The Role of Interventional Procedures in Sports Medicine

Zacharia Isaac M.D.
Director, Interventional Physical Medicine and Rehabilitation
Spaulding Rehabilitation Hospital

Spinal Injections

- Localize Diagnosis
- Reduce Pain/Inflammation
- Complement/Facilitate an Exercise Regimen
- Provide Non-Surgical Pain Management Options
- Overall, a Limited Role in Athletic Populations, Limited to no literature in this subset

Overview

- Mechanisms/Physiology
- Evaluation
- History
- Examination
- Diagnostic Testing
- Interventional Diagnoses and Procedures
PAIN
A time-based definition

**Acute Pain/Subacute**
- Time limited, <4 to 12 weeks
- Results from injury to tissue
- Resolves with healing
- Example: hnp

**Chronic Pain**
- ≥3 months
- Continues after initial injury heals
- Example: postherpetic neuralgia, chronic low back pain, fibromyalgia
- Less likely to improve

Mechanisms of pain

**Nociceptive Pain**
- Involves somatic structures
  - An appropriate physiologic response to painful stimuli

**Neuropathic Pain**
- Involves nervous system structures
  - An inappropriate response caused by a primary lesion or dysfunction in the nervous system

Neuropathic Pain

**Peripheral Mechanisms**
- Bradykins, PG, histamine, cytokines, nerve growth factors
- Membrane hyperexcitability
- Ectopic discharges
- Peripheral sensitization

**Central Mechanism**
- Wind up
- Central sensitization
- Membrane hyperexcitability
- Ectopic discharges
- Peripheral sensitization
- Loss of inhibitory controls
- Emotions/context
Predisposing factors to degenerative disc disease

- Aging (L1-2, L2-3, L3-4, L4-5)
- Lifting related occupations (L1-2)
- Sports Activities (L5-S1)
- High BMI (all lumbar discs)
- High LDL (L4-5)/ aortic atherosclerosis
- Genetics
- Tobacco
- Infectious – propionobacterium acnes, coag neg staph, cornyebacterium

Biochemistry and Disc Degeneration

- Painful structures
  - Intervertebral disc
  - Dorsal Ganglia of spinal nerve
  - Facet Joint
  - Ligaments
  - Muscles
  - Vascular perineural phenomenon
  - Osseous Pain from fracture/ stress reaction
Dysfunction

- Need to define the nature of the inciting event, and time relationship to onset of symptoms
- Axial or extremity symptoms?
- Axial is lumbosacral junction
- Extremity is the thigh and beyond
- The buttock is a subjective clinical judgement but usually gets lumped with the predominating complaint

History

- Assess Pain Intensity
  - VAS, PIVAS, PI--NRS
- Assess function
  - Work status
    - Basic activities of daily living
    - Instrumental activities of daily living
- Assess psychological function
  - Symptom exaggeration
  - Anxiety/Depression
  - Job satisfaction
Physical Examination

- Manual Muscle Testing
- Sensory Testing
- Reflex Testing
- Provocative Maneuvers
- Spinal Nerve Root Tension
- Psychological Pain Behavior
- Test Hip, knee, shoulder and for upper motor neuron signs

Dermatomes

- Not fully explanatory of clinical presentation
- Autonomic Disturbances
- Sensory changes discordant
Cervical Radiculitis Pain Pattern Summary

Upper Trapezius and Deltoid: C4-C8
Scapula: C6-C8 more so than C4 and C5
Upper Arm: C5-C8
Forearm Pain: C6-8 more so than C5
Chest Pain: C7,C8,C6


Pain referral pattern

- L5 Radiculopathy
Pain referral pattern

- L4 radiculopathy

Spinal Nerve Root Tension

- Herniated discs generate inflammatory cascade
- Tethering of spinal nerve root and dura
- Stretching leg stretches spinal nerve root and recreates pain
- Straight Leg Raise – L5 and S1 spinal nerves
- Femoral Stretch – L2,L3,L4 spinal nerves
Diagnostic Testing

- Xrays
- MRI/ CT/ Myelography
- Electromyography
- Diagnostic anesthetization or provocation
  - Spinal Nerve Root
  - Hip
  - Facet joint/ Medial Branch Blocks
  - Sacroiliac joint
  - Intervertebral Disc

Xrays

- Useful for fractures, spondylolisthesis, segmental instability

CT and MRI

- Identify herniated disc, spinal stenosis, degenerative disc disease, Pars Fracture/ Osseous Stress Reaction
- Evaluate for tumor, infection, fracture
- CT – radiation exposure, $$
- MRI – no radiation exposure, $$$
Asymptomatic Findings on MRI - boden 1990

Electromyography
- Needle exam identifies spinal nerve root motor involvement
- Does not identify sensory involvement
- Insensitive to clinical syndrome of radicular pain
- Can continue to show chronic changes in asymptomatic patients

Herniated Disc
Disc Herniations

- The larger the disc herniation, the more resorption
- The farther beyond the PLL, the more resorption
- Overall 69% herniations decrease in size
  - Subligamentous 56%
  - Transligamentous 79%
  - Sequestered 100%

Mechanisms of Nociception

- Local inflammatory mediators and intradiscal neuropathic pain
- Nucleus pulposus is remnant of embryonic notochord – herniation may result in antigen presentation to immune system
  - PLA2, TNF-alpha, Interleukin B1, IL-6, MMP, PGF2, bradykinins, C-Fos, Nerve growth factor, Substance P and CGRP and GAP-43 immunoreactive nerve fibers, etc.

