Radiofrequency Neurotomy in non-surgical Patients with chronic Hip Pain

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ABSTRACT (ARIAL, BOLD, 11 FONT, LEFT ALIGNED, CAPS)

Objectives: To evaluate the effectiveness of radiofrequency (RF) rhizotomy for managing chronic hip pain in patients with osteoarthritis and to describe the applied technique.
Study design:A quasi-experimental study with a 12-month prospective follow-up.
Setting and Duration of the Study: Orthopaedic pain management unit of a tertiary hospital over a 12-month period.
Methodology:A total of 22 patients with hip osteoarthritis and chronic pain were included, divided into two groups: the first treated with RF (n=11) and second group with conservative management (n=11). Functionality and pain were assessed using the WOMAC and VAS scales at five time points: baseline, 3, 6, 9, and 12 months. Data was analyzed using ANOVA to determine treatment effectiveness.
Results:RF rhizotomy improved by 65% in WOMAC scores in 12 months (51.5 points). ANOVA analysis revealed significant differences across follow-up intervals ($F = 127.0$, $p < 0.0001$), indicating treatment effects. Pain reduction peaked for 3 months and was sustained throughout the follow-up year. Patients treated with RF reported lower analgesic use, and no adverse effects were noted.
Conclusion: Radiofrequency rhizotomy is a safe and effective alternative for managing chronic hip pain in patients not eligible for arthroplasty, offering sustained functional improvement and a low complication rate. Prospective studies are needed to assess its long-term efficacy.

Keywords: Radiofrequency, pain, ANOVA, WOMAC, EVA, Rhizotomy, Chronic hip pain, Ablation.

1. INTRODUCTION (ARIAL, BOLD, 11 FONT, LEFT ALIGNED, CAPS)

The International Association for the Study of Pain defines pain in its latest update as an unpleasant sensory and emotional experience associated with actual or potential tissue damage. [1]

According to its duration, pain can be acute (less than 3 months) or chronic (greater than 3 months). By its origin, pain isclassifiedinto non-nociceptive (visceral and somatic), neuropathic, and psychogenic. Nociceptive pain of the somatic type of secondary to hip osteoarthritis has a prevalence of 7% in men and 10% in women, being the leading cause of disability in the United States, affecting approximately twenty-seven million people.[2, 3]

Conservative management of hip pain includes lifestyle changes, low-impact exercise, rehabilitation, and pharmacologic management with topical medications, paracetamol, nonsteroidal anti-inflammatory drugs (NSAIDs), opioids, and corticosteroids, and improves symptoms in 85% to 90% of patients, according to a review article published in The Clinical Journal of Pain. However, effectiveness can vary depending on the specific cause of hip pain and individual patient characteristics. [4, 5, 6, 7]

From 10% to 15% of patients present comorbidities such as osteoporosis, smoking, obesity, dementia problems, cardiovascular conditions (ischemic heart disease, pacemaker

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use, hypertension, congestive heart failure, etc.), which partially or completely contraindicate ATC as a therapeutic option. [8, 9, 10].

