ORIGINAL ARTICLE

Percutaneous pulsed radiofrequency ablation of articular nerves of the hip joint in patients with chronic hip pain refractory to conventional analgesics

Kronik kalça ağrısı olan hastalarda konvansiyonel analjeziklere dirençli kalça eklemi artiküler sinirlerinin perkütan puls radyofrekans ablasyonu

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Summary

Objectives: Total Hip Arthroplasty (THA) may be a risky proposition in patients with comorbidities, and they may require systemic analgesics for chronic hip pain (CHP). Since traditional pain medications may not provide complete pain relief or carry prohibitive adverse effects, pulsed radiofrequency (PRF) treatment of the hip articular nerves (HAN) has been proposed for effective clinical outcomes. We determined the efficacy of PRF-HAN in improvement in CHP compared to baseline pain on conventional systemic analgesics.

Methods: Between August 2015 and December 2021, 31 adult patients with severe comorbid conditions and excruciating chronic hip pain were subjected to a PRF-HAN procedure following a diagnostic block. All 31 patients received PRF of the articular branches of the femoral and obturator nerves. Demographic parameters, numerical rating scale (NRS), Harris Hip Score (HHS), WOMAC scores, the change of these scores from baseline, and any adverse effects were recorded before treatment and on day 1, 1st week, 6 weeks, and 6 months after treatment.

Results: All the patients who underwent the PRF-HAN reported a significant improvement in NRS, HHS, and WOMAC scores compared to the baseline values on day 1, at the end of the 1st week, and the 6th week (p<0.001). No adverse events were documented in the study post-procedure until the end of 6 months.

Conclusion: PRF-HAN is a strong alternative for chronic pain management and augments physical functioning and a return to daily activity in patients who would be deprived of arthroplasty considering associated comorbid conditions.

Keywords: Analgesia; arthroplasty; hip; obturator nerve; pain; pulsed radiofrequency ablation.

Özet

Amaç: Total Kalça Artroplastisi (TKA), komorbiditeleri olan hastalarda riskli bir teklif olabilir ve kronik kalça ağrısı (CKA) için sistemik analjezikler gerektirebilirler. Geleneksel ağrı ilaçları tam ağrı rahatlama sağlamayabilir veya kabul edilemez yan etkilere sahip olabilirken, etkili klinik sonuçlar için kalça artiküler sinirlerinin (KAS) puls radyofrekans (PRF) tedavisi önerilmiştir. Konvansiyonel sistemik analjeziklerdeki baz ağrısına kıyasla CKA'da PRF-KAS'ın etkinliğini belirledik.

Gereç ve Yöntem: Ağustos 2015 ve Aralık 2021 tarihleri arasında, şiddetli komorbidite durumları ve şiddetli kronik kalça ağrısı olan 31 yetişkin hastaya, tanısal bir blokajı takiben bir PRF-KAS işlemi uygulandı. Tüm 31 hasta, femoral ve obturator sinirlerin artiküler dallarına PRF aldı. Demografik parametreler, nümerik derecelendirme skalası (NDS), Harris Kalça Skoru (HKS), WOMAC skorları, bu skorların baz değerlerinden değişimi ve herhangi bir yan etki tedavi öncesi ve tedaviden sonra 1. gün, 1. hafta, 6. hafta ve 6. ayda kaydedildi.

Bulgular: PRF-KAS uygulanan tüm hastalar, 1. gün, 1. haftanın sonunda ve 6. haftada, baz değerlere kıyasla NDS, HKS ve WO-MAC skorlarında önemli bir iyileşme bildirdi (p<0.001). Çalışma süresince prosedür sonrası herhangi bir yan etki belgelenmedi.

Sonuç: PRF-KAS, kronik ağrı yönetimi için güçlü bir alternatiftir ve ilişkili komorbidite durumları göz önünde bulundurulduğunda artroplastiden mahrum bırakılacak hastalarda fiziksel işlevselliği ve günlük aktiviteye dönüşü artırır.

Anahtar sözcükler: Analjezi; artroplasti; kalça; obturator siniri; ağrı; puls radyofrekans ablasyonu.

