Innovative Interventional Approaches to Pain Management in the Elderly

Michael Bottros, MD

Disclosure

- Nothing to disclose

Objectives

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

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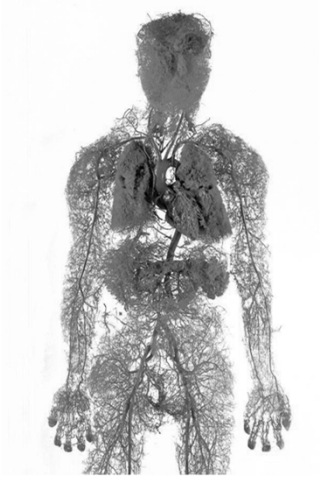
Outline

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



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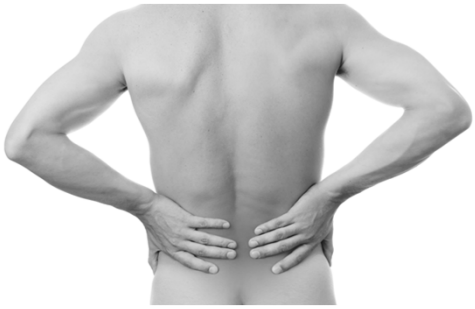
Pain Management in the Elderly is Complex

- Cognitive deficits
- Functional capacity
- Physical disability
- Fall risk
- Organ dysfunction



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Pharmacotherapy

- Inflammatory
- Neuropathic
- Antidepressant
- Muscle relaxants
- Opioids

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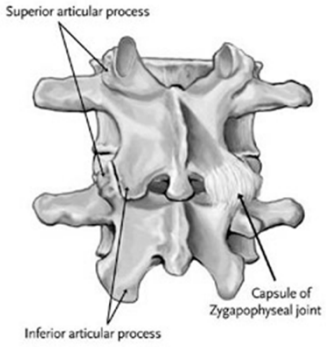
Facet Arthropathy

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% and 25% of axial load



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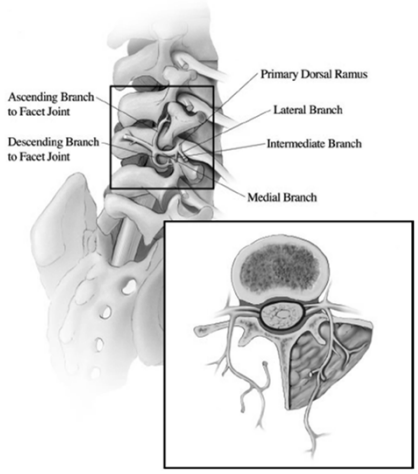
Medial Branches—Lumbar Dorsal Ramus



- Cohen and Raja, Anesthesiology, 2007

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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

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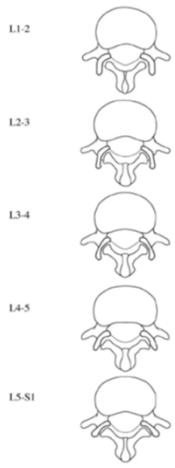
Lumbar Facet Joint Orientation in the Transverse Plane



- Cohen and Raja, Anesthesiology, 2007

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Facet Joint Arthropathy

- 15% to 45% of chronic low back pain (CLBP) is caused by facet arthropathy
- Prevalence varies between 6% and 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

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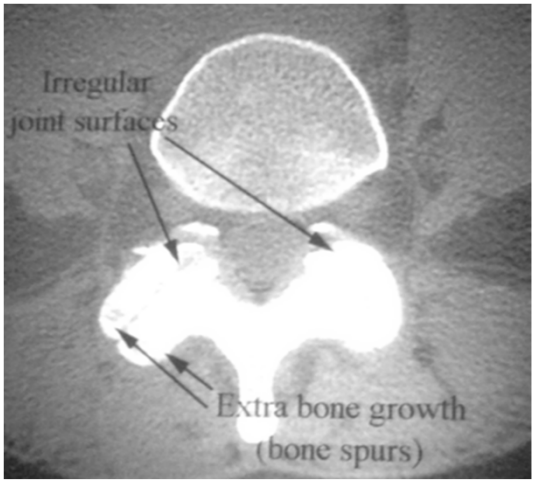
Manchikanti, 2007

