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Chapter 27 : "Percutaneous Discectomy"

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Lumbar discogenic pain may arise from any spinal structure, but primarily comes from the nucleus pulposus, annulus, facets, and adjacent spinal nerves. Studies of disc herniation has demonstrated that the annulus fibrosus is the site of primary pathologic change. The pathogenesis of degenerative disc disease starts from inside the disc outwards. Annular tears are associated with degenerative disc changes and contribute to the development of abnormal annular bulges that progress to protrusion when more severe[3]. The largest disc bulging indexes were always associated with annular tears, and when bulges become herniations, the size of the tears affect the long term outcome of surgical discectomy. Larger annular tears are more susceptible to disc herniation, and large herniations are more susceptible to re-herniation. There is a need, therefore, to visually demonstrate annular tears, establish correlation with back pain, and prevent progression of these annular defects associated with intractable symptoms[3-7]. Endoscopically visualized percutaneous discectomy, when utilized appropriately, may fill help evolve the surgical treatment of disc herniation and discogenic pain.

Few physicians question arthroscopic knee surgery's role in advancing our understanding of knee pain and the treatment options arthroscopy affords. Endoscopic spinal surgery, at a crossroads similar to where arthroscopic knee surgery was in the 1970s, is poised to serve the same role[6]. Percutaneous endoscopic discectomy techniques in spine surgery have evolved rapidly in the past several years. It was first introduced in the United States as arthroscopic microdiscectomy by Kambin for contained and subligamentous disc herniations[2]. Improvements in scope design, access cannulas, instrumentation, and adjunctive therapy now allow for a wider spectrum of endoscopic procedures that include routine spinal probing, tissue resection, tissue modulation, and ablation[4]. These advancements have enhanced the surgeon's ability to diagnose and treat discogenic pain and take on the full spectrum of disc herniations, including extruded and sequestered fragments[8,9]. Earlier techniques for percutaneous discectomy were simply a nucleotomy procedure to debulk the disc using various mechanical instruments within the disc. As newer articulating and deflecting instruments developed along with working channel endoscopes, targeted fragmentectomy was made easier by placing and manipulating the cannula ever closer to the herniation, offering direct visualization and extraction of the herniated disc fragment. These advancements make it possible to expand the technique of percutaneous endoscopic discectomy to include foraminoplasty, annular modulation, and exploration of the epidural space as an integral part of the discectomy procedure[7]. The favorable efficacy of endoscopic lumbar microdiscectomy compared to open discectomy, in a prospective and randomized study, was published by Hermantin et al.[1] This chapter expands on the endoscopic restrictions described in the article and does not exclude difficult cases at L5-S I or extruded, migrated, recurrent, or sequestered disc herniations.

INDICATIONS

Patients with a disc protrusion causing leg pain greater than back pain who have not benefited from conservative treatment are ideal patients for percutaneous discectomy. It is not necessary, however, to wait until there is radiculopathy or nerve deficit, because a visualized percutaneous approach using only dilation to enter the foramen minimizes or mitigates the paradoxical effects of the posterior approach. Traditional indications for disc surgery are rightfully more rigid. Just the invasion of the disc and spinal canal may destabilize the disc and create scarring in and around sensitive spinal nerves. The morbidity of the standard approach has therefore limited our use of surgical treatment as an early treatment option. Old concepts dictate surgery as the last option after extensive conservative treatment (i.e., physical therapy, epidural and foraminal steroid injections) are exhausted. The dogma that "disc surgery is really decompressive nerve surgery" dominates the rationale for traditional micro-discectomy for herniated lumbar discs. With the ability to enter the foramen and disc atraumatically, coupled with the ability to view internal disc architecture, true disc surgery utilizing tissue modulation techniques in addition to selective discectomy is available to the endoscopic spinal surgeon[3,5-7].

Alternative approaches, such as the percutaneous posterolateral or foraminal approach, can decrease the paradoxical effects of traditional surgery because of its minimally invasive approach. Indications may then be less rigid, focusing more on identifying and confirming discogenic pain generators not responsive to conservative treatment, then utilizing newer techniques of tissue modulation, to treat the annulus.

