

# Nonsurgical Pain Management: Options for Refractory Osteoarthritis or Painful Total Joint Arthroplasty

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Health Innovation Technology

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No Disclosures

# Objectives

- Guidelines for nonsurgical management of knee osteoarthritis
- Therapeutic agents in nonsurgical interventions
- Ultrasound-guided injections
- Genicular nerve denervation
- Peripheral nerve stimulation
- Genicular artery embolization

# Guidelines

Recommend / Benefit>Harm | Not Recommend / Harm>Benefit | Unclear / Requires additional evidence

## Strength of Recommendations for Non-Operative Therapies

<b>Strong</b> – ≥2 “High” quality studies	<b>Moderate</b> – ≥2 “Moderate” quality OR 1 “High” quality study; no or minor concerns in the evidence-to-decision (EtD) framework	<b>Limited</b> – ≥1 “Low” quality studies OR 1 “Moderate” quality study; major concerns	<b>Consensus</b> – no evidence, or higher quality evidence downgraded due to major concerns; clinical opinion of guideline group
Lateral wedge insoles	Cane	Dietary supplements	Needling
Topical NSAIDs	Braces	Manual therapy	Free-floating interpositional devices
Exercises (PT, aquatic)	Neuromuscular training (balance, agility, coordination)	Massage	
Patient education programs	Weight loss intervention	Laser therapy	
Self Management	Intra-articular corticosteroids (short-term relief)	Acupuncture	
Oral NSAIDs	Hyaluronic acid intra-articular injection (routine use)	Transcutaneous Electric Nerve Stim	
Oral acetaminophen	Arthroscopy with lavage and/or debridement	Pulsed Elec. Nerve Stimulation Pulsed EM Field Therapy	
Oral opioids	Arthroscopic partial meniscectomy	Extracorporeal shockwave therapy	
		Platelet Rich Plasma	
		Denervation therapy	
		High tibial osteotomy	

# Guidelines

## Osteoarthritis and Cartilage



Review

Recommendations for the management of hip and knee osteoarthritis: A systematic review of clinical practice guidelines\*

Alison J. Gibbs <sup>1</sup>, Binshi Gray <sup>1</sup>, Jason A. Wallis <sup>1</sup>, Nicholas F. Taylor <sup>1</sup>, Joanne L. Kemp <sup>1</sup>, David J. Hunter <sup>1</sup>, Christian J. Barton <sup>1</sup>

- RACGP = Royal Australian College of General Practitioners
- ACR = American College of Rheumatology
- OARSI = Osteoarthritis Research Society International
- NICE = National Institute of Clinical Excellence
- EULAR = European League Against Rheumatism
- APTA = American Physical Therapists Association
- BMJ = British Medical Journal Rapid Recommendations



# Guidelines

## Osteoarthritis and Cartilage



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## Recommendations:

### For:

- exercise
- education
- weight management
- walking aids
- NSAIDs
- intra-articular steroid injections

### Against:

- dietary supplements (glucosamine, chondroitin, fish oil/ omega-3, vitamin D)
- opioids
- stem cell injections

### Inconsistent:

- Tylenol
- hyaluronic acid
- PRP
- adjunctive treatments



RACGP – Royal Australian College of General Practitioners; \*\* Guideline with joint specific recommendations; ACR – American College of Rheumatology; OARSI – Osteoarthritis Research Society International; NICE – National Institute of Healthcare Clinical Excellence; \*\* guideline with general osteoarthritis recommendations; EULAR – European League Against Rheumatism; BMJ – British Medical Journal Rapid Recommendations; Land – Land-based exercise; CBT – Cognitive Behavioural Therapy; TENS – Transcutaneous Electrical Nerve Stimulation; US – Ultrasound Therapy; NSAIDs – Non-Steroidal Anti-inflammatory Drugs; ● – strong for; ● – option can be considered within strong for recommendation; ● – conditional for; ● – neutral; ● – conditional against; ● – strong against.