Imaging

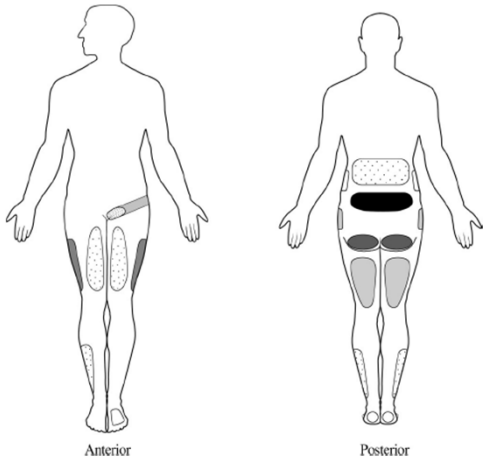


The presence or absence of facet arthropathy on imaging does not correlate with clinical symptoms or outcomes

Patient History

- Axial spine pain
  - +/- Referred pain to extremities (typically to the knees)
  - Nonradicular
- 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

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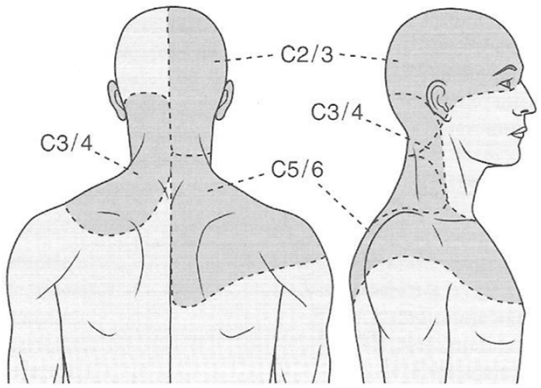
Cervical Facet Joint Pain Patterns

- Rathmell, Atlas of Image-Guided Intervention, 2006



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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

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Cohen SP et al. *Nature Reviews Rheumatol.* 2013

Physical Maneuvers Previously Associated With Facet Pain

- Bending forward
- Bending sideways
- Standing
- Walking
- Extension
- Rotation
- Paraspinal muscle tenderness

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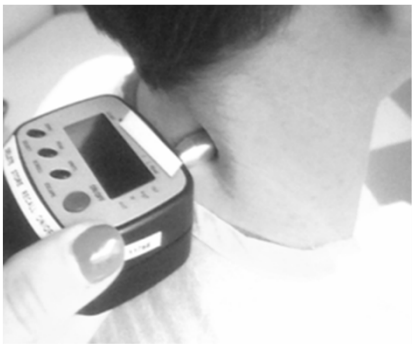
Paraspinous Muscle Tenderness

- The best physical examination feature associated with facet outcomes



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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

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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

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Schnitzer TJ et al. J Pain Symptom Manage 2004

Diagnosis of Facet Arthropathy With Medial Branch Blocks

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

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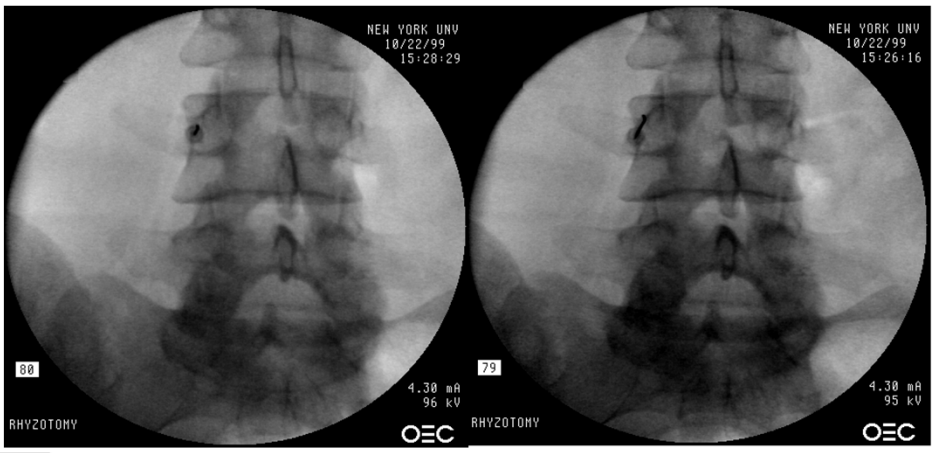
Lumbar Medial Branch Block



