physician and spending over $5 billion on tests and treatment directly. Indirect cost is more than that due to miss work and disability.

Because of frequency, backache represents the second most common group seeking medical attention.

HISTORY

The Greek father of medicine Hippocrates (460-379 BC) described the word sciatica. The earliest description of sciatica actually appeared in an Egyptian surgical manual (Edevin Smith Papyrus) dated from 1600 BC. Vesalius published the earliest anatomical description of intervertebral disc and cartilaginous plates in 1555 in his magnum opus.

In 1764, a classical description of sciatica was given by an Italian physician Domenico contugno. In 1864, relationship between low backache and sciatica was recognized by lasegue. In 1896 Kicker documented traumatic disc rupture in the patient who had fallen from 100 feet.

In 1929, Walter dandy operated on two patients with cauda equina syndrome successfully. In 1930, Alajoinene and petit-dutalis presented disc tumour protruding and causing neurologic symptoms that could be treated by surgery.

In 1934, Mixter and Joseph Bar clearly described herniation of disc as a cause of backache and sciatica. The lesion was previously called cartilaginous tumour. Since that time changes were brought in the management of sciatica due to disc prolapse.

Conservative measures in form of bed rest, analgesia, physiotherapy and manipulation are adopted. Epidural steroid and chymopapain neuclysis have been claimed by some clinician as an alternative treatment. Different surgical procedures in the form decompressive laminectomy with or without under cutting facetectomy,
hemilaminectomy, microdiscectomy laminectomy, fenestration, discectomy and percutaneous discectomy are practiced according to anatomical findings and clinical presentation.4

ANATOMICAL CONSIDERATION

About 25% of spinal column height is made of 5 lumbar vertebrae. Each vertebra has body and posterior neural arch. Lumbar vertebrae are taller anteriorly than posteriorly, therefore, lumbar spine achieves its lordosis. 75% of flexion, extension and bending occur at lumbosacral joint and 20% of flexion extension at L4-5 level. That is why, 95% disc herniation make occurs at these two levels5.

The intervertebral disc acts as a shock absorbing agent for spine, provide cushioning between the vertebrae. There are 3 part of intervertebral disc. Nucleus pulposis is a central part which represents the remnant of notochord. This nucleus pulposis is held in place by a very strong and elastic annulus fibrosis. The 3rd component is a cartilage that covers the vertebral end plates.

The nucleus pulposis is proteoglycans. The molecules have water binding capacity. With passage of time, water content is decreasing from 88% to 70% and by the age of the 70 years, nucleus pulposis has almost lost its bulk and gelatious characters. It acts as a ball bearing.

The annulus fibrosis consists on type-I and type-II collagen fibers. The lamellae attached to cartilaginous in plates and both longitudinal ligaments give strength to the disc.

The cartilaginous plate is a hyaline cartilage barrier which limits the pressure of the nucleus on the vertebrae and allows the nucleus to act as a ball bearing.

Intervertebral disc gets its nutrition from extra cellular fluid circulation. In developmental stage, it is supplied by vessels which get atrophic and ultimately involutes by 3rd decade. The loss of vascularity results in degenerative changes6.

The vertebral segment is innervated by the sinovertebral nerve which is recurrent nerve of luchka. It supplies the annulus fibrins (not nucleus pulposis), posterior longitudinal ligament, the foramenal floor of dura, the capsule of facet joint and the erector spinae muscles7.

PATHO PHYSIOLOGY

Many structural changes in the spine can be the result of normal aging and are difficult to differentiate from pathologic symptomatic disorders. There are different factors which prone the disc to herniation. These are genetic, anatomical, physiological and pathological factors. When all these factors combine, disc herniations occur. The genetic factors are genetically increase risk of juvenile lumbar disc and increase risk in patient with narrow spinal canal. The anatomical factors are eccentric location of nucleus pulposis, comparatively weak attachment of posterior longitudinal ligament with vertebral bodies and weak fibers of posterior longitudinal ligament in the postero-lateral aspect of disc space7.

