GORE SYSTEM: MANUAL Transforaminal Endoscopy For Lumbar spine

Dr. Satishchandra Gore

Gore System Manual

Transforaminal Endoscopy for Lumbar Spine

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THIS BOOK IS DEDICATED TO MY TEACHER

DR ANTHONY TUNG YEUNG, ARIZONA, USA.

Who taught me and showed me the right path in transforaminal work in lumbar spine.

It was his continuous support that made me what I am today a spine endoscopist.

Dr. Satishchandra Gore

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Why this book?

I have been doing spine surgery since 1980s and have seen the complete change in degenerative spine understanding and practical solutions. From days of back school to various management protocols, use of hardware that slowly encroached on degenerative spine, and for last 20 years I am devoted to transforaminal endoscopy and stitchless surgery for the degenerative spine under local anesthesia in an awake and aware patient.

For a beginner who wants to start on this surgery path, there are many books available, mine is just a manual that will hold his hand and take him further along the learning curve making it palatable and doable. This book will soon be accompanied by "endoscopy coach", that will complement this by an app and help surgeons take this up very rapidly.

I wish all spine surgeons appreciate that our patients many times suffer due to our ignorance and uncertainty to a large extent and we need to give solutions to their problems. I am sure we know that we are NOT changing natural history of the disease. There may be claims to the contrary. There is definite influence of western thought on spine surgery and we need to have our own solutions to our problems.
I see a large number of young patients who have low back ache sufficiently incapacitating that they are clueless about it, same as their treating surgeons. I also see middle aged patients with a common problem of knee pain due to sciatic neuralgia and seniors who have claudication affecting activities of daily life. Small proportion needs surgery, we need to build confidence about us by covering full spectrum of this suffering.
I hope this book adds to guides available to beginners and makes their journey safe precise innovative novel and enabling for them and their patients.

Satishchandra Gore

10 September 2021
Ganesh Chaturthi, Pune.
INDIA.

1. PRE-SURGERY PREPARATIONS

PATIENT COUNSELLING

This is foremost as a well- prepared patient to be operated under awake and aware anaesthesia requires high level of cooperation. Counselling can be carried out by specially trained counsellor and by an Anesthetist who must win the patient's confidence as he/she will frequently talk to the patient during surgery and keep the patient comfortable.

Counselling carried out should cover:

- Video demo of the procedure with a 4 minute standard video
- Advantages of the procedure and superiority of TFE
- How this is different than all under GA procedures
- Pitfalls of the procedure
- Failure related to the procedure
- Likelihood of dysesthesia and core area pain for a transient period of time especially when foraminoplasty and root handling is done.
- It is day care non-stitch surgery.

The patient must be explained the expected recovery schedule and his cooperation after surgery. The role of a specially appointed counsellor is for all the above and also to assess the mental state of the patient and cooperation to be received from the patient. Prior to, during and after surgery in the recovery period and also to assess the genuine VAS score or claudication score prior to surgery.

It is important for the Anesthetist to know the patient by name to be very comfortable with the patient. The patient must be addressed by name as it builds bonding and sense of comfort for the patient in a tense environment. This is true for all persons in theoperating room. We normally do a time out and identify each member of the team, confirm side and site of the surgery. Encourage the patient and advise the patient to give a feedback throughout the awake and aware anaesthesia, so that the Anesthetist may relieve the patient whenever the patientfeels pain. Pain is generally felt when we put the dilator through the annulus into the disc and whenwe guide the sleeve over the dilator. Response of the patient during provocative discography in form of pain has to be recorded by theAnesthetist.

BASIC SET OF INVESTIGATIONS

See that all the investigations are done and the reports are filed properly and are available to the Doctor, the ward and nursingand operation theatre staff, to the Anesthetist.

1. MRI
2. X-Ray
3. EMG - NCV for both upper/lower limbs, asthe case may be
4. Ultrasonography with pre and post voidresidual urine
5. Chest X-Ray (PA)
6. ECG
7. 2D Echo, if needed

8. Lab investigation
    a. Blood Sugar – Random (If patient is diabetic, BSL - Fasting and PP)
    b. HbA1C (If patient is diabetic)
    c. Hemogram (Complete Blood Count)
    d. S. Electrolytes
    e. S. Creatinine
    f. S. Uric acid
    g. C-Reactive Proteins
    h. ESR
    i. BT & CT
    j. Prothrombin Time (PT INR)
    k. Urea
    l. Creatinine
    m. HIV / HbsAg / HCV
    n. Urine Routine
    o. Thyroid Function Test, if needed
9. Physician Fitness and Cardiologist fitness, if needed. Added tests like color Doppler and 2D echo may be advised.
10. In patients with large discs and suspected cauda equina symptoms or elderly patients with canal stenosis, insist on pre and post void residual urine as silent bladder dysfunction may manifest. Such patients with significant post void urine retention may precipitate bladder problems post-surgery, mainly retention of urine needing catheterization and urological intervention for a long period of time. (Value males: 100 ml, females: 60 ml). Any values above that without a valid urological reason is a red flag of progressing neurogenic bladder due to S234 root involvement.

CONSENT FORM Appendix has all my consents used daily.

For consent to be relevant please note that the patient must be a sound mind and must consent to the procedure on his or her own. An additional consent of the relative as a witness is desirable. The consent form must also be signed by the doctor in presence of the patient, for it to be valid. Legalities about consents keep on changing and an updated consent is desirable.

PREOPERATIVE ORDERS

Patient is kept nil by mouth for a minimum period of six hours. This is to make sure stomach is empty and should the patientsuffer a mild vagal attack the patient will not vomit. It is also easier to sleep on an empty stomach when sleeping prone. In patients with history of poor bowel clearance, use a laxative the previous night so that there is complete emptying of bowels and gas shadows that would interfere in the AP and lateral view of the image intensifier are decreased.

Prior to surgery, the patient is administered atropine or Glycopyrolate. This is to prevent any bradycardia developing at the time of foraminal entry or annular penetration. Keepyour ear on the monitor beep when approaching the foramen. The Sinu-vertebral nerve which is a branch of the ventral ramus supplies the annulus and the posterior longitudinal ligament and carries fibres of the sympathetic and parasympathetic system stimulation of which can result in severe bradycardia.

All medications for any co-morbid conditions such as diabetes and hypertension should be given the previous night or early morning prior to the surgery, with a sip of water.

DOCUMENTATION AND FILE PREPARATION

Prior to sending the patient to operation theatre, the patient's file must be properly prepared with all investigations such as X-ray, MRI, etc., laboratory investigations and relevant investigations. Completeness of the file must be checked by the resident doctor and ward sister in charge. Patient's consent along with the witness signature of his relative and signature of the operating doctor must be taken by the resident doctor and/or the ward sister. Prior to sending the patient to the operating room patient's back must be examined especially male patients. Shaving prior to surgery must be carried out. Also intra venous access must be taken prior to sending patient to the operating room.

CO-MORBID CONDITIONS

A special note on the front page of file must inform the entire team of all allergies and any co-morbid conditions that the patient may be suffering from. All medication which has been put on hold such as diabetic drugs, antihypertensive medicines and blood thinning agents such as disprin, clopidogrel should be displayed prominently on this front page on the file including the date and time from when such drugs have been withheld. The obese patient has special requirements discussed in a separate chapter later.

REMOVAL OF ITEMS

All dentures, loose teeth caps and dental crowns, spectacles, contact lenses, hearing aids, any implants and threads around the waist must definitely be removed.

Indian patients especially, women are very fond of gold jewellery. Please insist that theseall be removed and handed over to the witness who signed the consent form, prior toshifting the patient to the operation theatre.

PRESCRIPTION CHART

As advised by the physician in charge of the patient, the daily medication chart of thepatient which he/she is currently taking mustbe separately attached to the file and forwardto the operating team. Along with this chart,must be the chart of medicines prescribed tothe patient on the day of the surgery.

PATIENTS WITH DISABILITIES

Patients with disability, visual impairment, and auditory impairment have special needs. Such patients must be accompanied by his caretaker who must be present in the operation theatre until the start of the procedure. With advent of medical tourism an interpreter also may be present to communicate with patient during surgery.

SUCCESS OF SURGERY

The success of any surgery is dependent upon essential preoperative planning. At times, in the same patient multiple discs are involved and sometimes on opposite sides. A proper pre-operative plan, noted down, helps prevent last minute confusion as to which disc is to be approached from which side, in case you plan to do more than one level at a time. Even when you wish to do a staged procedure involving multiple discs, it is advisable to have it all planned and written

down so that there is no confusion on whatyou have done and what you intend to do, when you take the same patient for the second procedure after a couple of days.

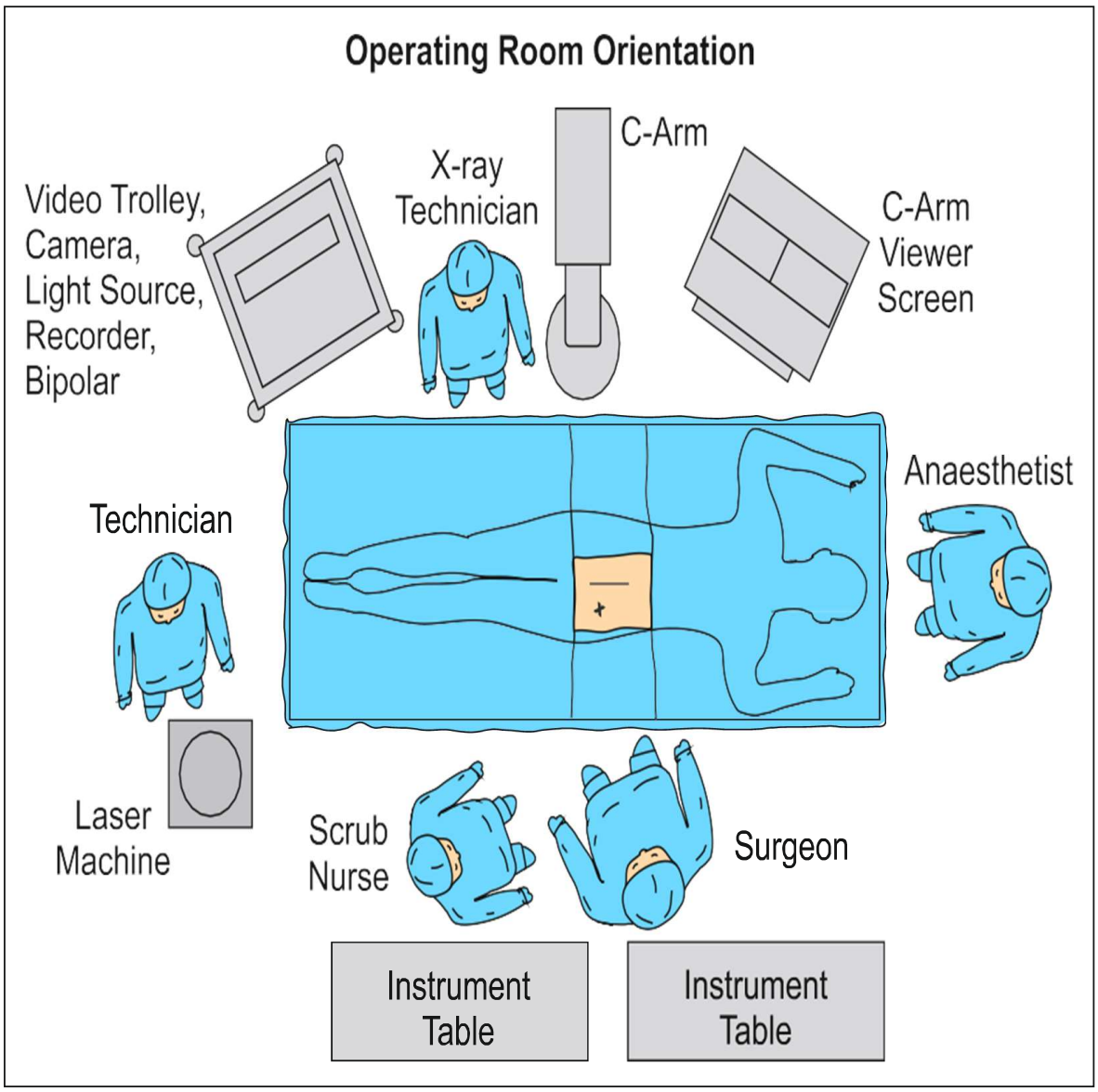
Finally, please remember that the patient is under awake and aware anaesthesia, please refrain from using profanities and loose talk as this may stress the patient. Please keep talking to the patient, as a gentle voice reassuring the patient is vital in getting cooperation from the patient.

2. THE OPERATION Theatre

The operating team essentially generallyconsists of:

- Operating surgeon
- Anesthetist and assistant
- Senior operating room nurse
- C arm Image intensifier technician
- Technician for handling accessory trolley
- General help

The theatre must be sealed and sterilized thenight before the surgery, the patient being taken as the first patient of the day. Routine swabs from the operating table, thefloor of the operation theatre, the walls of the operation theatre and top of surfaces must besent for culture and growth sensitivity tomake sure that the environment of the operation theatre is completely sterile. Periodical filling of these reports is a must. A checklist enumerating the number of instruments, surgeon is going to use must be prepared. Allinstruments must be present on the operating trolley and must be checked prior to commencement of surgery by the senior operating staff nurse. Absence of any instrument or breakage should be informed prior to the surgery to the operating surgeon as there is no room for surprises during the endoscopic spine surgery.



The surgery is heavily dependent on precise targeting therefore, the image intensifier is perhaps the most vital link in this entire operation. Preoperative check of the functioning of the image intensifier is vital.

In obese patients, please take mock shoots in AP and lateral view and pre op images to check the image quality prior to surgery as this will prevent last minute anxiety, especially if the lateral shoot is of poor quality. We may have to speak to the manufacturer / engineer and technical support team of the image intensifier company to try and rectify the situation.

Check:

- Camera
- Recorder
- Light source
- Monitor
- Radio-frequency machine
- Drill
- Burr motor

All equipment must be in proper working condition.

Sterilization protocol for instruments vary with various institutions. Please speak with the CSSD department and ensure that the endoscopic spine surgery instruments are sterilized by preferably:

A. ETO sterilization
B. Cidex sterilization
C. Autoclave sterilisation
D. Flash sterilisation
E. Use of per acetic acid (perasafe) Perasafe needs exact 10 minutes to sterilize instruments, so it is best suited for a busy day or in a camp. The endoscope must be sterilized by ETO or Cidex solution only though some scopes can be autoclaved.

We do not recommend the use of formalin sterilisation as residual formalin on instruments can cause chemical discitis. Also in case of Cidex sterilisation see that the instruments are washed thoroughly in normal saline prior to taking them on the operating table. Prior to starting surgery it is important for the Operating surgeon / anesthetist to carry out an independent verification of the:

- Consent Forms

- All Hospital forms
- Notes by operating staff
- Check that all the records and files areavailable

OPERATION TABLE/BOLSTERS/IRRIGATION

Endoscopic spine surgery is a very specific target oriented, image intensifier guided surgery with exact placement of needle intothe lower part of the Kambin's triangle, in anawake patient. This essentially means a very high use of theimage intensifier. To compliment this, it is essential to have an operating table which isimage intensifier compliant and is radiolucent. For taking lateral X-ray, the image intensifier has to swing below the operating table therefore, the operating table has to have a height adjusting mechanism, which if electrical is easier to operate. Endoscopic spine surgery procedure, especially when being done at multiple levelsin the same sitting for foraminoplasty takes long hours. All this time the patient has to lie down on his / her abdomen, which can be a very uncomfortable position to be in especially in obese patients. We have designed very comfortable bolsterswhich allows for correction of the lordosis, accommodates the protuberance of theabdomen and at the same time gives adequate support to the back, hence has the shape as shown below.

In the side to side profile the edges appear raised as compared to the central part. This allows for auto centering of the patient within the bolster as both sides are raised. This ensures that the patient does not fall off when the table is rotated for oblique views sometimes needed to square the vertebrae at the level of surgery in rotated scoliotic spine. Many times, patients with large abdomens will prefer a slightly rotated position to accommodate the large abdomen hence, for final adjustments table rotations are necessary. This contouring of the bolster helps the surgeon, else you may opt for the traditional bolsters shown earlier in pics used in routine spine surgery.

As a matter of principal, instruct the assisting technician to clean every bottle with sterilium and use a sterile needle every time puncture an airway in the sterile bottle. Irrigating fluid in endoscopic spine surgery is normal saline, available in convenient 3 litre packs. Fluid control during surgery is of paramount importance.1 cc of Epinephrine can be used with every litre of saline in dilution for control over bleeding, though we have not found it to be beneficial at all. Also addition of any antibiotic has not really been proven to be of any advantage. Use of a fluid pump with pressure setting not exceeding 20 cms of fluid pressure may be used, with enhanced pressure unto 30 cms in bursts controlled by foot pressure if needed.

This helps to stop oozing from epidural veinsas normal epidural pressure does not exceed 15 mm of hg. Please be sensitive to rise of epidural pressure and neck pain, if patient complains of the same, drop pressure. Gravity assisted flow is also more than enough if height of IV stand is raised in most cases and a pump is not needed. A urology Y set or irrigating tube that has dual chambers which when squeezed by assistant or operating room nurse, can give transient rise in flow pressure, there by not needing a pressure cuff around the irrigating fluid bottle. Y set is used in place of routine IV set as it allows larger volume to flow. No special advantage has been found in using cold saline and hence we do not advocate it.

Prior to surgery please do a mock trial by making the patient sleep on the bolsters and taking a trial x-ray. This will help establish two things:

1. The minimum dose needed for a good clear image.
2. To make sure that your machine is shooting and working well.

This way you do not have a last minute heartache after you have taken a patient for surgery. In obese patients, this becomes all the more important as different machines and different manufacturers have different penetration values, kilovolts KV /MA values in their machines.

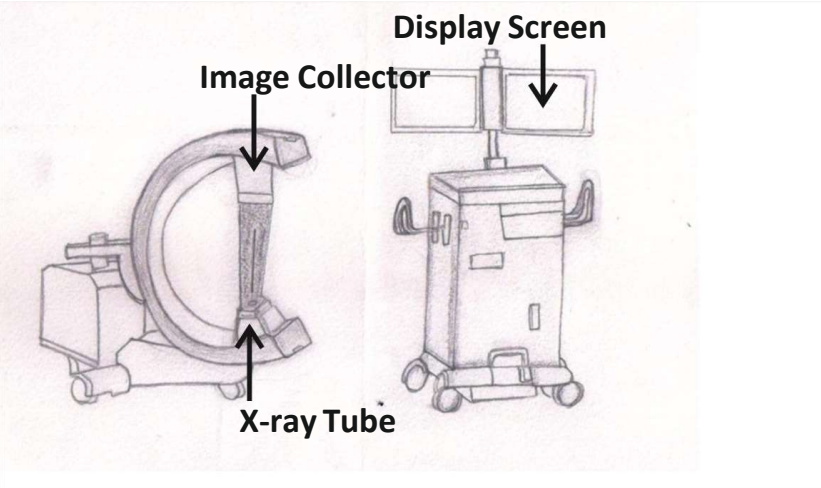
Gas shadows sometimes interfere with good vision. Use laxative to completely clear off the bowel of all fecal and gas residues. This gives a much clearer, sharper image and makes a bloated abdomen smaller. It is also easier for the patient to lie down completely empty stomach. Less radiation is needed.

IMAGE INTENSIFIER (C-ARM)

X-rays are a form of ionizing radiation as they pass through tissue and altar atoms by removing electrons and positrons leaving behind free radicals which can change our DNA resulting in the risk of developing malignancies but the benefits far outweigh the risks.

The C-Arm is a composite unit three parts: Part one - Is the production of X-rays, i.e. the x-ray generator tube. Part two - The image collector which is an imaging plate on which photons fluorescence at a lower energy, this differential penetration of X-rays through an object and subsequent image formation in real time is transmitted to screen. Part three - The display screen or CRT tube on which the images are finally displayed. C-Arms ultra-high density 4K machines with flat monitors are the next generation C-Arms which is available.

Adverse effects of bystander radiation: The entire surgical unit is exposed to ionizing radiation when using the C-Arm. Kindly keep a distance of 3 meters from the patient. This ensures zero scatter radiation.



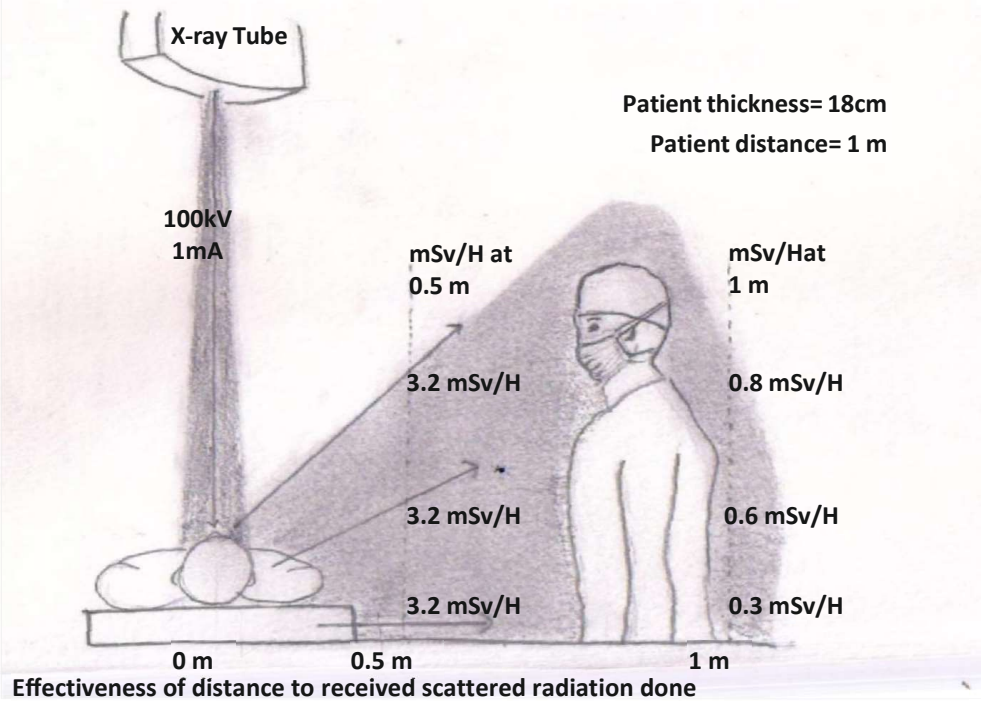


Image Intensifier

We create a mental matrix with regards to the C-Arm base, moving it changes all calculations. Once positioned on a patient it should not be moved. All arm movements are from a fixed position on the floor. Any change will adversely affect your trajectory and angle of approach. Use of lead aprons, neck guards is highly recommended. Use the lowest possible dose of radiation that matches with good image quality. The use of TLD badges by people exposed to constant use of C-Arm is advocated to ensure that accidental exposure and overexposure is not occurring and health check-up is needed for those who are using it repeatedly. Please confirm your disc levels prior to commencing the markings.

In the AP shoot, the closer the image collector is to the patient, the lesser will be the scattering of X-rays. It will also improve the image quality and reduce the radiation doses due to scatter throughout the operation theatre and reduce magnification. In under the table movement of the C-Arm for lateral shoot, the operator of the machine is usually facing the X-ray generator. This puts him directly in the path of the oncoming radiation beam hence, please advise the operator to use extension switch and move out of the range of the beam.

The C-arm must always approach the patient at exactly 90°, the swing arm being able to go under the patient to shoot a lateral view X-ray and AP view X-ray. Once you have confirmed the ability to do the same please lock the base of the machine so that it does not move with respect to the patient. Only in cases of L5-S1 Disc, a 15° tilt of the image collector towards head is required and is called Ferguson's view. In this view, the L5-S1 disc will open up as you are aligning with the lordosis of the patient. At L4-L5 a 5° tilt, at L5-S1 a 15° tilt and L1-L2, L2-L3 reverse tilt towards leg may be needed. Direct foraminotomy is useful only when the disc is severely collapsed and facet is massively enlarged, with no other way to approach the disc.

SKIN MARKING

Endoscopy is a precise art, as the underlying philosophy has evolved from debulking to precisely targeted fragmentectomy. Where you land determines the exact ability to remove the fragment and treat the pathoanatomy. However, basic targeting has been determined by the boundaries of the Kambin's triangle. Every single time targeting has to land you in the Kambin's triangle between the two live nerves & end plates.

3. ANAESTHESIA courtesy: Dr Luv Kush Pandey.

It is important for the Operating Surgeon to discuss the surgery and time required for completing the task with the Anesthetist. Endoscopic spine surgery is carried out underawake and aware anaesthesia, using principally local anesthetic supplementedby mild form of sedation from which the patient can be instantly reversed in a prone or lateral position. Respiratory depression mustbe avoided at all times.

Drugs commonly used by me are:

- 2% Lignocaine
- Bupivacaine
- Midazolam
- Dexmed
- Propofol
- Fentanyl

Drugs not to be used are:

- Paralytic agents
- Deeply sedating Opioids, like Pentazocine
- Hallucinogens like Ketamine

Sedatives ensure event amnesia and patientwakes up devoid of any memory, also providing relief from pain during procedure.

Protocol followed by me:

5 to 10 cc of 2% Lignocaine, or 5 ml with 10 ml
of Bupivacaine, 5 ml Normal Saline.
On average, not more than 20 ml of the abovemixture is used for single disc.

Prior to starting anesthetist gives1 cc of Midazolam and Oxygen at 2 lit per min. I introduce long needle and go up to a depth of 7 to 8cms. At this depth I am just outside the foramen. Use of a few drops of local ensures that when I push against the annulus, the patient does not get severe pain. We enter disc and appreciate the granular feel and giving way by the annulus. At this stage, one must be careful and keep one ear on the cardiac monitor, no bradycardia must occur. Change stylet to wire. Change to dilator over guide wire. This step is the only significantly painful part of surgery and we use a small dose ofFentanyl, as we hammer on the dilator to enter the spinal disc. After entering to the spinal disc, I inject 1 to 2 ml of local anesthetic to take care of the pain. We can now do further intradiscal procedure without use of any further local anesthetic. As a discal fragment tears through the annulus and breaches the outer layers of the annulus two things happen: 1.The outer annulus is supplied by the Sinuvertebral nerve and by the sympathetic chain, these trigger pain. 2. Because of the exposure of the discal fragment to the vascular structures of the spinal canal, vascularization of the fragment starts, chemical mediators from fragment leak triggering pain. These are washed out by irrigation. Neurovascular reaction at interface within the tear is a pain generator and the source of pain.

Use of a small amount of local anesthetic within the disc will help suppress the pain that will occur when you pull out this painful fragment.

Anesthesia in Transforaminal Endoscopic Discectomy

PRE REQUISITE

A. Pre Anesthetic Check-Up
B. Pre-Operative Orders
C. Pre Medication
D. Checklist of Drugs
E. Conscious Sedation
F. Intra Operative Monitoring
G. Post-Operative Orders

A. Pre Anesthesia Check-up

- Done by Anesthetist
- General and Physical examination
- Any history of co-morbidities such as (HTN, DM, Thyroid, CAD, Asthma, COAD) etc.
- Drug History (History of Blood thinning agents like Aspirin, Clopidogrel, Warfarin, Heparin, etc.)
- Allergy History
- Laboratory Investigations (Routine tests with Coagulation profile)
- Radiological Tests (CXR, Post void USG in elderly patients)
- Cardiopulmonary Evaluation (in CAD and COAD patients)

B. Pre-Operative Orders

- Written informed consent (Detailed explanation of prognosis, outcome of surgery and anesthesia).
- NPO guidelines (6 hours for solid food, 4 hours for clear fluids, 2 hours for plain water)

- Continue routine drugs with sips of water in the morning.
- Hold anti platelets for 48 hrs. Prior and 24 hrs. after the procedures (INR should be below 1.25)
- Lignocaine skin sensitivity test.
- Maintenance of Blood sugar, Blood pressure, O2 saturation, Coagulation status etc., up to optimum.
- Counseling of patients to make them aware of the surgery.
- Anxiolytic, Tab Alprazolam 0.5 mg PO onthe previous night.

c. Pre Medication (Prior to shifting to Operating Room or inRecovery area)

Anxiolytics: IV Midazolam 2 mg IM prior to shift to OR

Antacids: IV proton pump inhibitor Antiemetic: IV Ondansetron 4 mg Anticholinergics: IV Glycopyrolate 0.2 m Analgesics: IM Diclofenac Na 75 mg or IMTramadol 100 m

Antibiotics: As per surgeons or hospital policy

d. Drugs and Equipment

- Boyles Anesthesia Station
- Airway Management Tools – Guedle's and Nasal Airways, O2 Flow masks, Nebulizer mask
- Oxygen and Nitrous Oxide
- Normal Saline 0.45% for Irrigation and Dilution of drugs
- Emergency Drugs – Atropine, Adrenaline, Hydrocortisone, Furosemide, Mannitol, Methylprednisolone, 25% Dextrose, Trenexamic acid, Bronchodilators, Ondansetron
- Analgesics – Fentanyl, Tramadol, Diclofenac Na,
- Sedatives – Midazolam, Lorazepam,

Propofol

- Local Anesthetic – 2% Lignocaine, 0.5% Bupivacaine

Drugs Information:

Lignocaine:

Amide, Popular LA, Faster onset: 3 - 5 minutes, Longer lasting: 30 – 60 minutes, Safe Dose: 5 - 7 mg/kg, CNS side effects, available as 2% solution.

Bupivacaine:

Amide, Slower onset: 10 - 20 minutes, Longer duration agents: 4 - 8 hours, Safe Dose 2 - 3 mg/Kg, Cardiac side effects, available as 0.5% and 0.25% solution.

Midazolam:

Benzodiazepine, Amnesic effect, Reduces anxiety, Initial dose: 1 – 2 mg, Onset of action: 1 – 2 minutes, Peaks: 3 - 4 minutes, Short acting (duration of 15 - 80 minutes), Respiratory side effects, Reversal agent: Flumazenil.

Fentanyl:

Opioid Analgesic, Initial dose: 50 – 100 mcg, Onset of action: 1 – 2 minutes, Peaks: 3 – 5 minutes, Duration of effect: 30 - 60 minutes, Cardio respiratory side effects, Reversal agent: Naloxone.

Nitric Oxide:

Analgesic, Amnestic, Anxiolytic, Moderate sedation, Hypoxic if used alone.

Propofol:

Loss of consciousness within 90 seconds of bolus, No analgesia, No amnesia, Cardio respiratory Depression. Bolus doze of 1 - 2 mg/kg. Better be avoided.

Tramadol:

Opioid, centrally acting analgesic, Onset of action: 5 - 7 minutes, Duration of Action: 2 - 4 hours, Safe dose: 0.5 - 1.0 mg/kg for slow IV infusion and 1 - 2 mg/kg for IM, Side effects: Nausea and uneasiness.

e. Conscious Sedation

- Positioning of patient – Prone with the help of bolsters below the chest and pelvis, keep abdomen free, proper neck positioning, and care of pressure points.
- Counselling of patient to gain their confidence.
- Base line Vital Parameters, NIBP, HR, SpO2, RR, Consciousness.
- Start O2 inhalation by nasal prongs or facial mask, N2o in 50-50 ratio with O2 can be added for analgesia.
- IV fluids on maintenance at least 100 ml/hr. (20 drops/min).
- IV Tramadol 50 mg or Diclofenac Na 75 mg in the drip if not given in premedication.
- IV Midazolam 2 mg Bolus can be given as premedication.
- Skin Infiltration with LA 1% Lignocaine using 27G Spine needle at the entry point.
- IV Fentanyl Bolus of 50 mcg, once needle enters in to the foramen at medial pedicular line in X-ray AP view.
- 0.5 - 1 cc of 1% Lignocaine intra annular prior to negotiate the

dilator or working cannula through the neural foramen. IV Fentanyl of 50 mcg can also be added, if required.

- Wait for the drug to act.
- Don't cross the maximum limit of any drug. For a 1.5 hrs surgery, 150 mcg of Fentanyl, 2 mg of Midazolam, 20cc of 1% Lignocaine is sufficient.
- Titrate the dose of analgesics and sedatives according to the vitals of patient.
- Synergistic effects of the drugs should be kept in mind.

Special Conditions: Need more precautions

- In Obese patient there is Difficulty in positioning and managing airway.
- Neck deformity in Spondyloarthopathies –Difficulty in positioning and managing airway.
- Unable to lay prone may be due to severe pain or spine deformity. In case of Lignocaine Allergy – Use another local anesthetic.
- Neck pain or Headache during procedure due to high irrigation pressure

Complications: Are very Rare Intraoperative TIA, Epidural bleeding Neural Injury Dysthaesthia

Drugs to be avoided during procedure: Drugs causing general anaesthesia like Propofol, Ketamine, Thiopentone, long acting Benzodiazepines and Opioids, etc.

As the needle and guide wire or dilator or cannula come close to the foremen, the Anesthetist must always keep a loaded 2 cc Atropine syringe connected to the patient's IV systems as I have seen rapid onset bradycardia at such time. Waiting to load an ampoule of Atropine may be too late as the patient can rapidly progress to an arrest. Hence, preloading prior to the procedure inpatient and in syringe both is vital. in patients with short neck and obesity avoid deep sedation atany cost, in case patient de-saturates withdraw all hardware, keep a sterile mop and turn patient immediately, hence patient shifting trolley must be parked just outside the OR in anticipation of such complication. Anesthetist is always king and must be obeyed at all times. Life is precious and adecision must be immediate.

Complications: Are very Rare but to prevent them is wiser. Due to raised epiduralpressure from irrigation pressure. The patient will complain of a headache andneck pain. Transient blindness has also very rarely been noted. Keeping Eptoin and Leverahandy is a safe thing. The patient may become rowdy and disoriented if too much of sedation is given. At such times, withdraw scope and cannula and wait for the patient towake up. Do not take the patient deeperin anesthesia may result in danger to the patient's life, dueto rapid de-saturation and arrest.

d. Intraoperative Monitoring

- Vital Parameters – NIBP, HR, SpO2, RR, ECG, Level of Consciousness (BIS)
- Complaints of any neck pain, headache, uneasiness, nausea, breathlessness, painshould be taken care of.
- Counseling and keep talking to the patient.

- Inform the surgeon as and when required.

e. Post-Operative Orders

- NPO for 2 hours then starts with sips ofwater. Semi-solid food after 3 - 4 hours.
- IM Diclofenac Na 75mg SOS.
- Routine IV antibiotics in the evening.
- Discharge protocol according to thepatient.

The one cardinal rule is that the patient must always be in an arousable state as the safety of neural structures is guaranteed only in an awake patient.