# Therapeutic Agents

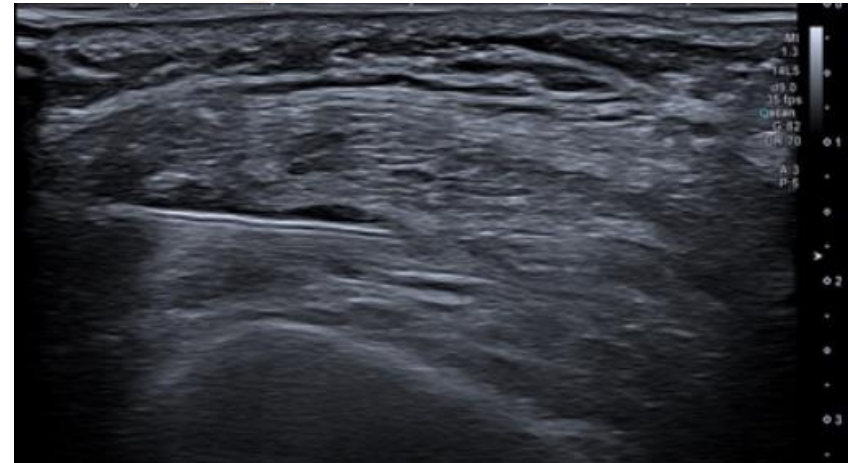
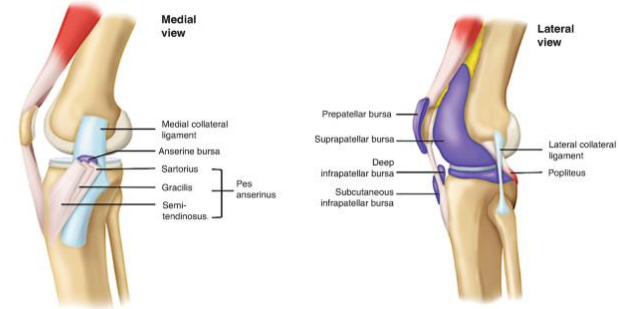
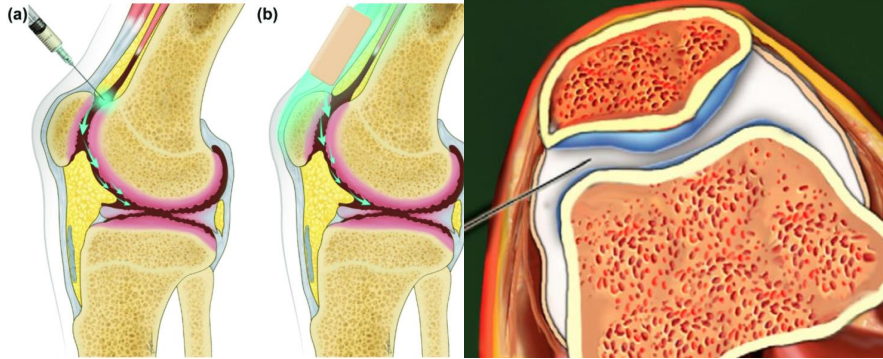
Therapeutic Agents		
	Description	Effects
<b>Corticosteroids</b>	<ul style="list-style-type: none"> <li>- derivatives of prednisolone – analog of cortisol, a glucocorticoid class of steroid hormones that control metabolism and inflammation</li> <li>- <b>Triamcinolone</b> acetonide and <b>methylprednisolone</b> acetate common</li> </ul>	<ul style="list-style-type: none"> <li>- provide anti-inflammatory effects</li> </ul>
<b>Hyaluronic Acid</b>	<ul style="list-style-type: none"> <li>- high molecular-weight glycosaminoglycan present in cartilage and synovial fluid (normal: 5000–6000 kDa, <u>linear chain</u> structure)</li> <li>- lubricant and regulator of cellular activities in joints</li> <li>- <b>Synvisc (Hylan g-f 20), 6000 kDa, most studied</b></li> <li>- <b>Euflexxa, 2400-3600 kDa</b> most similar to healthy HA wrt molecular structure and rheological property</li> </ul>	<ul style="list-style-type: none"> <li>- facilitate maintenance of joint lubrication</li> <li>- provide anti-inflammatory, analgesic, and chondroprotective effects: downregulate pro-inflammatory factors, such as PGE2 and NFkB, and proteases and proteinases that break down joint matrix</li> </ul>
<b>Platelet-Rich Plasma</b>	<ul style="list-style-type: none"> <li>- supraphysiologic platelet concentrations compared to whole blood, at least 5x, or <math>1 \times 10^6/\mu\text{L}</math></li> <li>- <b>Leukocyte content may increase risk of local adverse reactions, swelling and pain</b></li> </ul>	<ul style="list-style-type: none"> <li>- promote healing and anti-inflammation</li> <li>- provide longer-term relief</li> </ul>