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Radiofrequency Denervation

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

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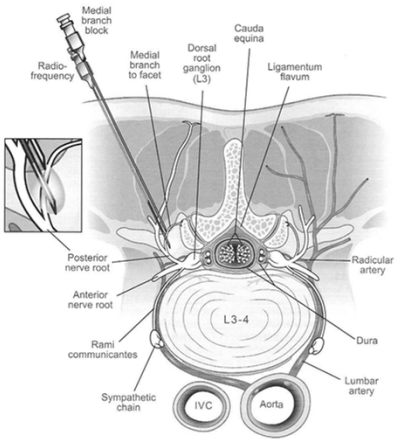
Axial View of Lumbar Lesion



- Rathmell, Atlas of Image-Guided Intervention, 2006

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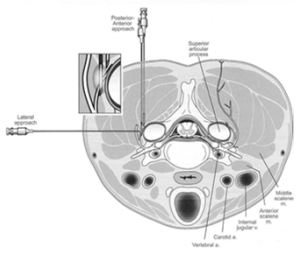
Axial View of Cervical Lesion



- Rathmell, Atlas of Image-Guided Intervention, 2006

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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

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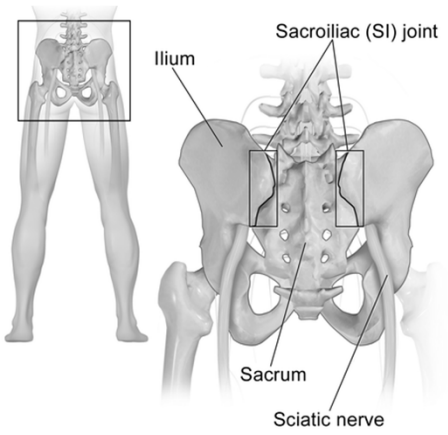
Sacroiliitis

Sacroiliac Joint



Sacroiliac Joint

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

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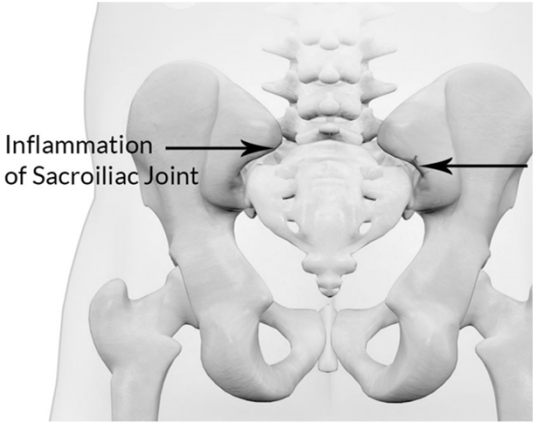
Sacroiliitis

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

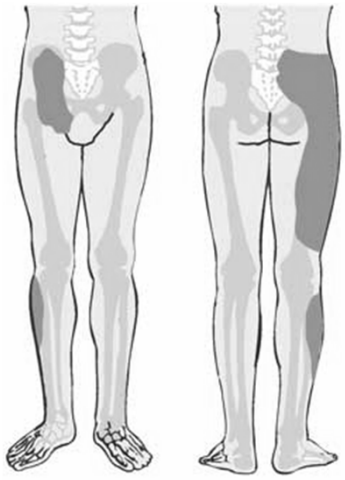


PaiNweek Spine (Phila Pa 1976), 1981; 6(6):620–8.