The factors are aging process which secondarily decreases the water content of nucleus pulposis, lead to decussation of nucleus pulposis and diminution in its property. The loss of elasticity, decrease in the height and failure to distribute forces equally prone the disc to herniation.

The pathological factors are bending activities and misuse of back leading to torsion-flexion injury which place the annular ligament mechanically in weakest position. This mechanism requires progressive degeneration and dysfunction before the actual herniation, once the phenomena of herniation starts some form of mechani-
cal instability is present which increases further rests of herniation

Symptoms in patients with disc herniation are due to stimulation of sinovertebral nerve when annulus fibers are it strain or tear occurs. Referred pain in the form of radiculopathy is due to nerve root compression leading to local ischemic and thus function of electrical conduction and axonal transport are impaired. The compress nerve root results in parasthesia, hyperesthesia and loss of strength but no pain

Pain is due to nerve root inflammation which results from chemical irritants like substance-P and leukotinines. The lag period of the onset of radicular pain is probably the development of inflammation. Now, it has been suggested that nucleus pulposus is antigenic. Acute inflammatory response occurs if these contents are injected in the epidural space with granulation and fibrosis. That is seen as loss of high signal on MRI; any how it is not very clear either this is due to loss of water continent, inflammation or an auto immune response. Few authors have attributed and production to protein degradation produces which are extruded by physical activity and irritate intra and peridiscal new fibers

Other factor like diving motor vehicle, sedentary occupation, vibration, smoking, repeated pregnancies, increase body mass index and tall stature also provoke disc for herniation

CLINICAL CORRELATES

Individual characteristics also play a role in the development of lumbar disc diseases. Disc herniation can result in sensory, motor or autonomic disturbances. The sensory disturbances in the form pain, parasthesia and numbness. Motor disturbances in the form decrease strength and even complete foot drop, while autonomic in the form of bowel and bladder dysfunction. Depending upon the anatomy of the spine, degree and type of herniation and progresses of disease, patient presents with back pain, root syndrome and cauda equina syndrome.

(1). LOW BACK PAIN

Low back pain is the most common and usually presenting symptom of lumbar disc diseases. This may be dull aching which increases with exertion, coughing and sneezing and decreases with rest. Most of time, leg pain starts after backache which is called sciatica, occasionally sciatica appear without antecedent low back pain. However this is an exception. Back pain may get better after onset of radicular pain

(2). ROOT SYNDROMES

A combination of sensory or motor finding related to a specific root is called nerve root syndrome. This requires both inflammation (for pain response) and compression for parasthesia numbness and decrease strength (for neurological deficit)

The symptoms vary according to involved nerve roots. The nerve roots syndrome may be specific or multiple root syndromes. These are: (a). S1 Root Syndrome (b). L5 Syndrome (c) L4 root syndrome (d) L2-L3 root syndrome.

(A). S1-ROOT SYNDROME

In S1 root syndrome, pain radiates down the back of the thigh and calf into the lateral aspect of the ankle. Clinical findings involve the lateral aspect of foot in the form of parasthesia and numbness. Planter flexion and foot eversion are weak commonly. Loss of bulk of calf muscle due to atrophy of gastrocnemius and diminished or weak ankle jerk may occur.

(B). L5-ROOT SYNDROME

Pain radiates like S1 and more to lateral aspect of calf and downward to
dorsum of foot and particularly to big toe. Weakness of extensor hallucis longus, muscle, weakness of dorsi flexes and foot inverter or some time complete foot drop may occur.

(C). L4 ROOT SYNDROME

In this syndrome, radiation of pain is toward anterior aspect of thigh and medial aspect of the leg. Weakness of quadriceps muscles and thigh adductors can be noticed. Loss of knee jerk is frequently found.