# Ultrasound Guided Injections

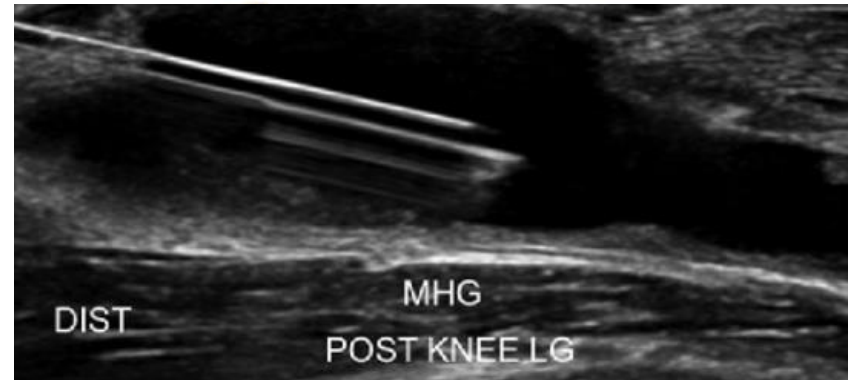
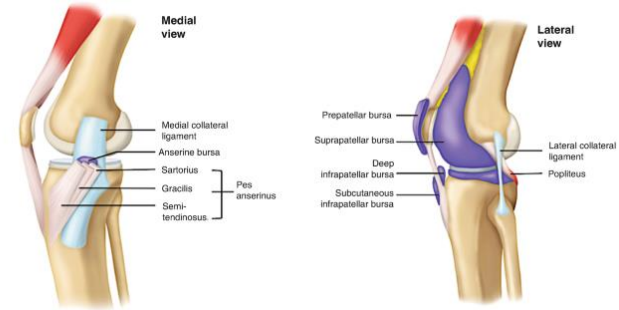
- Percutaneous musculoskeletal intervention serves to evaluate and manage knee pain
- Ultrasound guided procedures offer many advantages
  - Greater accuracy
  - Real-time visualization
  - Lack of ionizing radiation
  - Portability
  - Low cost



# Ultrasound Guided Injections: Knee Joint

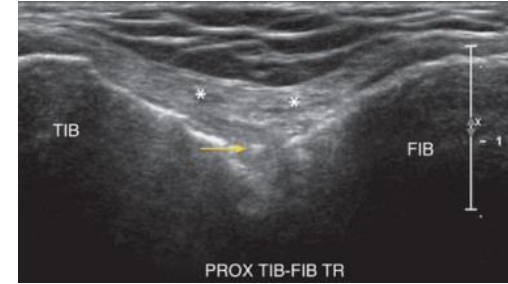
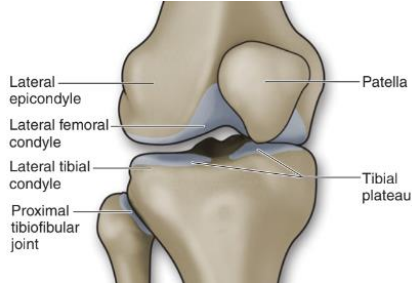