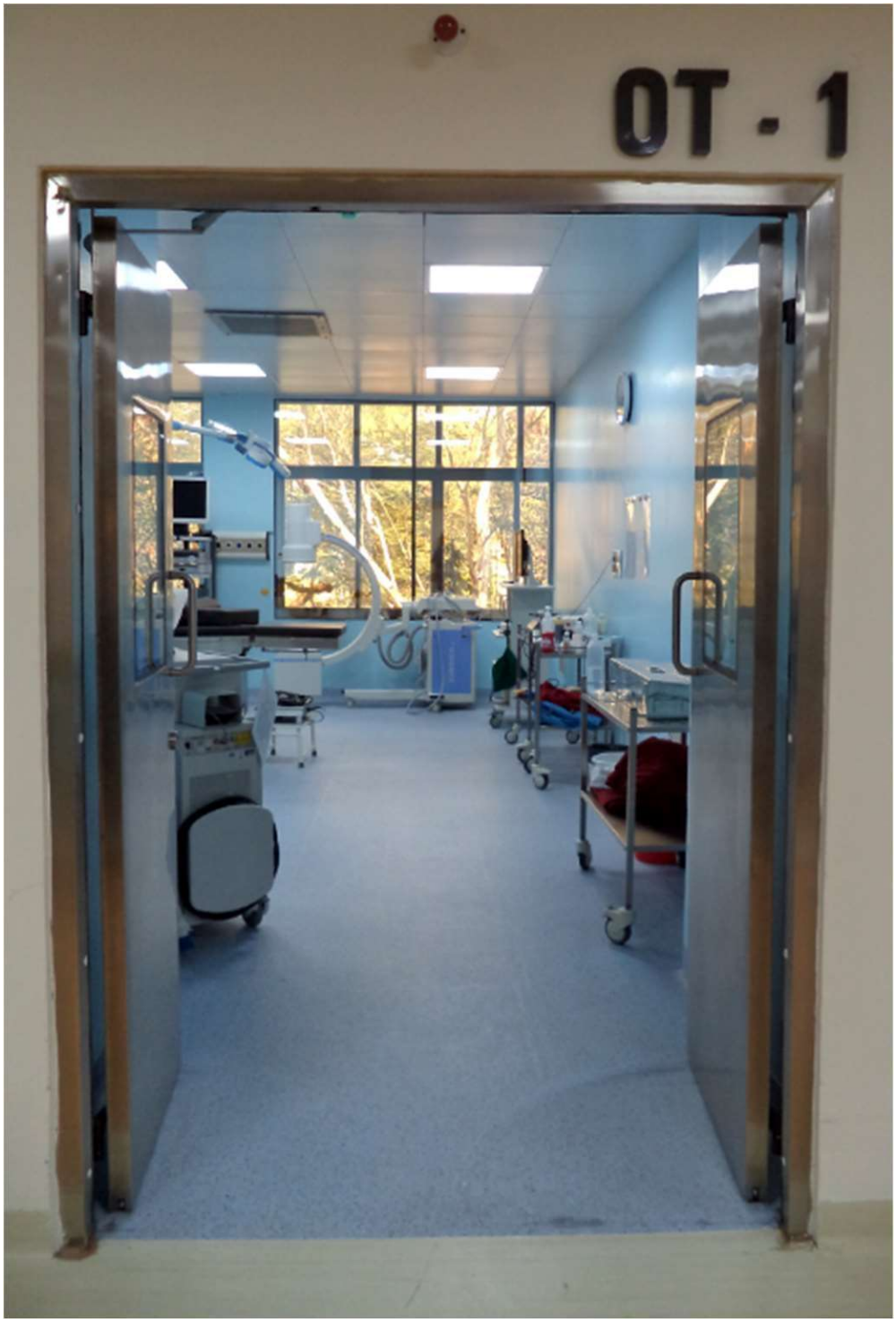
Now we will cover steps in surgical flow and our protocol pictorially and then instruments that we use in our surgery.

4. Preparation for stitchless Spine Surgery under local anesthesia

Operating Room

An Operating Room is assigned for Surgery

Operating Room

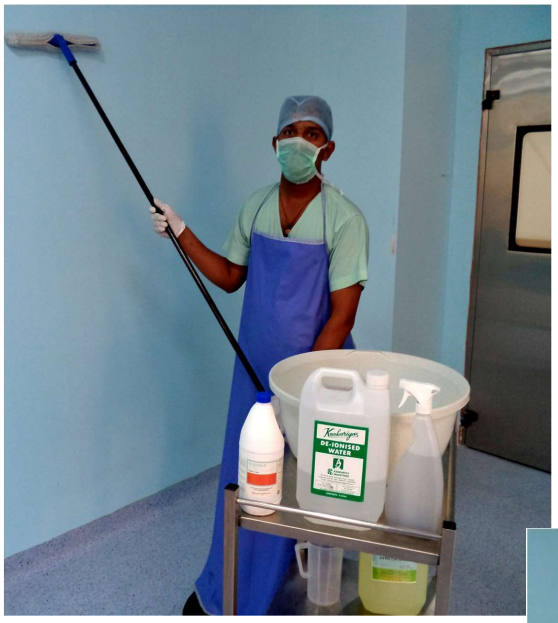


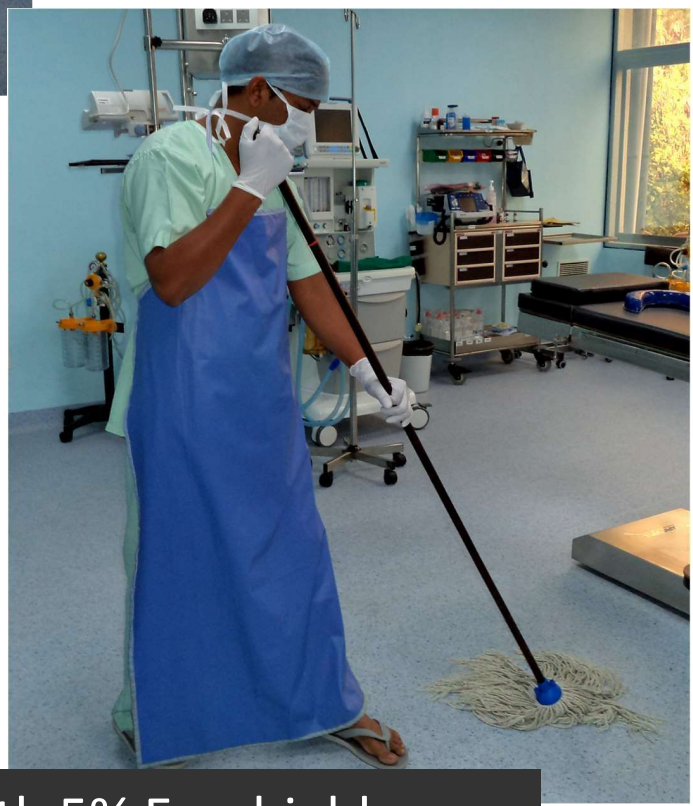
Operating Room

Attire Inside OT

Attire – Sterile Clothes, Cap and mask

Terminal Cleaning of OR





Walls - cleaned with 5% Ecoshield

Floor - cleaned with 1% Sodium Hypochlorite

Equipment Check

All Equipment is checkedto see if working Properly

C-arm

Equipment Check

Laser Machine

Equipment Check

Anesthesia Machine

Equipment Check

Bipolar **Cautery**

Equipment Check

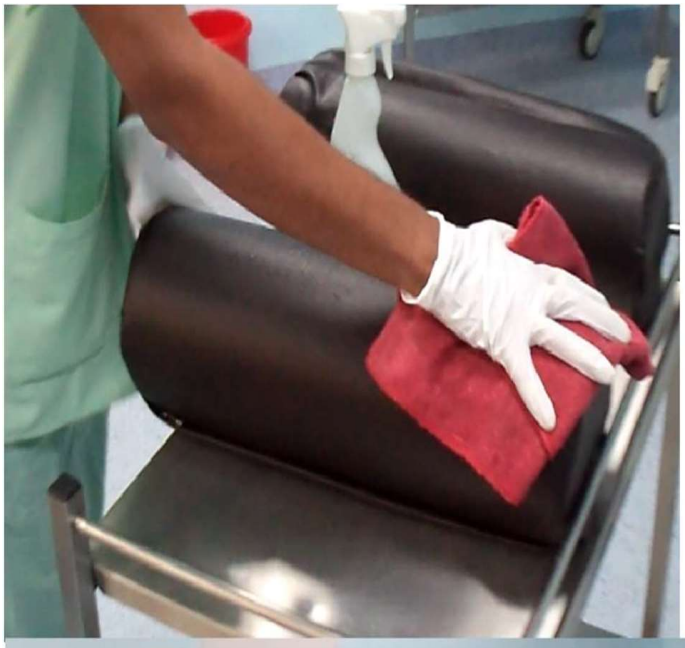
Video Trolley& Camera

Equipment Check

OT Lamp and Table

Terminal Cleaning of Equipment

Equipment - cleaned with 5% Ecoshield



Placement of Sterile Items

Sterile Packages placed in OR

Consumables

Consumables arranged for Before Surgery

LIST OF CONSUMABLES					
Date:					
Surgery Name:- Endoscopic Discectomy					
Surgeon Name: Dr. Satishchandra Gore					
Sr. No.	**Name of Item**	**Quantity**	**Received**	**Used**	**Balance**
1	C-arm cover				
2	Plastic sheet				
3	TUR set with pressure cuff				
4	Syringe 2cc, 10cc				
5	Injection Xylocaine 2%				
6	Urografine				
7	Blade no. 15				
8	Needle 24g				
9	Sterile gloves				
10	Injection Depomedrol 80mg & 40mg				
11	Camera cover				

Receive Patient in OT

Patient is received in to OT

Identity, Site, Procedure is confirmed

Investigations and Consents

Investigations checked

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ANAESTHESIA CONSENT

Procedure Explanation :
Diagnosis :
Surgery proposed :
Preoperative evaluation and examination has been done by Dr.

On date _____ time _____

Patient ASA Grading is: ASA 1 2 3 4 5 E

Patient Comorbidities are:

The Anaesthesia plan is:

In case of any problem with the above alternate plan is:

I have read the anaesthesia information related to my anaesthesi
The Operation Theatre & Surgical Unit is well equipped to handle
threatening event occurs patient may need Intensive Care Unit ma
patient will be shifted to a nearby ICU under our supervision. I hav
previous illness, allergies, drug reactions, surgical procedures and
treatment. I acknowledge that doctor has explained above anaest
after understanding all possible outcomes and risk involved.
If you have any questions please contact:-
I have understood the above.
Signature and Name of Patient/Parent/Guardian/Surrogate :

Date& Time:-

Signature and Name of Witness:

Date & Time: -

NOTE
- The consent form should be signed by the patient himself/herse frame of mind.
- The consent form will be signed by the parent/guardian/surroga patient lacks the ability to make an informed decision.
- Do not sign this form unless you have read and thoroughly unde

Method	:	RBC Morphology	:
Observation	:	WBC Morphology	:
RESULT	:	Platelets	:
Kit Used	:	Parasites	:
		Epithelial Cells	:

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INFORMED CONSENT FOR SURGERIES / INVASIVE PROCEDURE

INSTRUCTION : This consent form should be signed by patient (below 18 years) : by spouse, adult children, parents, adult brothe (in this order of priority), if the patient lacks the ability to make an infi

1. I hereby authorize the performance of the following operat (Hereafter referred to as procedures) : (Use no abbreviatio

Procedure Name

Diagnosis

Patient Name

2. I have been advised of the benefits and the reason for the diagnostics performed. I recognise that in the practice of outcomes. Potential benefits are as follows:

3. I have been adviced of the following existing alternatives done which are listed as follows:

4. I authorize Dr. ---------- and th perform full/any part of the procedures on myself/ the pat team may perform any part of the procedures according above named doctor the experience and capability

5. I have been advised that major risks involved in the above

6. As with any procedure, I am aware that risks such as allerg bleeding or any other complication, paralysis, etc. ma consenting to the performance of the particular proced and/or other unforeseeable event which may occur.

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MR No : IP No.
Name :

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DOCTOR GORE CONSENT

MR No :
Name :
Age/Sex
Comfort
Admissio

DR Satishchandra Gore Spine endosco

Dr. Satishchandra Gore or his associate has explained to me th back and leg pain in detail after clinically examining me and imaging analysis. I am aware that my leg pain is due to disc herniation at

.Presenting as sciatica on right/left side in my leg.

I am told about all treatment alternatives including NO surgery, or open surgery under general anesthesia. It can also be treated by oral medication and physical therapy etc. which I have tried for sufficient length of time and have not been able to relieve my pain. In view of the severity of my pain I have agreed to transforaminal endoscopy solution for my disc herniation.

I have been told that in spite of best efforts of the doctors there is 1% possibility of infection at site of surgery, about 0.5% chance of dysaesthesia due to use of laser. It is also told that my leg pain is primary target of my treatment and back pain may continue for little longer time. It may take 6-12-24 weeks for total relief. I am also aware that my Diabetes/hypertension/associated medical problems may delay my recovery. I am also aware that recovery of my function is dependent on my physical fitness and I will need exercises and some medication to recover fully and back to work.

After considering the above and severity and duration of my complaints I am giving my full and unconditional consent to Dr. Gore and his team to treat me with spine endoscopy technique under local anesthesia. I have therefore signed below and dated it just before my surgery.

Sign of patient undergoing surgery

Sign of relative

Sign of doctor explaining above

OM LABORATORY
INSTITUTE OF PATHOLOGY & MICROBIOLOGY

Reg No. : 0000315 / IPD
Name : Mrs Sathe Leena
Ref. by : Prime Surgical Centre

TEST		
Blood Sugar (Random)		
Blood Sugar Random	:	
Instrumet Used	:	
Blood Urea		
SERUM ELECTROLYTES		
Serum Sodium	:	
Serum Potassium	:	
Serum Chlorides	:	
Instrument Used	:	
Plasma Prothrombin Times		
Method	:	
Test	:	
Control	:	
ISI value of kit	:	
INR	:	
Bleeding Time	:	
Method	:	
Clotting Time	:	
Method.	:	
Hepatitis B surface antigen (AuAg) Rapid		
Method	:	
Observation	:	
RESULT	:	
HIV I & HIV II		
Method	:	
Observation	:	
RESULT	:	
Kit Used	:	

OM LABORATORY

Reg No. : 0000315 / IPD
Name : Mrs Sathe Leena
Ref. by : Prime Surgical Centre

TEST		
HAEMOGRAM ON CELL COUNTER		
Haemoglobin	:	
R.B.C. count	:	
PCV	:	
MCV	:	
MCH	:	
MCHC	:	
RDW	:	
WBC Count		
Total WBC count	:	
Differential count		
Neutrophil	:	
Lymphocytes	:	
Eosinophils	:	
Monocytes	:	
Basophils	:	
Platelet Count	:	
Peripheral Smear Examination		
RBC Morphology	:	
WBC Morphology	:	
Platelets	:	
Parasites	:	

OM LABORATORY
INSTITUTE OF PATHOLOGY & MICROBIOLOGY

Reg No. : 0000315 / IPD Age : 43 Years
Name : Mrs Sathe Leena
Ref. by : Prime Surgical Centre

Sex : Female
Reg. Date : 02-01-2015
Report Date : 02/01/2015

CLINICAL PATHOLOGY

TEST	RESULT	UNIT	REFERENCE RANGE
URINE ANALYSIS REPORT			
Physical Examination			
Quantity	: 20 Ml		
Colour	: Pale Yellow		
Appearence	: Slightly Turbid		
Deposits	: Absent		
Chemical Examination			
Reaction (pH)	: 6.5 Acidic		4.8-7.6
Proteins	: Absent		
Glucose	: Absent		
Ketone Bodies	: Absent		
Bile Pigments	: Absent		
Urobilinogen	: Normal		
Microscopic Examination			
PUS(WBC) Cells	: Occasional	/hpf	
RBC	: Absent	/hpf	
Casts	: Absent		
Crystals	: Absent		
Epithelial Cells	: Occasional	/hpf	

Receive patient in OR

Patient moved to OR with Anesthesiologist's Approval

Intra-Operative Checklist

Intra-Operative Checklist is completed Time out is announced

TIME OUT to identify team members for the surgery.

INTRA-OP CHECK LIST

Sr. No.	Description	Operationg Room No. 1	2	3	4
1	Confirm all team members have introduced themselves by name & Role		☐		
2	Patient has confirmed ☐ Identity ☐ Site ☐ Procedure ☐ Consent		☐		
3	Site Marked / Not Applicable		☐		
4	Anaesthesia safety check completed		☐		
5	Essential imaging displayed X-Ray, CT, MRI, and USG.		☐		
6	Surgeon, Anaethesiologist & Nurse verbally Confirm Patient Procedure Site ☐ Consent ☐		☐		
7	All Equipment Working		☐		
8	Assistant (If needed)		☐		
9	Skin Preparation		☐		
10	Verify that instrument, needle, swabs* counts are correct Before Surgery ☐ After Surgery ☐		☐		
11	Sterilization indicator have been confirmed		☐		
12	Special Equipment (If needed) Any other		☐		

* ONLY APPLICABLE FOR OPEN CASES

Position Patient on Operating Table

Patient Lies on Two Bolsters on Operating Table

Safety Straps are placed

Position Patient on Operating Table

C-arm lined over Center of Affected Area

Marking of Operative Site

Metallic Marker & Pen is Used

Mid-line is marked under C-arm

Marking of Operative Site

Disc Space is marked

Marking of Operative Site

Marker is put in Lateral

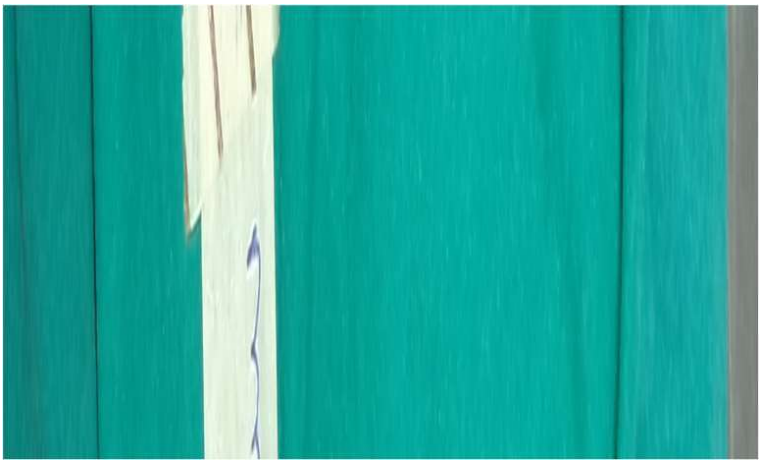
Depth of disc is measured

Marking of Operative Site

Point of Entry of Needle is Marked with a Cross

Opening Sterile Package

Sterile Packages are Opened Carefully



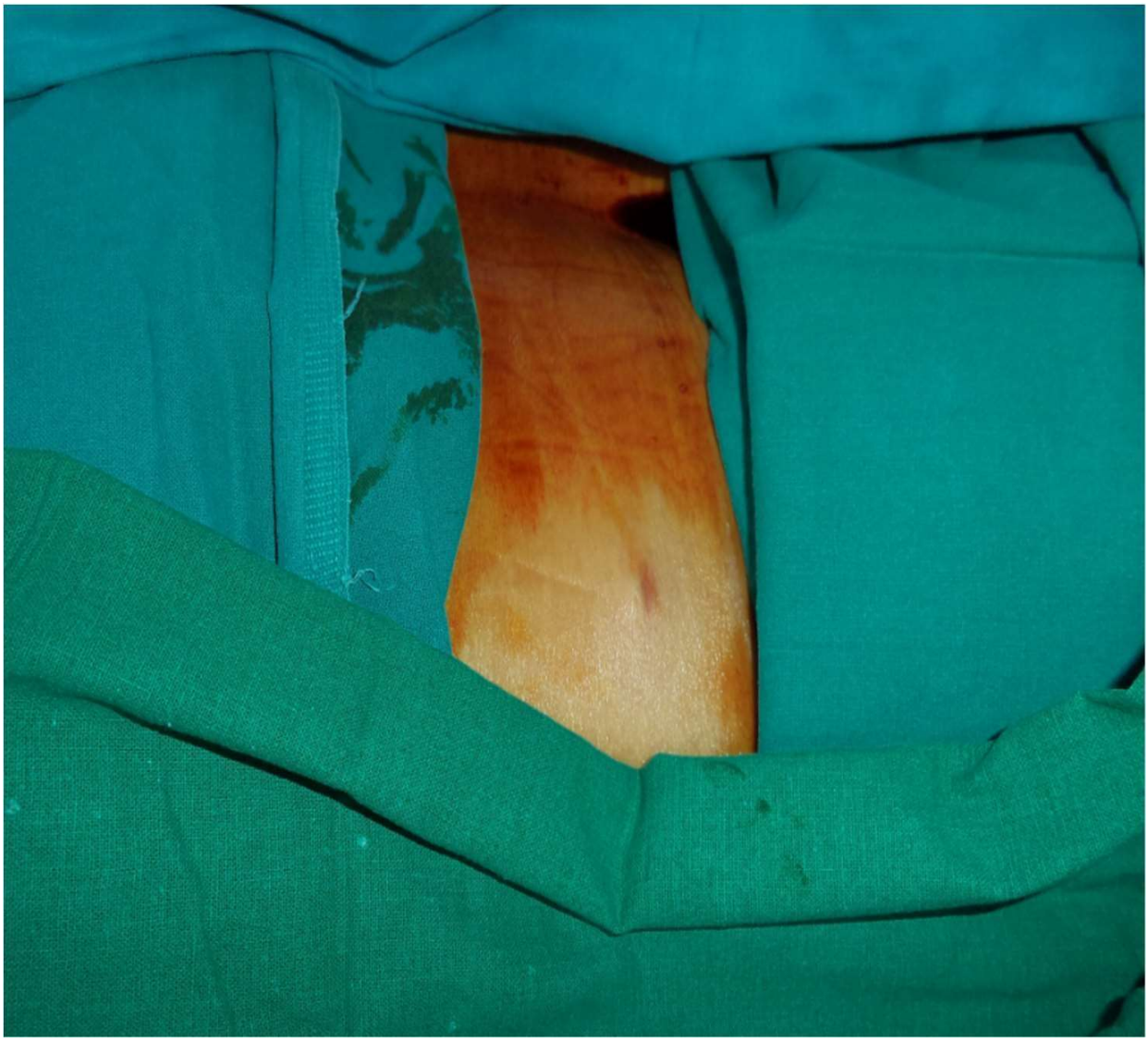
Skin Preparation

Skin Cleaned and Painted with Betadine, starting at Incision point

Prepared area is Dried

Draping of Patient

Patient is draped



Assist Surgeon in Gowning

Fasten the Gown at Neck and Waist

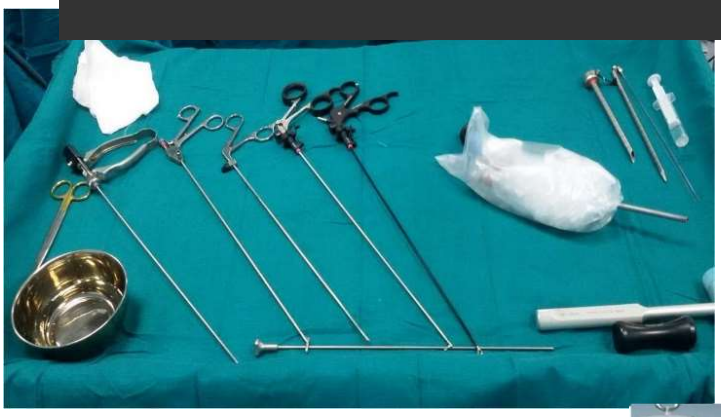
Gown is overlapped at the Back to Cover Clothing Completely

Assist Surgeon in Gloving

Gown Cuffs are Tucked Under Glove

Position Equipment & Instrument

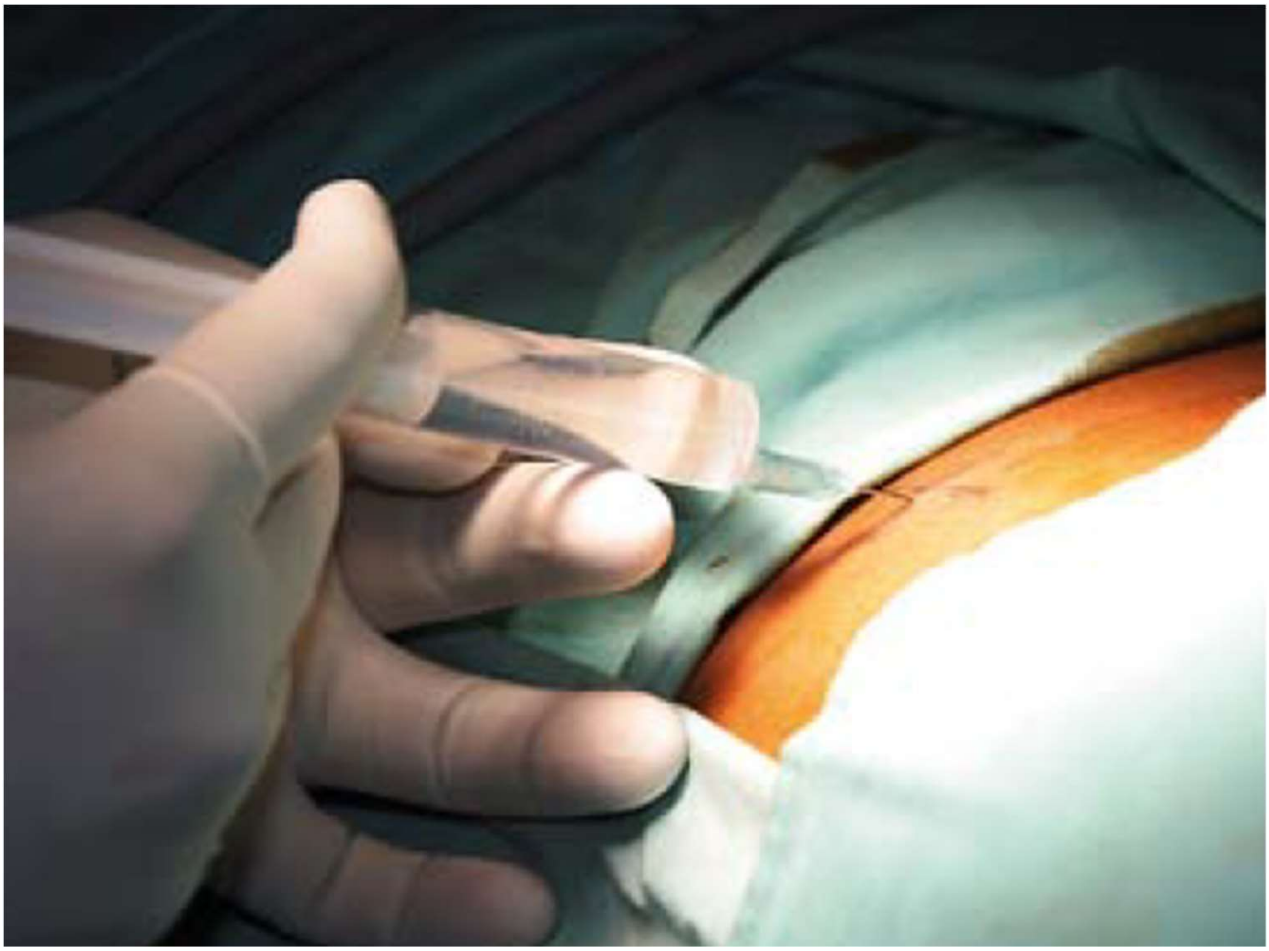
Instrument Tray is Arranged



Scrub Nurse to hand over Instruments to Surgeon during surgery

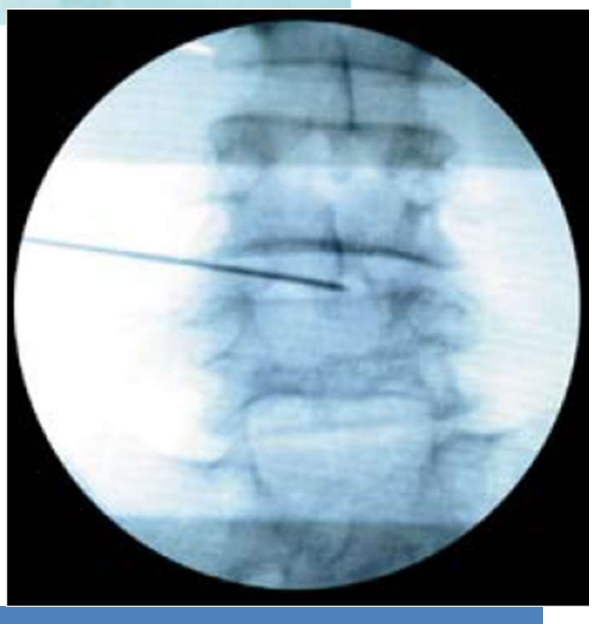
Local Anesthesia

Local Anesthetic 2% is Injected



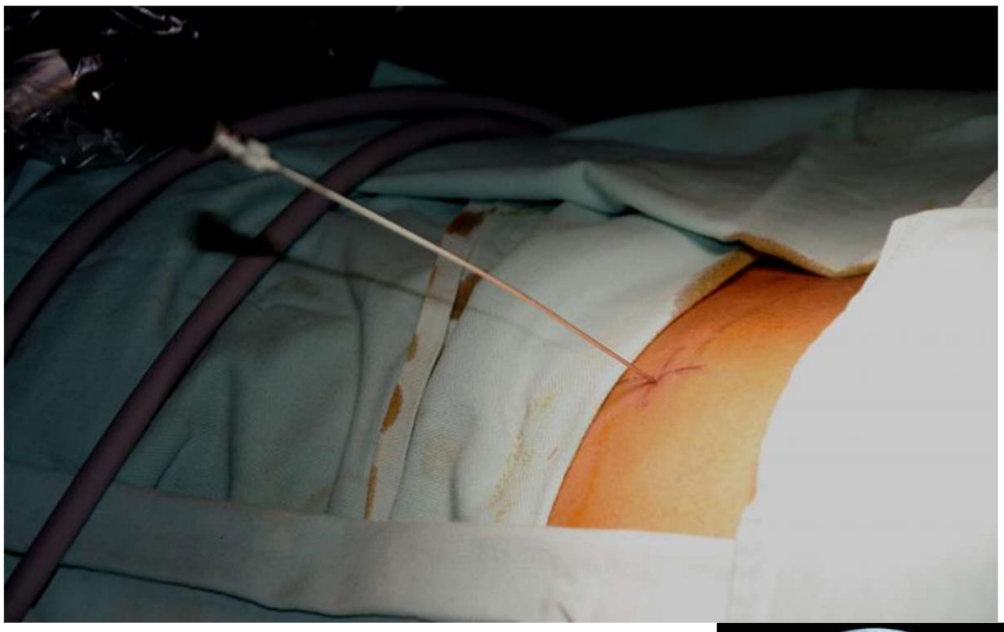
Confirm Path of Instruments

Position of Marker is checked under C-armto
Confirm Projected Path of Instruments



