Knee OA: Percutaneous Treatments

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OSTEOARTHRITIS OF THE KNEE JOINT

• Knee osteoarthritis is a degenerative type of arthritis
• Prevalence increases with age
• Ranks as the 11th leading cause of years lived with disability - 3rd greatest contributor to loss of health-related quality of life
• Risk factors: aging, obesity and mechanical stress

OSTEOARTHRITIS OF THE KNEE JOINT

- Kellgren-Lawrence scale: on the basis of radiographic findings

- American College of Rheumatology (ACR) proposal: clinical definition
OSTEOARTHRITIS
OF THE KNEE JOINT

Articular Cartilage disease
- Loss of cartilage
  - Heterogeneous
  - Progressive

Bone tissue production
Subcortical sclerosis
Osteophytes
OSTEOARTHRITIS OF THE KNEE JOINT

- Pain
- Stiffness
- Swelling
- Joint instability
- Reduced mobility
- Muscle weakness

OSTEOARTHRITIS OF THE KNEE JOINT

• Conservative therapies
  • physical and occupational therapy, weight loss, stretching exercises, acetaminophen, analgesics, oral and topic NSAIDs, tramadol

• Surgical Options
  • Total Knee Replacement Surgery (Total Knee Arthroplasty)
  • Partial Knee Replacement Surgery (Unicompartmental Knee Arthroplasty)

• Local therapies
  • Intra-articular injections
  • Neurolysis – neuromodulation
  • Trans-arterial therapies
INTRA-ARTICULAR INJECTIONS

- Corticosteroids
- Hyaluronic solution
- Concentrated platelet injections
- Stem cells
- Ozone
CLINICAL QUESTION Are intra-articular corticosteroids associated with improvement in pain and physical function compared with sham injection or no intervention in patients with knee osteoarthritis?

BOTTOM LINE Intra-articular corticosteroids may be associated with moderate improvement in pain and a small improvement in physical function up to 6 weeks after injection. However, the quality of the evidence is low.
**Key Points**

**Question** What are the effects of intra-articular injection of 40 mg of triamcinolone acetonide every 3 months on progression of cartilage loss and knee pain in patients with osteoarthritis?

**Findings** In a randomized clinical trial of 140 patients with symptomatic knee osteoarthritis, the use of intra-articular triamcinolone compared with intra-articular saline resulted in greater cartilage volume loss. There was no significant difference on knee pain severity between treatment groups.

**Meaning** Among patients with symptomatic knee osteoarthritis, intra-articular triamcinolone, compared with intra-articular saline, increased cartilage volume loss and had no effect on knee pain over 2 years.

HYALURONIC AND KNEE OA

• Second line treatment
• Superior over the placebo (intraarticular injection of saline or oral placebo)
• Vs NSAID: Symptom relief was not significantly different between the two groups after 4 or 12 weeks
• delay the need for knee replacement surgery

HYALURONIC AND KNEE OA

AMERICAN COLLEGE OF RHEUMATOLOGY
POSITION STATEMENT

SUBJECT: Intra-Articular Hyaluronic Acid Injection in Osteoarthritis of the Knee

PRESENTED BY: Committee on Rheumatologic Care

FOR DISTRIBUTION TO: Members of the American College of Rheumatology
Medical Societies
Members of Congress
Centers for Medicare and Medicaid Services
Managed Care Organizations/Third-Party Carriers
Insurance Companies and Commissioners

POSITIONS

1. The American College of Rheumatology recommends the use of intra-articular hyaluronic acid injection for the treatment of osteoarthritis of the knee in adults, in accordance with the ACR 2012 OA guidelines.

2. Hyaluronic acid injection is clinically indicated for management of osteoarthritis in patients who are not good candidates or who do not respond to other treatment options.

3. The American College of Rheumatology supports patient access to appropriate therapies including hyaluronic acid injection.
PRP AND KNEE OA

Intra-articular PRP injections probably are more efficacious in the treatment of knee OA in terms of pain relief and self-reported function improvement at 3, 6, and 12 months follow-up, compared with other injections, including saline placebo, HA, ozone, and corticosteroids.

