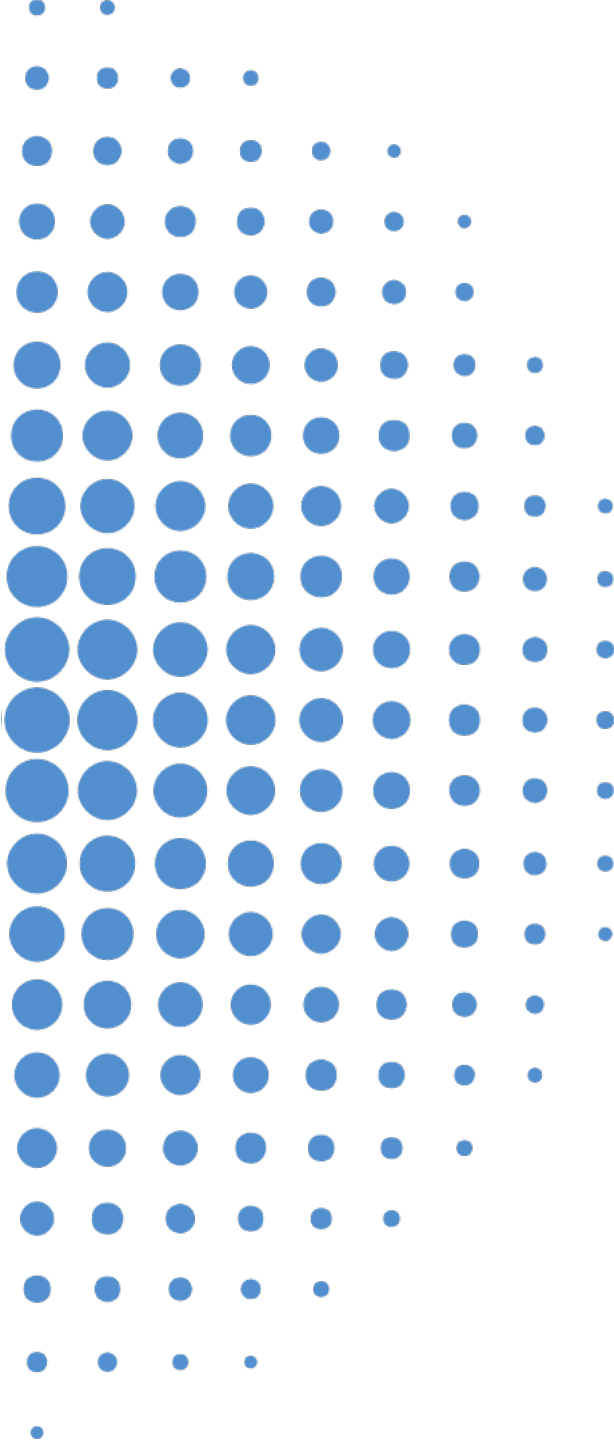




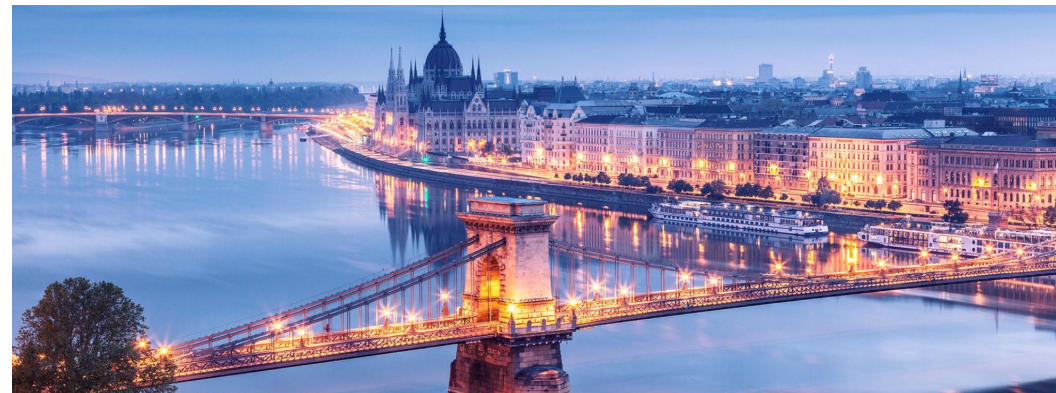
Radiculopathy

Agnes Stogicza MD, FIPP, CIPS

With special thanks for all the teaching to
Professor Gabor Racz

Disclosure

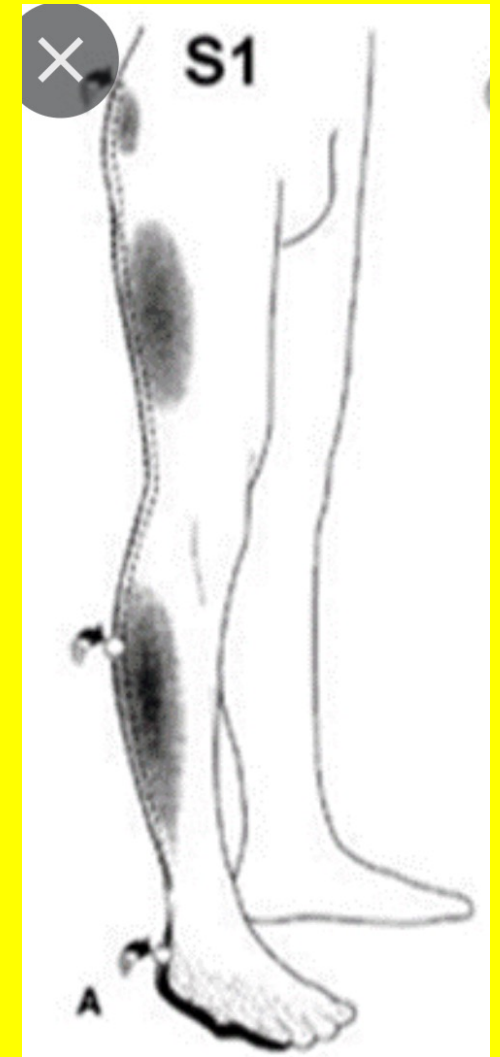
- EPIMED
- Metrum Cryoflex
- Co-founder of  **Pain School International**
- WIP Education Committee
- Vice-Chair of the Hungarian Section of WIP
- Faculty for
 - World Institute of Pain (WIP)
 - American Society of Interventional Pain Physicians (ASIPP)
 - American Society of Regional Anesthesia (ASRA)
 - World Academy of Pain Medicine Ultrasonography (WAPMU)
 - Singular



Patient #1---"VIRGIN BACK"

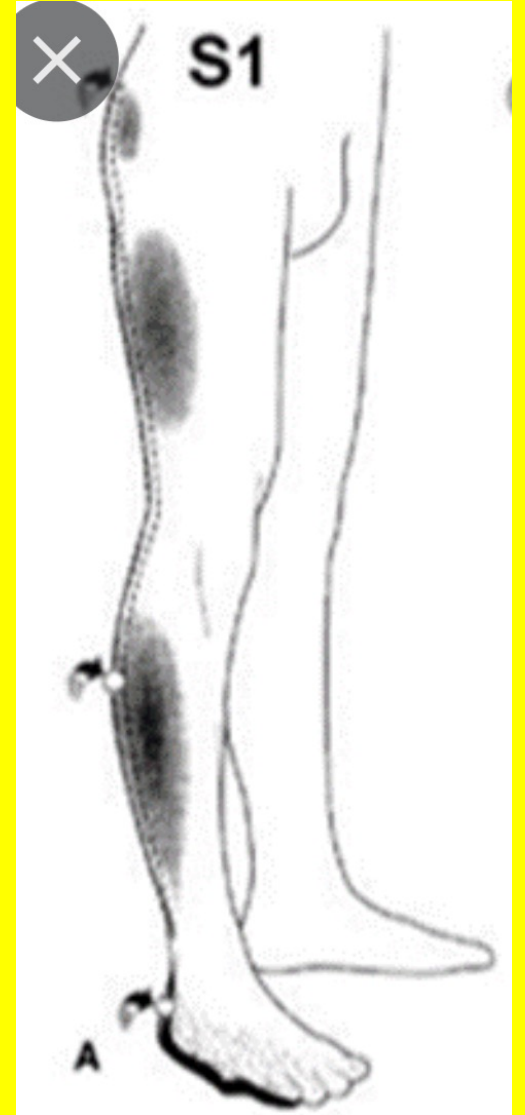
32 year old male, c/o persistent burning pain in buttocks, radiating down to the back of the leg and toe #5

- MSK: no tenderness to palpation at any lumbar area(facet, PSIS, muscles and attachments).
- Neuro: motor 5/5, preserved sensory, 2/4 DTR



Patient #2

- 47 year old male, s/p lumbar laminectomy in 2015, c/o persistent left leg pain, later L5-S1 fusion
- Patient noted initial “good” relief of left leg pain after laminectomy, but has noted a gradual return of left leg pain, “worse than it was”, as well as axial back pain
- Repeat MRI was “unremarkable”, according to the surgeon



Epidemiology

Epidemiology- Radicular pain

- ▶ The annual prevalence in the general population 9.9 – 25% ¹
- ▶ Commonest type of neuropathic pain
- ▶ Pain completely or partially resolves in 60% of the patients within 12 weeks of onset.²
- ▶ 30% of the patients still have pain after 3 months to 1 year.

1. Konstantinou K, Dunn KM. Sciatica: review of epidemiological studies and prevalence estimates. *Spine (Phila Pa 1976)*. 2008;33:2464–2472.
2. Weber H. The natural course of disc herniation. *Acta Orthop Scand Suppl*. 1993;251:19–20

Diagnosis

Physical Examination

Physical Examination

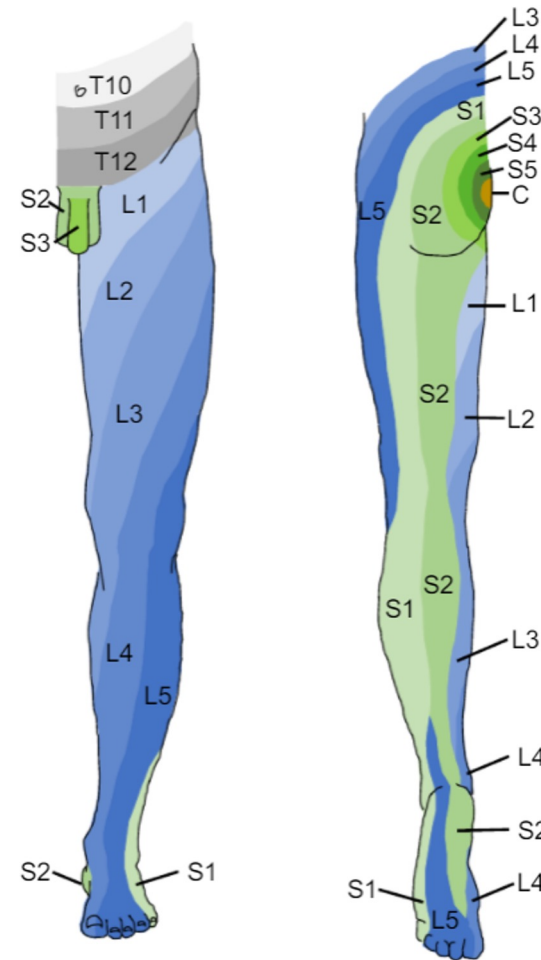
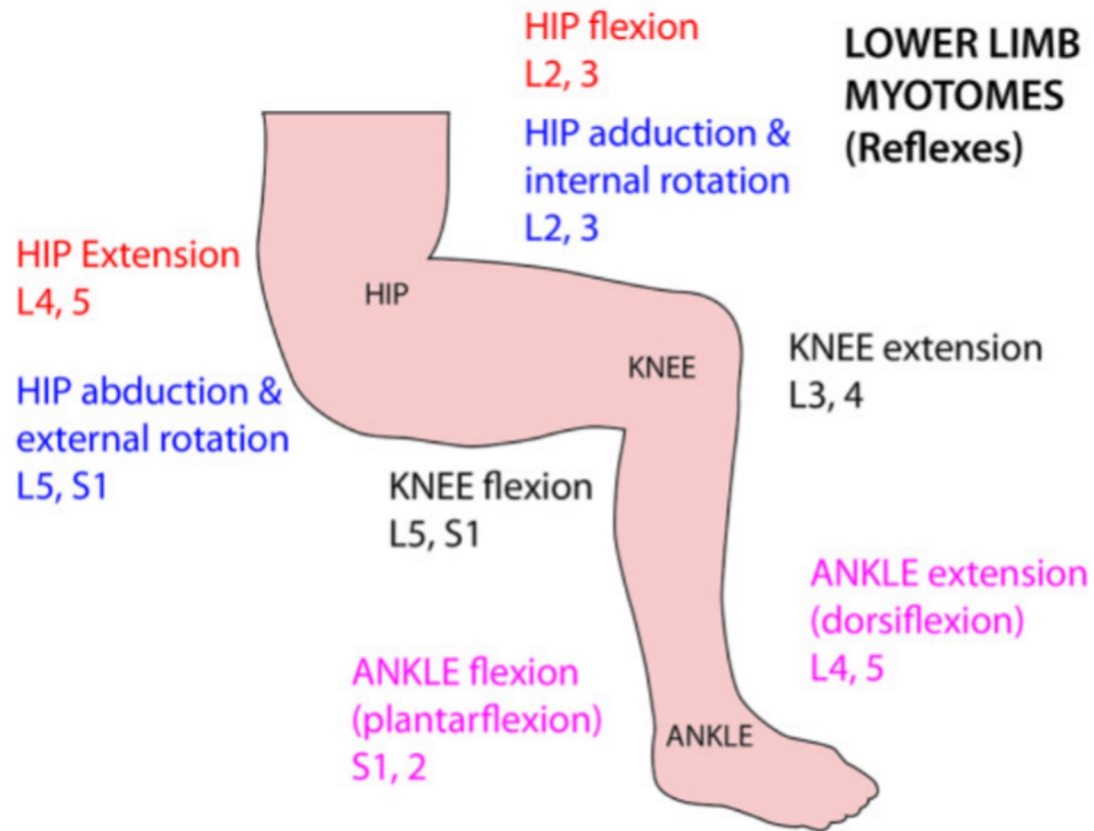
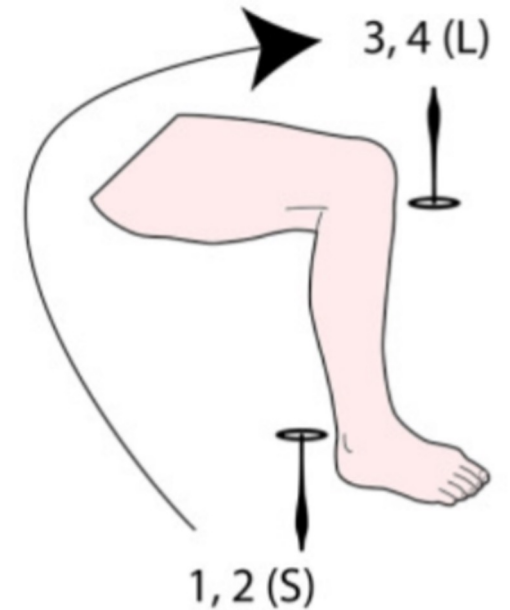


Figure 1. Dermatomes of the lower limb.