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Introduction

Osteoarthritis is one of the commonest causes of chronic hip pain (CHP) and disability from which the elderly population suffers. With an aging population, osteoarthritis of the hip joint is becoming a major health issue and is prevalent in up to 25% of people by 85 years of age.[1] Patients with significant comorbidities can have prohibitive risk factors for surgery and may not qualify for total hip arthroplasty (THA).

A major goal of osteoarthritis treatment is pain management to optimize pain relief and joint function, thereby improving the patient's overall quality of life. Symptomatic treatment of osteoarthritis consists of conservative non-pharmacological methods like physical therapy as well as pharmacological interventions, including the use of non-steroidal anti-inflammatory drugs (NSAIDs) and opioids.

Conservative pharmacological treatment measures generally provide incomplete pain relief or lead to significant side effects with a gradual deterioration in their quality of life. Total hip arthroplasty (THA) is the definitive treatment of the condition, but percutaneous radiofrequency ablation (RFA) of articular nerves supplying the hip joint has been put forth as an effective minimally invasive alternative when the surgical option is not advisable or has failed, and a repeat procedure is not desirable.[2] An anatomic study by Short et al.[3] demonstrated that high articular branches of the femoral nerve (FN), obturator nerve (ON), and accessory ON provide innervation to the anterior hip capsule. The hip capsule is divided into two parts: anterior and posterior, with pain generator nociceptive and mechanoreceptor fibers mostly present in the anterior part.[3,4] Hence, selective ablation of sensory articular branches of FN and ON can provide high success rates of pain relief and decrease complications by preserving motor branches.[2]

Pulsed RFA is a relatively novel technique that is safer than the continuous ablative RFA used earlier.[2] Literature in this regard so far is primarily based on case reports and small case series, and there is a relative paucity of literature on the short- and long-term analgesic efficacy of pulsed RFA for selective ablation of hip articular nerves (HAN).

We aimed to determine the efficacy of PRF-HAN in patients with CHP unresponsive to conventional measures, with the primary aim of finding out the degree of improvement in pain scores compared to the baseline ones on conventional systemic analgesics. Secondary outcomes were the difference in Harris Hip Scores (HHS), Western Ontario and McMaster Universities Arthritis Index (WOMAC) scores, and adverse effects after treatment.

Material and Methods

This single-arm retrospective clinical trial was conducted in a tertiary care orthopedics and rehabilitation center following Institutional Ethics Committee approval (approval number IEC-SIOR/ Agenda 067). The study was conducted in accordance with the Declaration of Helsinki. Thirty-five patients aged >60 years with CHP and significant comorbid conditions qualifying for exclusion from undergoing THA were offered pulsed RFA treatment between August 2015 and December 2021, and consenting patients were recruited for the study. None of these patients had undergone a previous surgical intervention or any block-related procedure. Written informed consent was obtained from each patient for the procedure following a discussion of various treatment modalities and their potential risks.

Any patient who refused to consent, had an extrinsic source of hip pain (e.g., lumbar radiculopathy), had pain related to bony fracture, avascular necrosis of the hip, or postsurgical pain; those who were on anticoagulation therapy or had a local site infection over the buttock and hip; those in systemic sepsis; had an allergy to local anesthetics; any psychiatric illness; and an inability to comprehend pain scores were excluded.