PATIENT SELECTION

Patient selection begins with matching the patient with the proper indication. Some patients with equivocal or small disc protrusions thought to be poor risks for surgical intervention because of psychiatric or drug dependency problems are able to be considered if the selection process is further defined by evocative discography as a screening test. The patient's response to the evocative procedure will help determine the patient's pain threshold and their ability to improve as a result of surgery. The incorporation of evocative chromodiscography helps correlate each patient's pain response to the MRI and endoscopic findings[3]. The MRI cannot always predict pain provocation of a concordant nature. Sometimes a larger contained disc herniation is less painful than the adjacent disc with an annular tear and a smaller protrusion. This adjacent disc, even in the presence of a "normal" MRI can be the disc that reproduces the patient's concordant pain[3]. A grade IV or V annular tear is usually identified. Thus, while patient selection follows standard protocol of back pain greater than leg pain in a patient with neurologic findings on physical exam confirmed by MRI, evocative chromodiscography provides additional information that will improve the surgeon's patient selection and surgical results. In order to maximize his patient selection acumen and improve his surgical results, the surgeon should perform his own preoperative discography. Since it is necessary to insert a needle into the disc for percutaneous discectomy anyway, why not add discography and use a vital dye to help stain the disc to be extracted? If evocative discography is added to the selection process, it will add about 30% more information about pain generators in the disc than is possible by just depending on the MRI to validate the patient's complaints (Box 27-1).

In addition to a thorough neurologic examination, the Mackenzie method for centralization of radiating leg pain also serves to help select patients who fail to centralize their leg pain with physical therapy. If lumbar extension does not centralize, but continually aggravates the patient's leg pain, it is less likely that the patient will respond to conservative treatment. The surgeon's surgical success and experience with percutaneous discectomy will gradually allow him to refine his patient selection skills. With the ability to correlate concordant pain reproduction with anatomic findings, previous surgical contraindications become "relative" contraindications, dependent on the surgeon's experience with patient selection through discography. His surgical skills that allow him to address spinal pathology such as annular tears associated with disc protrusions, noncontained extruded or sequestered disc fragments, recurrent disc herniations, and even foraminal and central spinal stenosis[7]. Discogenic pain due to annular tears, with or without disc herniation, is amenable to selective discectomy and thermal contraction of the annular tear under visual guidance. For the first time, with visualized percutaneous discectomy, we have the ability to do disc surgery, and not just nerve surgery[3-9].

PREOPERATIVE PLANNING

It is generally sufficient to correlate the clinical exam with MRI findings in classical disc herniations with classic signs of radiculopathy on physical examination. Many patients with less clear radicular symptoms or multi-level MRI findings may require additional tests. Evocative discography performed by the endoscopic surgeon has proven invaluable for identifying additional pathology and gives the surgeon a "trial run" to determine the ease of endoscopic instrument access to the pathologic lesion. Anatomic considerations may also play a role in the selection of an endoscopic procedure. A high narrow pelvis may make it difficult to access the L5-S1 disc space. Severe degenerative scoliosis or the presence of degenerative or developmental spondylolisthesis may make the endoscopic procedure less predictable (Box 27-2).

SURGICAL TECHNIQUE: THE POSTERO-LATERAL APPROACH

The endoscopic image of a herniated disc provides the surgeon with a different perspective of the pathology as compared to the more familiar transcanal picture. The pathology is further enhanced by endoscopic illumination optical magnification and light blue staining of the diluted indigocarmine dye. The novel perspective is the intradiscal image and the lateral projection of the pathology when the endoscope is positioned in the foramen. The light blue staining marks the boundaries of degenerative nucleus pulposus that is still contiguous with the disc space. The differential light blue staining therefore will mark the degenerative nucleus whether the nucleus material is within the disc space, within the intra-annular tract, or in the spinal canal.

