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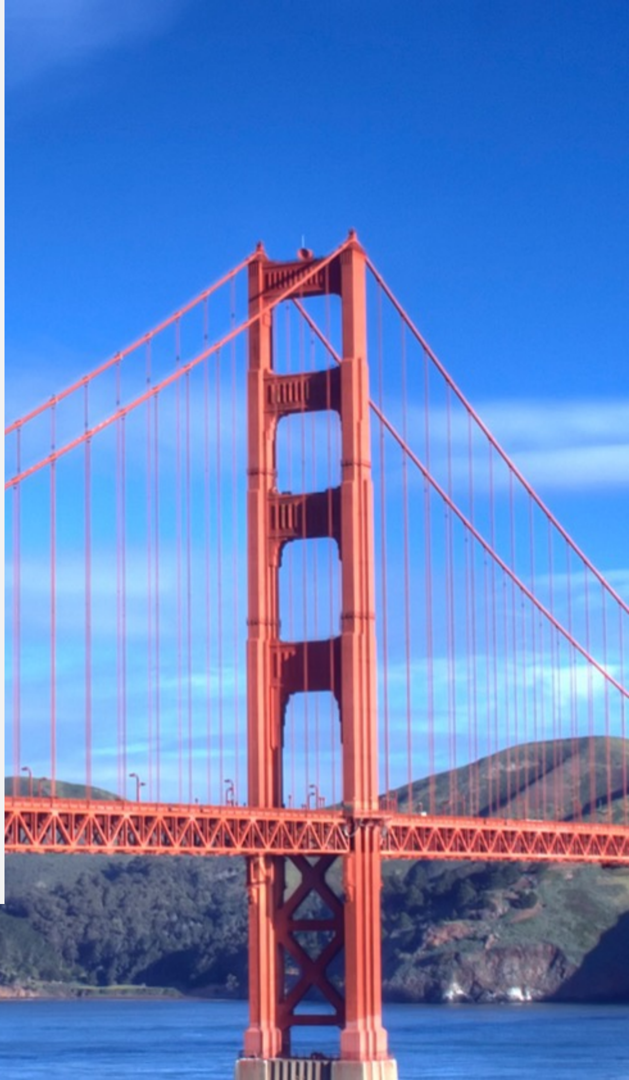
Non-Operative Interventions for Arthritis and Painful Total Joint Arthroplasty

UCSF Arthroplasty for the Modern Surgeon

Lyndly Tamura, MD

September 16, 2022



Disclosures

None

Disclaimer

Residency: PM&R at Stanford University

Fellowship: Interventional Pain at Hudson Medical (NY)

Current Position: UCSF-MarinHealth Non-Op Spine Doc

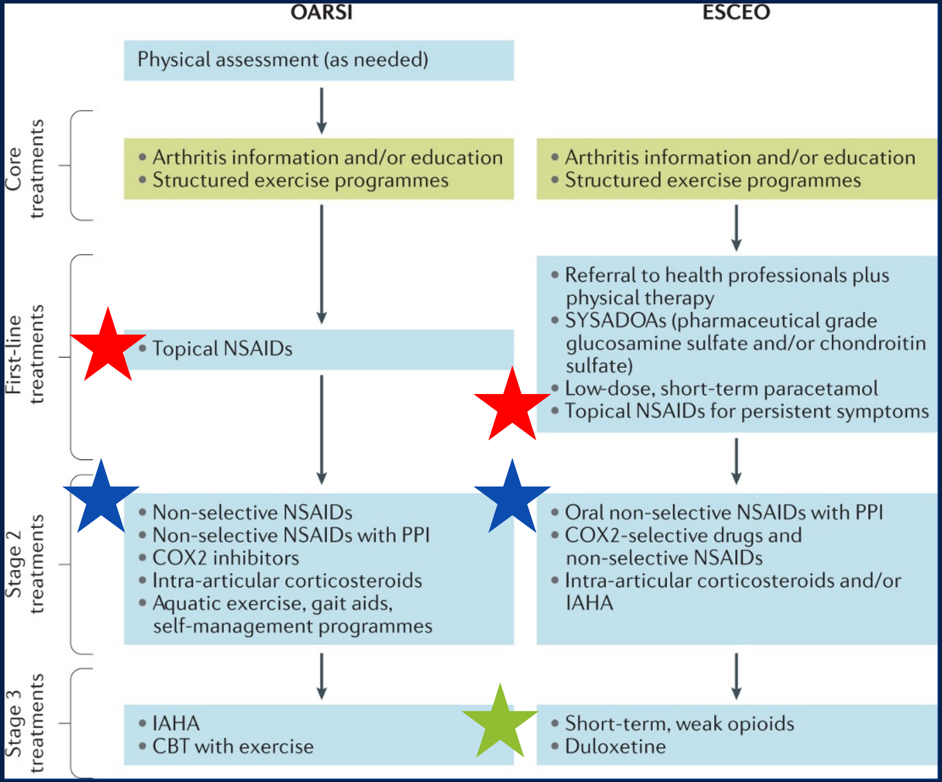
Medication Management

Perspective | Published: 28 October 2020

Non-surgical management of knee osteoarthritis: comparison of ESCEO and OARSI 2019 guidelines