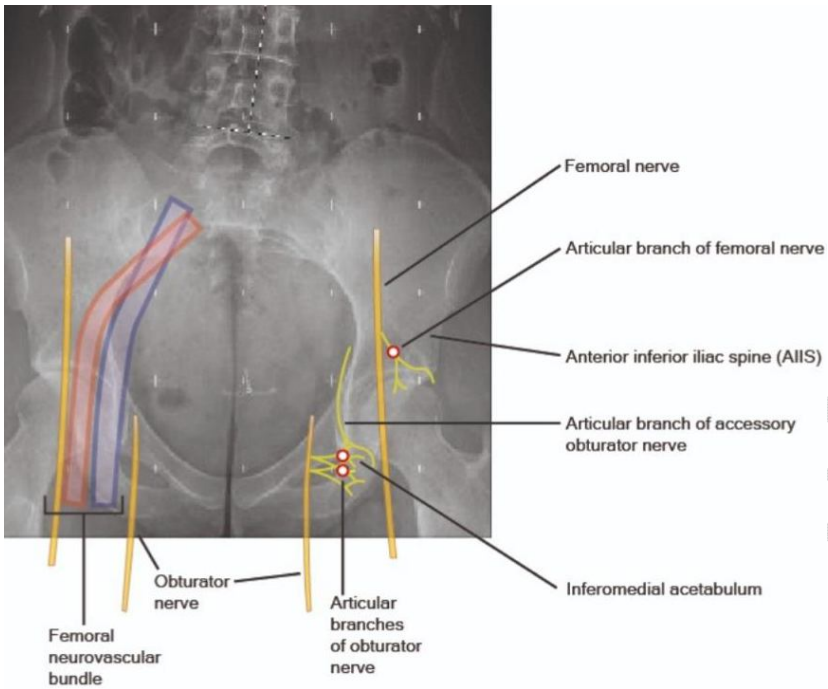


Fig. 1. Hip Anatomy

Radiofrequency is performed through the percutaneous insertion of cannulas that contact the nerve structures responsible for transmitting pain impulses, creating a therapeutic thermal lesion. This procedure involves denervation and percutaneous ablation of the articular branches of the hip, typically targeting the obturator and femoral nerves. The articular sensory branches of the obturator nerve innervate the anteromedial hip joint and are responsible for groin pain associated with this articulation. Conversely, the sensory branches of the femoral nerve innervate the anterior and anterolateral hip joint capsule, contributing to lateral and trochanteric hip pain. [11, 12, 13] (Figure 1)

The procedure involves impedance verification and sensory and motor stimulation tests. Parameters for pulsed radiofrequency (PRF) are set at 45 volts for 120 seconds, maintaining the internal temperature below 42 °C. Following the first PRF cycle, continuous thermal radiofrequency is applied, consisting of low-energy, high-frequency radiofrequency energy to achieve 80 °C for 180 seconds. This temperature is carefully controlled to avoid boiling (>90 °C) and tissue carbonization. [13, 14, 15, 16].

2. MATERIAL AND METHODS / EXPERIMENTAL DETAILS / METHODOLOGY (ARIAL, BOLD, 11 FONT, LEFT ALIGNED, CAPS)

A quasi-experimental study was conducted in 22 patients between August 2022 and August 2023 (one year). Participants were divided into two equal groups: 11 patients underwent hip RF targeting the obturator and femoral nerves, while the other 11 patients received conservative treatment. Both groups underwent rehabilitation as an adjuvant management during the follow-up period.

Patients were assessed during consultations through clinical history and physical examination to establish the diagnosis underlying chronic hip pain. Serial evaluations were conducted at 3, 6, 9, and 12 months, with functionality scores recorded using the WOMAC and VAS scales at each visit.

Of the 22 patients evaluated, 14 were diagnosed with hip coxarthrosis, 6 with post-total hip arthroplasty pain, and 2 with pain following osteosynthesis for hip fracture/dislocation. (Table 1)

Patient	Age	BMI	Comorbidities	Sex	Diagnosis
1	52	32	Obesity	F	Hip arthrosis
2	25	30	Obesity	M	Hip arthrosis
3	78	31	Obesity	M	Post-osteosynthesis hip fracture
4	86	40	Morbid obesity, post-total hip arthroplasty with persistent pain	F	Post-total hip arthroplasty pain
5	78	33	Ischemic heart disease	F	Hip arthrosis
6	50	28	Pacemaker, obesity	M	Post-total hip arthroplasty pain
7	63	29	Obesity	M	Hip arthrosis
8	55	34	Hypertension	F	Post-osteosynthesis hip fracture
9	48	36	Type 2 diabetes mellitus	M	Hip arthrosis
10	84	31	Hypertension	F	Hip arthrosis
11	65	33	Rheumatoid arthritis	M	Hip arthrosis
12	63	42	Morbid obesity, type 2 diabetes mellitus	F	Post-total hip arthroplasty pain
13	70	35	Hypertension, COPD	M	Hip arthrosis
14	46	32	Congestive heart failure	F	Post-total hip arthroplasty pain