Prior to the block intervention, all patients consumed paracetamol 650 mg, tramadol 50 mg, and pregabalin 75 mg. The eligible patients who had consented to the blocks first underwent a diagnostic denervation procedure (fluoroscopic-guided injection of 2% lignocaine 5 ml and triamcinolone 40 mg at the articular branches of both FN and ON). The patients who had a 50% fall in their numerical rating scale (NRS) scores were then scheduled for PRF-HAN.
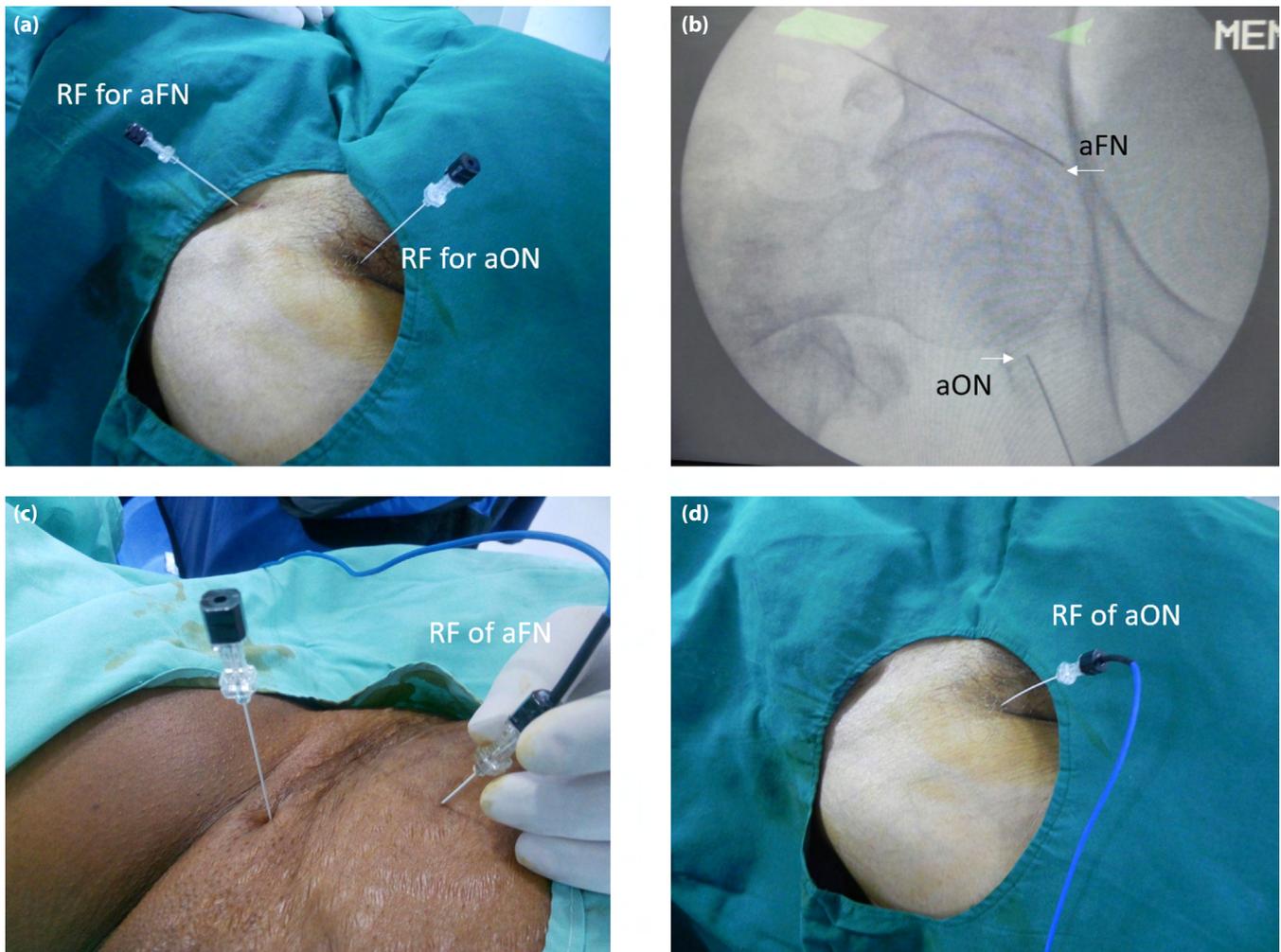
Figure 1. (a) Needle positioned for RFA of articular branches of femoral and obturator nerves; **(b)** Fluoroscopy determines the correct placement of the tip of RFA needles in the vicinity of articular branches of femoral and obturator nerves; **(c)** RFA ablation of articular branches of the femoral nerve in the process; **(d)** RFA ablation of articular branches of the obturator nerve in the process.