Insertion of Needle

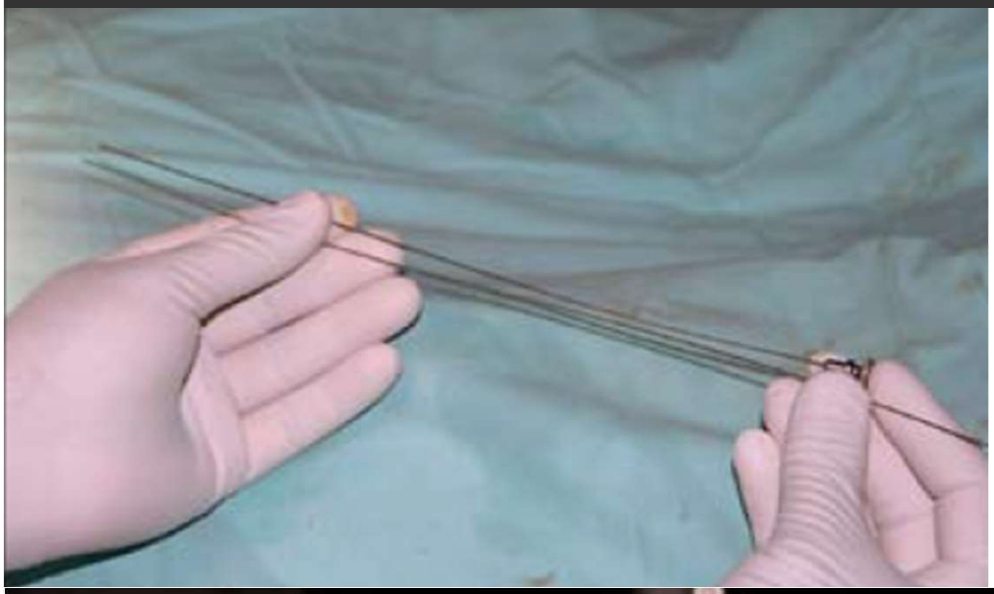
Entry done by a 18 G Needle

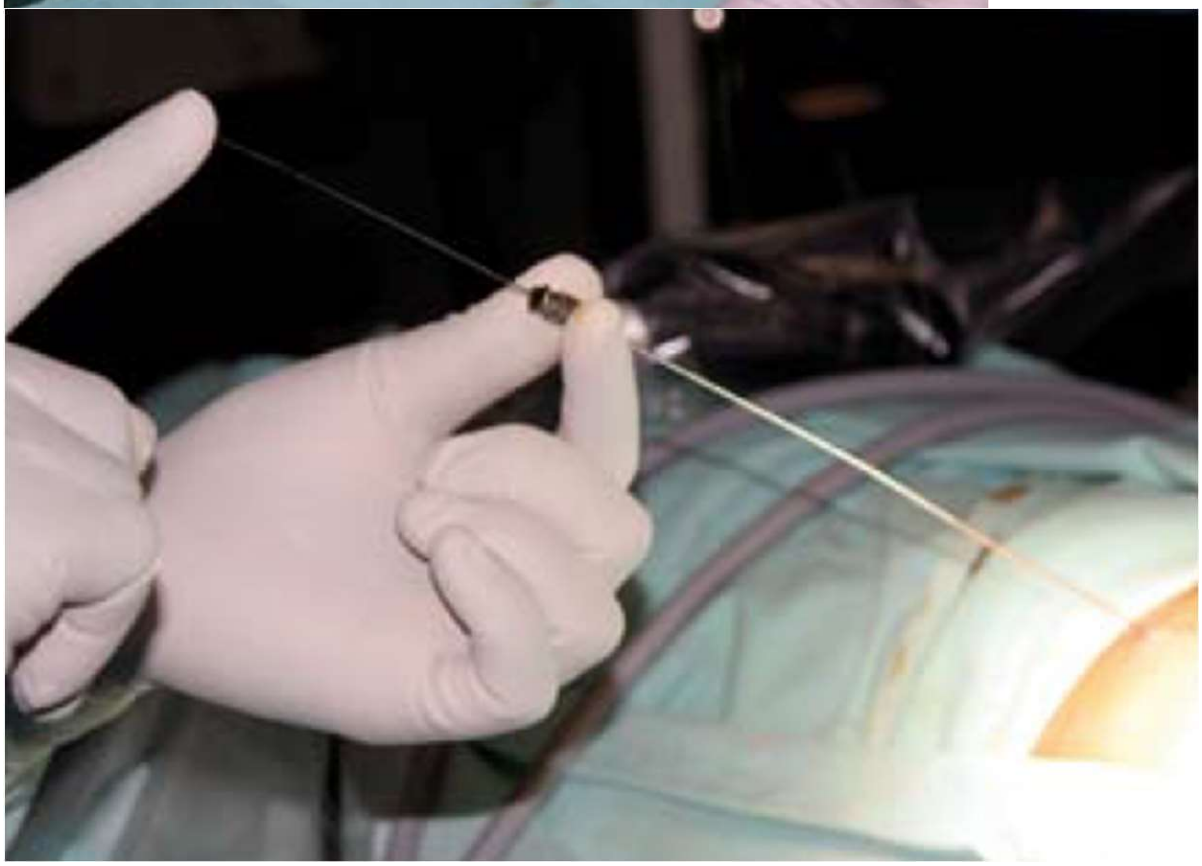


NEEDLE INSERTION IS KEY TO ALL SURGERYIT MUST BE EXACT AND PRECISE

Insertion of Guide Wire

Guide Wire is measured against the Stylet





Stylet in Needle is replaced by Guide Wire

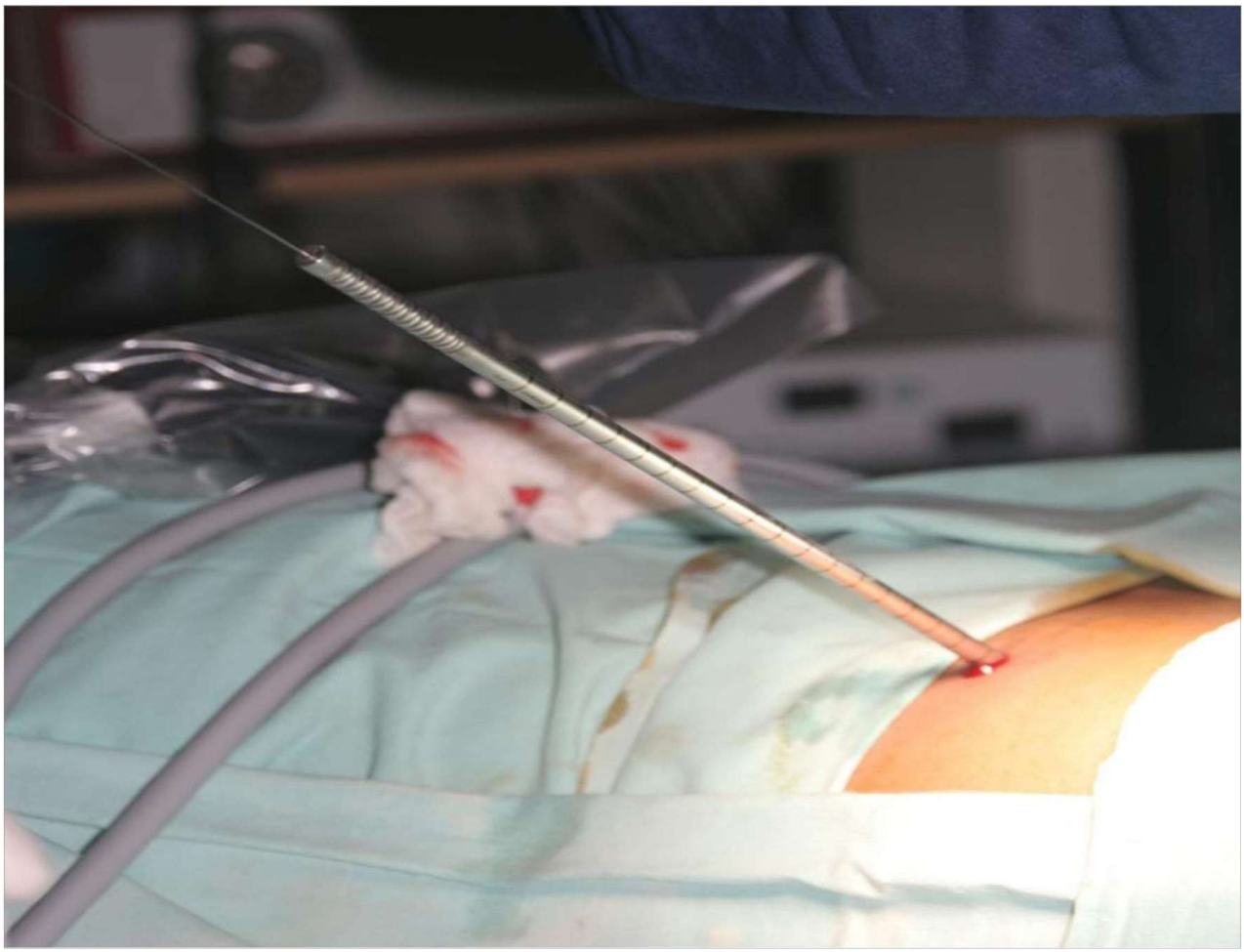
Insertion of Guide Wire

Guide Wire is Seen Inside the Disc

Guide Wire will Guide ALL the Activities in the Disc NOW ON

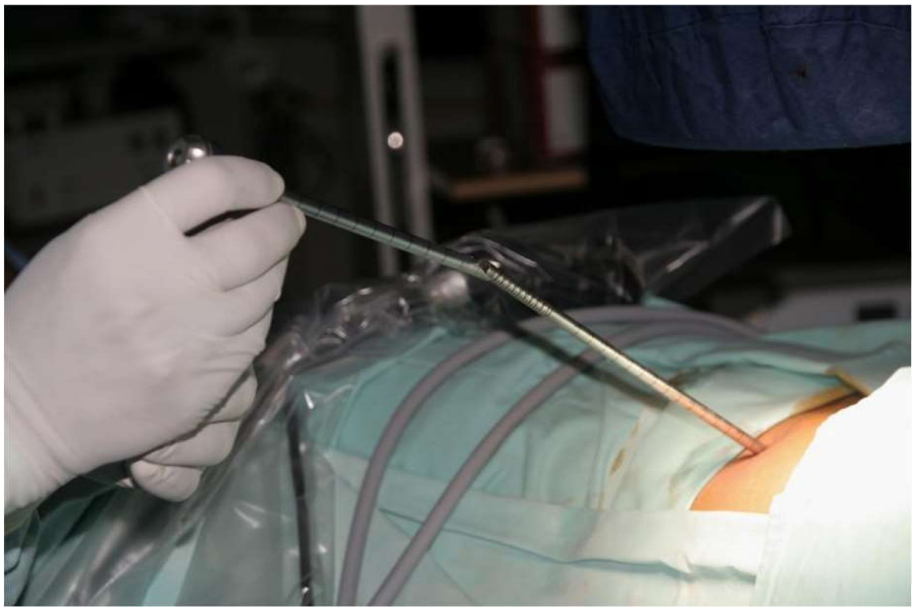
Skin cut by Number 15 Blade and Insertion of Dilator

Skin cut by Number 15 Blade and Dilator
is introduced OVER the Guide Wire

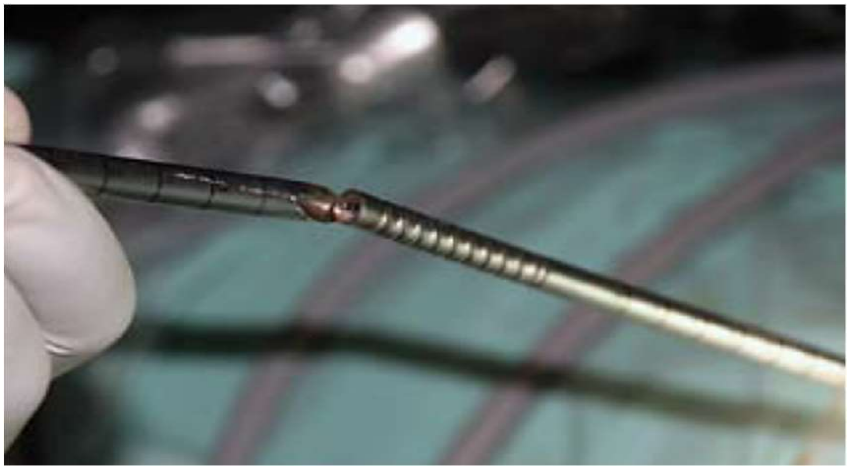


Insertion of Cannula

Cannula is pushed with Small Rotating Movements Over the Dilator



Cannula is the Gateway to the Disc



Insertion of Scope

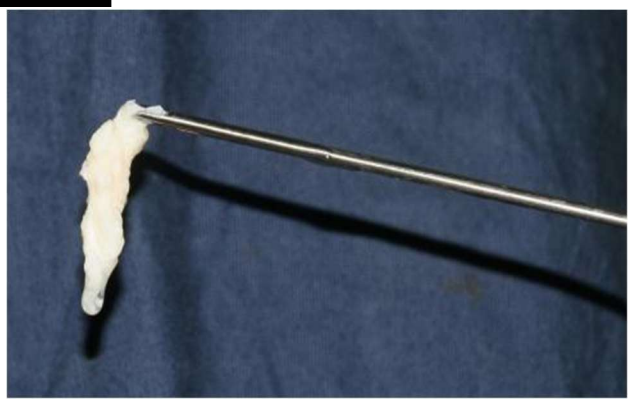
Scope is put inside the Cannula

Now we use BAG to Hold Fluid

Tray is put under table to Prevent
Wetting of floor during surgery

Removal of Fragment

The White Cotton like Fragment is Removed with a Grasper

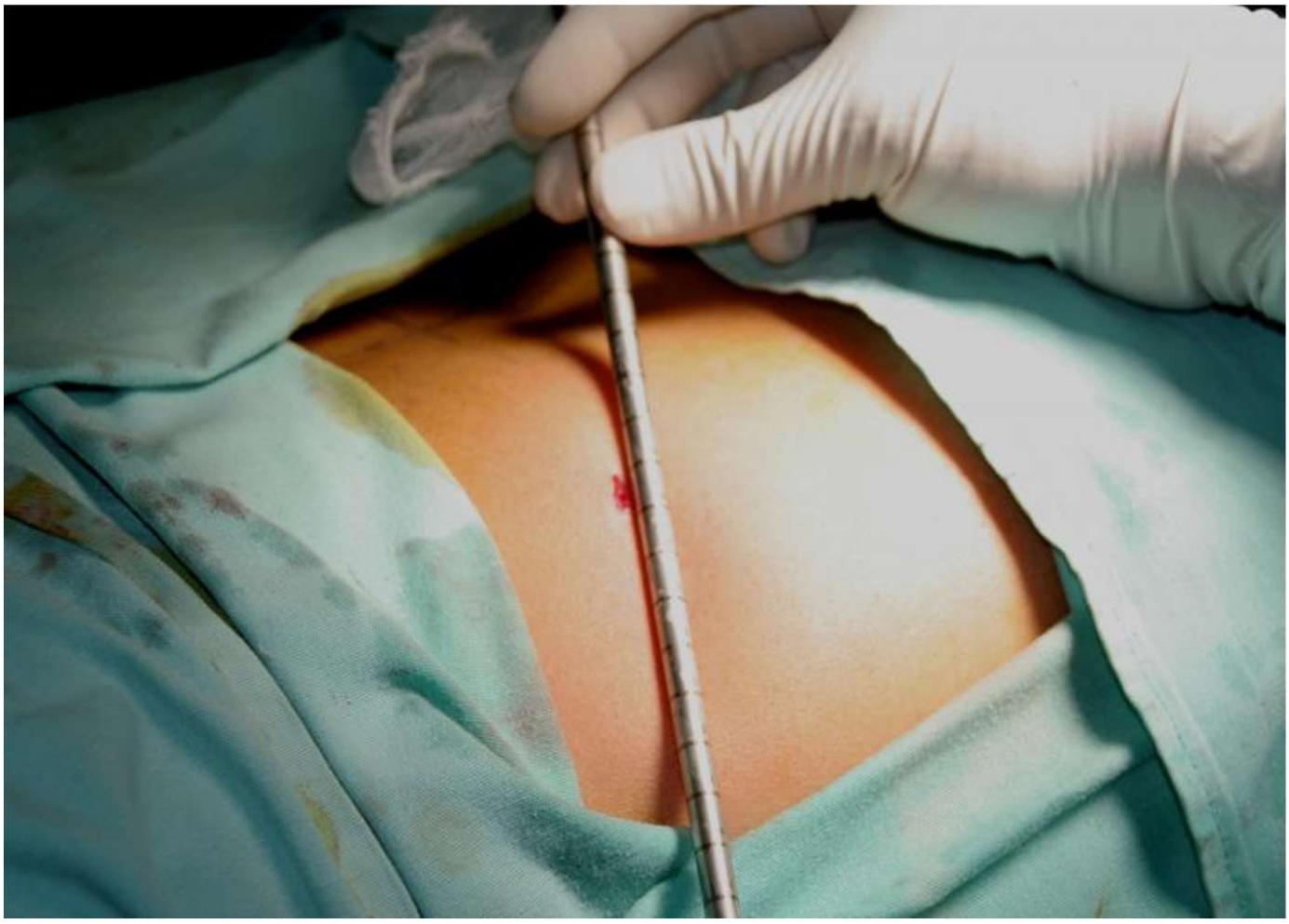


Skin Incision

The Skin Incision is just 8 mm.

It is stitch-less

True Minimal Invasion with No Cutting, No Bleeding.



Taping of Skin

Post-Operative Dressing is done

Intra-Operative Record

An Intra-Operative Recordis maintained to document Patient Care

INTRA-OPERATIVE RECORD

Age/Sex :

Comfort / Deluxe Bed No :

Admission Date :

Date	OR Room	Pt. Identified	Time in	Proc.Start	Proc.End	Time Out	Wound Class
		☐ Verbal ☐ ID BAND ☐ Parent ☐ Guardian					

Procedure / Side Verified : ☐ Right ☐ Left ☐ Bilateral ☐ Consents ☐ Surgeon ☐ Circulating ☐ Scrub ☐ Anaesthesiologist

☐ **Allergies :-**

Anaesthesiologist Name :-

Anaesthesia ☐ General ☐ MAC ☐ Local ☐ SAB ☐ Spinal ☐ Reg. Block ☐ EA

Surgeon Name :- **Assistant Name :-**

Scrub Name :- **Circulating Name :-**

Pre-op Diagnosis :-

Operative Procedure :-

Patient Position : ☐ Supine ☐ Prone ☐ Lateral ☐ L ☐ R ☐ Padded arm board ☐ L ☐ R ☐ Arm at Side ☐ L ☐ R ☐ Safety Strap ☐ Beach Chair ☐ Other

Skin Preparation : ☐ Betadine ☐ Dura prep ☐ Alcohol ☐ Other

Thermia Measures : ☐ Bair Hugger ☐ Warm Blanket ☐ Other

Cautery : ☐ Monopolar ☐ Bipolar Unit ☐ Coag ☐ Cut ☐ Blend ☐ Pad Placement

Tourniquet :- ☐ RA ☐ LA ☐ RL ☐ LL Applied By :-
Inflated Time :- Deflated Time :-
Total Time :-

Irrigation :- ☐ Normal Saline ☐ Lactated Ringer ☐ Antibiotic Added

COUNT BY : ☐ Scrub ☐ Circulating

Swab Count :-	☐ Correct	☐ Incorrect	**Drain - Type :-**	
Needle Count :-	☐ Correct	☐ Incorrect	**Site :-**	
Instruments Count :-	☐ Correct	☐ Incorrect	**Packing - Type :-**	
Types of dressing :-	☐ Staples	☐ Suture	**Site :-**	

Specimens :- Histopathology :- _____
Culture :- _____
Any Other :- _____

Nurse's Note : _____

Intra-op Total intake : **Intra-op total Output :-**

Transferred with :-

Name & Signature of Circulating Nurse, Date & Time :-

Counter Signature of Surgeon, Name, Date & Time :-

Operation Notes completed by Surgeon

Operation Notes

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OPERATION NOTES

MR No :	IP No.
Name :	
Age/Sex :	
Comfort / Deluxe Bed No :	
Admission Date :	

Date of Operation	Time Started	Time Completed	Duration in Hour	OR NO 1 / 2 / 3 / 4

Pre Operative Diagnosis :

Post Operative Diagnosis :

Type of Operative Wound	Clean	Clean Contaminated	Contaminated	Dirty
	☐	☐	☐	☐

General Anaesthesia	Spinal Anaesthesia	Epidural Anaesthesia	Monitored Anaesthesia	Anaesthesia / Local
☐	☐	☐	☐	☐

Surgeon	Assistant	Anaesthesiologist	Scrub Nurse	Technicians

Counts :- ☐ Correct ☐ Incorrect

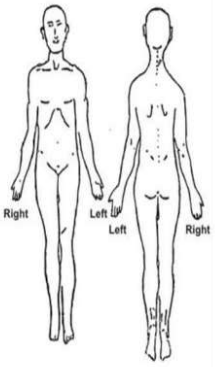
Emergency ☐ Yes ☐ No Specimen Sent to Pathology : ☐ Yes ☐ No

Name of the procedure(Indicate side of operation):-

Incision :

Findings :

PROCEDURE/OPERATION NOTES



CLOSURE :

DRAINAGE :

ESTIMATED BLOOD LOSS :

URINE OUTPUT :

NATURE OF SPECIMEN SENT :

POST OPERATIVE CONDITION :

POST OPERATIVE ORDERS :

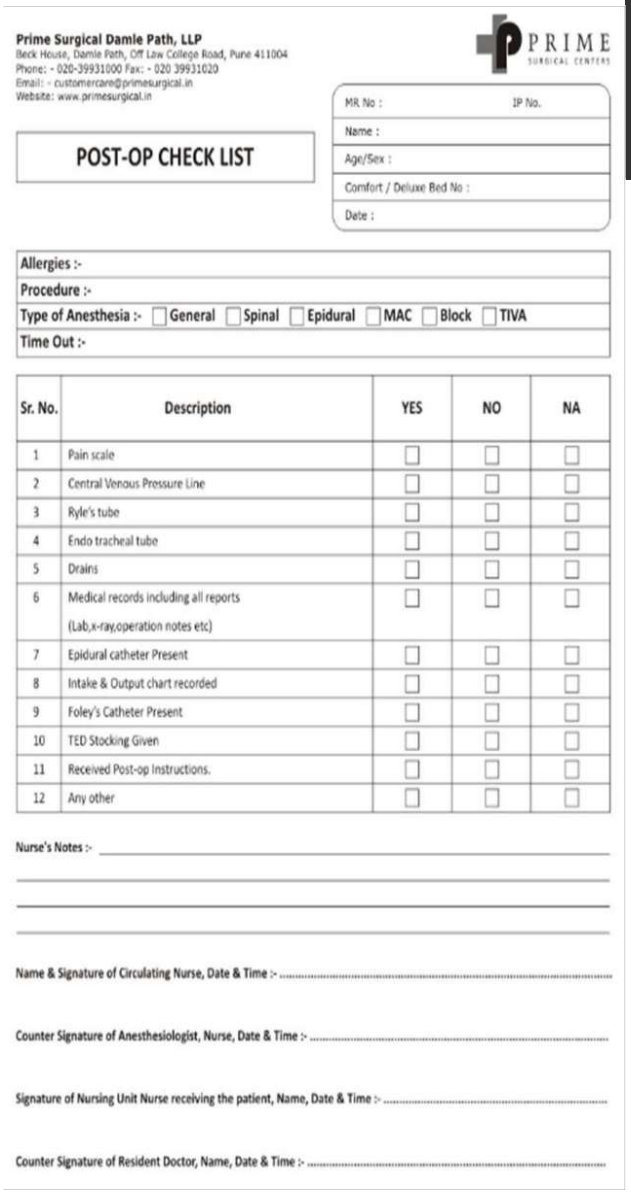
Signature of the surgeon Date & Time:-	Signature of the Scrub Nurse Date & Time:-
Name of the surgeon Date & Time:-	Name of the Scrub Nurse Date & Time:-

Transfer to Recovery Room

Patient is Transferred to Recovery room with Anesthesiologist consent

Handover to Ward Nurse

We hand over patient with post-operative check list and orders.
We also have a post-operative consent for the patient relevant to procedure done.



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PRIME SURGICAL CENTERS

POST-OP CHECK LIST

MR No :	IP No.
Name :	
Age/Sex :	
Comfort / Deluxe Bed No :	
Date :	

Allergies :-
Procedure :-
Type of Anesthesia :- ☐ General ☐ Spinal ☐ Epidural ☐ MAC ☐ Block ☐ TIVA
Time Out :-

Sr. No.	Description	YES	NO	NA
1	Pain scale	☐	☐	☐
2	Central Venous Pressure Line	☐	☐	☐
3	Ryle's tube	☐	☐	☐
4	Endo tracheal tube	☐	☐	☐
5	Drains	☐	☐	☐
6	Medical records including all reports (Lab,x-ray,operation notes etc)	☐	☐	☐
7	Epidural catheter Present	☐	☐	☐
8	Intake & Output chart recorded	☐	☐	☐
9	Foley's Catheter Present	☐	☐	☐
10	TED Stocking Given	☐	☐	☐
11	Received Post-op Instructions.	☐	☐	☐
12	Any other	☐	☐	☐

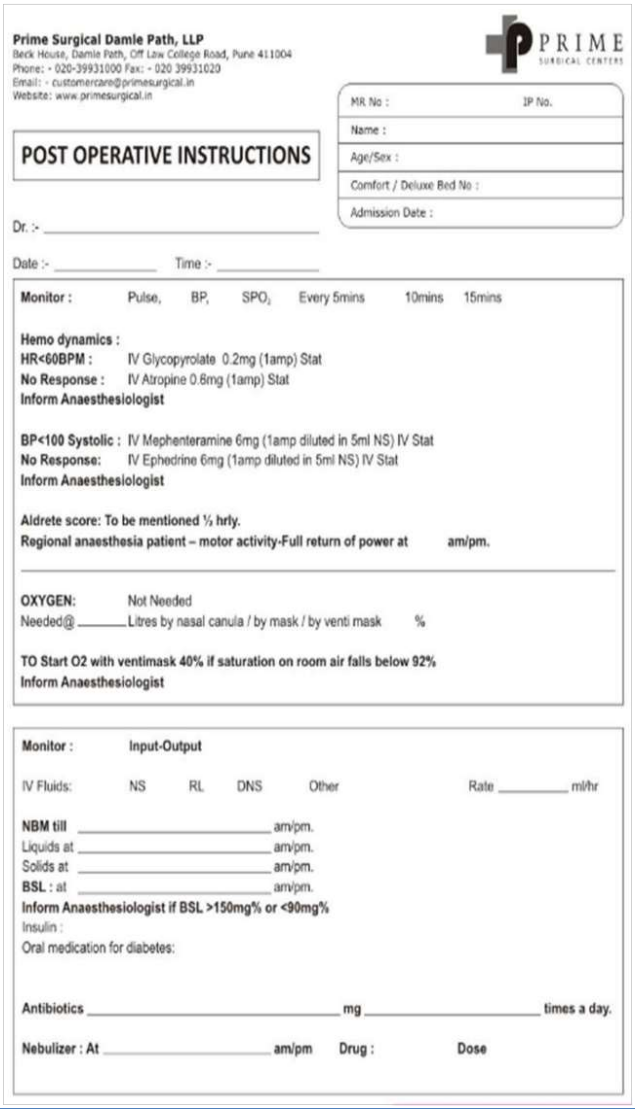
Nurse's Notes :- _____

Name & Signature of Circulating Nurse, Date & Time :- .....

Counter Signature of Anesthesiologist, Nurse, Date & Time :- .....

Signature of Nursing Unit Nurse receiving the patient, Name, Date & Time :- .....

Counter Signature of Resident Doctor, Name, Date & Time :- .....



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PRIME SURGICAL CENTERS

POST OPERATIVE INSTRUCTIONS

MR No :	IP No.
Name :	
Age/Sex :	
Comfort / Deluxe Bed No :	
Admission Date :	

Dr. :- _____

Date :- _____ Time :- _____

Monitor : Pulse, BP, SPO$_2$ Every 5mins 10mins 15mins

Hemo dynamics :
HR<60BPM : IV Glycopyrolate 0.2mg (1amp) Stat
No Response : IV Atropine 0.6mg (1amp) Stat
Inform Anaesthesiologist

BP<100 Systolic : IV Mephenteramine 6mg (1amp diluted in 5ml NS) IV Stat
No Response: IV Ephedrine 6mg (1amp diluted in 5ml NS) IV Stat
Inform Anaesthesiologist

Aldrete score: To be mentioned ½ hrly.
Regional anaesthesia patient – motor activity-Full return of power at am/pm.

OXYGEN: Not Needed
Needed@ _____ Litres by nasal canula / by mask / by venti mask %

TO Start O2 with ventimask 40% if saturation on room air falls below 92%
Inform Anaesthesiologist

Monitor : **Input-Output**

IV Fluids: NS RL DNS Other Rate _____ ml/hr

NBM till _____ am/pm.
Liquids at _____ am/pm.
Solids at _____ am/pm.
BSL : at _____ am/pm.
Inform Anaesthesiologist if BSL >150mg% or <90mg%
Insulin :
Oral medication for diabetes:

Antibiotics _____ **mg** _____ **times a day.**

Nebulizer : At _____ **am/pm** **Drug :** **Dose**

Decontamination / Sterilization

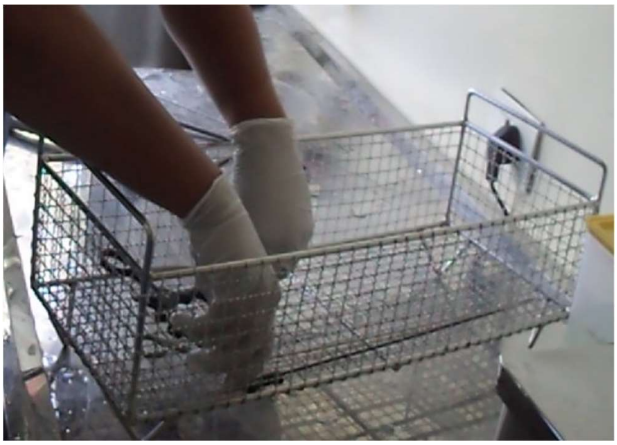
Instruments are Primarily Cleaned Under Running Water

Decontamination / Sterilization

Instruments with Removable Parts are Disassembled

Decontamination / Sterilization

Instruments are Cleaned with Brush under Running Water and Drained



Decontamination / Sterilization

Instruments are submerged in Warm Water
Cleaned with ultrasound machine

Decontamination / Sterilization

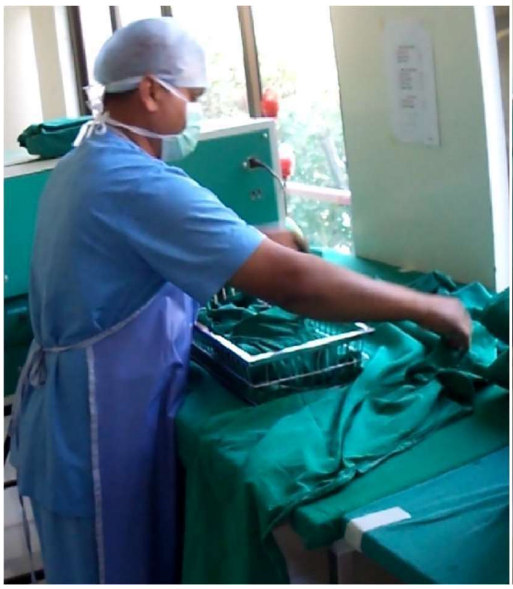
Instruments are dried in Dryer

Sterilization

Instruments are Inspected for Cleanliness and Freedom from Defects

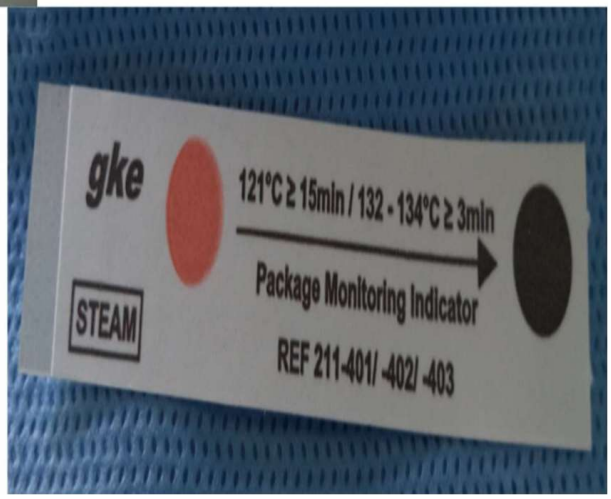
Sterilization

Instruments are assembled in Tray and Double Packed



Sterilization

Instruments are
Autoclaved



Before Sterilization Indicator is RED

Sterilization

Sterile Packs Received in Sterile Room

After Sterilization Indicator turns BLACK

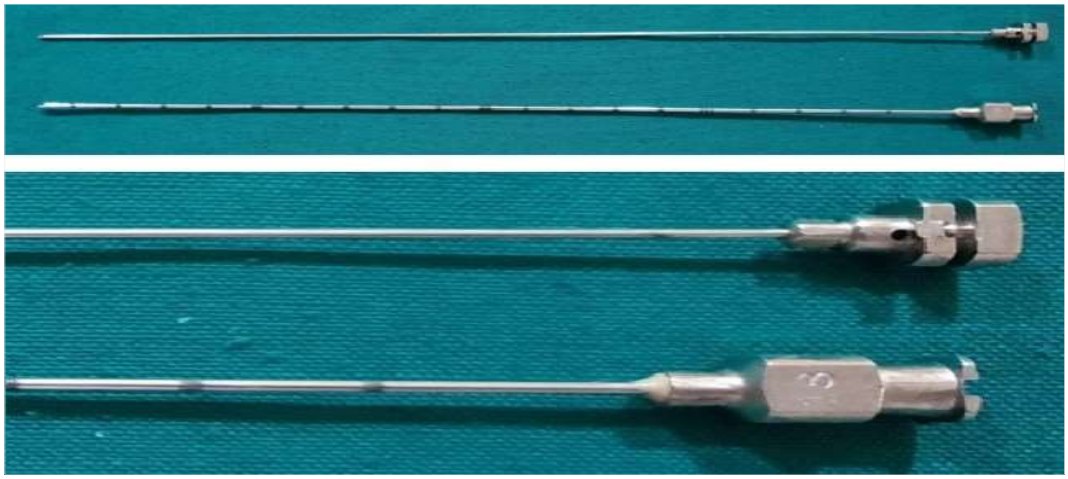
WASTE MANAGEMENT

TYPE OF WASTE	COLOR CODED BAG
Domestic Waste	**Black** Bag
Infectious Waste	**Yellow** bag labeled with the **Universal Biohazard sign**
Sharps (needles, ampoules, etc.)	**Red Sharp Box** with the **Universal Biohazard sign**
Needles, Contaminated Sharps with Cytotoxic Agents	**Red** leak-proof sharp container with **Cytotoxic Hazard** label
Pathological Waste	**Yellow** bag
Contaminated Solid Metal	**Yellow Sharp Box** with the **Universal Biohazard sign**
Instrument	
Contaminated IV/Blood Bags, Plastic Tubing, Catheter, Urine Bag, Rubber Wastes, etc.	**Red** bag
Used Vials	**White** bag

5. INSTRUMENTS:

1 THE NEEDLE

The needle is basic access instrument. Everything follows the needle. Exact precise placement of needle is essential for a successful transforaminal endoscopy.



Dimension:

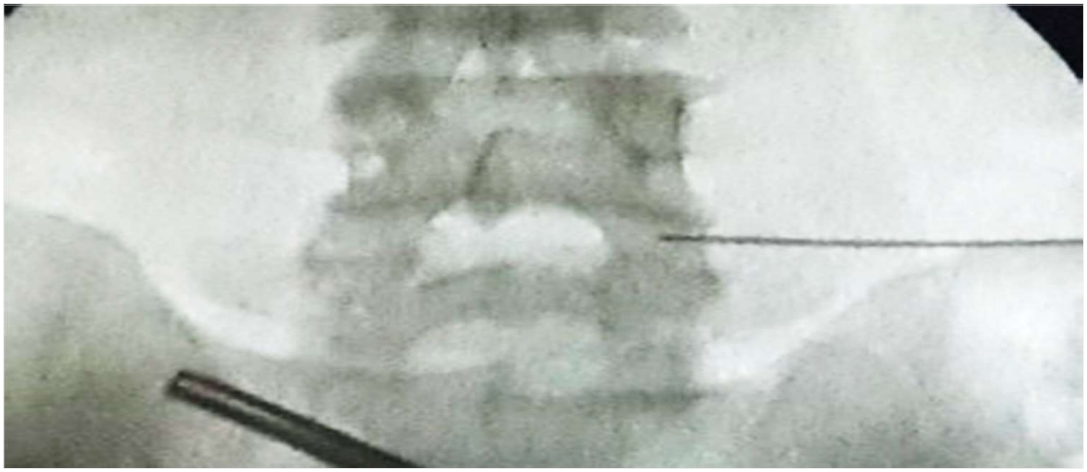
18 G x 25 cms18 G x 30 cms diameter 1.2

mm

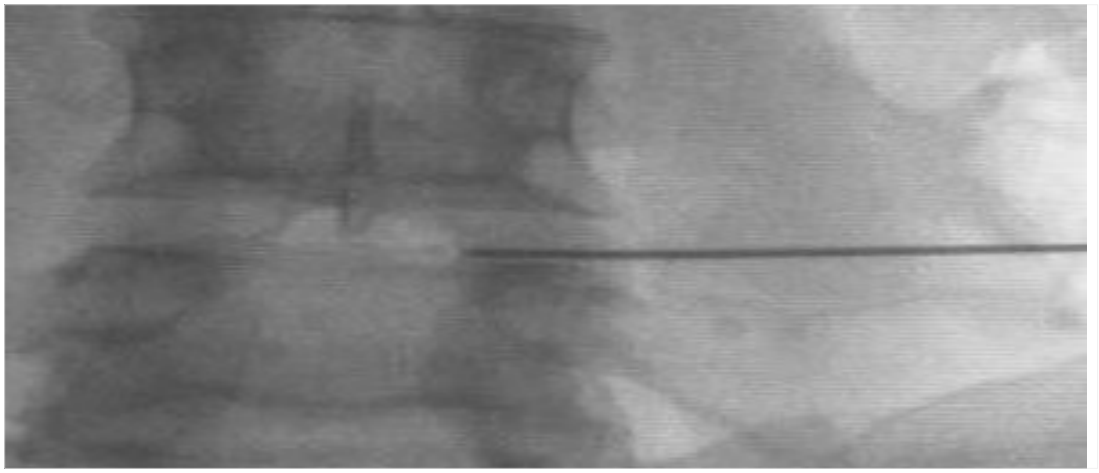
The needle has a leur lock and has 1 cm graduation marking on its length. The lock and number in the leur always facesthe Bevel edge. As the bevel edge cuts the tissues, the needle deviates towards tip of needle or away from open side of bevel. We can guide it deeper/ ventrally, shallower/dorsally, cranially/ caudally depending on how we use bevel. To know where the bevel is it is very easy, for all the surgeon has to do is to look at the leur lock and to see where the notch is in the locks. Bevel of the needle decides in what direction it will travel. When bevel is up towards ceiling it goes down. If it covers 10 cm distance it will go down by 1 com. So in short if you aim at nose tip from a distance of 10 cms it will touch upper lip border.

Let bevel be your friend. Not a foe. Do not fight with bevel. The needle is 25 cm long and has graduated markings of 1 cm along it's length and triple marks at every 5 cms along with a stopper. Set the green plastic stopper at 7 cms at the first step. In the standard Indian patient, start at distance of 11.5 cm from the midline, this is derived from our marking we have seen before. Insert needle and take check X-rays, it is important not to accidentally go anterior and injure the lumbar plexus hence, series of anterior posterior x-rays with the C-Arm is of vital importance. Posterior is facet or bone so is safe. Look for: in AP - Direction and in Lateral – Depth of needle tip. Below are a series of C-Arm images to show how we navigate the facet and reach the post-lat corner of the spinal disc. See the markings on needle and correlate. At 9 cms, the needle will be outside the foraminal near the lateral pedicular line and may be hitting the facet if shallow.

