A/Prof
Raj Gunaratne
ORTHOPAEDIC SURGEON

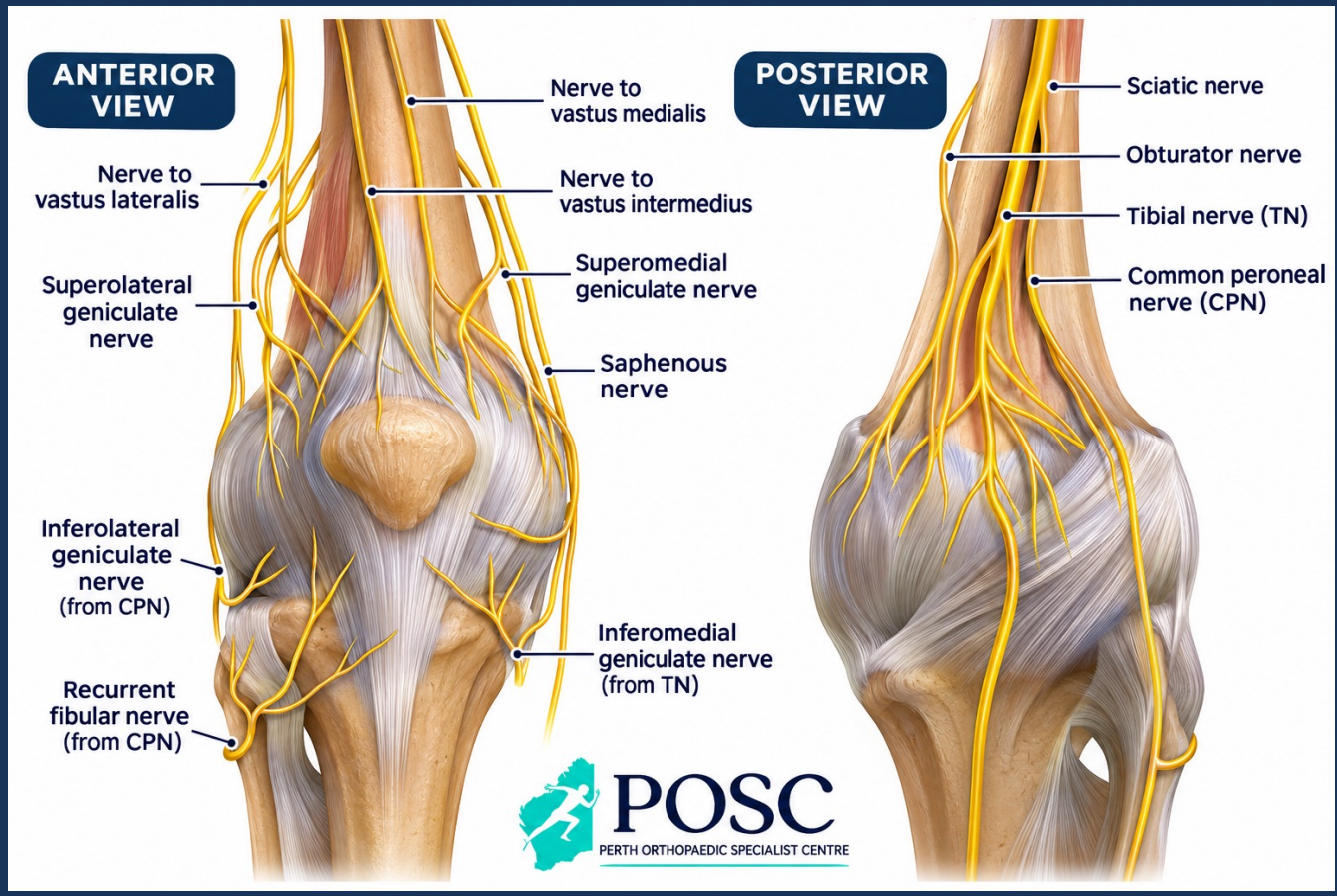
GENICULAR NERVE ABLATION FOR KNEE PAIN

If the Hinge Works,
Treat the Pain — Not the Joint

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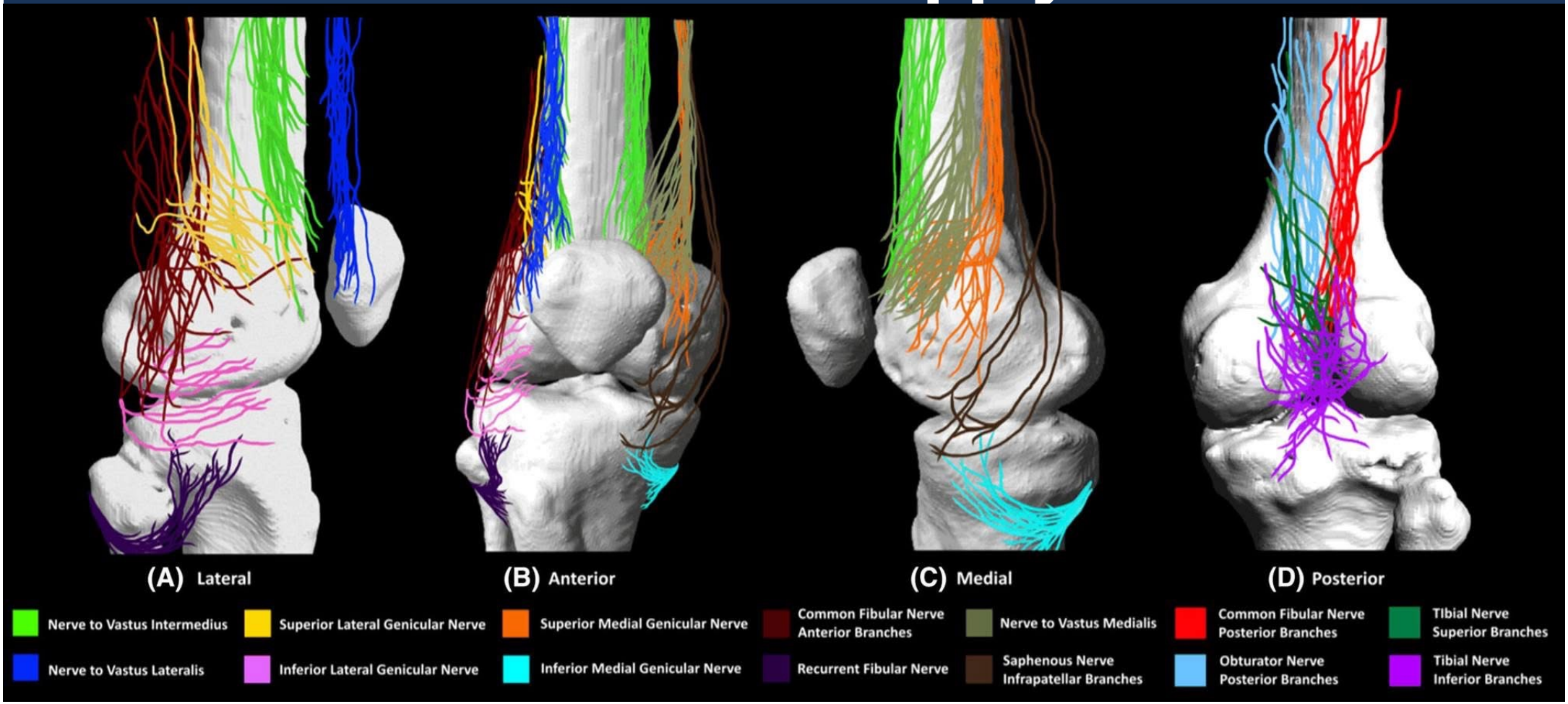
What Are Genicular Nerves?