What Would Be Your First Step?

Physical exam

- MSK
 - No facet tenderness
 - No PSIS tenderness
- NEURO EXAM-neg
- SLR + 30 degrees
- Dural tug at L5S1



DURAL TUG TEST

Sit up patient with a straight leg -> bend forward flexing the lumbar spine until their back pain starts to become evident -> flex the head and neck rapidly forward.

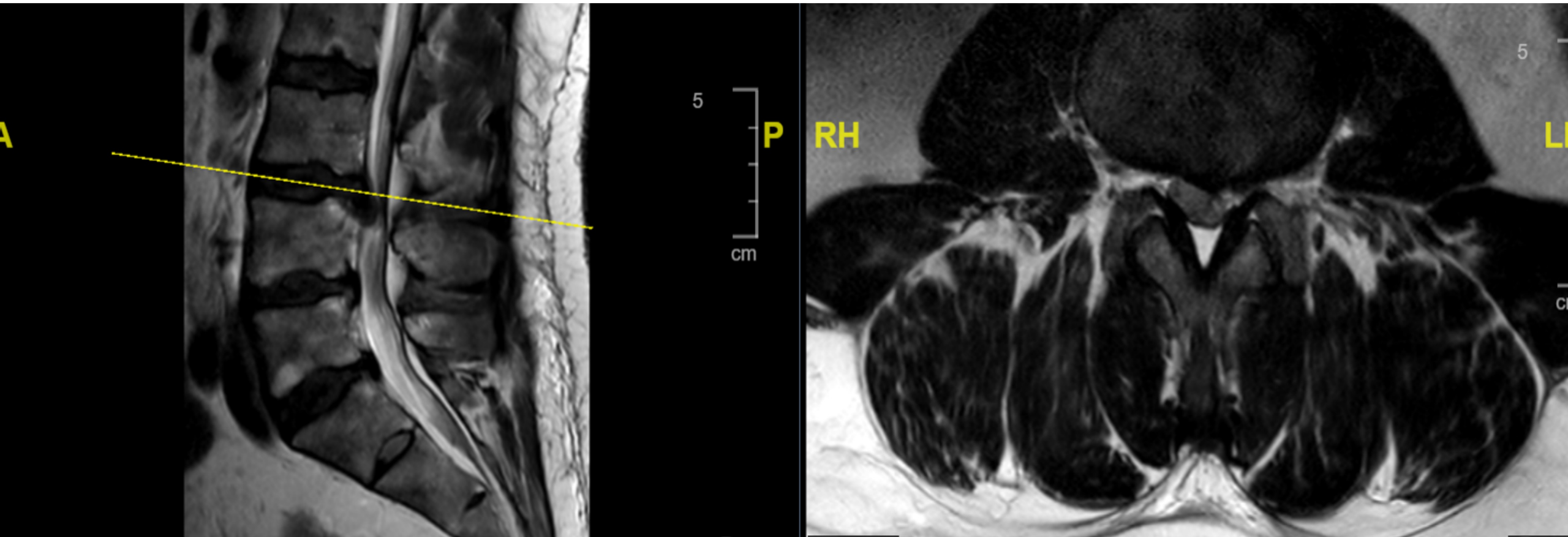


Additional tests

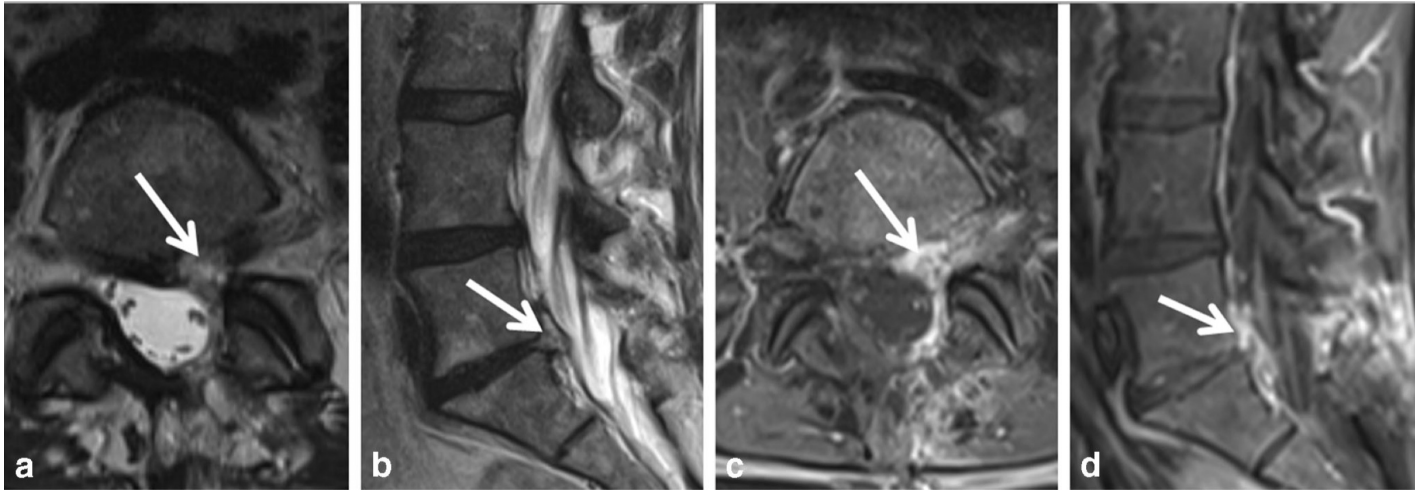
Additional Tests

- ▶ MRI (CT)
- ▶ Consider EMG if discrepancy between clinical signs and imaging

Case

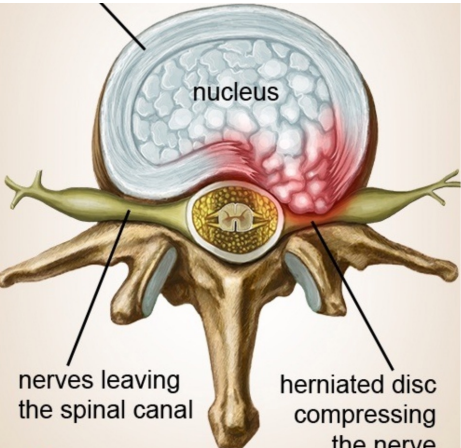


Radiculopathy- Pathology

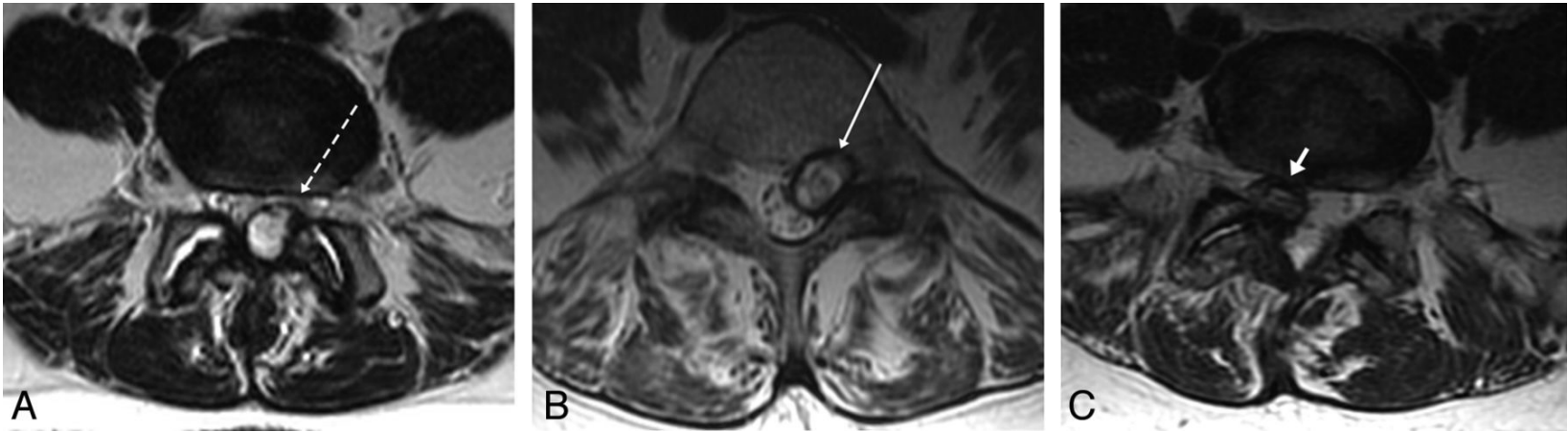


Epidural scarring

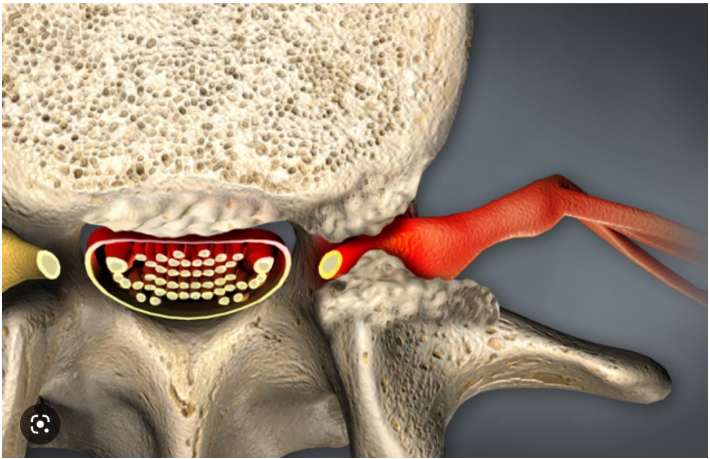
Passavanti et al, 2020 Skeletal Radiology



Disc herniation



Facet cyst



Bony stenosis

Differential Diagnosis

Differential Diagnosis

- ▶ Consider SI Joint disease
- ▶ Facet Joint Pain
- ▶ Discogenic Pain
- ▶ Piriformis Syndrome
- ▶ Tumors
- ▶ Infection
- ▶ Hematoma
- ▶ Spinal trauma

Pain intervention strategy

Pain Management Strategy

Conservative :

► Medication :

- acetaminophen, NSAID, oral steroids, opioids, topiramate, pregabalin, gabapentin

◆ no sign./clear favourable effect low quality evidence

► Physiotherapy

Pinto BMJ 2012 , Goldberg JAMA 2015, Rasmussen Cochrane 2016

Baron Pain 2010, Mathieson NEJM 2017

Finnerup Lancet 2015, Enke CMAJ 2018

TREATMENT OPTIONS

Next Step? Intervention?

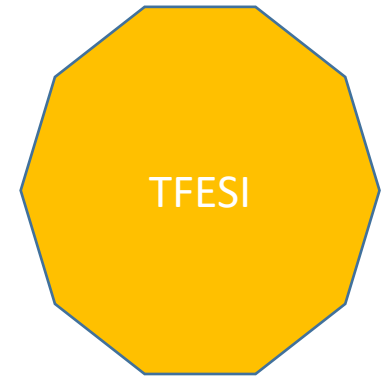
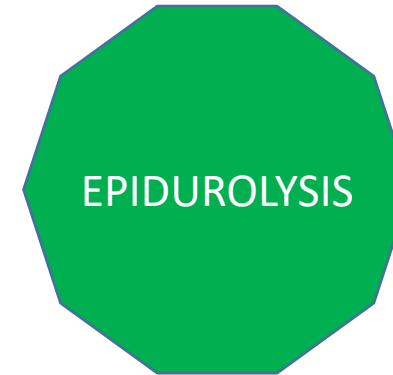
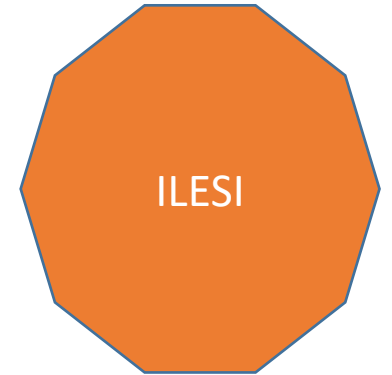
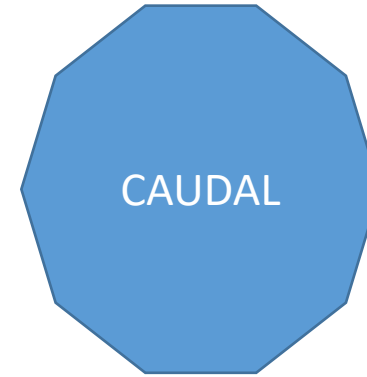
- ? Epidural
- ? Caudal
- ? Transforaminal
- ? Epidurolysis
- ? Epiduroscopy

SCS

Disc procedures

Things to consider

- Patient selection/pathology treated
- Diagnostic value
- Likelihood of pain relief
- Length of pain relief
 - Meds you are able to inject
- Complications
- Ease of procedure/proficiency in performing procedure
- Price



