Discogenic Pain: Diagnosis and Treatment

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Learning Objectives

• Discuss the degenerative cascade that leads to discogenic pain
• Explain discography, the controversy surrounding this test, and opinion regarding its use in evaluating low back pain
• Apply an evidence-based approach to use of new treatments for discogenic pain
Discogenic Pain

- Anatomy and pathophysiology
- Patient evaluation
- Treatment
  - Functional restoration
  - Intradiscal Electrothermal Therapy (IDET)
  - Lumbar fusion
Lumbar Spine Pain: General

• Very common in active population
• Mechanism of injury
  – Acute, dynamic overload
  – Chronic, repetitive exertion
• Natural history
  – First time episode usually self-limited
  – High recurrence rate, 70-90%
Lumbar Spine: Degenerative Cascade

- Segmental dysfunction
- Segmental instability
- Segmental stabilization
Segmental Dysfunction

• Disc pathology
  – Circumferential annular tears
  – Radial annular tears

• Z-joint pathology
  – Synovitis
  – Hypomobility

• Clinical correlates
  – Axial pain
  – “Lumbar sprain/strain” syndrome
Segmental Instability

• Disc pathology
  – Internal derangement/degeneration
  – Herniation
• Z-joint pathology
  – Degeneration
  – Capsular laxity
• Clinical correlates
  – Axial pain ± radicular pain
  – HNP, instability, stenosis
Segmental Stabilization

• Disc
  – Progressive degeneration
  – Osteophytes

• Z-joint
  – Progressive degeneration
  – Osteophytes

• Clinical correlates
  – Axial pain/stiffness
  – Radicular pain
  – Osteoarthritis, spinal stenosis
Incidence of back pain and disc degeneration as a function of age
Lumbar Disc: Annulus Fibrosis

- Mostly H$_2$O (60-70%)
- Type I collagen (thickness)
- Proteoglycans – binds H$_2$O
- Layers (lamellae) arranged in opposite directions
Lumbar Disc: Nucleus Pulposus

- Mostly H₂O (70-90%)
- Type II collagen (viscosity)
- Proteoglycans
- Posterior location
Lumbar Disc: Stabilizing Functions

**Weight bearing:**
- nucleus pulposus transmits force to annulus fibrosis and endplate

**Rotation:** Lamellae of annulus in concentric layers oriented in opposite direction to resist torsion
Disc Degeneration (Early)

Internal disc disruption
- Chemical phenomenon of nucleus or annulus
- Trauma = end-plate fracture
- Heal or radial fissure
- Diagnosis
  - Discography
  - High-intensity zone on MRI
Disc Degeneration (Late)

- Radial fissure
- Disc bulge
- Disc protrusion
- Disc extrusion
- Disc sequestration
Discogenic Pain

• Anatomy and pathophysiology
• Patient evaluation
• Treatment
  – Functional restoration
  – Intradiscal Electrothermal Therapy (IDET)
  – Lumbar fusion
Degenerative Disc Disease

- Axial back pain
- Pain worsened with prolonged sitting or standing
- Radiographic changes are variable
- Pain reproduction with provocative discography

Lumbar Spine: Discogenic Pain-Axial

Symptoms and signs

– Onset
  • Sudden: annulus fibrosis tear
  • Insidious: internal disc disruption
– Truncal shift or forward list
– Painful motion: usually flexion
– Midline and paravertebral tenderness/spasm
– Usually normal neurologic exam
Lumbar Spine: Discogenic Pain – Axial

Imaging: plain radiographs

- Acute
  - Limited sensitivity and specificity
- Chronic
  - Evaluate for multilevel degenerative changes
  - Evaluate for instability with flexion-extension lateral images
Lumbar Spine: Discogenic Pain

Imaging: advanced: MRI test of choice, to assess for:

- high intensity zone, correlates with annular tear
- internal architecture of disc
- disruption of endplates
- central disc herniation
Discography

- Discography consists of 4 components:
  - Volumetric
  - Manometric
  - Radiographic
  - Pain provocation
    - Concordant versus discordant
- Controversy: can discography determine pain generators?

What is the role of discography?

The debate continues

Pro: “…disc stimulation is a highly specific diagnostic test…if a disc hurts in a patient there must be something wrong with that disc…”

-Nikolai Bogduk

What is the role of discography?

The debate continues

Con: “Until submitted to strict scientific evaluation, there is no basis for the performance of discography in clinical medicine.”

-Michael Modic

**Bogduk** N, Modic MT. Spine 1996;21:402-404
Discography: Indications

To determine if a given disc is symptomatic in…

- The further evaluation of demonstrably abnormal discs
- Presence of persistent, severe symptoms where other tests have been unrevealing
- The assessment of failed surgery patients
- The assessment of discs before fusion
- The assessment of minimally invasive surgical candidates

Discogenic Pain

• Anatomy and pathophysiology
• Patient evaluation
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  – Functional restoration
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  – Lumbar fusion
Discogenic Pain: Acute Phase Rehabilitation
Why Rehabilitate?