At 9.5 cms, you should be at middle pedicular line and just in the facetal window which means you are within the foramen.



At 10 cm of needle inside, we are at the medial pedicular line that means you are at the edge of the dural sac. Itis at this point that in the lateral view you must be touching the posterior annulus.

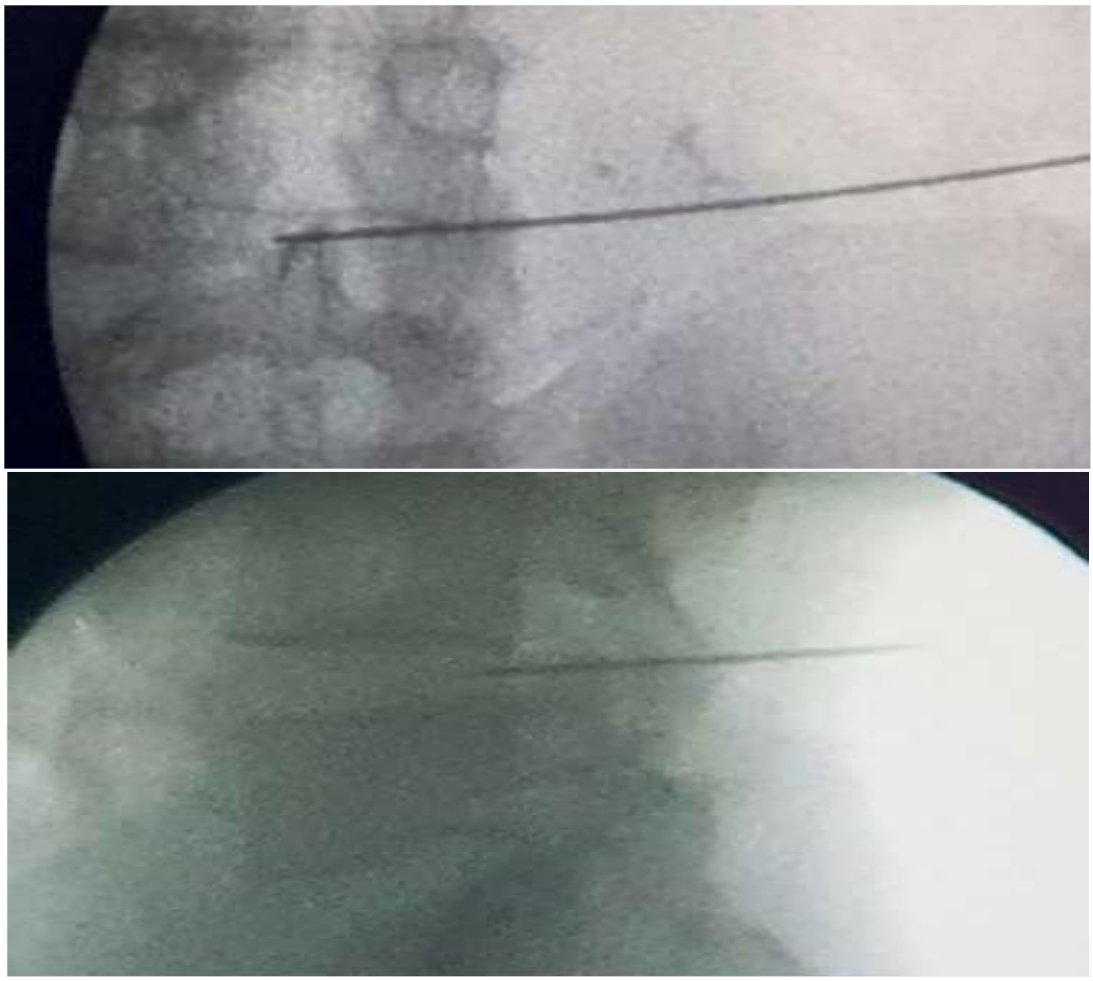


At 12 cms in AP we will be approaching the midline. In lateral our position must be in the posterior fourth quadrant inside the disc.

We take help of these markings on needle and follow them diligently, and will progress centimeter by centimeter.

When we reach close to the lateral pedicular line, we note whether the patient complains of pain or a jerk in lower limb will tell whether we are near anerve root.

If we stay in lower foramen it is very unlikely.



Now, these are calculations based on an average Indian height (male: 5'.6", female: 5'.1"). Please stay more flat than vertical.

If near the 9 cm depth mark, if we hit bone, we STOP and take an AP and lateral x-ray to confirm our depth. This will tell whether we are above the facet or not. If we are posterior or dorsal to the facet then we have to withdraw till needle tip is felt free and change our trajectory by raising our hand as we want to go ventral to the facet. We also keep the bevel facing towards ceiling. We have to reach the posterior-lateral corner of the disc in lateral when at the medial pedicular line in AP.

As we go through the skin:

1. After skin subcutaneous tissue we go through thoracolumbar fascia.
2. Needle will then feel light and move smooth until we feel a change in resistance as we cross the posterior inter transverse muscle then intertransverse ligament and then anterior intertransverse muscle. After that is a void.
3. We try to aim at facet, when we get the bony feel we turn the bevel open towards ceiling this will glide the needle under the facet into the foramen as raise the hand and walk into the foramen.
4. We will proceed further more smoothly but be careful as now we are in foramen and closer to annulus. Rarely patient may get a vasovagal syncope due to pain here. Proper premedication with atropine or glycopyrolate is enough to cover this but we [surgeon and anesthetist] have to be watchful.
5. At the annulus we confirm our position in the medial pedicular line in AP and at the annulus in the lateral before entry to the disc. We may inject about 1/2 cc of the 2% lignocaine and wait for a couple of minutes. The annulus feels firm, granular and as if we are putting needle through a rubber stopper of an injection vial.
6. So it is skin- subcutaneous tissue- fascia- muscles- fascia- intertransverse muscle ligament muscle- void- --- annulus.

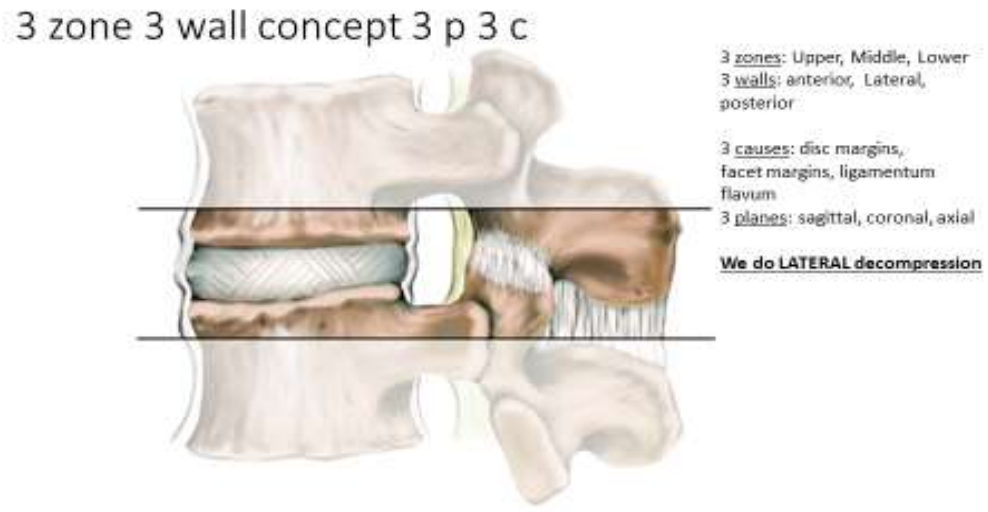
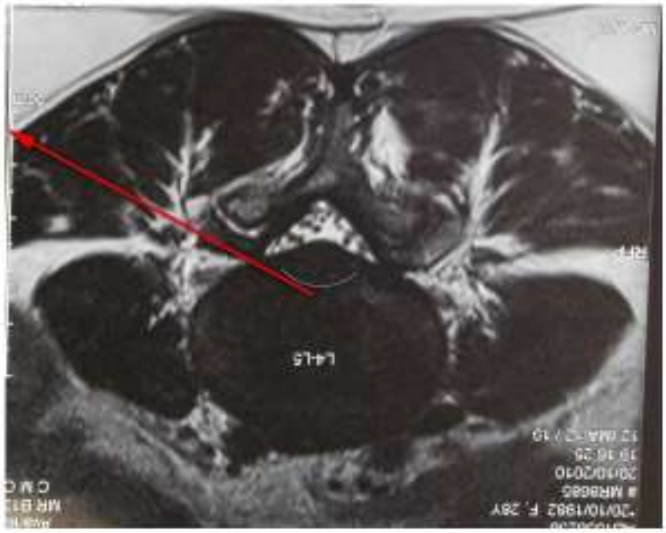
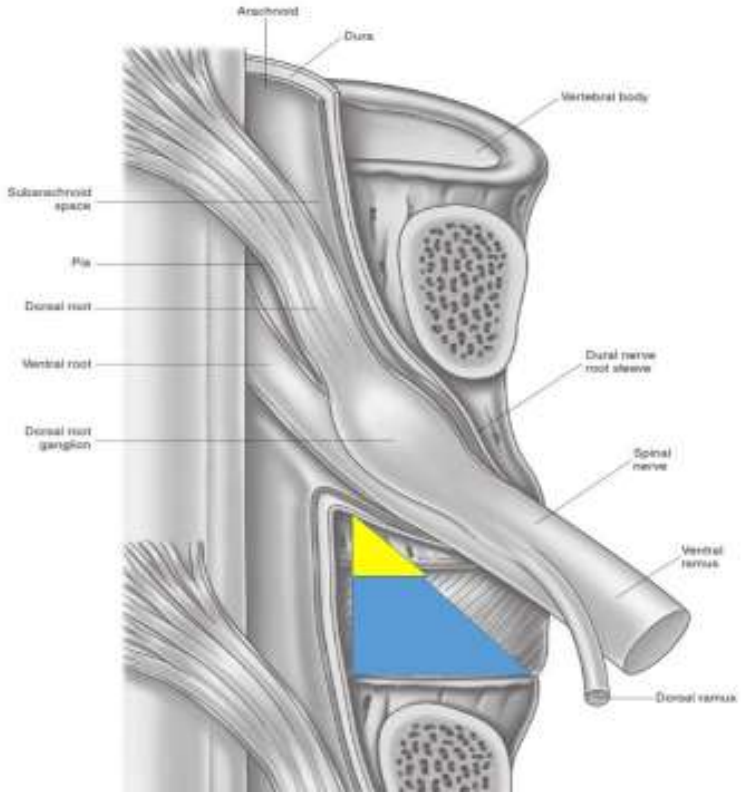


Image shows the target area in lumbar motion segment through foramen. Below Distances from midline for skin entry and angles.

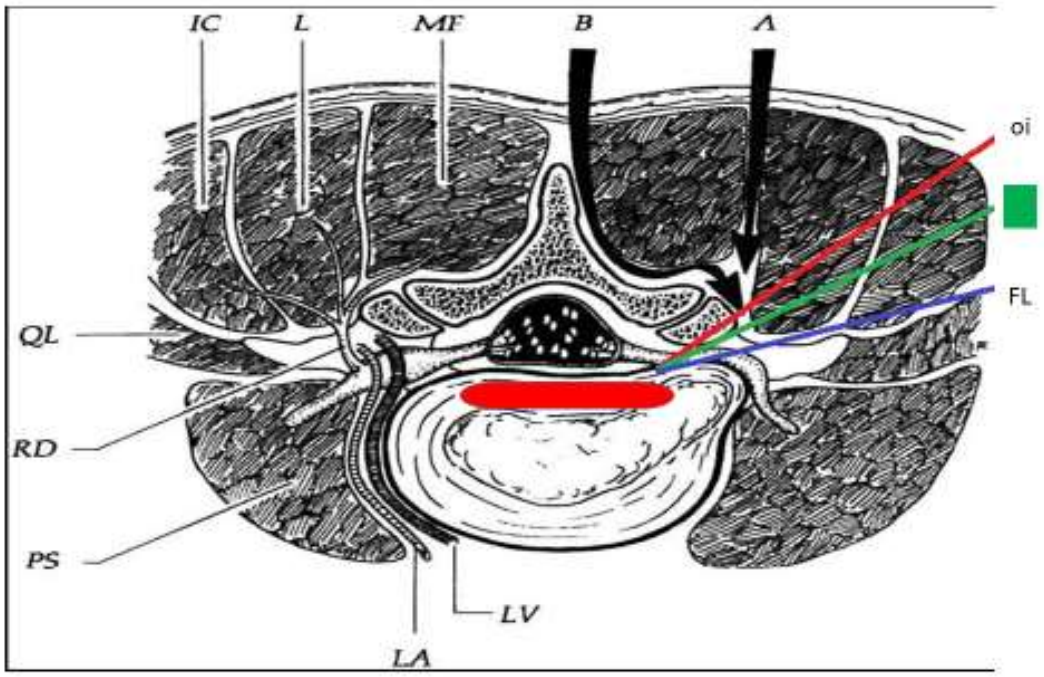
Access to disc: note loss of concavity



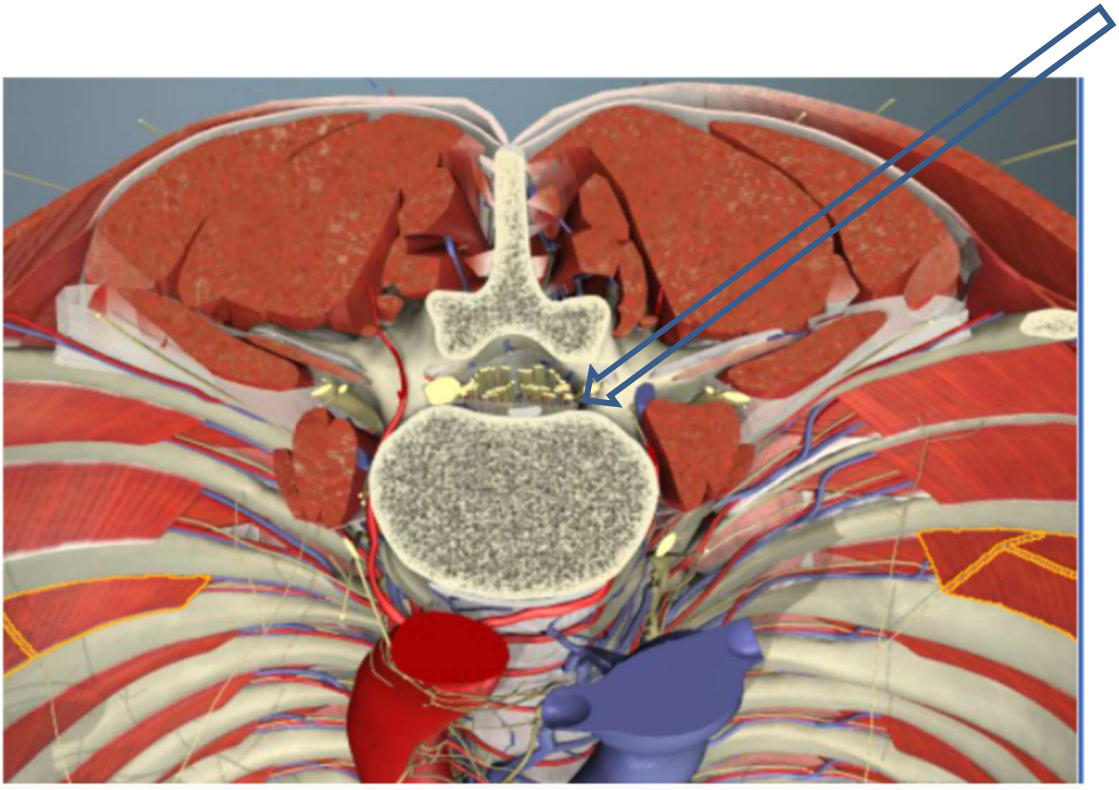
Access to posterior sub annular area through KAMBIN's triangle. Note kambin's triangle cephalad is bony floor, lower is disc.



VARIATIONS IN ENTRY TO FORAMEN : oi, io, FL : green is safest: gore system



Variations in access. Lower image is structures felt and encountered.



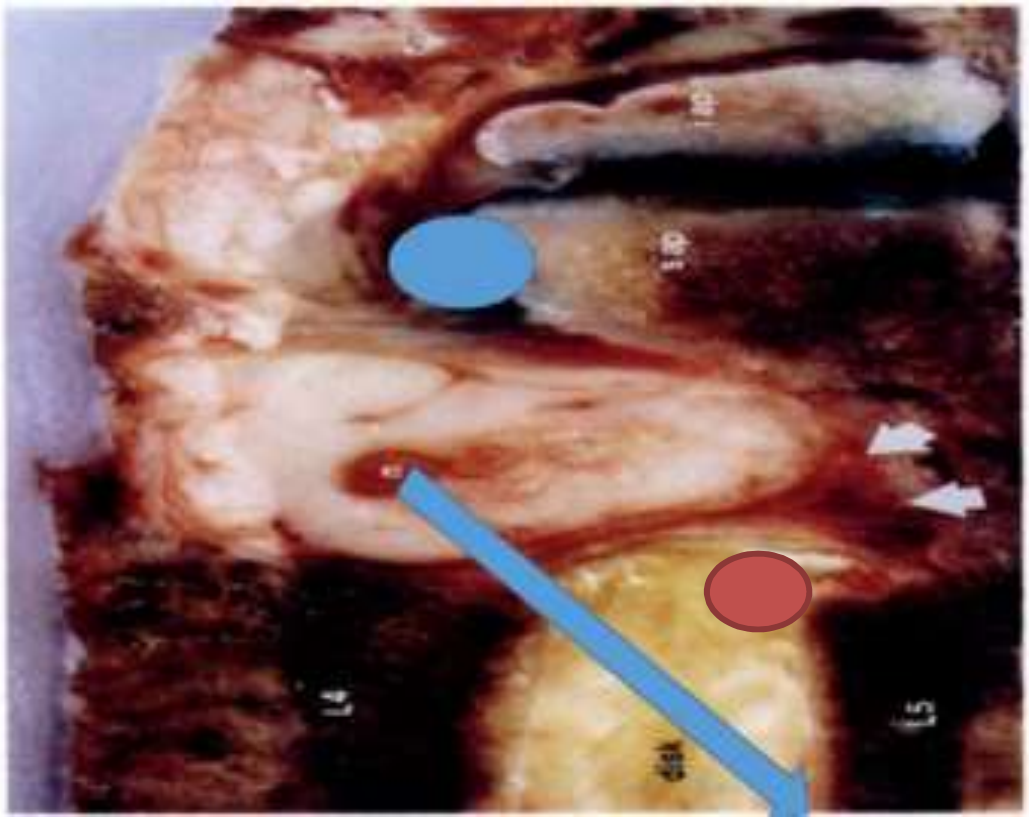


Image above is our landing area and target. Blue circle is SAP tip. The blue arrow is the exiting nerve. We are in foramen of L45 left side. Yellow is the disc, we land medial to blue arrow closer to lower end plate. Landing spot is shown as red dot. White arrows are ligaments in lower foramen. L4 and L5 bodies are marked clearly.

INTERNATIONAL JOURNAL of SPINE SURGERY

The "inside out" transforaminal technique to treat lumbar spinal pain in an awake and aware patient under local anesthesia: results and a review of the literature

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[1]Prime Surgical Centre, Pune, India [2]Desert Institute for Spine Care, Phoenix, AZ, USA

Abstract

Surgical management of back and leg pain is evolving and changing due to a better understanding of the patho-anatomy well correlated with its pathophysiology. Pain is better understood with in vivo visualization and probing of the pain generators using an endoscopic access rather than just relying on symptoms diagram and image correlation. This has resulted in a shared decision making involving patient and surgeon, focused on a broader spectrum of surgical as well as non-surgical treatments, and not just masking the pain generator. It has moved away from decisions based on diagnostic images alone, that, while noting the image alterations, cannot explain the pain experienced by each individual as images do not always show variations in nerve supply and patho-anatomy.

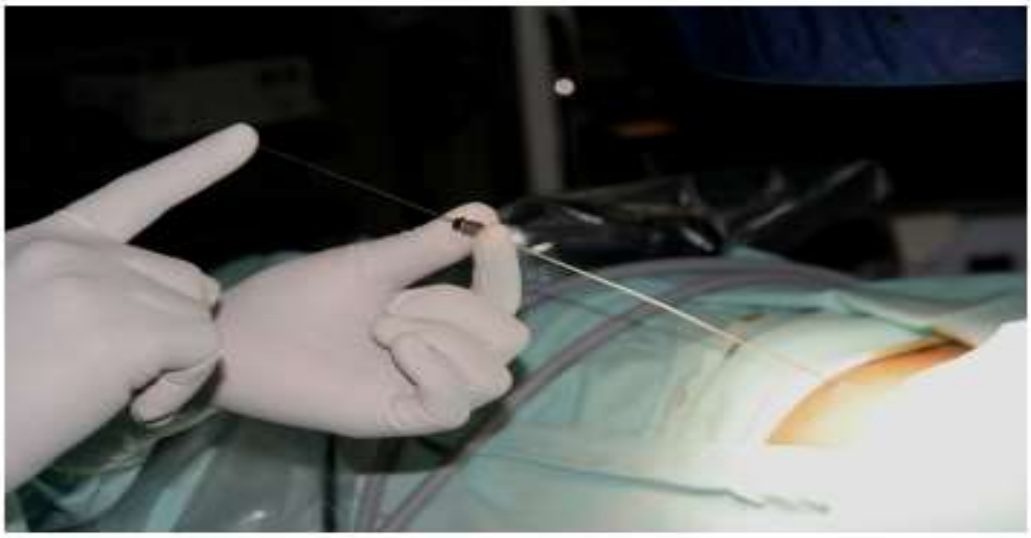
2 THE GUIDE WIRE

The guide wire is a 0.9 mm x 41 cm long wire which passes through the needle. After passing the guide wire through the needle, we gradually remove the needle by gentle twisting movements keeping thumb on the guide wire. Rotary movements of the needle will gradually free the needle and allow us to gently pull it out without pulling out the guide wire. Thumb will prevent the guide wire from being pulled out with the Needle. Also, your **gentle** pressure will ensure that you do not accidentally push the guide wire through the disc and out of the opposite side into some important neurovascular structures. If in doubt, we take C- Arm image and readjust our guide wire. When passing the guide wire, please make sure that the tip of the wire is not angled or bent. All our instruments pass on the guide wire. If the tip of the wire is bent when hammering in our dilator, further bending of the tip will lock our instruments and we will be unable to pull out the guide wire without pulling out the dilator. Please get a straight wire. It is better to use a new wire every time that glides smoothly in the needle every time. In addition let it be checked that wire is compatible with needle. The dilator also must glide easily on it. Wire is always removed before we tap the dilator inside the disc.

Guide wire ready

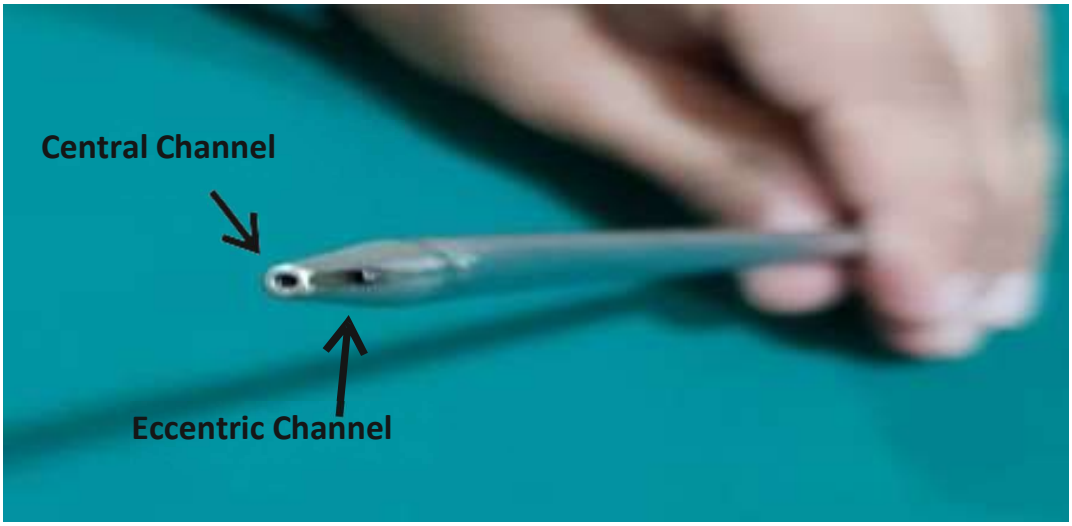
Measure guide wire against stylet, saves one x-ray. Remove needle out and gently very gently push wire in.

Remove needle

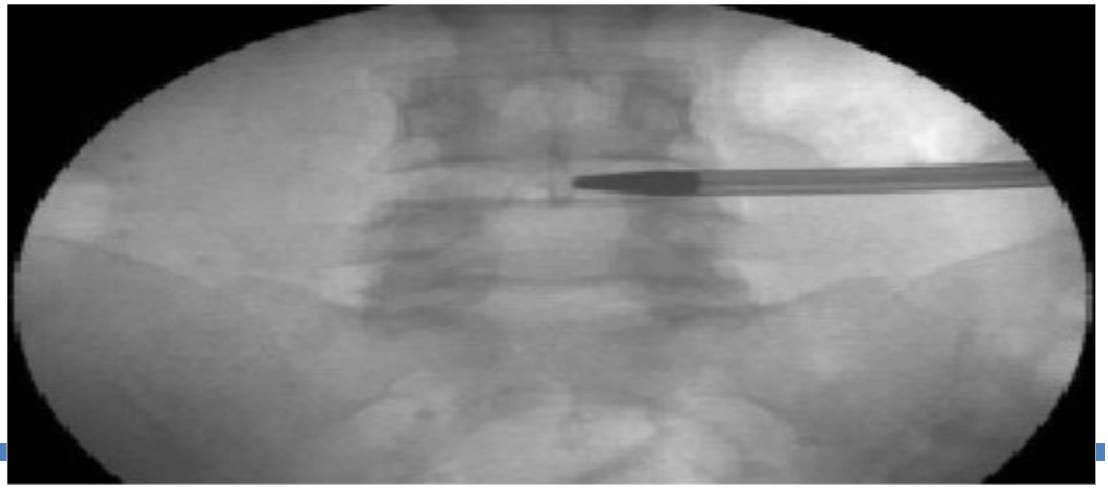


3 THE DILATOR

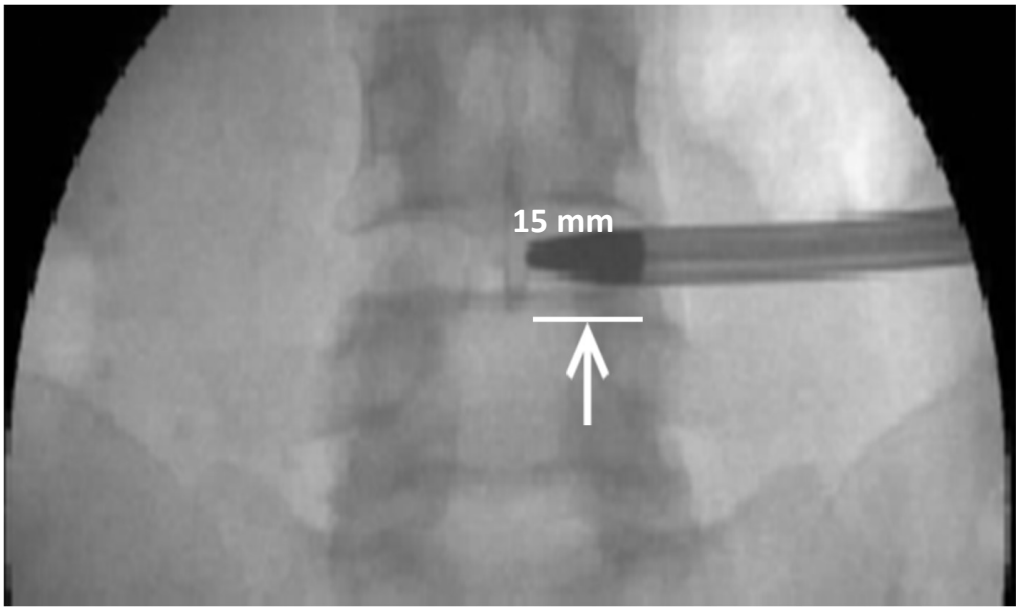
Dilator is used to dilate a path in the paraspinal muscles in most atraumatic manner leading us to foramen and disc. The length is 22 cms. The outer diameter is 6.8 mm in thickness and has 2 working channels in it. Each channel hole is of 1.4 mm. One channel is Central and the second channel is Eccentric.



The dilator is crafted in such a way that it has solid tip of higher density. The tip of 15 mm i.e. tapered end is of higher density than the rest of the shaft. This allows visualizing the exact positioning of the tip in the spinal foramen under C-arm. The taper is gradual 2 mm to 7 mm as the dilator expands.



The darkened tip is 15 mm in length.



When the tip is at midline its lateral end of dark area will be at the lateral pedicular line. This means that the dilator is exactly midway and sub-annular at L4-L5. Ideally it should be at medial pedicle line. At L5-S1, the interpedicular distance may be around 34 to 36 mm. The lateral margin of the darkened tip will be at the medial pedicular line when the tip is at the midline.

The surgeon end of the dilator, the terminal 2 inches, has a ribbed pattern or "knurling" to allow for grip by both the thumb and index finger to gently rotate and push the dilator in.

The length of the dilator and cannula is matched such that when you tap the cannula on the dilator, you can tap up to the full exposed ribbed area. That is the exact position, and you save X-ray for this confirmation. There are single channel telescoping dilators available. The thickness of the dilator may be from 2 mm, 4 mm, and 6.8 mm. These are used to sequentially dilate intra- discal space in case of the severely arthritic spine where disc might have collapsed.

The dilator is a very important instrument when we are working in a very precise way and landing in a KAMBIN'S triangle of following dimensions. Height 12 mm, base 18.9 mm and hypotenuse 23 mm in an individual that is 80 Kg. weight and 6' tall. Sometimes whatever we do due to do difficult anatomy we are unable to land exactly as needed. Then we have **Creeping adjustment by use of the eccentric channel.**

This is used to make an adjustment when we are just outside the foramen and we realize that our trajectory needs to change so that we may be able to reach the fragment more accurately in the disc.

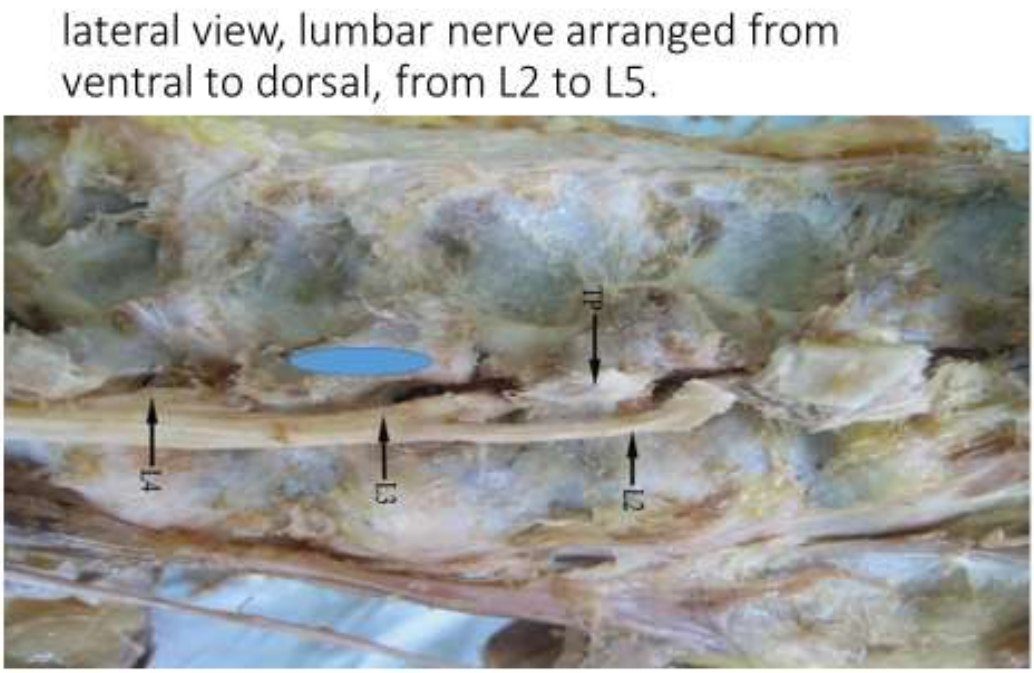
- Pass the guide wire through the accessory channel, which will be 2 mm parallel to the original central K wire. But now tip has moved away.
- Remove the central guide wire and remove the dilator.
- Now reintroduce the dilator on the eccentric guide wire, which is now in central position. This will allow us to shift your dilator by 2 mm without losing our position in the foramen.
- The eccentric channel may also be used to infiltrate local in the caudal part of the foramen, should the patient be feeling pain at

the time of the passing of the dilator. This will augment the local anesthetic, which was previously injected.

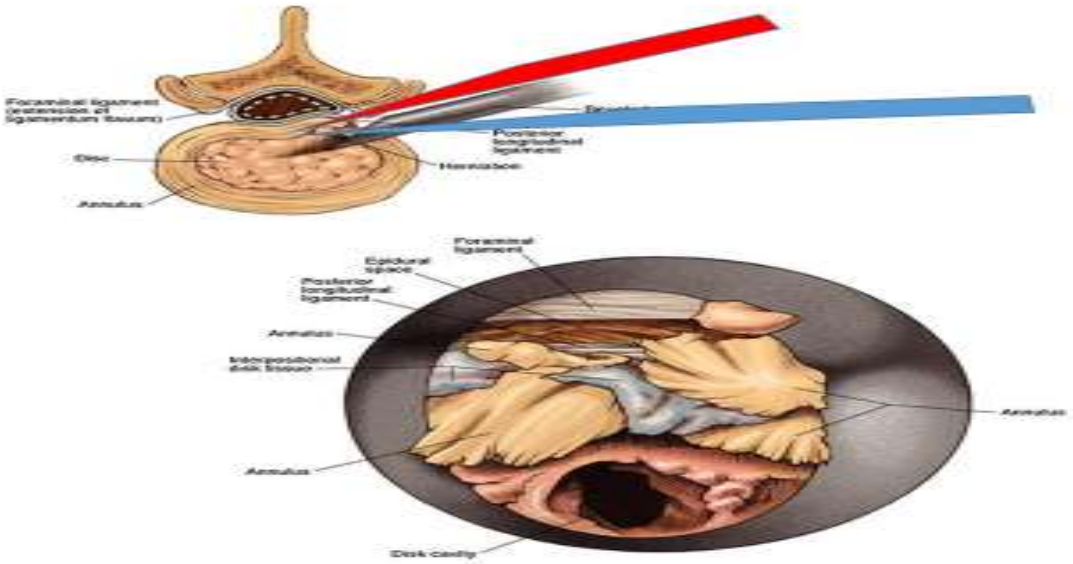
- We rotate dilator when on the wire in central hole but not when on eccentric wire. We have made a channel in tissue when working on central wire, we use the same channel in soft tissue so there is no need to rotate the dilator.
- Second hole also allows us orientation using that hole as guide e.g. 12 o'clock will be facet area.
-
- Dilator is a solid rigid instrument with 7 mm diameter and can be used to gently move and adjust our trajectory, when in foramen before tapping it in disc.
- In patients with very large facets or facets oriented more sagittally, sometimes while passing the dilator if we feel that our entry is too vertical, such times we may remove the guide wire and on passing ahead of the facet, hinge the dilator tip on the facet edge to gain a more horizontal (or sub- annular) entry into the disc space entering the disc close to medial pedicular line.