<table>
<thead>
<tr>
<th>Study or Subgroup</th>
<th>Mean SD</th>
<th>Control Mean SD</th>
<th>Weight</th>
<th>Mean Difference IV Random, 95% CI</th>
<th>Mean Difference IV Random, 95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PRP</strong>&lt;br&gt;1.1.1 At 3 months&lt;br&gt;Doymus 2016</td>
<td>7.2 2.4</td>
<td>33 11.1 3.4</td>
<td>35 6.9%</td>
<td>-3.00 [-5.29, -2.51]</td>
<td>-3.00 [-5.29, -2.51]</td>
</tr>
<tr>
<td>Doymus 2016</td>
<td>7.2 2.4</td>
<td>33 7.1 3.7</td>
<td>34 7.2%</td>
<td>0.20 [-0.80, 1.20]</td>
<td>-0.80 [-1.20, 0.40]</td>
</tr>
<tr>
<td>Patel 2013</td>
<td>4.9 5.4</td>
<td>25 10.4 3.9</td>
<td>23 5.7%</td>
<td>-5.50 [-8.15, -2.85]</td>
<td>-8.15 [-10.8, -5.50]</td>
</tr>
<tr>
<td>Smith 2015</td>
<td>2.1 1.8</td>
<td>15 8.3 6.6</td>
<td>15 4.4%</td>
<td>-0.00 [-0.34, 0.34]</td>
<td>-0.34 [-0.68, 0.00]</td>
</tr>
<tr>
<td>Subtotal (95% CI)</td>
<td>217</td>
<td>107</td>
<td>324</td>
<td>26.3%</td>
<td>-3.69 [-6.87, -0.51]</td>
</tr>
<tr>
<td><strong>Heterogeneity</strong>: Tau^2 = 9.51; Chi^2 = 117.35; df = 5 (P &lt; 0.00001); I^2 = 96%</td>
<td>Test for overall effect: Z = 2.92 (P = 0.004)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Control</strong>&lt;br&gt;1.1.2 At 6 months&lt;br&gt;Doymus 2016</td>
<td>9.4 1.7</td>
<td>33 9.7 1.6</td>
<td>34 7.3%</td>
<td>-0.30 [-1.09, 0.49]</td>
<td>-1.09 [-1.62, -0.56]</td>
</tr>
<tr>
<td>Doymus 2016</td>
<td>9.4 1.7</td>
<td>33 16.2 2.9</td>
<td>35 7.1%</td>
<td>-6.80 [-7.72, -5.88]</td>
<td>-7.72 [-8.66, -6.78]</td>
</tr>
<tr>
<td>Patel 2013</td>
<td>6.2 6</td>
<td>25 10.9 4</td>
<td>23 5.5%</td>
<td>-4.70 [-7.56, -1.84]</td>
<td>-7.56 [-9.10, -6.02]</td>
</tr>
<tr>
<td>Sanchez 2012</td>
<td>4.8 3.1</td>
<td>89 5.4 3.2</td>
<td>87 7.3%</td>
<td>-0.60 [-1.53, 0.33]</td>
<td>-1.53 [-2.13, 0.00]</td>
</tr>
<tr>
<td>Smith 2015</td>
<td>3.3 6</td>
<td>15 9.9 3.6</td>
<td>15 5.8%</td>
<td>-0.00 [-1.58, -1.42]</td>
<td>-1.58 [-2.16, -0.00]</td>
</tr>
<tr>
<td>Vazquez 2013</td>
<td>5.3 1.1</td>
<td>48 10.3 4.8</td>
<td>48 6.0%</td>
<td>-5.30 [-6.92, -3.68]</td>
<td>-6.92 [-8.55, -5.29]</td>
</tr>
<tr>
<td>Subtotal (95% CI)</td>
<td>243</td>
<td>242</td>
<td>365</td>
<td>39.9%</td>
<td>-3.82 [-6.40, -1.25]</td>
</tr>
<tr>
<td><strong>Heterogeneity</strong>: Tau^2 = 9.51; Chi^2 = 117.35; df = 5 (P &lt; 0.00001); I^2 = 96%</td>
<td>Test for overall effect: Z = 2.92 (P = 0.004)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>PRP</strong>&lt;br&gt;1.1.3 At 12 months&lt;br&gt;Doymus 2016</td>
<td>11.4 2.4</td>
<td>33 16.2 2.8</td>
<td>35 7.1%</td>
<td>-4.80 [-6.04, -3.56]</td>
<td>-6.04 [-7.28, -4.76]</td>
</tr>
<tr>
<td>Doymus 2016</td>
<td>11.4 2.4</td>
<td>33 14.2 1.1</td>
<td>34 7.3%</td>
<td>-2.80 [-3.70, -1.90]</td>
<td>-3.70 [-4.60, -2.80]</td>
</tr>
<tr>
<td>Raissadat 2015</td>
<td>4.3 4</td>
<td>77 5.1 3.7</td>
<td>62 7.1%</td>
<td>-1.10 [-2.29, 0.09]</td>
<td>-2.29 [-3.48, 0.00]</td>
</tr>
<tr>
<td>Smith 2015</td>
<td>2.1 1.8</td>
<td>15 9.5 4.6</td>
<td>15 5.5%</td>
<td>-7.00 [-8.88, -4.12]</td>
<td>-8.88 [-10.76, -6.91]</td>
</tr>
<tr>
<td>Vazquez 2013</td>
<td>6.3 3.3</td>
<td>48 10.7 3.7</td>
<td>42 6.9%</td>
<td>-4.40 [-5.86, -2.94]</td>
<td>-5.86 [-7.32, -4.40]</td>
</tr>
<tr>
<td>Subtotal (95% CI)</td>
<td>206</td>
<td>188</td>
<td>394</td>
<td>33.9%</td>
<td>-3.76 [-5.36, -2.16]</td>
</tr>
<tr>
<td><strong>Heterogeneity</strong>: Tau^2 = 2.71; Chi^2 = 28.35; df = 4 (P &lt; 0.00001); I^2 = 86%</td>
<td>Test for overall effect: Z = 4.61 (P &lt; 0.00001)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Control</strong>&lt;br&gt;Total (95% CI)</td>
<td>555</td>
<td>537</td>
<td>1092</td>
<td>100.00%</td>
<td>-3.77 [-5.07, -2.47]</td>
</tr>
<tr>
<td><strong>Heterogeneity</strong>: Tau^2 = 5.82; Chi^2 = 200.56; df = 14 (P &lt; 0.00001); I^2 = 93%</td>
<td>Test for overall effect: Z = -5.69 (P &lt; 0.00001)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test for subgroup differences: Chi^2 = 0.00; df = 2 (P = 1.00); I^2 = 0%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Regenerative approaches for the treatment of early OA.