The author has coined the term selective endoscopic discectomy to describe the discogram staining technique he uses for percutaneous discectomy of targeted disc material. A specially designed endoscopic system (YESS, Richard Wolf Surgical Instrument Company) features a specially designed endoscope with distal irrigation and access cannulas that allow for foraminoplasty and removal of osteophytes while protecting nerve and other sensitive anatomy. The 2.8 mm working channel spine scope is multi-channeled and has flow integrated distal irrigation (Fig. 27-1). In the past, percutaneous methods of treating back pain and sciatica have had limited application and success due to the utilization of a single surgical device dedicated to a narrow spectrum of indications. Most percutaneous studies specifically excluded noncontained disc herniations, but the technique described here, the selective endoscopic technique, includes extruded, sequestered, and recurrent disc herniations.

The spinal anatomy accessible via the posterolateral foraminal portal include the superior articular process, the pedicles of the superior and inferior vertebra, the lateral and subarticular recess, epidural space, traversing nerve root, annulus, exiting nerve root, psoas muscle, and the annulus in the area of the foramen (Fig. 27-2). Through a biportal fenestration of the annulus, the entire nucleus pulposus is accessible. A flexible irrigated shaver blade is used for rapid central and posterior nucleotomy (Fig. 27-3). The epidural space is also accessible, especially with flexible instruments. Figure 27-4 shows the Ellman 4.0 MHZ flexible bipolar radiofrequency probe contracting disc and annular tissue. Dysesthesias are minimized by the use of high frequency bipolar electrodes. By using a blunt dilating obturator, such as the Wolf dual hole blunt obturator which has a side port for probing and anesthetizing structures adjacent to the blunt probe, stripping of muscle or ligament to access the disc herniation or annular tear is not necessary (Fig. 27-5). The YESS system includes an access cannula set. Each cannula has beveled and slotted ports which provide surgical access to the foramen. The tube protects nearby vital structures (Fig. 27-6). With this tube system, it is possible to perform foraminoplasty and remove noncontained disc fragments in the subligamentous area and epidural space. Figure 27-7 examples a foraminoplasty of the superior articular process with a Holmium 90 degree Sidefire laser probe. By stripping the capsule and ligamenturn flavurn, extra room will become available. Adjuvant therapies, such as chymopapain, radiofrequency, laser, and steroids can be employed when dictated by the visualized spinal anatomy.

To aid visualization, chromo-discography is always performed prior to endoscopy. Indigocarmine dye is added to a non-ionic contrast agent (1 cc indigocarmine to 9 cc Isovue 300M) to stain the nucleus pulposus (Fig. 27-8). Radial tears and degenerated portions of the nucleus pulposus stain light blue, while the more normal portions of the disc and annulus do not retain the dye and remain white (Fig. 27-9). Indigocarmine has an affinity for acidic tissue, partially explaining the selective staining of degenerated disc material over the more alkaline normal disc. Morphologically, degenerated disc material is either collagenized or crab meat like in consistency, while normal disc tissue has a firm turgor, resisting removal by mechanical means. Selective discectomy is accomplished by targeting the removal of stained disc material.

The incorporation of discography with a vital dye as an integral part of the surgical technique allows for "selective diseectomy," facilitating nucleotomy and targeted fragmentectomy.

The percutaneous discectomy is conducted with the aware patient in prone position. A radiolucent frame is used to hold the patient's spine in kyphosis, opening up the foramen. The technique begins with precise placement of a spinal needle (18G >6 to 8 inches long) into the disc through the Kambin's triangular zone which is bordered by the superior articular process dorsally, the exiting nerve ventrally, and the endplate of the disc caudally. The needle is directed to the area closest to the base of the herniation (Fig. 27-10.) A C-arm is needed to position and confirm the location of needle and various instruments throughout surgery. The optimal intradiscal placement of the operative endoscope is critical for the successful extraction of the herniated lumbar disc. This begins with the optimal location of the skin window, calculated by measuring the distance of a projected image of a rod targeting the center of each disc in a biplane projection. In order to reach that ideal operative target the surgeon must insert the endoscope through an imaginary narrow tunnel. This tunnel ideally will be placed directly under the apex of the herniation just deep to the inner one third of the annulus fibrosis through a mid-pedicular annular window.