- Peripheral sensory branches - Key branches: SMGN, SLGN, IMGN
- Sensory innervation to the knee capsule
- Also innervate the periosteum and synovium
- **Transmit nociceptive signals from osteoarthritic knees**



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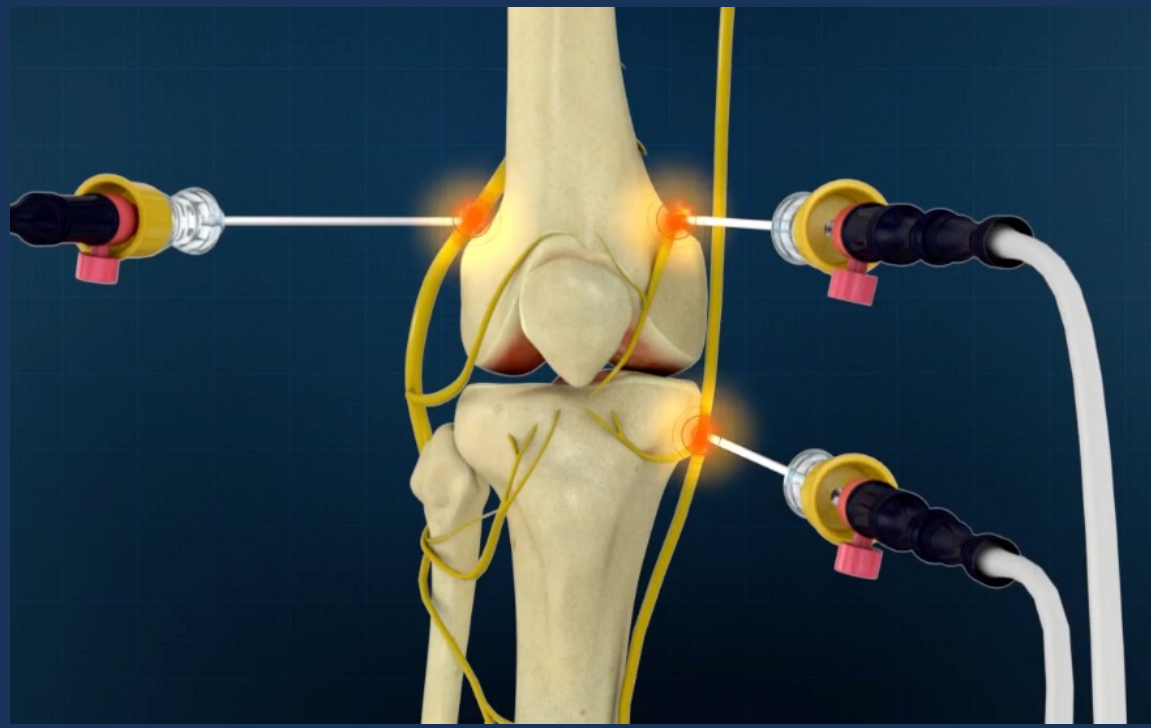
What Do Genicular Nerves Supply?



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What Is Genicular Nerve Ablation (GNA)?

- Minimally invasive, image-guided procedure targeting sensory nerves
- Typically uses radiofrequency ablation (RFA) to denature nerve proteins
- Day Procedure
- Light Anaesthetic
- Back to work the next day if they want



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Interventional Pain Medicine 1 (2022) 100003

Contents lists available at ScienceDirect

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journal

Long-term clinical outco
chronic knee pain using

Edvin Koshi [a,*], James B. Meili
Taylor R. Burnham [c]

[a] Department of Physical Medicine and Rehabilitation,
[b] Department of Physical Medicine and Rehabilitation,
[c] Department of Physical Medicine and Rehabilitation,

Journal of Pain Research

Dovepress
Taylor & Francis Group

Open Access Full Text Article

ORIGINAL RESEARCH

Genicular Ner... Radiofrequency Ablation for
Chronic Knee...
Tip Needle: A...
Observational...

Giuliano Lo Bianco [1], Mari...
Michael E Schatman [5,6], Al...

[1]Anesthesiology and Pain Department, Fo...
Rizzoli Sicilia di Bagheria, Bagheria, Palerr...
Research, Department of Anesthesiology,...
Pain Medicine, NYU Grossman School of...
Grossman School of Medicine, New York...
[8]Anesthesiology, Perioperative, and Pain I...

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90015, Italy, Email giulianolobianco@gmai...

Interventional Pain Medicine 3 (2024) 100390

Contents lists available at ScienceDirect

ELSEVIER

Interventional Pain Medicine

journal homepage: www.journals.elsevier.com/interventional-pain-medicine

IPM Interventional Pain Medicine

Check for updates

Effectiveness comparison of genicular nerve ablation for knee osteoarthritic versus post-total knee arthroplasty pain☆

Weibin Shi [a,b,*], To-Nhu Vu [c], Thiru Annaswamy [a,b], Hong Wu [d], Bryan Moore [a,b], Nicole Hatchard [a,b], Chad Mears [c], Allen R. Kunselman [e]

[a] Department of Physical Medicine and Rehabilitation, Penn State Health Milton S Hershey Medical Center / Penn State College of Medicine, Hershey, PA, USA
[b] Penn State Hershey Rehabilitation Hospital, Hummelstown, PA, USA
[c] Department of Anesthesiology & Perioperative Medicine, Penn State Health Milton S Hershey Medical Center / Penn State College of Medicine, Hershey, PA, USA
[d] Department of Physical Medicine and Rehabilitation, RUSH University Medical College, Chicago, IL, USA
[e] Department of Public Health Sciences, Penn State Hershey College of Medicine, Hershey, PA, USA


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J Pain Res. 2026 Sep 19:19:638862. doi: 10.2147/JPR.S638862. eCollection 2026.
Clinical Outcomes and Repeat-CRFA-Free Survival After Ultrasound-Guided Cooled Radiofrequency Ablation Using the Matsuoka Direct Nerve Targeting (MDNT) Technique for Knee Osteoarthritis: A Retrospective Cohort Study of 1,025 Consecutive Knees
Pain Med. 2026 Jun 1;27(6):635
Genicular nerve rad
treatment of chron
with Bayes
Meta-Analy
Mohammed Quazi
Napatpaphan Kanja
Aaron M Conger 5
Affiliations + expa
PMID: 41460188
techniques for knee osteoarthritis: a svstematic
review a
randomi
Ronald Bispo Ba
Davi Martins Ba
Pain Med. 2026 Feb 1;27(2):189-208. doi: 10.1093/pm/pnaf115.
Effectiveness of genicular nerve radiofrequency ablation in osteoarthritis and post-surgical knee pain: systematic review
Napatpaphan Kanjanapanang 1, Roy Madrid 2, Peter Lin 3, Mark Shilling 3, Amanda Cooper 1, Hasan Sen 1, Sherwin Thiyagarajan 4, Kai-Hua Chang 3, Henry Luo 2, Aaron Conger 1, Zachary L McCormick 1, Reza Ehsanian 3
J Pain R
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Knees
Yoshinori Matsuoka 1
Affiliations + expand
PMID: 42781084 PMCID: PMC13599791 DOI: 10.21

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- How many sites?
- What device? Coolief ablation
- Surgeon?

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ORIGINAL ARTICLE

OPEN

Prospective, Multicenter, Randomized, Crossover Clinical Trial Comparing the Safety and Effectiveness of Cooled Radiofrequency Ablation With Corticosteroid Injection in the Management of Knee Pain From Osteoarthritis

Tim Davis, MD, Eric Loudermilk, MD,† Michael DePalma, MD,‡ Corey Hunter, MD,§ David Lindley, DO,‖ Nilesh Patel, MD,** Daniel Choi, MD,†† Marc Soloman, MD,‡‡ Anita Gupta, DO, PharmD,§§ Mehul Desai, MD,‖‖ Asokumar Buvanendran, MD,*** and Leonardo Kapural, MD, PhD†††*

GNA more effective than Steroid injections

At 6 months:

Outcome	Cooled GNRFA	Steroid
≥50% pain reduction	**74.1%**	**16.2%**
Mean NRS reduction	**4.9**	1.3
Oxford Knee Score	**35.7**	22.4
Improved global perceived effect	**91.4%**	23.9%

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Cooled Radiofrequency Ablation Compared with a Single Injection of Hyaluronic Acid for Chronic Knee Pain

A Multicenter, Randomized Clinical Trial Demonstrating Greater Efficacy and Equivalent Safety for Cooled Radiofrequency Ablation