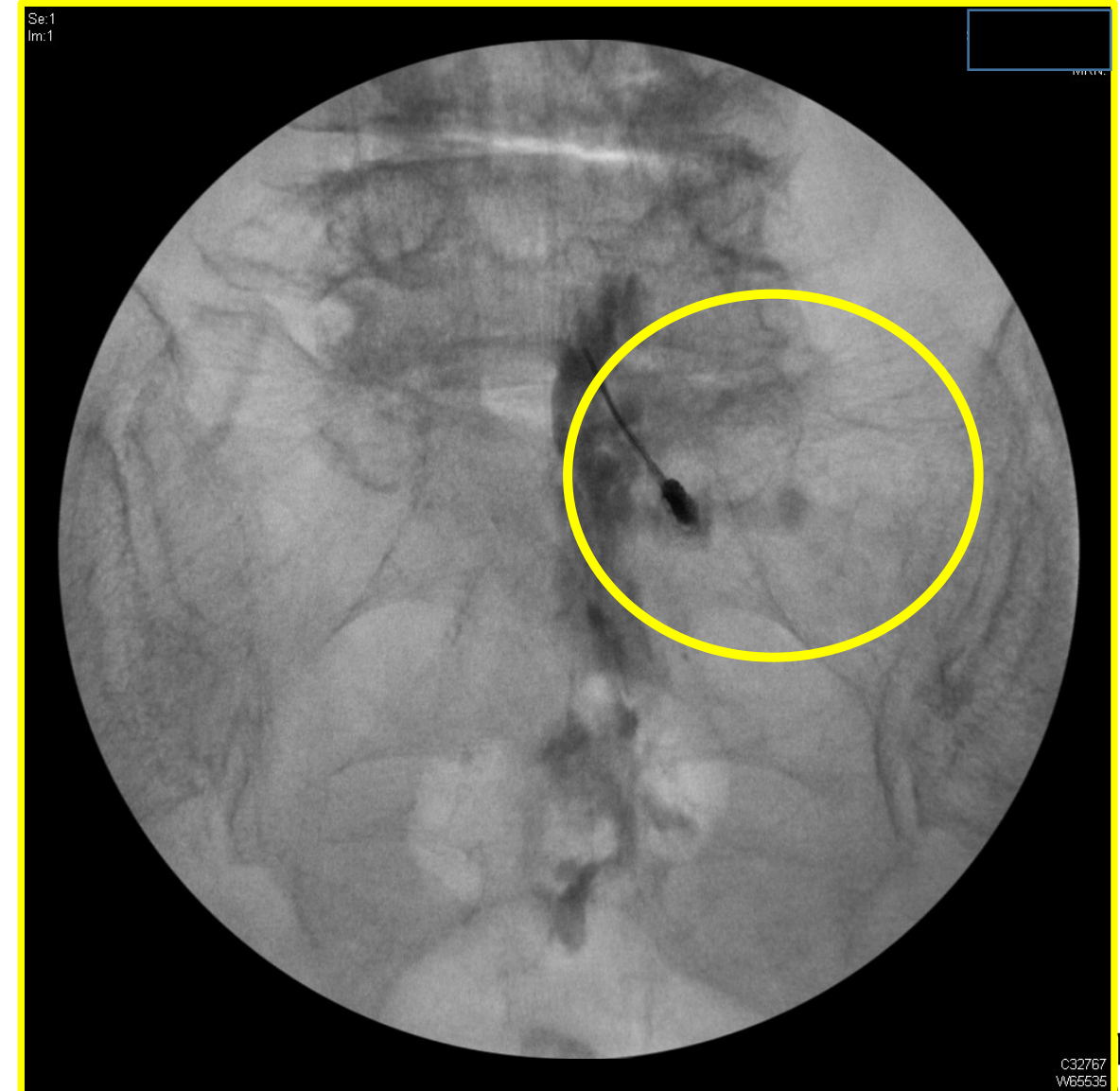
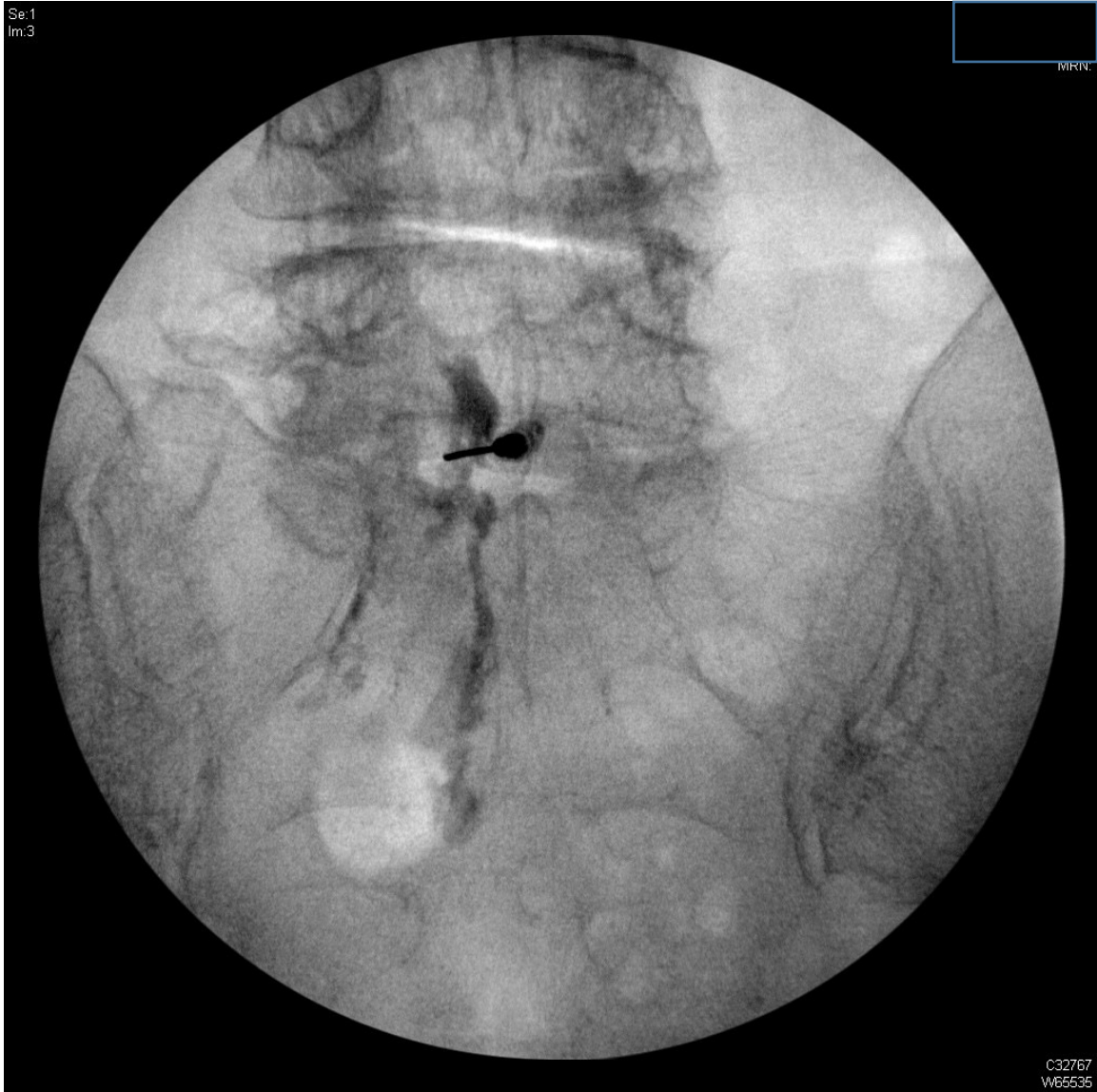
Mik az TFESI vs ILESI?

Caudal and Interlaminar

- Technically easy
- Cheap
- Potential diagnostic value
- BUT:
- No spread to problematic area



ILESI-Right L5 radiculopathy



Contrast Runoff Correlates with the Clinical Outcome of Cervical Epidural Neuroplasty Using a Racz Catheter

Yun-Joung Han, MD, Myoung No Lee, MD, Min Ji Cho, MD, Hue Jung Park, MD, PhD,
Dong Eon Moon, MD, PhD, and Young Hoon Kim, MD, PhD

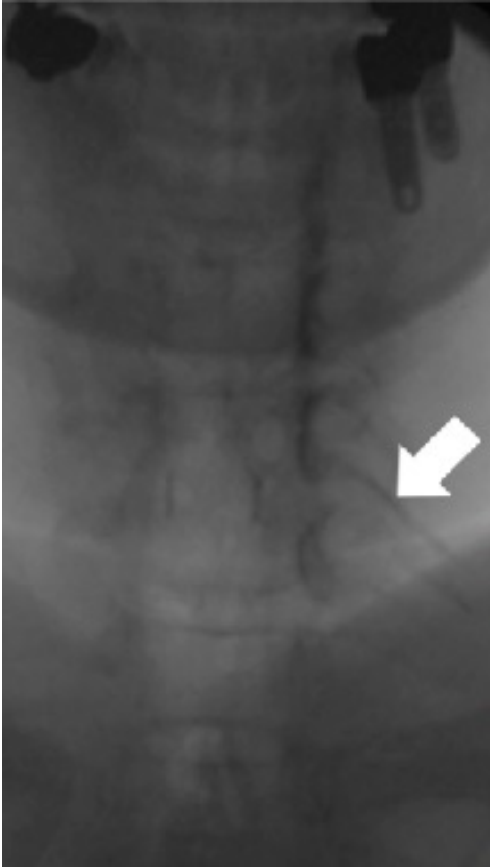
- The spread of contrast from the neural foramen to a nerve root was called contrast runoff. If the contrast did not spread, there was no contrast runoff.
- Successful epidural neuroplasty → 50% or greater reduction in pain and an at least 40% reduction in the neck pain and disability score.

Table 2. *Relationship between contrast spread pattern and outcome of procedure.*

	1 month		3 months		6 months		12 months	
	Fail	Success	Fail	Success	Fail	Success	Fail	Success
No contrast runoff	28 (70%)	12 (30%)	28 (70%)	12 (30%)	30 (75%)	10 (25%)	30 (75%)	10 (25%)
Contrast runoff	33 (25.6%)	96 (74.4%)	32 (24.8%)	97 (75.2%)	43 (33.3%)	86 (66.7%)	50 (38.8%)	79 (61.2%)
<i>P</i>	< 0.001*		< 0.001*		< 0.001*		< 0.001*	

Contrast Runoff Correlates with the Clinical Outcome of Cervical Epidural Neuroplasty Using a Racz Catheter

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VS



Correlation between **Epidurographic Contrast Flow** Pattern and **Clinical Effectiveness** in Chronic Lumbar Discogenic Radicular Pain Treated with Epidural Steroid Injections Via Different Approaches.

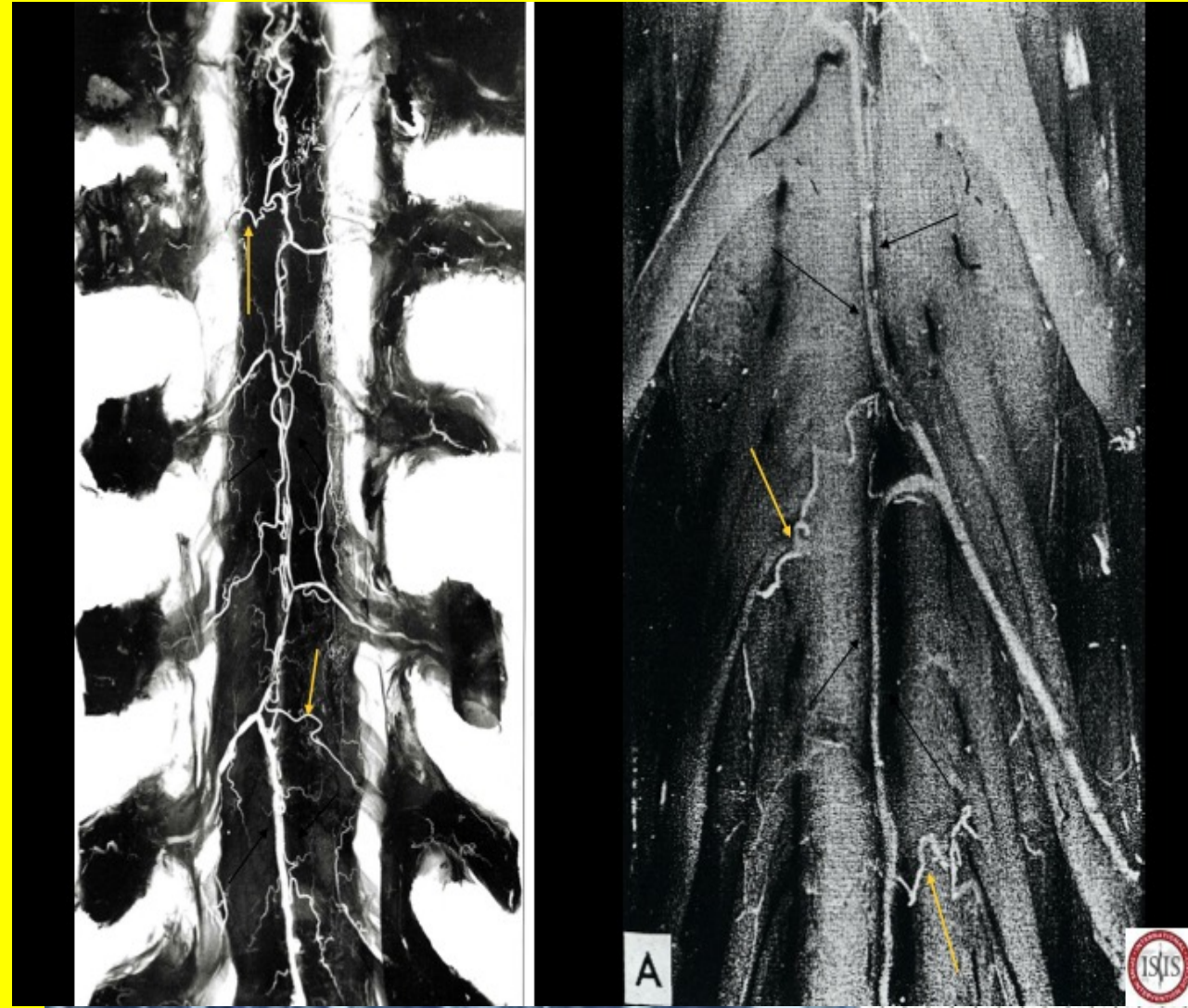
Korean J Pain 2014

- “ventral spread and nerve root delineation shows a definite correlation with clinical improvement”
- ILESI less efficacious than TFESI.