Once the optimal intradiscal needle position is confirmed by biplane C-arm views, a provocative discogram is then performed, utilizing a non-ionic water soluble agent (iso-vue 200 or 300) mixed 9:1 with indigocarmine dye. A guide wire is inserted into the lumen of the 18 gauge spinal needle. An incision is made with a No. 11 scalpel. An obturator then dilates the muscle, docking on the annulus of the disc. The offset hole in the two hole obturator is used to anesthetize the tract, including the annulus. Blunt techniques are used to fenestrate the disc annulus. A cannula is inserted around the dilator, which forms the main access to the disc. A beveled or slotted cannula is selected to anchor the ventral portion of the cannula into the annulus of the disc, leaving the dorsal window open towards the epidural space. The disc, posterior annulus, and epidural space are in view through the endoscope (Fig. 27-11). The location and position of the cannula, ventral or dorsal, is dependent upon the individual pathology to be addressed. A work space is created within the dorsal cavity by evacuating the stained disc material with flexible shavers and special hinged pituitary forceps (Fig. 27-12). The hinged pituitary forceps are extremely efficacious for removing extruded fragments. Once the degenerated disc is removed, the annular defect and tears are visualized as a blue stained fissure extending to the outer annulus (Fig. 27-13, A). The annular defect is thermally contracted by using the 4.0 MHZ bipolar radiofrequency trigger flex probe by Ellman (Fig. 27-13, B). While the use of electrothermal energy is associated with temporary dysesthesia, the Ellman probe has caused the lowest incidence of dysesthesia. Higher incidence and more severe dysesthesia was encountered with a unipolar probe. The holmiurn Yag laser can also be utilized under direct vision to thermally contract the annular defect (Fig. 27-13, C). Success of thermal modulations are illustrated in the before and after images (Fig. 27-13 D, E). Lastly, the epidural space is explored to confirm the adequate decompression of the traversing nerve (Fig. 27-14). If it is desirable to see the exiting nerve, the cannula is rotated cephalad to expose the nerve either at the 4 o'clock or 8 o'clock position depending on a right or the left side approach (Fig. 27-15).

Intradiscal use of the scope to probe spinal structures and to better understand the pathology is an evolving process. The patient is only minimally sedated and monitored for pain during the procedure. The procedure is video taped and operative details recorded on commercially available video still program that incorporates MRI and intraoperative images with the dictated text in the operative report. Postoperatively, patients are followed as needed to monitor their clinical response, and adjuvant modalities are used when the visualized pathology dictates it. For example, when a grade V annular tear or an extruded or sequestered fragment occurs, an inflammatory membrane is frequently the result. The application of Celestone Soluspan or Depomedrol in the foramen postoperatively will provide rapid pain relief and improve the postoperative course (Fig. 27-16). In each patient an attempt is made to correlate the patient's symptoms with the pathology visualized. There are many variations of lumbar disc herniations according to the patterns of displaced intervertebral disc components: the nucleus pulposus, annulus, and the endplate, as related to each other and the stationary osseous vertebral parts. Four basic types are each associated with a specific surgical technique for disc fragment excision in the confined space accessed by the endoscope. The four basic types of herniations are listed below and each is given a descriptive name[8,9]:

1. Iceberg: Contained or transannular herniations usually with the bulk or the herniation still within the disc. This type of herniation should be removed with the "inside-out" technique by pulling the herniation into the disc cavity after central nucleotomy (Fig. 27-17, A).
2. Mushroom: Contiguous subligamentous or supraligamentous herniations. The annulus should be released either before nucleotomy or after nucleotomy to extract the herniation trapped by the annular fibers. The annulus is cut with the cutting basket forceps and can be further enlarged by laser ablation with a side firing Ho:Yag laser (Fig. 27-17,C).
3. Open hinged door: Massive annular attachment failure containing an endplate fragment still attached to the vertebral comer. The endplate attachment must be detached before the fragment can be extracted. This type of herniation takes careful planning or a residual

disc fragment will be left behind and result in a technical failure to adequately decompress the nerve root. This was one of the most common causes of failure requiring subsequent re-operation with the traditional posterior approach (Fig. 27-17,C).