# Ultrasound Guided Injections: Baker's Cyst

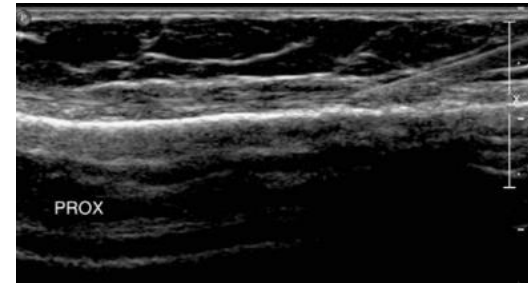
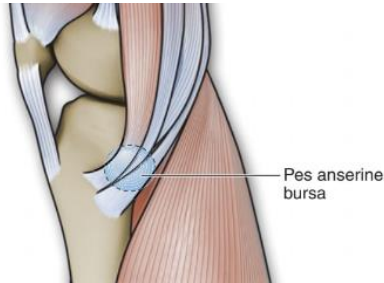


# Ultrasound Guided Injections: Related

- Proximal Tibiofibular Joint

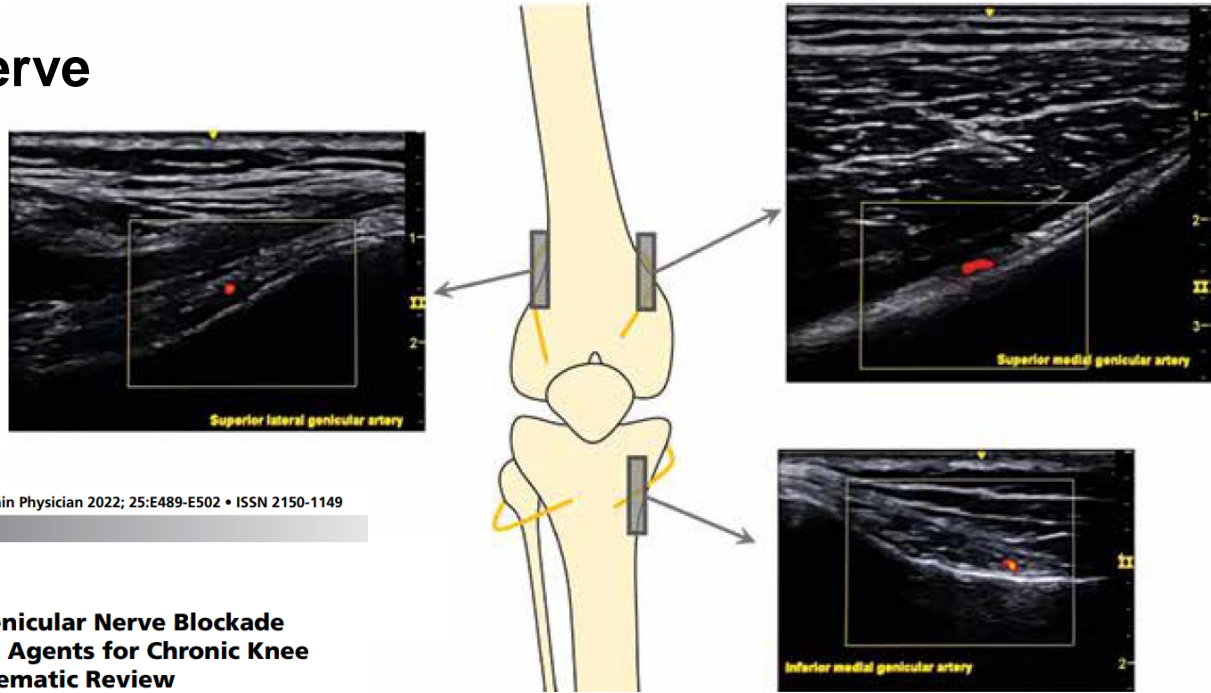


- Pes Anserine Bursa



# Ultrasound Guided Injections: Nerve Block

- Genicular Nerve



Pain Physician 2022; 25:E489-E502 • ISSN 2150-1149

Systematic Review

**Ultrasound-guided Genicular Nerve Blockade  
With Pharmacological Agents for Chronic Knee  
Osteoarthritis: A Systematic Review**

Yeow Leng Tan, MBBS, MRCP<sup>1</sup>, Edmund Jin Rui Neo, MBBS, MMed<sup>2</sup>, and Tze Chao Wee, MBBS<sup>3</sup>



