Innovative Interventional Approaches to Pain Management in the Elderly

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Disclosure

Dr. Michael Bottros has no relevant financial interests to disclose.

Learning Objectives

- Describe the treatments for facet-mediated arthropathy
- Explain the tests used to diagnose sacroiliitis
- Describe treatment options for persistent post-arthroplasty knee pain.

Outline

- Introduction
- Facet Arthropathy
- Sacroiliitis
- Hip/Knee Pain
- Vertebral Augmentation
- Neuromodulation
- Conclusion



Pain Management in the Elderly is Complex

- Cognitive Deficits
- Functional Capacity
- Physical Disability
- Fall Risk
- Organ Dysfunction



Pharmacotherapy

- Inflammatory
- Neuropathic
- Antidepressant
- Muscle relaxants
- Opioids

Facet Arthropathy

Facet Joints

- True synovial joints
- Innervation by 2 medial branches
- Protect against axial rotation, shearing forces (backward and forward sliding), and assist disc in resisting compressive forces in lordotic postures
- Load-bearing by z-joint varies between 3-25% of axial load



Medial Branches - Lumbar Dorsal Ramus



Facet Joint Arthropathy

 With aging, the lumbar facet joints become weaker and their orientation changes from coronal to sagittal positioning, predisposing them to injury from rotational stress.

Lumbar Facet Joint Orientation in the Transverse Plane



Facet Joint Arthropathy

- 15% 45% of chronic low back pain (CLBP) is caused by facet arthropathy
- Prevalence varies between 6%-40%
- Prevalence increases with age
- Etiology includes:
 - inflammatory arthritides, synovial cysts and synovitis, microtrauma, capsular tears and inflammation, splits in the articular cartilage, meniscoid entrapment and osteoarthritis

Imaging



The presence or absence of facet arthropathy on imaging does not correlate with clinical symptoms or outcomes.

Patient History

- Axial spine pain
 - +/- Referred pain to extremities (typically to the knees)
 - Non-radicular
- Older patients
 - Whiplash can be an exception
- No clear cut factors that reproduce pain

Lumbar Facet Joint Pain Referral Patterns



Cohen and Raja, Anesthesiology, 2007

Cervical Facet Joint Pain Patterns



 Rathmell, Atlas of Image-Guided Intervention, 2006

Challenges in Detecting Facetogenic Pain

- There is no gold standard for diagnosing facet pain
- Overlapping pain complaints with other problems
- Some patients have multiple pain generators
- False positive and negative rates after diagnostic (prognostic) MBBs are high

Physical Maneuvers Previously Associated with Facet Pain

- Bending forward
- Bending sideways
- Standing
- Walking

- Extension
- Rotation
- Paraspinal muscle tenderness

Paraspinous Muscle Tenderness

• The best physical examination feature associated with facet outcomes.



Cohen SP et al. Nature Reviews Rheumatol. 2013

Treatment

- A multimodal approach is essential.
- No study has evaluated pharmacotherapy and/or physiotherapy specifically for facet-mediated pain.
- Osteopathic manipulation and acupuncture have shown benefit in nonspecific LBP.

Treatment

- NSAIDs and acetaminophen are considered first-line drugs.
 - Little evidence to support one drug over another.
- Schnitzer published a comprehensive review of clinical trials evaluating pharmacotherapy for LBP:
 - Strong evidence for use of antidepressants in CLBP.
 - Strong evidence for use of muscle relaxants in ALBP.

Diagnosis of Facet Arthropathy with Medial Branch Blocks

- Sensitivity and specificity comparable to intraarticular injections
- Criteria for success varies between 50-90% pain relief
- False-positive rate varies between 25-38%
- Controversy exists regarding use of placebo controls, confirmatory blocks, and even the utility of performing diagnostic blocks prior to proceeding to RF denervation

Lumbar Medial Branch Block



Radiofrequency Denervation

 Radiofrequency energy channeled through a small diameter needle to create a controlled burn that severs the zygapophaseal joint nerve supply

Axial View of Lumbar Lesion



 Rathmell, Atlas of Image-Guided Intervention, 2006

Axial View of Cervical Lesion



 Rathmell, Atlas of Image-Guided Intervention, 2006

Repeat Neurotomy

Pain returns after RF denervation between 6 months and 1 year

 Repeated RF ablation of the medial branches can be performed with no decrease in efficacy

Schofferman, Spine, 2004

Sacroiliitis

Sacroiliac Joint



- Diarthrodial
- Designed for stability
- Largest axial joint in the body

Sacroiliitis

- 16-30% of CLBP
- 6th decade pericapsular ankylosis
- 8th decade ubiquitous marked erosion & plaque formation



Sacroiliitis Referral Patterns

2% abdomen

14% groin



72% lower lumbar region

94% buttock

50% lower extremity

Pain Pract. 2010 Sep-Oct; 10(5):470-8.