In our early learning curve, when we try to work outside the foramen, we may at times withdraw the working cannula excessively and lose vision. We do not push the working cannula back in blindly. Cannula or sleeve always ONLY travels over the dilator. WE reintroduce the working cannula under proper C-Arm guidance. Vital structures like the exiting root and plexus are barely a millimeter or two away from the working cannula. Therefore, blindly pushing your working cannula is not done.

These are ventral relations of the foramen. Blue dot is on transverse process. The intertransverse plane is a physiological plane.



Black cannula is correct landing. Bevel open towards facet. Lower part of pic shows endoscopic views with details of structures 12 is dorsal.



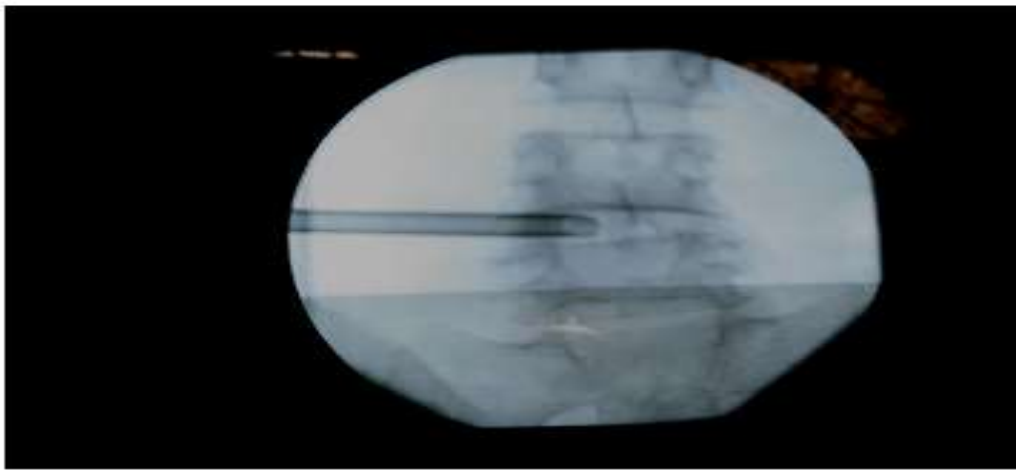
4 THE working cannula or SLEEVE

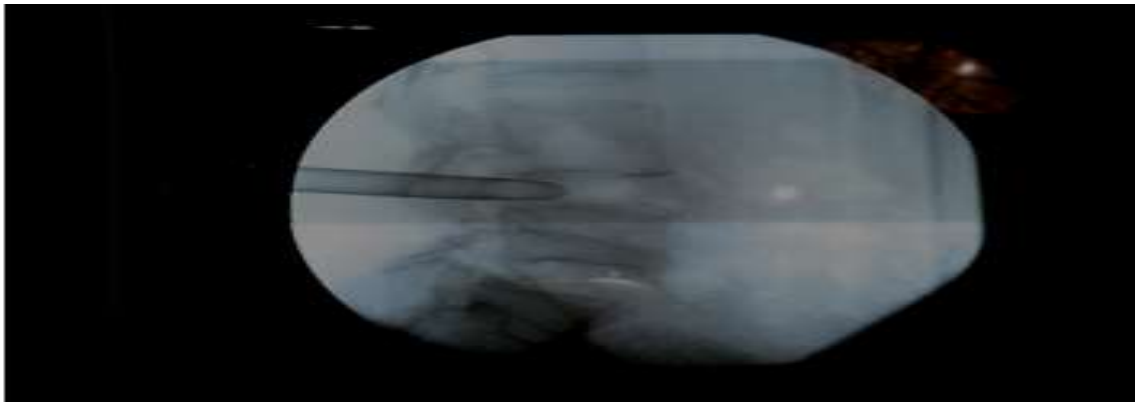
The sleeve is 17 cmsin length, with centimeter graduated markings. Its outer diameter is 7 mm, inner diameter is 6.8 mm. The sleeve is ALWAYS mounted ona dilator. The tip is called Tang. The openingof the sleeve is always cut at an angle i.e. a bevel. The cut bevel is an immensely important contribution to endoscopic spine surgery by Dr. Anthony Yeung. This allows view of dorsal structures with our 25 degree scope. It contributed to simultaneous visualization of the sub annular disc and the epidural space and working in both intra and extra-discal planes at same time. The original Craig cannulas were circular andhad a restricted field of vision. The proximal end of the sleeve has a water inlet or hilt which is always in the direction ofthe bevel i.e. opposite to the tang. This allows the surgeon to know exactly where he is looking. It also acts as a grip torotate the cannula when inside. Working cannula or sleeve:

1. Holds open the path to the disc.
2. Protects the exiting nerve root unless youturn the cannula towards the axilla
3. Protects the endoscope.
4. Allows visualization and use of trephine, larger burrs with or without the use ofscope in the channel.
5. Allows removal of larger disc fragments,which cannot be pulled through channel of scope.
6. Today, transparent cannulas with neuromonitoring attachments are developed and patented by me and will soon be available to give a 360-degree vision.

Cannula on dialtor

Cannula in disc below fragment



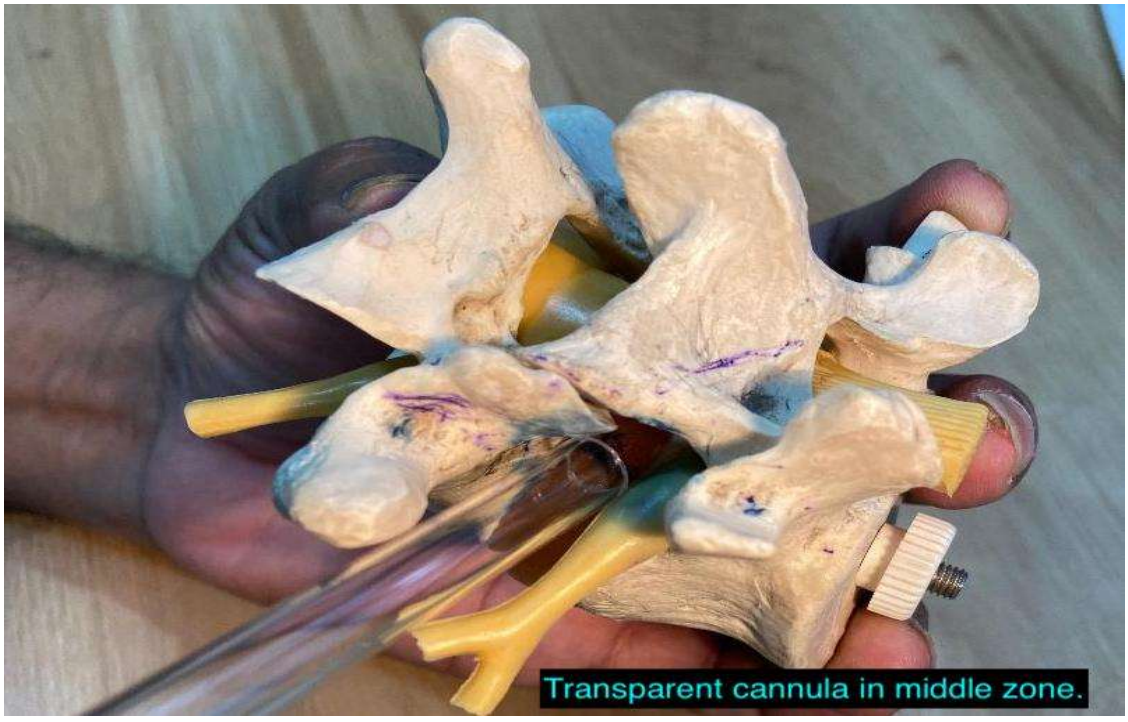


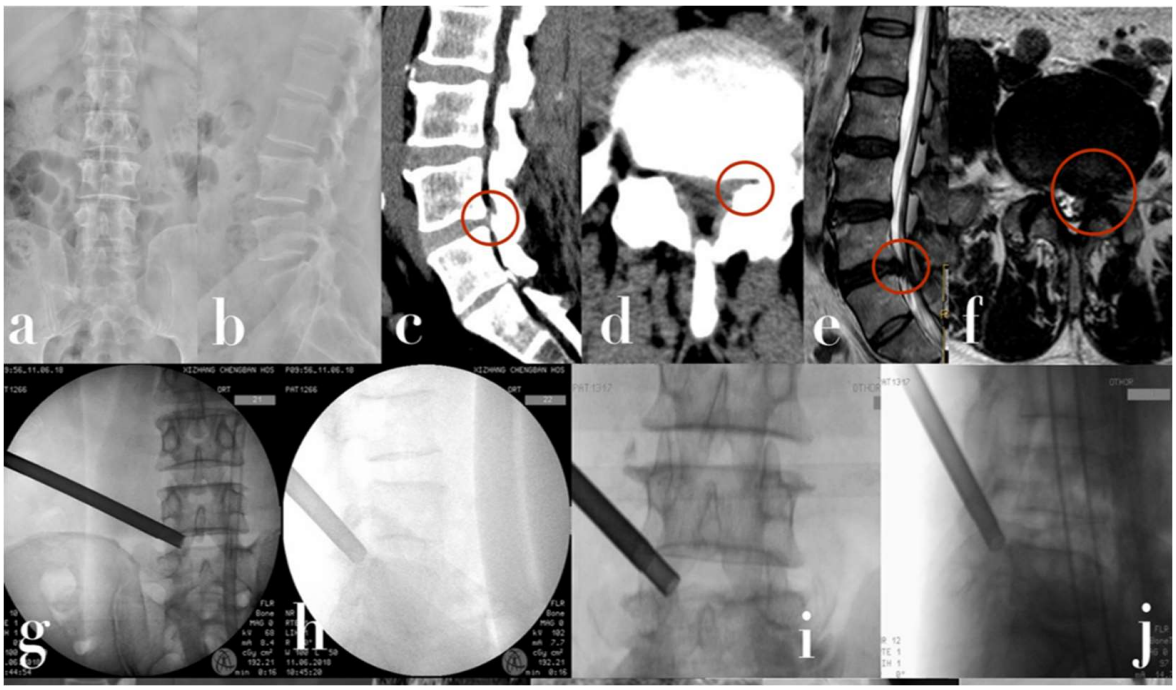
Cannula ventral to fragment.

Scope and grasper in cannula

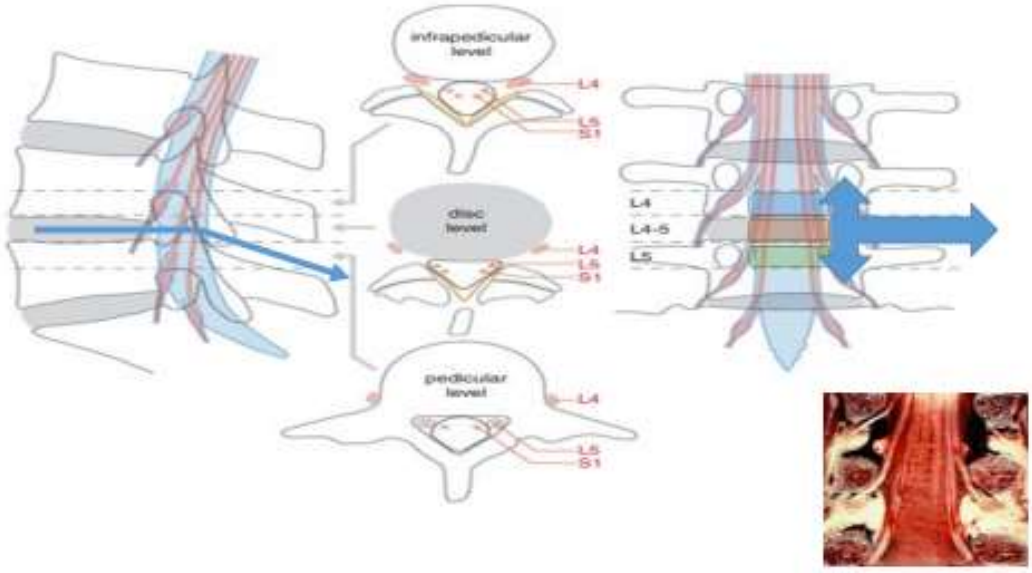
Cannula holds scope. It is a passage from skin to disc. It is metal and is radiopaque, so I have developed new transparent cannula. The cannula walls make our surgery secure.

Transparent cannula makes working more safe and easy. It is radiolucent so lateral X-ray images are more informative. As the overlapping shadow of metal cannula is absent.





Cannula is round tip and is used for stenosis related decompression.



Cannula can lead to all 3 zones and 3 walls of the lumbar spinal canal.

THE TANG

Tang is the tip of the working cannula and is modified as per application. The length of the tang may be from 1/2 cm to 2 cms. Its profile may vary, that is, the bevel slope may vary from 20 degrees to 45 degrees. Along with varying angle, the length of the tang also varies from 1/2 cm to 2 cms. Standard length of the sleeve is 17 and marked per centimeter, longer sleeves up to 22 cms are available for extremely obese patients. Number markings are always on the dorsal surface when inserted in a patient and always on the side of open bevel. (Some companies do not have such markings).

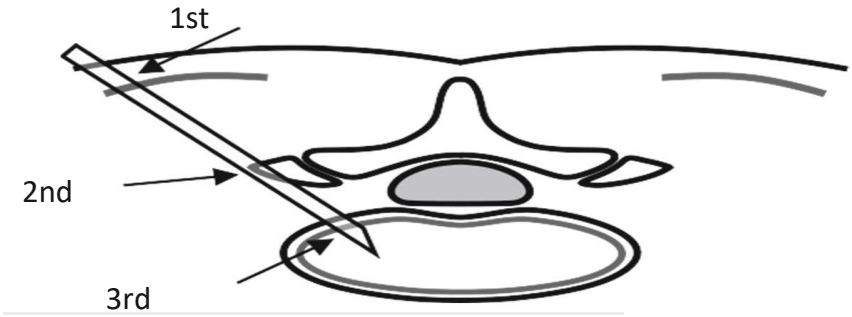
My rule of the Thumb, where the index finger represents the traversing root and the thumb represents the exiting root. The MCP joint of the thumb represents DRG. The V formed is the axilla. Open bevel faces the axilla at all times during introduction of the sleeve. Cannula should be introduced with bevel facing the axilla till you reach annulus, then rotate to make it vertical.

A gap remains between the sleeve and the dilator, which may trap the exiting root resulting in dysesthesia if you keep open bevel away from the axilla as seen in pic on right.

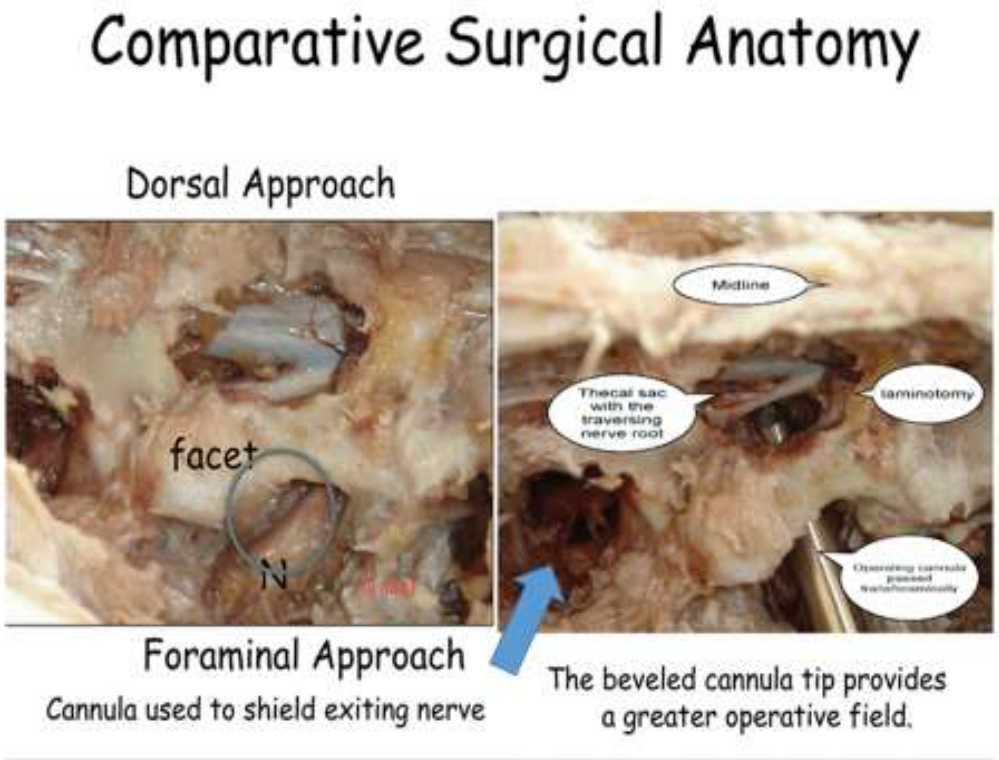
GORE thumb Rule RIGHT hand denotes right side root arrangement

During use of needle and dilator and cannula we have to push them gently. There are 3 points where we may feel a giving way sensation once at fascia, then at intertransverse ligament and lastly at annulus. Pass the sleeve with small jog movements.

Image of cut sections showing give way zones



1st give way - Thoracolumbar fascia
2nd give way - Intertransverse ligament (between 2 transverse processes)
3rd give way - At annulus



The sleeve slides over dilator. The technique of insertion of the sleeve. Bevel edge will always face the axilla/head, to make sure that you do not accidentally pinch the existing root in the foramen.

TANG PROFILES AND THEIR RELEVANCE

Sleeve have various profiles so that they may be used in a different manner. 20-degree slope end-on profile:

This sleeve is used specifically if one aims foran outside-in approach via a foraminoplasty into the epidural space for targeting a migrated (high and low) disc and an outer foraminal and extra formal disc. This profile allows approach close to the facet and 20degree upward vision allows an end-on view ofthe facet. This makes burring and drilling in the safe zone possible.

45 degree slope end-on profile with Tang (theregular sleeve)

This allows the s cope (Karl Storzscope) to transverse in and out of the disc. Surgeon has an advantage as tang on anchoring in the annulus stabilizes it. The Surgeon can work in the discand if he desires he can withdraw the scope tovisualize the annular fibers without having toadjust the working cannula (which is not possible with round end working cannula). Therefore, the operation which starts as an inside-out approach to the disc can be adjusted to outside-in, and allow you to do foraminoplasty when you are anchored in the disc. This allows easier visualization of tear of the annulus. Extended long tang sleeve helps disc/annulus and facetal work while the tang is in the annulus, especially at L5-S1 staying extraforaminal. Hence, endoscope glide and steady position will allow work on both inner outer sides of the annulus as well as the facet. Beginner should stay with 45 degree cannula. The view through sleeve is always oblong and never circular and different due to bevel. To improve visualization, we work by rotating the sleeve. V of the camera must always bealigned at 6 o'clock meaning that vision of the scope and tang are aligned. For working in upper or lower zone we prefer to rotate both as per need.

5 BURRS

Burrs is most useful tool for foraminotomy or foraminoplasty and oblique pediculectomy after visualized access to the foramen. It is used in patients with:

- high riding superior articular process, with hypertrophic tissue,
- osteophytes arising from the inferior endplate of the cranial vertebrae,
- down migrated disc herniations,
- Large central disc needing medialization of window.
- Stable degenerative listhesis having foraminal stenosis.
- Lateral canal stenosis due to enlarged facets,
- Hard calcified annulus can be cut by the burr for end plate to end plate clearance.

Burrs commonly used are - normal or diamond tip. Sizes in visualized burring are usually 2.5 to 3 mm. I have designed an oversized 6 mm burr that can be used by reverse entry in scope. The tip of the burr may be round / oblique, with or without a guard. A special type with angled articulating tip is also available for those hard to reach corners. Image below shows Karl Storz drill set.

How safe is it to use drill or burr in scopy? The answer lies in the angle of approach in transforaminal endoscopic spine surgery. In the standard inside-out approach, we are at an angle of almost 30 to 40 degrees as we dock the tang in the disc to anchor the cannula in a partial in-out position and scope is looking up by 25 or 30 degrees depending on its make. The drilling angle does not change, we start from the outer ventral non-articular surface of the facet from lateral pedicular line and we do not cross medial pedicular line in AP view. Even if we go ahead we land in disc if we are in line with disc and exiting root is protected by sleeve. I use 525 RPM drill, handheld and cordless. Other commercial high-speed burrs with upto 100,000 rpm per minute are also available. We use a wood working burr of 3 mm head diameter through working channel of 3.625 of my scope. We start by first probing the superior edge of the inferior pedicle with radio frequency probe vaporize the tissue, then on the superior articular process stripping the facetal capsule and exposing the bony outer ventral non articular surface of the superior articular process right up to its tip. At the tip, with the use of a curette, I strip the soft tissue which is G knot attached to the superior articular process and I work my curette to free the tissue around the tip along with the use of a hook. G knot is an amalgamation of soft tissue from facet, disc edges and foraminal ligaments. We work on tip of the superior articular process and continue downwards up to the base of the inferior pedicle.

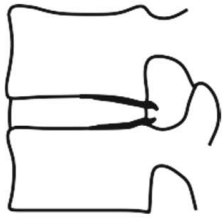
For down migrated disc start at corner of the superior surface and medial surface of the inferior pedicle (superior oblique pediculectomy), which allows us visualization to almost the entire depth of the lower pedicle. From here, using bendable graspers it is easy to identify and remove an extruded disc fragment from within the

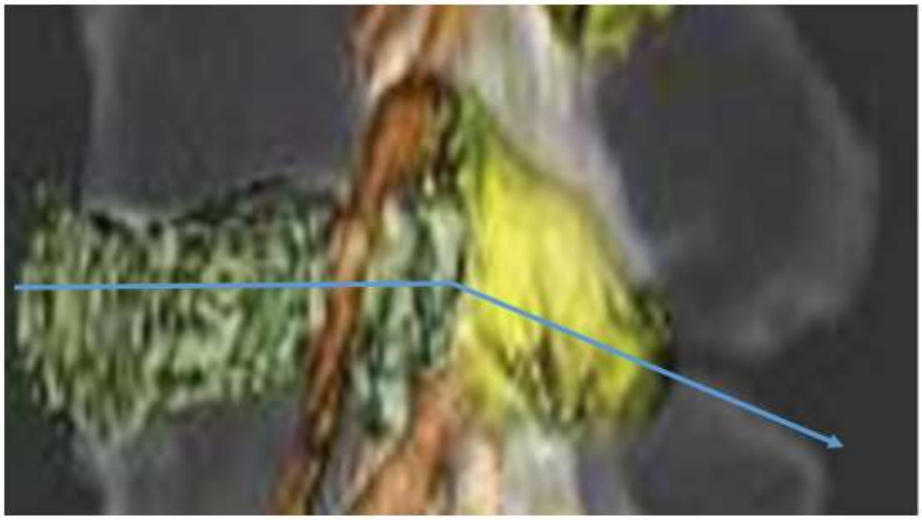
vertebral canal. We can also approach the roof of lateral recess part 2 if necessary.

It is pertinent to note that, our angle of approach allows us to open up the vertebral canal at the medial most end of the drilling of the superior articular process, as we are drilling from lateral to medial. The opening at the medial edge is usually inadequate to completely relieve the lateral canal and traversing root. Here, one has to focus on further opening the medial edge dorsally on medial face of the facet in central canal by flattening the undercutting. Here, I use the articulating burr or if I'm using a simple burr I depress the scope and hinge upwards.

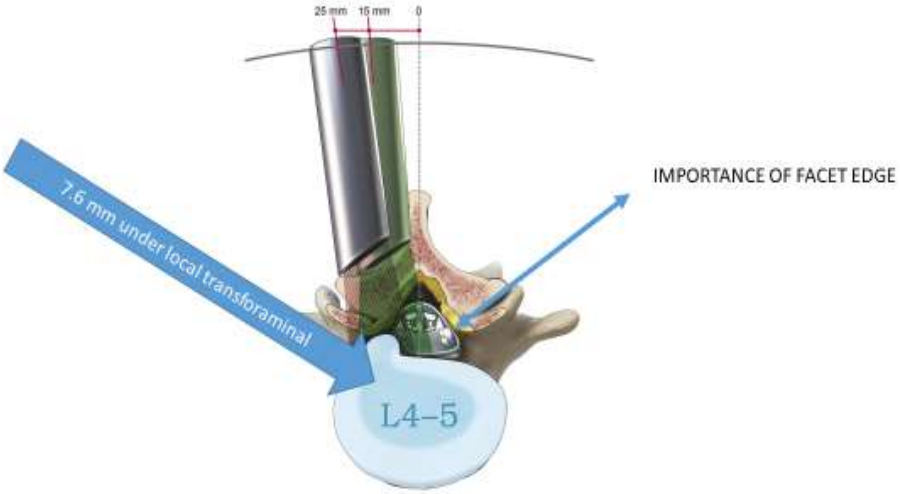
I avoid step of going under and going medially to facet rather i go around the superior articular process and gradually stripping the bone with a curette for which I developed the right and left sided curettes. This way one can achieve the same effect. A side-firing laser at 2 joules and 20-hertz frequency also achieve the same. Optionally, one may use the tubular Kerrisons for facet undercutting.

Burr / Drill is used to remove posterior osteophyte and hardened annulus as only annulectomy will not help.





Sagittal image to highlight 3d fusion MRI image showing yellow ligament, orange nerve and green disc with black vertebrae. Image below is to highlight our 7.6 mm cannula landing at base of herniation as compared to 16-25 mm cannula of posterior midline or paramedian access of unirrigated disc surgery. We are lateral to facet edge. Midline access may not be able to cover this area.



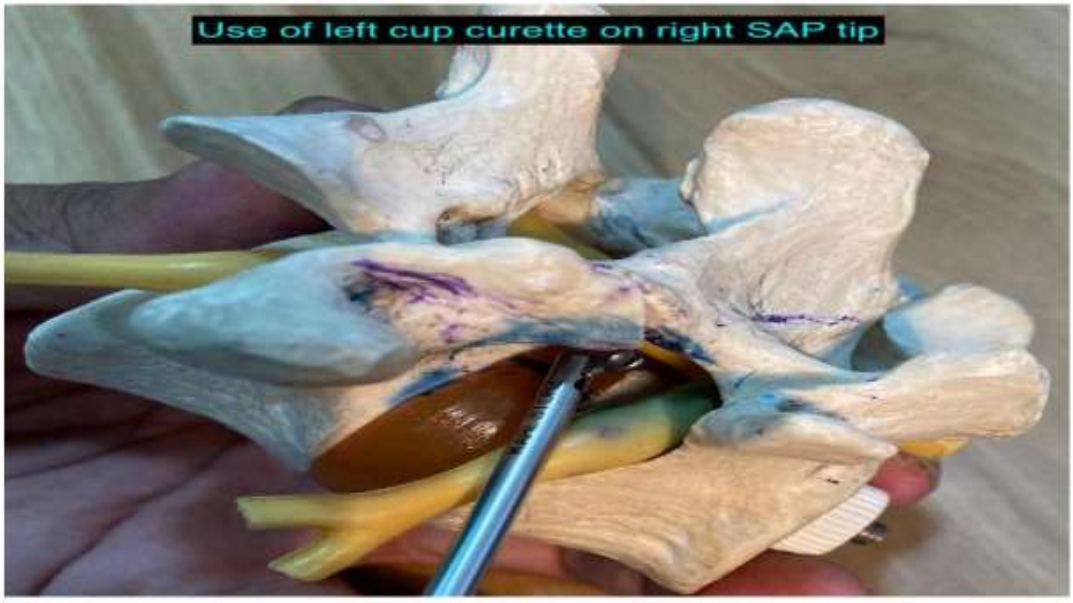
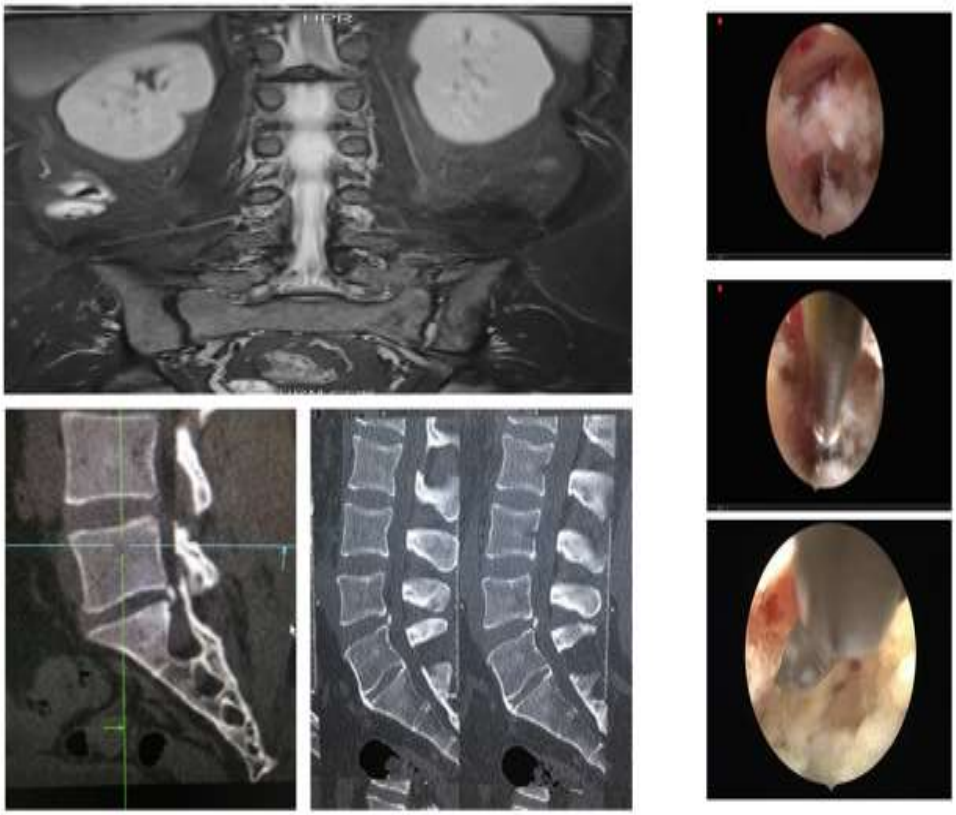


Image below shows use of curette and drill for removal of osteophyte



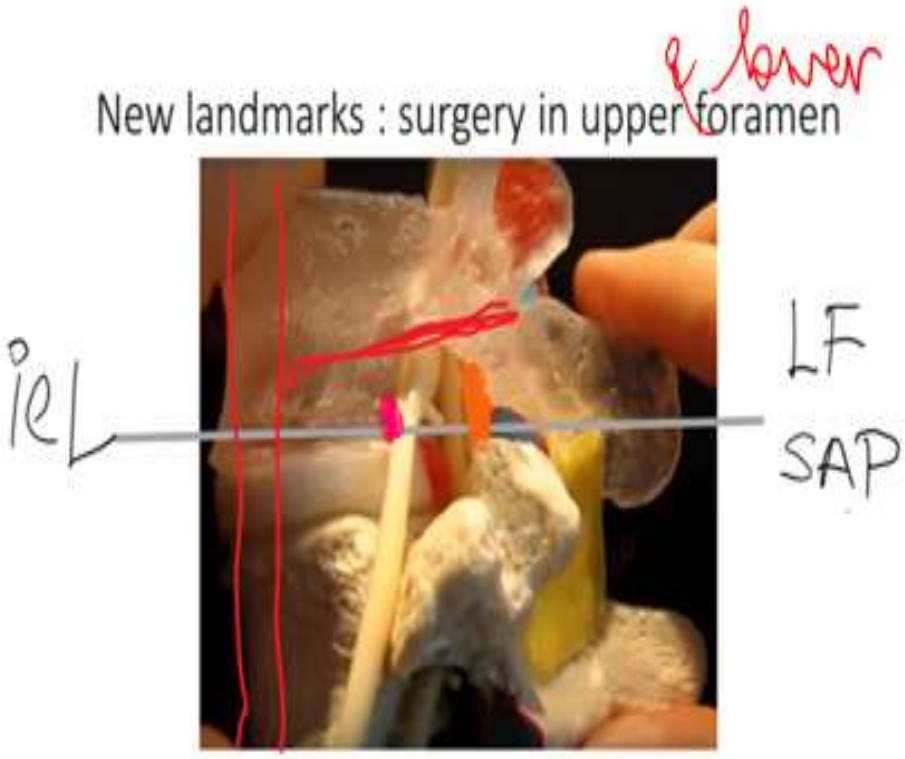
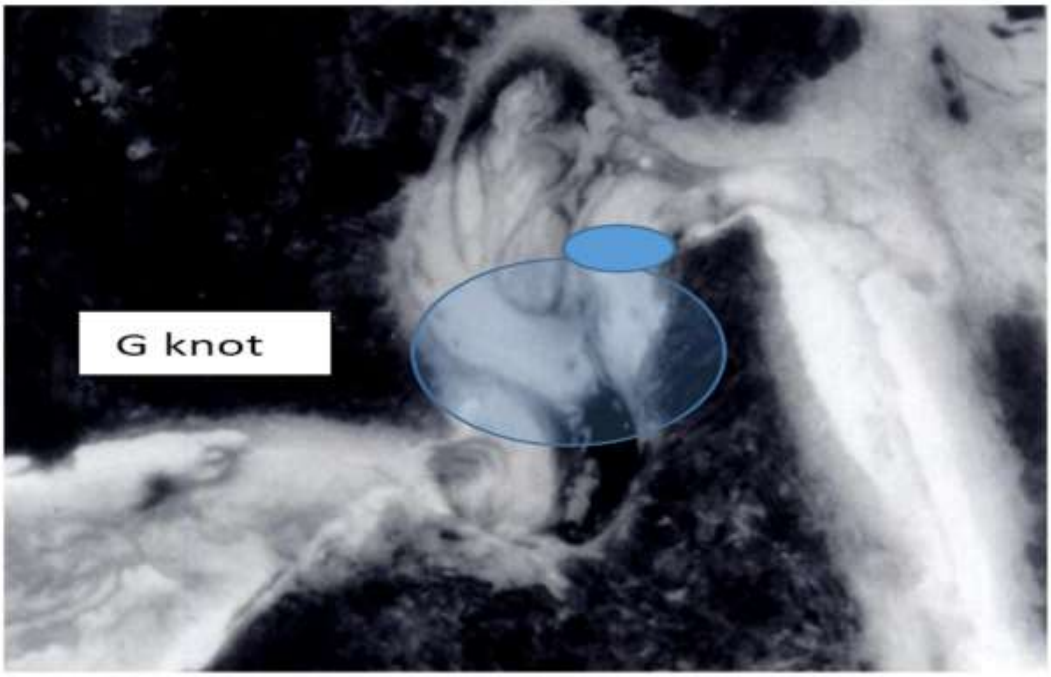


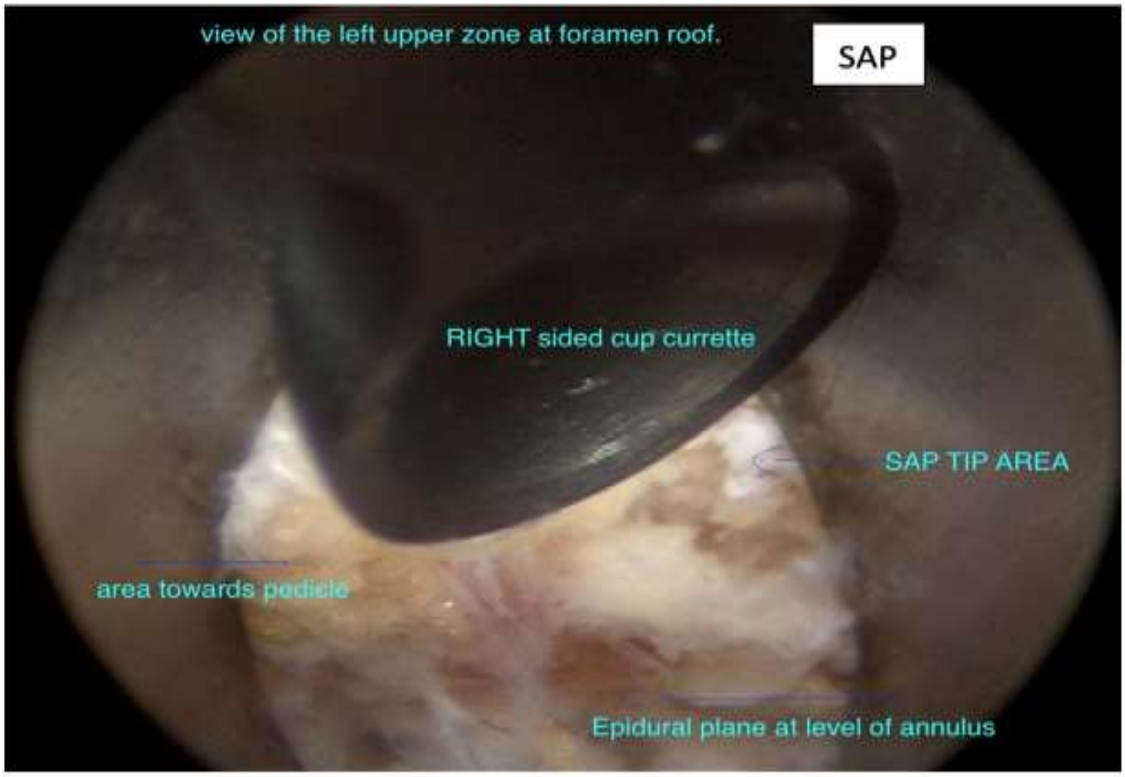
Image above is new landmarks in transforaminal endoscopy. Below is the G knot in foramen, left of image is anterior, up is cephalad.