After counseling and informed consent, all patients underwent percutaneous radiofrequency lesioning of the sensory branches of the ON and FN. Post-block, all patients were to receive pregabalin 75 mg and paracetamol 650 mg if necessary. Patients were placed in the supine position. After preparation with 2% chlorhexidine and draping the inguinal area, the radiofrequency machine with probes was tested.

A 22-gauge electrode with a 5-mm exposed tip (Neuro Therm; Diros Technology Inc; Canada) was used for denervation, using a current supplied by the radiofrequency generator (Neuro Therm, Wilmington, MA, USA). The needle tip position was verified by electrical stimulation of the target nerve. Sensory stimulation at 50 Hz, up to 0.7V, was made to cause paraesthesia and elicit groin and thigh pain similar to the usual pain of the patient to confirm the exact position of the tip. A gradual increasing motor stimulation at 2 Hz, up to 0.9V, was made to exclude muscle contractions for the presence of a motor branch near the electrode. After administering 1 ml of 1% lidocaine, radiofrequency ablation was performed twice at 90 °C for 90 seconds.

Denervation of the Articular Branch of the FN
The needle was inserted by an anterolateral approach (Fig. 1a), and the tip was placed at the site of the articular branches of FN below the anterior inferior iliac spine near the anterolateral margin of the hip joint between the 11 and 12 o'clock positions. The needle tip placement was confirmed with fluoroscopy (Fig. 1b). A sensory test (paraesthesia at the site of usual pain) and a motor test (absence of quadriceps contractions) were performed to improve the accuracy of needle placement and exclude needle placement near the main trunk of the FN. After 1 ml of 1% lidocaine, pulsed radiofrequency ablation was performed.

Table 1. Mean (±SD) NRS, HHS and WOMAC scores of patients at various time points

	NRS (n=31)	HHS (n=31)	WOMAC (n=31)	Adverse events
Pre-DB	7.4±1.6	29.6±9.2	62±9.9	NA
Post-DB	1.8±0.7	84.9±7	36.4±8.5	Nil
Post-RFA-HAN day 1	2±0.7	86.6±5.7	41.9±8.8	Nil
Post-RFA-HAN after 1 week	2.1±0.8	84.1±7.6	45.6±9.1	Nil
Post-RFA-HAN after 6 weeks	2.3±0.7	71.5±16	58.8±10.3	Nil
Post-RFA-HAN 6 months	3.1±2.1	62.9±18.1	69.2±12	Nil

SD: Standard deviation; NRS: Numeric rating scale; DB: Diagnostic block; RFA: Radiofrequency ablation; HAN: Hip articular nerves; HHS: Harris hip score; WOMAC: The Western Ontario and McMaster Universities Arthritis Index.

Denervation of the Articular Branch of the ON

After palpating for the femoral artery, the needle was inserted just medial to the femoral artery, below the inguinal ligament, or 3 cm lateral to the femoral artery, forming a 70° angle with the sagittal plane (Fig. 1c). Under fluoroscopy (Fig. 1d), the tip of the needle was placed at the site of articular branches of ON below the inferior junction between the ischium and the pubis, which is teardrop-shaped in the anteroposterior view. A sensory test and motor test were performed to verify correct needle placement and exclude needle placement near the main ON. The presence of paraesthesia at the site of the patient's usual pain was construed as a positive sensory test, whereas the absence of contraction of the adductor muscle group in the upper leg innervated by branches of the ON was an acceptable motor test. After 1 ml of 1% lidocaine, pulsed RFA was performed. Complications, e.g., pain, numbness, dysesthesia, bleeding, hematoma, and motor weakness of the leg, if any, were noted until the patient was discharged on the same day.

Post-RFA-HAN patients were evaluated using NRS, HHS, and WOMAC scores on the immediate next day post-block (day 1), 1st week, 6 weeks, and at 6 months as per our institutional protocol. These scores were retrieved from patient records and analyzed. Any complications were noted.

Statistical Analysis

Power analysis was performed for repeated measures ANOVA to detect a clinically significant effect size f of 0.25, alpha error of 0.05, total sample size N=31, number of groups=1, and number of measurements=6. The achieved power is 97.22%.