15	49	41	Morbid obesity, type 2 diabetes mellitus	M	Hip arthrosis
16	48	33	Hypertension	F	Hip arthrosis
17	72	38	Coronary artery disease, type 2 diabetes mellitus	M	Post-total hip arthroplasty pain
18	69	34	Rheumatoid arthritis	F	Hip arthrosis
19	60	31	Hypertension, chronic lower back pain	M	Hip arthrosis
20	74	33	Hypertension	F	Hip arthrosis
21	58	39	Obesity, hypertension	M	Post-total hip arthroplasty pain
22	67	32	Coronary artery disease, type 2 diabetes mellitus	F	Hip arthrosis

Table 1. Characteristics of the patients participating in the study

The function of both groups was assessed using the Visual Analog Scale (VAS) and the WOMAC scale at 0, 3, 6, 9,and12 months post-treatment. Statistical analysis was conducted using ANOVA to evaluate variability across these time points, allowing for the determination of significant results.

Inclusion Criteria

1. Hip pain lasts at least 3 months, unresponsive to conservative management (physical therapy, rehabilitation, and lifestyle changes).
2. Pain relief of >50% on the VAS after in-office anesthetic block.
3. Lack of consent for joint replacement surgery.
4. Unsuitability for surgical management due to comorbidities.[17, 18, 19]

Exclusion Criteria

1. Refusal to participate in the study.
2. Patients with mild to moderate hip pain according to the VAS (score <7).
3. Presence of local infection at the skin or hip tissue, systemic sepsis, pregnancy, or blood dyscrasias. [17, 18, 19, 20]

Informed consent was obtained from all participants.

2.1 Protocol

Characteristic	RF Group (n=11)	Conservative Group (n=11)
Age (years)	62.1 (SD 17.6)	61.4 (SD 9.6)
Sex **Female (%)** **Male (%)**	 7 (63.6%) 4 (36.4%)	 6 (55%) 5 (45%)
Pain Location **Left (%)** **Right (%)** **Both (%)**	 4 (36.4%) 5 (45.5%) 2 (18.2%)	 3 (27.3%) 5 (45.5%) 3 (27.3%)

Table 2. Demographics of both groups. SD = Standard Deviation

The patients were divided into two groups: the first group consisted of patients who received treatment with radiofrequency neurotomy, while the second group included patients managed with conservative treatment, which comprised physical rehabilitation, nonsteroidal anti-inflammatory drugs (NSAIDs), and opioid therapy (tramadol).

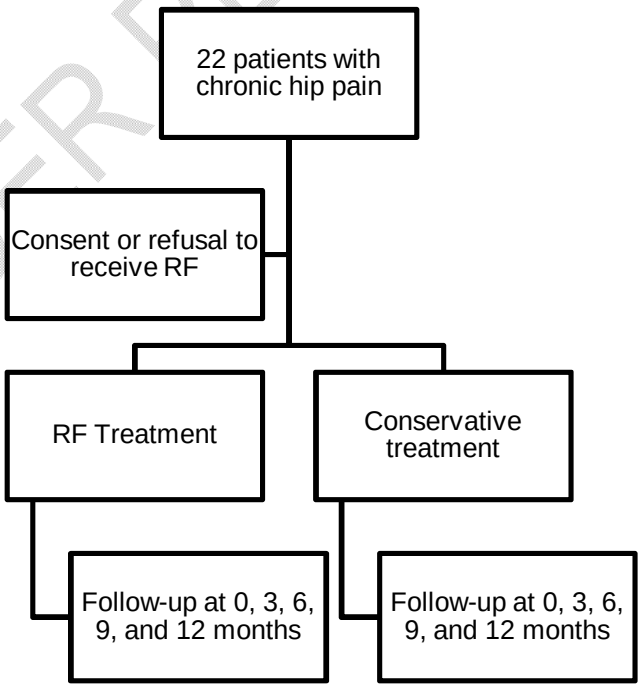
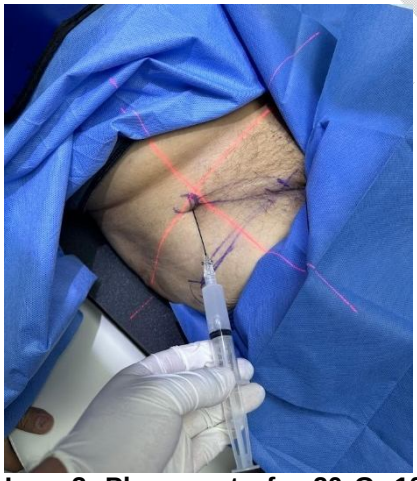