(D). L2 & 3 SYNDROME

These are less commonly involved area. Pain radiates to groin and anterior aspect of thigh. Hip flexion and knee jerk may be diminished.

(3). CAUDA EQUINA SYNDROME

Some time compression of many nerve roots in the neural canal can result multiple root deficit. The acute onset of severe pain and parasthesia in the groin, weakness of both legs with sphincteric dysfunction in the form of bowel, bladder and sexual loss and saddle anesthesia. Most of the times, clinically patient are having bilateral foot drops with numbness, bilateral ankle hypo or areflexia and saddle anesthesia. Rectal and urinary tone can be tested by anal wink and bulbo cavernouses reflexes which are absent. In 50% cases disc herniation occur at L4-5 level13.

(4). PHYSICAL EXAMINATION

The interesting findings with disc prolapse depend on spinal anatomy, onset, site, type and degree of disc prolapse. The characteristic appearances are in the form of loss of normal lumbar lordosis, the knee and hips are commonly held slight flexed. Scoliosis away from site of lesion in laterally disc and towards symptomatic in axillary located disc. These postures relieve tension of the nerve roots.

Focal point tenderness with adjacent paravertebral muscle spasm is noted at corresponding level of disc prolapse. Palpating sciatic nerve course is necessary for discovery of local tumour like Neurofibroma.

(5). TENSION FINDINGS

Tethering of nerve roots over the compressive lesion reproducing radicular complaints can be detected by tension signs. Different manoeuvre can be used in the form of straight leg raising, (frost lasegue), well leg raising, bowstring and femoral stretch. Straight leg raising test was described by Lazorevic in 1880 in which full extension of knee is maintained as leg is slowly raised. Its positive predictive value is 64-76%. Frost lasegue test is actually sciatic stress test described in 1881. The leg is raised in the same fashion like straight leg raising when positive symptoms are produced. Leg is lowered for 10 degrees approximately and foot is dorsiflexed this last maneuver reproducing symptoms for a positive result. The positive predictive value ranges from 83-96.8%. Well raising test was describe by Fajervain in 1901 i.e. pain is produced on the effected side by raising unaffected leg which causes lateral displacement of nerve root in the canal and traction is put on contra lateral nerve root. Its predictive value is about 97%. This warrants exploration even in the case of negative lumbo-sacral myelogram13.

Bowstring signs were described by Gower in 1988. The symptomatic leg is flexed at the knee slightly and completely at rest; the examiner presses the posterior tibial nerve with finger there by tensioning the sciatic nerve in the popleteal fossa.

In femoral stretches test is hyper extension of the leg on the affected site with patient in the decubitis position. This test is performed for femoral nerve side roots (L2-3).
Some other useful tests are needed in separating root lesion from nerve roots diseases like in case of foot drop, inversion of ankle (Tibialis posterior) and flexion of toes (flexor digitum longus) is very important as these muscle are innervated by L5 root which are spared in peroneal neuropathy and an involved in L5 radiculopathy. In case of L2-3-4 root syndrome, thigh abductors are essential in differentiating femoral neuropathy which is not involved.

In proximal muscle weakness of lower extremity, compare the quadriceps and thigh abductors to thigh abductors. If the weakness is quite different, think about selecting nerve root involvement rather than myopathy. The disc L2-3-4 versus L4-5-S1 for gluteus medius.

Reflex changes are the only truly signs because they don’t depend on patient effort and should be elicited in patient in relaxed state.

INVESTIGATIONS

IMAGING STUDY

Radiologic investigations of suspected prolapse intervertebral disc are essential for accurate localization and differentiation between pathology.

PLAN RADIOLOGY

The application of plain x-ray in the evaluation of PDI is debatable in the individual. Bony anatomy is clarified with it. Scoliosis towards opposite side on antero-posterior image and loss of lumbar lordosis on the lateral image are seen. Which occur disc to spasm of paraspinous muscles? This is the earliest radiological findings in painful spine. Not only anatomical variants like sacralization or lumbnerization can be detected. Other conditions mimicking disc prolapse can be excluded like infective lesion, metastatic lesion, metabolic bone disorder and spondylothesis.