# Genicular Nerve Denervation

## AMERICAN JOURNAL OF Physical Medicine & Rehabilitation

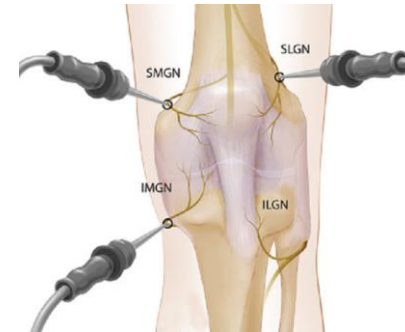
LITERATURE REVIEW

### The Effectiveness of Fluoroscopically Guided Genicular Nerve Radiofrequency Ablation for the Treatment of Chronic Knee Pain Due to Osteoarthritis A Systematic Review

Fogarty, Alexandra E. MD; Burnham, Taylor DO; Kuo, Keith BS; Tate, Quinn MD; Sperry, Beau P. BA; Cheney, Cole MD; Walega, David R. MD, MSCI; Kohan, Lynn MD; Cohen, Steven P. MD; Cushman, Daniel M. MD; McCormick, Zachary L. MD; Conger, Aaron DO



- moderate-quality evidence notes fluoroscopically guided genicular nerve RFA is effective for reducing pain from knee OA ( $\geq 50\%$ ) at a minimum of 6-9 months (49-74% success rate)



# Genicular Nerve Denervation

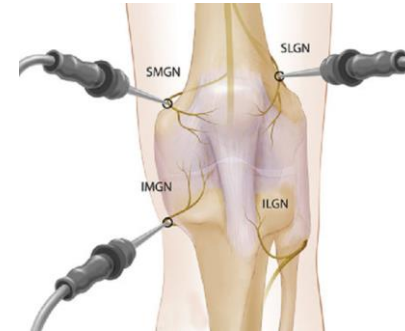
## Safety and Efficacy of Genicular Nerve Radiofrequency Ablation for Management of Painful Total Knee Replacement: A Systematic Review

Naga Cheppalli <sup>1</sup>, Amit W. Bhandarkar <sup>2</sup>, Senthil Sambandham <sup>3</sup>, Solomon F. Oloyede <sup>1</sup>

<sup>1</sup>. Orthopaedics, University of New Mexico School of Medicine, Albuquerque, USA <sup>2</sup>. Orthopaedics, SSM Health St Mary's Hospital, Centralia, USA <sup>3</sup>. Orthopaedics, University of Texas Southwestern Medical Center, Dallas, USA



- genicular nerve radiofrequency ablation can treat residual pain after TKR, with 50-55% improvement in pain up to 3 months with minimal complications



# Peripheral Nerve Stimulation

## TECHNICAL NOTE

## Open Access

Ultrasound-guided percutaneous peripheral nerve stimulation for analgesia following total knee arthroplasty: a prospective feasibility study



Brian M. Ilfeld<sup>1\*</sup>, Christopher A. Gilmore<sup>2</sup>,  
Amorn Wongsamphoon<sup>3</sup> and Joseph V

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

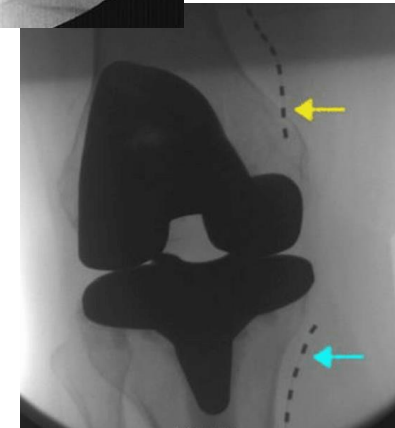
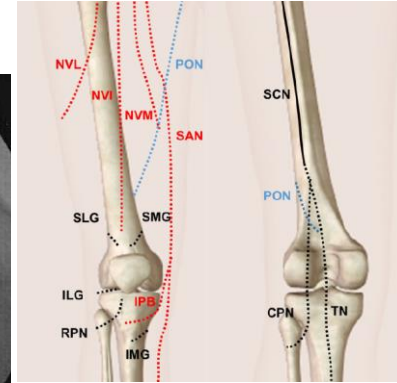
Chih-Peng Lin, MD, PhD,