Nigel K. Arden, Thomas A. Perry, Raveendhara R. Bannuru, Olivier Bruyère, Cyrus Cooper, Ida K. Haugen, Marc C. Hochberg, Timothy E. McAlindon, Ali Mobasheri & Jean-Yves Reginster

Nature Reviews Rheumatology **17**, 59–66(2021) | Cite this article



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Non-Operative Procedures for Arthritis

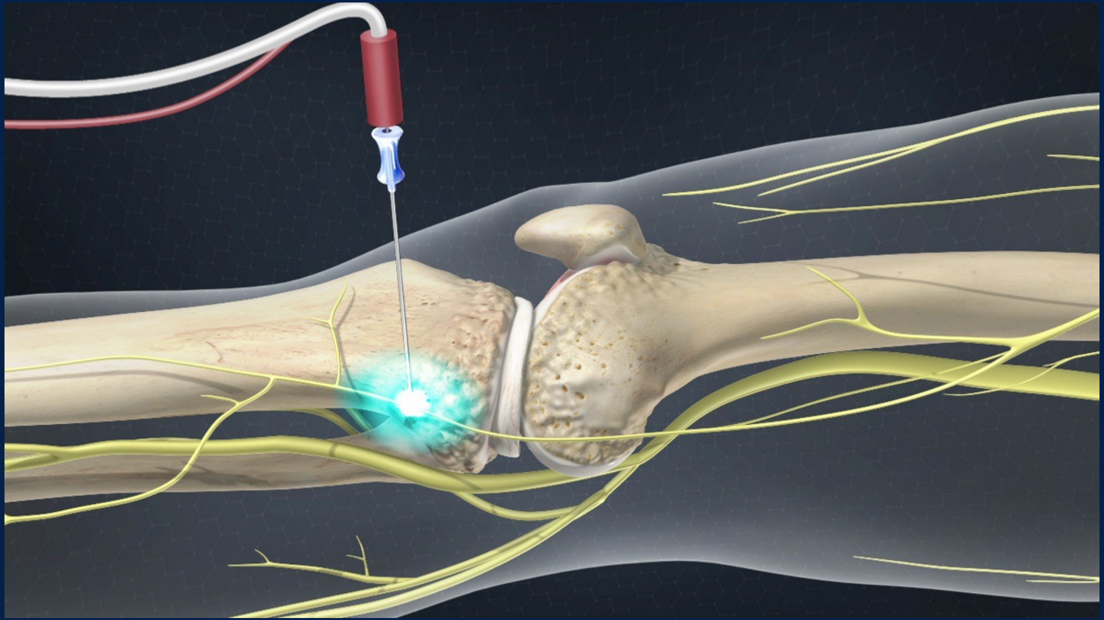
Injections
- Steroid
- Hyaluronic acid
- PRP

Ablations
- Genicular nerve
- Femoral and Obturator articular branches
- Suprascapular nerve

Neuromodulation
- Spinal cord stim
- DRG stim
- Peripheral nerve stim

NERVE ABLATIONS

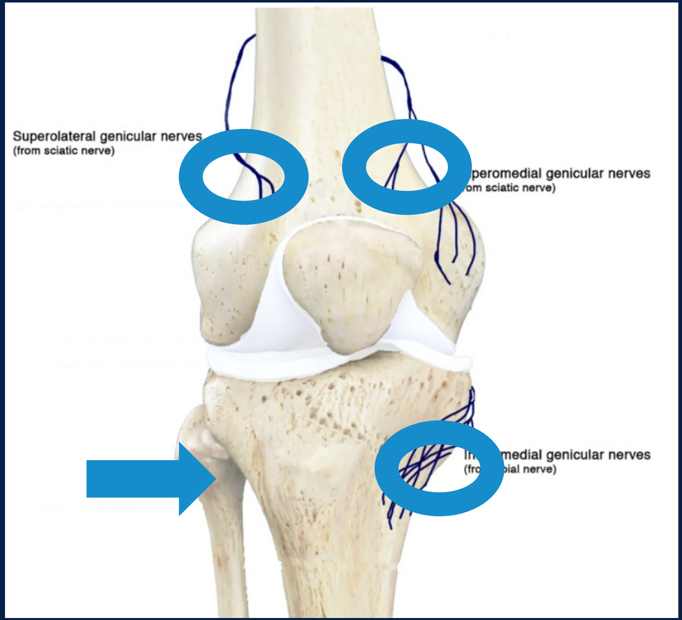
Genicular Nerve Radiofrequency Ablation



Genicular Nerve Anatomy

Genicular nerves = sensory articular branches off various nerves

Superolateral and superomedial genicular nerves: respective concave transitions of the femoral metadiaphysis and femoral condyles