Sacroiliitis Referral Patterns

2% abdomen

14% groin



72% lower lumbar region

94% buttock

50% lower extremity

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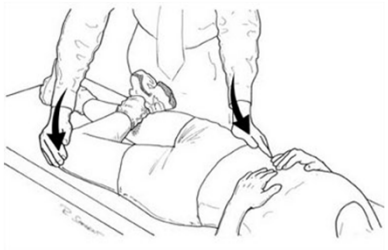
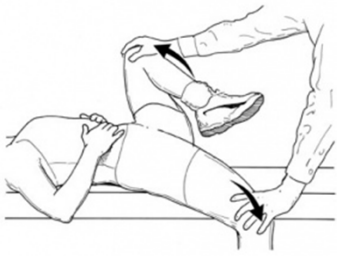
Pain Pract. 2010 Sep-Oct; 10(5):470-8.

Sacroiliitis—Physical Exam



FABER Test



Gaenslen's Test

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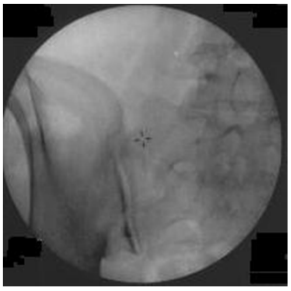
SI Joint Injection

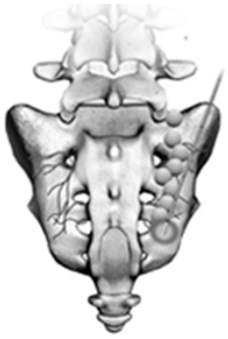
- "Gold standard" in diagnosing SI joint pain
- Has been shown in various studies to be both diagnostic and therapeutic for a duration of 6 months to 1 year



PaiNweek 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



PaiNweek Expert Rev Neurother. 2013 Jan;13(1):99-116.

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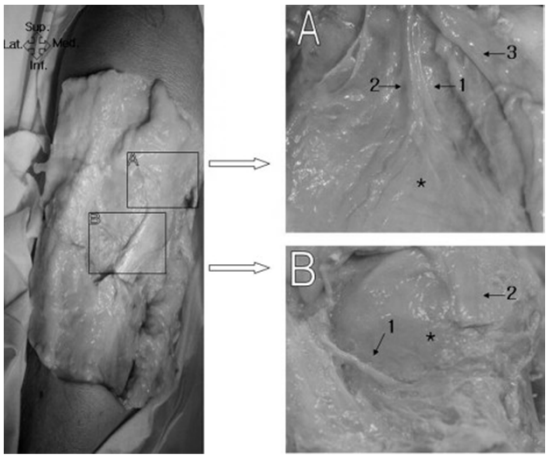
Refractory Knee & Hip Pain

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



PaiNweek Pain. 2011 Mar;152(3):481-7

PAIN® 152 (2011) 481–487

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www.elsevier.com/locate/pain