Antonia F. Chen, MD, MBA, Fred Khalouf, DO, Keith Zora, DO, Michael DePalma, MD, Lynn Kohan, MD, Maged Guirguis, MD, Douglas Beall, MD, Eric Loudermilk, MD, Matthew Pingree, MD, Ignacio Badiola, MD, and Jeffrey Lyman, MD

GNA more effective than Hyaluronic acid injections

CRFA vs Hyaluronic Acid Injection for Chronic Knee Pain

Results at 6 Months

Outcome	Cooled Radiofrequency Ablation (CRFA) (N=76)	Hyaluronic Acid Injection (HA) (N=82)	Between-Group Difference (p value)
≥50% Pain Reduction (Primary Endpoint)	71%	38%	33% more with CRFA *(p < 0.0001)*
Mean Pain Reduction (NRS Score) Scale 0–10	4.1 ± 2.2	2.5 ± 2.5	1.6 points more with CRFA *(p < 0.0001)*
WOMAC Improvement from Baseline (Percent)	48.2%	22.6%	25.6% more with CRFA *(p < 0.0001)*

NRS = Numeric Rating Scale (0 = no pain, 10 = worst pain imaginable)
WOMAC = Western Ontario and McMaster Universities Osteoarthritis Index

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Nnake *et al. Knee Surgery & Related Research* (2024) 36:18
https://doi.org/10.1186/s43019-024-00222-9

Knee Surgery
& Related Research

REVIEW ARTICLE Open Access

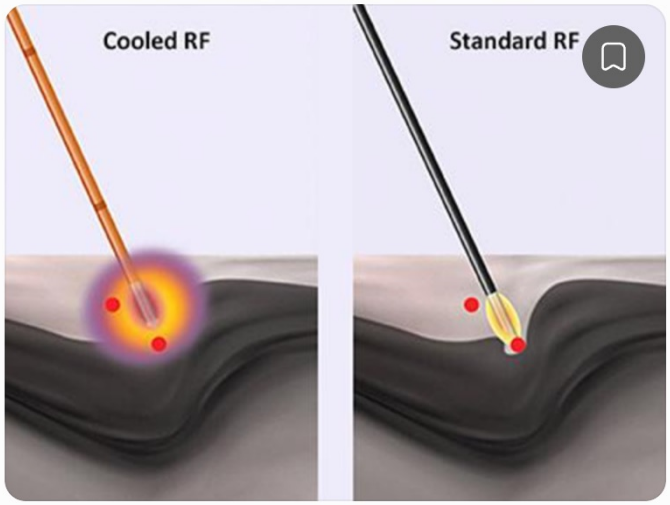
Genicular nerve radiofrequency ablation: a systematic review of application for perioperative pain control in total knee arthroplasty and as treatment for chronic pain in well-appearing total knee arthroplasty

Chidebelum O. Nnake[1], Mouhanad M. El-Othmani[1], H. John Cooper[1], Roshan P. Shah[1], Jeffrey A. Geller[1] and Alexander L. Neuwirth[1*]

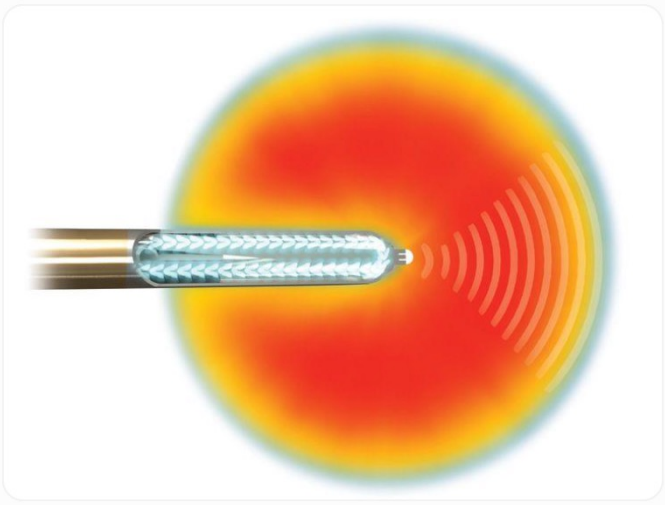
Minimize opioid consumption, patient-reported pain, length of stay, and increased range of motion and activity.

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How cooled RFA differs from conventional RFA?



Conventional RFA
A smaller thermal lesion forms around the electrode's active tip.



Cooled RFA
Internal cooling permits a larger lesion to develop around the electrode.



Thermal lesion around a sensory nerve, while circulating cooling fluid through the electrode tip

No charring immediately adjacent to the electrode

Increases the likelihood of capturing small sensory nerve branches despite anatomical variability

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Long-term outcomes of cooled versus conventional radiofrequency ablation of genicular nerves for chronic knee osteoarthritis pain: A randomised comparative study

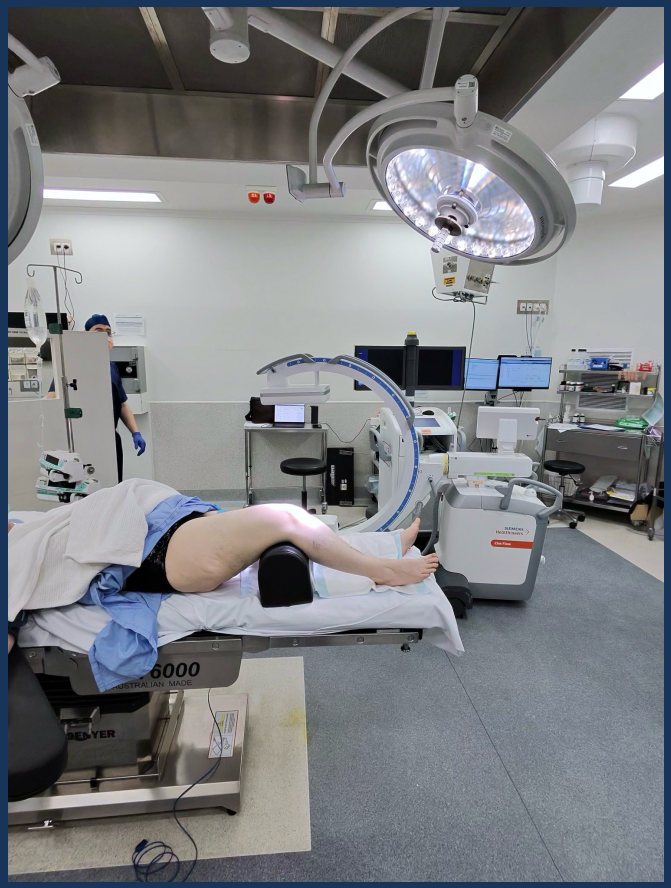
Abhirup Nayak [1], Debolina Gosh [2], Gargi Nandi [2], Indira R Kasar [1]

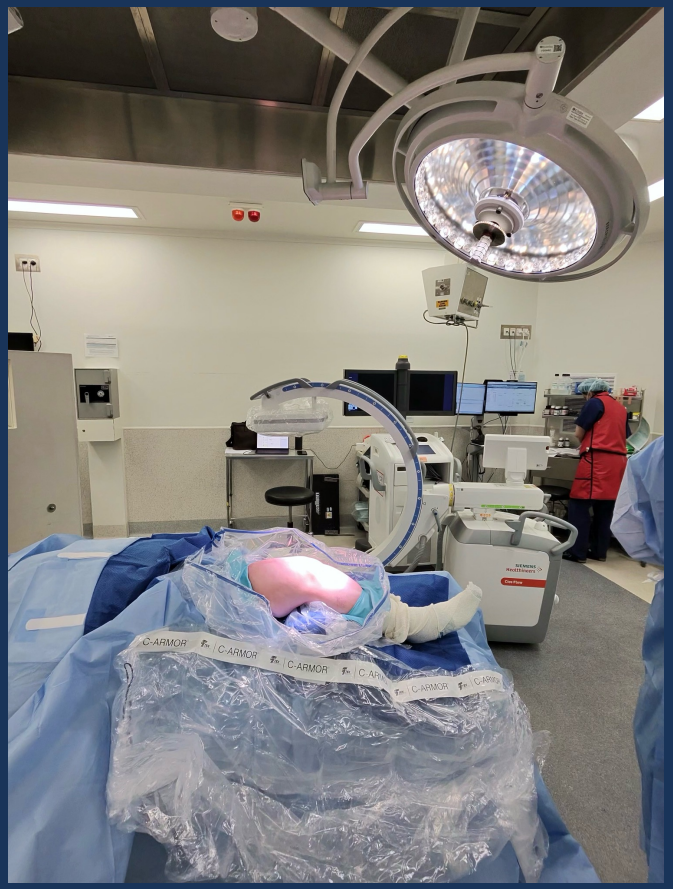
Cooled radiofrequency ablation offers superior long-term benefits in pain relief and functional improvement compared to conventional.

