Approaches to chronic low back pain treatment: Current role of Interventional Pain Management, Trends and Future of Care

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Disclosures

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1. R01-NS-089530 (Role:C0-PI K VEIZI MD,PhD)
   PI: K Kilgore - NIH-NINDS
   Kilohertz Frequency Alternating Current Spinal Cord Stimulation for Chronic Pain Relief

2. NEUROS Inc., FDA pivotal trial
   Study # 14050-H34
   Title: Altius System High Frequency Nerve Block Pivotal Study
   Principal Investigator: Elias Veizi MD, PhD

3. Coulter Foundation & Case Western Reserve University
   Project title: “A Chronic Safety Study of Direct Current Nerve Block”
   BME Investigator: Niloy Bhadra, MD, PhD
   Clinical Investigator: Elias Veizi, MD, PhD
Global, regional, and national incidence, prevalence, and years lived with disability for 301 acute and chronic diseases and injuries in 188 countries, 1990–2013: a systematic analysis for the Global Burden of Disease Study 2013

Global Burden of Disease Study 2013 Collaborators

Funding Bill & Melinda Gates Foundation.

Lancet 2015; 386: 743–800
Institute for Health Metrics and Evaluation, UW -Seattle, WA

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Objectives

- Multimodal treatment of CLBP
- Understanding the role of interventional pain management modalities as component of care of CLBP patient
- Discuss the various types of interventions and their role in complementing medical decision making and treatment of CLBP
- Critical review of the evidence
- Future directions
Treatment of chronic low back pain

- Persistent chronic low back pain has both physical and psychosocial components
- Evolving trends in treatment of CLBP try to match care to both components according to patient experience
- Implications: a) determine patient needs-both psychosocial and physical - b) deliver the best evidence-based active and passive treatment
- End product: individual package/protocol ranging from low to the highest level of care complexity delivered by a multidisciplinary team.

“Individual Care” for treatment of low back pain

- Pharmacotherapy
- Physiotherapy
- Exercise
- McKenzie therapy
- Manipulative therapy
- Electrical therapies (TENS)
- Traction
- Trigger point injection
- Prolotherapy
- Acupuncture
- Pain Psychology
- Interventional pain procedures
- Brief education
- Fear of Avoidance training
- Multidisciplinary pain management
- Surgery
The role of interventional pain techniques

- Pain unrelieved by conservative management
- Unacceptable side effects from systemic therapies
- Patient desire to avoid systemic therapy
- Pain “crisis”

Interventional Pain Procedures

**Objective**

- **Diagnostic**
  - “used to identify/isolate the main pain generator”
- **Prognostic**
  - “Used to determine if definitive procedure/surgery is useful/indicated”
- **Therapeutic**
  - prolonged pain relief
  - Part of the multimodal treatment in conjunction with PT and pharmacological management

**Type of intervention**

- **Diagnostic**:
  - Medical Branch Block
  - Discography
  - SI Joint injections*
- **Prognostic**:
  - Dorsal column electrical neurostimulator trial
  - Intrathecal infusion trial
- **Therapeutic**:
  - Epidural steroid injections
  - Radiofrequency ablation of MB
  - Intradiscal procedures
  - Vertebroplasty/Kyphoplasty
  - MILD
  - SCS neurostimulation devices
  - Implanted intrathecal pumps

*Veizi et al. Neuromodulation 2014; 17:31-45
Source of back pain

Potential sources of pain: 193 patients → spinal decompression “progressive local anesthesia”
Tissue stimulation under microscope by
- Mechanical: blunt instruments
- Electrical: electrocautery
Application of 1% lidocaine at the painful sites → relief of pain
Kuslich et al. 1991
- Nerve roots
- Dura
- Anterior and posterior longitudinal ligaments
- Disc
- Facet joint capsule
- Periosteum


Low back pain

I. Facet joint Pain
II. Intervertebral disc pathology
   a. Spinal stenosis
   b. Herniated disc
   c. Discogenic pain; degenerative disc disease
III. Postlaminectomy syndrome
IV. Vertebral fractures
Facet Joint Pain

- Prevalence: 5-15% of patients with axial LBP [Dreyfuss et al 1997]
- Common cause: degeneration and arthritis [less often; systemic inflammatory arthropathy; facet fracture; infection]
- Follows invariably disc degeneration

Diagnostic: Medial Branch Block
Medial branch blocks and facet joint injections as predictors of successful radiofrequency ablation

Elias Veizi, MD, PhD, Ali Mchaourab, MD

From the "Division of Pain Medicine, University Hospitals Case Medical Center, Case Western Reserve University, Cleveland, Ohio, and the "Case Western Reserve University, Division of Pain Medicine, Cleveland Veterans Affairs Medical Center, Cleveland, Ohio.

Algorithms for appropriate use of blocks have been described; however, better validation is necessary. Performing 2 diagnostic blocks would decrease the false-positive rate, but unfortunately the false-negative rate will increase, thus increasing the risk of withholding an active treatment from patients. Moreover, aberrant MB innervations demonstrated in 11% of patients pose an additional risk for false-negative blocks. The second concern is related to the balance of the burden of multiple interventions vs the potential benefit.