de Girolamo L, Kon E, Filardo G, Marmotti AG, Soler F, Peretti GM, Vannini F, Madry H, Chubinskaya S.

Abstract
The diagnosis and the prompt treatment of early osteoarthritis (OA) represent vital steps for delaying the onset and progression of fully blown OA, which is the most common form of arthritis, involving more than 10% of the world’s population older than 60 years of age. Nonsurgical treatments such as physiotherapy, anti-inflammatory medications, and other disease-modifying drugs all have modest and short-lasting effect. In this context, the biological approaches have recently gained more and more attention. Growth factors, blood derivatives, such as platelet concentrates, and mesenchymal adult stem cells, either expanded or freshly isolated, are advocated amongst the most promising tool for the treatment of OA, especially in the early phases. Primarily targeted towards focal cartilage defects, these biological agents have indeed recently showed promising results to relieve pain and reduce inflammation in patients with more advanced OA as well, with the final aim to halt the progression of the disease and the need for joint replacement. However, despite of a number of satisfactory in vitro and pre-clinical studies, the evidences are still limited to support their clinical efficacy in OA setting.
STEM CELLS AND KNEE OA

Property of Dimitrios Tsoukas MD
www.miosmedcenter.gr
Clinical efficacy and safety of mesenchymal stem cell transplantation for osteoarthritis treatment: A meta-analysis.

Yubo M, Yan-an L, Li L, Tao S, Bo L, Lin C.

Abstract

PURPOSE: The aim of this study was to evaluate the therapeutic efficacy and safety of mesenchymal stem cells (MSCs) for the treatment of patients with knee osteoarthritis (OA).

MATERIALS: We performed a meta-analysis of relevant published clinical studies. An electronic search was conducted for randomized controlled trials (RCTs) of MSC-based therapy in knee OA. The visual analogue scale (VAS), International Knee Documentation Committee (IKDC) form, Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC), Lequesne algofunctional indices (Lequesne), Lysholm knee scale (Lysholm), Tegner activity scale (Tegner) and adverse events (AEs) were evaluated.