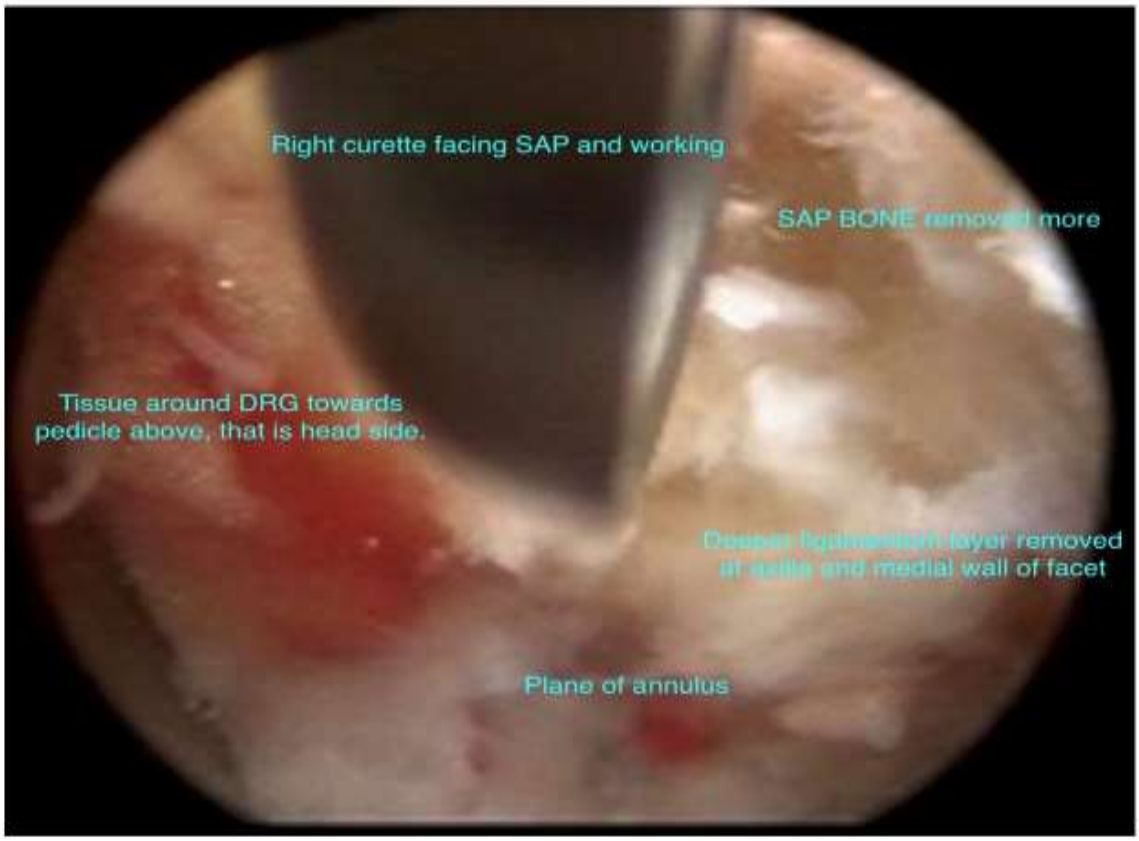


Curette spoon offset to the right

Curette spoon offset to the left

Above 3 images show 3 varieties of curettes. On next page in use on SAP.


view of the left upper zone at foramen roof.
SAP
RIGHT sided cup currette
SAP TIP AREA
area towards pedicle
Epidural plane at level of annulus


Right curette facing SAP and working
SAP BONE removed more
Tissue around DRG towards
pedicle above, that is head side.
Plane of annulus

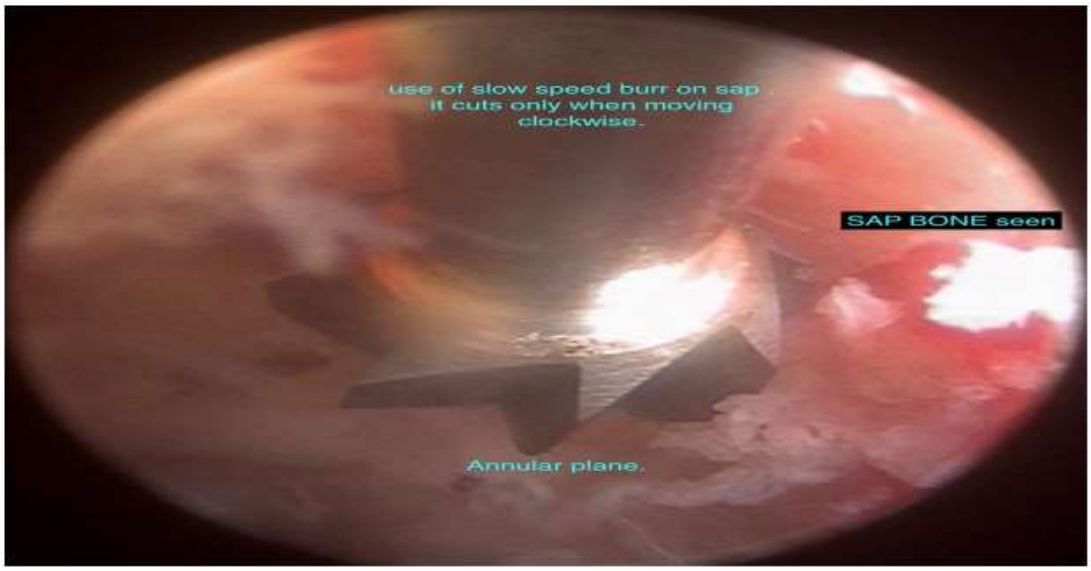
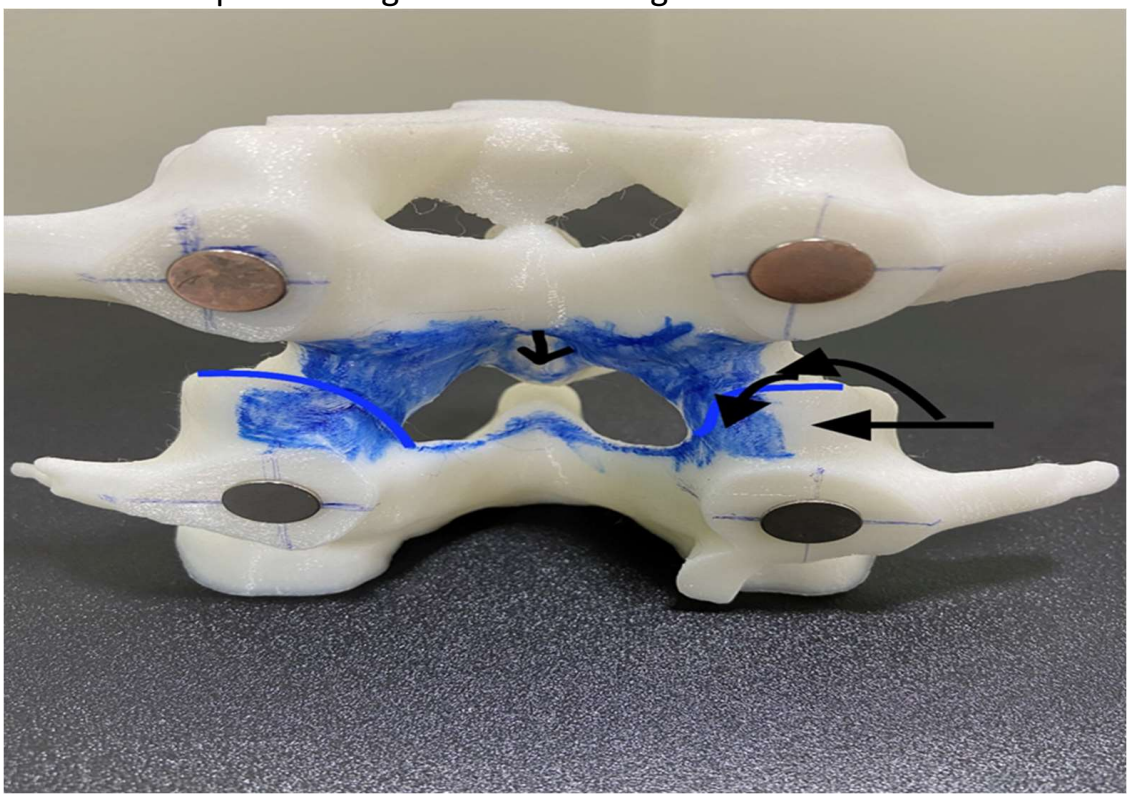


Image above shows use of endoscopic burr or drill on SAP.
Image below highlights blue “ligamentum flavum. Arrow in midline to show that midline is far away from dural sac. Arrows on right indicate two strategies to reach ligamentum flavum in stenosis curved arrow “above SAP tip and straight is after cutting ventral facet.



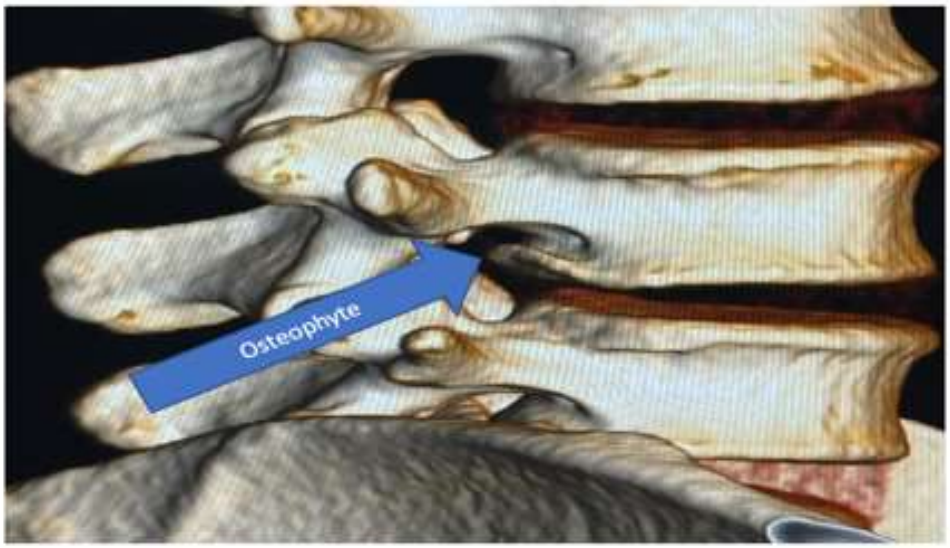
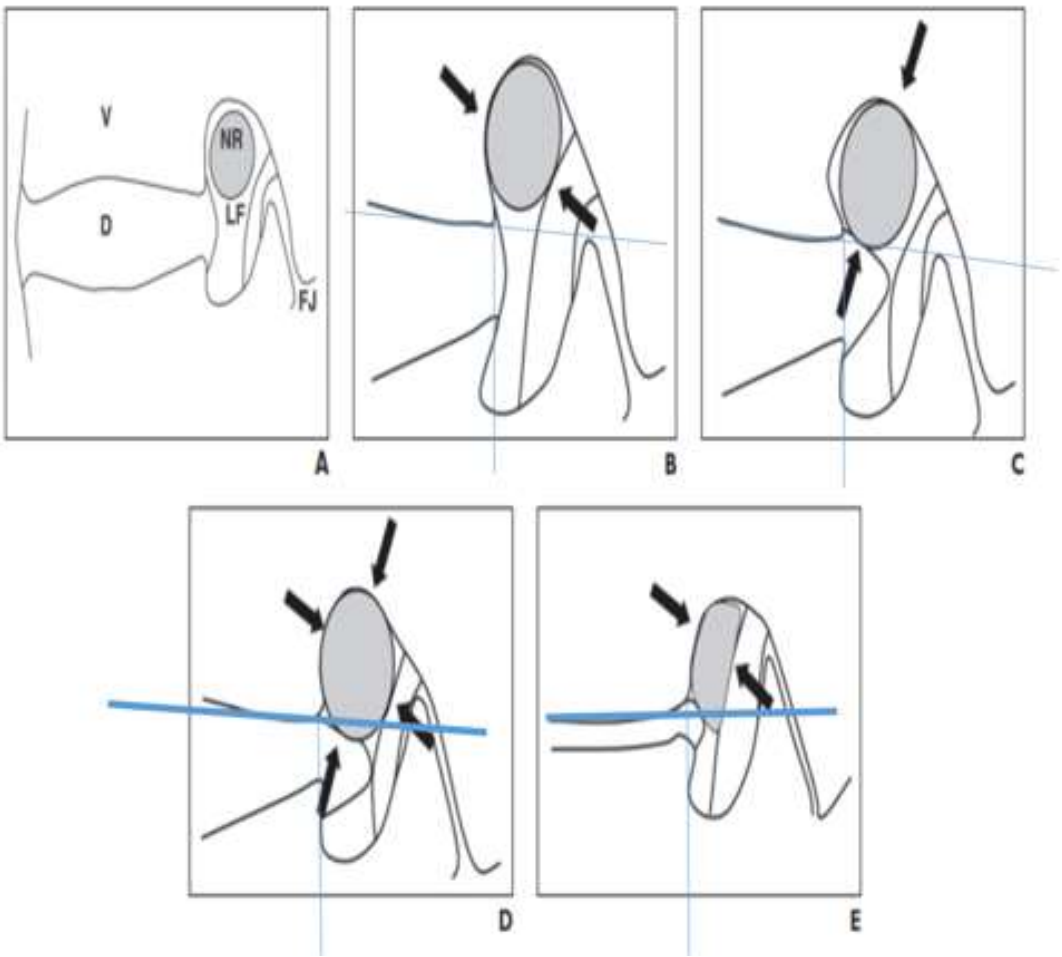
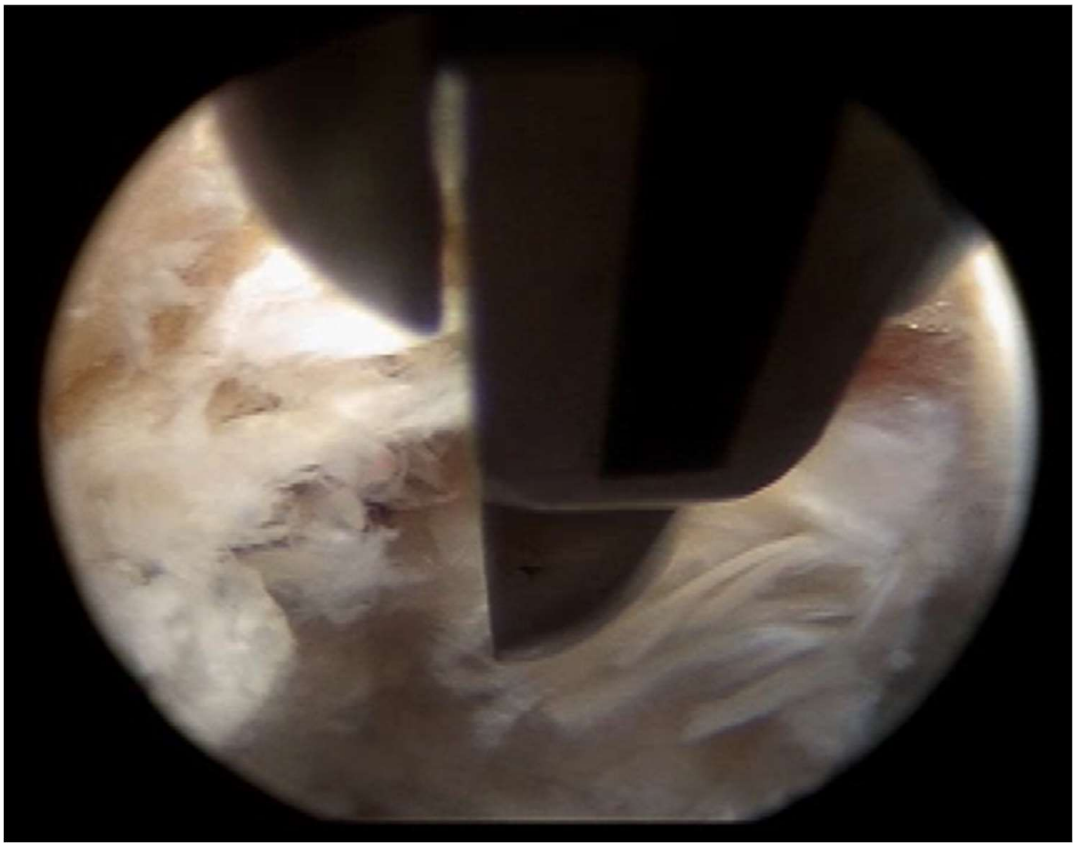
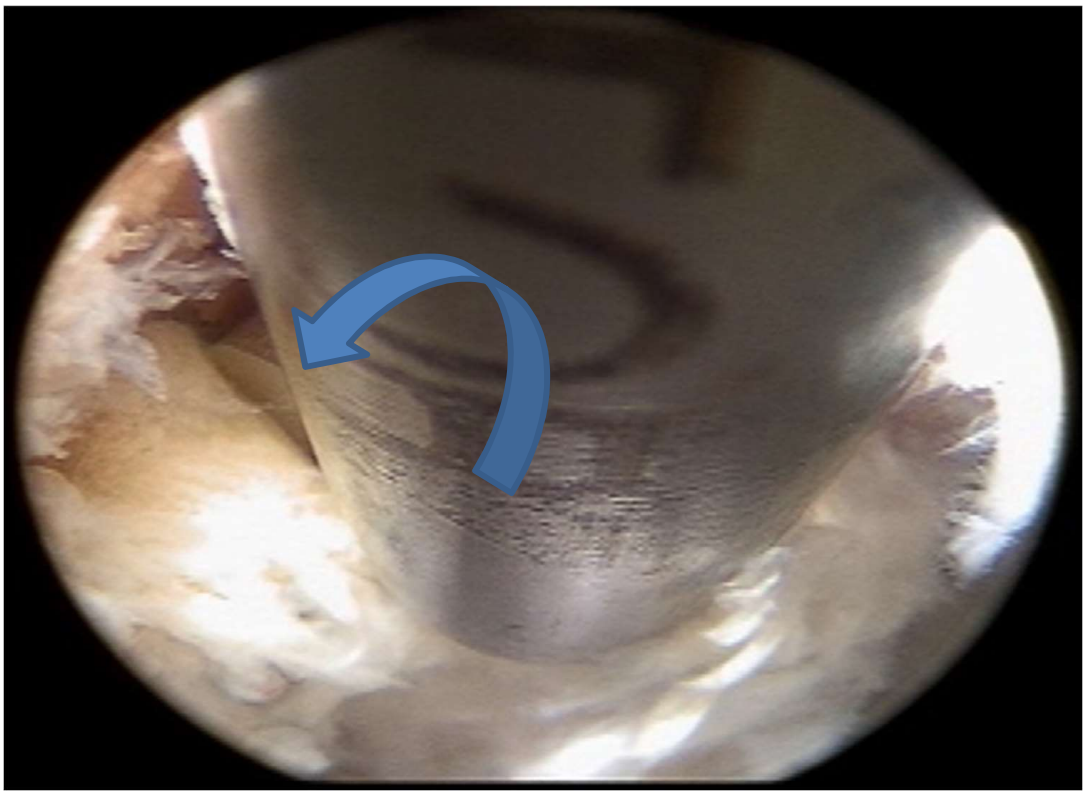


Image above is osteophyte as seen in CT. Below is foraminal stenosis classification.

Lee classification of foraminal stenosis grades A to E.

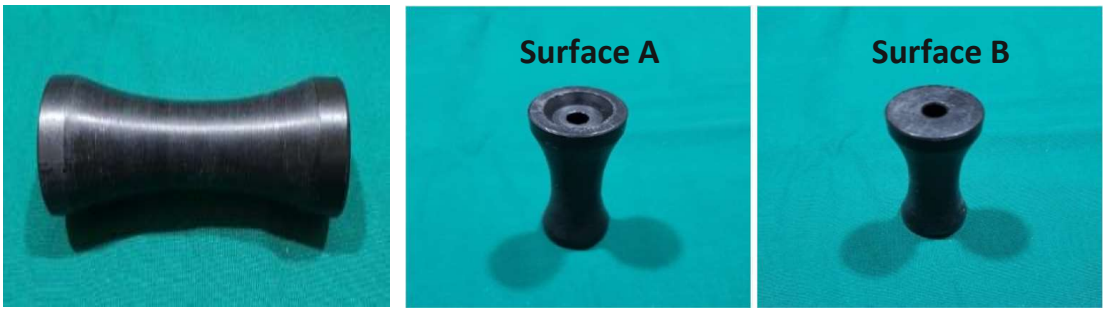






Left sided curette working on right Sap in foramen. Above and turned to left as seen in image below.

7. TAPPER



As the annulus is tough tissue, the blunt tipped dilator and the endoscopic spine surgery sleeve both cannot enter disc without being tapped in. When hammering the tapper make sure of 2 things: The rounded inner cut edge is sitting firmly on the rounded surface of the sleeve. (Surface A).Hammering is done on flat surface. (Surface B). The dilator must be smoothly gliding within the sleeve. The tapper must glide smoothly over the dilator. Should there be any restriction to the movement of the dilator in the central hole of the tapper, please do not hammer. Prior to the surgery, we counsel the patient that we will be hammering a sleeve and some noises may be heard. Patient may feel some pressure on the back, this should not alarm the patient.

8 THE HAMMER

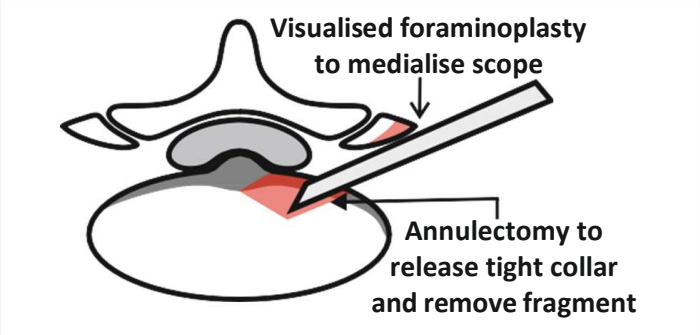
The hammer is used to tap a dilator and the tapper on sleeve head. Handle is approximately 20 - 25 cms in length. Both its ends are teflon coated, so as not to damage the small central and eccentric channels in the dilator and avoid splaying metal and create less noise on tapping.

9 ANNULOTOME

Annulotome or annular cutter is used to cut rigid annulus, to allow access to trapped annular fragments and medialization of window at floor. A standard annulotome has length of 300 mm.

Annular Fibers are arranged in seven concentric rings. With degeneration, the nucleus may bulge through it or it may also be trapped in it. Annular fibers cannot be taken apart by use of graspers and the need of annulectomy torelease a herniation trapped fragment is necessary or in stenosis. In cases of central disc herniation, the annularfiber between the entry point of

our sleeve/scope and the herniation is a collar, which may not allow the larger fragment to be retrieved from inside the disc. Annulectomy is mandated to release the entrapment of a large fragment and then grasping it out. Secondly in a large disc (Broad-Based Central) with enlarged facet annulectomy with foraminoplasty allows for medialization of scope closer to the tear/bulge in floor as well as roof.



The annular cutter is a basket punch and may be: **Straight**

We use the annular cutter when both tips are visualized as free of neural tissue before cutting the tissue. To visualize the tip we rotate scope in

one direction and instrument in other.

Angled annulotome is useful especially when the angle of entry is a little steep. Facet is enlarged and it may not be possible to do the annulectomy deeper within the foramen by a straight annulotome. The angled annulotome in such circumstances is of greater advantage.

10 GRASPERS

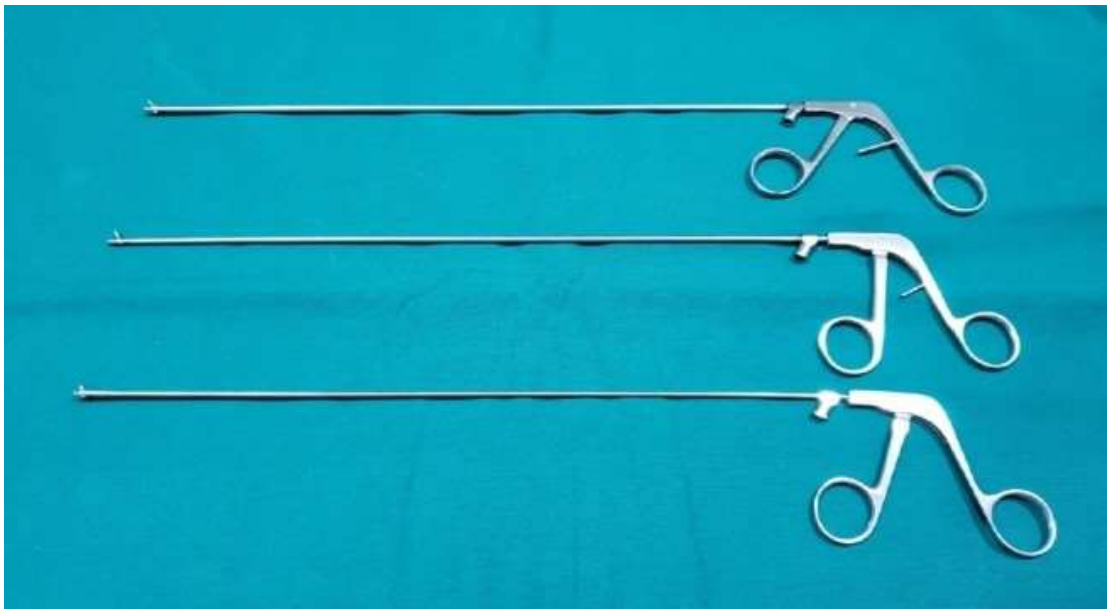
The grasper is the single most important tool for doing targeted fragmentectomy. We grasp and pull fragments and deliver it through scope working channel / sleeve. Set of good graspers is vital to reach every corner and pull out the offending fragments. The length of the graspers may vary from 30 -36 cms.

Scope has a working channel of 3.625 mm diameter. Standard graspers are available in 2.8 mm and 3.5 mm in diameter. For scopes with larger working channels graspers with 3.8 mm diameter can also be used. Graspers are classified according to:

A. Shape

1. Straight Grasper:

It is straight in orientation when used. It has jaws that open up to 75 degrees. Variation will be double opening jaws.



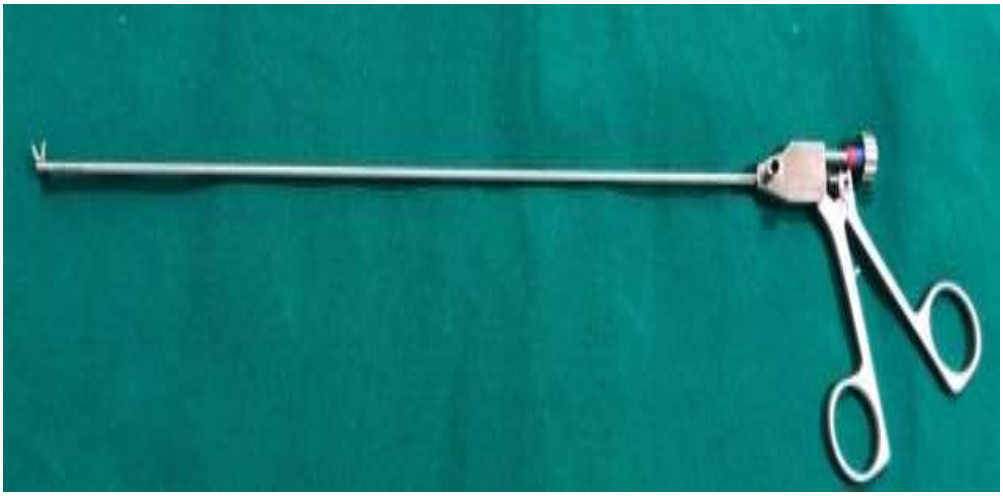
2. Up looking or oblique Oblique or Angled or Up looking Grasper: The lower lip is angled at 20 degrees from the horizon and hence the jaw opens at 95 degrees at the upper range

3. The Bendable Grasper: This instrument allows the pre-bending of the grasper.

It straightens and post passage again takes a bent form, allowing the removal of discal material from the roof of the annulus. Especially useful when removing a down or up migrated fragment by passing it through the rent in the annulus to target a migrated ruptured disc fragment. This grasper comes in sizes of 2.8 mmand 3.5 mm.

4.The Deflectable Grasper:

An external knob allows for the grasperangle to be changed from 0 to 45 degrees for both jaws. As we rotate knob one way the grasper straightens out and when handles are left lose it bends. While putting this in scope we put it straight , on coming out inside disc it bends upto 90-130 [both jaws combined] and allows safe removal of hanging tissue at roof of disc.



5. Serrated Edges Grasper:

These graspers have serrated edges, which are useful in grasping hard collagenised discal fragments or ragments attached to the end plate fragment.

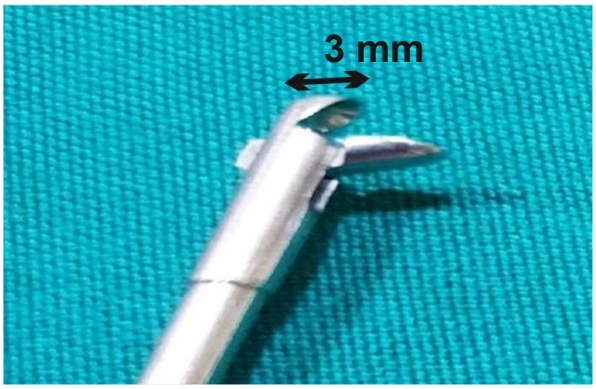
6. Dome Shaped Grasper:

Smooth edged graspers. These are for pure discal fragments.

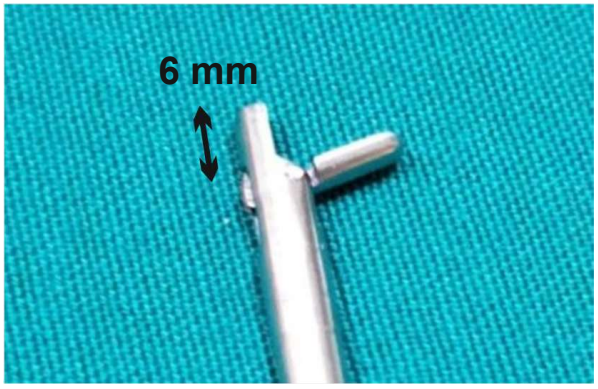
B. Length of Grasping Jaws:

The length of the grasping jaw also determine where they can be used.

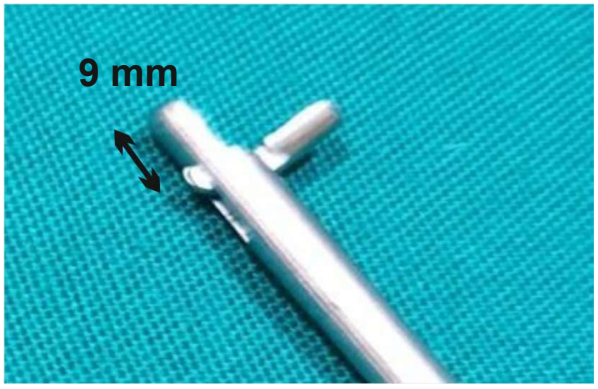
1.



2:



3.



This is a full length grasper, which is a work horse for working inside the annulus. Complete opening of the jaw allows you to remove substantial amount of disc fragmentat one time. I designed it to have jaws open 90 degrees.

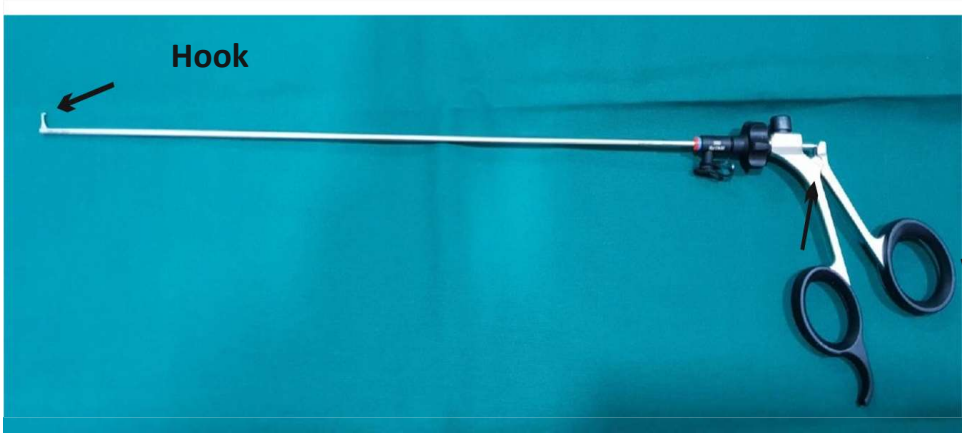
C. Direction

1. The Up-Biter

For removal of flavum and small fragments. This small jaw instrument may be rigid or bendable. It is specifically to be used to extract small hard to reach fragments and also gently remove flavum. It's bite surface is only 1 mm.