Figure 1. Patient Assignment and Follow-Up

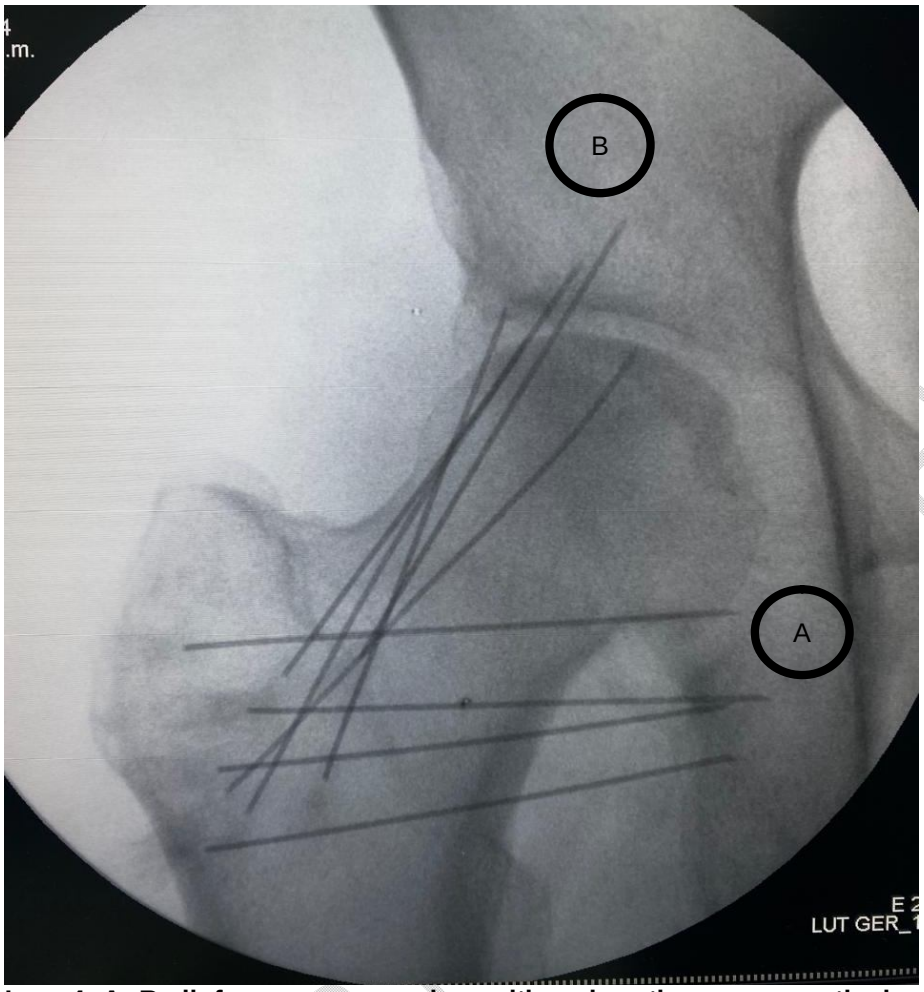
2.2 Technique

The patient is positioned in the supine position, and asepsis and antisepsis are performed over the anterior portion of the hip, the inguinal region, and the medial thigh. The femoral vascular bundle is palpated, and the arterial pathway is marked below the inguinal ligament (Figure 2). A fluoroscope is used in the anteroposterior position to locate the hip joint. A 25G needle is used to infiltrate the skin with local anesthetic. Subsequently, a 20G radiofrequency cannula with a 100-mm length and a 10-mm active tip is inserted (Figure 3). The electrode is directed to the articular sensory branch of the femoral nerve at the superior portion of the acetabular roof. A second radiofrequency cannula is then placed for ablation of the obturator nerve at the ischiopubic branch (Figure 4).

