



Neurosurgery News

Department of Neurosurgery

BHOPAL MEMORIAL HOSPITAL & RESEARCH CENTRE, BHOPAL



January - 2010

Minimally Invasive Spine Surgery

" Happy New Year "

Degenerative lumbar spine disorders constitute one of the most common and disabling medical conditions. Since the inception of surgery for this condition, continued refinements have occurred to improve patient outcomes and reduce complications. It is also the condition wherein there is significant difference of opinion regarding the best management options for a particular patient. We present this month a brief outline of indications to intervene and the minimally invasive options in managing these conditions.

Lumbar disc disease is one of the most common conditions that a neurosurgeon or a spine surgeon manages in his clinical practice. With the easier access to the MRI scans, more patients are being diagnosed to have "the disc". This brings us to 2 questions: What subgroup of patients require intervention and what is the better way amongst the many to intervene?

Studies have shown that there is no significant relationship between the actual size of disc bulge or herniation and the patient's symptoms. Hence, a clinical correlation is of absolute importance. The most common indications for surgery in lumbar disc disease are :

1. Cauda equina syndrome.
2. Progressive motor deficit.
3. Significant neurological deficit with reduced tension signs as straight leg raising.
4. Failure of adequate conservative management.
5. Recurrent episodes of sciatica.

While the first three are self-explanatory and require surgical intervention, decision making in the other two is the most difficult and ambiguous. Failed conservative treatment is the most common indication for surgical intervention. The duration of conservative / non-operative treatment depends upon the severity of pain, the occupation of patient and initial response to pharmacological agents. Most of literature supports a trial of 4-6 weeks but no longer than 3 months to avoid permanent pathologic changes that may occur in the nerve root. Surgery may also be considered in those with recurrent episodes of sciatica. While 80-90% patients will respond to conservative management after first episode and remain stable, following second episode 50% may have recurrence of symptoms. In a study comparing surgical and conservative outcomes in patients with mild, moderate and severe symptoms of leg pain and back pain without deficits, significant improvements were seen

in those with moderate or severe symptoms with surgery. In those with mild symptoms, there was no significant difference however.

Since the first lumbar disc surgery reported in 1934, significant advances and improvement have occurred in surgical approaches. The basic aim is to decompress the neural elements with minimal disturbance of the normal anatomy. Most surgical specialities have embraced this concept with spine surgery being no exception. Although traditional surgeons are still skeptical regarding minimalist approaches to spine, the evolution of minimal access spine techniques has been significant in past 2 decades and is now the most common method of managing this condition. The advantages of microscopic or endoscopic approaches include smaller incisions, lesser muscle dissection, preservation of posterior spinal elements, better visualization, lesser complications and faster recovery. Both microscopes and endoscopes can be used. Traditional microsurgical lumbar microdiscectomy requires a midline incision and stripping of the paraspinal muscles from the lamina. Tubular access to lumbar disc has been used for the last decade. Here, the approach is paramedian and is a muscle splitting rather than a "muscle stripping" approach. Though these tubular channels were initially designed for endoscopes, they have now been adapted for use with microscope thereby increasing the levels and pathologies that can be managed with these minimal access tubular approaches. At our department, majority of the lumbar disc surgeries are done using these minimally invasive approaches. In addition, these approaches are also used in cervical disc, lumbar canal stenosis, spondylolisthesis and tuberculosis of spine. We present a few of the representative cases of each of these conditions performed at our department using these minimal access approaches.