These differences persisted till 24 months

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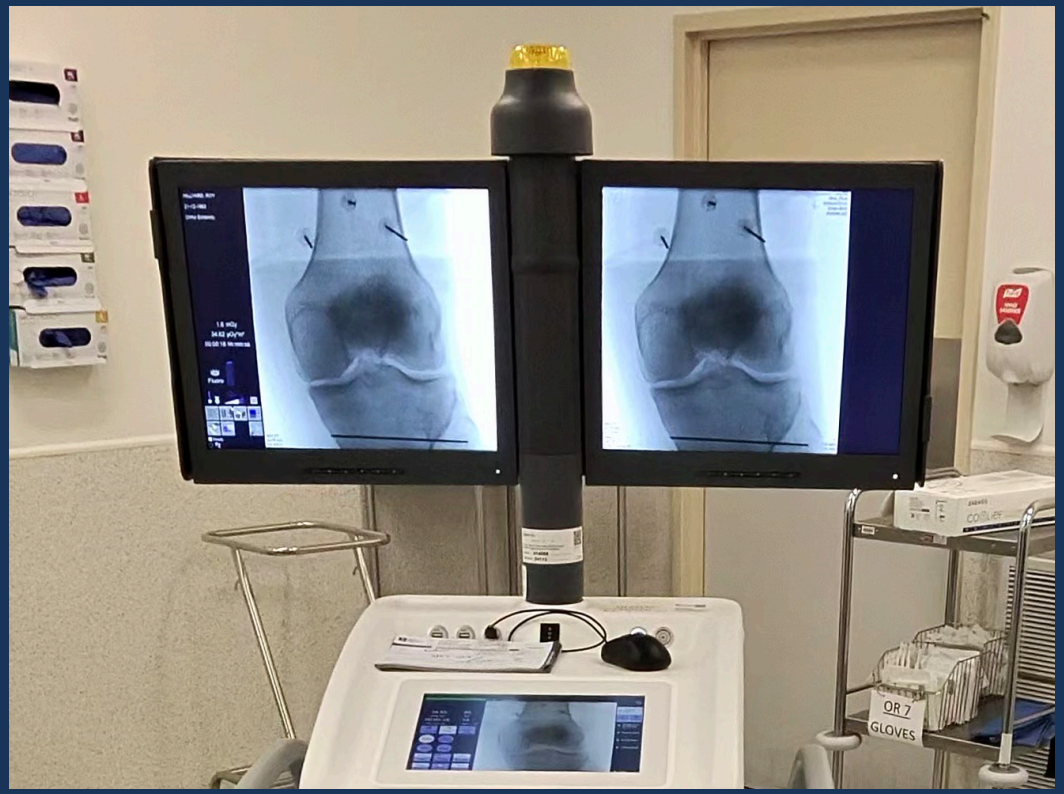




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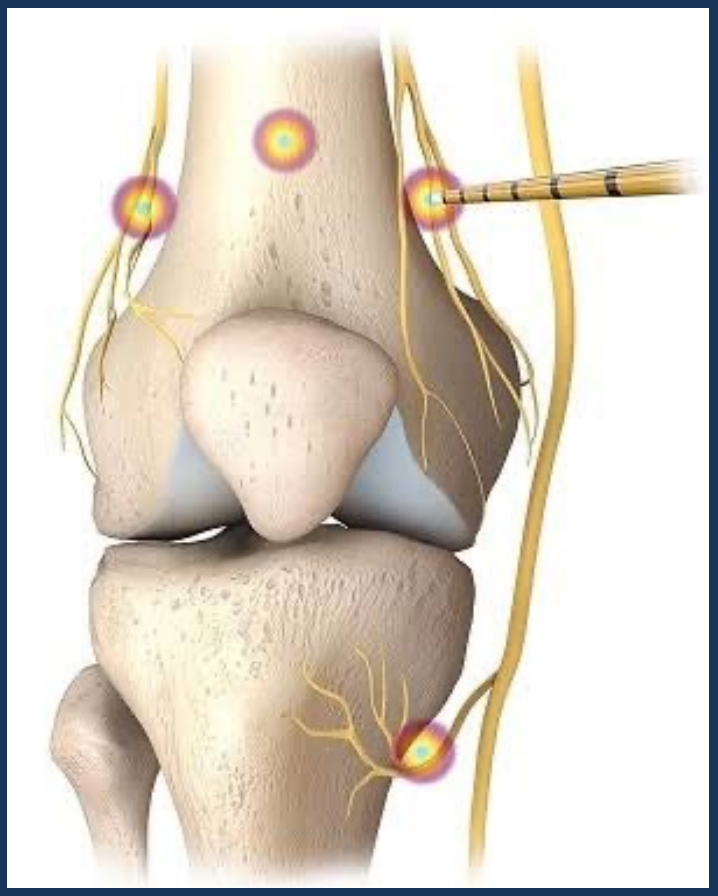
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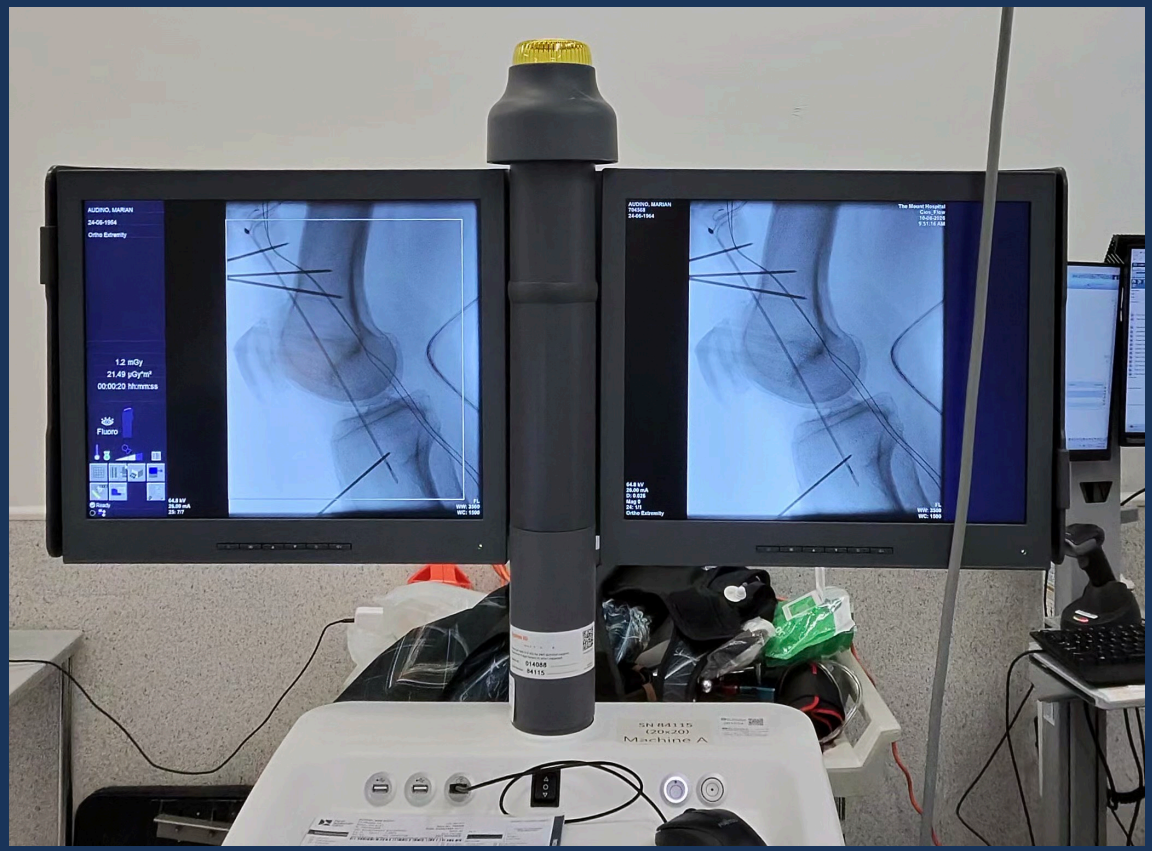