Img. 2. Marking of arterial and venous pathways below the inguinal ligament.



Img. 3. Placement of a 20 G, 100-millimeter (mm) radiofrequency cannula with a 10 mm active tip, Cosman G4 type.



Img. 4. A: Radiofrequency cannula positioned on the sensory articular branch of the obturator nerve. B: Radiofrequency cannula for ablation of the femoral nerve at the superior portion of the acetabulum.

3. RESULTS AND DISCUSSION

The average age of the study population was 61.8 years, with a range of 25 to 86 years.

The analgesic effect was evaluated using the Visual Analog Scale (VAS) at baseline (0 months) in both groups, with an initial mean score of 8.4 (severe pain) and a range of 6 to 10 (Figure 1.2). Following the radiofrequency procedure, pain was reduced by 76.1%, resulting in a mean score of 2/10 (mild pain) with a range of 0 to 4.

Function was assessed using the WOMAC questionnaire prior to treatment (0 months) and at 3, 6, 9, and 12 months. The average pre-treatment score was 79.9, indicating severe symptoms of pain, stiffness, and physical function limitations.

Function as measured by the WOMAC scale improved by 74.8% at 3 months and remained stable at 6, 9, and 12 months.

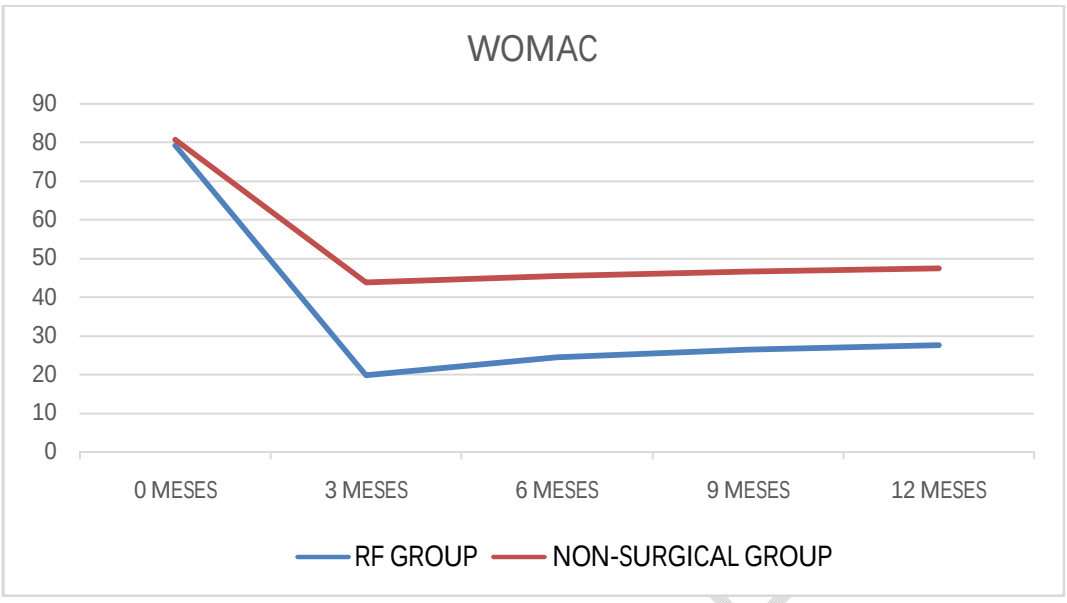


Fig. 3. WOMAC questionnaire results for both groups during the treatment follow-up period. (RF GROUP IN BLUE, NON-SURGICAL GROUP IN RED)

The analysis of variance (ANOVA) showed significant differences among the various follow-up periods of treatment. The results showeda statistical difference over the function ($F = 127.0$, $p < 0.000$). The low p-value suggests that obtaining these results without a treatment effect is unlikely. The critical F value (2.6) further confirms the significance of the findings, as the calculated F statistic far exceeds this threshold.

