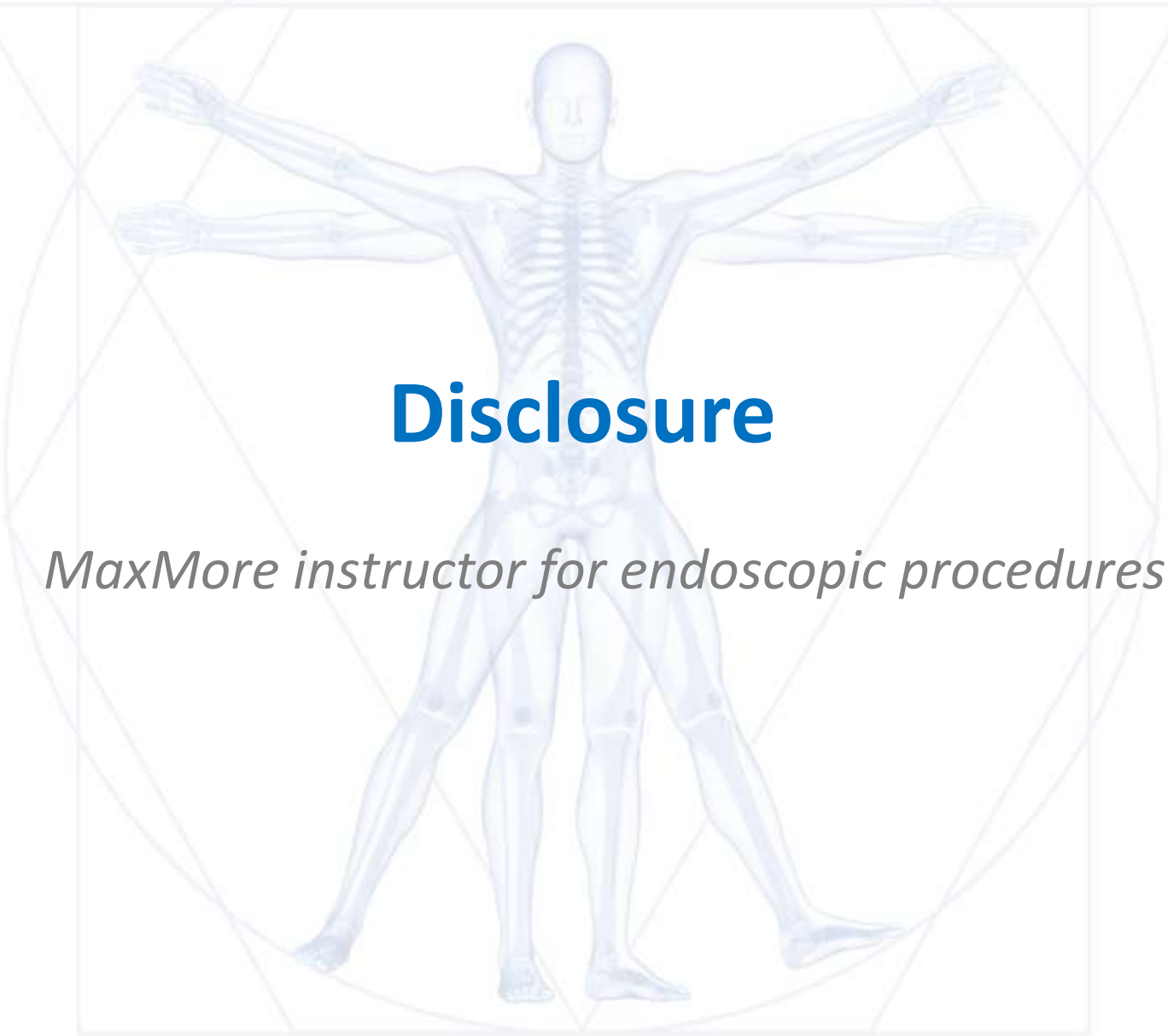

16th World Congress
of Pain Clinicians 2023
Dubai, UAE
EuroPainClinics
relief is our mission

EuroPainClinics®
relief is our mission

Procedures in Interventional pain management

Discogenic Pain:
Back pain dilema

Róbert **Rapčan**



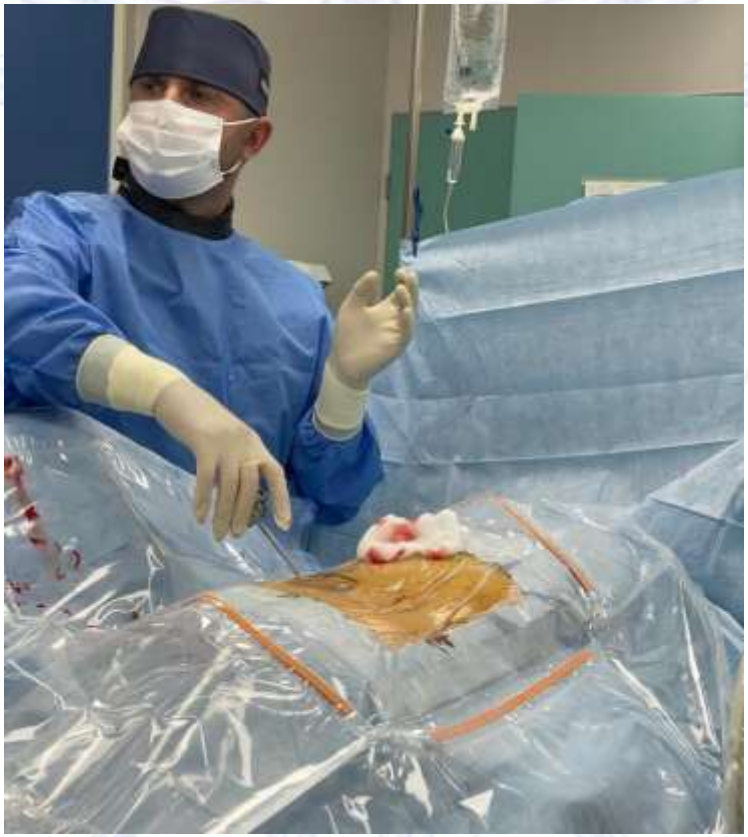
Disclosure

MaxMore instructor for endoscopic procedures

Spine Care – The Back Pain Dilemma

- Poor understanding of the fundamental basis of LBP in many individuals
- Expanding array of treatment options (medications, manipulative care)
- Percutaneous interventional spine procedures
- Increasing repertoire of surgical approaches
- Variations of medical insurance systems
- Expectations and mentality of patient populations

Spine Care – The Back Pain Dilemma



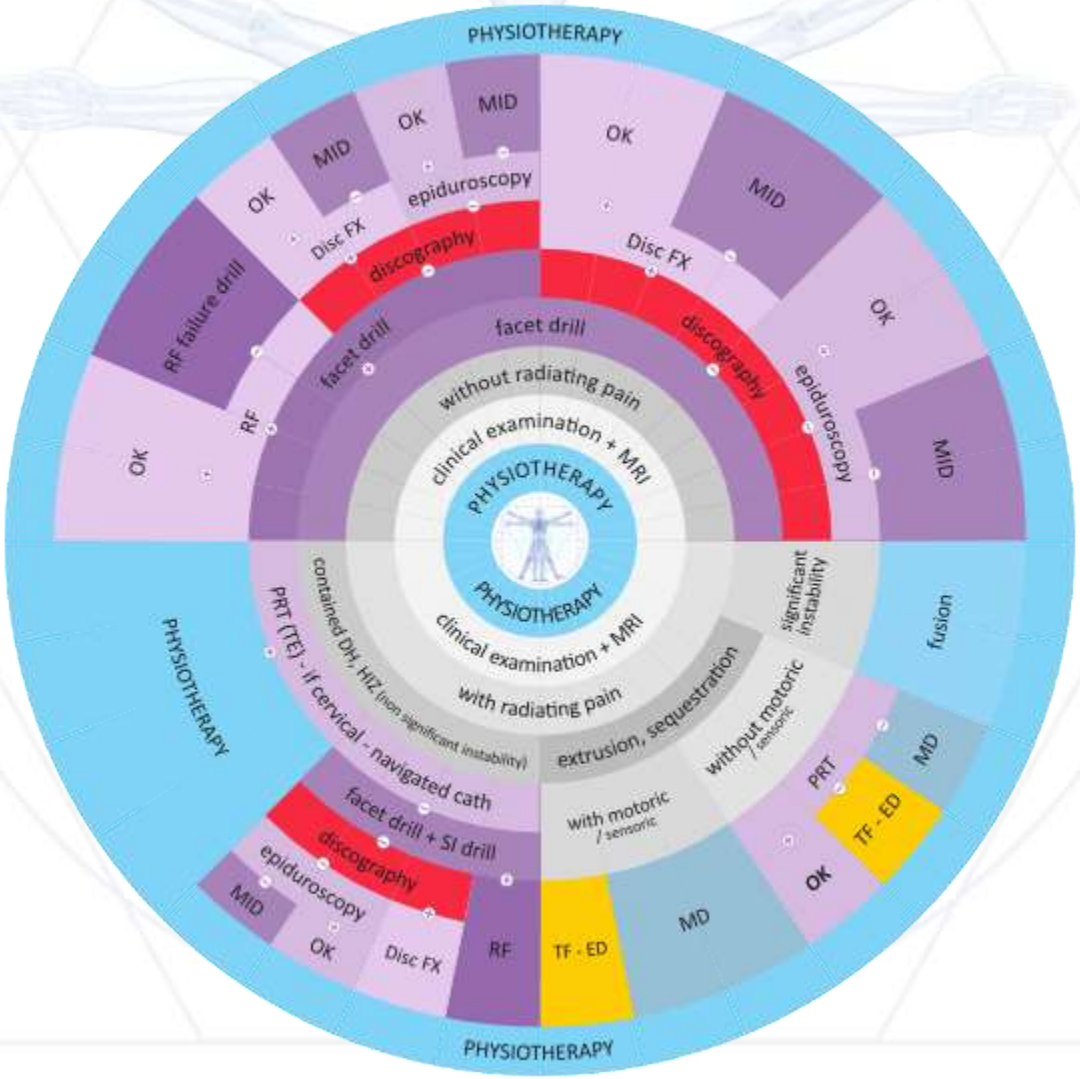
Key Question: Are spine problems worsening over time or are we simply using an increasing number of costly treatments that are not effective?