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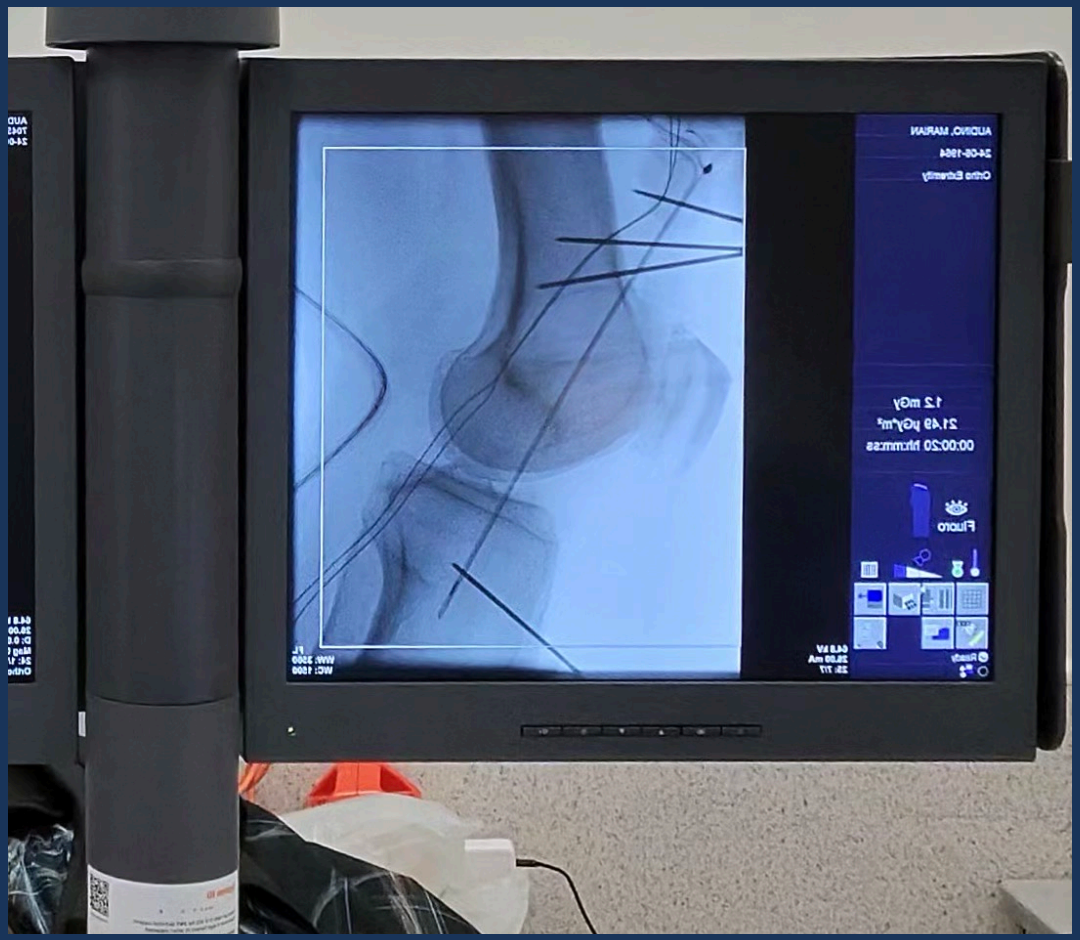
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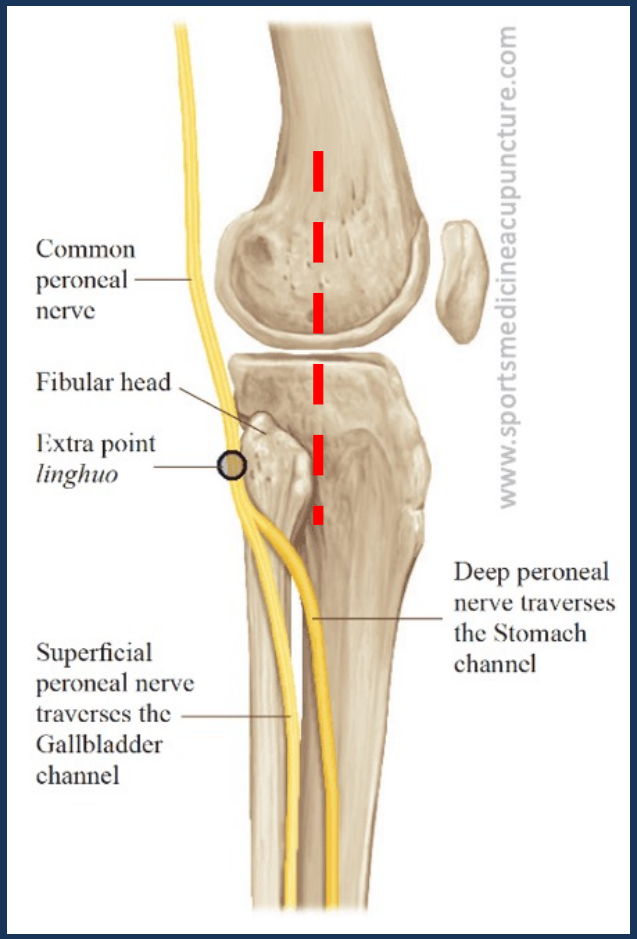