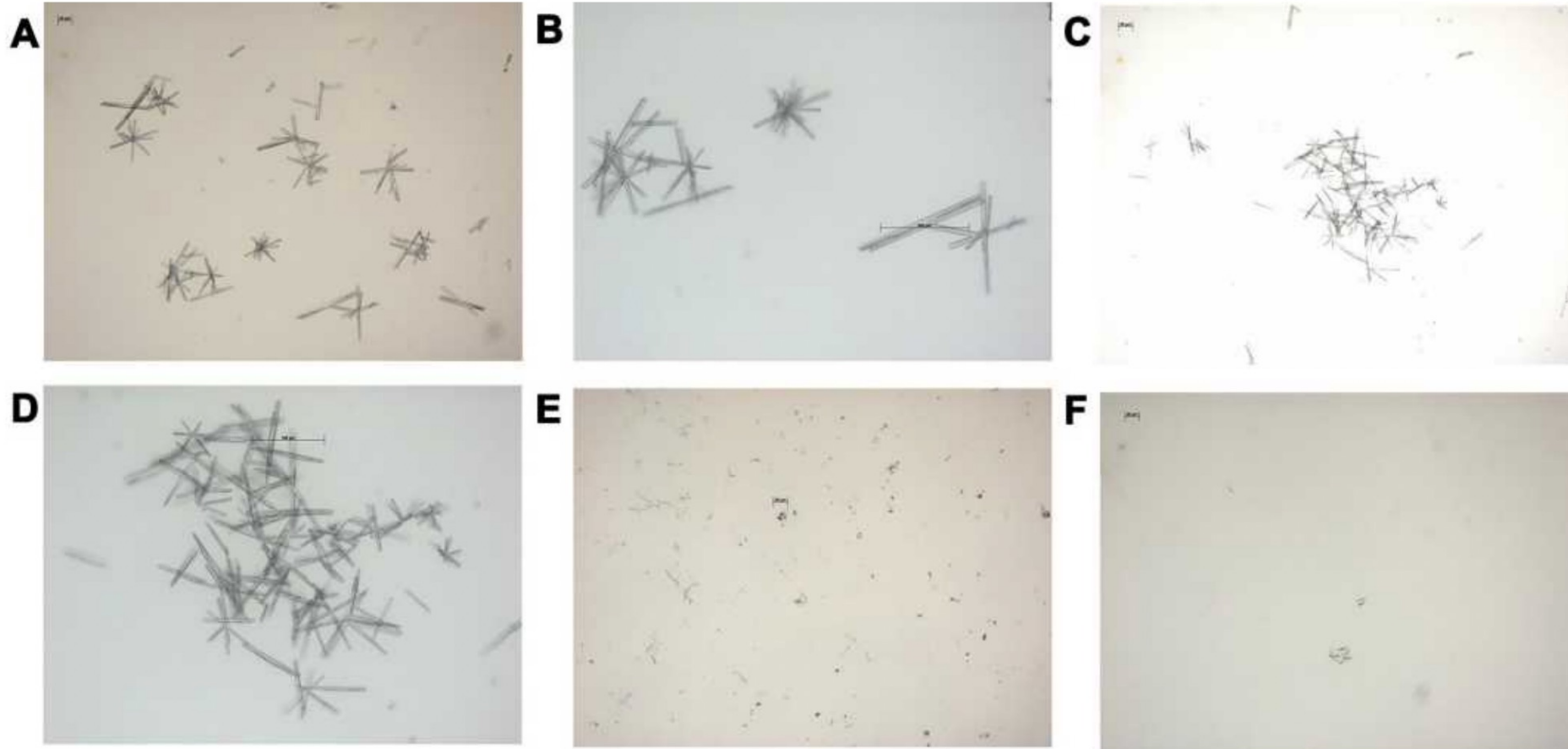
TRANSFORAMINAL

INJECTATE

- Local anesthetic
- VOLUME:0.5ml (in the US)
- Steroid
 - Non-particulate



Bethamethasone Particulate???



PARTICULATE OR NON_PARTICULATE?

Epub 2016 Mar 3.

Percutaneous Epidural Adhesiolysis with Epidural Steroid Injection: A Non-inferiority Test of Non-particulate Steroids Versus Particulate Steroids

Sooyoung Cho ¹, Hahck Soo Park ²

Affiliations + expand

PMID: 26940717 DOI: [10.1093/pm/pnw021](https://doi.org/10.1093/pm/pnw021)

General Consensus that particulate steroids have a risk of small arteries embolism with cord injury and paraplegia
Retrospective study comparing 55 subjects who had triamcinolone (80mg) vs 29 who had dexamethasone (10mg)

3M success: 51% T vs 48% D

6M success: 45% T vs 62% D

Is TFESI a selective nerve root block(SNRB)?

- 0.5 mL of contrast, 30% of LS-TFESIs is no longer "selective" for the specified root level.
- 1.0 mL of contrast, 67% of SNRB=TFESIs
- 1.5 mL of contrast, 87% of SNRB=TFESIs
- Diagnostic SNRB cannot reliably be considered diagnostically selective with volumes exceeding 0.5mL.

Pain Physician. 2008 Nov-Dec;11(6):855-61.

Contrast flow selectivity during transforaminal lumbosacral epidural steroid injections.

Furman et al

TFESI Comparison to Interlaminar ESI

- 5 RCTs
- 249 patients with unilateral radicular pain
- Lumbar disc herniation
- Pain score >6
- Onset of symptoms 2weeks-1 year

TFESI Comparison to Interlaminar ESI

All TFESI performed at 2 levels.

3 studies: 15% more pain relief favoring TFESI at 2 weeks & NO difference at 1-6 month

2 studies: NO difference at both short of long term

Functional improvement: no difference

One study correlated better pain relief with ventral spread for TFESI and lateral ILES.

Epidural Lysis of Adhesions

Also known as:

Neurolysis

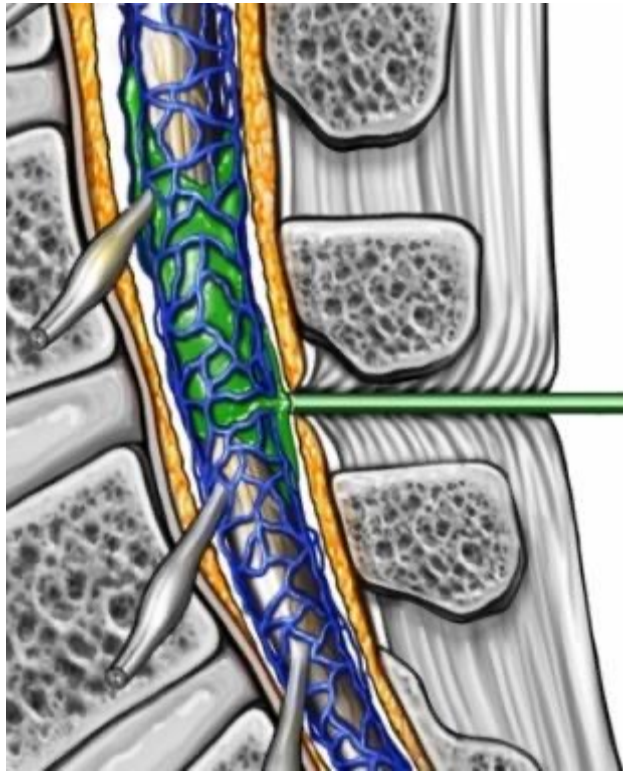
Epidurolysis

Neuroplasty

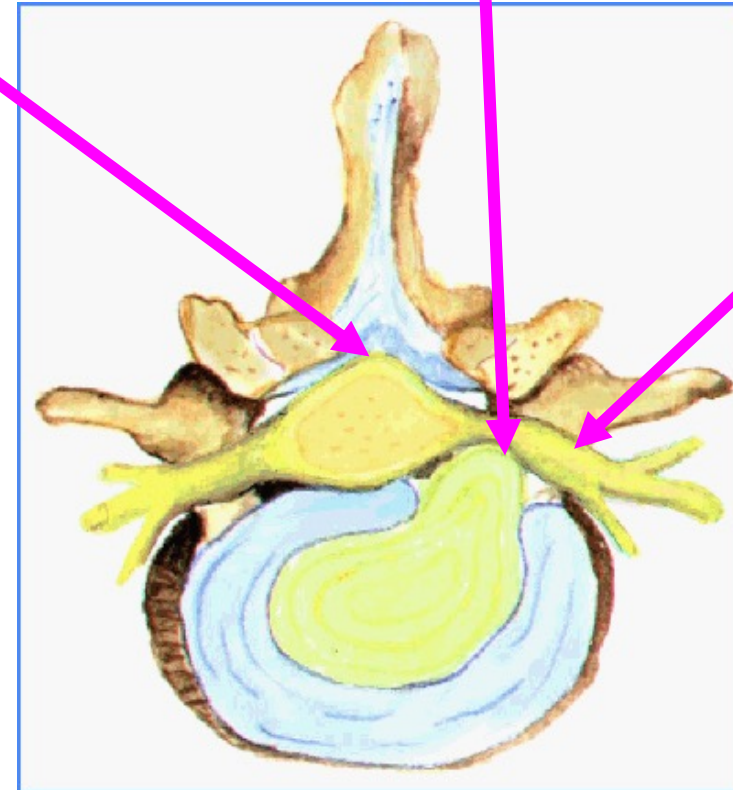
RACZ Procedure

Principles of neurolysis

Traditional interlaminar
epidural steroid inj

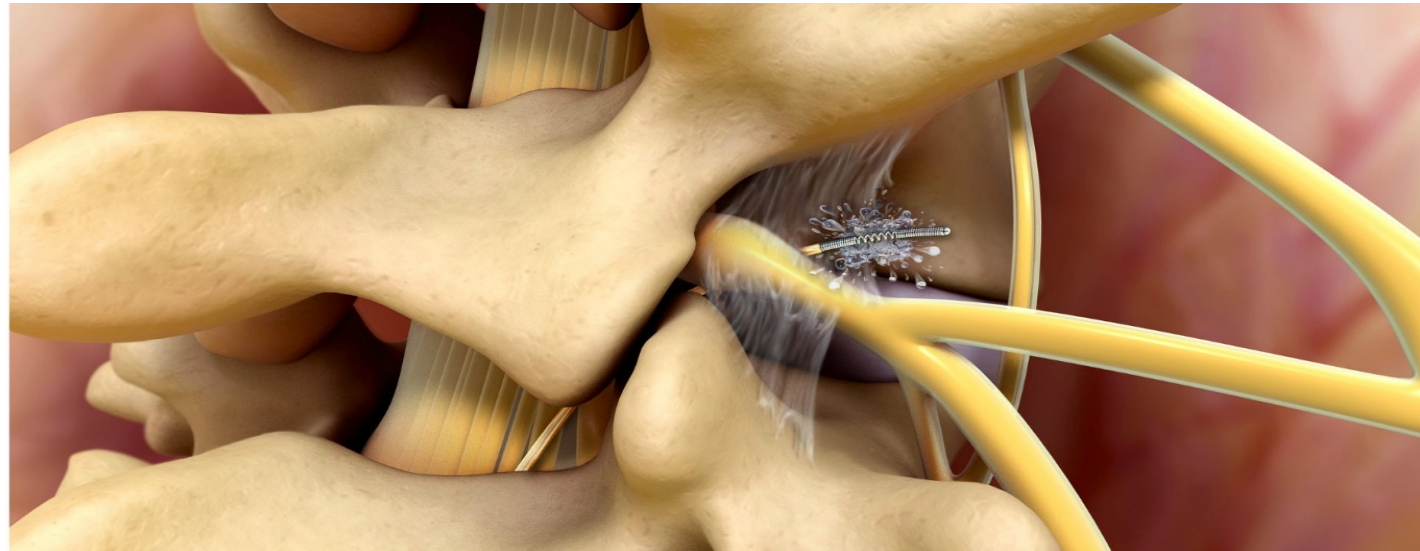


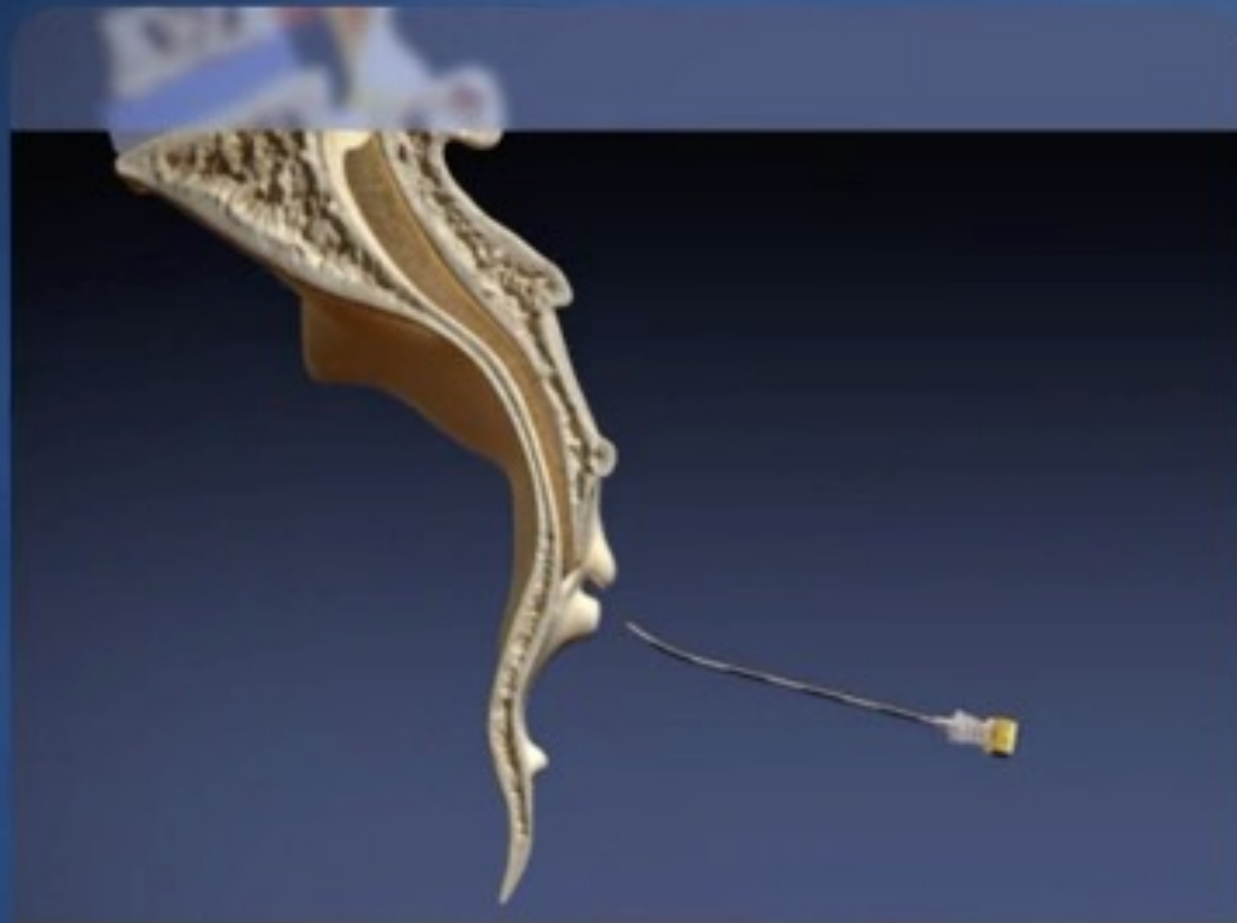
Epidurolysis



Fundamental Aspects of Lysis

- Site-Specific Placement
- Fluid Volume Effect





Typically, the target nerve is in the lower lumbar region. The dura ends at around the S2 level; therefore the most convenient approach is through the sacral canal.