Sacroiliitis – Physical Exam



FABER Test



Gaenslen's Test

SI Joint Injection

- "Gold standard" in diagnosing SI joint pain.
- Has been shown in various studies to be both diagnostic and therapeutic for a duration of 6 months to 1 year.



Anesth Analg, 2005; 101:1440–53.

Lateral Sacral Branch Denervation

- Used for over 12 years
- For those who have obtained effective but short-term relief with SIJ blocks
- Numerous controlled and uncontrolled studies have demonstrated benefit



Refractory Knee & Hip Pain

Genicular Nerve Anatomy

(A) The superior medial genicular nerve (1) runs down the upper part of the medial epicondyle (asterisk) of the femur with genicular vessels (2).
(B) The inferior medial genicular nerve (1) passes the lower parts of the medial epicondyle (asterisk) of the tibia.





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Research papers

Radiofrequency treatment relieves chronic knee osteoarthritis pain: A double-blind randomized controlled trial

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- 38 elderly patients with
 - (a) severe knee OA pain lasting more than 3 months
 - (b) positive response to a diagnostic genicular nerve block
 - (c) no response to conservative treatments
- Randomly assigned to receive percutaneous RF genicular neurotomy under fluoroscopic guidance (RF group; n = 19) or the same procedure without effective neurotomy (control group; n = 19)
- RF group had less knee joint pain at 4 (p < 0.001) and 12 (p<0.001) weeks compared with the control group (VAS)
- Oxford knee scores showed similar findings (p < 0.001)
- No adverse events during the follow-up period
- RF neurotomy of genicular nerves leads to significant pain reduction and functional improvement in a subset of elderly chronic knee OA pain, and thus may be an effective treatment in such cases









Reg Anesth Pain Med. 2001 Nov-Dec;26(6):576-81.

Percutaneous Radiofrequency Lesioning of Sensory Branches of the Obturator and Femoral Nerves for the Treatment of Hip Joint Pain

Masahiko Kawaguchi, M.D., Keiji Hashizume, M.D., Toshio Iwata, M.D., and Hitoshi Furuya, M.D.

Background and Objectives: The sensory innervation of the hip joint includes the sensory articular branches of the obturator and femoral nerves. In this report, we retrospectively evaluated 14 cases in which hip joint pain was treated by percutaneous radiofrequency lesioning of sensory branches of obturator and/or femoral nerves.

Methods: Fourteen patients who had hip joint pain and underwent percutaneous radiofrequency lesioning of sensory branches of obturator and/or femoral nerves were studied. In all cases, intra-articular hip joint block or articular branch block of obturator nerve with local anesthesia was transiently effective. Radiofrequency lesioning was performed at 75°C to 80°C for 90 seconds using an RFG-3B generator and Sluijter-Mehta cannulae kit (Radionics, Burlington, MA) for the obturator nerve in 9 patients and for both the obturator and femoral nerves in 5 patients. To assess pain intensity, a visual analog scale (VAS) was used.

Results: The VAS scores before and after the radiofrequency lesioning were 6.8 ± 0.9 and 2.7 ± 1.3 , respectively. Twelve patients (86%) reported at least 50% relief of pain for 1 to 11 months. There were no side effects or motor weakness observed.

Conclusions: Percutaneous radiofrequency lesioning of sensory branches of the obturator and femoral nerves is an alternative treatment in patients with hip joint pain, especially in those where operation is not applicable. *Reg Anesth Pain Med 2001;26:576-581*.