**Peripheral Stimulation of the Saphenous and Superior Lateral Genicular Nerves for Chronic Knee Pain**

Jamal Hasoon<sup>1</sup>, **Wireless High-Frequency Peripheral Nerve Stimulation for Chronic Refractory Knee Pain Post-total Knee Replacement**

Gaurav Chauhan<sup>1</sup>, Suresh K. Srinivasan<sup>2</sup>, Suchit Khanduja<sup>3</sup>

- Peripheral nerve stimulation is likely to be a feasible and safe treatment for both knee OA and post-operative knee pain, however its effectiveness is still being explored.



# Genicular Artery Embolization

## Genicular Artery Embolization for Primary Knee Osteoarthritis

Ravi Tyagi, BS<sup>1</sup> S. Samaduddin Ahmed, BA<sup>2</sup> Yilun Koethe, MD<sup>3</sup> Aleksandr Raskind, BS<sup>2</sup>  
Osman Ahmed, MD<sup>4</sup>

- low-grade inflammation and neo-angiogenesis play a central role in knee osteoarthritis pain
- embolization of abnormal hyperemic genicular arteries can decrease synovial inflammation, neovascularization, and pain in affected areas



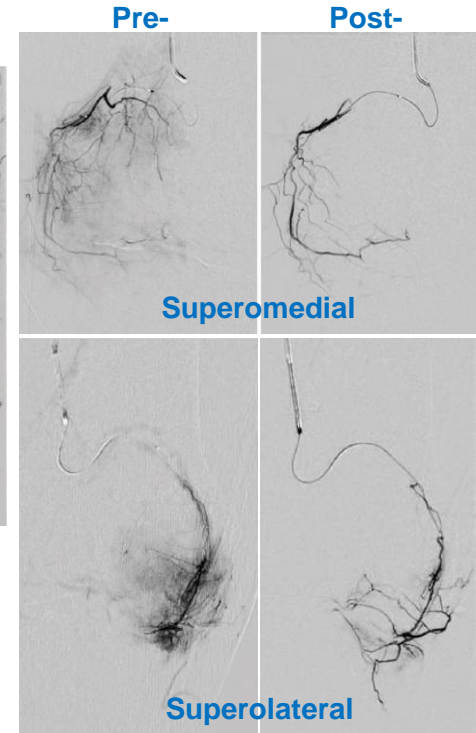
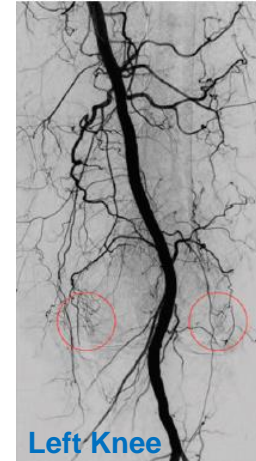


# Genicular Artery Embolization

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- superficial femoral artery is catheterized
- abnormal arteries have a “tumor blush”
- selective embolization using a microcatheter suppresses filling (“blush”) of abnormal arteries
- embolic agents vary: imipenem/cilastatin; polyvinyl embolic material (10-70 $\mu$ m); Embozene (75-100 $\mu$ m); Embosphere microspheres/ Optisphere (100-300 $\mu$ m); gelatin sponge particles (150-350 $\mu$ m)



# Genicular Artery Embolization

## REVIEW ARTICLES

## Genicular Artery Embolization for Knee Osteoarthritis A Comprehensive Review

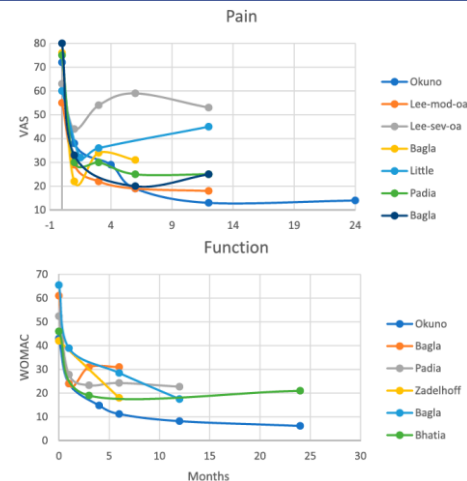
 Poursalehian, Mohammad MD<sup>1</sup>;  Bhia, Iman MD<sup>1</sup>;  Ayati Firoozabadi, Mohammad MD<sup>1</sup>;  Mortazavi, Seyed Mohammad Javad MD<sup>1,a</sup>