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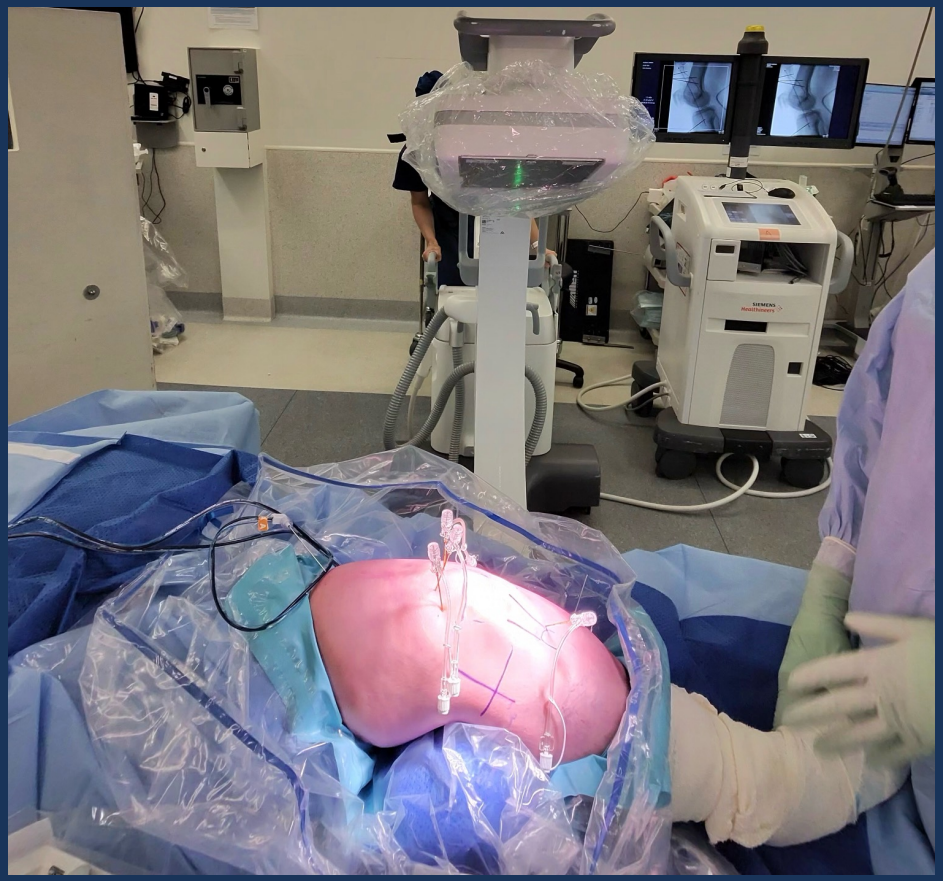
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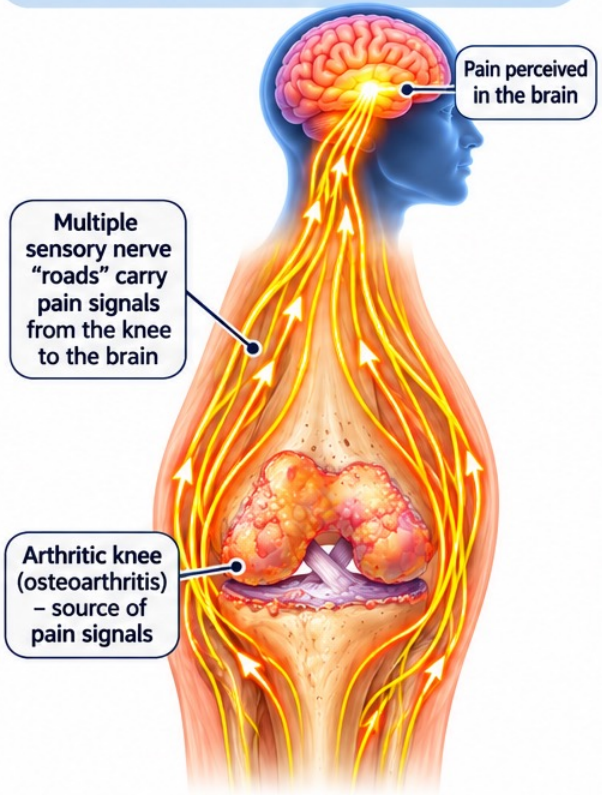




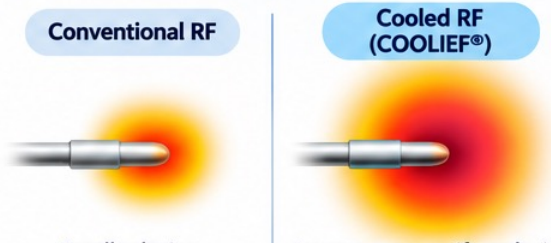
Genicular Nerve Ablation for Knee Pain

The goal is to disrupt as many pain "roads" as safely possible by using a larger ablation lesion with cooled radiofrequency (RF) and treating multiple key sites (up to 12).

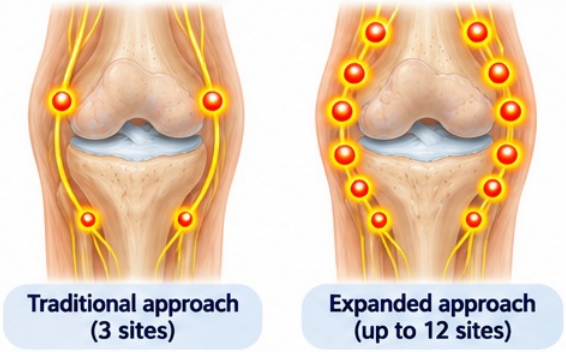
1. Pain Pathways – Many "Roads" from Knee to Brain



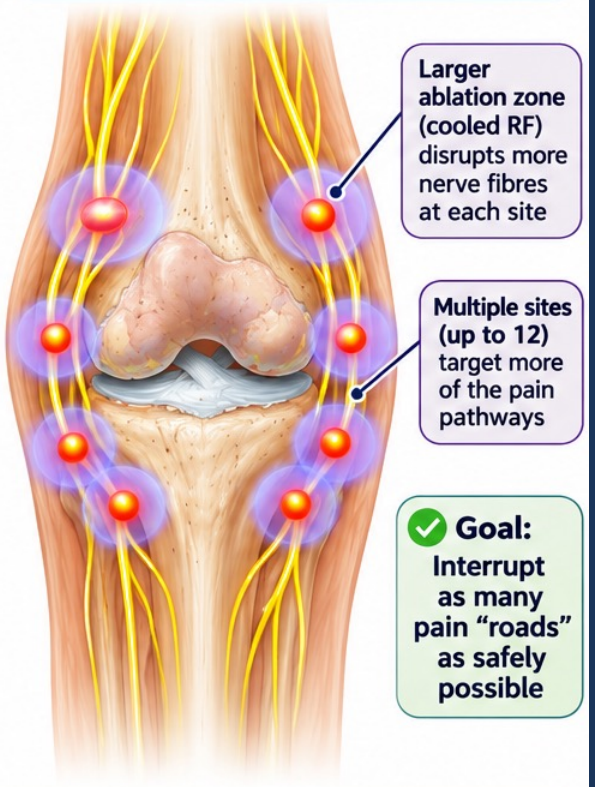
2. Larger Ablation Lesion (with Cooled RF)



3. Multiple Ablation Sites (Up to 12)



4. The Result – Disrupt More Pain "Roads"

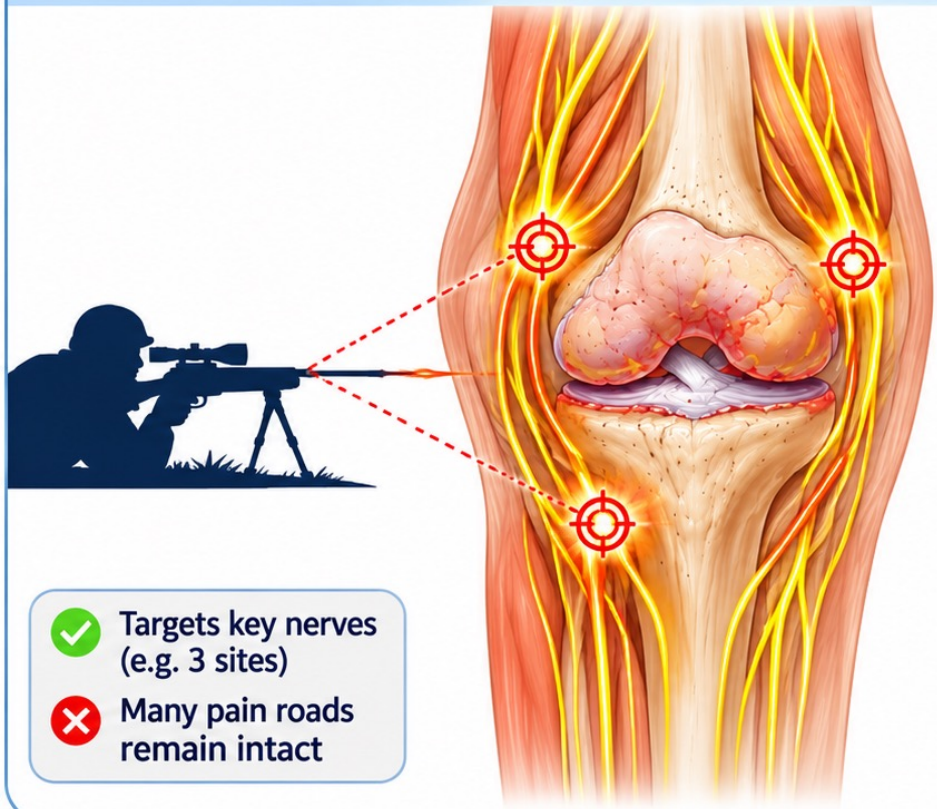


KEY TAKEAWAY

- Use a larger ablation lesion (with cooled RF) to cover more nerve fibres.
- Treat multiple key sites (up to 12) to disrupt more pain pathways.
- **Aim:** reduce pain signals from the knee to the brain and provide longer-lasting pain relief.