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sacral cross-section



HOW DOES EPIDUROLYSIS WORK?

- Wash-out of inflammatory mediators
- “Shrinkage” of tissue compressing and/or tethering the nerve roots
- Dissolution of epidural fibrosis and prevention of reoccurrence
- Improved target delivery of drugs (steroids) and epidural spread
- Hydraulic separation of tissues planes
- Inhibition of recurrent scar formation (fibroblasts inhibition)

Indications for Epidural Adhesiolysis

- **Radiculopathy;**
- **Epidural fibrosis**
- **Post-laminectomy** syndrome at C, T, L S spine
- Disc disruption;
- Spinal Stenosis
- Pain unresponsive to spinal cord stimulation and spinal opioids

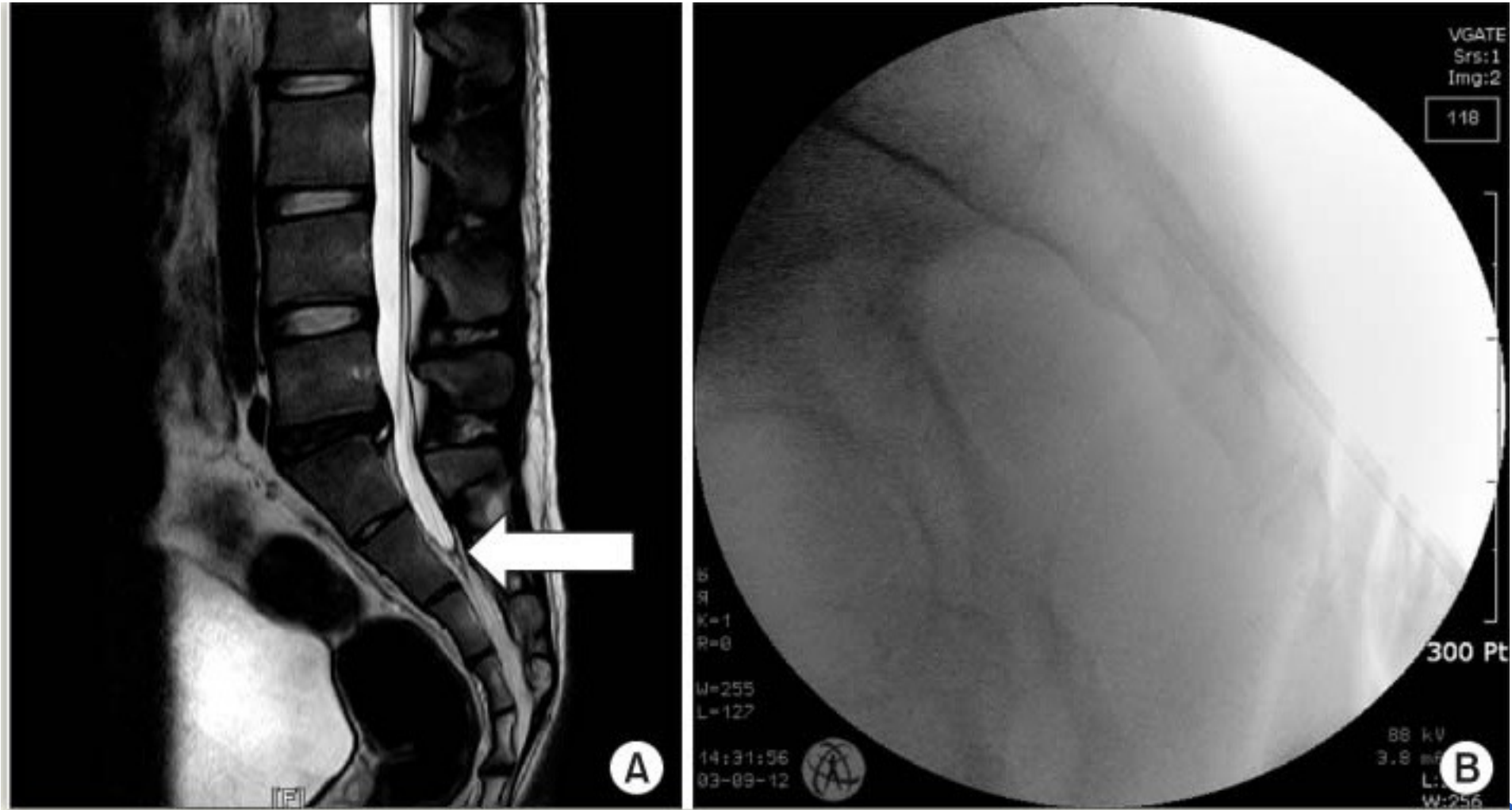
Epidurolysis-the procedure

Caudal epidurolysis (and L, T, C spine)

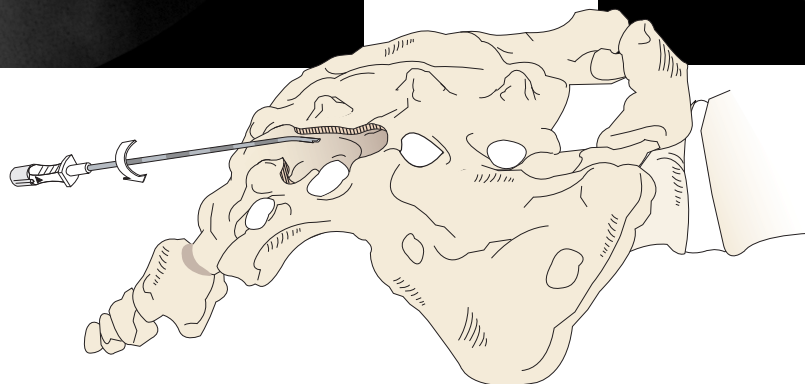
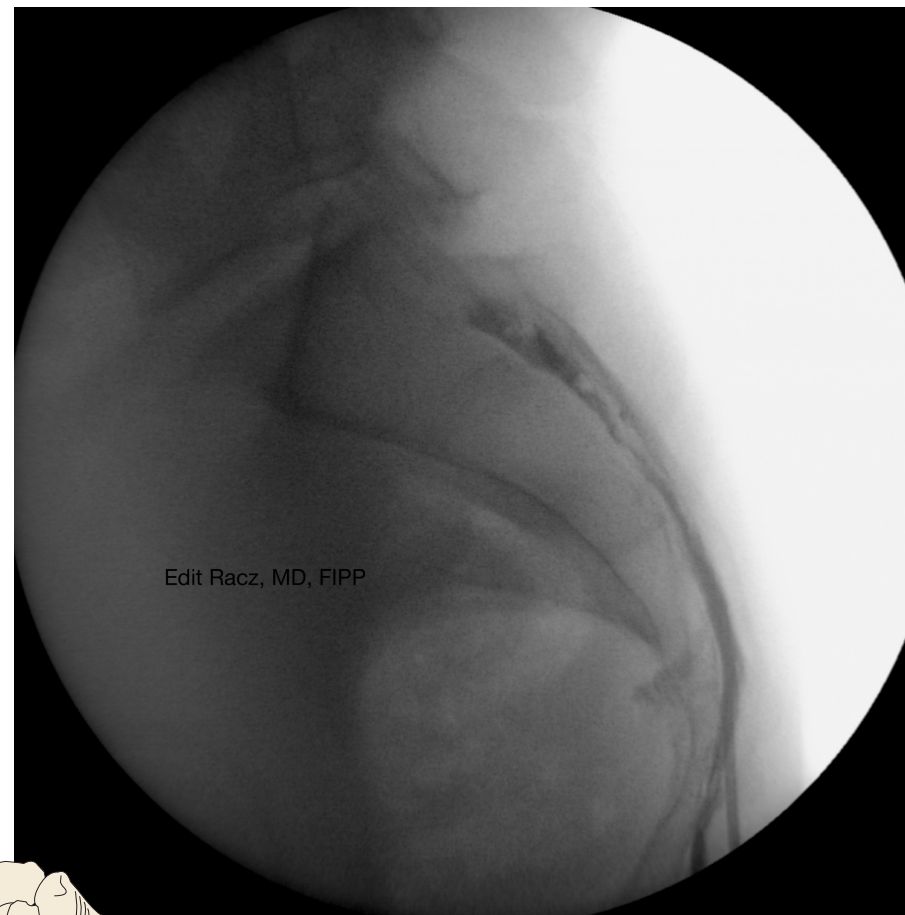
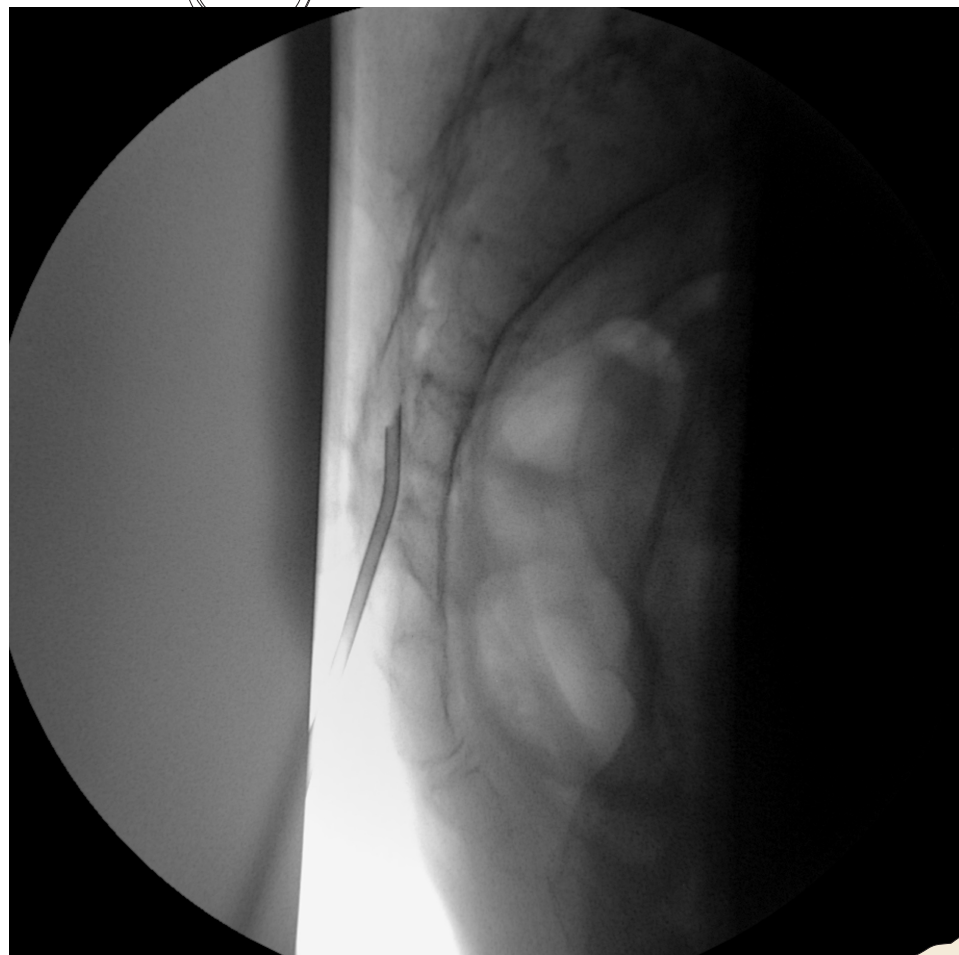
(patient under IV sedation and local anesthetics)



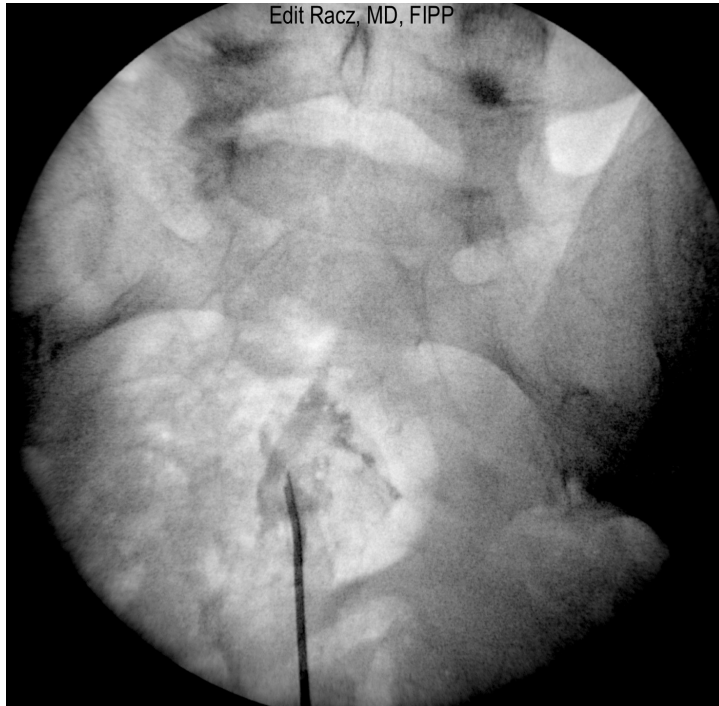
Check the Intrathecal Sac







What does the epidurogram tell us?