RESULTS: Eleven eligible trials with 582 knee OA patients were included in the present meta-analysis. We demonstrated that MSC treatment could significantly decrease VAS and increase IKDC scores after a 24-month follow-up compared with controls (P<0.05). MSC therapy also showed significant decreases in WOMAC and Lequesne scores after the 12-month follow-up (P<0.01). Analysis of Lysholm (24-month) and Tegner (12- and 24-month) scores also demonstrated favorable results for MSC treatment (P<0.05).

CONCLUSION: Overall, MSC transplantation treatment was shown to be safe and has great potential as an efficacious clinical therapy for patients with knee OA.
### NEUROLYSIS

The ability to create a greater local neuronal lesion to increase the changes of effective denervation

- **Time:** 60-90 sec.
- **Θ:** 70-90 °C
- Continuous RF

### NEUROMODULATION

Similar effects on neuronal conduction, the disruption of which is often reversible

- **Time:** 10-12 min.
- **Θ:** <42 °C
- Pulsed RF
NEUROLYSIS - NEUROMODULATION

• Genicular nerves (RFA, CWA)

• Intra-articular application (pulsed RF)

• Composite nerve supply (pulsed RF)
PATIENT SELECTION – ideal patient

- adult patients capable of providing consent
- symptomatic, advanced knee osteoarthritis
- X-rays - grade II to IV Kellgren–Lawrence classification
- pain score ≥4NVS - located at the knee joint
- without neurologic impairment
PATIENT SELECTION – contraindications

- untreatedable coagulopathy
- active, systemic or local infection
- neurologic signs
- patient unwilling to consent to the procedure
GENICULAR NERVES

1) Femoral Nerve: gives branches from the nerves to the three vasti

2) Tibial Nerve Branches
   a) Superior medial genicular
   b) Inferior medial genicular
   c) Middle genicular nerve

3) Common Peroneal Nerve Branches
   a) Superior lateral genicular
   b) Inferior lateral genicular
   c) Recurrent genicular nerve

4) Obturator Nerve: gives genicular branch from its posterior division

Main innervating articular branches for the knee joint
Adjacent to periosteum
Can be targeted using bony landmarks under fluoroscopy

GENICULAR N. cRF technique
GENICULAR N.
cRF technique

Sensory stimulus: high frequency repetition rate (50 Hz cycles/sec) in a duration of 1 millisecond with a threshold voltage of 0.2 to 0.5 volt

Motor stimulus: low frequency repetition rate (2 Hz cycles/sec) in a duration of 1 millisecond with a threshold myotomal voltage of at least 2 volts
GENICULAR NERVES

GENICULAR NERVES

Results
The post-injection cadaveric dissections revealed that 12 of the 12 ultrasound-guided injections (100%) accurately placed the red ink. Both genicular nerves in all 6 knees were dyed with red ink.

Conclusion
In conclusion, the results of the present study demonstrated that superior and inferior medial genicular nerve branches can be precisely located using the above-stated anatomic landmarks and ultrasound guidance. The accuracy of the ultrasound-guided genicular nerve block was also confirmed in the cadaveric model.

Fig. 1. (a) SMGN (arrows) and the corresponding artery (arrowheads) shows a course curving around the femur shaft (infinity) and passing between the adductor magnus tendon (star) and the femoral medial epicondyle (cross), then descending anterior to the adductor tubercle. Target point (square) for SMGN is one cm anterior to the peak of the adductor tubercle (asterix). (b) IMGN (arrows) is situated horizontally around the lower parts of the tibial medial epicondyle (cross). IMGN passes beneath the medial collateral ligament (stars). Target point (square) for IMGN is at the midpoint between the peak of the tibial medial epicondyle (asterix) and the initial fibers inserting on the tibia (infinity) of the medial collateral ligament. (c) The diagram shows the course of the genicular nerves and related anatomic structures.
SMGN: superior medial genicular nerve, IMGN: inferior medial genicular nerve.

GENICULAR NERVES

Fig. 1. (a) Transverse ultrasound image of the knee at the level of the femoral medial epicondyle. Superior medial genicular nerve (thick arrow) and the corresponding artery (thin arrow) were visualized. (b) The needle (arrows) was placed to the bony cortex 1 cm anterior to the peak of the adductor tubercle for the superior medial genicular nerve.