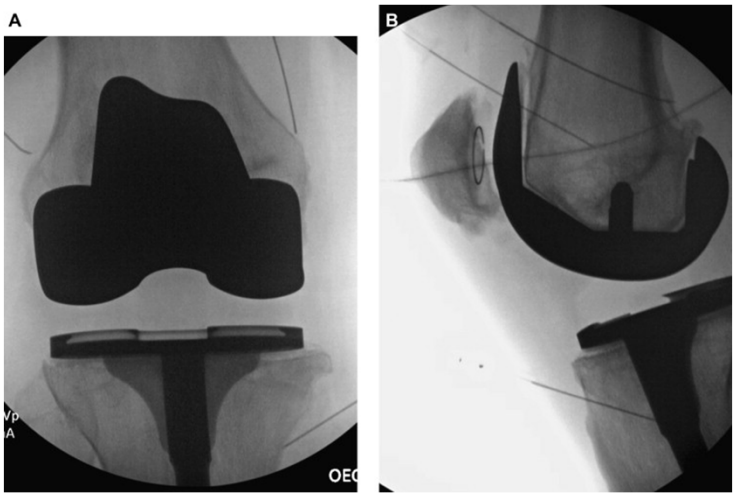
Research papers

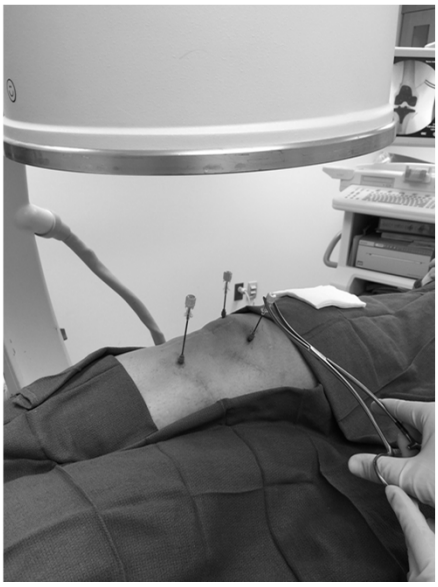
Radiofrequency treatment relieves chronic knee osteoarthritis pain: A double-blind randomized controlled trial

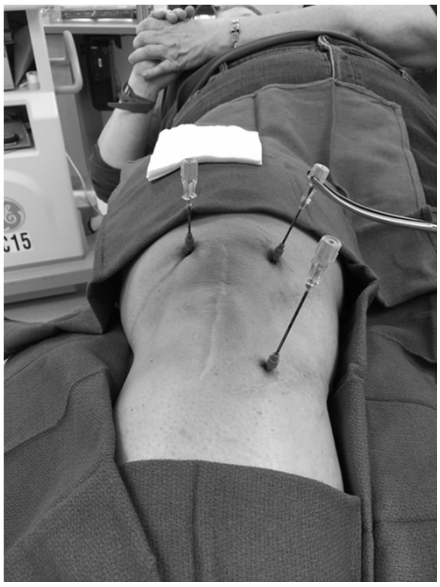
Woo-Jong Choi [a], Seung-Jun Hwang [b], Jun-Gol Song [a], Jeong-Gil Leem [a], Yong-Up Kang [c], Pyong-Hwan Park [a], Jin-Woo Shin [a,*]

[a] Department of Anesthesiology and Pain Medicine, Asan Medical Center, University of Ulsan College of Medicine, Seoul, Republic of Korea
[b] Department of Anatomy and Cell biology, Asan Medical Center, University of Ulsan College of Medicine, Seoul, Republic of Korea
[c] Chung sol Pain Clinics, Pusan, Republic of Korea

- 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







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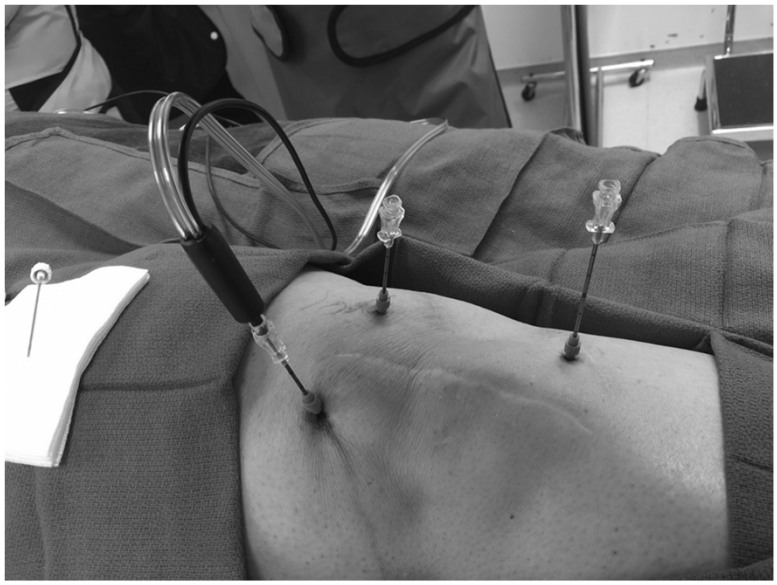