Limited Ablation – 3 Precise Shots

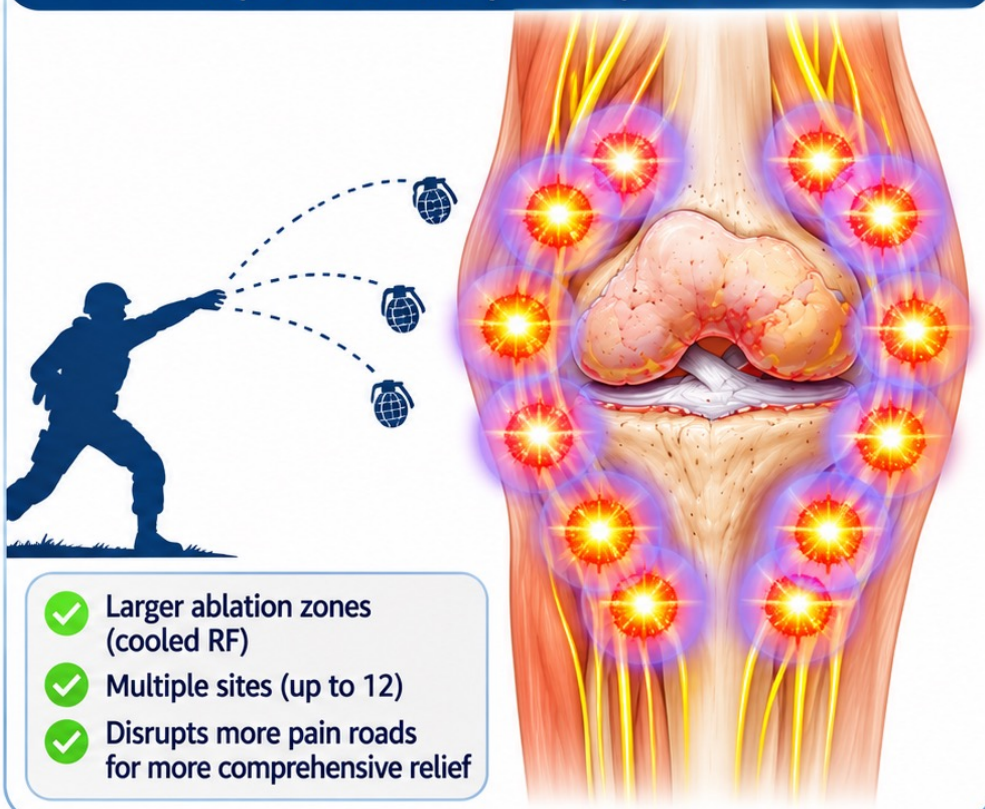
Targets only a few pain roads (typically 3 sites)



- ✓ Targets key nerves (e.g. 3 sites)
- ✗ Many pain roads remain intact

Comprehensive Ablation – Multiple Grenades

Uses a larger ablation zone (cooled RF) at multiple sites (up to 12) to disrupt more pain roads



- ✓ Larger ablation zones (cooled RF)
- ✓ Multiple sites (up to 12)
- ✓ Disrupts more pain roads for more comprehensive relief

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What Pain Relief Can Be Expected?

- >50% pain relief (up to ~90%) in 60–70% of patients for 12 months
- Improvement in WOMAC and KOOS scores
- Repeat ablation can be repeated annually
- Evidence supports efficacy vs placebo in RCTs (e.g., Choi 2021, Davis 2022)

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Risks and Benefits of GNA

- Benefits:
  - Pain reduction, improved function, minimal recovery
  - Improvements in gait speed, activities of daily living, and analgesic use reduction

- Risks: Local bruising, transient numbness, rare complications (neuritis, vascular injury)

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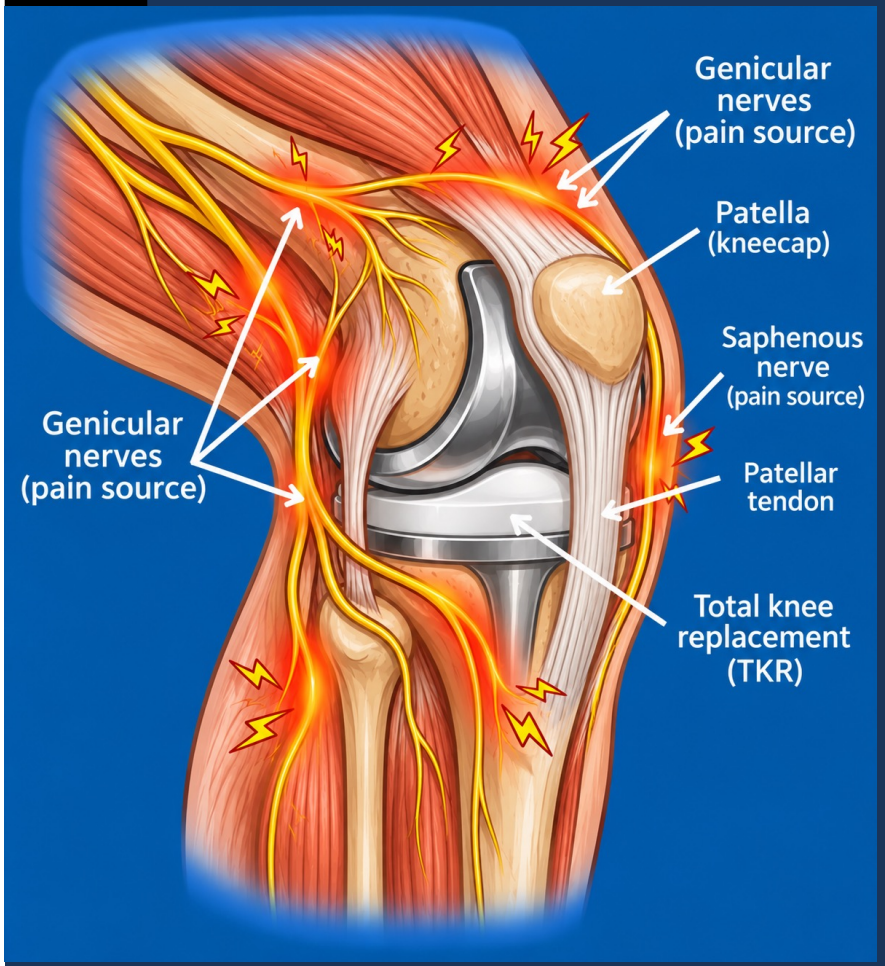
Suitable Candidates for GNA

- Mild to Moderate OA
- Failed conservative treatment
- **Patients unfit for arthroplasty**
- **Not ready for surgery**
- Post-TKA chronic pain
- **Preop TKR for a smoother recovery post arthroplasty**

- Not suitable: Infection, coagulopathy, poorly defined pain

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Pain Post Knee Replacement



› Biomed Res Int. 2026;2026(1):e4650605. doi: 10.1155/bmri/4650605.