Spine Care – The Back Pain Dilemma

Recommendations from the IMMPACT (Initiative on Methods, Measurement, and Pain Assessment in Clinical Trials) group include the use of a composite outcome measure that includes at least 2 individual outcome measures encompassing self-reported pain, physical function, emotional well-being, and global assessment of improvement in clinical trials of pain interventions.

Many of the available studies report improvements in only one outcome measure and fail to meet the recommended criteria for a successful outcome.

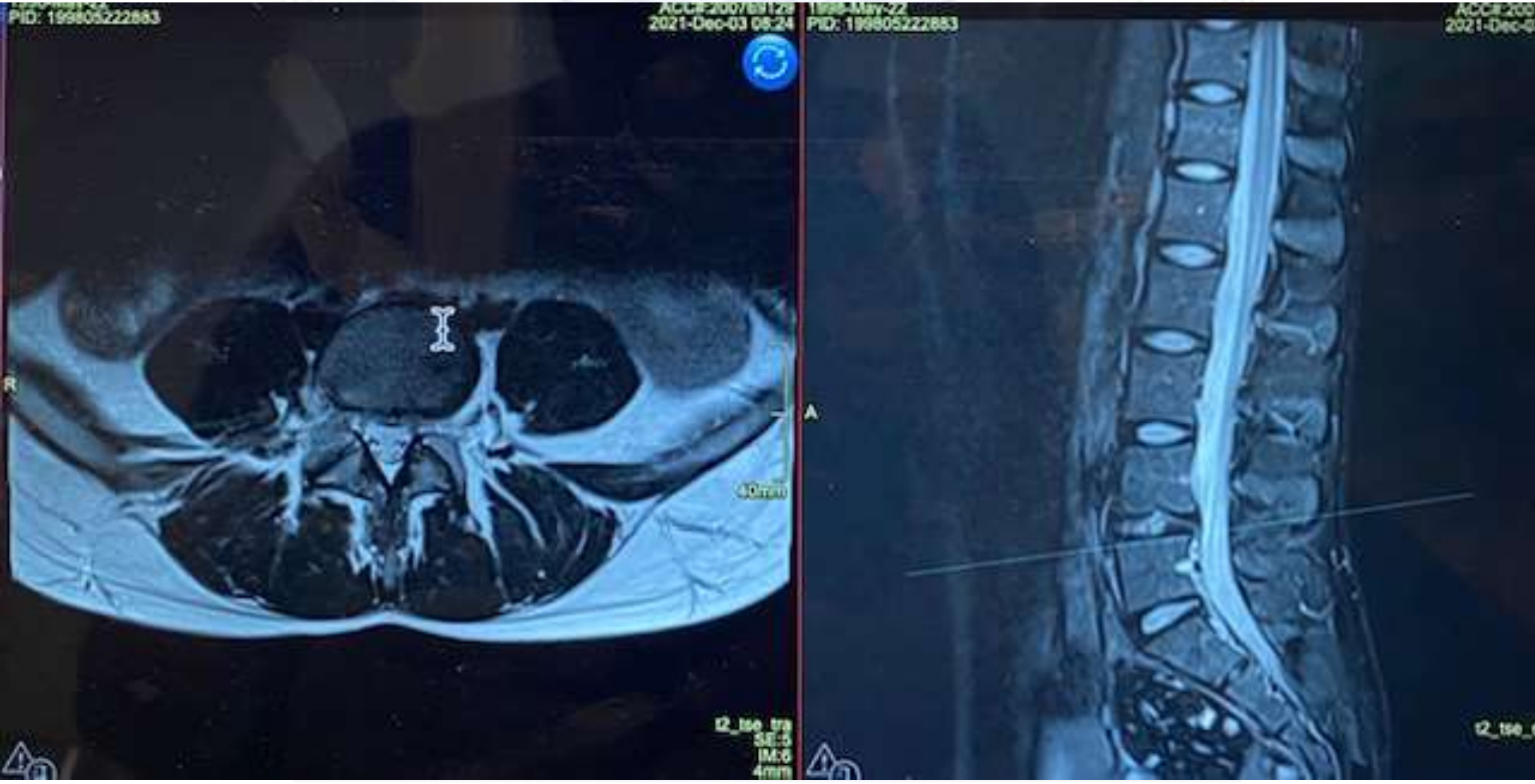
Procedures by therapeutic segments



There are no established treatments for discogenic low back pain, yet the condition appears to be common among patients with chronic low back pain. Surgery is the mainstay of treatment, but it is a major undertaking and its effectiveness is limited.

NIKOLAI BOGDUK, MD, PHD
Spine Section Editor, The University of Newcastle,
Callaghan, New South Wales, Australia

What is wrong with this MRI?



Alicja Persson,
Elite Swedish cross country skier

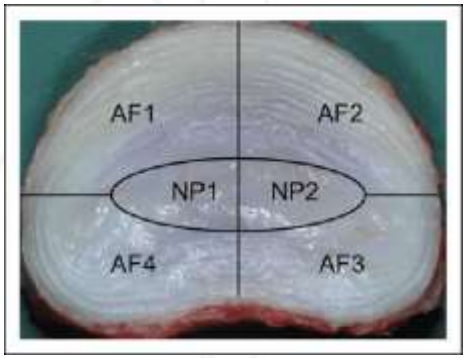
Thermal annuloplasty using percutaneous endoscopic discectomy for elite athletes with discogenic low back pain in EuroPainClinics

Patient	Sport	Sex	Age	Disc level	Duration of LBP (months)	VAS before	VAS after	HIZ	Return to activity (months)
P1	Cross-country sking	Female	17	L5/S1	11	9	0	+	2
P2	Cross-country sking	Female	19	L5/S1	18	10	1	+	3
P3	Cross-country sking	Female	20	L4/L5	16	9	0	+	2
P4	Cross-country sking	Female	21	L5/S1	13	8	0	+	2
P5	Alpine sking	Female	18	L4/L5	9	9	1	+	2
P6	Running	Female	33	L5/S1	6	10	1	-	3
P7	Running	Male	23	L4/L5	7	9	0	+	4
P8	Soccer	Male	24	L5/S1	4	8	0	+	3
P9	Soccer	Male	27	L4/L5	11	10	1	+	4
P10	Soccer	Male	19	L4/L5	14	9	0	+	4

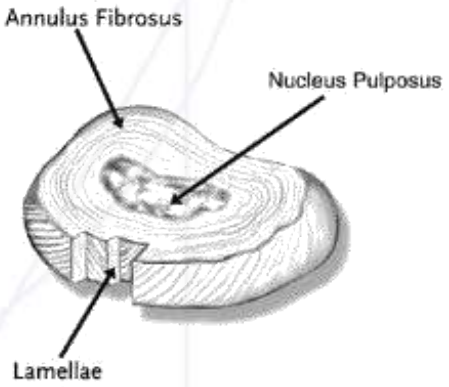
Basic IVD anatomy

Nucleus is a **poorly compressible** structure with 80% water helping it carrying out its role of load dispersion, shock absorption and maintenance of internal pressure

Annulus Fibrosus is a structured concentric lamellae consisting of **fibrocartilaginous tissue**. It is referred to 2 sections, the inner and outer annulus fibrosus.



The collagen has anisotropic, **nonlinear and inhomogeneous mechanical property which help to withstand complex load pattern and in particular radial forces**



AF is able **to transfer and distribute load allowing radial bulge, tensile stress, rotation and compressive loading** facilitating IVD joint mobility

Mechanism of discogenic pain

The necrosis of chondrocyte like cells in nucleus, it is a natural process with accelerating rate as per aging.

Starting around 2% at birth to 50% in adulthood.

Cells necrosis causes pathological state - cartilage—collagen interphase degradation, syndesmophyte formation with abnormal bone growth at the adjacent vertebra and calcification, stiffening the IVD joint

Vertebra end plate porosity increases up from 50–130% with aging and disc degeneration, affecting its mechanical property

Risc factors of discogenic pain

Structural changes and biomechanics of spine and pelvis, trauma, genetics, smoking, nutrition deficiency plays important role in leading to DDD.

Vertebra body shape plays a role in determination of the stress distribution between the superior and inferior adjacent IVD

A wedge shape L5 will have different forces going through the L4/5 and L5/S1 disc compared to regular and rectangular shape L5. (Study showed that asymmetry of superior and inferior endplates in the mid-sagittal plane is a risk factor for lumbar disc degeneration).

Altered paraspinal muscle morphology and joint laxity

Chronic and excess exposure to high mechanical load can lead to deleterious effects on IVD

Low rate of loading is important for forced convection aiding in diffusion of nutrients both to normal and degenerated disc

Mechanism of discogenic pain

A normal disc is aneural and avascular

The flow of nutrients are by passive diffusion from adjacent end plate vessels and pre-disc vessels reaching from the inner layer of the disc in centrifugal manner to outer layer of disc diffusing outwards

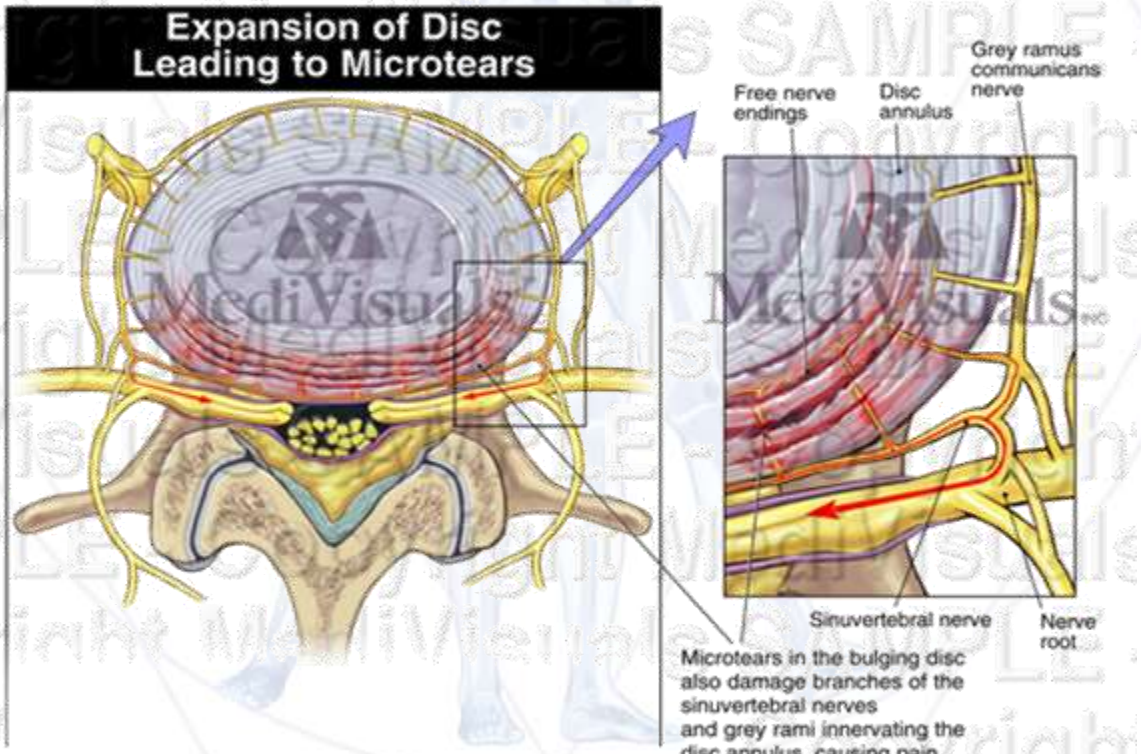
A degenerated intervertebral disc releases nociceptive and growth factors that lead to ingrowth of nerve fibers into the intervertebral disc

The loads applied to these nerve fibers cause pain

Athletes are more likely to be subjected to repeated overload of the spine than non-athletes

Mechanism of discogenic pain

Pain generators are postulated to be discogenic origin, although recent studies found some association with adjacent vertebral end plates and vertebral bodies, known as modic changes.