2. Deflectable PUNCH Similar to grasper jaw of the punch can be varied from 0 degrees to 75 degrees and further opened to 110 degrees. This allow for easy extraction of fragments entrapped in the annular roof. After the grasping as we close handles jaws straighten out from its angled position allowing removal of fragment in one smooth action.

As you land below the herniated fragment, in the offending tear you will able to open the jaws of grasper. This indicates we have landed in exact position where we should be working. Should we be too posterior or land in the normal central disc, it will be difficult for you to open the jaws of your grasper. Should this happen, please recheck your position by AP and Lateral shoot and readjust yourself so that you are directly below the fragment, as there is an empty space left behind below the herniated fragment. This is available as punch where jaws cut than grasp. Lower jaw is rectangular window.



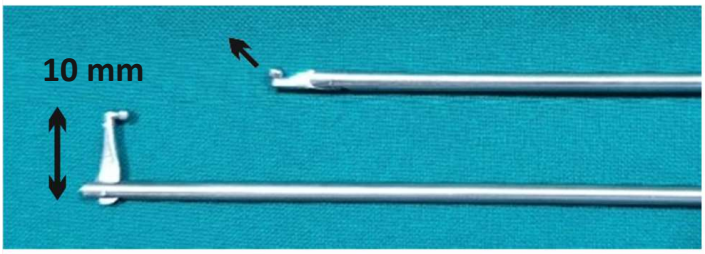
11 THE HOOK

The most important instrument which plays a great role in endoscopic spine surgery, the hook is used for: Hooking of a fragment and pulling it towards you, Probing the annulus fibrosus for entrapped fragment, Probing the epidural space through rent in the annulus, for retrieving migrated fragments, Routinely sweeping the epidural floor above the annulus after partially coming out for any loose fragments and confirming free root and adequacy of decompression, during facetectomy, use the hook at the distal end of the facetectomy to separate the flavum or adhesions from the bone, prior to lateral recess decompression.

Soft tissue foraminoplasty

Soft tissue foraminoplasty is removing tissue above the superior articular process. It includes the transforaminal ligament which is arising from the tip of the superior articular process and the ligamentum flavum extension that attaches itself to the superior articular process. All these tissues have to be released with other instruments like curettes and annulotome to carry out a soft tissue foraminoplasty and free the exiting root along. These are standard hooks.

Further modification allows rotation of the hook, allowing working on either end plate, without need for movement of your entire arm. Primarily in two sizes: 5 mm and the 10 mm. When deeper in the disc, the annular surface is further away from the scope. At such times, it is useful to have a 10 mm which will allow you to reach the remote annular fibers dorsally. This problem usually occurs when our entry is not bang posterolateral on the annulus but more ventral. We can correct this situation by using a 10 mm hook or changing direction of cannula by medialization or gently moving your cannula levering against the facet downwards by a couple of millimeters.



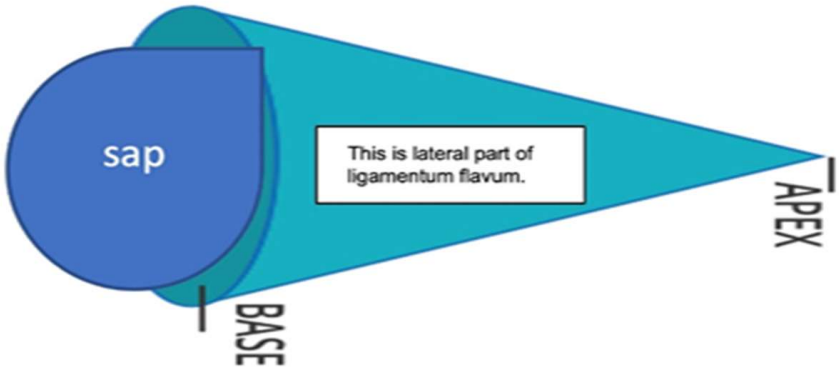
When probing through an annular rent in the epidural space try and move your scope close to the rent. The water pressure from the scope will push and float away the dura substantially, allowing you safe probing of the rent. Be prepared for some epidural ooze when you do that probe along the floor through the rent. This way you pull out fragments and also avoid pushing against the dura, expect some venous ooze from the epidural space.

As our surgery progresses, we realise cannula becomes looser as the hold of the annulus becomes loose. Also the space created by removal of loose discal fragments, allows us to hinge your cannula on the facet to become more horizontal. Generally a 5 mm hook suffices for our work.

<u>12 Curettes:</u> As mentioned above they are in 3 forms straight, left or right sided. Left sided on used on top oi right SAP on the tissue cone.

28163 FKA **CLICKLINE Curette,** bendable to 90°, **rotating,**
with LUER-Lock irrigation connector for cleaning,
size 3.5 mm, length 36 cm
including:
Metal Handle, without ratchet,
with larger contact area
Outer Sheath, with working insert

Right SAP tip with its conical soft tissue cap seen. Right side of image is cephalad towards pedicle above.



Curette spoon offset to the left

28163 FKF **CLICKLINE Curette,** bendable to 90°, **lateral cutting left,** with LUER-Lock irrigation connector for cleaning, size 3.5 mm, length 36 cm
including:
Metal Handle, without ratchet, with larger contact area
Outer Sheath, with working insert

Curettes are my designs and contributions to spine endoscopy instruments for use in stenosis.

13 BIPOLAR RADIO FREQUENCY CAUTERY

The use of radio frequency cautery in surgery involves the passage of high-frequency radio waves of 4.1 MHz through soft tissue to cut, coagulate and remove tissue. RF waves make the water molecule in the cell to oscillate at that frequency and the cell bursts. The RF works only in tissues which have water in them. This is Cold cautery and No spread of heat. Radio frequency has many advantages over conventional cautery mainly quicker operating time, Rapid healing of tissues, less tissue damage, less post-operative discomfort. Radio frequency bipolar tip, energy passes between the two poles of the electrode. The resultant release of energy produces vapour. Radio frequency induces intracellular oscillation of water molecules and elevation of intra cellular temperature. When the intracellular temperature reaches 60°C, instantaneous cell death occurs. As the

tissue is heated between 60 to 99 degrees, the simultaneous process of tissue desiccation and protein coagulations occurs. If the intracellular temperature rapidly reaches 100 degrees then the intercellular contents undergo a liquid to gas conversion and into a massive volumetric expansion resulting in explosive vaporization. We are able to use this new technology in plasma cautery, with a working tip designed by me with bonss ®, called cannon.

Radio frequency electro surgery is performed using a bipolar RF electrosurgical generator and hand piece which, usually has two electrodes that is bipolar in the contact instrument. As we are using bipolar an inactive skin pad is NOT needed. Wet field electrosurgical systems operate in a saline solution. Heating is a result of alternating-current that passes between the two electrodes and is usually greatest when the current density is the highest. Therefore, the smallest tip of electrode will generate the largest amount of heat, especially when the system is operating in coagulation mode the voltage is higher, tissue remains grossly intact but cells are destroyed at the point of contact, and smaller vessels are destroyed and sealed, stopping capillary and small arterial bleeding. Using bursts of several tens of microseconds in duration, the tissues cut but the heat diffusion zone does not extend on the cellular scale to more than 1 mm. The heat accumulation during repeated applications of burst is also vital to allow sufficient delay in between the bursts, allowing the tissue to cool down. This proportion of on and off time are varied to allow control of the heating rate. This technology is called pulse width modulation and are features of advanced RF machines.

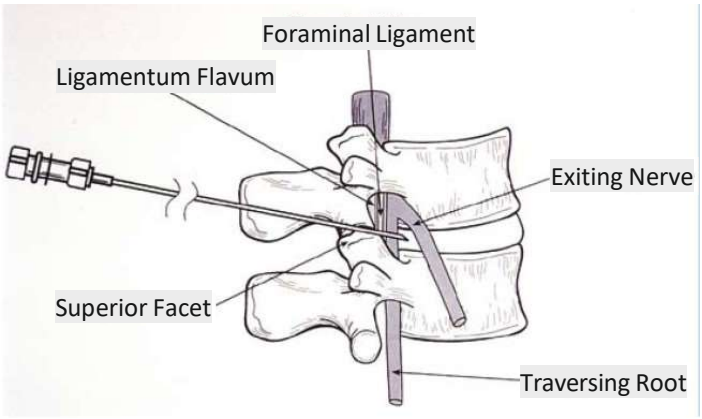
6 TECHNIQUE

INSIDE-OUT TECHNIQUE

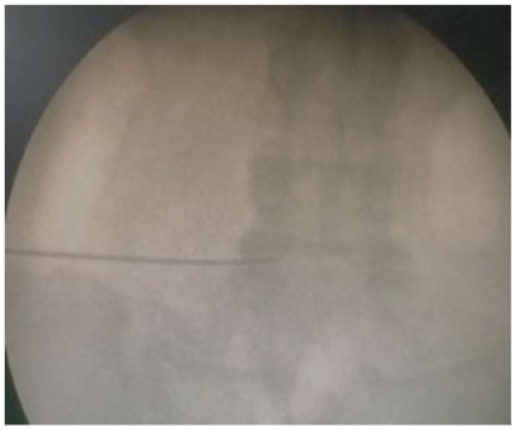
Dr. Yeung and I published in 2001 the Inside-Out Technique, which is definitely a safer technique in the learning curve of a young endoscopic spine surgery surgeon. It was Dr Kambin (1976) who while working as a traditional post midline access surgeon with simultaneous use of a zero degree scope through the foramen came up with the idea of posterolateral corner of the disc between the two nerves, where one can with reasonable accuracy and dependability take a safe entry into the spinal disc as safe landing point. The disc is the largest avascular and aneural structure in the body and degenerative annular tear is inside out. The essential principle is Safe entry into the spinal disc and work from within, thereby keeping the barrier of the annulus between working instruments and the neural tissues.

Technique Steps

Position the patient prone on specially designed bolsters with proper headrest. Skin entry is at 10 to 12.5 cms from the midline. Skin and tract infiltrated with 2% Xylocaine through a spinal thin needle. 18 G needle is inserted at an angle range of 20 to 30 degrees, depending on the level targeted, through paraspinal muscles towards the intervertebral foramen. The lower part of the foramen is basically selected for the entry in the DISC part of Kambin's triangle.



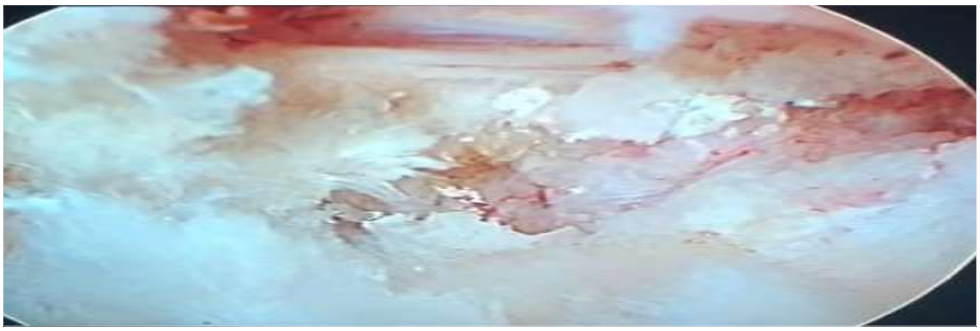
The Kambin's triangle is defined as the area between the exiting root, the traversing nerve root, and its base is the superior endplate of the caudal vertebra. Entry AP plane has to be in the medial pedicular line, in the lateral plane it should be at the posterior vertebral line near the lower end plate. Advance your needle further by about 2 cm and repeat your AP and lateral X- rays. In optimal position, the needle tip is at the spinous process line in AP view, and in the lateral X-ray, posterior quadrant of the intervertebral disc. You are well within avascular and aneural disc and are near your target the symptomatic annulus,



Although that is the end point for entering the disc I say safest way to the triangle is to hit the facet and scrape along UNDER the facet and enter the disc. This allowed entry to the disc safely but also allowed pivoting on the facet using it as fulcrum to medialize the scope. As we remove hernia material, we will be able to visualize the annular rent and the tail of the fragment. Through this rent pull the fragment into the disc for removal. We will be able to see the neural tube floating away through this annular rent. With a hook, probe and sweep the epidural space to check for any loose migrated fragments, pulling them back in the disc.

After we clear the central area, pull back working sleeve into the Foraminal zone. We clear this posterior-lateral corner of any further fragments and then pull sleeve out even a little further. At this location, the tip of the cannula is anchored in the annulus because of the bevel and 25-degree scope visualization, now we are able to visualize: Facet undersurface, Epidural fat annular fibers, track in the disc. Probing the annular rent for retained fragments can be done safely.

Image above shows use of hook around pedicle tip has gone thru annular rent. Image below 1 is intraoperative image showing nerve traversing seen through annulotomy and 2 Use of bendable grasper for migrated fragments.



Matthew described the foraminal ligament as the door to the foramen. His approach advocated a more horizontal trajectory to the disc and visualization. Our target thus changed from central nucleus to symptomatic post annulus on both its symptomatic inner and outer surfaces and also the epidural space. Dr. Yeung introduced bevel of sleeve or cannula end. This provided visualization of the epidural space while targeting the base of the herniation, allowing for protecting the exiting nerve root and simultaneous visualization of all the structures mentioned above and at the same time. YESS system with its oval design and the concept of the working channel through the scope revolutionized endoscopy, allowing simultaneous visualization and operation of visualized patho-anatomy. At this stage of the surgery, we are partially in and partially out of the annulus looking at the epidural space. We sweep the epidural space for loose fragments. Turn the cannula cranially towards the head position to visualize the exiting nerve root, especially in cases of foraminal and extraforaminal discs, to make sure that there is no sequestered fragment lying below the exiting nerve root. This is to ensure adequacy of surgery.

Annulectomy

Annulectomy is the process of cutting the annulus of the posterior part of the disc. It is done for a number of reasons:

- Annulectomy is needed to release a large herniation which we are unable to pull the herniation into the disc. At such times release of tight collar around the neck of the fragment, will allow us to free the fragment and remove it.
- Annulectomy also allows you to medialize the scope when dealing

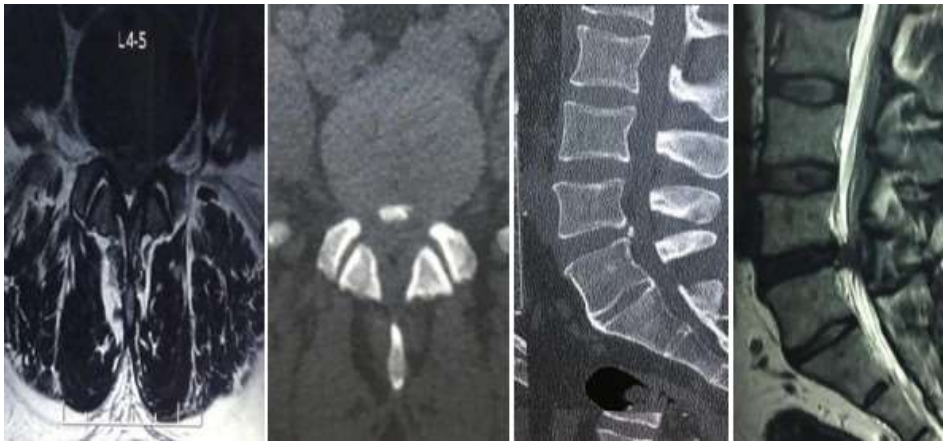
with a central herniation, enlarged facet may also need a foraminectomy, or hinge on the facet to reach the post lat annulus target.

- Annulectomy lowers the floor of both the lateral and central canal especially in case of stenosis, as a bulging disc can occupy unto 20% of the central canal space, easily detected by loss of natural concavity of post annulus.

- This is most relevant in patients with chronic non-healing central annular tears, causing chronic discogenic back pain.

- In cases of lateral canal stenosis due to disc bulge, even a single mm shift can mean a 33% volume enhancement of the space needed by the exiting root (Lee and others). This means that a patient can gain substantial long-term relief because the annulus nucleus complex is the cause of symptoms.

- In the case shown below, annulectomy was needed for ossification of the annulus in a hard calcified cartilaginous disc causing foraminal and central stenosis seen clearly in the CT scan cuts.

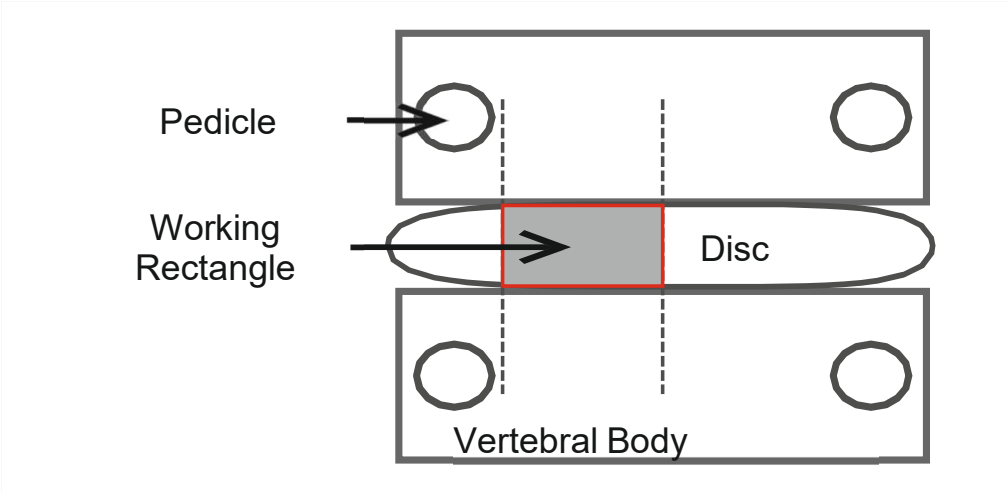


We end surgery by putting in the Dervan plug as explained below. This was developed at Dervan medical college by our team Dr. S M Nadkarni, Dr. P Kohli, and Dr. Bhupesh Patel.

About 15 ml of blood is drawn and immediately (before clotting cascade is triggered i.e. less than a minute and without any anticoagulant) transferred to an autoclaved plain glass tube with a cap and centrifuged at 3000 rpm for 10 minutes. Thereafter, a standing time in the centrifuge of 10 minutes is allowed. Blood in the tube after centrifugation of 3000 rpm for 10min and 10min of standing time, separated in three fractions, upper fraction of acellular layer, middle of PRF and bottom fraction of RBC's. Using aseptic precautions, the tube is then uncapped by the circulating theatre personnel and the plug is lifted from the tube and is ready for insertion through working cannula at symptomatic annular tear or annular rent. This plug is placed in the cannula and pushed into the disc using the dilator to seat it at annular defect or rent at the end of the procedure.

We remove sleeve and close the wound with a small surgical tape. That is the completion of endoscopic spine surgery.

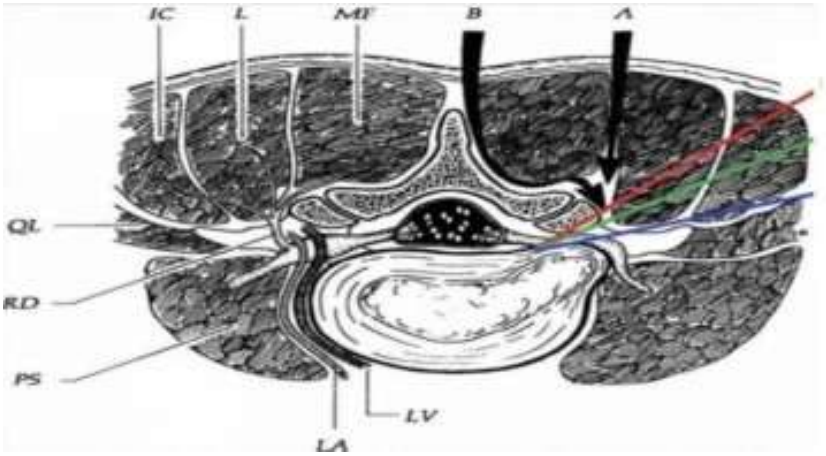
The inside-out technique is an all-inclusive technique capable of handling all endoscopic spine surgery contingencies in the safest manner. In endoscopic surgery, commonly we use uniportal one sided approach. We cover symptomatic posterior annulus from inside. Inside out is more physiological as degenerative annular tear starts from inside. We cover half of the annulus in interpedicular distance. This working part of annulus is working rectangle seen in fluoroscopic view, it is bound by endplates and midline and medial pedicle line.



Surgical endpoint is the total relief of leg pain, no pain on extension on table, free movement of annular flaps on coughing, adequate removal of fragment matching the image, tip of fragment having vascular reaction indicating complete removal of the offending fragment, a loose nerve root pulsating and easily moving with the water column and epidural fat coming in and out of your field are generally the endpoints of surgery. This can also be confirmed using the hook to sweep the epidural floor and superior and inferior notch of the foramen.

B OUTSIDE-IN TECHNIQUE

Dr. Thomas Hoogland started using trephines & reamers under image intensifier guidance as a method of foraminotomy to increase ease of epidural access to the herniated disc. It was developed to create ease of access to the non-contained disc in the epidural/sub posterior longitudinal ligament space for central/paracentral and migrated fragments. The access was developed as a blind procedure using large bore trephines and reamers, under image intensification making sure not to transgress the medial pedicular line in anterior-posterior view under C-arm. Foraminotomy increases the volume of the foramen however it ignores pathologies in the foramen. Dr Yeung and I advocate concept of visualized foraminotomy after visualization of the furcal nerve and anomalous sympathetic nerves in the foramen. I suggest use of the curette in foraminotomy for removal of the superior articular process and in stenosis to scrape soft tissue away from bone.



Green line is inside out access, red is outside in. The blue is far lateral. The outside in access is fluoroscopy guided not endoscopic.

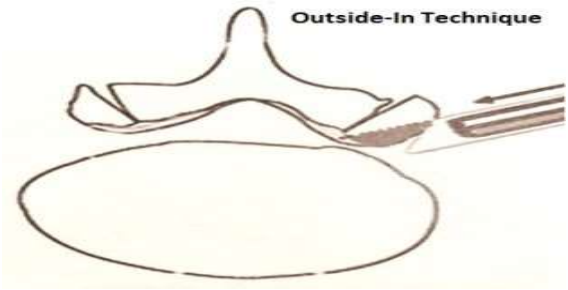
Procedure

In the outside-in procedure (Hoogland technique) the entry point is a little more medial as compared to our standard inside- out procedure.

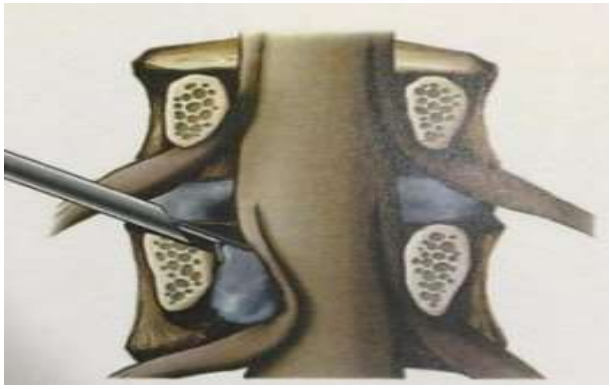
Far Lateral

- Under image intensification guidance, theneedle is aimed between the lateral pedicular line and the middle pedicular line in anteroposterior view and in the lateral view.
- Needle is dockedon the lower part of the facet with the eventual aim and target being the roof ofthe lower corner of the Kambin's triangle.
- Infiltrate the facet capsule and continue infiltration while withdrawing to infiltrate the track up to the skin with 2% Xylocaine.
- Using a 2 mm guide wire start drilling through the outer part of (the superior articular process) the facet and into the disc.
- As we cross the facetal window in lateral view, stop drilling and gently push theguide wire making sure that the patient does not feel any pain. Making sure that we are not hurting or damaging root and anchor into the discbelow.
- Now using the serial Hoogland reamers gradually cut through non-articulating part of the body of the superior articular process. You can use the reamers going upto 8 mm but at all times make sure that youdo not cross the medial pedicular line in anteroposterior view and only cross the foraminal bone arch in the lateral view.

In place of reamers, one can use serially large trephines to remove the bone as when you use trephines the bone gets in trapped within the cavity of the trephines and is easily removed. This outside-in technique allows you to medialize and position scope close to herniated fragment and for evacuation of fragments from the epidural space, herniated and non-contained.

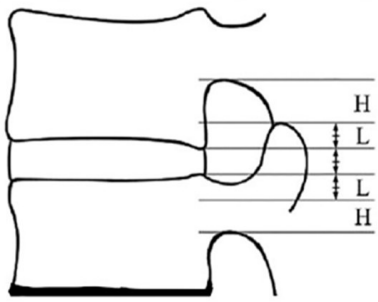


The drilling of the superior pedicle of the inferior vertebrae along with the undersurface of the facet is more safe way at achieving a caudal position of sleeve for retrieving a highly migrated disc fragment.



Direct epidural access by undercutting the facet is the key point of outside-in surgery. Even pediculectomy may be needed. As outside-in surgery is essentially blind and is done by use of serial reamers, one must be very sure and have a detailed study of the MRI prior to surgery, to make sure that there is no anomalous nerve root, furcal nerve or any venous malformation within the foramen. If one is not careful, complications such as dyasthesia / exiting root injury/causalgia due to irritation of the DRG and copious oozing is likely.

MIGRATED DISC: Migration of disc is classified as up migrated down migrated depending upon the direction of migration after its extrusion from the confines of the annulus. If migration is more than the disc height in a sagittal MRI, then it is classified as highly migrated. If it is less than the disc height in a sagittal MRI, then classified as low migrated by Lee /Wildermuth and others. Down migration is through a tear in annulus at inferior endplate, and up migration at superior.



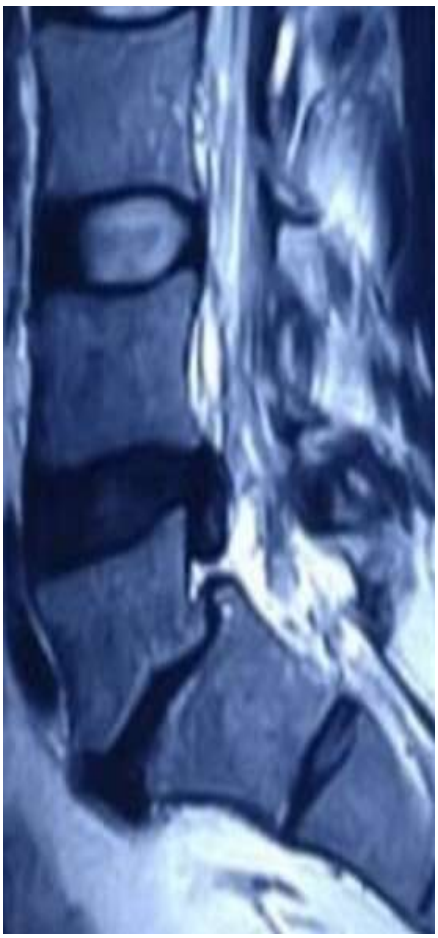
H=High-grade migrationL=Low-grade migration
L = Low-grade migration

Migration is referenced by:

A. Direction,
B. Distance equal to / beyond height of disc.

Inside-Out Technique:

In sagittal as well as axial views of MRI, check for continuity of the fragment with the rest of the nucleus. The presence is the key to extraction of this fragment in the inside-out technique by using hook. Plan your angle of entry exactly in the direction of the migration by an angle of 20° to 30° with the eventual aim of landing at the base of the fragment. This will again depend upon whether the fragment in the axial plane is paracentral or central. Plan your angle of entry as usual but use the hook.



We search rent between the annulus and the endplate. Identify fragment tail and pull in the migrated fragment with the hook.

Note that this may not be successful all the time. Sometimes, a fragment is completely sequestrated and is not attached to the rest of the nucleus. At such times it is necessary to probe the epidural space through the rent in a safe manner to mobilize the fragment back into the rent for extraction. This may entail enlarging the rent if the fragment is large and the rent is small.

By positioning of your sleeve in the LINE OF SIGHT of the migration, work towards the junction of the annulus with END plate, inevitably we come across the rent. With radio frequency wand, probe this rent and clear out the loose tissues around the rent. If the fragment has continuity with the rest of the nucleus, pull it in. If the fragment is highly migrated and you are not confident that you have pulled in all the fragments, use of the hook becomes important. Push the hook through the rent and bend it so that it sweeps space around fragment. The hook is not directed towards the dura but towards the posterior vertebral surface add flexible grasper. The surgeon is able to pre bend the grasper and push it through the rent into the epidural space and target the removal of the fragment. Annulectomy up to the midline will allow sweep the area on the back of the vertebral body below the axilla superiorly and in case of inferior migration on the lower vertebral body.

In the case of an extraforaminal disc, we have a more vertical approach by starting closer to midline and once inside the disc, flip the sleeve/scope 180 degrees to see ventrally outwards at the base of the tear and proceed to remove the fragment. Remember, the entry will be in the exit part of the foramen closer to the lateral pedicular line in anterior-posterior view.

The outside-in technique:

Surgeon approaches this problem in a slightly different manner. The targeting of the disc is essentially thesame. Use of round cannula without tang isessential. The sleeve is positioned outside the annulus on the floor of the Kambin's triangle, ANNULOTOMY IS NOT DONE but ventral facet is removed.

In the case of superiorly migrated discs, the release of the soft tissues adherent to the superior articular process along with the release of the superior transforaminal ligament and ligament flavum, if necessary. This will allow an epidural positioning of the cannula helps extract fragment from below the axillaand the exiting nerve root. In the case of down migrated fragments bony foraminotomy is necessary, to allow for advancement of the cannula into the epidural space to pull out the sequestered disc fragment. Here, a regular cannula with tang may give bettervision. It is advisable to carry out discography along with an injection of indigo carmine or methylene blue so as to mark the displaced fragment. This helps inidentifying it in the epidural space.

In all these maneuvers whether inside- out or outside-in, please remember to frequently check your position on the image intensifier along with your direction and the position of your instrument in the epidural space in relation to the pedicle of the concernedvertebrae. In patients of highly migrated disc fragments, it greatlyadvantageous to pre-inform the patientof the likelihood of failure to extractfragment, and immediate need to proceed with the salvage procedure like interlaminar posterior endoscopy or microscope assisted microdiscectomy. We insist on an immediate

post-operative MRI and switch to a salvage procedure mentioned above. This will be important during your learning curve which will gradually improve and you will achieve the ability to extract the highly migrated disc fragment.

Oblique pediculectomy is necessitated when trying to extract highly down migrated disc fragment, which is lying medial to inferior pedicle, essentially along with undercutting of the ventral non-articular part of superior articular processes. This will allow access to your scope in the epidural space and allow you to look down parallel to the pedicle at the fragment. With the above-mentioned techniques and the use of the hook, it is possible to retrieve highly migrated disc fragments by a transforaminal endoscopic approach with great success.

The only absolute indication of proceeding with an interlaminar approach is when the disc herniation fragment has migrated dorsally, that is, it is abutting the lamina. Here, it is impossible by any means to transforaminally endoscopically retrieve such a fragment.

The outside-in technique requires an advanced level of experience and has a higher possibility of complications for a beginner.

<u>For Foraminal and Extraforaminal Disc Herniations by Epidural Placement of Scope:</u>

A large fragment will very likely lift and push the exiting nerve root in an upward direction towards the cephalad and dorsal part of the foramen. Entry in such a foramen has to be carefully done with the needle placed closer to end plate of the relevant vertebra.

When passing the needle in such cases, see that you target closer to the upper end plate of the lower vertebra landing in the lowermost corner of the Kambin's triangle. Here the advantage of awake and aware anesthesia helps guide you. As you're passing the needle be aware to monitor the patient's response, the absence of pain/jerking of the limb will ensure that you are not on the displaced exiting nerve root.

As you are targeting the outer part of the foramen and extraforaminal disc herniations, it is not possible to reach this area with the standard targeting approach. In this case, one has to be closer to the midline (8 to 10 cms) and has to have a steeper angle of entry. This will make sure that you land in the outer part of the foramen thereby, coming close to the extruded discal fragment.

- After docking your needle, gradually start dilating by using 2 mm dilator, then by a 4mm dilator, followed by 6 mm dilator. This gradual dilatation allows you to gently push away the exiting nerve root. By any chance, should the exiting root be very close to your point of entry, slowly with gentle turning movements reach the posterior vertebral line with your dilators in the lateral X-ray but do not cross the posterior vertebral line.
- You now have made space in the foraminal zone.
- Slowly pass the sleeve over the dilator, keeping a watch on the patient's response.
- Again, make sure that your sleeve does not cross the posterior vertebral line.
- Use the round sleeve with minimal tang, so that you do not inadvertently damage the exiting route.

- Turn slowly and gently towards the 3 o'clock position in case of right side surgery, you will be able to visualize the exiting root with a small amount of fat, which surrounds the root and the protruding disc below the root.
- Use of a probe or hook at this stage helps to mobilize the exiting root from theherniated sequestrated discal material.
- Manipulation of the root will cause some pain and discomfort to the patient. This would be the perfect time to inject 2 cc of 2% Xylocaine to numb the root and a smallbolus of Fentanyl to put the patient to sleep.
- Proceed to grasp and remove the sequestered herniated disc thereafter.
- Under direct visualization, you may push your instrument into the disc space tocomplete the rest of the surgery as a typical inside-out procedure. Only remember to flip your sleeve and scope by 180 degrees so that you are visualizing laterally / ventrally as needed.

<u>For Paramedian and Central Herniations</u> (with sequestered fragments lying by theinner side of the facet by epidural placementof the scope).

- Standard needle placement in AP and lateral position is needed.
- In the upper part of the foramen a soft tissue foraminoplasty has to be performed, at the tip of the superior articular process along with lateral flavum release once that is achieved the surgeon is able to clearly visualize the neutral structures
- Almost up till the midline, the spinal disc annular surface will be seen at 6 o'clock position on your monitor and the dural structures

will be in the mid-screen area.

- Visualization of the facet will be at 12 o'clock.
- The Herniated /extruded fragment lying below the dural structure will now be visualized and can be safely grasped/cut into and pulled out subsequently. If your angle is right, you may extend the annular rent towards you laterally and you may beable to probe into the sub-annular area forany further free fragments.
- At this stage, you may enter the disc using dilator and proceed intra-discally inside-out to deliver the best result.

All migrations are commonly paracentral because the tear is always towards the edge of the PLL asthe PLL is fixed in the midline. Size of the foramen is larger cranially and is round. The lower part is narrower because ofthe overhang of the facet joint. Protruding facet in the lower part of the foramen makes the foramen smaller. Hence, in an MRI the exiting root and surrounding fat are seen in a keyhole shape. The overhang of the facet will prevent epidural positioning of scope. Under visual guidance, we have three options

1. To use a high-speed burr. Burr size being 3 to 3.5 mm.
2. Just use a slow speed burr with a low-speed drill and
3. To use a trephine of 3 mm.

All the above work through the working channel of the scope under visual control. The other option is to use instruments that work through sleeve, thereby enabling the use of larger diameter instruments with the help of imageintensifier guidance, but lacking visual guidance and essentially a blind procedure.

Here the surgeon has the option of using:

- Large diameter (5 mm - 6 mm) trephines.
- Use of serial reamers of 4 mm to 8 mm popularized by Dr. Thomas Hoogland and Dr. Michael Scubert.