Inferomedial genicular nerve: concave transition between the tibial plateau and adjacent metadiaphyseal shaft

Gonzales et al. *Techniques in Vascular and Interventional Radiology.* 2020
Choi et al. *Korean J Pain.* 2016

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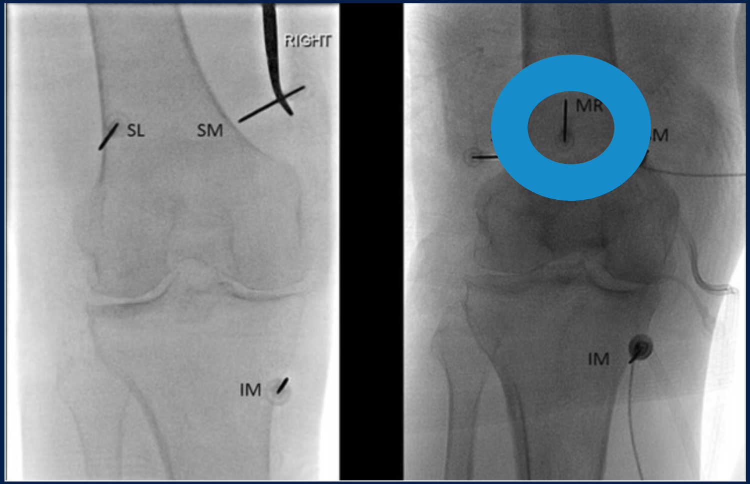
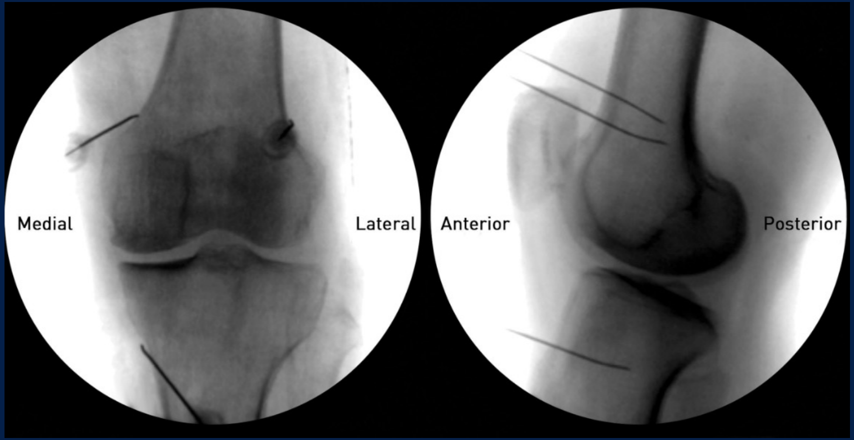
Genicular Nerve Block

Procedure details for genicular nerve block





Medial retinacular branch (optional fourth site): midline anterior distal femoral diaphysis 3 cm cephalad to the superior aspect of the patella

Choi et al. *Korean J Pain.* 2016

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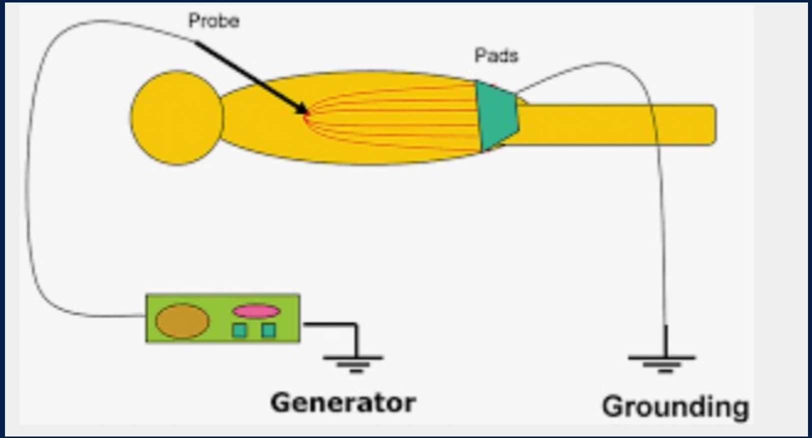
Genicular Nerve Radiofrequency Ablation

Procedure details for genicular nerve RFA



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First RCT for Genicular Nerve RFA

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

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

Pain: March 2011 - Volume 152 - Issue 3 - p 481-487
doi: 10.1016/j.pain.2010.09.029

Inclusion criteria: 38 patients with a) severe knee OA pain > 3 months, b) + response to genicular nerve block, c) no response to conservative measures

Methods: treatment group (n = 19) had fluoroscopy-guided genicular RFA. control group (n = 19) had fluoroscopy-guided needle placement without ablation