Discogenic pain and sinuvertebral nerves

Sinuvertebral nerve (SVN) **is associated with 26–39%** of patients with lower back pain

It has a variable penetration to annulus in normal and diseased state, **penetrating much deeper in diseased state and even as deep as nucleus pulposus**

The penetration is mediated **by vascularized granulation formation bringing in the neurotropic factors and facilitating the pathologic penetration** of sinuvertebral nerve fibers to deeper disc region

The sinuvertebral nerve fibers are denser in the end plates of degenerated disc as compared to normal disc

Studies showed that when sinuvertebral nerve penetrated deep enough to be in contact with nucleus pulposus, various side effects occurs such as increased neural damage, inflammatory cells accumulation and increased capillary permeability and increment of nerve discharge

There are patients with sinuvertebral and basivertebral nerve pain presenting with **radicular pattern of pain without any significant radiological evidence** of significant irritations

Basivertebral nerve and discogenic pain

Basivertebral nerve (BVN) is a paired nerve believed to play an important role in end plate pain nociceptive transmission. BVN transmits pain signal from end plate.

BVN are branches of SVN which enters vertebral body through central vascular foramen together with basivertebral vessels and branches around the end plates.

The transmission substances are found to be substance P, protein S-100, PGP 9.5 and CGRP which **are predominantly nociceptive neurotransmitters**.

BVN density is proportional to the amount of disc damage, creating evidence of its role in chronic lower back pain.

Diagnosis of discogenic pain – basic examination

The physical findings characteristic of discogenic low back pain do not include symptoms in the lower limbs

The pain typically increases in affected patients **on forward bending** of the lumbar spine

The reason for this is that flexion of the lumbar spine increases the load on the **anterior structures** (the discs and endplates of the vertebrae)

Pain **on bending** of the lumbar spine should **raise suspicion** for a lesion of the intervertebral disc

Diagnosis of discogenic pain – imaging techniques

MRI is indispensable when an accurate diagnosis is needed

A HIZ is a region that shows as a high- intensity change at the posterior annulus fibrosus on T2-weighted

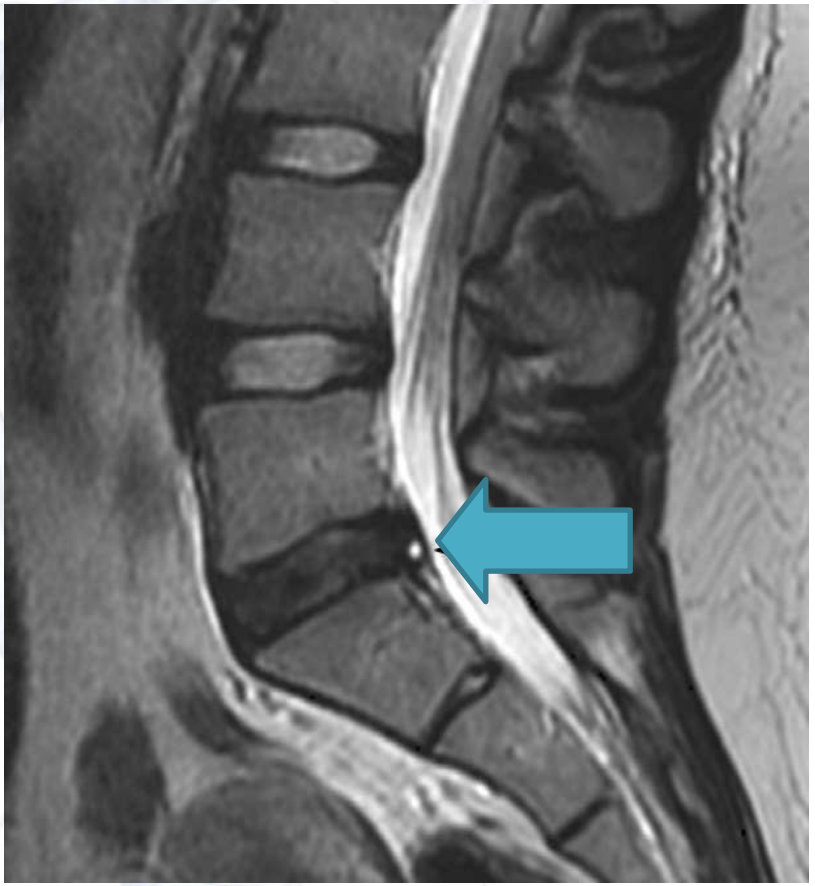
Several reports have shown that **fluid accumulates at the site of a tear lesion** at the annulus fibrosus and reflects secondary inflammatory changes

A HIZ does not necessarily cause low back pain, so the relation between a HIZ and low back pain remains controversial;

Discogenic pain

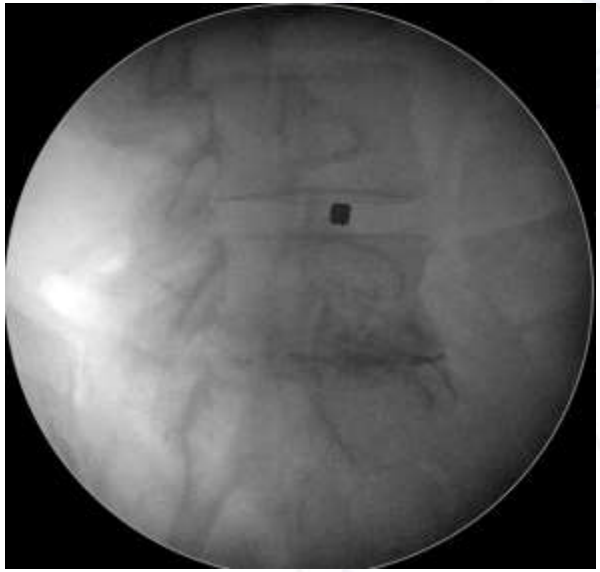
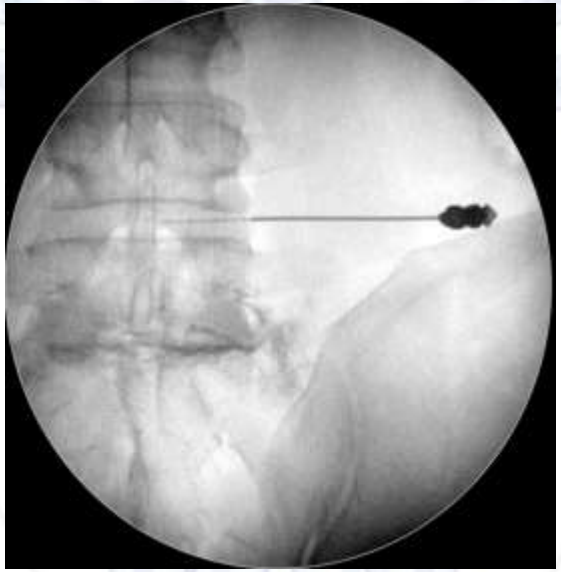
High Intensity Zone (HIZ)

- Visible on T2 MRI images (1)
- Hyperintensive (white) zone at the AF
- 83-86% positive predictive value for concordant pain during discography (2)



C. Aprill and N. Bogduk, "High-intensity zone: a diagnostic sign of painful lumbar disc on magnetic resonance imaging," Br. J. Radiol., vol. 65, no. 773, pp. 361–369, 1992.
K. S. Lam, D. Carlin, and R. C. Mulholland, "Lumbar disc high-intensity zone: the value and significance of provocative discography in the determination of the discogenic pain source," Eur. Spine J., vol. 9, no. 1, pp. 36–41, 2000.

Discography and discogenic pain


Confirming reproducible pain by discography is still essential for definitive diagnosis of discogenic pain.

Special groups with discogenic pain

Low back pain in elite athletes is a serious problem, and early diagnosis and appropriate treatment are required.

Some reports suggest that pain originating from an intervertebral disc is relatively common, accounting for up to 26–42% of all cases of low back pain.

Low back pain is often treated conservatively, surgery may be indicated when the pain is refractory to conservative therapy or when an early return to play is desired.

For athletes, it is preferable that the treatment is minimally invasive.