Fig. 2. (a) Longitudinal ultrasound image of the knee at the level of the tibial medial epicondyle. Inferior medial genicular nerve (thick arrow) and the corresponding artery (thin arrow) were visualized using power doppler. (b) The needle (arrows) was placed to the bony cortex at the midpoint between the peak of the tibial medial epicondyle (square) and the initial fibers inserting in the tibia of the medial collateral ligament (star) for inferior medial genicular nerve.
GENICULAR NERVES

# Genicular Nerves


<table>
<thead>
<tr>
<th>Year Reported</th>
<th>Age and Gender</th>
<th>Procedure</th>
<th>Type(s) of Complication</th>
<th>Time to Identify Injury Post-operation</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>1987 (8)</td>
<td>73 F</td>
<td>TKA</td>
<td>Pseudoaneurysm and AVF</td>
<td>3 weeks</td>
<td>Surgical excision of pseudoaneurysm, disruption of the arteriovenous fistula and ligation of the medial inferior genicular artery</td>
</tr>
<tr>
<td>1987 (8)</td>
<td>67 M</td>
<td>TKA</td>
<td>Pseudoaneurysm and AVF</td>
<td>2 months</td>
<td>Surgical excision of pseudoaneurysm, disruption of the arteriovenous fistula and ligation of the medial inferior genicular artery</td>
</tr>
<tr>
<td>1989 (21)</td>
<td>58 F</td>
<td>TKA</td>
<td>Aneurysm</td>
<td>2 months</td>
<td>Percutaneous embolization</td>
</tr>
<tr>
<td>1994 (7)</td>
<td>57 F</td>
<td>Arthroscopic resection of posterior horn of medial meniscus</td>
<td>Pseudoaneurysm</td>
<td>1 week</td>
<td>Two operations: 1. Resection of hematoma 2. Removal of pseudoaneurysm and ligation of medial inferior genicular artery</td>
</tr>
<tr>
<td>2000 (9)</td>
<td>30 M</td>
<td>ACL repair</td>
<td>Pseudoaneurysm</td>
<td>5 weeks</td>
<td>Open exploration, resection of thrombus and ligation of medial inferior genicular artery</td>
</tr>
<tr>
<td>2005 (31)</td>
<td>87 F</td>
<td>TKA</td>
<td>3 recurrent hemorrhagic episodes eroding through the medial skin incision</td>
<td>4 weeks</td>
<td>Exploration and evacuation of the hematoma and ligation of the medial inferior genicular artery</td>
</tr>
<tr>
<td>2006 (32)</td>
<td>37 M</td>
<td>ACL reconstruction with hamstring tendon autograft</td>
<td>Pseudoaneurysm</td>
<td>1 hour</td>
<td>Hematoma evacuation and ligation of the medial inferior genicular artery</td>
</tr>
<tr>
<td>2009 (20)</td>
<td>47 M</td>
<td>Closed intramedullary nailing of the tibia</td>
<td>Pseudoaneurysm</td>
<td>A few days</td>
<td>Percutaneous embolization</td>
</tr>
<tr>
<td>2011 (33)</td>
<td>23 M</td>
<td>ACL construction</td>
<td>Hemarthrosis and pseudoaneurysm</td>
<td>2 weeks</td>
<td>Percutaneous embolization</td>
</tr>
</tbody>
</table>
**PULSED RADIOFREQUENCY**

- When compared to continuous radiofrequency, pulsed mode has much less (if any) neurodestructive characteristics.

- The long silent phases (480 milliseconds) between the short bursts of energy application (10-20 milliseconds) maintain tissue temperature under 42°C which is below the nerve tissue damage threshold.
INTRA-ARTICULAR pRF technique
PULSED RADIOFREQUENCY

- Karaman et al applied with a blind technique pulsed RF intra-articularly reporting significant pain decrease (>50%) over a 6 months follow-up
- Masala et al report significant pain decrease and improved autonomy in daily life post intra-articular application of pulsed RF over 12 months follow-up period.