Radiofrequency Ablation of MB

Radiofrequency ablation of the L3, L4 medical branch, and L5 posterior branch. (A: lateral view of the RF needle positioning and B: AP view for the target). RF canules are positioned between one third and two thirds of the SAP at the L4 and L5 and lateral to the S1 SAP.

Veizi et al RAPM, 2011
Sacroiliac joint injection

- Prevalence of SI joint pain 15-20% of patient with low back pain
- There is no standard in diagnosis
- Imaging is not very helpful
- Lateral branches of the L4 to S3 dorsal rami are cited as comprising of the major innervation
- The innervation of the anterior joint is also controversial
The Role of Radiofrequency Ablation for Sacroiliac Joint Pain: A Meta-Analysis

Steve M. Aydin, DO, Christopher G. Gharibio, MD, Michael Mehnert, MD, Todd P. Silitk, MD

Table 5. Outcomes of the Nine RFA studies

<table>
<thead>
<tr>
<th>Author</th>
<th>Outcome</th>
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<tbody>
<tr>
<td>Bulje et al (11)</td>
<td>63.2% of the patients had a greater than 50% reduction in their pain at 12 weeks post-RFA</td>
</tr>
<tr>
<td>Burnham and Youm (15)</td>
<td>67% of the patients indicated a “very satisfied” response postprocedure at 12 weeks post-RFA</td>
</tr>
<tr>
<td>Cohen and Abdi (13)</td>
<td>100% of patients had a greater than 40% improvement in pain at 9 months post-RFA. RFA group showed a reduction of pain of 60% at 1 month, 60% at 3 months, and 57% at 7 months. Crossover group showed pain reduction of 28% at 1 month, 59% at 3 months, and 49% at 6 months.</td>
</tr>
<tr>
<td>Cohen et al., June 2000 (34)</td>
<td>1.9% of patients in group 1 showed a greater than 50% reduction in pain at 6 months</td>
</tr>
<tr>
<td>Ferranti et al (11)</td>
<td>34.2% of patients had a 50% decrease of pain at 6 months post-RFA</td>
</tr>
<tr>
<td>Gevargiz et al (21)</td>
<td>65.3% of patients had “a substantial relief” in pain at 3 months post-RFA</td>
</tr>
<tr>
<td>Kapural et al (33)</td>
<td>13 patients had ≥50% relief at 3 months post-cooled RFA</td>
</tr>
<tr>
<td>Yin et al (23)</td>
<td>64% of patients had a reduction in pain of 50% at 6 months post-RFA</td>
</tr>
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RFA = radiofrequency ablation.

SI joint RFA: Simplicity probe

Evidence of efficacy superior than conventional RFA is not clear yet
Reduces OR time since you do not have to perform 12-15 lesions
11 diagnostic accuracy studies and 14 therapeutic studies were included

- Dual blocks with at least 70% pain relief have higher specificity and less FP responders

- The evidence for cooled radiofrequency neurotomy in managing sacroiliac joint pain is Level II to III.

- The evidence for conventional radiofrequency neurotomy, intraarticular steroid injections, and periarticular injections with steroids or botulinum toxin is limited: Level III or IV.

Intervertebral disc disease and epidural steroid injections

- First authors citing IVD as a source of pain in American literature were Mixter and Barr with their 1934 hallmark description of the herniated nucleus pulposus

- Mixter and Ayers in 1935 demonstrated that radicular pain can occur without disc herniation.

- Since than many authors have described pain syndromes emanating from the lumbar intervertebral disc without mechanically compressing neural structures
Proposed etiologies of back pain include neural compression with dysfunction and vascular compromise.

Neurotoxicity has been attributed to many agents including phospholipase A2 (PLA2), metalloproteinases, and interleukin-6, both prostaglandin E2 and tumor necrosis factor (TNFα) have been shown to have an essential role in intervertebral disc-induced nerve root damage.

Epidural steroid injections

Lumbar Radiculopathy

Discogenic pain  Sciatica
Epidural steroid injections

* Why: Neural blockade has been postulated to alter or interrupt nociceptive input.
* Various modes of action of corticosteroids include:
  a) membrane stabilization;
  b) inhibition of neural peptide synthesis or action;
  c) blockade of phospholipase A2 activity;
  d) prolonged suppression of ongoing neuronal discharge; and suppression of sensitization of dorsal horn neurons.

Local anesthetics have been shown to:

a) produce prolonged dampening of C-fiber activity.

b) Physical effects include clearing adhesions or inflammatory exudates from the vicinity of the nerve root sleeve.