Original article doi: 10.2176/nmc.oa.2018-0256
Neurol Med Chir (Tokyo) 59, 48–53, 2019
Online January 23, 2019

Thermal Annuloplasty Using Percutaneous Endoscopic Discectomy for Elite Athletes with Discogenic Low Back Pain

Hiroaki MANABE,[1] Kazuta YAMASHITA,[1] Fumitake TEZUKA,[1] Yoichiro TAKATA,[1] Toshinori SAKAI,[1] Toru MAEDA,[1] and Koichi SAIRYO[1]
[1]Department of Orthopedics, Institute of Biomedical Sciences, Tokushima University Graduate School, Tokushima, Tokushima, Japan

Special groups with discogenic pain

Adolescent Lumbar Disc Herniation

Lumbar disc herniation (LDH) in children and adolescents is rare, representing 0.5% to 3% of all herniations

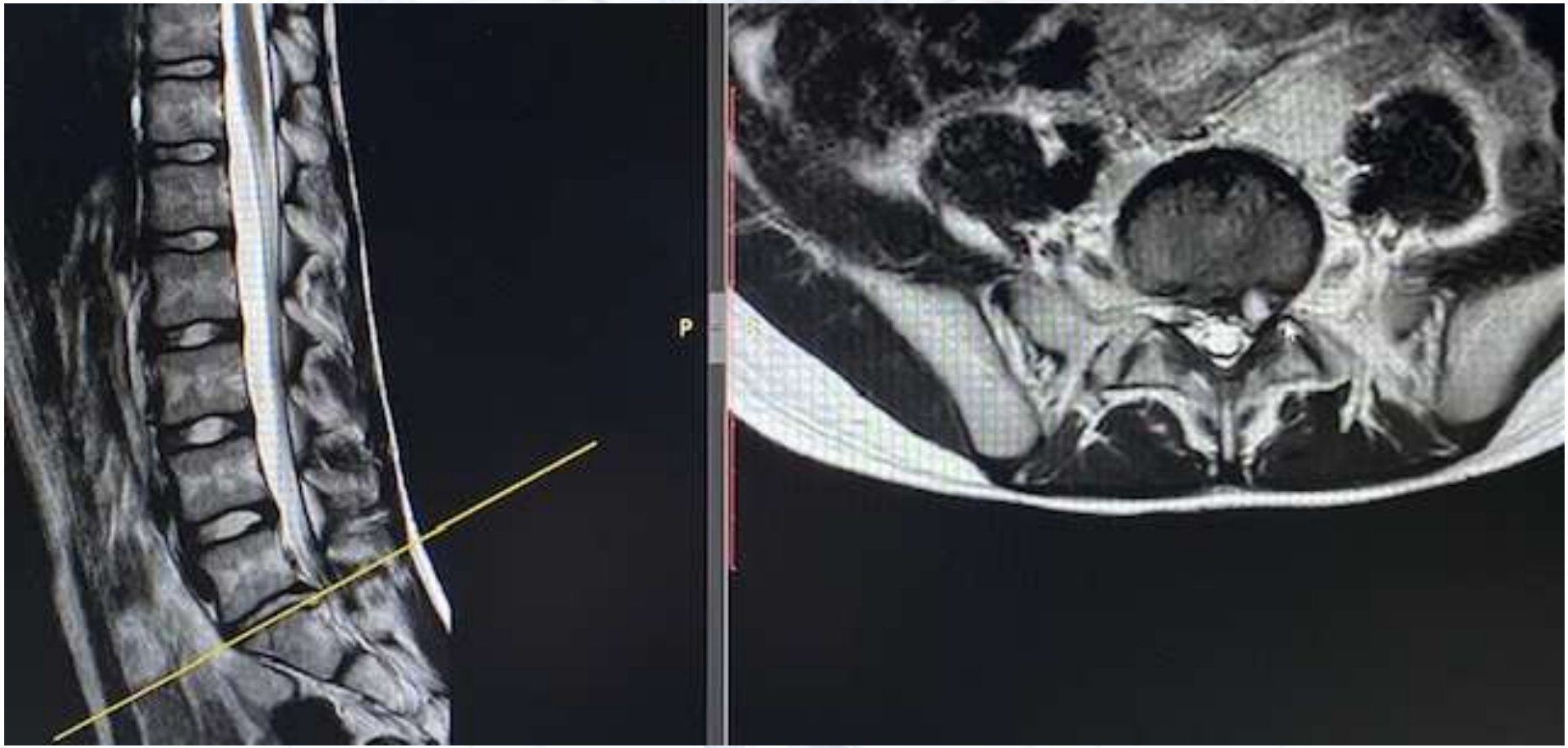
Because conservative treatment is not as effective for pediatric LDH as it is for adult LDH in pediatric patients with neurological deficits responding poorly to conservative treatment should undergo surgical procedures.

Surgical modalities comprise conventional open discectomy, microsurgical discectomy (MD) and percutaneous endoscopic discectomy (PED)

The optimal choice is controversial due to the rarity of this disease.

Transforaminal endoscopy offers direct acces to the herniation without any trauma of sorrounding structures.

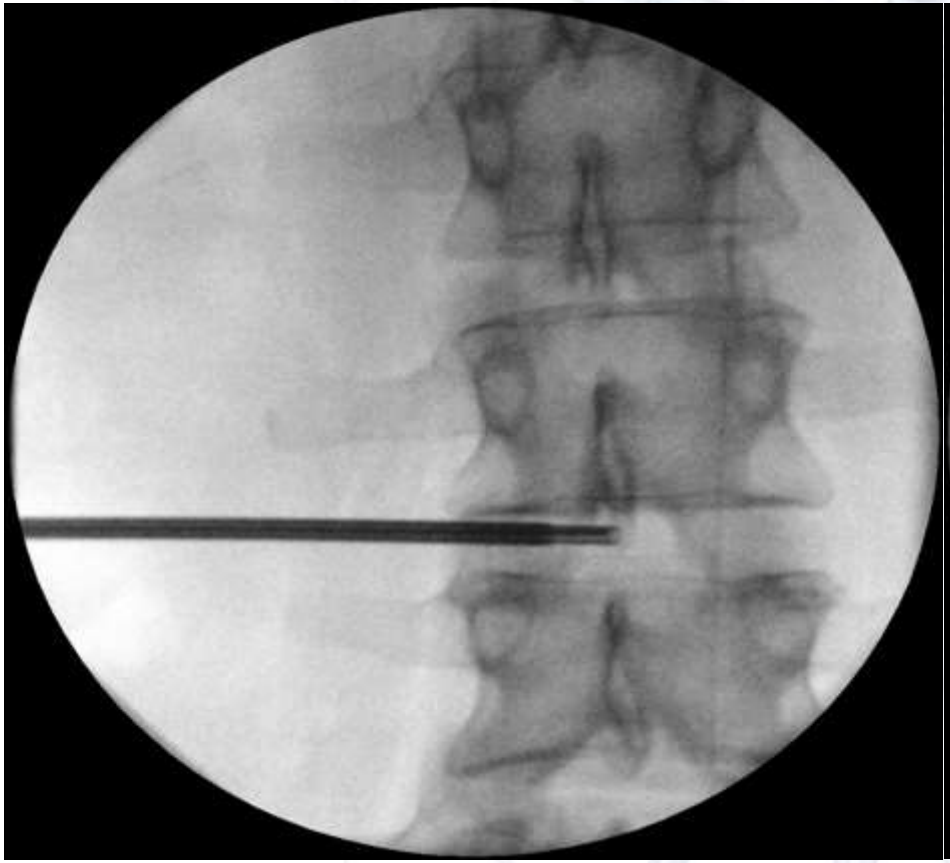
Adolescent disc herniation



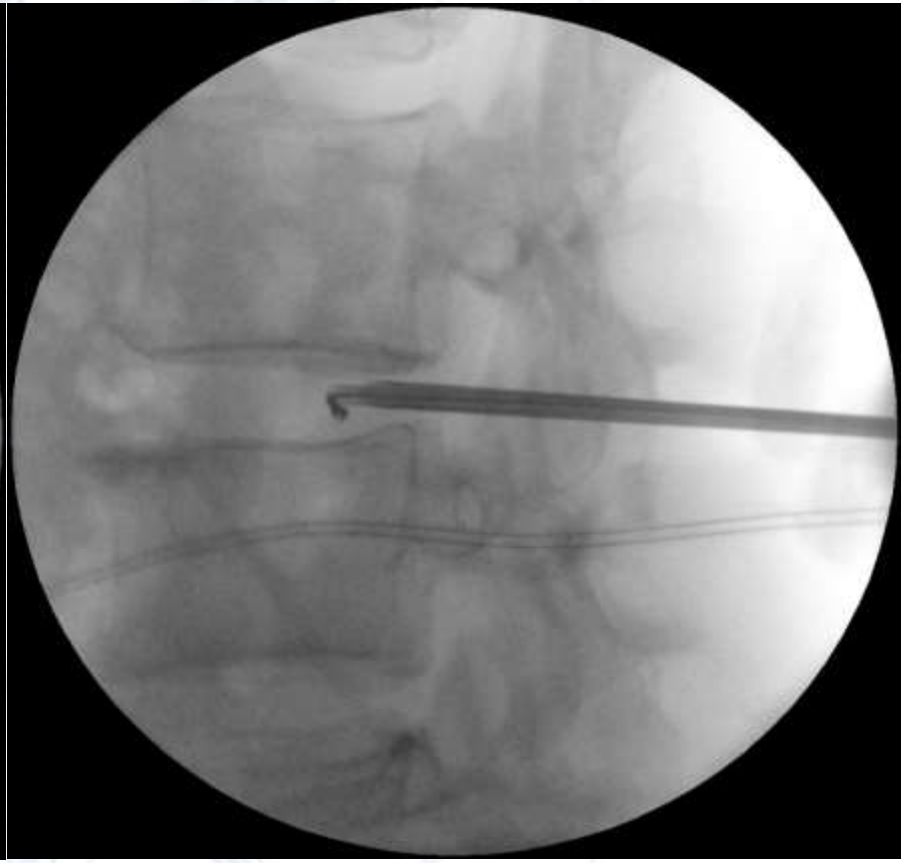
Treatment options for the discogenic pain

- **Radical surgery** (interbody fusion, disc prothesis) - damages the back muscles and decreases the mobility of the lumbar spine
- **Intradiscal injections** (corticosteroids, methylen blue, ozone) – does it work?
- **Intradiscal procedures** (laser, IDET, pulsed RF, disc fx) – controversial
- **Regenerative therapy** (PRP, stemcells) – promising results?
- **Basivertebral nerve denervation** (transpedicular intraosseous probe insertion) – still not availbale out of the USA
- **Transforaminal Endoscopy with thermal anuloplasty** – promising?