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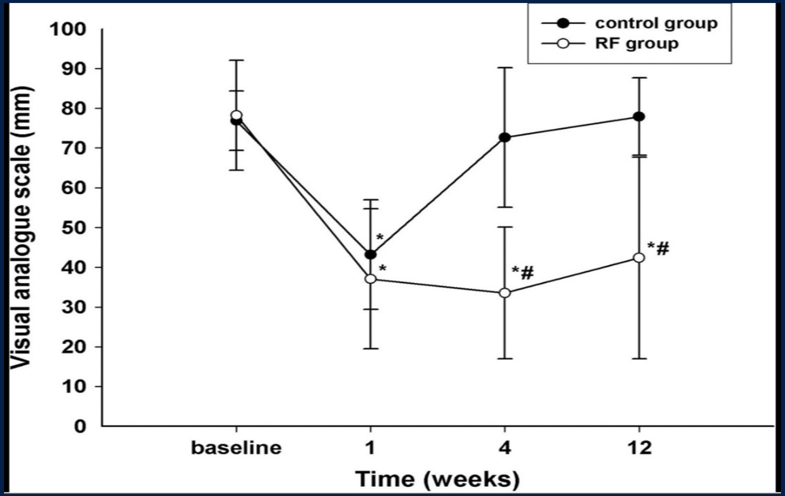
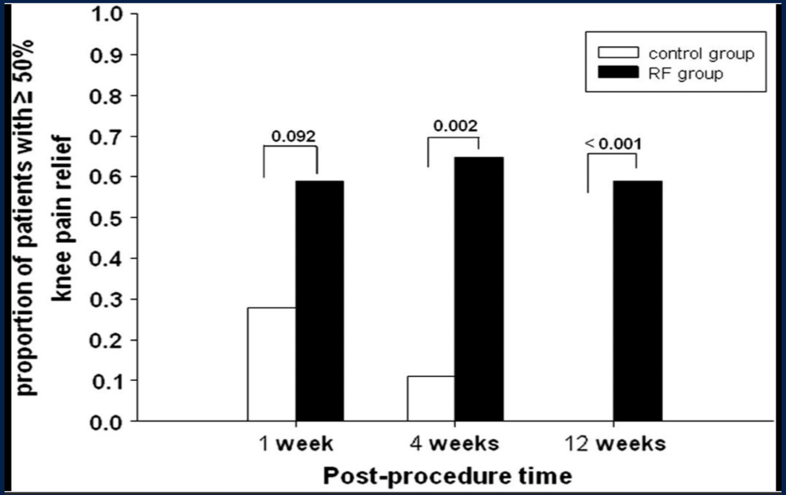
Choi et al.



VAS Score: significant decrease in VAS scores compared to sham at 4 and 12 weeks in the RFA group (p<0.001)

Proportion achieving > 50% pain relief: 10 participants (59%) achieved this at 12 weeks in RFA group. Sham = 0



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Choi et al.

Secondary Outcomes and Adverse Events

The RFA group's Oxford Knee Scores were better than control group scores at 4 and 12 weeks ($p < 0.001$)

The RFA group's satisfaction was better than the control group satisfaction at 4 and 12 weeks ($p < 0.001$)

There were no adverse events reported

Evidence of Genicular RFA for Knee OA

Musculoskeletal Rehabilitation (B Schneider, Section Editor) | Published: 14 September 2019

The Effectiveness and Safety of Genicular Nerve Radiofrequency Ablation for the Treatment of Recalcitrant Knee Pain Due to Osteoarthritis: a Comprehensive Literature Review

Quinn Tate, Aaron Conger, Taylor Burnham, Daniel M. Cushman, Richard Kendall, Byron Schneider & Zachary L. McCormick

Current Physical Medicine and Rehabilitation Reports **7**, 404–413 (2019) | Cite this article

- Eight articles (including six RCTs) included
- Primary outcome: pain reduction > 50%
- Secondary outcome: validated functional assessments and avoidance of TKA

Tate, 2019 (RCTs)

Author/year	Study question	Outcomes	Complications
Sari, 2018	RFA vs IA steroid	RFA treatment of pain exceeded MCID in VAS + WOMAC	None
Choi, 2011	RFA vs sham	> 50% improvement in pain at 12 weeks for 59% of patients	None
Davis, 2018	RFA vs IA steroid	> 50% improvement in pain at 6 months for 74% of patients	None
McCormick, 2018	RFA vs RFA w/ prior block	> 50% improvement in pain at 6 months for 74% of patients	None
El-Hakeim, 2018	RFA vs NSAIDs	RFA treatment of pain exceeded MCID in VAS + WOMAC	None
Jadon, 2018	RFA: bipolar vs monopolar	RFA treatment of pain exceeded MCID in OKSS	None