- Absence of symptoms does not imply normal function
- Prolonged “rest” is detrimental
- Accelerate restoration of function
- Decrease recurrence frequency, duration and intensity
- Limit the need for surgery
Goals of Acute Stage

- Education
  - Posture and body mechanics
  - Protection of the injured tissue

- Control pain and reduce inflammation

- Early mobility to produce physiologic loading

- Aerobic fitness
Methods to Control Pain & Inflammation

- Activity modification
- Thermal and electrical modalities
- Medication
- Manual therapy
- Traction
- Bracing
- Spinal injection
- Initial exercise
Deleterious Effects of Inactivity

• Decreased muscle strength
• Loss of large muscle flexibility
• Increased segmental stiffness
• Impaired cardiovascular fitness
• Reduced bone density
• Decreased disc nutrition
Medication

• Analgesics
  – NSAIDS (mechanism of pain relief unclear)
  – Tylenol, Tramadol
  – Opioids (time contingent use most effective)
• Anti-inflammatories
  – NSAID’s (consider side effects)
  – Corticosteroids (consider side effects)
• Muscle relaxants
  – True persistent muscle spasm unusual
  – Most act via central nervous system
Traction

• Types: inversion, pelvic belts
• Benefits
  • Myofascial stretch low back and hip girdle
  • Joint distraction
  • Neural canal decompression
• Intervertebral traction requires at least 25 - 50% of body weight
• Temporary measure
Bracing

- Soft corset (±metal stays) as limited measure
  - Comfort and warmth
  - Proprioceptive feedback
  - Body mechanics reminder

- Rigid brace
  - Symptomatic instability or hypermobility
  - Acute spondylolysis (comfort vs. healing)
  - Immobilization probably not effective for L5-S1 segment
Intradiscal Electrothermal Therapy (IDET)

- Recently introduced as a less invasive treatment for patients with symptomatic discogenic pain (Smith & Nephew)
- Uses a navigable, insulated resistive heater to treat intervertebral disc collagen
Intradiscal Electrothermal Therapy (IDET):

Outcomes:

- No randomized trials prior to release
- No complications, adverse events, or worsening of the baseline clinical condition at one-year follow-up reported after IDET (2 prospective studies in a total of 115 patients)
- >50% improvement well over half of treated patients
  - SF-36: Physical Function, Pain
  - Oswestry Disability Scores

Intradiscal Electrothermal Therapy (IDET):

Outcomes:

• Randomized, sham-controlled trial
• 1,360 patients screened to identify 64 eligible for enrollment
• 37 IDET/27 sham
• Strict inclusion criteria/standardized outcome measures (SF-36 and Oswestry)

Intradiscal Electrothermal Therapy (IDET): Outcomes

- Patients improved after both IDET and sham (SF-36 Physical Fxn, Oswestry, & VAS)
- NNT = 5 to attain 75% pain improvement
- 40% achieved >50% improvement
- 50% experienced no appreciable benefit

Intradiscal Electrothermal Therapy (IDET): Future Directions

A Randomized Clinical Trial of Intradiscal Electrothermal Therapy (IDET) versus Anterior Spinal Fusion for Treatment of Chronic, Discogenic Low Back Pain

James P. Rathmell, MD
Robert A. Monsey, MD
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Back Break

New treatments offer hope to those with bad backs, but picking one can be just as painful as the aches that all you.

BY ROB WHERRY

TODD DOUGLAS Fought MAKing back pain for more than a decade. The 53-year-old computer technician consulted 13 doctors, took ten different painkillers and endured four grueling spinal injections of cortisone. “I was taking a handful of pills a day just to exist,” he says.

Last year his doctor, James Rathmell, at the nearby University of Vermont Medical School in Burlington, pinpointed the problem: a cracking disc between two of his vertebrae. Douglas had three options: Continue to manage the pain with medication, have open-back surgery to fuse the vertebrae, or undergo an experimental, less-invasive treatment that shrinks the damaged disc by pricking a hot wire into it. Douglas decided on the hot wire last October, with the university picking up the $10,000 tab as part of a clinical trial of the new procedure. He has been pain-free ever since.

His treatment, called intradiscal electrothermal therapy, or IDET, is the latest in a wave of new remedies for back pain, an ailment that continues to torment the masses. A cure has eluded researchers, despite years of intensive study. Four of five adults have periodic back pain, and it is one of the leading causes of missed workdays in the U.S. (According to insurers and employers $45 billion in 1999.) A bad back pushed baseball star Cal Ripken into early retirement and forced President Kennedy into a rocking chair during staff meetings.

The spine’s downfall stems from its beauty, complexity; 24 vertebrae are interconnected by 170

DAMAGED DISC

HOW IT HAPPENS: Aging; obesity; sedentary lifestyle.

TREATMENT 20 YEARS AGO: Traction or surgery if pain didn’t subside.

TREATMENT NOW: Minimally invasive surgeries like IDET or discectomy. The latter involves removing 10% or so of the damaged disc to relieve pressure on nerve endings.

PROGNOSIS: More than two-thirds of patients have decreased pain.
IDET v. ALIF

Rathmell JP, Monsey RB. IDET v. Anterior Lumbar Interbody Fusion. JUR 2003;0:00-00.
Conclusions

• Nonspecific factors associated with the procedure account for a portion of the efficacy of IDET

• IDET appears to provide worthwhile relief in a small proportion of strictly defined patients with low back pain
Minimally Invasive Discectomy

Nucleoplasty

• Prospective observational study of 67 patients with DDD with/without contained disc protrusions

• Sustained improvements in pain reduction and improved function in >60% of patients at 12 months after treatment

Minimally Invasive Discectomy
Minimally Invasive Discectomy
Anterior Interbody Lumbar Fusion

A 50 year old man following anterior interbody fusion using titanium interbody cages.
Lumbar Fusion: Pedicle Instrumentation

A 56 year-old man following lumbar laminectomy and posterior fusion with pedicle screw-rod construct.
Discogenic Pain

Conclusions

• A common cause of axial low back pain
• Pain is usually self limited
• IDET has shown limited efficacy in selected patients
• Disc replacement is evolving
• Lumbar interbody fusion remains the only established therapy for persistent pain