Disc FX procedure

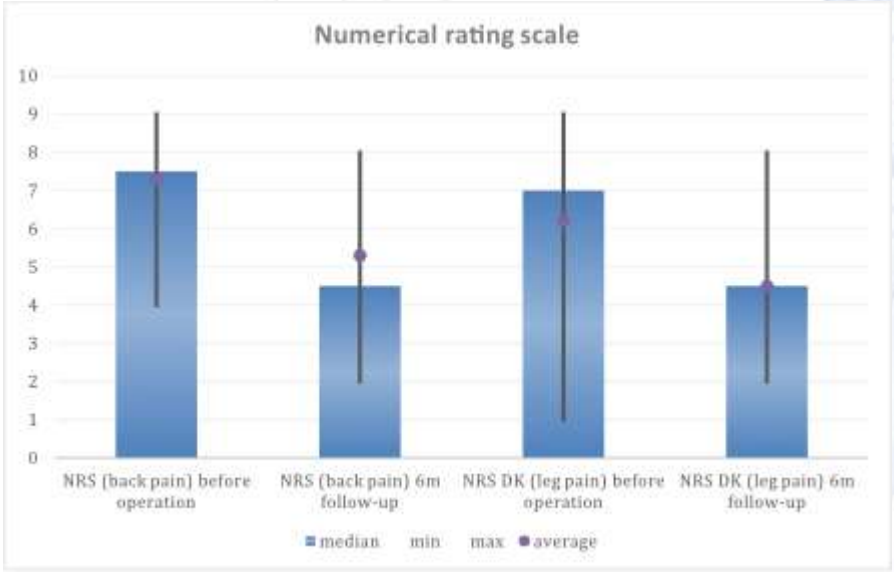


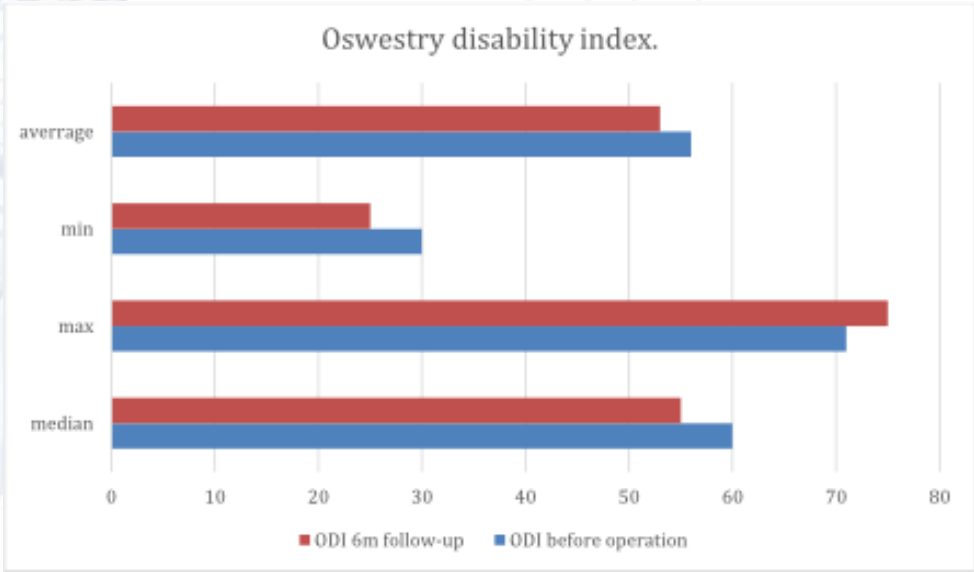
Manual decompresion



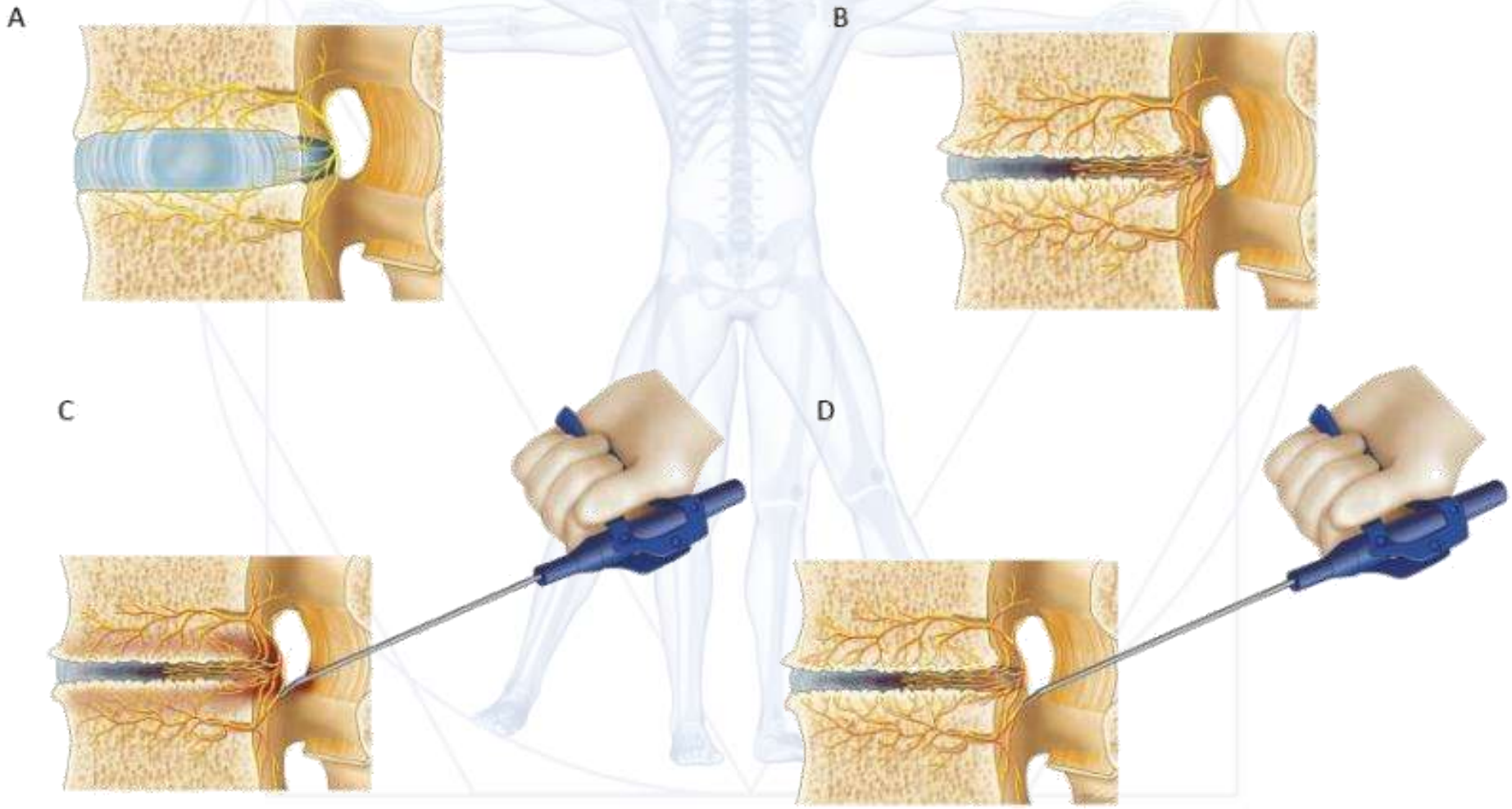
RF of the posterior Annulus Fibrosus

Disc FX procedure – our results





Basivertebral nerve and sinuvertebral nerves denervation



Transforaminal endoscopy with thermal annuloplasty

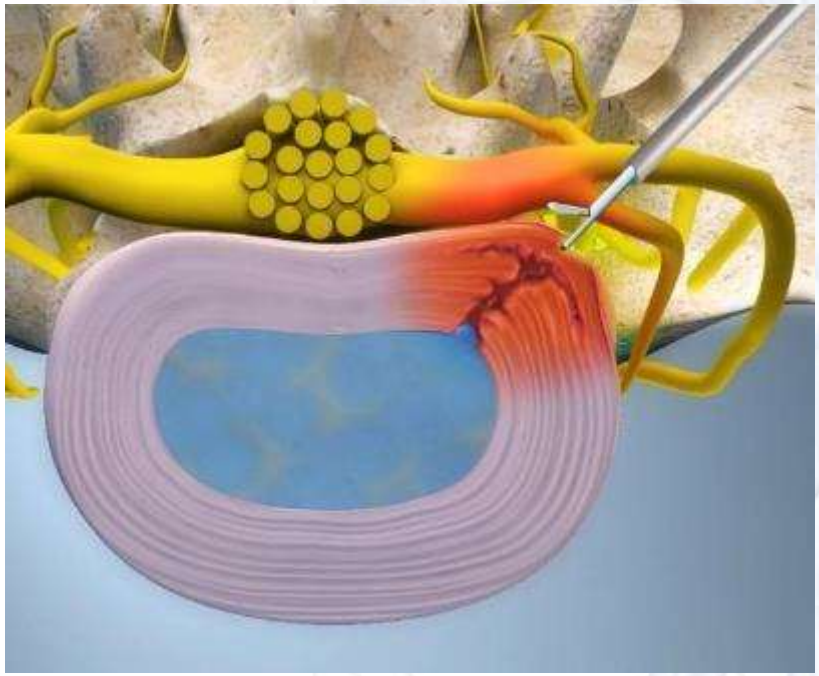
- TE with thermal annuloplasty is commonly performed via a transforaminal approach under local anesthesia
- Requires an 8-mm skin incision
- The TE technique is minimally invasive and preserves the back muscles
- The TE technique is also used for chronic discogenic back pain
- After selective discectomy of the degenerated disc, the posterior annulus fibrosus and site of the tear are modulated by thermal annuloplasty (TA) using a bipolar radi- ofrequency coagulator
- This procedure (TE/TA) has been reported to be an effective treatment for discogenic low back pain in some studies cali

Transforaminal endoscopy with thermal annuloplasty

(A) we can assess the traversing nerve root to be decompressed, the pedicle and location of basivertebral nerve above the pedicle are observed.

(B) Application of radiofrequency ablation on the basivertebral nerve above the pedicle. Application of radiofrequency ablation on the basivertebral nerve.