Tate, 2019

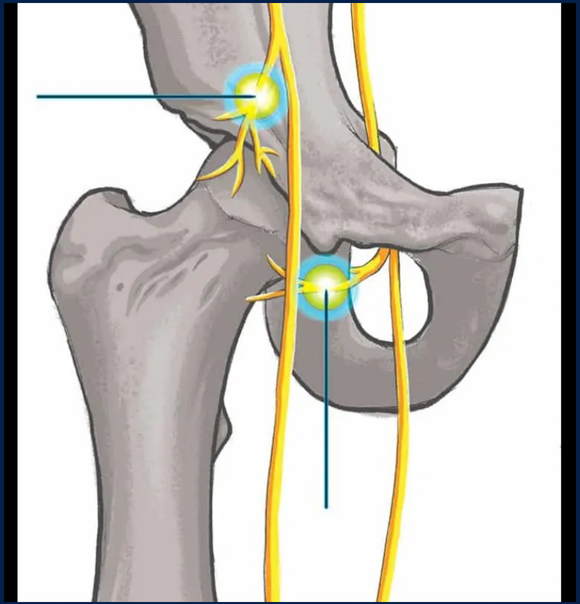
Results

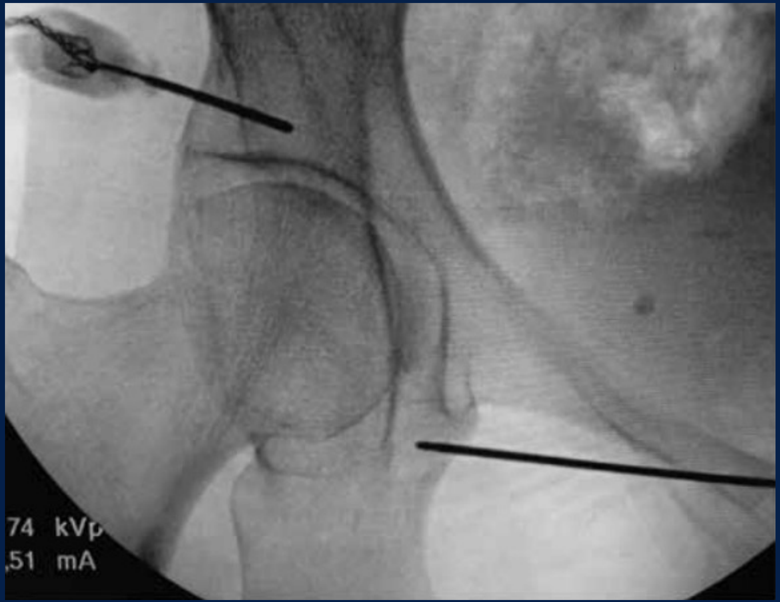
RCTs an... of flu... genicular... demonstrated ... in respo...

...tions were ...ugh case ...ave noted pes ...don injury, ...d 3rd ...ree skin burns

"genicular RFA provides an effective treatment option for patients with recalcitrant chronic knee pain secondary to OA with up to 74% of patients experiencing greater than 50% pain relief at 6 months"

Hip Joint Radiofrequency Ablation





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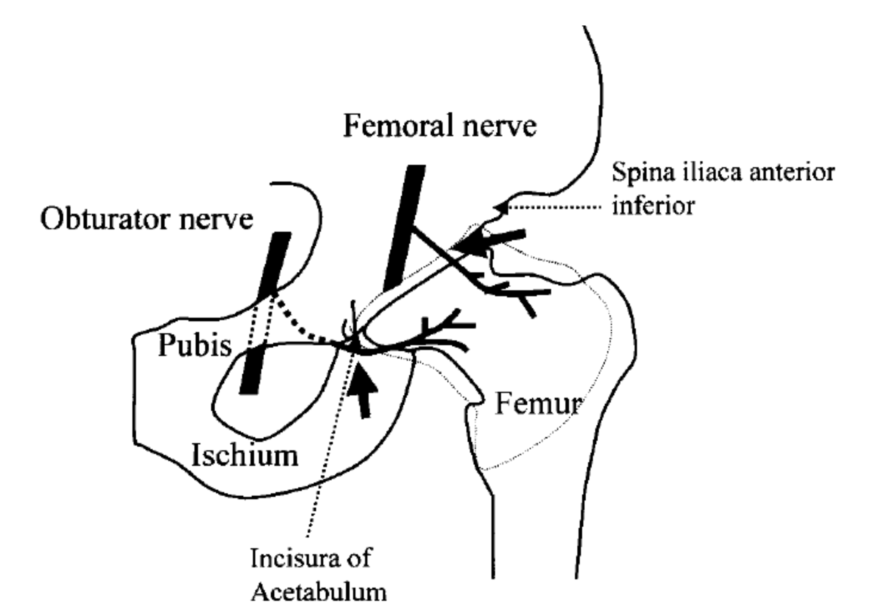
Sensory Inputs Responsible for Hip Pain

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.