Surgical Treatment

- Professional athletes successfully returned to sport 82% of the time, with an average career length of 3.4 years
- 226 patients who underwent surgical treatment, 184 successfully returned to play (81%), on average, for 3.5 years after surgery.
- There were no statistically significant differences in outcome in the surgical and nonoperative cohorts
- MLB more likely to return to sport, but discectomy associated with shorter careers compared with nonoperative cohort
- NFL less likely to return to sport, but had best benefit from surgery
Mechanical Low Back Pain

- Discogenic Pain
- Facet Joint
- Myofascial Pain
- Sacroiliac Joint Syndrome

Discogenic Pain

- Typically exacerbated with prolonged sitting
- Younger age group (20-50)
- MRI demonstrates nonspecific findings of degenerative disc disease: disc dessication, loss of disc height, anular tears/high intensity zone lesion (HIZ), herniations may be present but not required.
- Nonsedated provocative lumbar discogram (controversial)

Mechanisms of Nociception

- Mechanical insufficiency of disc
- Pain typically increased with prolonged sitting, stand, bending forward
- Pain from anulus, vertebral endplate, dura, spinal nerve root, or other mechanisms
Discogenic Pain

- Disc receives innervation from: Sinuvertebral nerve (ventral Ramus), Vertebral Nerve (autonomic root from sympathetic nervous system) and collateralize with ventral rami (somatic afferent)
- Based on Discography?
- Discography Limitations
- Pain Referral Patterns Reproducible and follow an anatomic trend

Facet Syndrome

- back pain, exacerbated with standing and walking
- referred pain to extremity without neural compression
- MRI findings can demonstrate nonspecific findings of facet arthropathy
- diagnosis made with controlled diagnostic anesthetization of the facet joint or its innervation
Facet osteoarthropathy

Facet Pain Referral

Cervical Z-Joint Pain
- Occipitoatlantal (OA) and Atlantoaxial (AA) joints are innervated by ventral rami of first and second cervical spinal nerves
- C2-3 joint innervated by two branches of the Dorsal Rami of the third Cervical Spinal Nerve (communicating branch and Medial branch known as the Third Occipital Nerve)
- C3-4 to C7-T1 joints innervated by medial branches of dorsal rami one level cephalad and one level caudal to joint


Facet Pain

- Facet injections/ radiofrequency ablation

RF Ablation for Facet Syndrome

- Slipman, Bhat, Gilchrist, Isaac, Chou, Lenrow - Spine Journal 2003
- Literature review
- Moderate evidence for long term benefit with RF denervation
SI Joint Syndrome

- Back and buttock pain which can refer to the extremity
- Often seen post trauma, intra or post partum, or without inciting etiology
- Not associated with specific radiographic features
- Gold standard of diagnosis is controlled diagnostic anesthetization

Sacroiliac Joint Syndrome

- Not sacroilitis
- Need to consider radicular pain, discogenic pain, facet pain first
- Double block to define diagnosis
- Intra-articular steroid and physical therapy
- Role of Denervation?

SI Joint Syndrome

- More than 2 provocative exam maneuvers correlates with positive diagnostic block (Broadhurst, Laslett, Slipman)
- Symptoms in back, buttock, groin, thigh
- If symptoms above the L5 transverse process, less likely
Treatment of Back Pain

Reassure Vs restrict Patients

- Borenstein 2001
- Asymptomatic patients with MRI abnormalities followed for 7 years
- 58% did not develop back pain
- No correlation between severity of abnormality and symptoms
- However, athletic population much more active and may have unrealistic expectation for age

Treatment

- Targets of treatment
  - Biomechanics
    - Core strength, Activity level, Surgical
  - Local inflammation
    - Injections, Oral anti-inflammatory, Motion
  - Centrally Mediated Pain
    - Desensitize: meds, exercise, behavioral
  - Comorbidities
    - Mood, Sleep
Treatment of Spine Disorders

- Injections
  - Fluoroscopic guidance
  - Diagnosis specific injections
    - Medical Branch Blocks/Facet injections, radiofrequency ablation
    - Selective nerve root blocks/transforaminal epidurals

Epidural Steroid Injections

- More helpful for radicular pain
- Reasonable to consider if less invasive means are unhelpful or more rapid relief is indicated
- Fluoroscopic guidance important
- 3 main routes
  - Interlaminar (Translaminar)
  - Caudal
  - Transforaminal

Transforaminal Injection
Spine Pre-Surgical Planning

- Exclusion of significant nonspinal pain generator
- Evaluate patient expectations of surgery
- Evaluate comorbid diagnoses that may affect outcome
- Diabetic, tobacco, psych, secondary gain, obesity, spinal anatomy
- Medical Stability and operative risk

Pre-Surgical Planning

- Establish as best possible the pain generator
  - History, Exam, Imaging
  - selective nerve root blocks
  - discography
  - Hip, sacroiliac joint, facet joint anesthetization
- Communication between Medical Spine Specialist, Spine Surgeon and Patient