Transforaminal approach

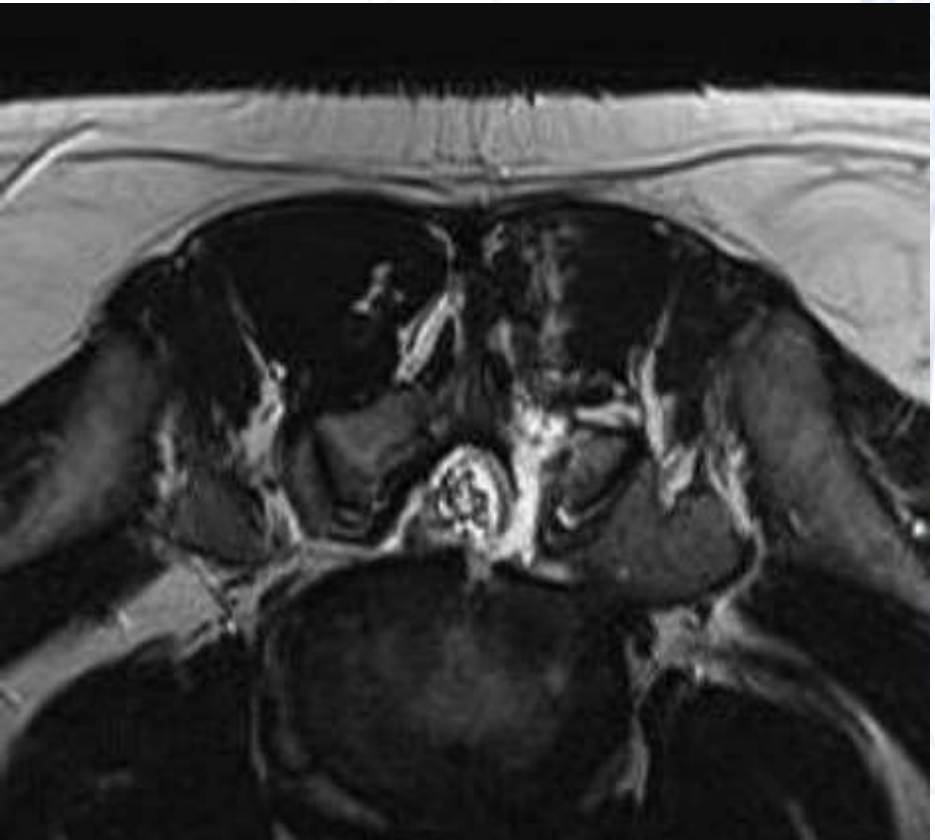


- Endoscopic transforaminal with MaxMore system
- Target: lateral recess and anterior epidural space, posterior annulus

Approach trauma by disc decompression

4 days post surgery

Endoscopic interlaminar



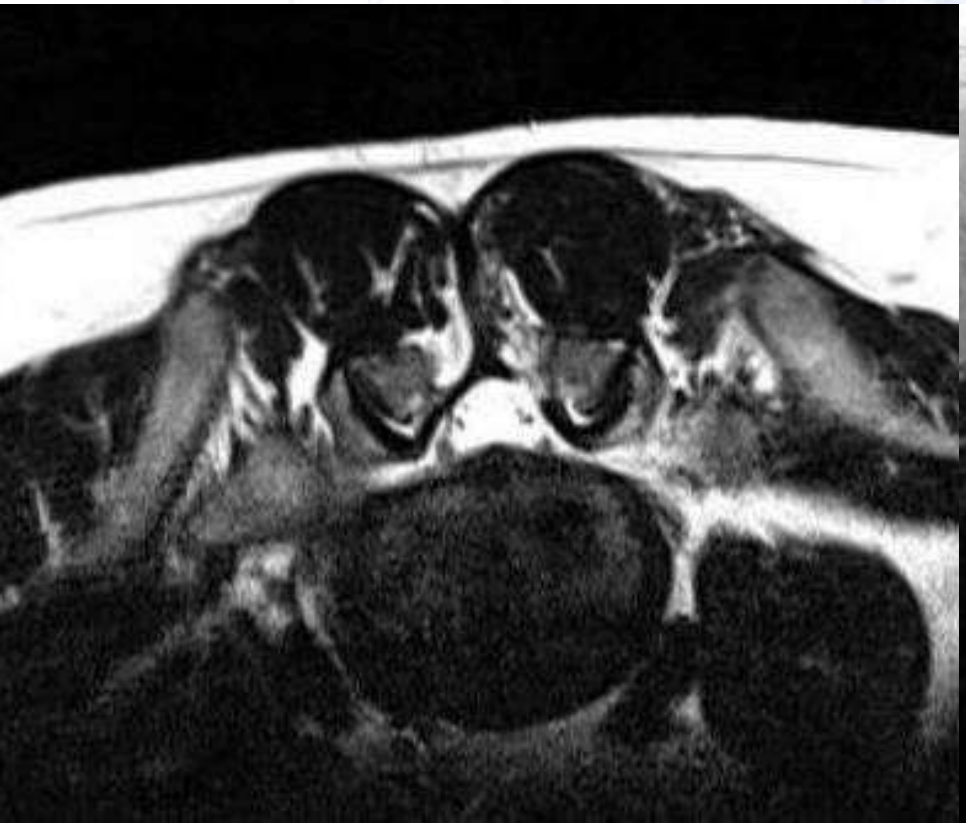
Microsurgery

Approach trauma by disc decompression

12 month after surgeries - fat degeneration

ongoing study for „muscle demages after different surgical approaches for disc surgery“

Endoscopic interlaminar



Microsurgery

Transforaminal approach, instruments

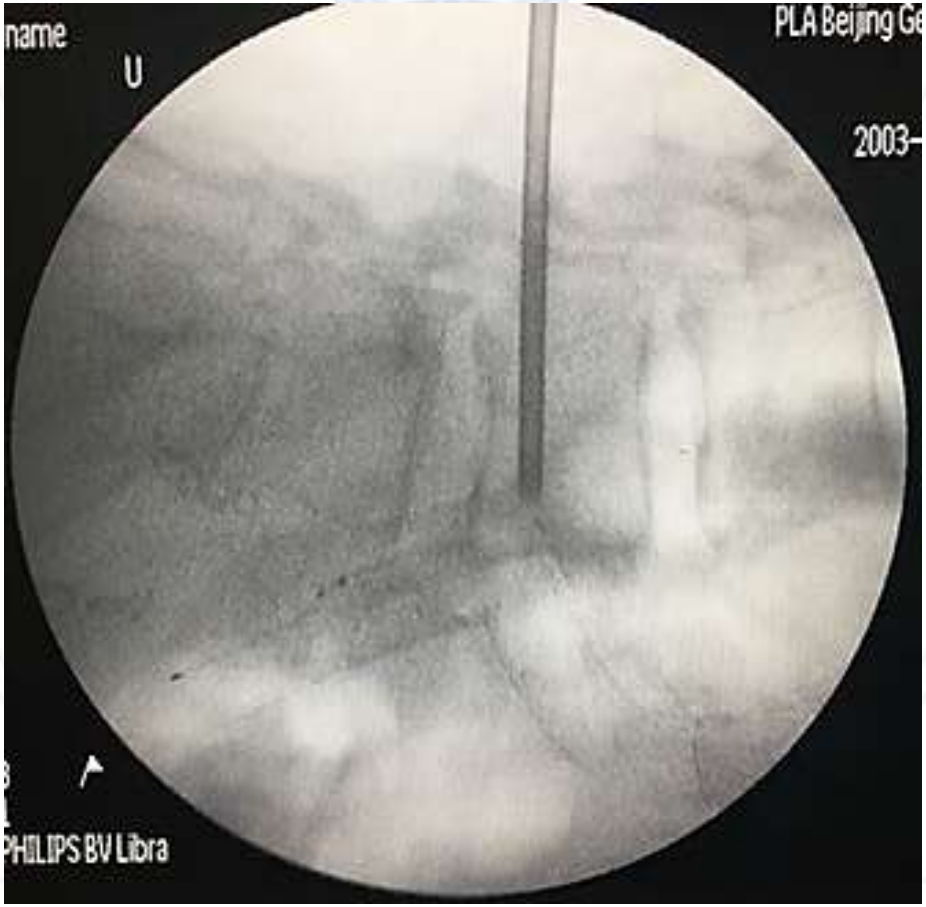
Complications

Study design: A retrospective clinical review.
Purpose: To explore the type, morbidity, risk factors and treatment strategies of postoperative complication following percutaneous endoscopic lumbar discectomy (PELD) surgery.
Methods: 10120 patients after PELD surgery were studied.

Results: There are 2 patients died in the perioperative period and 2 patients with permanent impairment of neural function after surgery, which should be the severest complication of PELD surgery. Transient paresthesia, intraoperative bleeding and dura sac tear are the most common complications reported by 6 surgeons. There are 2 suspected cases of postoperative hematoma, several cases of surgical instruments broken during the surgery and 20 cases of infection in 10120 patients, regarded as rare complications of PELD. Recurrence rate of PELD surgery is 4.7% to 6% reported by 3 surgeons. However, recurrence defined as complications of PELD surgery remain controversial.

Conclusion: Excellent clinical outcome of large case series after PELD surgery is reported. However, we need to face the limitations and complications of the surgery. The complication rate should be reduced by caring about the treatment, surgical indications strictly selected and the guidance of experienced surgeons.

The wrong direction of puncture needle increased the risk of injury of lumbosacral plexus, blood vessels and abdominal viscera



Radiation

N	Age	G	Approach	Level and characteristics	Time (sec)	Radiation (mGy)
1	55	F	TF	L3L4 - foraminal - extrusion	00:48	28.036
2	51	M	TF	L5S1 - foraminal - extrusion	00:40	29.350
3	71	M	TF	L4L5 - posterolateral - extrusion	00:45	35.296
4	35	M	IL	L5S1 - posterolateral - extrusion	00:19	11.352
5	40	F	TF	L1L2 - central - extrusion	00:59	40.704
6	30	M	TF	L4L5 - posterolateral - extrusion	00:28	21.939
7	63	M	TF	L4L5 - posterolateral - protrusion	00:44	37.110
8	54	M	TF	L4L5 - posterolateral - down migration	00:34	23.871
9	42	M	TF	L4L5 - posterolateral - down migration	00:23	15.254
10	41	M	IL	L5S1 - posterolateral - extrusion	00:09	4.236
11	59	M	TF	L4L5 - posterolateral - extrusion	00:34	17.308
12	41	F	TF	L5S1 - central - extrusion	00:50	25.510
13	41	F	TF	L4L5 - central - extrusion	01:30	30.400
14	38	M	IL	L4L5 - posterolateral - down migration	00:09	13.860
15	72	M	IL	L5S1 - central - extrusion	00:06	5.115
16	32	M	TF	L4L5 - posterolateral - extrusion	00:42	31.963
17	39	F	TF	L4L5 - posterolateral - extrusion	00:35	37.490
18	37	F	TF	L5S1 - foraminal - extrusion	00:29	30.620
19	49	F	IL	L5S1 - posterolateral - extrusion	00:17	11.079
20	41	M	IL	L5S1 - posterolateral - extrusion	00:07	4.566

Abbreviations: F, female; G, gender; IL, interlaminar; M, male; mGy, miligray; n, number; sec, seconds; TF, transforaminal.

