

# Revisiting ultrasound-guided Radiofrequency Ablation for osteoarthritis of the knee and hip: update on clinical and emerging evidence

## Abstract

In 2021, our Musculoskeletal (MSK) Rehabilitation and Intervention Unit at the North Rehabilitation Center (Portugal) published a case series on ultrasound-guided thermal radiofrequency ablation (RFA) for refractory knee and hip osteoarthritis (OA) pain.<sup>1</sup> Since then, RFA has evolved from an emerging technique to a more widely adopted therapeutic strategy. Our center now performs over 100 procedures annually, reflecting both increasing demand and clinical confidence. This letter revisits the original publication in light of recent evidence. Systematic reviews and meta-analyses in the past five years have reinforced the short-term efficacy of RFA while highlighting differences between techniques. Bipolar genicular nerve RFA (GNRFA) demonstrated superior pain relief at six months compared to monopolar and pulsed modalities. Still, methodological heterogeneity persists, with variation in study quality, outcomes, and protocols. While some studies report sustained benefits and functional gains, others emphasize limitations and urge caution regarding routine use. RFA's scope has also expanded in anatomical targets and clinical indications. Comparative studies suggest that RFA may provide longer-lasting pain relief than intra-articular injections in selected patients. In the knee, newer protocols include additional branches such as the infrapatellar and recurrent fibular nerves. In hip OA, recent data support the efficacy of ablating the obturator and femoral articular branches. Our clinical experience is consistent with the encouraging trends reported in recent literature, while underscoring the need for rigorous research. We advocate for patient-tailored technique selection (e.g., ultrasound vs. fluoroscopy) and evidence-based refinement of neural targets. Importantly, RFA should not be viewed as a stand-alone treatment, but rather as a complementary intervention within a comprehensive rehabilitation strategy-incorporating physical therapy, pharmacological management, patient education, nutrition, and therapeutic exercise. A cautious and structured integration of RFA into clinical pathways may enhance outcomes and support continued critical appraisal of its evolving role in OA pain management.

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## Letter to the Editor

### Initial contribution and clinical context

Three years have passed since the publication of our case series, “*Ultrasound-guided thermal radiofrequency ablation to treat refractory knee and hip pain: Outcomes of a case series.*”<sup>1</sup> This work not only highlighted the pioneering efforts of our Musculoskeletal Rehabilitation and Intervention Unit at the North Rehabilitation Center, Portugal, but also laid the foundation for the wider clinical adoption of radiofrequency ablation (RFA) for osteoarthritis (OA) treatment in Portuguese tertiary hospitals—a practice that, at the time, remained relatively limited.

### Clinical evolution and growing implementation

Since then, RFA has emerged as a rapidly evolving field in the management of chronic knee and hip pain due to OA. Our centre now performs over 100 procedures per year, targeting both the knee and hip, primarily using thermal ablation in degenerative pathologies, with increasing clinical demand and application. The evidence landscape has changed substantially, with high-quality randomised controlled trials (RCTs), systematic reviews and meta-analyses reinforcing RFA's role in clinical practice.

### From early promise to broader evidence

The first RCT on genicular nerve RFA (GNRFA), published by Choi et al.,<sup>2</sup> in 2011, demonstrated significant pain relief at three months in 59% of patients. At the time of our publication in 2021,

radiofrequency ablation remained a marginal option in mainstream guidelines. For instance, Katz et al., in their comprehensive review of non-surgical knee OA management in the *Journal of the American Medical Association* (JAMA), noted that “genicular nerve ablation has been reported to reduce pain in some patients, but long-term safety and efficacy data are limited”.<sup>3</sup> This highlights the caution that characterised clinical recommendations at that stage, in contrast with the growing body of evidence available today. Since then, studies have continued to accumulate. A systematic review by Wu et al.<sup>4</sup> confirmed RFA's short-term efficacy, showing no significant difference between ultrasound and fluoroscopy guidance. However, this apparent equivalence should not negate the potential value of patient- or operator-tailored imaging strategies. While fluoroscopy may offer more consistent anatomical landmarks in cases of altered anatomy or obesity, ultrasound guidance provides real-time visualisation, avoids radiation exposure, and may be preferable in younger patients or settings with limited access to fluoroscopy. This underlines the importance of contextualising the choice of guidance technique rather than assuming universal interchangeability. This network meta-analysis involving 21 RCTs and 1,818 patients further showed that conventional bipolar GNRFA had the greatest impact on pain relief at six months (Visual Analogue Scale [VAS] mean difference [MD] -5.5; surface under the cumulative ranking curve [SUCRA] 0.98), while cooled monopolar GNRFA yielded the best Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) score improvements (MD -33; SUCRA 0.99). Notably, bipolar RFA was superior to monopolar across modalities, and the

combination of pulsed intra-articular RFA with platelet-rich plasma showed no added benefit.