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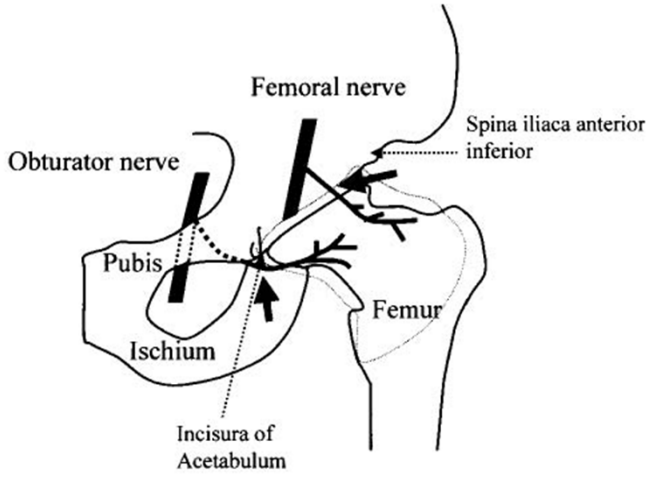
Hip Articular Anatomy



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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.

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Percutaneous Radiofrequency Denervation in Patients With Contraindications for Total Hip Arthroplasty

FABRIZIO RIVERA, MD; CARLO MARICONDA, MD; GIOVANNI ANNARATONE, MD

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.

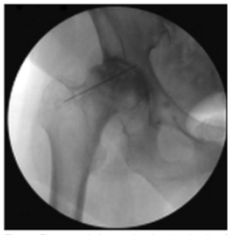

Figure: Fluoroscopic image showing the the tip of the needle placed below the inferior anterior iliac spine near the anterolateral margin of the hip joint (approach to sensory branches of the femoral nerve).

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

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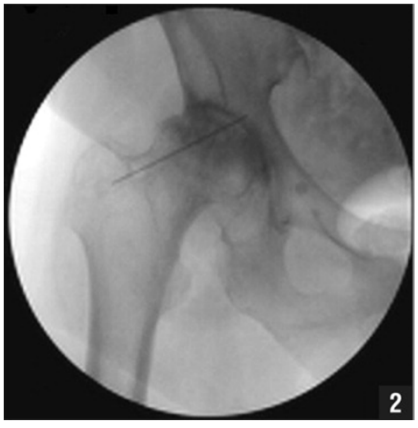

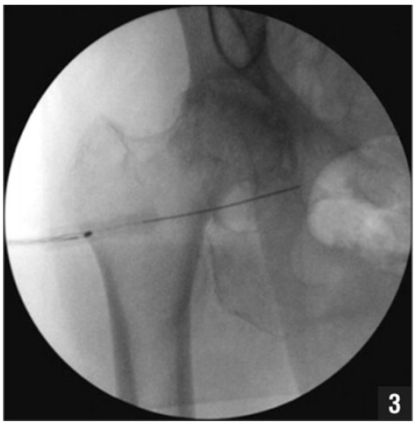

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Vertebral Augmentation

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

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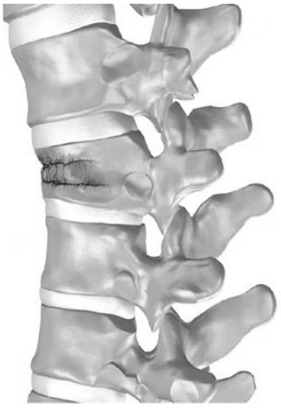
Curr Womens Health Rep, 2003; 3(5):418–24.

VCF Risk Factors

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



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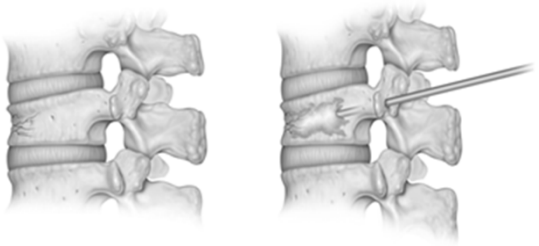
Vertebroplasty