Patient characteristics

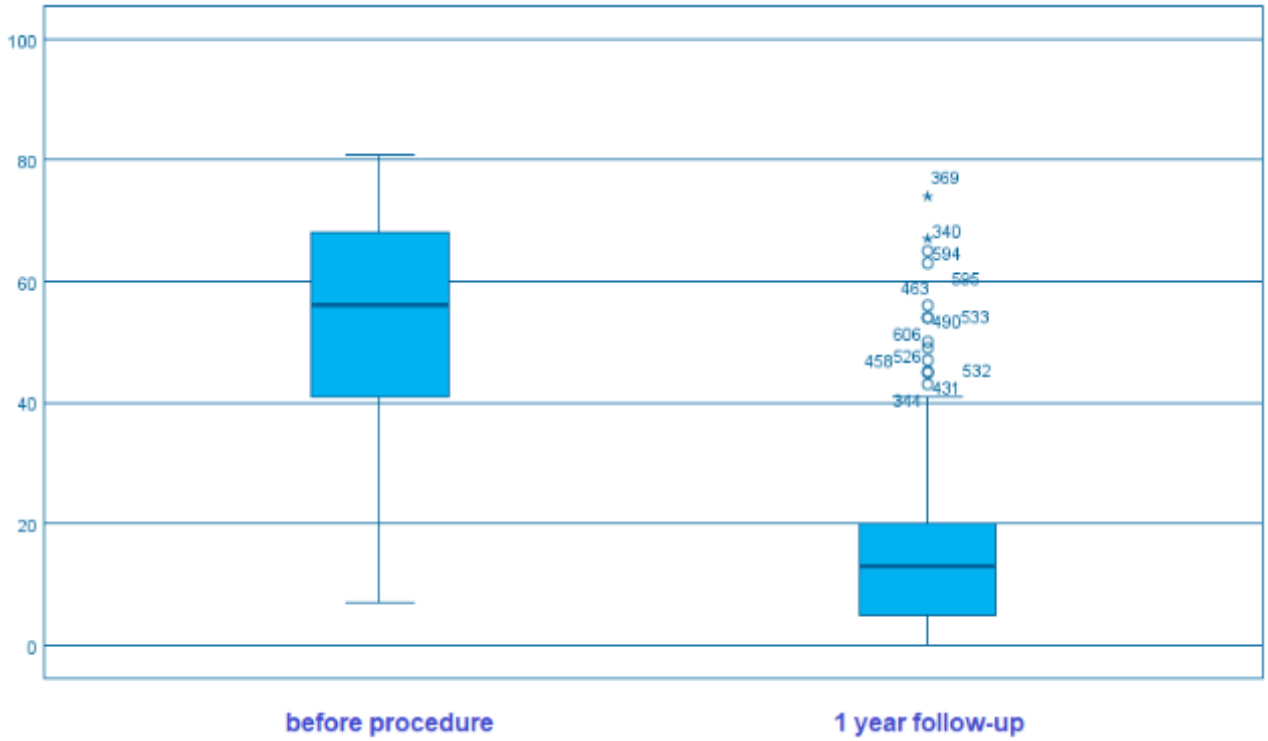
Endoscopic discectomy – 405 patients follow-up

Gender	
Male	**209**
Female	**196**
Age	
Minimum	**21**
Maximum	**79**
Median	**45**
Average	**46,3**
Surgical approach	
TF	**319**
IL + TL	**74+12**

Disc herniation	
L1/L2	**0**
L2/L3	**3**
L3/L4	**18**
L4/L5	**169**
L5/S1	**208**
L3/L4 + L4/L5	**6**
L4/L5 + L5/S1	**1**
Reoperations	
Count	**44**
%	**10,9**

Oswestry Disability Index

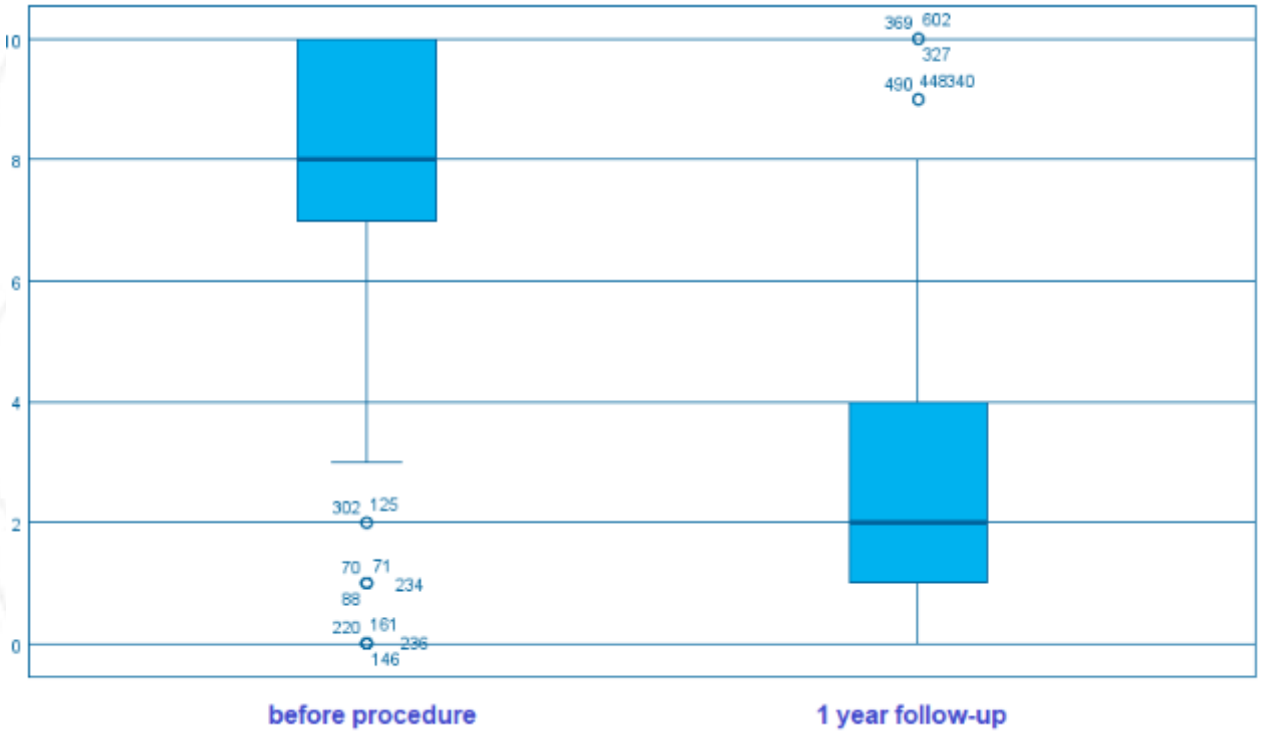
N 405pt



Paired Samples Test			95% Confidence Interval of the Difference		Sig. (2-tailed)
Mean (ODI) before procedure	Mean (ODI) 1 year follow-up	Std. Deviation	Lower	Upper	p
67,01	18,62	25,5	45,52	51,276	< 0,001

Low back pain

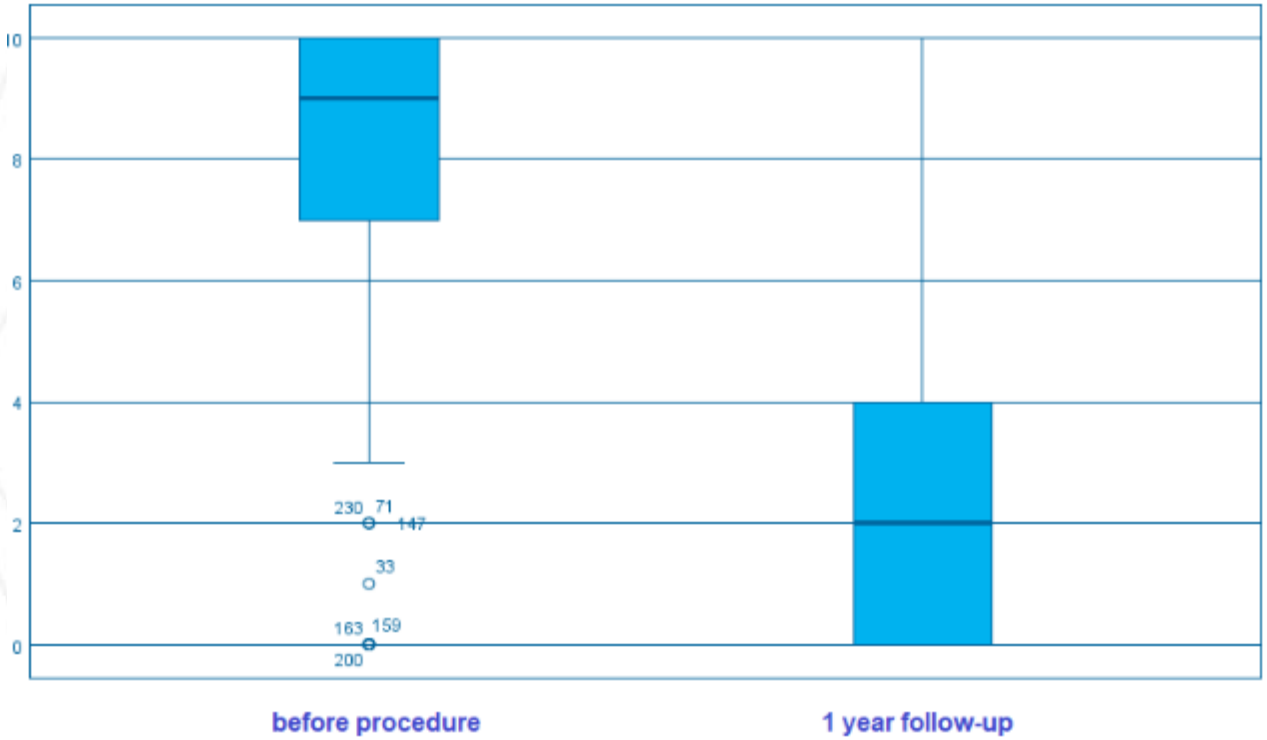
N 405pt



Paired Samples Test			95% Confidence Interval of the Difference		Sig. (2-tailed)
Mean (NRS) before procedure	Mean (NRS) 1 year follow-up	Std. Deviation	Lower	Upper	p
7,83	2,77	3,321	4,688	5,437	< 0,001