### Modality-specific outcomes: pulsed and cooled RFA

A recent meta-analysis by Soetjahjo et al.<sup>5</sup> specifically analysed cooled and pulsed GNRFA, including 604 patients. Both techniques provided significant pain reduction at one, three, six and twelve months with few adverse effects. Pulsed RFA showed modest functional improvement at one and three months, while cooled RFA did not demonstrate functional gains. These findings underline the nuanced performance of different RFA modalities and the importance of aligning technique choice with therapeutic goals.

### Critical appraisal and methodological caution

In contrast, the recent publication by Almeida et al.<sup>6</sup> encompassing 25 RCTs and over 2,000 participants, presents a more cautious interpretation. Their meta-analysis found that RFA may offer modest short-term pain relief at 4 and 12 weeks (MD -1.70 and -1.86, respectively), but no benefit at 24 or 48 weeks, and no consistent improvement in function. The certainty of evidence across comparisons was rated low to very low, driven by concerns over high risk of bias, small sample sizes and inconsistent results. Importantly, the authors advised against the routine use of RFA in knee OA until higher-quality evidence is available. This raises a necessary and healthy tension in the current literature between encouraging clinical results and the need for diagnostic and methodological rigour. While observational experience and some trials report sustained benefit, others call for greater caution.

### Comparisons with intra-articular therapies and neurological target expansion

In the knee OA, comparative studies between RFA and intra-articular injections reinforce the debate. Chalidis et al.<sup>7</sup> showed that RFA offered more sustained pain relief and higher patient satisfaction than hyaluronic acid, platelet-rich plasma or corticosteroid injections. In parallel, target refinement has progressed beyond the original three genicular nerves. Recent meta-analyses and anatomical studies describe additional targets including the infrapatellar branch of the saphenous nerve, the recurrent fibular nerve, and articular branches to the quadriceps musculature (e.g., nerve to vastus medialis or lateralis). These extended protocols aim to improve sensory coverage of the anterior and lateral aspects of the knee and have been associated with enhanced pain relief in select cases.

### Emerging evidence in hip osteoarthritis

Although the evidence for hip OA remains less robust than for the knee, recent meta-analytic data are beginning to address this gap. The systematic review and meta-analysis by Ciaffi et al.,<sup>8</sup> which evaluated minimally invasive procedures for osteoarthritis and inflammatory arthritis, included seven studies on RFA for hip pain, of which six were pooled in quantitative synthesis. Results showed consistent reductions in VAS at 1, 3, 6, and 12 months, with mean differences ranging between -3.16 and -4.34, all statistically significant, though with substantial heterogeneity at longer follow-up. These findings support the efficacy of RFA in refractory hip pain, although the body of evidence is still largely based on non-randomized studies with small sample sizes.

This supports previous narrative reviews, such as the one by Cheyne et al.,<sup>9</sup> and aligns with our own retrospective findings,<sup>10</sup> in which >75% of patients reported substantial pain relief and 85% reduced their need for pharmacological analgesia following ultrasound-guided thermal RFA. Taken together, these findings from meta-analyses reinforce

the emerging role of RFA as a viable therapeutic option for hip OA, though further high-quality RCTs remain essential to define optimal techniques and patient selection criteria.<sup>11</sup>

### Final considerations

In summary, RFA has gained relevance as a therapeutic option for refractory osteoarthritis pain, yet important questions remain. Which patients benefit most? Which technique and nerve targets are optimal? How should success be measured beyond short-term pain reduction? Until these answers are supported by robust, low-bias evidence, RFA should be pursued with scientific scrutiny, even as its clinical promise continues to attract attention. Our experience encourages its use with thoughtful patient selection and follow-up, while echoing the call for higher-quality, longer-term research. Importantly, we underline that RFA should not be seen as a standalone solution, but rather as a complementary intervention within a multimodal rehabilitation framework that may include physical therapy, pharmacological treatment, patient education, nutrition, and therapeutic exercise. This integrated approach may enhance clinical outcomes and support more sustainable functional gains for patients living with osteoarthritis.

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### Conflicts of interest

The authors declares that there are no conflicts of interest.

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