In chronic disc disorder narrowing of disc spaces, reactive osteophytes of vertebrae can be seen. Evidence of instability such as translation, bony neural foraminal stenosis and osseous hypertrophy can visualize.

DISCOGRAPHY

This procedure involves injection of radio-opinion contrast material into the disc itself and radiographs are taken immediately. Due to limited diagnostic value and increased complication rate the procedure appears out dated now. Due to severe pain, the procedure is of little help as other modality like CT, MRI and Myelogram helps a lot.

It has only of significant in procedure like necrosis for contained disc herniation.

MYELOGRAPHY

It was introduced in 1921 initially. The contrast is injected in sub-arachnoid space with series of antero-posterior and lateral films. It has been considered the gold standard for diagnosis of extra dural compressive lesion of spine.

The oily contrast agent has been largely replaced by water soluble agent like metrazamide and now metrazamide. The water soluble agent has the advantage if better visualizing of theca and roots sleeves, marked reduction in the development of arachnoiditis and elimination of the need to remove the material. Of course, side effects like headache, nausea, vomiting and even seizures can occur. These side effects can be relieved by injecting small amount of contrast in good hydrated patient and avoiding the flow of material into the intracranial subarachnoid space. If performed with accuracy it is a useful investigation with accuracy rate ranging.
from 71.8-84%. The invasive nature of this procedure is a major draw back. The technique gives fairly high positive results is specially in post operative imaging\textsuperscript{16}.

**CT. SCAN**

CT. scanning was introduced in 1971 by Hounse Field. It has become valuable in diagnosis of lumbar disc due to its accuracy, non invasive and simultaneously evaluating surrounding soft tissue. It is more useful in lateral disc herniation and delineating the abnormality of canal shape, lateral recess size and neural canal opening\textsuperscript{16}.

The co relation of the thecal sac compression, neural elements and bony anatomy are better delineated by CT with intra thelical contrast (CT Myelography).

**MRI**

It is a rapidly imaging study primarily for the spinal disorder and especially in the lumbar region. It is non invasive without the hazards of radiations. It can clearly delineate disc motes. Nerve root dural sac with CSF and canal diameter or out line. Inability of fat signal on T1 imaging near a nerve root suggests compression. One and very useful feature of MRI is its ability to distinguish between the anterior/posterior longitude complex and the nucleus pulposis\textsuperscript{20}.

In one of I/V contrast if (G.dtpa) with immediate scan is affective in postoperative imaging of spine which distinguish scar and epidural fibrosis from recurrent disc\textsuperscript{17}.

**Miscellaneous**: other investigation like epidural venography and EMG are very indirect way of evaluating the intervertebral disc and now is out dated.

**TREATMENT**

There was different opinion regarding treatment of disc prolapse, but the ultimate goal is to minimize patient suffering and early return to maximum level of function. As low back pain has many causes and prolapse disc is only one cause. Therefore, before surgical intervention, conservative treatment is necessary. Apart from absolute surgical indication which includes (advanced neurosurgical deficit), the rest of the cases should be treated conservatively till failure. Conservative treatment consists of absolute bed rest for 2-3 weeks with muscle relaxant and anti inflammatory agents.

Absolute bed rest in supine position with flexion of legs by a pillow under knee is helpful. It decreases the intra discal pressure as water is absorbed from disc material. In this way pressure is decreased on nerve roots. The irritation inflammation cycle is broken and thus pain is decreased.