The conservative group had an initial average WOMAC score of 80.7 (at 0 months), showeda function improvement in 45.6% at 3 months. However, this improvement declined over time, with the treatment effect plateauing.

The analgesic effect in the non-surgical group demonstrated a mean VAS score of 7.4/10 (range 6 to 10) at baseline, with an 11.9% reduction in pain following physical therapy and medication use.

Within the conservative group, 9 patients ultimately chose to undergo hip radiofrequency neurotomy, while 2 opted for total hip arthroplasty.

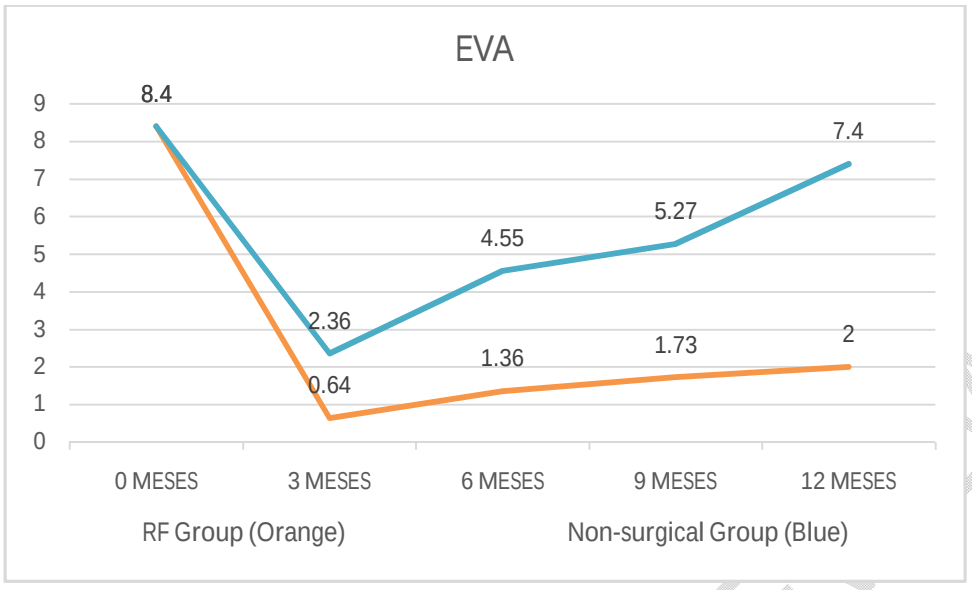


Fig. 3. EVA scale results for both groups during the treatment follow-up period.

3.1 DISCUSIÓN

Total hip arthroplasty (THA) is the preferred method for osteoarthritis, however 15% of those patients with grade iv hip arthrosis are not candidates for this procedure due to its comorbidities. [21, 22]

While previous studies have demonstrated that blocks of the obturator and femoral nerves can provide temporary pain relief for approximately 2 weeks, long-term benefits are limited as the pain typically returns to baseline levels after the block wears off. [23, 24, 25]

In this article, the RF group showed a 76.1% pain reduction, and a 74.8% function improvement remained at 3, 6, 9, and 12 months in the RF group, offering additional benefits such as minimal invasiveness, shorter recovery times, the advantages of local anesthesia, and the absence of significant adverse effects.

4. CONCLUSION

radiofrequency combined with physical therapy reduced to 76.1% non-surgical patients, decreasing from 8.4 down to 2.0 points over the vas scale at 12 months. while the non-surgical approach (combining medication and physical therapy) showed pain improvement starting at 3 months (61%), the pain worsened at 6 months (39%), and 9 months (32%), and even returned to its baseline pain at 12 months (11.9%).Functional assessment using the WOMAC scale in the RF group showed a 74.8% improvement in 3 months, which remained at 6 months (54.7%), 52.7% at 9 months, and 51.1% at 12 months.with no significant complications reported in rf group, in contrast to the complications commonly associated with THA, and compared to the conservative approach, RF is shown to be an effective method for managing hip pain in non-surgical patients.

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APPENDIX