Percutaneous Radiofrequency Denervation in Patients With Contraindications for Total Hip Arthroplasty

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abstract

Full article available online at ORTHOSuperSite.com. Search: 20120222-19

Multiple comorbidities sometimes represent a contraindication for total hip arthroplasty (THA). Major symptoms of patients with hip pain include groin, thigh, and trochanteric pain. Groin and thigh pain arise from sensory branches of the obturator nerve, whereas trochanteric pain arises from sensory branches of the femoral nerve. Between January 2009 and October 2010, eighteen patients with chronic hip pain with several contraindications for THA were selected for a prospective study. Predenervation diagnosis was osteoarthritis in 16 patients and prolonged postoperative hip pain in 2 (1 THA, 1 Girdlestone). Hip joint pain was treated by percutaneous radiofrequency lesioning of the sensory branches of the obturator and femoral nerves. Six-month follow-up data revealed a statistically significant decrease in visual analog scale (VAS) scores and Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) scores, and a statistically significant increase of Harris Hip Score. Before radiofrequency and at 6-month follow-up, mean VAS scores were 9.52 (range, 7-10; standard deviation [SD], 0.79) and 6.35 (range, 3-10; SD, 2.17), respectively; mean Harris Hip Scores were 28.64 (range, 19-41; SD, 6.98) and 43.88 (range, 23-71; SD, 16.38), respectively; and mean WOMAC scores were 75.70 (range, 92-59; SD, 9.70) and 63.70 (range, 78-44; SD, 11.37), respectively. All values were statistically significant (P<.05) for Student's t test and Wilcoxon signed-rank test. Eight patients reported ≥50% pain relief at 6-month follow-up. No side effects were reported.

Use of this technique for hip pain control is controversial. In our experience, percutaneous radiofrequency lesioning of the sensory branches of the nerves innervating the hip joint can be an option for patients with intractable hip joint pain.



Figure: Fluoroscopic image showing the the tip of the needle placed below the inferior anterior iliac spine near the anterolateral margin of the hip joint (approach to sensory branches of the femoral nerve).

Orthopedics. 2012 Mar 7;35(3):e302-5.







Vertebral Augmentation

Vertebral Compression Fractures

- 1.4 million fractures per year
- Most common cause is osteoporosis
- Incidence in women > 50 years is 26%
- Incidence in women > 80 years is 40%
- May cause long-term sequelae of pulmonary dysfunction, immobility, spinal deformity, chronic pain, depression

VCF Risk Factors

- Age
- Gender (post-menopausal women)
- Cigarette smoking
- Ethnic group (Caucasian, Asian > 6)
- Long-term steroid therapy
- Renal or Hepatic failure
- Prolonged immobilization



Vertebroplasty



Fracture

Cement Injection





Kyphoplasty



Balloon inserted into fractured vertebra Balloon inflated inside damaged vertebra Special material injected into fractured vertebra Special material hardens, stabilizing vertebra

Controversies

- N Eng J Med 2009; 361:557–68.
- N Eng J Med 2009; 361:569–79.
 - "Acute" fracture defined as < 1yr, not 4-6 weeks</p>
 - Patients' pain was not attributable to compression fracture
 - Control group in both groups underwent LA infiltration in the periosteum
 - No threshold in pain scores

VERTOS II

- 202 patients >50 years (mean age, 75 years) with acute (<6 weeks) compression fractures with VAS > 5
- Randomized to either VP vs conservative treatment and followed up at 1-month and 1-year intervals
- Difference between groups in reduction of mean VAS score from baseline was 2.6 (95% CI, 1.74-3.37) at 1 month and 2.0 (95% CI, 1.13-2.80) at 1 year

Neuromodulation

Mechanism of Action

- Gate control theory
- Noxious stimuli mediated via A delta/C fibers



Gate Control Theory

- SCS activates inhibition via large diameter afferents in the dorsal column
- Suppresses both acute/chronic nociceptive pain signals at segmental level (Garcia-Larrea et al 1989)
- Supra-spinal loops may be involved (El-Khoury et al 2002)



Mechanism of Action



Strujk J. et al. IEEE Transactions on Rehabilitation Engineering 6 (3); 1998



Clinical Applications

High Probability of Success

- "Failed Back" Syndrome
- CRPS I or II
- Brachial Plexitis
- Arachnoiditis
- PVD (ischemic leg pain)
- Intractable Angina Pectoris
- Painful Peripheral Neuropathy