Genicular Nerve Radiofrequency Ablation for Persistent Postsurgical Pain After Total Knee Arthroplasty: A Systematic Review of Clinical Effectiveness and Safety

Yerdar Shaukhin [1], Talgat Anashev [2], Tamerlan Shokanov [3]

All included studies reported improvement in at least some outcome measures following GNRFA

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A special subset: Scope + GNA

Has mild to moderate degeneration + New Meniscal tear with mechanical symptoms

Knee with Moderate Degeneration and Meniscal Tear



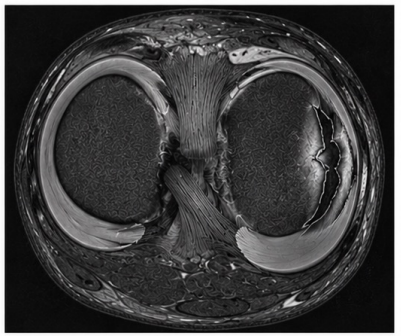
KEY FINDINGS

- Moderate thinning and wear of articular cartilage (joint space narrowing, more pronounced in the medial compartment)
- Medial meniscus tear (likely degenerative)
- Early osteophyte formation may be present (not shown)
- Mild subchondral sclerosis and joint effusion may be present

CORONAL (FRONT) MRI VIEW



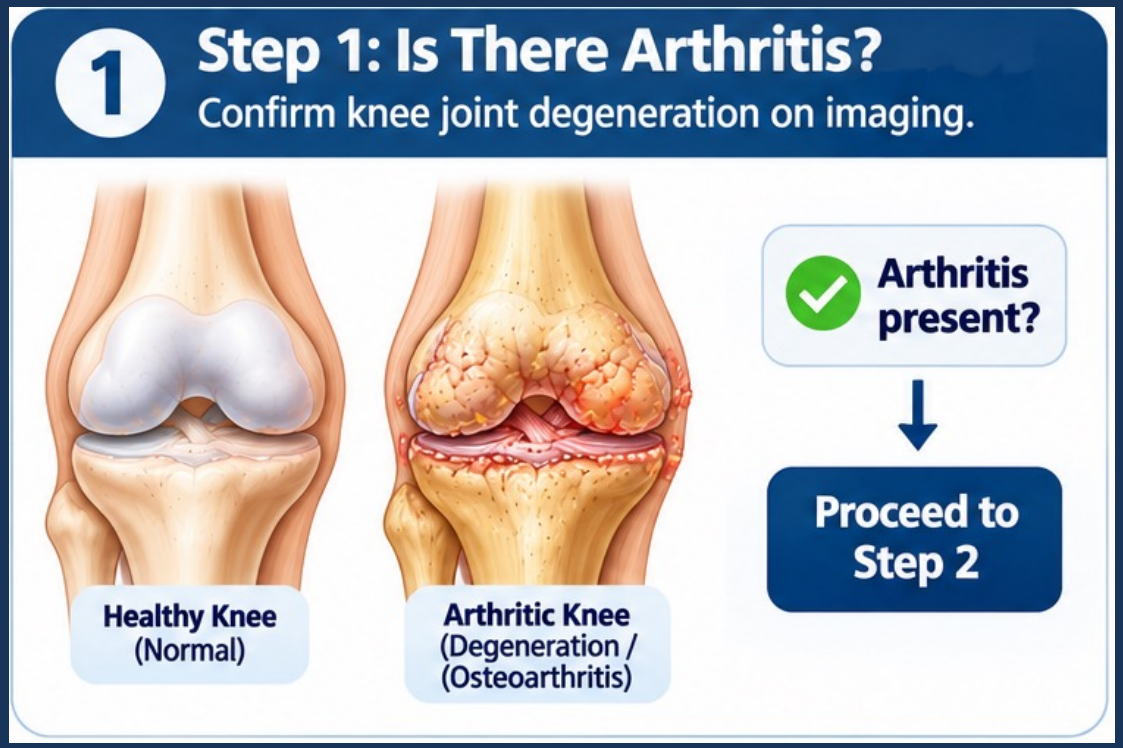
AXIAL (TOP-DOWN) MRI VIEW



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Challenging conventional views

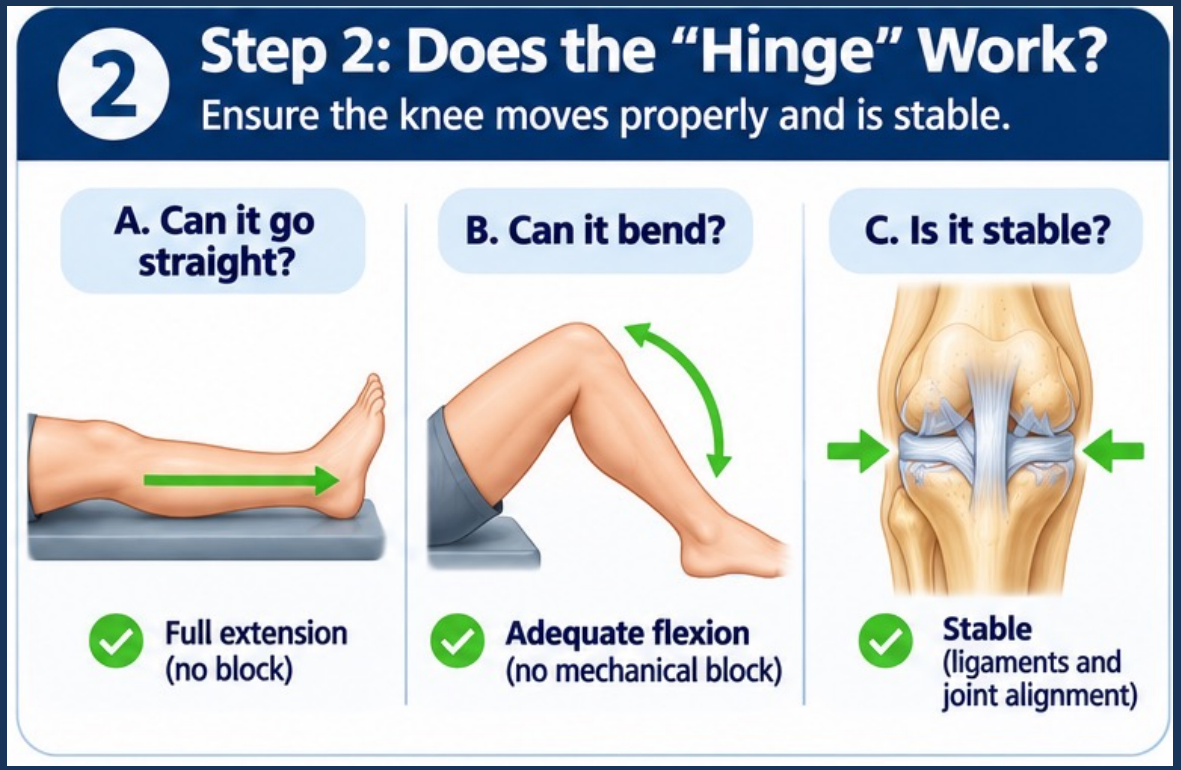
My approach to knee replacements have changed from conventional teachings!



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Challenging conventional views

My approach to knee replacements have changed from conventional teachings!



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Challenging conventional views

My approach to knee replacements have changed from conventional teachings!



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Challenging conventional views

My approach to knee replacements have changed from conventional teachings!

4 Treat the Pain First: Genicular Nerve Ablation

Use genicular nerve ablation to reduce pain, keep the patient's own knee and delay knee replacement.



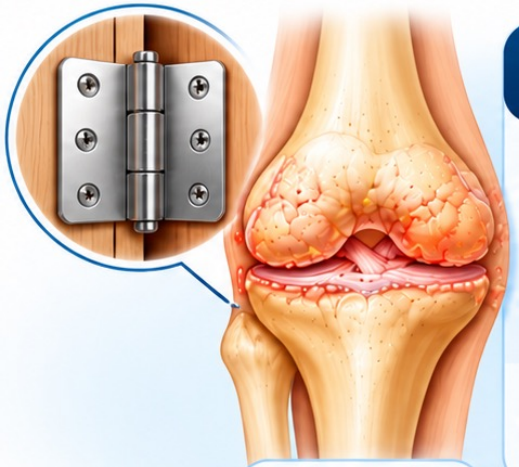
Genicular Nerve Ablation

- Targets the pain nerves around the knee
- Reduces knee pain
- Allows you to keep your own knee and delay knee replacement

Knee replacement remains an option later if needed.

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If the Hinge Works,
Treat the Pain — Not the Joint



Arthritic Knee
(Degeneration)

Does the hinge work?

- Goes straight (extenstion)
- Bends (flexion)
- Is stable (ligaments)



Genicular Nerve Ablation

- Reduces pain
- Keeps the patient's own knee
- Improves function and quality of life
- Can delay knee replacement



Knee Replacement
(later if needed)

1. Confirm Arthritis (on imaging)
2. Check the Hinge (movement and stability)
3. Treat the Pain (Genicular nerve ablation)

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