Leg pain

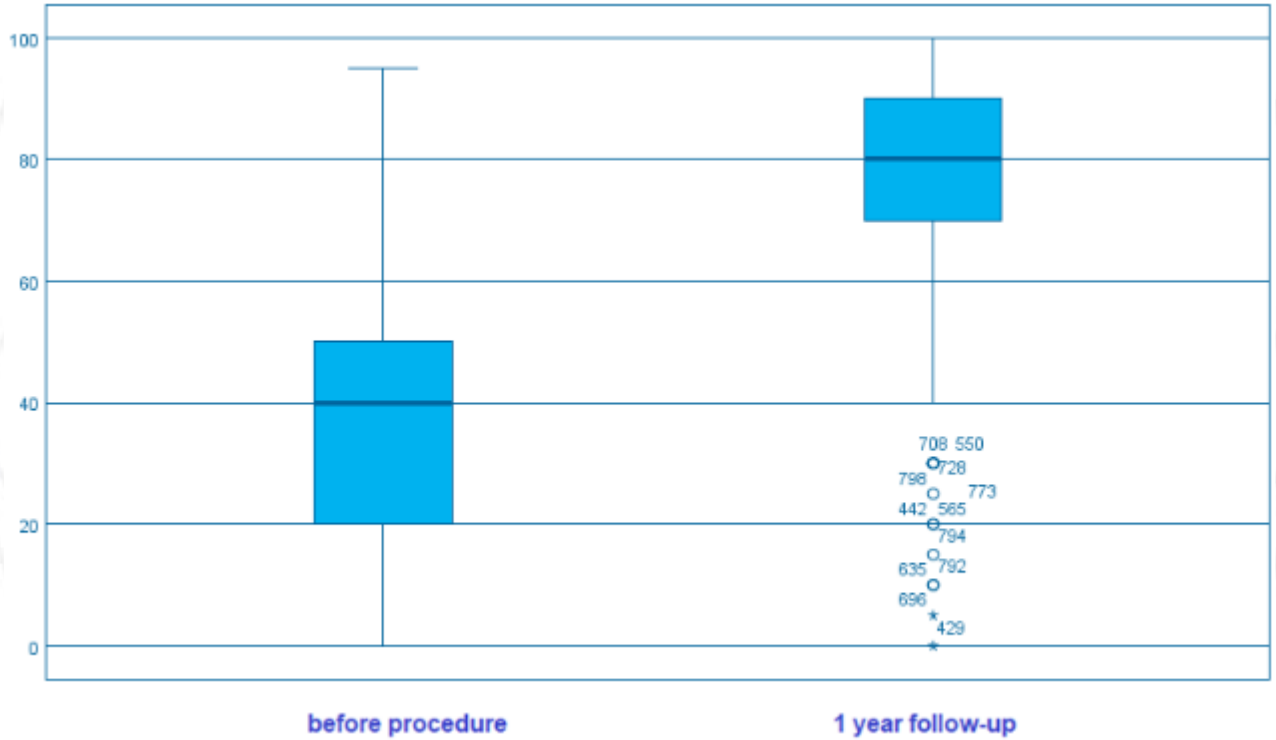
N 405pt



Paired Samples Test			95% Confidence Interval of the Difference		Sig. (2-tailed)
Mean (NRS) before procedure	Mean (NRS) 1 year follow-up	Std. Deviation	Lower	Upper	p
7,96	2,40	3,499	5,164	5,954	< 0,001

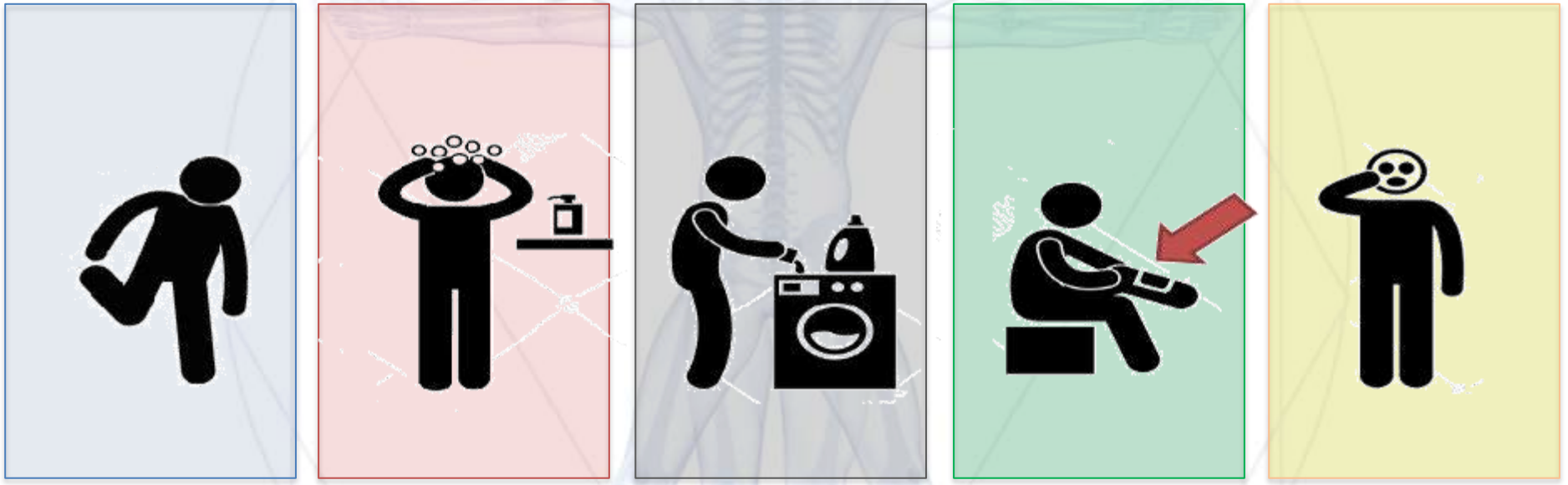
EQ-VAS

N 405pt



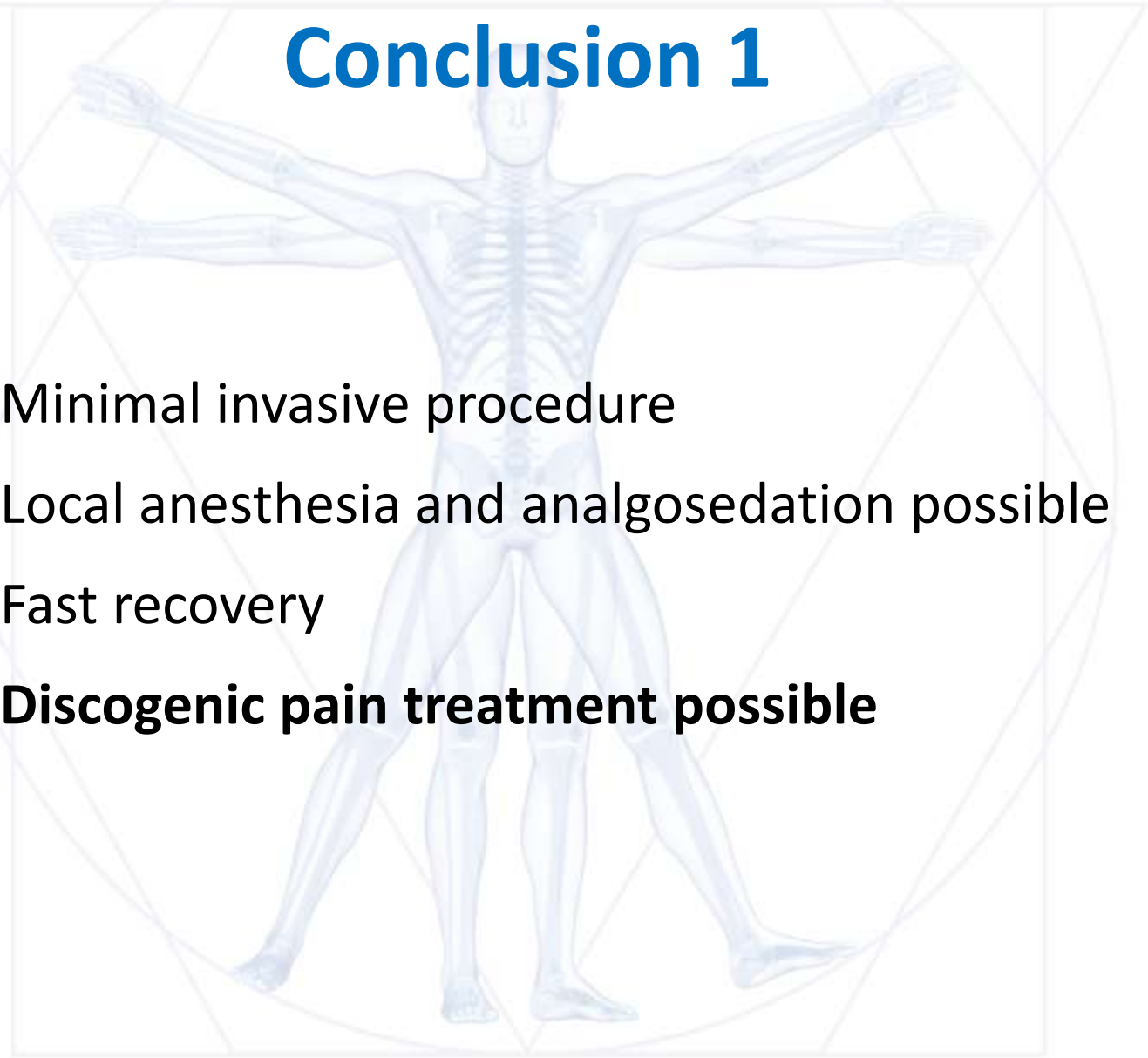
Paired Samples Test			95% Confidence Interval of the Difference		Sig. (2-tailed)
Mean (EQ-V) before procedure	Mean (EQ-V) 1 year follow-up	Std. Deviation	Lower	Upper	p
39,13	79,38	30,317	-43,203	-37,281	< 0,001

EQ-5D-5L



Mobility | **Self-care** | **Usual activities** | **Pain & discomfort** | **Anxiety & depression**

Conclusion 1



- Minimal invasive procedure
- Local anesthesia and analgosedation possible
- Fast recovery
- **Discogenic pain treatment possible**

Conclusion 2

The associated medical and psychosocial factors that are likely contributing to the ongoing pain and disability (sleep disturbance, fear avoidance, cata-strophizing, obesity, depression, anxiety, socioeconomic issues) need to be addressed in any treatment plan for chronic LBP, **or the intervention is doomed to fail.**

It is time to revisit old concepts with respect to the treatment of chronic LBP: interdisciplinary, comprehensive programs that **encourage physical activation despite pain.**

LBP, particularly in the chronic state, **cannot be successfully treated with individual interventions of any kind.**






ME SILU POMÁ