Fracture Cement Injection

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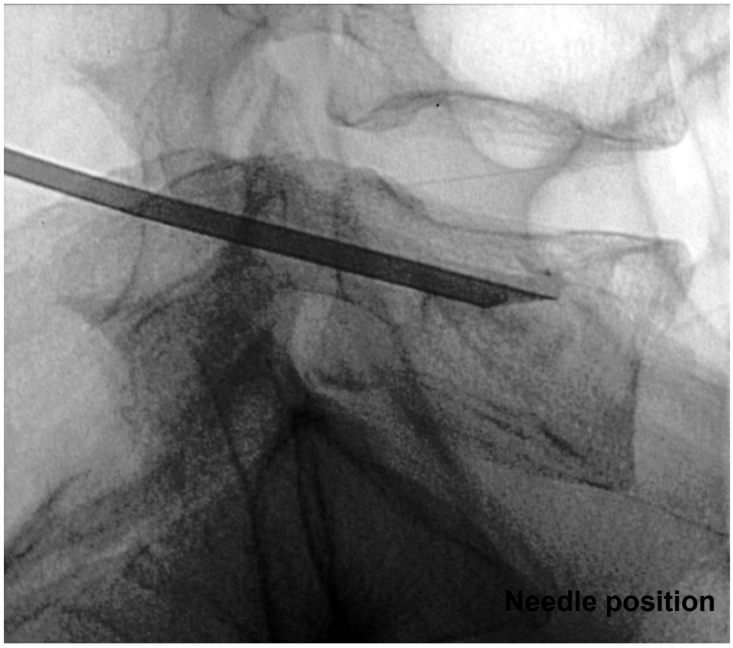

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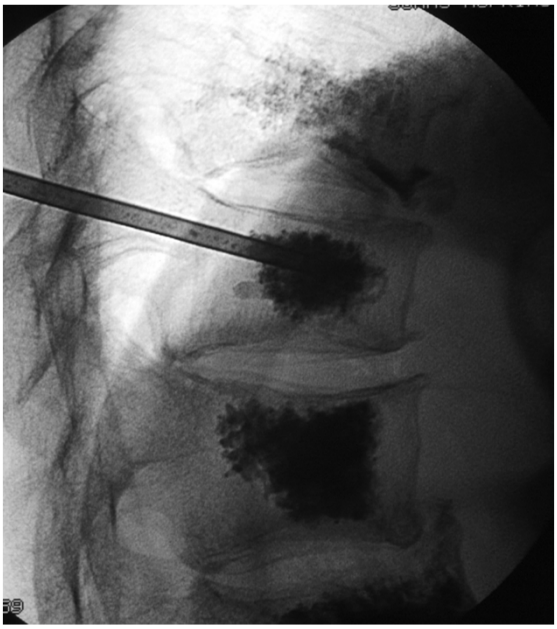

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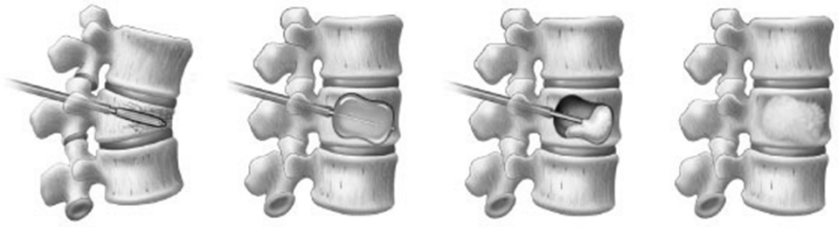
Kyphoplasty



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Controversies

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

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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

PaiNweek Lancet. 2010 Sep 25;376(9746):1085-92

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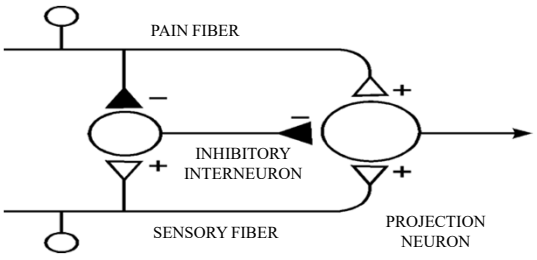
Neuromodulation