Lower Probability of Success

- Axial Spinal Pain
- Rectal and Perineal Pain
- Brachial Plexus Avulsion
- Spinal Cord Injury
- Stump Pain

Neuromodulation Advantages

- Electrical stimulation and spinal drug infusion
- Testable with reasonable degree of certainty
- Nondestructive, reversible
- Does not "burn bridges"
- Can be a long-term solution
- Almost always preferable as initial surgical treatment

Spinal Cord Stimulation Procedure

- Screening Trial
 - Coverage of pain pattern
 - Tolerance to stimulation
 - Analgesic effectiveness
 - Reduction in VAS
 - Reduction in medications
 - Improvement in ADL
- Permanent SCS Implant
 - Percutaneous or surgical lead
 - Power source
 - Internal pulse generator (IPG)
 - Radiofrequency receiver
 - System programming



Single Or Dual Trial Leads



Implantation



Reduction in Pain

| Author | No. Patients | Follow-Up | Results |
|------------|--------------|---------------|--|
| Kumar | 410 | 8 years | 74% had ≥ 50% relief |
| North | 19 | 3 years | 47% had ≥ 50% relief |
| Barolat | 41 | 1 year | 50%-65% had good/excel. relief |
| Van Buyten | 123 | 3 years | 68% had good/excel. relief |
| Cameron | 747 | up to 59 mos. | 62% had ≥ 50% relief or significant reduction in pain scores |

Kumar K, Hunter G Demeria D. Spinal Cord Stimulation in Treatment of Chronic Benign Pain: Challenges in Treatment Planning and Present status, a 22-Year Experience. Neurosurgery. 2006;58:481-496.

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Barolat G, Oakley JC, Law JD, North RB, Ketick B, Sharan A. Epidural Spinal Cord Stimulation with a Multiple Electrode Paddle Lead is Effective in Treating Intractable Low Back Pain. *Neuromodulation*. 2001;4:59-66. Van Buyten JP, Van Zundert J, Vueghs P, Vanduffel L. Efficacy of Spinal Cord Stimulation : 10 Years of Experience in a Pain Centre in Belgium. *Eur J Pain*. 2001;5:299-307.

Cameron T. Safety and Efficacy of Spinal Cord Stimulation for the Treatment of Chronic Pain: A 20-Year Literature Review. J Neurosurg Spine. 2004;100(3):254-267.

Reduction in Medication

| Author | No. Patients | Follow-Up | Results |
|------------|--------------|---------------|---------------------------------|
| North | 19 | 3 years | 50% reduced med use |
| Van Buyten | 123 | 3 years | >50%reduction in med use |
| Cameron | 766 | up to 84 mos. | 45% reduced med use |
| Taylor | 681 | n/a | 53% no longer needed Analgesics |

North RB,Kidd DH, Farrokhi F,Piantadosi SA. Spinal Cord Stimulation versus Repeated Lumbosacral Spine Surgery for Chronic Pain: a Randomized Controlled Trial in Patients with Failed Back Surgery Syndrome. *Pain*. 2007;132:179-188.

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Taylor RS, Van Buyten JP, Buchser E. Spinal Cord Stimulation for Chronic Back and Leg Pain and Failed Back Surgery Syndrome: A Systematic Review and Analysis of Prognostic Factors. Spine. 2005;30:152-160.

Improvement in Daily Activities

| Author | No. Patients | Follow-Up | Results |
|---------|--------------|-----------|---|
| Barolat | 41 | 1 year | As a group, significant improvements in function and mobility |
| North | 19 | 3 years | As a group, improvements in a range of activities |

Barolat G, Oakley JC, Law JD, North RB, Ketick B, Sharan A. Epidural Spinal Cord Stimulation with a Multiple Electrode Paddle Lead is Effective in Treating Intractable Low Back Pain. *Neuromodulation*. 2001;4:59-66.

North RB,Kidd DH, Farrokhi F,Piantadosi SA. Spinal Cord Stimulation versus Repeated Lumbosacral Spine Surgery for Chronic Pain: a Randomized Controlled Trial in Patients with Failed Back Surgery Syndrome. *Pain*. 2007;132:179-188.

Conclusions

- Chronic pain in the elderly can be multifactorial and complex
- Treatment should be multimodal and multidisciplinary
- In carefully selected patients, interventional therapies can be a safe and effective part of these treatment algorithms