Anti inflammatory drugs either steroid or non-steroid are both effective in decreasing the nerve root oedema, inflammation and hyperemia. Muscle relaxants are useful as adjunct to analgesic. Systemic steroids have been proven very effective for pain relief. Short course of steroid is very effective with abrupt withdrawal .The role of epidural steroid is still controversial. Many theories are postulated to explain the success of epidural steroids. Steroids are supposed to help in breaking down of scar tissue, lyses of adhesion and an anti inflammatory action. All these theories are flawed for several reasons, like when contrast injected it will follow up the path of least resistance and is guided away from scar tissue. High volume is simple passes out of the intervertebral foremen. Its effects are generally a tempotizing in case of herniated disc and can put the patient at risk for infection.

The use of pelvic leg traction does not appear to be of any therapeutic value other than immobilizing the patient. Spinal manipulation should be avoided in patients with radicular symptoms or neurologic
signs because of its potential harm as abrupt passive movement of vertebra, beyond its physiologic range but within the anatomic range can make the condition worse\(^2\).

**SURGICAL TREATMENT**

Different surgical procedures like, Laminectomy with or without under cutting facetectomy, hemilaminectomy, laminotomy, fenestration discectomy and laser discectomy have been advised, keeping the clinical features and radiology in mind\(^3\).

The detail about the each surgical procedure has not been highlighted in this article, because of lengthy discussion. Any how brief description for surgical candidates has been discussed.

The American Association of Neurological Surgeons and the American Academy of Orthopaedic Surgeons have listed criteria for patient undergoing surgical treatment.

1. Failure of 2-4 weeks of appropriate conservative therapy.
2. Radicular pain in dermatomal pattern.
3. Sensory loss in the same dermatome (Weakness in the correct distribution.)
4. Depressed tendon reflexes appropriate to pain.
5. Sensory or motor loss.
7. An abnormal imaging study consistent with neurological deficit.

The criteria are considered if one of the neurologic finding is present in all other criteria. Basically, the history, clinical examination and radiologic findings must correlate. Early surgery is indicated in two situation only i.e. cauda equina syndrome and patient with progressive or acutely marked radicular weakness. Patient with intact neurology should be treated with a course of conservative therapy before surgical intervention and therefore investigation before the consideration of surgical therapy is unnecessary as management will not be altered.

Important predisposing factors from which satisfactory outcome of surgery can be determined are:

1. Radicular pain more severe than back pain.
2. Positive SLR (Lasegue sign), SLR, cross lasegue sign is more specific.
3. Neurologic deficit.
4. An abnormal MRI/CT/Myelogram.

If all the factor are present adequate surgery is likely to produce satisfactory result with these factor in mind, the following are indications for surgery.

A. Severe intractable pain.
B. Progressively worsening neurologic deficit.
C. Intractable recurrence of pain (failure of conservative treatment).
D. Cauda equina syndrome (absolute indication).

Apart from cauda equina syndrome, the rest of indications are relative and depends on how the patient will tolerate the symptoms.

Few Contraindications to surgery are:-

a. First episode of low backache and sciatic pain without adequate trial of conservative treatment.
b. Interment low back pain with occasional leg pain.
c. Improvement of pain with conservative therapy.
d. Prolong history of intermittent, low back pain and equivocal results on myelography.

e. Low back and intermittent sciatic pain with myelogram demonstrating lesion at wrong level.

As a matter of fact minimal amount of surgery that can adequately relieve the symptoms is preferred over attempting prophylactic surgery for symptoms that have not yet developed. Whatever surgical procedure is adopted, symptoms, neurological deficit, age, profile of the patient and experience of surgeon should be considered.18,19,20

CONCLUSION

Disc degeneration is characterized by progressive changes in the disc cellular and biochemical composition. Complex, biomedical loading may result in nuclear herniation and sciatica. A high proportion of symptomatic herniation disc resolves with conservative treatment and surgery is reserved for those cases in which symptoms persist.

In addition to open discectomy procedure, percutaneous and arthroscopic procedures are adopted. Randomized trial are required to fully assess the long term results of the minimally invasive technique.

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