4. Free fragment: Noncontiguous to parent disc space. The experienced surgeon will reach the epidural space by removing the ventral and lateral portion of the superior articular process to get access to the "tail " of the sequestered fragment for direct, visualized removal. With a biportal approach, the use of flexible pituitary rongeurs can reach the base of the fragment from the disc space. In experienced hands, fragments have been removed from behind the vertebral body by careful palpation. (Fig. 27-17, D).

Foraminal and extraforaminal herniation are not placed in a special group because disc extraction utilizes the same technique as the above herniation types. For the smoothest surgical routine, the anesthesiologist must also be familiar with all phases of the surgery so he can administer medication when it is needed, but no more than is needed. Only Fentanyl and Versed is needed for sedation, and the use of general anesthesia is not recommended.

POSTOPERATIVE CARE

Postoperative treatment progresses in stages, beginning with gentle mobilization and return to activities of daily living. It relies on close monitoring of the patient's symptoms and principles of lumbar stabilization. As the pain decreases, gradual increase in aerobic and conditioning exercises are added to the regimen. The final phase of rehabilitation focuses on rehabilitating the weakened spinal musculature. The average period from surgery to discharge ranges from one to three months.

COMPLICATIONS

Complications mirror those encountered in microdiscectomy but are less severe (Box 27-3). Nerve injuries, discitis, dural tears, and psoas hematoma can occur. When a disc fragment is extracted, adhesions to nerve, dura, or blood vessels can cause complications even when all precautions are taken. Anomalous location of spinal nerves, forked (furcal) nerves, and autonomic nerves have been detected and biopsied from the foramen. These anomalies may explain the onset of dysesthesias following foraminal surgery even when there is no indication of adverse events with neuromonitoring. The incidence of discitis is 0.5%, and is not usually from a skin contaminant, but more commonly either sterile or from an endogenous source. The complication rate overall is about 1-3%.

Complications and The Learning Curve

There will always be a learning curve that may serve to limit each surgeon's utilization of endoscopic techniques. The ability to easily and comfortably introduce the spinal needle is the first step of the surgeons learning curve. Some may never get over this obstacle and will always prefer the open approach. Direct and indirect irritation of the nerve root can always occur, but if leg pain persists, the procedure is aborted before any permanent harm is done to the nerve. Intra-operative continuous EMG monitoring and pre-and postop dermatomal seps may help prevent and decrease the severity of dysesthesias and nerve complications. Local anesthesia for this portion of the procedure is recommended unless there are extenuating circumstances and the surgeon is well versed in the use of blunt techniques to bypass the spinal nerve. Whenever extruded disc fragments are removed, there is always the chance of nerve injury or dural tears, since the disc may be adherent to the nerve or dura (Fig. 27-18 A). The technique for extracting a disc fragment adherent to the nerve sheath involves grasping the tail of the fragment and gently pulling the fragment free or wrapping the tail of the fragment around the micro-pituitary forceps (Fig. 27-18 B). The decompressed nerve is visualized (Fig. 27-18, C). However, extraction, no matter how carefully performed, can result fascicles of the nerve being removed with the fragment. Minute fragments of nerve tissue can also show up in the disc specimen, but there is usually no clinical consequence with this finding. These microscopic fragments will usually not compromise the surgical result unless the nerve is already compromised. Nerve injury must be recognized as a risk of any discectomy procedure, but it is more readily recognized endoscopically and in a conscious patient. When the nerve is adherent to the disc fragment, the patient will experience leg pain as the fragment is removed. Incidental findings of autonomic ganglia and nerve fibers can also arise from the periannular membrane (Fig. 27-17,D refer also to Fig. 27-20). Dural tears can also occur upon extraction and can be recognized by inspecting the epidural space and visualizing the nerve roots of the cauda equina (Fig. 27-19). The dura usually heals without further intervention due to the lack of surgical dissection which will allow the tissues to simply retract and seal the tear. Irrigation fluid from the scope will also keep the cauda equina from exiting the dura (Fig. 27-19). If a tear is recognized, simply tuck the nerve roots back by increasing the irrigation flow, then remove the cannula. Postoperative headaches will subside in a few days after the wound heals. Other complications of discitis (often sterile) and psoas hematoma can occur but are readily treatable by the insertion of a drain prior to placing the patient in the recovery room, or just allowing the wound to bleed onto a dressing until it stops spontaneously as the dilated portal closes on its own (within a few minutes).