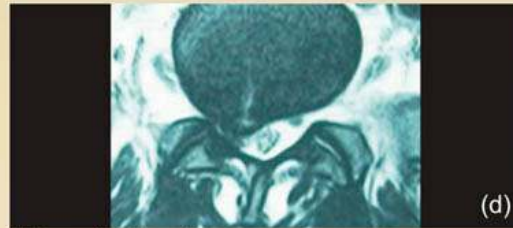
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Lumbar Disc Prolapse

Surgery for disc prolapse constitutes almost 30% of any spine surgical practice. Conventional method for managing these patients is by laminectomy and discectomy. However, this results in removal of the dorsal elements of spine including lamina and interspinous ligaments. Post-laminectomy syndrome is now a well recognized problem in these patients. Hence, a microscopic or endoscopic discectomy is now favoured approach. Traditional microscopic discectomy is a midline approach and endoscopic discectomy is a paramedian approach. The incision size in both these varies from 2-3.5 cm. The posterior elements are preserved and visualization is far better reducing risk of neural or dural injury. Minimal access tubular approach combines the benefit of being a muscle-splitting paramedian approach providing a three dimensional image through the microscope. We perform majority of our lumbar disc surgeries using either of these approaches. There is no significant difference between these two approaches, though familiarity of tubular access for disc is an important stepping stone for performing minimal access surgeries for other pathologies as canal stenosis, spondylolisthesis and tuberculosis.

Almost any type of disc prolapse can be managed with these minimalistic approaches: central, paracentral, extruded, and migrated (upward or downward) discs. The amount of bony removal can be tailored to the type and direction of disc prolapse.



(d) Paramedian disc prolapse



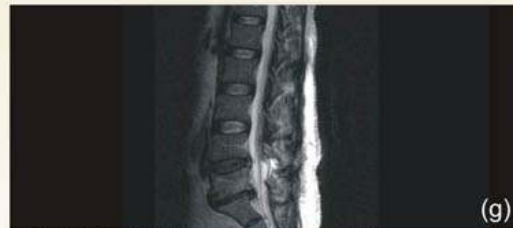
(e) Downward migrated disc



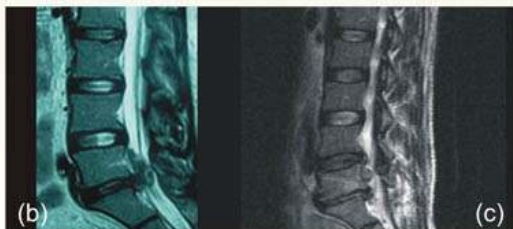
(f) Decompressed dural sac and root



(a) Central disc prolapse

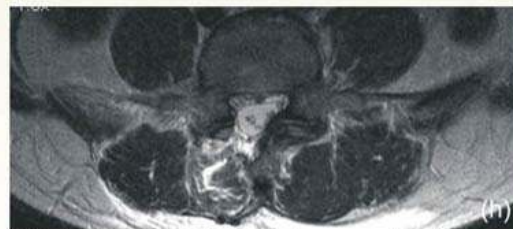


(g) Post-op image migrated disc (pre-op figure (c))



(b) Upward migrated disc

(c) Downward migrated disc



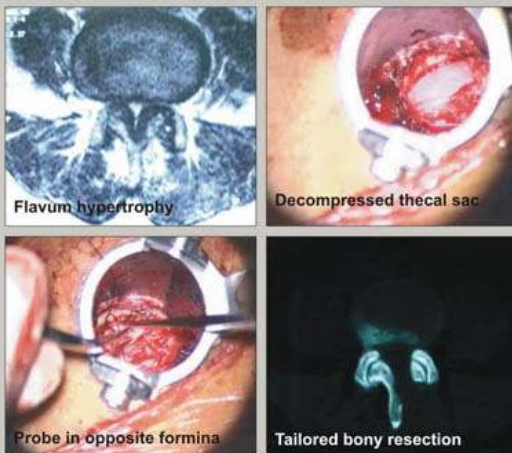
(h) Post-op image migrated disc with decompressed thecal sac (pre-op figure (e))