To minimize the risks make sure that at no time you cross the medial pedicular line border because beyond that is neural structures. At L3/L4 restrict yourself to the mid pedicular line as dural sac is larger and maybe a little out and lamina is small and there is no facet overhang. Realizing the dangers of blind trephining with larger bore trephines that can put the exiting root at risk, we have maxmore system of drills. They have a small point in front and are basically atraumatic towards soft tissues, at the same time allowing for drilling of hypertrophied bone in a safe manner. These drills allow for manual slow gradual drilling over a guide wire. Ensuring that you do not wrap or damage soft tissue along with awake and aware patient responding to the slightest of stimuli one can safely, with reasonable accuracy use the Maxmore system.

In blind foraminotomy, use needle in AP view on the outer pedicular line. Gently tap and hammer on this needle. It easily passes through the hypertrophic tissue and enters the disc. Pass guide wire through it. If we encounter hard bone I go back and drill with a 2 mm * 400 mm K wire.

As I cross the facetal line in lateral view, I push gently with hand and not drill, watching for patient's pain, as I traverse the facetal window and land at the posterior vertebral line, keeping a close watch on patient's pain response. This way I am sure not to hurt the exiting

nerve root.

The outside-in technique is a blind fluoroguided procedure and is not for the faint- hearted as one has to deal with epiduralbleeding from the venous plexus and to control this oozing higher fluid pressure is needed, that manifestin neck pain. Inside out however is safe. Annulus is a protective barrier between thesurgeon and the neural tissues.

7. DISCITIS

Complications of disc surgery. Devastating by nature if left untreated. Endoscopic spine surgery offers a great advantage in tackling this condition. The infection is localized to disc, as it has no blood supply. Resolution of infection takes a long time until vascular ingrowth occurs from the endplates; absorption of nuclear material takes a very long time with great pain and disability to the patient leaving behind destroyed vertebrae and formation of epidural or dural abscesses may result in neural injury.

Discitis manifests a few days post-surgery, with a patient complaining of excruciating pain in the spine, inability to move in bed, severe spasm, cold sweats, no recordable rise in body temperature, lightning current like sensation in both lower limbs, positive straight leg raising and in most cases pain is disproportionate to signs.

Laboratory parameters: Marginal leukocytosis,
raised ESR, CRP and pro calcitonin.
Radiology

1. Plain X-ray: Shows no early changes. CT scan: In early stages will show no signs.
2. MRI: Hypo intense signal in T1 images since inflammation will lead to loss of fat in the affected area. Hyper intense signal in T2 images due to inflammation.
3. Contrast MRI studies show: Flair response in the presence of inflammation with even the smallest fluid collection being seen prominently.

These parameters ESR; CRP and Pro calcitonin assume great importance in monitoring further course of the disease. C reactive protein is the marker that is most sensitive currently available CRP normalizes around 21 days and has a half-lifeof about every three days this means that CRPon its own should become half of whatever it is has peaked at in the second or third week. If CRP is elevated beyond the three weeks period and if there is a secondary rise after the first increase which is due to the inflammatory response of surgery then thereis 82% chance that the patient will develop a post-operative spinal infection. This sensitivity of 82% when combined withserial ESR and serial pro calcitonin values can increase the predictability and monitoring of spinal infection including response to antibiotic therapy.

TC 99 bone scan and neutrophil scan can alsohelp but the diagnosis is essentially clinical and laboratory-based with MRI giving very reliable inputs. Hence, treatment should not be delayed asendoscopy is relatively safe and easy to perform in such patients who have de novo or post open surgery or post endoscopy discitis.

FDG Pet scan has been shown to be most sensitive and specific to diagnose spinal infection with a sensitivity of 100% and specificity of 79% as compared to MRI also inpresence of hardware where artifacts canaffect MRI. FDG Pet is able to distinguish between spondylodiscitis and endplate degeneration. It can determine the efficacy of treatment and be used to decide the termination of antibiotic therapy. However, it is a costly investigation.

Sources of Discitis:

1. Skin contamination, and theatre contamination, usually Staphylococcus epidermis and Staphylococcus aureus. Both these organisms can be methicillin resistant superbugs.
2. Improperly sterilized scope and instruments,
3. Unsterile irrigation fluid or poor handling of it. Many endoscopic spine surgery surgeons prefer to use antibiotics in irritating fluids. There is nothing to prove that this is a better option than proper handling of fluids with irrigation pump in a closed circuit.
4. Relying upon gravity with the airway in the bottle or with attached sphygmomanometer bulb to increase pressure in the bottle may be the source of contamination.

Chemical Discitis:

1. This condition is caused by formalin as an agent to sterilize equipment. The disc is highly sensitive to the presence of formalin, dust and powder and vapors within the long instruments which can slowly elute themselves into the disc while doing surgery. This severe chemically induced inflammation will mimic infective discitis in the early postoperative period.
2. Endplate injury at surgery can cause chemical discitis.

Laser-induced Discitis:

Laser is now routinely used in doing for Foraminoplasty, where one uses it evaporate facetal bone and osteophytes arising from the

inferior endplate of the cranial vertebral along with evaporation of facetal capsule around the foramen. Deposition of 1260 Jules of energy, evenin the pulsed manner, in the sensitive bone end plates and cartilage can lead to sterile inflammation of the endplates / facetal bone / vertebral bone. This mimics infective discitis. Symptomsdisappear very fast, it can give rise to a confusing picture. Ho / YAG laser under irrigation results in dissipation of heat energy and will cause minimum irritation as compared to other lasers.

Careful use of laser and avoiding formalin as asterilizing medium can avoidthese two causes of discitis.

Once the clinical / laboratory parameters along with imaging studies confirm thepresence of discitis it is imperative to start thetreatment immediately. The patients are counseled about problem, given assurance of a favorable outcome if treated immediately and to undergo an immediate repeat endoscopic spine surgery.

As the patient is shifted to the theatre, the slightest of movement causes excruciatingpain, under this circumstance it is not easy toshift and position the patient on operating bolsters. Therefore prior to turning, Igenerally request the anesthetist to giveultra-short-acting GA to allow to position the patient. By the time painting and draping is carried out the patient is generally awake enough to help guide initial needle and guidewire under local anesthesia.

One has to rely upon the image intensification system when using dilator in extremely soft inflamed annulus. This puts you at risk of penetrating the opposite side and causing harm to the

patientif you are not gradual /gentle and have to advance slowly centimeter by centimeter under proper image intensification control. Inflamed annulus is very painful, sedative a small dose is necessary at entry. Once within the disc and in the proper position, infiltrate around 2 ccs of2% lignocaine to numb the pain response of the nerve endings within the disc. Subsequently, introduce sleeve, remove the dilator and introduce your grasper. With the help of the grasper, remove infective tissue and send it for pus culture and antibiotic sensitivity test. We remove multiple samples to be sure. Generally, bacterial enzymes make a good cleavage between nucleus and annulus and so with irrigation the infected nucleus will flow out as slimy material. We need to irrigateenough, minimum 3 liters of normal saline. Introduce your scope and start irrigation to flush out all the infected fluid and any loose fragments that may be lying partially necrotized within the disc. Gradually curate the walls of the disc to remove only the loose tissue. If the end plates are intact and not involved bythe disease, do not be aggressive and overdothe curating. The eventual goal is to remove Infected Nuclear Tissue. Control the disease and preservation of whatever be the possible discheight. We may deposit 1gram of vancomycin within the disc space andwithdraw sleeve. If the MRI shows the formation of an epidural abscess around this can easily be drained by putting small epidural catheter through the scope into the epidural space in a caudal or a cranial direction, catheter is gradually guided towards the abscess using the image intensifier, we see pus draining through the catheter as well as pouring out in the scope field.

We can also use a flexible 3 mm scope (available) that goes through my scope, to goepidural and reach to all corners as needed.

Vancomycin

1. Resistance to this by gram-positive bacteria is less.
2. Until the report of the antibiotic sensitivity comes through, it is not possible to decide on the specific targeted antibiotic regimen and therefore a broad-spectrum antibiotic especially targeting the gram-positive bacteria is the preferred drug of choice.

The postoperative patient will immediately feel a great sense of relief. Pain will come down substantially and will start responding to normal analgesics. We put a fentanyl patch up to 10 days. At the time of re-do surgery, we may use central line for two weeks of broad-spectrum IV antibiotic therapy, which will change course after the report of pus culture and antibiotic sensitivity arrives.

In the first week, all laboratory parameters such as CBC, ESR, and Pro Calcitonin are monitored on an alternate day basis. We use chart format and check for a gradual fall in all the three parameters. Even the CBC which is in the normal range will show some further decline. The ESR is the parameter which will show rapid response if the antibiotic therapy is working well, after having washed out and removed all toxic products. Pro Calcitonin will show a gradual decline. Until it comes within the normal range it must be monitored. It is a specific marker for infection.

By post redo surgery third day, usually sensitivity report and pus culture report will clearly specify the targeted organism. If necessary, switch the antibiotics to a more targeted regimen.

On the completion of two weeks of IV antibiotics, all the three

laboratory parameters should ideally be within or near the normal range. The third week is empirical and wholly optional. Clinically, the patient's pain should have disappeared and the patient will have started turning in bed. At this stage we give patient a lumber corset and mobilize the patient. If the mobilization is comfortable, the patient can be discharged on further four weeks of oral antibiotic therapy, as per the pus culture report. Monitor the patient over the next few months. Repeat MRI at one month with contrast should show an almost absence of inflammatory flair from within the vertebral bones. This is a definite sign of improvement. Further, repeat MRI at three and six months.

As sequelae:

1. Some patients develop spinal instability, which is the cause of recurrent pain. Such patients will need fusion /stabilization in the future. This must be explained to the patient at the time of discharge.
2. Majority of the patients, however, will show some settling of the disc and will achieve a state of severe fibrosis and stable spine.
3. In some patients, gradually the entire disc will disappear and spontaneous fusion of adjacent vertebrae will occur. However, there will be foraminal narrowing in these patients which may manifest with some pain and claudication, for which a future foraminoplasty may be needed.

The incidence of infection sure comes down as team develops responsibility and works cohesively with set protocols.

Discitis is also the bane of all spinal surgeons. The endoscopic spine

surgery surgeon is better equipped to deal with this disaster, hence discitis patients even from your colleagues who do open spine surgery can usually be treated with the above protocols. What used to once be an institutionally referred case, can now be treated in even a small set up in a bloodless manner. Implant-related discitis with abscess dorsal to the spinal cord and in posterior tissues will need additional post approach.

Pre contrast MRI

Post contrast MRI of same patient showing flair response.

Endoscopic Surgery generally has less than 0.1% incidence of infection, which is less than open spine surgery or microdiscectomy, in my hands it has been almost non-existent.

OBESITY AND ENDOSCOPIC SPINE SURGERY [by Dr Pestonjee]

Obesity is defined as BMI of 30 kg/m2 and above. It is a lifestyle disease affecting a large percentage of the population. Obesity manifests itself along with other co-morbid conditions and makes traditional spine surgery extremely challenging or very high-risk procedure.

Obesity complicates surgery by:

1. Needing a larger incision to work at greater depths.
2. Difficult retraction of paraspinal tissues, and poor wound healing.
3. Higher incidence of durotomy.
4. Greater incidence of wound dehiscence.
5. A greater percentage of wound infection.

The obese patient is prone to:

- Hypertension
- Diabetes
- Metabolic syndrome X
- Cardiac failure
- Tachycardia
- Deep vein thrombosis
- Severe sleep apnea with tongue fall

Longer periods of post anesthesia weaning isneeded, necessitating a stay in ICU and leading to massive costs. Surgery under local Anaesthesia is a great way to avoid all the above problems. Some review of theliterature does attribute higher risk of recurrence post discectomy as compared to microdiscectomy. However, the

incidence of accidental durotomy in micro-discectomy is as high as 14% even in expert hands, requiring immediate revision to open surgery. Also, the more obese the patient, the deeper the tube needed which further restricts the movement of instruments in the spine. Higher incidence of durotomy has also been seen in interlaminar approach as compared to PELD. There is 30% decrease in trunk strength after open discectomy surgery. However in PELD surgery, since there is no paraspinal muscle trauma and almost immediate mobilization, there is no reported decrease in trunk muscle strength which is important in obese patients. Endoscopic spine surgery is independent of the working distance between the skin and the intervertebral disc. The distance between skin and fascia increases but not between fascia and disc. As there is a direct visualization of pathoanatomy, the incidence of complications is near nil.

Pre-operative work up

Breathing exercises to improve peak flow. Spirometer with 2 lit O2 breathing for one hour, every day morning and evening. The patient is put in compressive stockings on both lower limbs 1 week before the procedure, to reduce the incidence of deep vein thrombosis in obese patients.

<u>During surgery</u>

Slight head high position, so that the abdomen falls away from the diaphragm, DVT pump over and above the stockings, prone position.

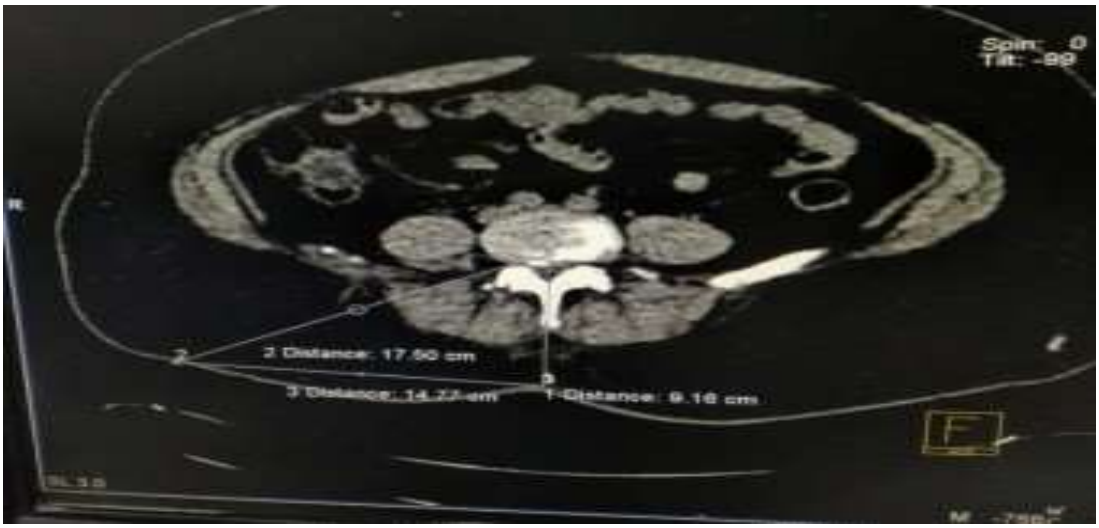
<u>Post-operative</u>

Shift to ICU for a day, Propped up to the position immediately post-op, Continue DVT pump, strict control of hypertension to avoid a poses hematoma, Air mattress to make sure no bed sore develops,

same day mobilization out of bed.

FOV view of CT scan is insisted upon in pre-operative assessment.

There however is a fallacy in the FOV view asthe patient is sleeping supine and not prone, in the prone position on good bolsters or Wilsons frame the abdomen falls away, hence about 15 to 20 % DISTANCE LESS MUST BE CONSIDERED.



This helps to calculate the distance between the center of the disc and the surface of the skin. This allows calculating the depth atwhich cannula has to go. Longer cannulasof up to 12 cms are available. The patient is preferably put on high bolsters so that the abdomen is free. Rest of the procedure is the same. As surgery is over in an average time of one hour, catheterization is not needed. The patient is mobilized within hours of surgery and discharged on the same day or the next day.

Tablet of Aspirin started 48 hours post-surgery for a period of 2 weeks until the patient is adequately mobilized. At this stage, the DVT stocking may be discarded.

Conclusion

The increased complication rates in obese patients can be due to technical difficulties associated with deep surgical field, operations taking more time, increased chances of contamination, more paraspinal muscle trauma, necrosis of paraspinal muscles and subcutaneous tissue because of more forceful retraction during surgery, higher rate of wound dehiscence due to increase tension in facial edges at time of wound closure, formation of hematoma or seroma creating internal tension on incision and post-operative leak from wound.TFE transforaminal endoscopy is the answer to all these problems of open surgery.

8. POST-OPERATIVE CARE

Post-operative care is what determines the certainty of outcomes of surgery.

This is a unique surgery and as such requires very minimal post-operative care. However, there are some factors to be considered namely, annular healing as this is not something that happens overnight and as with all disc surgeries re herniation to the tune of 4% does occur, if annulus does not heal and nucleus fragments.

Immediate post-operative period:

Patient's body has been touched only at point of pain generator and not anywhere else. Encourage the patient to walk to the washroom, this will convince the patient that he does not have much pain and can pass urine on his own. It improves and maintains proprioception that is sense of position and pressure.

From the following day:

1. We encourage the patient to sit ONLY for 5 to 10 minutes at meal time so that he can ingest food.
2. Patient is given a gentle laxative so that patient does not strain in the washroom.
3. Patient can travel to his home by bus or car or by flight, as far as possible in a gentle reclining position avoiding major jerks and impacts during travel.

4. Normally annular healing occurs over a period of 4 to 6 weeks, patient is advised not to lean forward or sit in a slouched manner. The back must be kept upright as far as possible and patient can use a lumbar belt which acts as a policeman around the waist and can prevent the patient from inadvertently bending forward. Now this is important because we do not want leaking through the annulus before it has healed and patient lands up for painful symptomatic recurrence. We must be aware that recurrence of symptoms and pain and recurrence of herniation are two different things.
5. To judge progress of annular healing we ask the patient to start extension and note pain location and intensity. The pain in leg would go away and will start centralizing over 4-6 weeks.
6. At around three weeks, patient can go for small walks around his house and neighborhood and can gradually increase the walk time depending upon his comfort by about 5 to 10 minutes every week.
7. Patient is discouraged from using an Indian toilet where the patient has hunched. Use of a western toilet is recommended.
8. Till around 3 to 4 weeks after surgery, the exiting root at the foramen can be the cause of the small amount to dysesthesia. The patient may feel small amount of tingling, numbness sometimes a burning sensation depending on the root involved. This is managed by gabapentin or similar drugs.
9. Refraining from any sexual activity is advised for a period of two months as it can be the cause of re herniation or longer recovery period and pain.
10. Car or bike driving should not be encouraged before a period of two months and definitely not for long drives.

11. Starting extension exercises around 3 weeks is beneficial and this will activate the paraspinal musculature and bring about better stabilization of the spine.
12. Please avoid exposure to extreme cold or air-conditioning as this can increase the pain that you perceive as a patient.
13. Avoid having visitors, as a bad cough /sneezing from common cold and throat infection can ruin your surgery by causing pain.

Post-operative medication

- Use of IV injectable in one dose pre -operative and two doses post- operative.
- Following this, patient is shifted on to oral antibiotics for a period of one week.
- Normally analgesics such as paracetamol is more than enough and the platelet rich fibrin (PRF) plug, that is the Dervan plug, is more than enough to relieve pain.

- Avoid use of diclofenac as it will work against the PRF plug. If I have worked in the axilla or handled exiting root, then I prefer to put the patient on one week of gabapentin 100-600 mg twice a day. If the patient has severe post-operative dysesthesia, a single shot of 500 mg methyl prednisolone is enough to take care.

- We follow with Appendix of consents.

1. Consent for diagnosis and selective blocking of back and leg pain: Root block or Intra-Discal Injection for Lumbar Spine

I, Mr. / Mrs. / Ms._____ Male / Female, Aged_____years. Education: Have (complaints and duration)

I was assessed by Dr. Satishchandra Gore on date_as per his algorithm forback and leg pain [ref: Gore Matrix] I have matrix class 1/6. I have been advised to consider injection of anti-inflammatory drug, substance to relieve my pain from back and/or leg and confirm diagnosis of pain. This injection will be given under local anesthesia at the skin and controlled fluoroscopy or C-arm X-raysto visualize the spine. I am told that this will further help in identification of pain cause as my imaging has been only partly contributory. The injection is expected to act for a short / long duration andwould in turn help in identifying the location, cause and likely mechanism of pain. This injection is **not** cure and is not likely to act forever. As the age and the cause of pain progresses it would need further treatment in future.

I have tried medication, exercises and other physical therapy and since it is not effective, and my pain is not tolerable and is hampering my activities of daily life I consent to this injection popularly called as selective nerve root block. I would be required to report its effect during the procedure and in next few days as to location, intensity and duration of relief.

After considering the above and severity and duration of my complaints I am giving my full and unconditional consent to Dr. Gore and his associate/team to treat me. I have therefore signed below and dated it before my procedure. I also give my consent to photography or televising the procedure for purpose of advancing medical education, or its publication in scientific journal. In an effort to further medical science and education I permit the presence of observers/trainees as may be authorized by Dr. Gore. I understand that my identity would not be disclosed during this and utmost will be done to guard my privacy.
I have been made aware of the contents of below publication on pain in back and leg its causation and outcomes of various alternatives of treatment.

Ref: Gore S. New emerging Gore Matrix: Basis of stitch less spine surgery under local anesthesia. J Orthop Allied Sci 2017 5:1-5. Available from: http://www.joas.in/text.asp?2017/5/1/1/209255

Name and Signature of patient: Name and Signature of relative:
Doctor explaining above sign date time.

2. Consent for Transforaminal Endoscopy Stitch Less Disc Surgery under Local Anesthesia

I, Mr. / Mrs. / Ms. Male / Female, Aged years. Education: Have (complaints with duration, location and intensity) _

I have been examined by Dr. Satishchandra Gore on date based on his algorithm [ref: Gore Matrix] for my complaints of pain in back and / or leg of duration. I have medical co-morbidities: _

He has explained to my satisfaction the likely cause and effect in relation to this pain. My pain seems to be coming from a piece of disc at the spinal level [as per scan label]_and I have been told that my disc herniation can be of 3 types. (1) Soft that may resolve over time generally 3 months (2) Firm that may not resolve totally or may take up to 8 months and (3) Hard that may not resolve naturally or up to 2 years. I am told based on images that my cause is likely to be type 2/3 that may not resolve fully on its own naturally. I have severe pain hampering my activitiesof daily life and it has not responded to adequate non-surgical treatment including rest, medication, physical therapy and traditional solutions.

I am therefore advised to consider surgery that will be done under local anesthesia using an endoscope through the side of my back to reach and remove this pain causing fragment, with my inputs during surgery. The surgery is known to help in resolution of inflammation and pain and symptoms on removal of the fragment. [Ref: Inside out technique of transforaminal endoscopy by Gore System]. In view of severity of my symptoms of above duration, location and intensity I consentto stitchless or endoscopic transforaminal surgery under local anesthesia. I will be given suitable sedation and pain relievers during surgery.

I am also told that leg pain that I have is primary target of my treatment and back pain may lingeron for quite some time. It can take 6/12/24 weeks for relief of back pain. I am aware that since this condition has been there for --- several months/years it may take longer time to resolve, may be several months. My recovery also depends on my level of physical fitness and other medical co- morbidities.

I am also told that recovery after surgery is a function not of surgery alone, but my body structure and fitness and I will be required to do exercises and a suggested post op regime to gain max benefits. My pre-operative investigations and medical co-morbidities issues as stated above have revealed the limitations that I may face in recovery and have been explained to me.

My analysis of symptoms was done based on images and my narration and I am aware that understanding of pain as it is subjective varies. There are other alternate therapies including no surgery, rest, exercises, traction and alternative therapies etc.

I have been told that despite best efforts by the doctors there is 1-2% possibility of infection at site of surgery and can be associated with dysesthesia due to use of laser in 1% patients. There is a chance of recurrence of pain symptoms in short run up to 2-5% and herniation up to 2-5%.

After considering the above and severity and duration of my complaints I am giving my full and unconditional consent to Dr. Gore and his associate/team to treat me. I have therefore signed below and dated it before my procedure.

I also give consent to photography and televising my procedure for use in advancing medical education and its publication in scientific journal. I permit the presence of observer trainees as may be authorized by Dr. Gore for the same purpose.

I fully agree to undergo the surgery on date_

Name and Signature of patient:

Name and Signature of relative:

Name and Signature of Doctor explaining above:

Name and Signature of witness:

Date: Time:

References:

1. Gore S. New emerging Gore Matrix: Basis of stitchless spine surgery under local anesthesia. J OrthopAllied Sci [serial online] 2017 [cited 2018 Jul 22]; 5:1-5. Available from: http://www.joas.in/text.asp?2017/5/1/1/209255
2. Satishchandra Gore and Anthony Yeung. The "inside out" transforaminal technique to treat lumbar spinalpain in an awake and aware patient under local anesthesia: results and a review of the literature Int J Spine Surg. 2014; 8: 28. Published online 2014 Dec 1. doi: 10.14444/1028

3. Consent for Transforaminal Endoscopic Foraminoplasty and Widening for Lumbar Canal Stenosis with Claudication

I, Mr. / Mrs. / Ms._____
Male / Female, Aged_years. Education: _ Have
(complaints and duration) _

I have been suffering from pain in back and / or leg and have difficulty in standing and walking. The duration or distance in standing and walking is
This suffering has been for duration:
I have medical co-morbidities.

I have been examined by Dr. Satishchandra Gore on date_based on his algorithm [ref: Gore Matrix below]. I have been told that my symptoms arise from narrowing of the spinal path for the nerves and are known to negatively progress as my age advances. In view of the severity of symptoms I agree to undergo surgery under local anesthesia for my lumbar canal stenosis. I have associated causes causing instability namely Listhesis, and medical co-morbidities as stated above.

My surgery will be under X-ray control and will be based on newer understanding of the stenosis, of upper foraminal causes near the nerve roots. This is different than traditional thinking where posterior midline open surgery is done under general anesthesia based only on image analysis. [Ref: inside out technique] [Ref: rethink on lumbar canal stenosis] I am also aware that if my surgery through foramen is not able to relieve me as to my satisfaction I still may need further assessment and treatment. It can also involve injections, open surgery, stabilization etc. for the emergent instability. In view of my age and morbidity I opt for the less invasive alternative.

I am also aware that since my symptoms are not fully quantifiable, and I DO NOT suffer at rest, it may not be fully and accurately understood or assessed. This understanding can be further improvedby use of imaging studies. My dynamic imaging analysis tells us that I have /do not have instability.

The plan of surgery is likely to involve stages, decompression of the nerve root and then stabilizationof the segments as per need. I have consented to this staged surgery after understanding and appreciating the value and likely improvement in quality of my life.

I am also told that recovery after surgery is a function not of surgery alone, but my body and fitness and I will be required to do exercises and a suggested post op regime to gain max benefits. Drugs and diet supplements also may be needed.

I am aware that since this condition has been there for several months/years it may take longer time to resolve, may be several months. I am also aware that natural age progression may make my results short lived

and may need further added treatment. My pre-operative investigations and medical co-morbidities issues as stated above have revealed the limitations that I may face in recovery and have been explained to me.

I have been told that despite best efforts by the doctors there is 1-2% possibility of infection at site of surgery and dysesthesia due to use of laser in 2-5% patients.

After considering above and severity and duration of my complaints I am giving my full and unconditional consent to Dr. Gore and his associate/team to treat me. I have therefore signed below and dated it before my procedure.

I also give consent to photography and televising my procedure for use in advancing medical education and its publication in scientific journal. I permit the presence of observer trainees as may be authorized by Dr. Gore for the same purpose.

I fully agree to undergo the surgery on the date _____

Name and Signature of patient:

Name and Signature of relative:

Name and Signature of Doctor explaining above:

Name and Signature of witness:

Date: Time:

References:

1. Gore S. New emerging Gore Matrix: Basis of stitchless spine surgery under local anesthesia. J OrthopAllied Sci 2017; 5:1-5. Available from: http://www.joas.in/text.asp?2017/5/1/1/209255
2. Satishchandra Gore and Anthony Yeung, The "inside out" transforaminal technique to treat lumbar spinalpain in an awake and aware patient under local anesthesia: results and a review of the literature Int J Spine Surg. 2014; 8: 28.
3. Gore S. Stable, developmental; LUMBAR canal stenosis: Rethink needed. J Orthop Allied Sci 2018 ;6,Suppl S1:3-7. Available from: http://www.joas.in/text.asp?2018/6/3/3/223047
4. Lessons Learned from 27 Years' Experience and Focus Operating on Symptomatic Conditions of the Spine under Local Anesthesia: The Role and Future of Endoscopic Spine Surgery as a "Disruptive Technique" for Evidenced Based Medicine Anthony T. Yeung* J Spine 2018, 7:2 DOI: 10.4172/2165-7939.1000413

4. Consent for Transforaminal Endoscopic Foraminoplasty and Widening for LumbarCanal Stenosis with Claudication combined with use of Implants for Stabilization

I, Mr. / Mrs. / Ms. Male / Female, Aged years. Education: I have been suffering from pain in back and / or leg and have difficulty in standing and walking. The duration or distance in standing and walking is…This suffering has been for duration: I have medical co-morbidities:

I have been examined by Dr. Satishchandra Gore on date based on his algorithm [ref: Gore Matrix below]. I have been told that my symptoms arise from narrowing of the spinal path for the nerves and are known to negatively progress as my age advances. In view of the severity of symptoms I agree to undergo surgery under local anesthesia for my lumbar canal stenosis. I have associated causes causing instability namely Listhesis, and medical co-morbidities as stated above.

My surgery will be under X-ray control and will be based on newer understanding of the stenosis, of upper foraminal causes near the nerve roots. [Ref: inside out technique] [Ref: rethink on lumbar canal stenosis] unlike image based decisions of past.

I am also aware that since my symptoms are not fully quantifiable, and I DO NOT suffer at rest, it may not be fully and accurately understood or assessed. This understanding can be further improvedby use of imaging studies. My dynamic imaging analysis tells us that I have instability. THIS INSTABILITY NEEDS ADDITIONAL USE OF IMPLANTS TO MAKE MY SYMPTOM CAUSING AREA STABLE. Stabilization is done by holding together the bones with metal implants. The utility of implants though proven has certain uncertainties due to quality of bone, age, vitality and fitness applicable to me.

The plan of surgery is likely to involve decompression of the nerve root and then stabilization of the segments as per need. This will involve use of epidural or general anesthesia. I have consented to this modality of surgery after understanding and appreciating the value and likely improvement in quality of my life.

I am also told that recovery after surgery is a function not of surgery, but my body and fitness andI will be required to do exercises and a suggested post op regime to gain max benefits. Drugs and diet supplements also may be needed.

I am aware that since this condition has been there for several months/years it may take longer timeto resolve, may be several months. I am also aware that natural age progression may make my results short lived and may need further added treatment. My pre-operative investigations and medical co-morbidities issues as stated above have revealed the limitations that I may

face in recovery and have been explained to me.

I have been told that despite best efforts by the doctors there is 1-2% possibility of infection at site of surgery and dysesthesia due to use of laser in 1% patients. After considering above and severity and duration of my complaints I am giving my full and unconditional consent to Dr. Gore and his associate/team to treat me. I have therefore signed below and dated it before my procedure.

I also give consent to photography and televising my procedure for use in advancing medical education and its publication in scientific journal. I permit the presence of observer trainees as may be authorized by Dr. Gore for the same purpose.

I fully agree to undergo the surgery on the date _____

Name and Signature of patient:

Name and Signature of relative:

Name and Signature of Doctor explaining above:

Name and Signature of witness:

Date: Time:

References:

1. Gore S. New emerging Gore Matrix: Basis of stitchless spine surgery under local anesthesia. J OrthopAllied Sci [serial online] 2017 [cited 2018 Jul 22]; 5:1-5. Available from: http://www.joas.in/text.asp?2017/5/1/1/209255
2. Satishchandra Gore and Anthony Yeung, The "inside out" transforaminal technique to treat lumbar spinalpain in an awake and aware patient under local anesthesia: results and a review of the literature Int J Spine Surg. 2014; 8: 28. Published online 2014 Dec 1. doi: 10.14444/1028
3. Gore S. Stable, developmental; LUMBAR canal stenosis: Rethink needed. J Orthop Allied Sci [serialonline] 2018 [cited 2018 Jul 22];6, Suppl S1:3-7. Available from: http://www.joas.in/text.asp?2018/6/3/3/223047
4. Lessons Learned from 27 Years' Experience and Focus Operating on Symptomatic Conditions of the Spine under Local Anesthesia: The Role and Future of Endoscopic Spine Surgery as a "Disruptive Technique" for Evidenced Based Medicine Anthony T. Yeung* J Spine 2018, 7:2 DOI: 10.4172/2165-7939.1000413

5. Consent for post op Care and Discharge

I was seen on
By Dr. Gore as per his algorithm I was told that my problem is
I was suffering from Duration
I was op on Nature of op
I have been told about the likely event of following limitations and complications.

I am told that with my medical co morbidities I may have … time for recovery to properly guide my recovery from my treatment I am now told

1. Recovery is NOT a function of the surgery but of my physical and mental fitness
2. I will follow the advice given about my post op course and care and report back to the doctor as per his written instructions
3. I may be advised by other non-scientific sources about care that I will not follow.
4. I would be closely expected to monitor my symptoms for which I was treated and give a proper full feedback and I am aware that as my symptoms are not seen a better description in its change is necessary.
5. I may have to undergo electrophysiology and imaging study to consider the trend of my recovery.
6. In case the symptoms do not resolve in requisite time I am told that images alone will not guide me about treatment. That is doing an MRI only does not help in further planning of treatment. I may have recurrence of symptoms that may not be a recurrence of pathology.
7. I would be truthful and honest in reporting in my recovery and trend so that desired outcomes will be achieved.
8. At time of my discharge Dr Gore has advised me in total about further course of action.
9. I have been given a detailed print out of instructions for my help and I will read those.
10. I have been told that in case of difficulty I am expected to call for a paid video call consultation and relevant information will be asked by Dr Gore or his team and further information and advice will be given.
11. I am aware that unless I am seen by Dr Gore or his team in person or on video it may not be possible to give further care.
12. I may need added medication for a limited period to control my flare up of symptoms.
13. I am aware that following physical restrictions is the key and

pain will have to be used as guide.

14. I am aware that each patient is unique and I will not be able to compare my recovery times against my expectations or other patients.
15. In case of use of implants or hybrid surgery about 12 weeks of consolidation is needed.
16. Since I was in pain before surgery my real level of physical fitness [not to be mixed with fitness for surgery or anaesthesia] was unknown and could not be assessed. It was entirely based on my inputs.
17. This consent is given by me after all the relevant matter has been explained and I am being sent home for my recovery.
18. I am given a copy of my discharge summary and relevant information and reports for my record.
19. I am aware that in case of issues with insurance payers my inputs will be used by the Dr. Gore or his team and I have no complaints about same. I assure that all inputs have been truthful and honest.
20. In case of deficiencies in payment from insurance I agree to cover the gap.

I am signing willingly on Date
Time Place
In presence of

Above guidelines are based on 38 years of spine surgery experience of Dr. Gore and his various publications, books and insights.

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mission.spine@gmail.com

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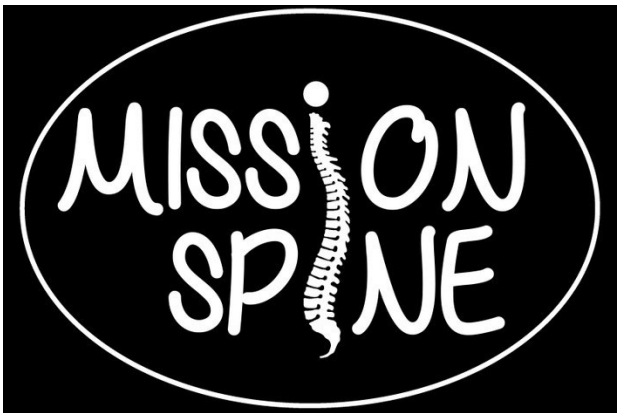

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