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Kagawachi, 2001

Cases	Age/ Sex	Disease	Pain	Treatments	VAS Scores Before	VAS Scores After	Outcome	Duratio Effective (mo	Operation
1	62/F	Osteoarthritis	rt-groin	O	6.5	1.8	Effective	6	Rejected
2	74/F	Osteoarthritis	rt-groin	O	6.2	2.2	Effective	3	Rejected
			rt-trochanteric	F	6.2	2.5	Effective	3	
3	71/F	Osteoarthritis	bil-groin	O	7.2	3.5	Effective	2	Rejected
4	85/F	Osteoarthritis	bil-groin	O	6.5	4.5	Ineffective		Rejected
5	74/M	Osteoarthritis	lt-groin	O	6.5	1.5	Effective	6	High risk (AAA)
6	77/F	Osteoarthritis	lt-groin	O	7.2	1.5	Effective	3	Rejected
			lt-trochanteric	F	7.6	2	Effective	3	
7	64/F	Osteoarthritis	rt-groin	O	7.5	3.1	Effective	5	Rejected
8	55/F	Osteoarthritis	rt-groin	O	7.2	3.5	Effective	1	High risk (heart disease)
9	42/F	Congenital dislocation	rt-groin, thigh	O	7.2	0.5	Effective	11	Postoperative
10	26/M	Dislocation and fracture	lt-groin	O	8.2	1.3	Effective	8	Postoperative
11	26/F	Congenital dislocation	lt-groin	O	6.5	3.8	Ineffective		Postoperative
			lt-trochanteric	F	4.5	4	Ineffective		
12	87/F	Osteoarthritis	rt-groin	O	6.5	3.2	Effective	4	Postoperative
			rt-trochanteric	F	5.7	2.3	Effective	6	
13	57/F	Metastasis	lt-groin	O	7.8	2.5	Effective	1	Not indicated
			lt-trochanteric	F	7.8	2.5	Effective	1	
14	70/M	Metastasis	lt-groin	O	7.1	6	Ineffective		Not indicated

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10	26/M	Dislocation and fra e	lt-groin	O	.2	1.3	Effective	8	Postoperative
11	26/F	Congenital disloca	lt-groin	O	.5	3.8	Ineffective		Postoperative
			lt-trochanteric	F	.5	4	Ineffective		
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Obturator Branches

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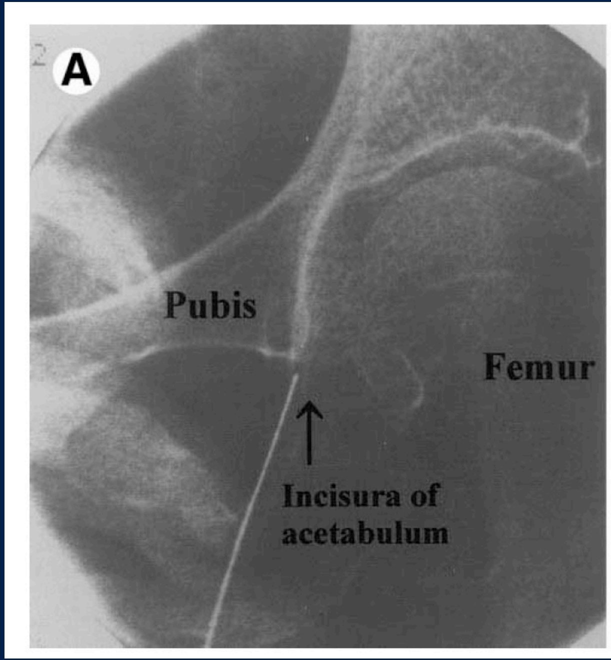