PULSED RADIOFREQUENCY

• NO reported evidence of long-lasting structural effects by pulsed RF application
• NO architectural impairment of the axonal myelin sheath bundles
• interstitial edema (which is temporary and persists for a few weeks post the session)
• ultra-structural changes of the C and A delta nociceptive fibers

PULSED RADIOFREQUENCY

Intra-articular application of pulsed RF:

- suppresses the excitatory C fiber response and the synaptic transmission resulting in immediate pain relief

- causes an immune response interrupting production of pro-inflammatory cytokines (interleukin-1b and interleukin-6)

PULSED RADIOFREQUENCY
PULSED RADIOFREQUENCY

both sensory and motor nerves supplying all the structures around the knee: joint, muscles, and skin

ultrasonography (USG) guided PRF of saphenous, tibial, and common peroneal nerves along with subsartorial, peripatellar, and popliteal plexuses

USG guided PRF of the femoral nerve was also done to address the innervation of the quadriceps muscle.


Pulsed radiofrequency of the composite nerve supply to the knee joint as a new technique for relieving osteoarthritic pain: a preliminary report.
Acute differential modulation of synaptic transmission and cell survival during exposure to pulsed and continuous radiofrequency energy.

Cahana A¹, Vutsikis L, Muller D.

Abstract
Pulsed radiofrequency, in which short bursts of radiofrequency energy are applied to nervous tissue, has been recently described as an alternative technique devoid of nerve injury, a subsequent side effect of thermal lesions created by continuous radiofrequency lesioning. Yet the mechanism of this effect remains unclear. In this study we compared the acute effects of pulsed versus continuous radiofrequency energy on impulse propagation and synaptic transmission in hippocampal slice cultures and on cell survival in cortical cultures. A differential effect was observed on both systems, with pulsed radiofrequency producing a transient and continuous radiofrequency a lasting inhibition of evoked synaptic activity. In addition, although both continuous radiofrequency and pulsed radiofrequency treatments induced a distance-dependent tissue destruction under the stimulating needle, the effect was more pronounced in the continuous radiofrequency group. These findings suggest that the acute effects of pulsed radiofrequency are more reversible and less destructive in nature than the classic continuous radiofrequency mode, even in normothermal conditions. This model might help elucidate the importance of various parameters for the clinical application of radiofrequency lesioning and might open new horizons for the role of pulsed radiofrequency lesioning in cases of neuropathic pain.
CONTROVERSIES – continuous or pulsed RF?

Comparative Effectiveness Review of Cooled Versus Pulsed Radiofrequency Ablation for the Treatment of Knee Osteoarthritis: A Systematic Review.

Gupta A, Huettner DP, Dukesich M.

Abstract

BACKGROUND: Patients suffering from osteoarthritis of the knee and patients post total knee arthroplasty often develop refractory, disabling chronic knee pain. Radiofrequency ablation, including conventional, pulsed, and cooled, has recently become more accepted as an interventional technique to manage chronic knee pain in patients who have failed conservative treatment or who are not suitable candidates for surgical treatment.

OBJECTIVE: This systematic review aimed to analyze published studies on radiofrequency ablation to provide an overview of the current knowledge regarding variations in procedures, nerve targets, adverse events, and temporal extent of clinical benefit.

STUDY DESIGN: A systematic review of published studies investigating conventional, pulsed, or cooled radiofrequency ablation in the setting of chronic knee pain.

METHODS: Medline, Google Scholar, and the Cochrane Central Register of Controlled Trials (CENTRAL) databases were reviewed for studies on radiofrequency ablation for patients with chronic knee pain through July 29, 2016. From the studies, the procedural details, outcomes after treatment, follow-up points, and complications were compiled and analyzed in this literature review. Included studies were analyzed for clinical relevance and strength of evidence was graded using either the NHLBI Quality assessment of controlled intervention studies or the NHLBI quality assessment for before-after (pre-post) studies with no control group.

RESULTS: Seventeen total publications were identified in the search, including articles investigating conventional, pulsed, or cooled radiofrequency ablation. These studies primarily targeted either the genicular nerves or used an intraarticular approach. Of the studies, 5 were small-sized randomized controlled trials, although one involved diathermy radiofrequency ablation. There were 8 retrospective or prospective case series and 4 case reports. Utilizing the strength of evidence grading, there is a low level of certainty to suggest a superior benefit between targeting the genicular nerve, an intraarticular approach, or targeting the larger nerves such as femoral and tibial nerves. Utilizing the strength of evidence grading, there is a low level of certainty in supporting the superiority of any specific RFA procedure modality. The majority of the studies report positive patient outcomes, but the inconsistent procedural methodology, inconsistent patient assessment measures, and small study sizes limit the applicability of any specific study to clinical practice.