## ■ Outcomes

- early (4 months) improvement in pain and function for mild-moderate OA
- significant improvement of synovitis, but no change to joint pathology at 2 years
- poorer outcomes with severe OA (~1 month), bone marrow lesions, meniscal injury
- insufficient literature on outcome of TKA after GAE
- GAE could be viable option on for treating post-TKA pain

TABLE I Summary of Studies on GAE in Knee OA\*

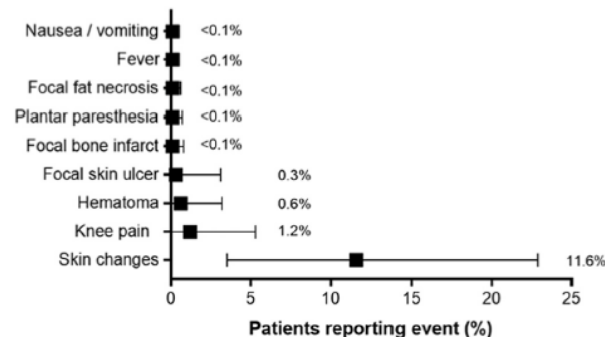
First Author, Year; Country	Level of Evidence	No. of Knees	Follow-up (mo)	Outcome Measures	KL Grade
Okuno, 2017 <sup>13</sup> ; Japan	4	95	24	WOMAC, VAS, WORMS (MRI)	1-3
Lee, 2019 <sup>14</sup> ; Korea	4	71	10	VAS, change in medication	1-4
Bagla, 2020 <sup>15</sup> ; USA	4	20	6	WOMAC, VAS, change in medication	1-3
Choi, 2020 <sup>16</sup> ; Korea	4	49	3	VAS	1-4
Landers, 2020 <sup>17</sup> ; Australia	4	10	24	KOOS, MRI	1,2
Little, 2021 <sup>18</sup> ; UK	4	38	12	KOOS, VAS, WORMS (MRI)	1-3
Padia, 2021 <sup>19</sup> ; USA	4	40	12	WOMAC, VAS	2-4
Zadelhoff, 2021 <sup>20</sup> ; Japan	4	45	6	WOMAC	1-4
Bagla, 2022 <sup>21</sup> ; USA	2	21	12	WOMAC, VAS	1-3
Bhatia, 2023 <sup>22</sup> ; USA	4	20	48	WOMAC	2-4



# Genicular Artery Embolization

Genicular artery embolization for treatment of knee osteoarthritis pain:  
Systematic review and meta-analysis

Bedros Taslakian<sup>a,\*</sup>, Larry E. Miller<sup>b</sup>, Tarub S. Mabud<sup>a</sup>, William Macaulay<sup>c</sup>, Jonathan Samuels<sup>d</sup>,  
Mukundan Attur<sup>d</sup>, Erin F. Alaia<sup>e</sup>, Richard Kijowski<sup>e</sup>, Ryan Hickey<sup>a</sup>, Akhilesh K. Sista<sup>f</sup>



- Most studies have not reported severe complications to date
  - resolving focal skin ulcerations (3 days); tissue necrosis; bone infarction
  - plantar paresthesias; leg numbness; heat sensation
- Mild adverse effects
  - transient (3 weeks) skin discoloration with <100- $\mu$ m particles; skin redness; purpura
  - resolving subcutaneous hemorrhages/ hematoma at access site
  - post-embolization syndrome: knee pain, low-grade fever, malaise



# Summary

- Guidelines for nonsurgical management of knee osteoarthritis
- Therapeutic agents in nonsurgical interventions
- Ultrasound-guided injections
- Genicular nerve denervation
- Peripheral nerve stimulation
- Genicular artery embolization

# Thank You