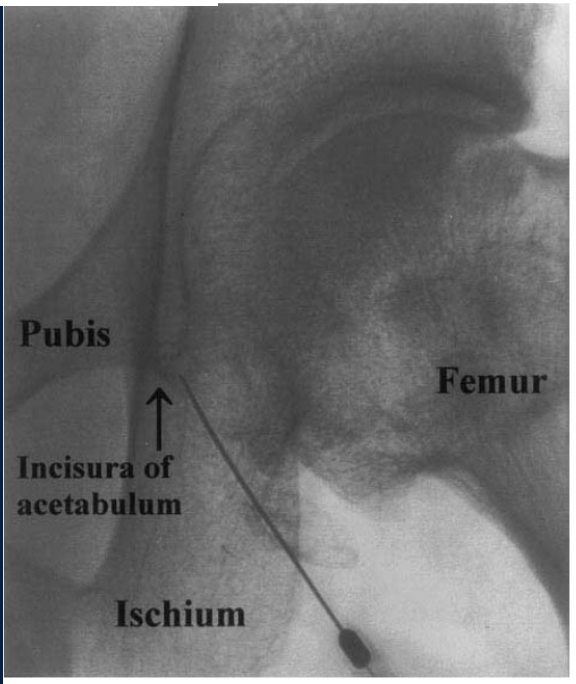

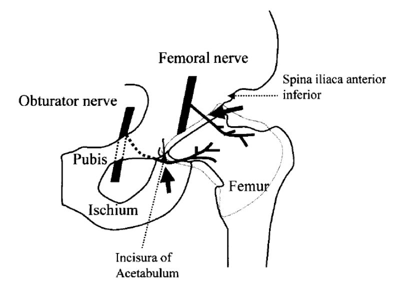

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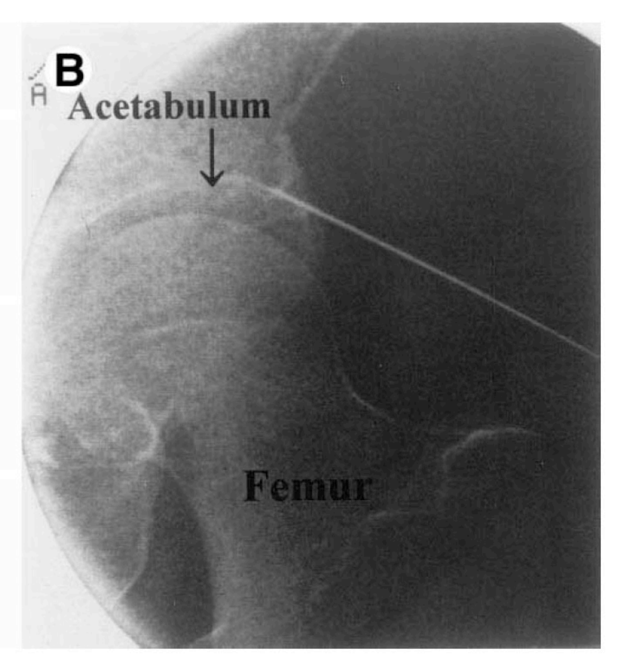
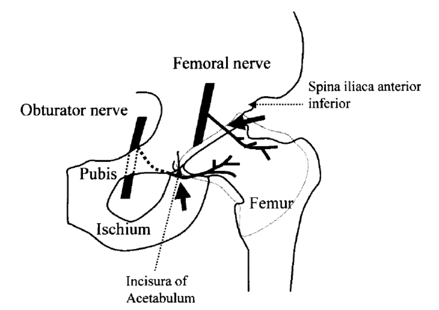
Femoral Branches





Kagawachi, 2001

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8	55/F	Osteoarthritis	rt-groin	O	7.2	3.5	Effective	1	High risk (heart disease)
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Limited Evidence

Curr Pain Headache Rep. 2019 May 1;23(6):38. doi: 10.1007/s11916-019-0775-z.

A Review of Current Denervation Techniques for Chronic Hip Pain: Anatomical and Technical Considerations.

Kumar P[1], Hoydonckx Y[1], Bhatia A[2,3].

Author/yr	Sample Size	Nerve	Imaging	Follow up time	Outcome on Pain
Kawaguchi, 2001	14	ON and FN	Fluoroscopy	11 months	60% reduction in pain score
Rivera, 2012	18	ON and FN	Fluoroscopy	6 months	33% reduction in pain score
Chye, 2015	15	ON and FN	Fluoroscopy	3 months	60% reduction in pain score
Okada, 1993	15	ON and FN	Fluoroscopy	12 months	Pain relief in 14/15 patients
Kapural, 2018	23	ON and FN	Fluoroscopy + ultrasound	6 months	>80% reduction in pain score
Tinnirello, 2018	14	ON and FN	Fluoroscopy	12 months	>50% improvement in 9/14 pts at 12 mo

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Interventional Options for Post TKA Pain

Genicular RFA for Post TKA Pain

The therapeutic effect of genicular nerve radiofrequency for chronic knee pain after a total knee arthroplasty: A systematic review

James B. Meiling [a,*], Brandon S. Barndt [b], Christopher T. Ha [a], James E. Eubanks Jr. [c], Justin B. Schappell [a], George M. Raum [c], Samir A. Khan [d], Larry Prokop [e], Aaron Conger [f], Zachary L. McCormick [f], Christine L. Hunt [g]

11 studies included

- 1 RCT, 5 retrospective cohort studies, 2 case series, 3 case reports

265 patients total

Studies included regular RFA, cooled RFA, and pulsed RFA

Meiling et al.

RCT by Qudsi-Sinclair et al.

Double-blind RCT of 28 patients comparing genicular RFA vs genicular nerve block (anesthetic + steroid)

Both groups demonstrated significant improvements at **6 and 12 months** in NRS, OKS, and Knee Society Score

Between group differences were not significant ($p > 0.05$)

Patient perception:

- 65% of RFA group reported "very much better" or "much better"
- 35% of nerve block group reported the above

Meiling et al.