LIMITATIONS: While the wide search strategy included a variety of articles, broad conclusions and pooled data could not be obtained based on the studies analyzed.

CONCLUSIONS: Overall, the studies showed promising results for the treatment of severe chronic knee pain by radiofrequency ablation at up to one year with minimal complications. Numerous studies, however, yielded concerns about procedural protocols, study quality, and patient follow-up. Radiofrequency ablation can offer substantial clinical and functional benefit to patients with chronic knee pain due to osteoarthritis or post total knee arthroplasty. Key words: Radiofrequency ablation, knee osteoarthritis, knee pain, genicular nerve, total knee arthroplasty (TKA), cooled radiofrequency ablation, pulsed radiofrequency ablation.
CONTROVERSIES – RF and viscosupplementation?

• protective effect on the superficial layer of cartilage (mechanical effect)

• reaggregation of proteglycan molecules

• inhibition of articular nociceptive receptors (analgesic effect)

• prostaglandin-E2 synthesis blockade and inhibition of arachidonic acid release (anti-inflammatory action)
### OUR OWN EXPERIENCE

<table>
<thead>
<tr>
<th>CHARACTERISTIC</th>
<th>MALE</th>
<th>FEMALE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (yr):</td>
<td>71.32±5.697</td>
<td>68.15±7.226</td>
</tr>
<tr>
<td>Height (cm):</td>
<td>174.58±5.748</td>
<td>164.31±5.320</td>
</tr>
<tr>
<td>Weight (kg):</td>
<td>81.63±11.480</td>
<td>66.69±9.911</td>
</tr>
<tr>
<td>BMI:</td>
<td>26.7485±3.32683</td>
<td>24.6770±3.39543</td>
</tr>
</tbody>
</table>

**Figure: Distribution of variables**

- **Before_RF**
- **Week_1**
- **Month_1**
- **Months_6**
- **Year_1**

**Error Bars: +/- 1 SD**

**Mean pain (NVS Units)**

- **before PRF**
- **after 1 week**
- **1 month**
- **6 months**
- **1 year**
WHY EMBOLIZATION OF
ABNORMAL VESSELS RELIEVE PAIN?

• Improvement of inflammatory conditions (abnormal vessels maintain inflammation)

  Mapp et al Nat Rev Rheumatol 2012

• Reduction of stimulation from accompanying nerve fiber close to small vessels (nerve fibers grow around neovessels)

Midterm Clinical Outcomes and MR Imaging Changes after Transcatheter Arterial Embolization as a Treatment for Mild to Moderate Radiographic Knee Osteoarthritis Resistant to Conservative Treatment
Okuno, Yuji et al JVIR, Volume 28, Issue 7, 995 - 1002
EVIDENCE-BASED MEDICINE

• Exponential increase in the number of published meta-analyses, including many that address the same question yet yield different conclusions

• Marginally different study designs, the capture and inclusion of different studies and different analytic approaches

• Which meta-analysis best approximates a true summary of relevant literature

• The number of published trials, which provide the basis for the growing number of meta-analyses, has not increased

TAKE HOME MESSAGES

• Intra-articular injections: from corticosteroids and hyaluronic to PRP and Stem cells
• Neurotomy – neuromodulation: longer lasting effect when compared to corticosteroid and hyaluronic (anecdotal experience – randomized comparative trial ongoing)
• Intra-arterial therapies: Treatment goal is not total vessel occlusion but to decrease abnormal blood flow and return of physiologic blood flow

• Advantages: low cost, short hospital stay, safety and efficacious profile
TAKE HOME MESSAGES

• NEUROLYSIS: continuous RF to create local neuronal lesion. NEUROMODULATION: creates a theoretic net which stops signals over/below a specific threshold with NO nerve damage.

• Lack of evidence supporting superiority of one technique over the other.

• Longer lasting effect than corticosteroid or viscosupplementation?

• Advantages:
  • low cost, short hospital stay, safety and efficacious profile.
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Thank you

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