Mechanism of Action

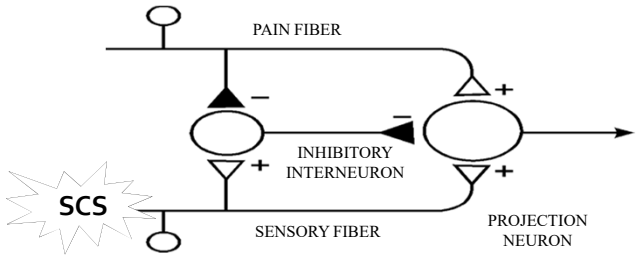
- Gate control theory
- Noxious stimuli mediated via A delta/C fibers



PaiNweek

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)
- Supraspinal loops may be involved (El-Khoury et al 2002)



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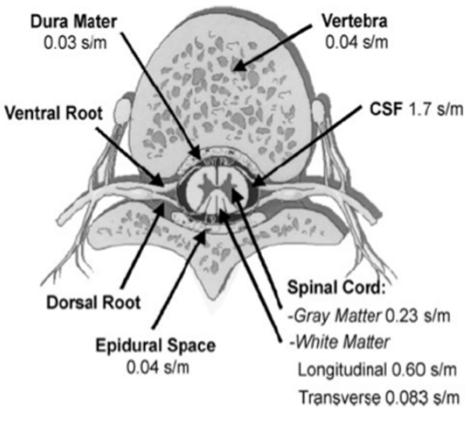
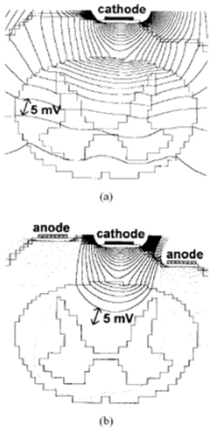
Mechanism of Action





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

PAINWEEK

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

PaiNweek

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

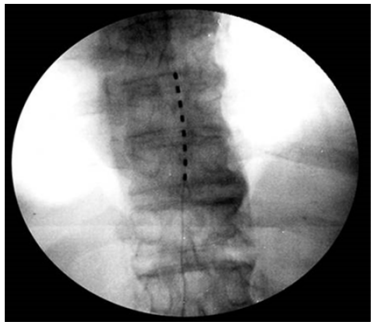
PaiNweek

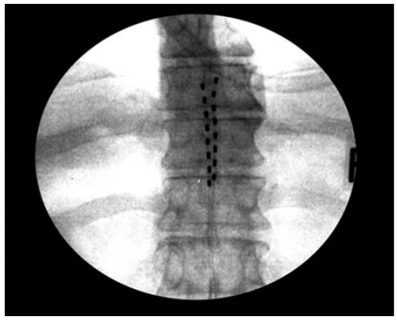
Spinal Cord Stimulation Procedure

- 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

PAINWEEK

Single or Dual Trial Leads





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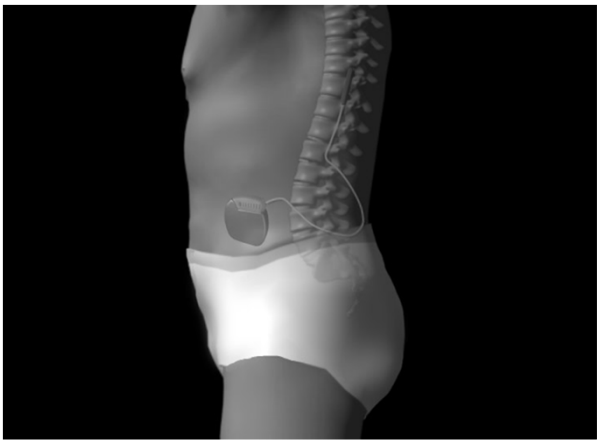
Implantation



PAINWEEK

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% to 65% had good/excel relief
Van Buyten	123	3 years	68% had good/excel relief
Cameron	747	Up to 59 months	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.

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.

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.

PAINWEEK

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 months	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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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.

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.

PAINWEEK

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.

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PAINWEEK

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

PAINWEEK

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