The most common adverse post operative complaint is dysesthesia, an unpredictable phenomenon[5-7]. This can occur in the absence of electrothermal tools or laser, as reported by Kambin and Savitz[3]. It can also come as a delayed symptom weeks after surgery. Fortunately, and for 95% of patients, this is transient, resolving completely in a matter of days. The more severe dysesthesias may take months, but an aggressive treatment regime utilizing long acting pain medication, neurontin, (Gabapentin) and selective epidural or nerve blocks will mitigate the dysesthesia. Less than one percent end up with permanent residuals of numbness, weakness or continued sympathetic like pain. The temporary dysesthesia rate went from a high of 20% to less than 5% when the thermal source was switched to the Ellman Surgitron system and a bipolar 4.0 MHZ trigger flex probe. The overall complication rate, excluding temporary dysesthesia, is less than 2% in over 1700 patients.

TECHNICAL TIPS

When the nerve is adherent to the disc fragment, the patient can feel leg pain as the fragment is being extracted, alerting the surgeon to gently extract the fragment or use dissectors to first free up the nerve endoscopically. If there is a dural tear, the rootlets of the cauda equina are directly visualized. It is not necessary to repair the dural defect, as the surgical approach will allow the tissues to close over the defect. When the operating endoscope is used, the distal suction port can be reversed, and the inflow of irrigation fluid will push the cauda equina back into the thecal sac. The worst that has happened is a few days headache that is relieved by lying down. The surgeon is usually alerted by what is visualized and by the patient's complaint of pain while the disc fragment is extracted. Occasionally, small nerves not part of the traversing or exiting nerve, are observed in the perineural fat in the triangular zone (Fig. 27-20). These small nerves may be branches of the exiting or traversing nerve or may be part of the sinuvertebral nerve innervating the annulus; however, the significance of these findings is currently unknown. These nerves can show up with the extracted disc specimen and usually have no adverse effect on the patient. If it can be avoided, blunt techniques are used to bypass the nerve branches unless it is determined to contribute to the patient's back pain.

Discitis may occur, though sterile or from organisms in the patient's blood. It is rare to have discitis due to staphylococcus from a skin contaminant. The utilization of a bactericidal drugs such as bacitracin and polymixin-B in the irrigant has eliminated the incidence of bacterial discitis since its incorporation. When there is excessive bleeding, the use of a small drain on the completion of the surgery will prevent the formation of a psoas hematoma.

When an inflammatory membrane is observed, the use of steriods such as Celestone Soluspan injected in the foramen will give more rapid resolution of leg pain.

OUTCOMES

With this technique, the author has reported on successful removal of the whole spectrum of disc herniations, including far lateral extra-foraminal herniations and sequestered, migrated disc herniations. In a formal review of the first 500 consecutive patients with over 2 years follow up, Yeung reported 86.4% Good/Excellent results by Modified MacNab Criteria.(ref) Having treated more than 1,7 00 patients and 3500 discs since 1991, the surgical success rate continues to rise concurrent with diligence in the refinement of indications, techniques, and adjunctive therapy.

THE FUTURE OF ENDOSCOPIC DISC SURGERY

Ultimately, discectomy through the posterolateral approach will provide a minimally invasive alternative to standard, conventional surgery of the lumbar spine. The ability to visualize, document, and probe spinal structures under local anesthesia will enable the surgeon to gain valuable information about the pathology of discogenic pain. In the future, endoscopic discectomy will only be a small part of the surgical process which will incorporate techniques of tissue augmentation such as annular reinforcement, and nuclear replacement. Adjunctive therapies such as chymopapain, injectable bio-materials that enhance tissue healing, or endoscopic means of segmental stabilization or fusion, will be an integral part of percutaneous endoscopic discectomy.