Spondylolisthesis

Many different surgical procedures have been described for spondylolisthesis. Majority of our cases are degenerative spondylolisthesis with focal canal stenosis. The cause of stenosis is the instability at these joints thereby resulting in ligamentum flavum and facetal hypertrophy. Hence, treating only stenosis without addressing the instability results in higher chance of failed back syndromes. Anterior, posterior and trans-foraminal lumbar interbody fusions (ALIF, PLIF, TLIF) and posterolateral fusion procedures have been described for these patients. While PLIF is the more commonly used approach, TLIF is being used increasingly due to more lateral approach thereby reducing the need for thecal sac and root retraction. These can be performed by conventional midline open approaches or minimal access tubular paramedian approach. The entire thecal sac and bilateral foramina can be decompressed from a single sided paramedian approach by undercutting through the spinous process and the contralateral lamina thereby preserving the interspinous ligaments and without dissecting off the muscles from the lamina. The fusion is achieved with interbody PEEK cages and percutaneous titanium transpedicular screws. Thus, one can achieve thecal sac decompression, restoration of the disc space height and thus the foraminal height and correction of the instability.



(a,b) Isthmic L5-S1 listhesis
 (c,d) Degenerative L4-L5 listhesis
 (e) Degenerative L4-5 listhesis with canal stenosis
 (f) Facetal hypertrophy
 (g) Post-op image with canal decompression with interbody cage



Lumbar canal stenosis

Lumbar canal stenosis is treated by decompressive laminectomy. In majority of these patients, the canal stenosis is due to combination of a central disc prolapse and significant ligamentum flavum hypertrophy. Laminectomy is done to gain access to remove the hypertrophied flavum and the prolapsed disc. However, laminectomy has its own problems such as post-laminectomy syndrome resulting in persistent low back pain. With the use of minimally invasive technique, this can be achieved from a unilateral side only. Part of inferior border of superior lamina and superior border of inferior lamina is removed on one side and the base of the spinous process is undercut to gain more access to the opposite side. Subsequently ligamentum flavum is also removed both on the ipsilateral side and the contralateral side. Both the foramina can be decompressed.

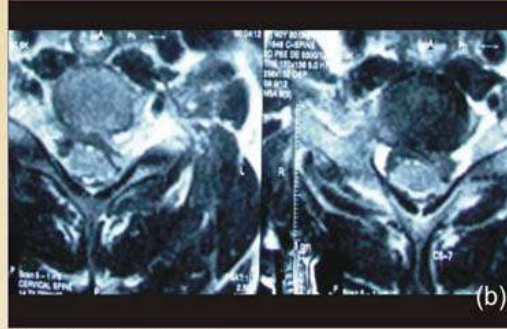
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Cervical disc

Anterior cervical approach is the traditional method for cervical discectomy. Many patients present with paramedian / foraminal disc prolapse with neural foramina compromise causing severe radiculopathy. Patient can have resolution of their symptoms by removal of only this prolapsed fragment / portion by an anterior or dorsal microforaminotomy. By this approach, the remaining of the disc material is left untouched thereby preserving the function of the disc. In other words, this is a "disc sparing" surgery. The anterior microforaminotomy is accessed through standard transverse skin crease incision. The dorsal approach can be through a midline or a paramedian minimal access tubular approach. We present one of such cases of foraminal disc managed by dorsal foraminotomy and discectomy using X-tube.



(a) Para central prolapse



(b) Left Foramina compromise



(c) X-tube in position

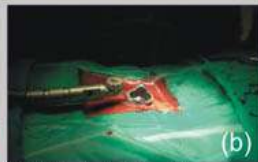
MIS instrumentation

The working port is the X-tube, a tubular port with diameter of 25 mm. This is inserted through a paramedian incision over sequentially increasing metal tubular dilators which split the muscles. These dilators are from 5.3mm to 20.8mm in diameters. It can be expanded at the

base to a diameter of 40mm. Further increase in access in all directions can be achieved by changing the angulation of the X-tube in any of the directions. Fusion is done by percutaneous transpedicular titanium screws and interbody cages.



(a) X-tube placed over muscle dilators



(b) X-tube docked in position



(c) X-tube expanded with the extent of exposure



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