Approach

- TF vs. IL
- SS vs HD
- Number of injections for optimal therapeutic effect
- Choice and dose of steroids

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Epidural Injections for Spinal Pain

*A Systematic Review and Meta-analysis Evaluating the “Control” Injections in Randomized Controlled Trials*

Mark C. Bicket, M.D.,* Anita Gupta, D.O.,† Charlie H. Brown IV, M.D.,‡ Steven P. Cohen, M.D.§

*Anesthesiology 2013; 119:907-31*
**Effect of ESI to Prevent Spine Surgery Randomized Controlled Trials**

<table>
<thead>
<tr>
<th>RCTs: Negative</th>
<th>RCTs: Positive</th>
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**Uncontrolled Studies: Positive**
- NAROZNY 2001
- WANG 2002
- LIN 2006 (neck)
- MANSON 2013

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**Pain Medicine**

**Epidural Steroid Injections, Conservative Treatment, or Combination Treatment for Cervical Radicular Pain**

*A Multicenter, Randomized, Comparative-effectiveness Study*

Steven P. Cohen, M.D., Salim Hayek, M.D., Ph.D., Yevgeny Semenov, M.A., Paul F. Pasquina, M.D., Ronald L. White, M.D., Elias Veizi, M.D., Ph.D., Julie H. Y. Huang, M.D., M.B.A., Connie Kurihara, R.N., Zirong Zhao, M.D., Ph.D., Kevin B. Guthmiller, M.D., Scott R. Griffith, M.D., Aubrey V. Vardun, M.D., David M. Gianpetro, M.D., Yakov Vorobeychik, M.D., Ph.D.

**Epidural steroid injections compared with gabapentin for lumbosacral radicular pain: multicenter randomized double blind comparative efficacy study**

Steven P. Cohen,1,2 Steven Hanling,3 Mark C Bicket,4 Ronald L White,5 Elias Veizi,6 Connie Kurihara,7 Zirong Zhao,8,9 Salim Hayek,10 Kevin B Guthmiller,11,12 Scott R Griffith,13 Vitaly Gordin,14 Mirinda Anderson White,15 Yakov Vorobeychik,16 Paul F Pasquina17
Epidural injections definitely provide short-term relief for radiculopathy a HNP, but the evidence for long-term benefit is conflicting. May provide long-term relief in some patients, and prevent surgery, by permitting the body time to heal itself. NNT’s higher for stenosis and axial LBP. Epidural studies evaluating other medications disappointing [TNFα inhibitors].

Summary of the effectiveness of epidural steroid injections

Epidural Lysis of Adhesions

Hsu et al. Anesth Analg 2014: Sequential AP fluoroscopic images demonstrating successful LOA.
Discography

Discogenic pain

Sciatica

“classic” presentation: axial low-back pain without radicular symptoms

exacerbated with lumbar flexion and/or sitting

Pain typically increases with maneuvers that increase intradiscal pressure (e.g. Valsalva’s)
Diagnostic discography: Indications

* To identify symptomatic disc level
* Recurrent disc vs. scar tissue pain
* Preliminary test to spinal fusion
* Preliminary test for IDET, chemonucleolysis, nucleoplasty
* Negative MRI, symptomatic patient

Intradiscal procedures

Evolution of Thermal Intradiscal Therapy

- Intradiscal RF
  Sluijter, 1994
- IDET
  Smith and Nephew, 1998
- discTRODE
  Tyco / Radionics, 2000
- Biacuplasty
  Baylis Medical, 2006


A randomized, placebo-controlled trial of transdiscal radiofrequency, biacuplasty for treatment of discogenic lower back pain.

Vertebral augmentation procedures

- Vertebral compression fractures occur when the bone of the vertebral body collapses.
- These fractures are often caused by osteoporosis and less commonly by trauma or tumors.
- Vertebral compression fractures can be treated with either vertebroplasty or vertebral augmentation.

Augmentation procedure
Multiple prospective studies have shown the benefits of VP and KP vs. the non-surgical management of VCFs.

Many issues are still controversial.

However, considering the tremendous scientific interest in VAPs as determined by the number of publications on this topic, the field is still looking for direction.

Regenerative Therapy: Stem cells for treatment of IVD disease

- Pericytes: cells on capillaries and microvessels
- Adult Adipose Tissue stem cells
- Or MSC
- Intradiscal delivery with the goal of:
  a) Restoring disc height
  b) Reducing chronic inflammation
  c) Regenerating and sealing the disc
Future Treatments for Discogenic Pain

Axial and sagittal reconstructions from PET-CT images obtained 3 days following the percutaneous needle delivery of radiolabelled MSCs, confirming accurate delivery and containment of cells post transplantation.

Summary

- Interventional Pain Management Procedures are part of the complex care provided for patients with CLBP
- Stronger evidence via a well designed clinical trials is needed to offer the best treatment option to patient that benefit the most.
- Regenerative therapy is extremely promising in treatment of CLBP
- Increase in expenditures over the last decade have not been associated with improved outcomes and reduced disability rates:
  - 457% for opioids
  - 357% for MRI
  - 629% for epidural injections
  - 220% for spinal fusion surgeries
- Recognizing CLBP as a “chronic condition” that you cannot “cure” but you can “treat” would require significant commitment from physicians in community as well as specialized centers since a complex rehab based approach would be the most beneficial path