REFERENCES

1. Hermantin, Peters, Todd, Quartartaro, Kambin. A prospective, randomized study comparing the results of open disectomy with those of video-assisted arthroscopic microdisectomy. JBJS 81-A:958-965,1999.
2. Kambin, Parviz, O'Brien, Zhou, Schaffer. Arthroscopic microdisectomy and selective fragmentectomy. Clinical Orthopedics 347:150-167, 1998.
3. Savitz MH, Chiu JC, Yeung AT. The Practice of Minimally Invasive Spinal Technique, 1st ed. AAMISMS Education, LLC, 2000. (Chapters 12, 29, 30, 37)
4. Yeung AT. Minimally invasive disc surgery with the Yeung endoscopic spine system (YESS). Surgical Technology International VIII: I- 11, 1999.
5. Yeung AT. The evolution of percutaneous spinal endoscopy and discectomy: State of the art. Mt Sinai Journal of Medicine 67:327-332,2000.

6. Yeung AT. Endoscopic Spinal Surgery: What Future role? The Journal of Musculoskeletal Medicine, Vol 18,Issue 11, November, 2000. 518-528

7. Yeung AT. Evolving Methodology in Treating discogenic Back Pain by Selective Endoscopic Discectomy and Thermal Annuloplasty. Journal of Minimally Invasive Spinal Technique. Vol. 1., Inaugural 2001. 8-16

8. Transforaminal Endoscopic Decompression for Radiculopathy Secondary to Intracanal Noncontained Lumbar Disc Herniations: Outcome and Technique. The Spine Journal 2, 2002. 41-48

9. Yeung AT., Tsou, P.M. Posterolateral Endoscopic Excision for Lumbar Disc Herniation: Surgical Technique, Outcome, and Complications in 307 Consecutive Cases. Spine, Vol. 27, Number 7, April 1, 2002. 722-731

Box 27-1 The Role of Evocative Discography

Traditional use of X-ray, MR, CT, or CT myelography is insufficient for pain evaluation in many patients. Current imaging studies can identify an anatomic condition in minute detail and at an early stage, but cannot reliably predict the severity of a patient's pain. Annular tears are manifest on MRI as a high-intensity zone (HIZ) of annular enhancement. Correlation is also found between abnormal disc morphology and the HIZ, but even the most sophisticated scanners will miss lateral annular tears. Moreover, annular tears are frequently found in asymptomatic patients. When used in conjunction with percutaneous discectomy, evocative discography:

- Correlates and confirms discogenic pain with abnormal discogram pattern
- Provides additional information on internal disc architecture and annular tears
- Outlines extent of the disc herniation, whether soft or possibly collagenized
- Alerts surgeon of the possibility of an extruded, or sequestered fragment Adding a vital dye will label degenerated disc and annulus for surgical treatment

Box 27-2 Selective Endoscopic Discectomy

- Incorporates evocative chromodiscography as an integral part of percutaneous discectomy
- Nucleotomy and posterior fragmentectomy of the herniated and degenerated nucleus pulposus
- Thermal modulation of the annular defect

Box 27-3 Complications

With the exception of Dysesthesias, complications have been limited to 1-2% In 1,7 00 cases. The same complications encountered in traditional surgery is also possible with endoscopic surgery. Dysesthesias occur about 5% and is almost always temporary. It can occur even without the use of radiofrequency or laser. In a formal review of my first 500 cases, the complications are listed below:

- Broken Instrument 1
- Partial nerve injury 1
- Psoas hematoma 1
- Dysesthesia with mild residuals 2
- Dural tear 1
- Discitis 3

LEGEND

Fig. 27-2 Image provided courtesy of Hal Matthews, M.D.

Fig. 27-17 A-D Illustrations provided courtesy of Paul Tsou, M.D. Dept of Orthopedics, UCLA

Fig. 27-11 Endoscopic view of the foramen with a slotted or beveled cannula includes the epidural space above and the disc herniation below. The posterior longitudinal ligament is seen separating the herniation from the epidural space containing the traversing nerve root. It is possible confirm adequate decompression of the nerve in large herniations where posterior fragmentectomy rather than central nucleotomy is desired (How do we fit this in?).

Fig. 27-15 Rotating the cannula cephalad will expose the exiting nerve when the cannula is placed in the axilla under the traversing nerve and next to the cephalad pedicle.

Fig. 27-18a Tail of a large foraminal disc fragment adherent to the traversing nerve root.