Systematic review results

Extreme heterogeneity in the studies included in this review

Studies included reported positive results in pain and disability ranging from **30-100%**

Very few adverse events reported

Conclusion: there is limited evidence associated with low certainty to support the use of genicular RFA for post-TKA pain, largely due to inconsistency and risk bias

Genicular RFA for Post-TKA Pain

NIH U.S. National Library of Medicine
ClinicalTrials.gov

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Home > Search Results > Study Record Detail

Efficacy of Genicular Nerve Radiofrequency

ClinicalTrials.gov Identifier: NCT04100707

NIH U.S. National Library of Medicine
ClinicalTrials.gov

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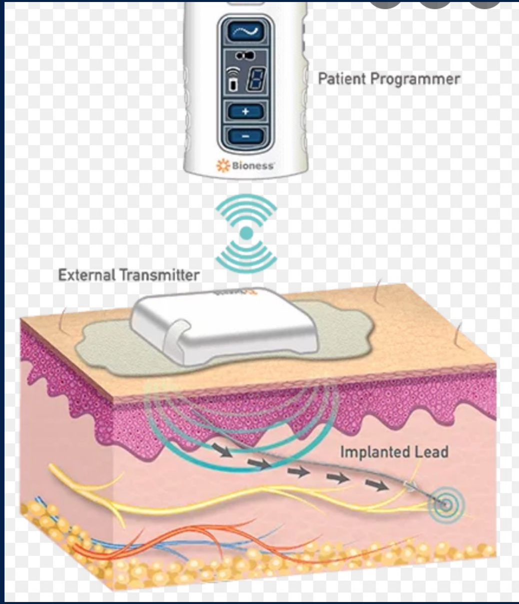
Home > Search Results > Study Record Detail

Radiofrequency For Chronic Knee Pain Post-Arthroplasty (DEFIANT)

ClinicalTrials.gov Identifier: NCT02931435

Neuromodulation

Peripheral Nerve Stimulation (PNS)



Mechanism of Action for PNS

- Gate control theory
- Excitation failure in c-fiber nociceptors and suppression of dorsal horn activity
- Stimulation-induced blockade of cell membrane depolarization
- Decreased hyperexcitability of dorsal horn neurons
- Depletion of excitatory amino acids (glutamate)

Nayak et al. *Pain Research and Treatment.* 2018.

Ultrasound-Guided Peripheral Nerve Stimulation for Knee Pain: A Mini-Review of the Neuroanatomy and the Evidence from Clinical Studies FREE

Chih-Peng Lin, MD, PhD, Ke-Vin Chang, MD, PhD ✉, Wei-Ting Wu, MD, Levent Özçakar, MD

Pain Medicine, Volume 21, Issue Supplement_1, August 2020, Pages S56–S63,

Author, Year, Journal	Study Design	Patient's Characteristics	Number	Mean Age, y	Target Nerves	Treatment	Outcome	Adverse Effects
Ilfeld et al. 2017 [18], *Pain Practice*	Case series	Persistent pain after TKA	2 males, 3 females	53	Femoral and sciatic nerves	Helically coiled monopolar-insulated electrical leads (MicroLead, SPR Therapeutics) connected to an external pulse stimulator used for 2 h	Immediate pain relief at rest by 63%, during passive ROM by 14%, and during active ROM by 50%	No device-related adverse events
Ilfeld et al. 2017 [19], *Journal of Orthopaedic Surgery and Research*	Case series	Persistent pain after TKA	2 males, 3 females	60.8	Femoral and sciatic nerves	Helically coiled monopolar-insulated electrical leads (MicroLead, SPR Therapeutics) connected to an external pulse stimulator used for 1–2 h	Average pain decrease: 93% at rest, 27% at passive ROM, and 30% at active ROM	No device-related adverse events
Ilfeld et al. 2019 [20], *Neuromodulation*	Case series	Being scheduled to undergo primary unilateral TKA	3 males, 4 females	67.7	Femoral and sciatic nerves	Helically coiled monopolar-insulated electrical leads (MicroLead, SPR Therapeutics) connected to an external pulse stimulator used both at home and in the hospital for up to 6 wk	Postoperative pain <4/10 of NRS (N = 6), opioid discontinuation (N = 4), improvement of >10% on 6MWT and 95% on WOMAC at the 12-wk follow-up	Discomfort (N = 1) and bruise (N = 1) over the implant site, nonspecific headache (N = 1), no serious device-related adverse events

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PNS for Chronic Post-TKA Pain

Novel approach for peripheral subcutaneous field stimulation for the treatment of severe, chronic knee joint pain after total knee arthroplasty

William Porter McRoberts [1], Martin Roche

Two patients with chronic intractable knee pain (>1 year out from TKA) with failed conservative treatment

Excellent relief with PNS trial x 1 week

Permanent implantation

- significant improvement in walking distance, standing and sitting tolerance
- **patient 1**: 50-70% pain improvement during the day and 100% at night at 6mo
- **patient 2**: 80-90% relief at 2.5 mo

Summary

- **Medication Mgt:** Topical NSAIDs (1st line), Non-selective oral NSAIDs (2nd line). Consider Tramadol and Duloxetine
- **Ablations:** Genicular nerve, Femoral/Obturator sensory articular branches
  - Promising evidence for genicular nerve RFA for refractory knee OA pain, with a success rate of 74% at 6 months.
  - Limited evidence for hip denervation and post-TKA pain
- **PNS:** Some limited evidence for acute post-TKA pain. More evidence needed for both acute and chronic post-TKA pain

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