2ml contrast



5ml contrast



10ml contrast

Left L5 radic

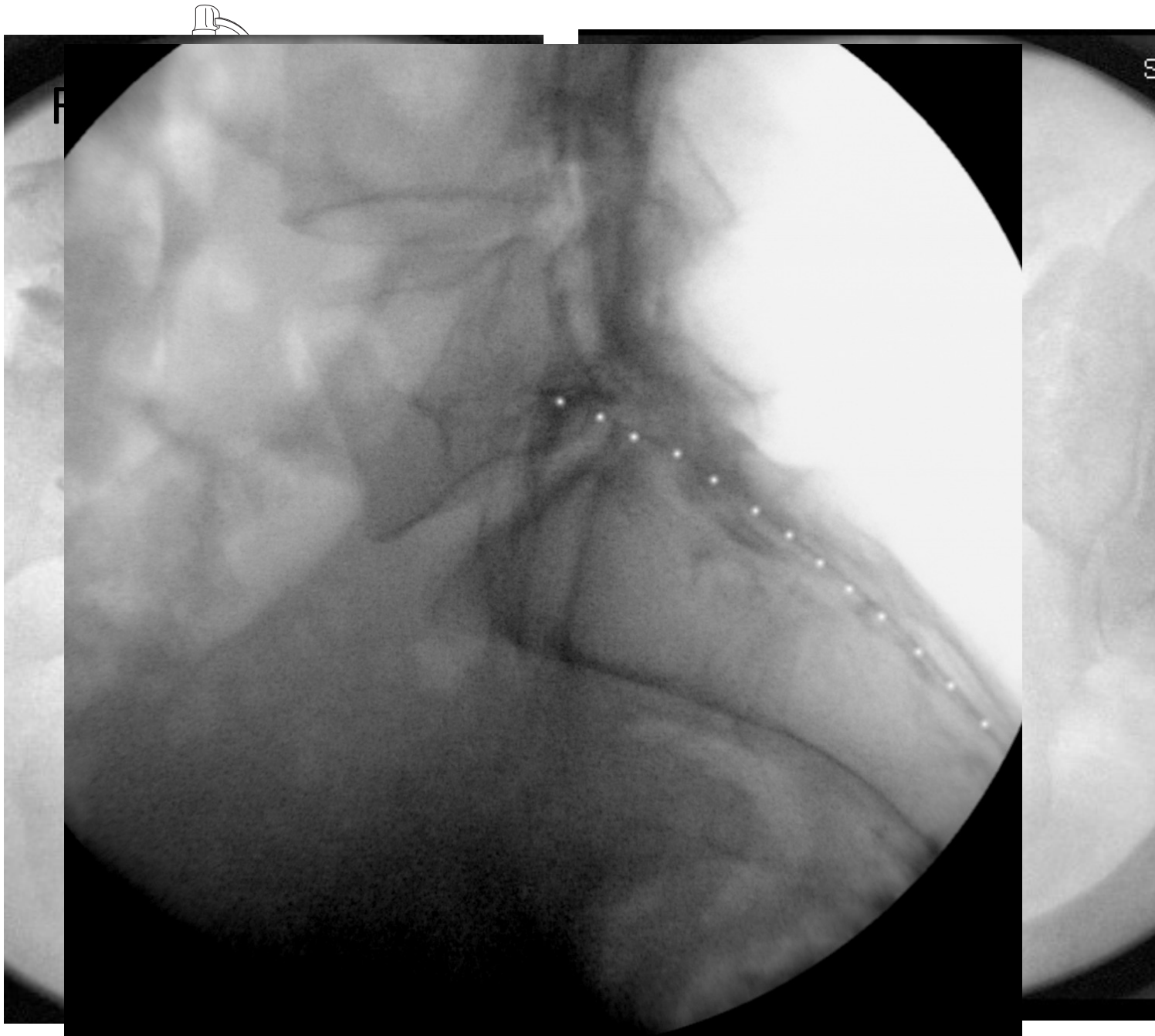
Radiological Diagnosis of Fibrosis

- Magnetic resonance imaging (MRI) and Computerized tomography (CT)
Sensitivity and specificity are 50% and 70% respectively¹
- Myelography
- Epidurography
Considered the best diagnostic tool for epidural fibrosis²
- A combination of several of these techniques would increase ability to identify epidural fibrosis

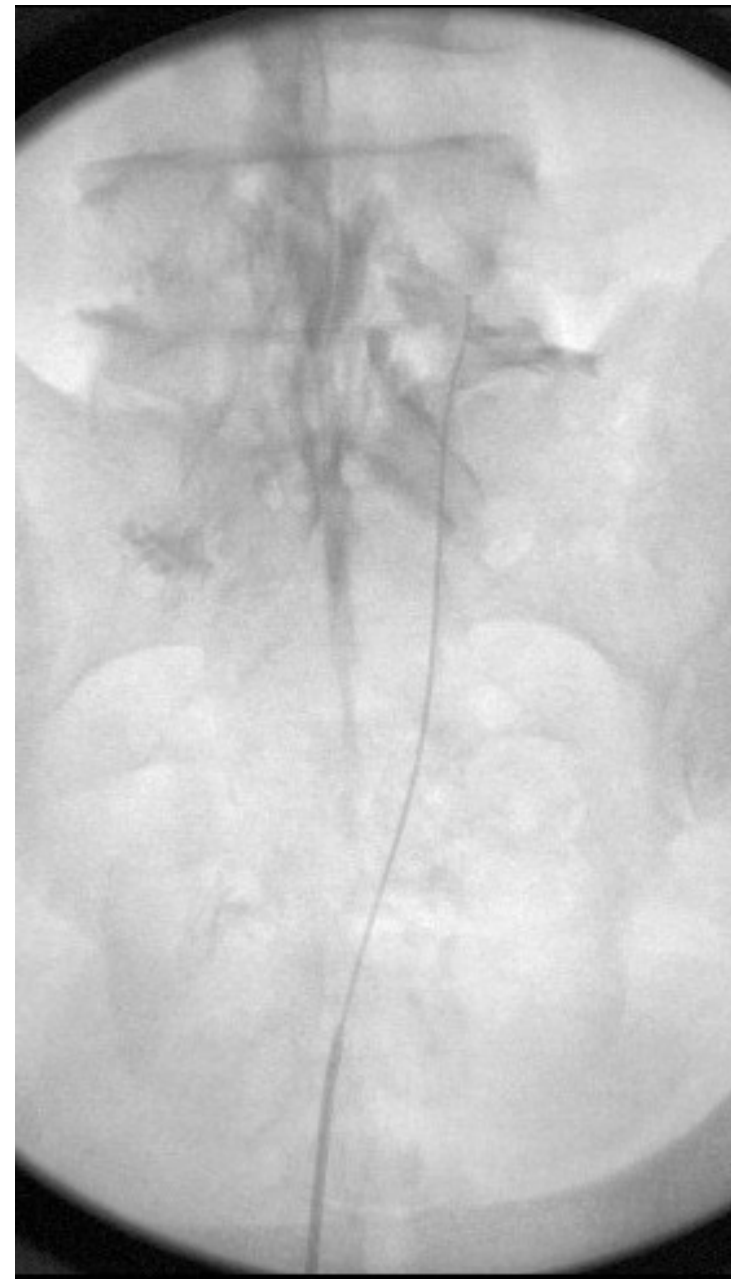
¹Special techniques in pain management: lysis of adhesions; Viesca, C.,
Racz, G., Day, M; Anesthesiology Clin N Am; 2003: 21:745-766

² Role of epidurography in caudal neuroplasty.

Manchikanti L, Bakhit C, Pampati V. Pain Digest 1998; 8:277-281



S2-lateral



Solutions used-WHY?

- Water soluble contrast (Isovue[®]; Omnipaque[®]), 10ml
- Normal saline (0.9% NaCl) or Lido 1% 10ml
- Hyaluronidase, 10ml
- Local anesthetics, 10ml
- Corticosteroids
- Hypertonic saline (10% NaCl), 10ml

Hyaluronidase

(hyaluronoglucosaminidase)

Mechanism of action

- Liquefies the interstitial barrier between cells by cleaving β -1,4 glycosidic bonds
- Improves the diffusion of injected substances within most connective tissue planes except for collagenous barriers.

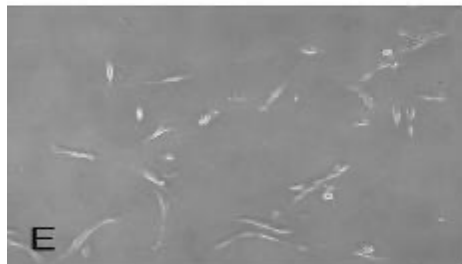
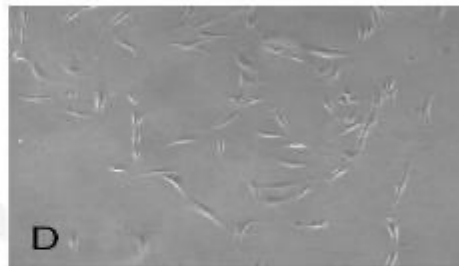
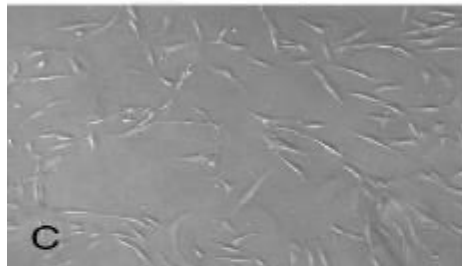
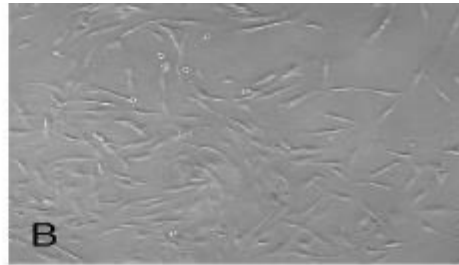
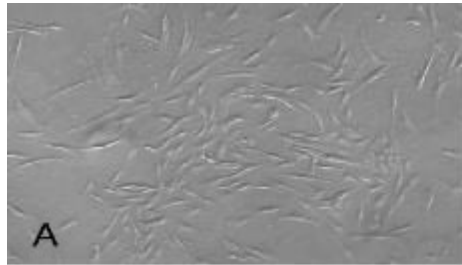
Watson D. Hyaluronidase. *Br J Anaesth* 1993;71:422-425

Solutions used-WHY?

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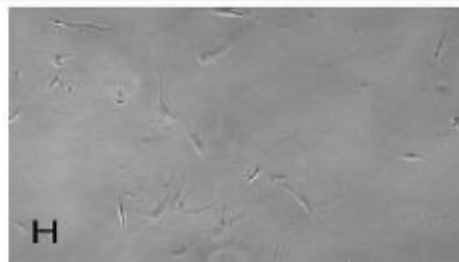
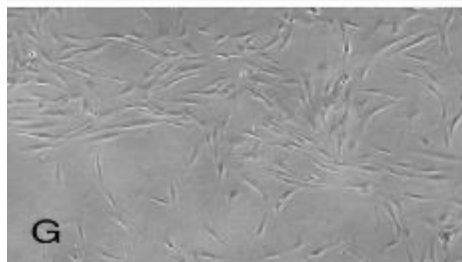
Monolayer of Cultured Human Fibroblast in NaCl and DMEM

3 days of incubation and 1 hour exposure to various percentages listed below



- A. Control-DMEM
- B. 0.9% NaCl-DMEM
- C. 2% NaCl-DMEM
- D. 4% NaCl-DMEM
- E. 6% NaCl-DMEM
- F. 10% NaCl-DMEM

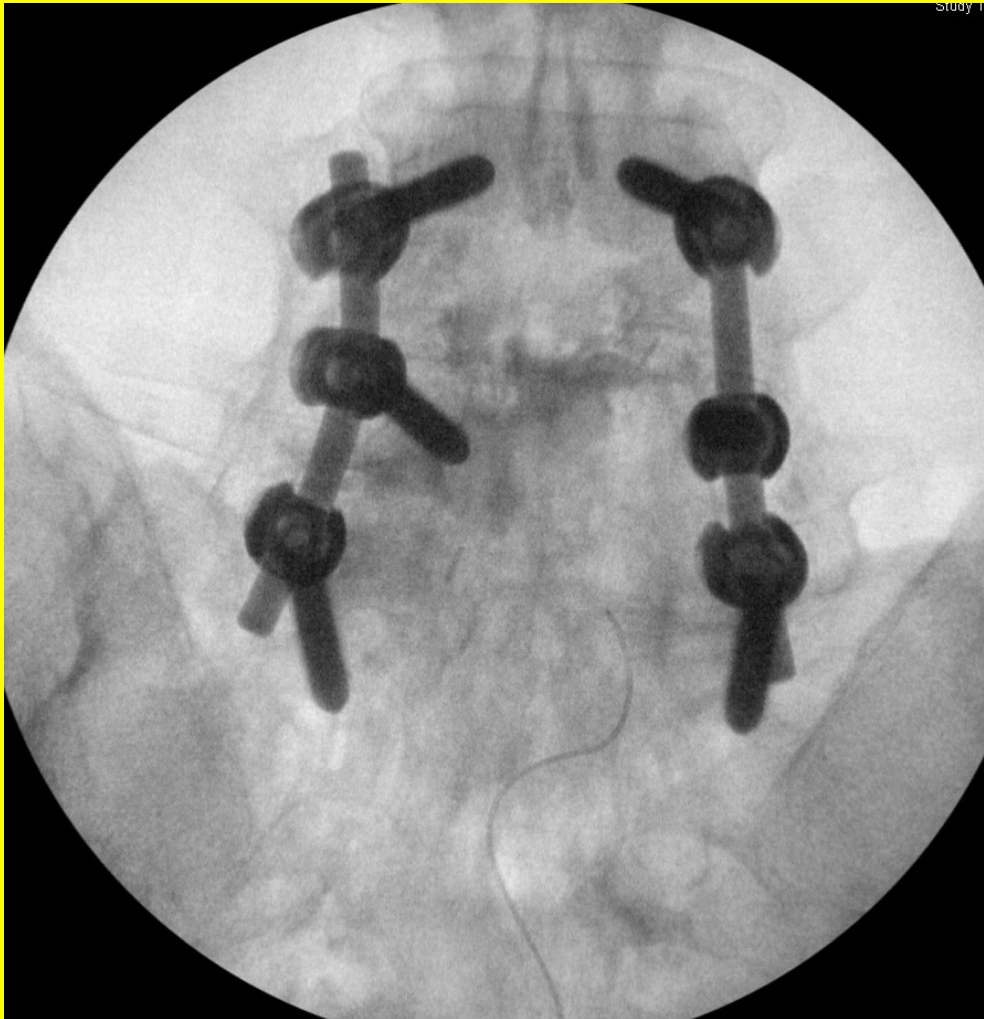
Below black line represents 3 days incubation and 24 hour exposure:

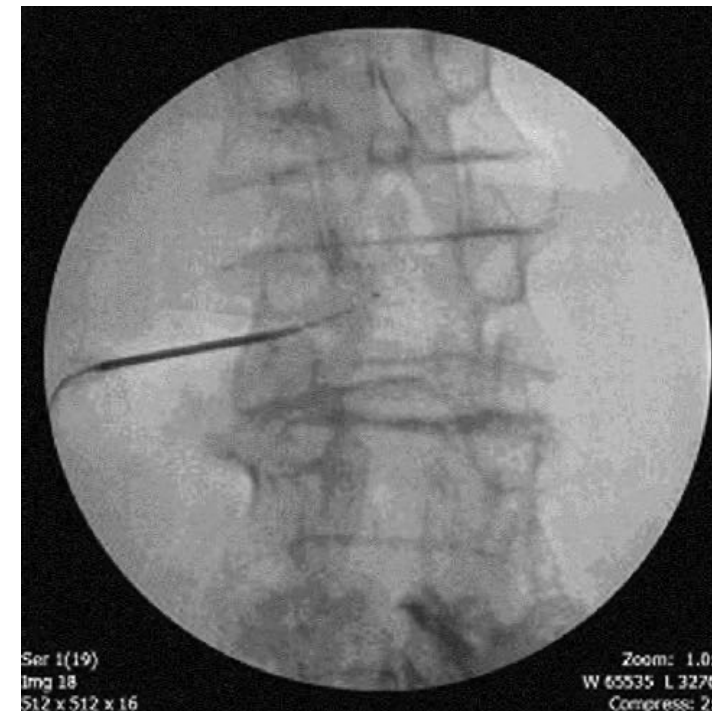
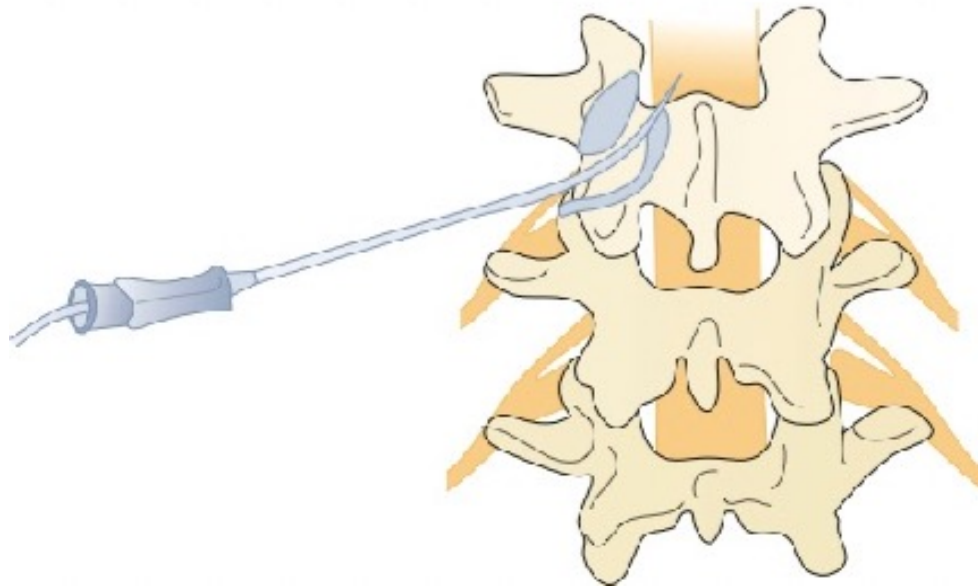
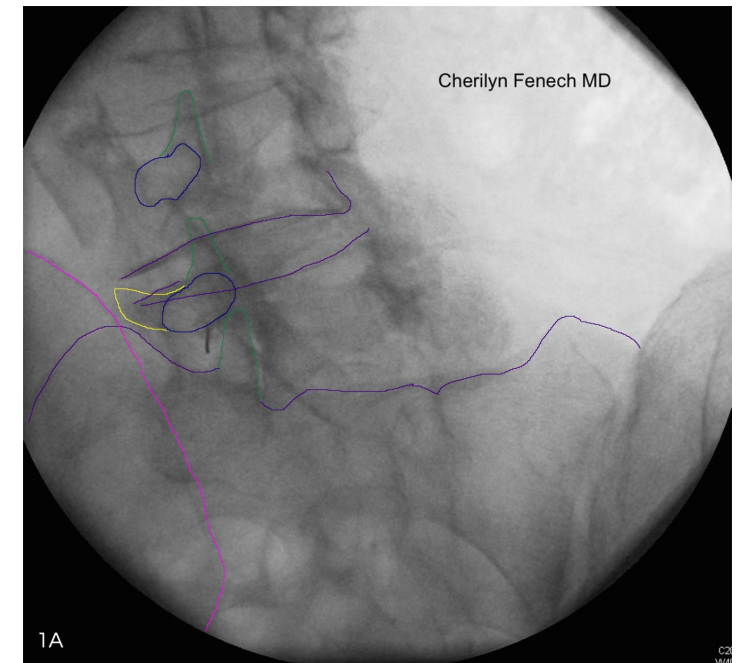
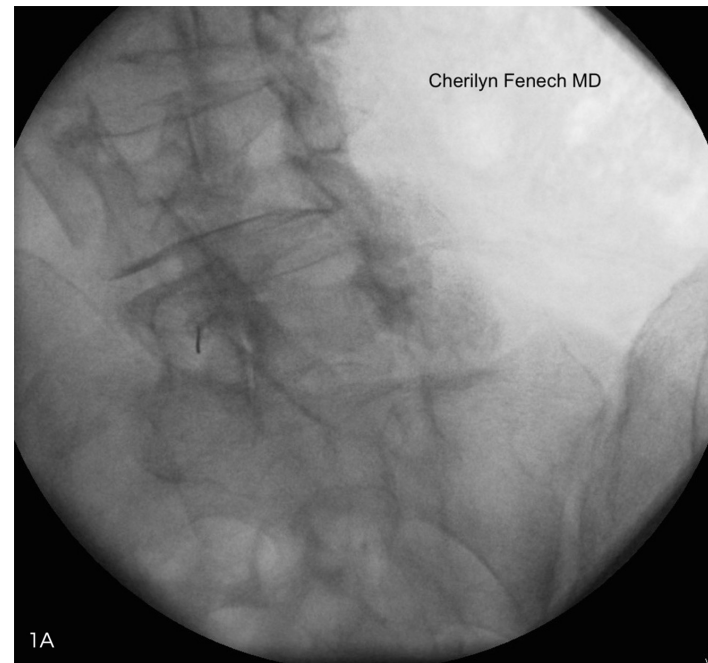


- G. Control-DMEM
- H. 0.9%-DMEM

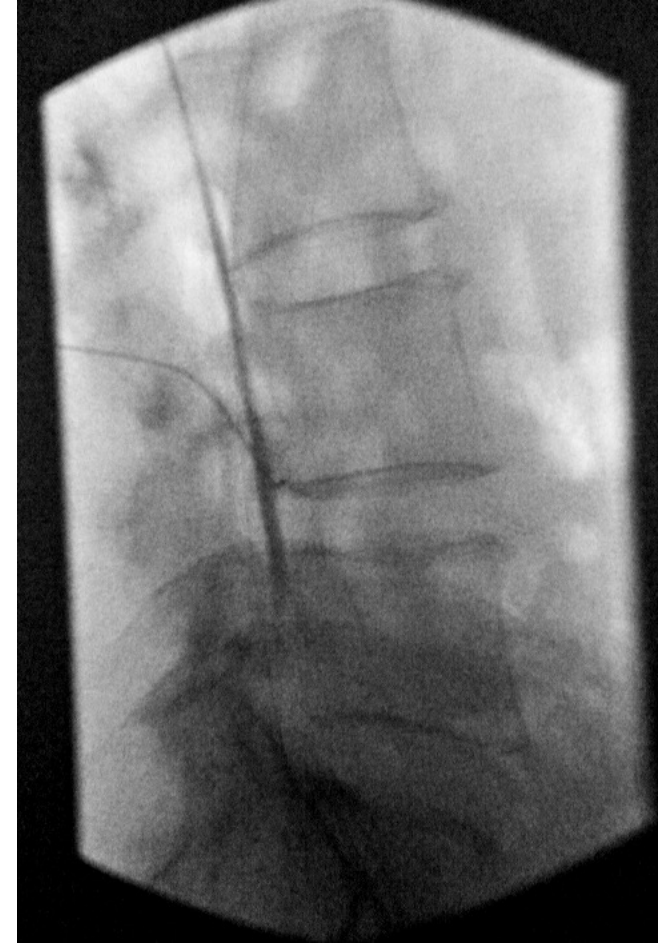
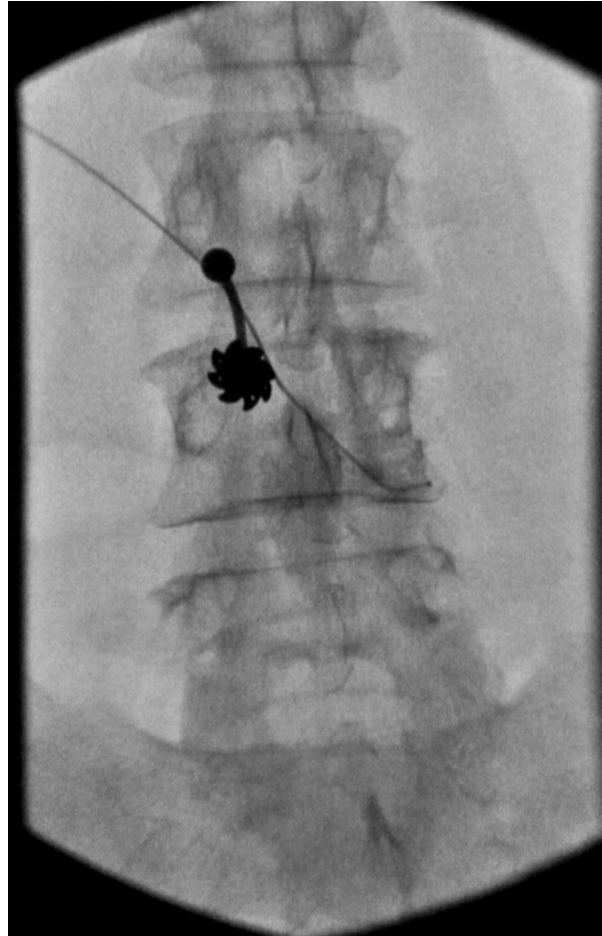
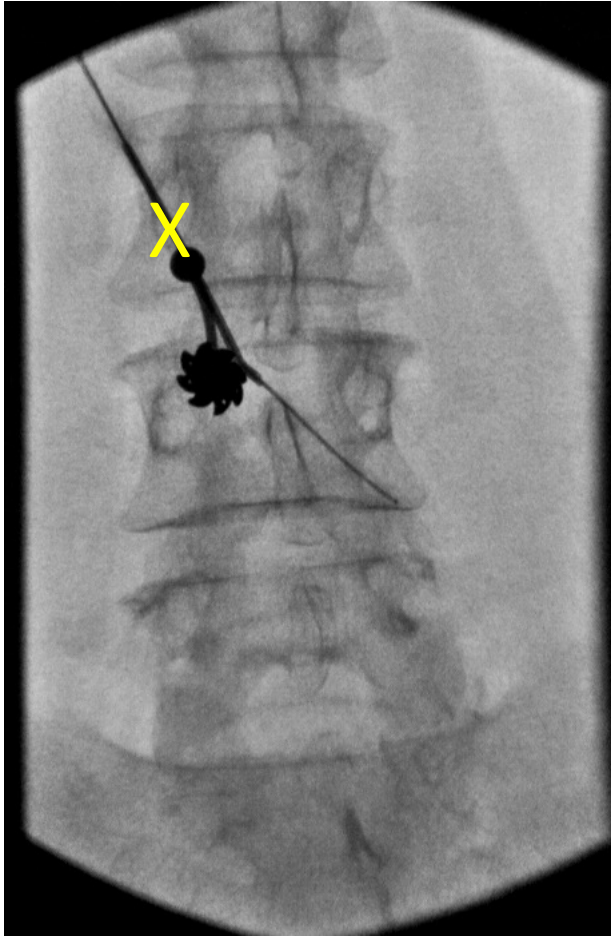
Birkenmaier *et al.*, 2011

CAN'T ACCESS TARGET AREA?





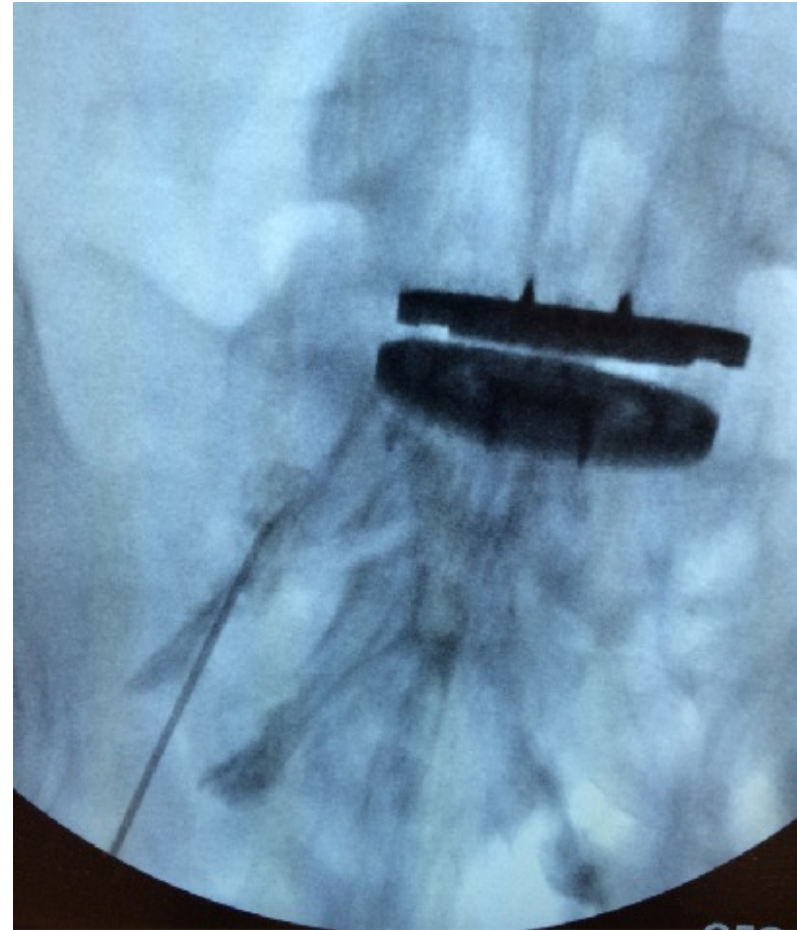
TRANSGRADE APPROACH



Epidurolysis Infusion Volumes

	Contrast	Hyaluronidase and Normal Saline	Local Anesthetic and Steroid	10% Hypertonic Saline Infusion
Lumbar	10 mL	10 mL	10 mL	10 mL
Caudal	5 mL	5 mL	5 mL	5mL
Thoracic	8 mL	8 mL	8 mL	8 mL
Cervical	5 mL	6 mL	6 mL	5 mL

TRANS S1 APPROACH





Comparison of 3 Approaches to Percutaneous Epidural Adhesiolysis and Neuroplasty in Post Lumbar Surgery Syndrome

- caudal,
- S1 foraminal
- L5-S1 transforaminal

- 60pts
- 1, 3, 6M follow up

- same outcome with regard to pain relief and complication rate.

DURAL TUG TEST, BEFORE AND AFTER



Neural Flossing



As soon as possible after the procedure: have the patient perform the neural flossing exercises
The neural flossing exercises were designed and developed by the Texas Tech Physical Therapy Department and are critical to obtaining positive outcomes with the procedure.

Complications

- Catheter sheering
- Subdural / subarachnoid puncture
- Paralysis
- Bladder, bowel dysfunction
- Spinal cord compression
- Hematoma
- Spinal Cord Compression from loculation

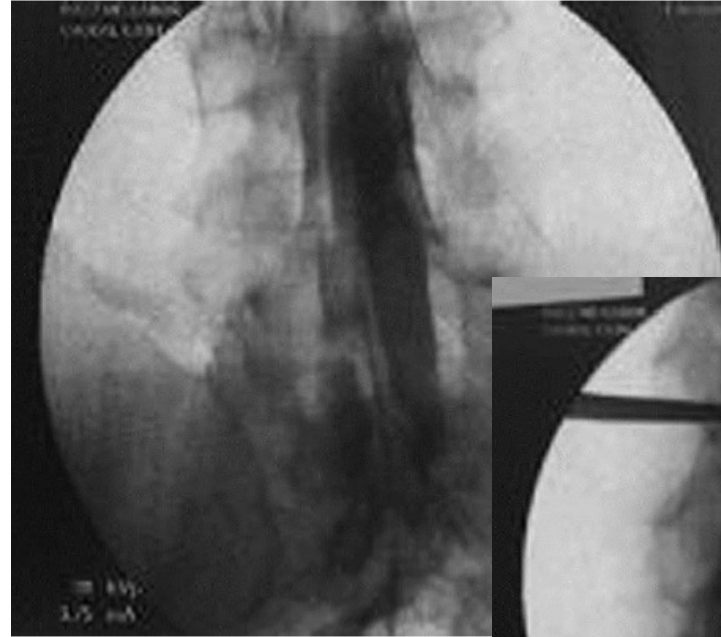
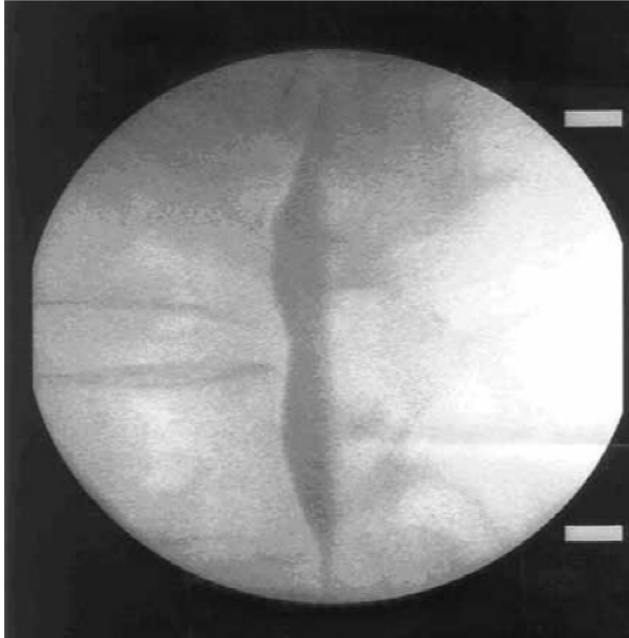
Complications of Epidural Neuroplasty: A Retrospective Evaluation

Gul K. Talu, MD, ■ Serdar Erdine, MD

Department of Algology, Medical Faculty of Istanbul, Istanbul University, Istanbul, Turkey

Complications	Cervical N, N/T,%	Lumber N, N/T,%	Total N, N/T,%
Bending of the tip of needle	1, 1/56, 1.7%	11, 11/194, 5.6%	12, 12/250, 4.8%
Tearing of the catheter	1, 1/56, 1.7%	2, 2/194, 1.0%	3, 3/250, 1.2%
Breaking of the catheter in epidural space	–	1, 1/194	1, 1/250, 0.4%
Blood aspiration in the epidural space	4, 4/56, 7.1%	35, 35/194, 18%	39, 39/250, 15.6%
Termination of procedure due to bleeding	–	10, 10/194, 5%	10, 10/250, 4%
Misplacement (Paravertebral space, vein, intradural)	2, 2/56, 3.5%	18, 18/194, 9.2%	20, 20/250, 8%
Problems of catheter withdrawal	1, 1/56, 1.7%	4, 4/194, 2.0%	5, 5/250, 2.0%
Blocking of the catheter	1, 1/56, 1.7%	5, 5/194, 2.5%	6, 6/250, 2.4%
Hypotension	4, 4/56, 7.1%	8, 8/194, 4.1%	12, 12/250, 4.8%
Respiratory depression	–	1, 1/194, 0.5%	1, 1/250, 0.4%
Migration	–	3, 3/194, 1.5%	3, 3/250, 1.2%
Numbness			
Transient	4, 4/56, 7.1%	15, 15/194, 7.5%	19, 19/250, 7.6%
Prolonged	–	3, 3/194, 1.5%	3, 3/250, 1.2%
Bowel-bladder dysfunction	–	3, 3/194, 1.5%	3, 3/250, 1.2%
Sexual disjunction	–	1, 1/194, 0.5%	1, 1/250, 0.4%
Headache	–	1, 1/194, 0.5%	1, 1/250, 0.4%
Infection at entrance site	–	8, 8/194, 4.1%	8, 8/250, 3.2%
Epidural abscess	1, 1/56, 1.7%	2, 2/194, 1.0%	3, 3/250, 1.2%
Meningitis	–	1, 1/194, 0.5%	1, 1/250, 0.4%

Complications



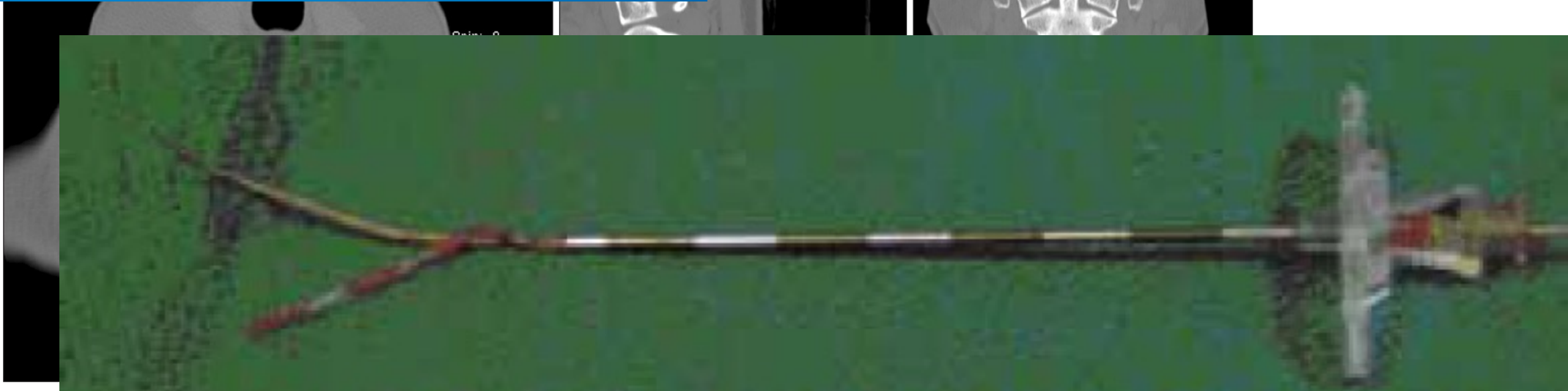
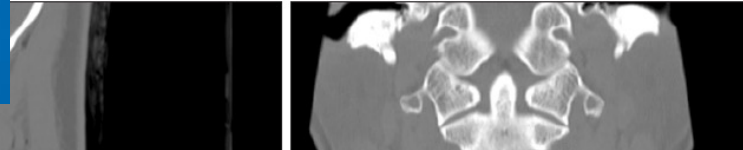
Gerdesmeyer, 2013. Racz, 2014.

A sheared Racz catheter in cervical thoracic spine thirty months

², Min Kyu Lee¹, and

y, Seoul St. Mary's Hospital, College of Medicine,

nt surgical removal of a sheared
ns after cervical Racz neuroplasty



EVIDENCE

Clinical Efficacy

- Total Publications: 61
- Case Studies: 8
- Technique: 11
- Clinical Outcomes: 39
 - RCT: 8
- Non-clinical: 3

Systematic Review

Systematic Review of Percutaneous Adhesiolysis and Management of Chronic Low Back Pain in Post Lumbar Surgery Syndrome

Richard S. Epter, MD¹, Standiford Helm II, MD², Salim M. Hayek, MD, PhD³,
Ramsin M. Benyamin, MD⁴, Howard S. Smith, MD⁵, and Salahadin Abdi, MD, PhD⁶

Results:

3 randomized trials

4 observational studies met

Evidence of percutaneous adhesiolysis in the management of chronic low back pain in post-lumbar surgery syndrome is **Level I to Level II1**, with evidence derived from 3 randomized trials.

Percutaneous epidural lysis of adhesions in chronic lumbar radicular pain: a randomized, double-blind, placebo-controlled trial

Ludger Gerdesmeyer ¹, Stefan Wagenpfeil, Christof Birkenmaier, Andreas Veihelmann, Matthias Hauschild, Klaus Wagner, Munjed Al Muderis, Hans Gollwitzer, Peter Diehl, Andreas Toepfer

The ODI and VAS scores as well as the success rates for ODI vs VAS were significantly better 3, 6, and 12 months in the lysis group vs the control group.

Long-term Efficacy of Percutaneous Epidural Neurolysis of Adhesions in Chronic Lumbar Radicular Pain: 10 Year Follow-up of a Randomized Controlled Trial

Ludger Gerdesmeyer ¹, Carl Noe ², Alexander Prehn-Kristensen ³, Norbert Harrasser ², Munjed Al Muderis ⁴, Matthias Weuster ⁵, Tim Klueter ⁶

The statistical difference of the ODI and VAS between the treatment and control groups remain significant up to 10 years.

This procedure should be considered as the first treatment option for patients with chronic lumbosacral radicular pain

CONCLUSION

Mechanism

- Neuroplasty relieves irritation of nerve roots or the intrinsic nerves of the dura, peridural membrane and posterior longitudinal ligament. This irritation may or may not be caused by scarring.

Indications

- Neuroplasty has been used for failed back surgery syndrome, spinal stenosis, persistent axial and radicular pain and radiculopathy.

Procedure

- The procedure can be performed using caudal, transforaminal and interlaminar approaches and in the lumbar, thoracic and cervical regions.

Evidence

- Multiple high-quality studies have shown that neuroplasty is safe and effective.

	Indication for intraspinal pathology	Diagnostic value	Ease of procedure US/Fluoro	Equipment needed	Expected benefits Short term	Expected benefits At 1 year	Risks
Caudal	✓	✓	✓✓✓	US or Fluoro	✓	0	✓
Interlaminar epidural	✓	0	✓✓✓	Fluoro	✓✓	0	✓✓
Transforaminal	✓✓	✓?	✓✓	Fluoro	✓✓✓	0	✓✓✓
Epidurolysis	✓✓✓	✓✓✓✓	✓	Fluoro	✓✓✓✓	✓✓	✓✓ ✓

THANK YOU!

Stogicza@gmail.com