The data on categorical variables are presented as number (% of cases) and the data on the continuous variable are presented as mean±standard deviation (SD). Evaluation of the difference between multiple repeatedly measured means was done using the repeated measures analysis of variance (RMANOVA) with the Greenhouse-Geisser correction for sphericity. Post-hoc analysis with Tukey's HSD tests was used to evaluate where significant differences lie. The underlying assumptions for normality (Shapiro-Wilk) and sphericity (Mauchly) were tested before subjecting the study variables to RMANOVA.

P-values less than 0.05 are considered significant. p-values and confidence intervals have been corrected for multiplicity using Tukey's correction. All hypotheses were formulated using two-tailed alternatives against each null hypothesis. Power analysis was done using G*Power, version 3.1.9.7 for MS Windows. Statistical data analysis was done using R software, version 4.2.2 for MS Windows.

Results

From August 2015 to December 2021, thirty-five patients with CHP and severe osteoarthritis ineligible to undergo THA were identified and offered RFA. Four patients refused to consent to the procedure, and the remaining 31 patients received diagnostic and therapeutic blocks. All 31 patients had been followed up for 6 months, and their data were retrieved from patient records. The mean (±SD) age of the patients was 66.6±5.7 (n=31; range 62–84 years). Out of 31 patients, 13 (41.9%) were males, while 18 (58.1%) were females.

At baseline (pre-DB), the patients had a mean (±SD) NRS score of 7.4±1.6, HHS score of 29.6±9.2, and WOMAC scores of 62±9.9 (Table 1).
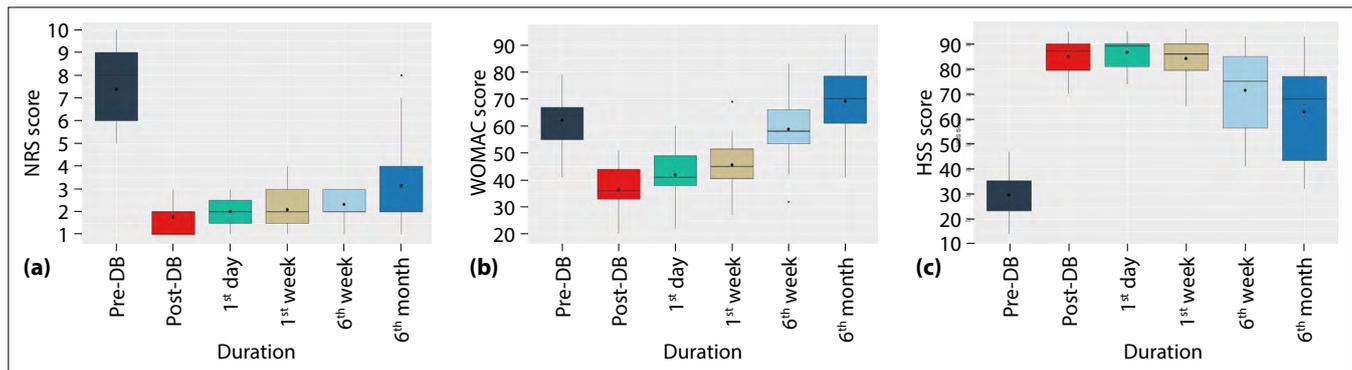
Figure 2. (a) Box plot for NRS. The solid horizontal black line inside the box corresponds to the median NRS and the solid black circle inside the box corresponds to the mean NRS. The lower and upper hinges correspond to the first and third quartiles (the 25th and 75th percentiles). The upper whisker extends from the hinge to the largest value no further than 1.5 * IQR from the hinge (where IQR is the inter-quartile range or distance between the first and third quartiles). The lower whisker extends from the hinge to the smallest value at most 1.5 * IQR of the hinge. Data beyond the end of the whiskers are called "outlying" points and are plotted individually as black dots. **(b)** Box plot for HSS score. The solid horizontal black line inside the box corresponds to the median HHS and the solid black circle inside the box corresponds to the mean HHS. The lower and upper hinges correspond to the first and third quartiles (the 25th and 75th percentiles). The upper whisker extends from the hinge to the largest value no further than 1.5 * IQR from the hinge (where IQR is the inter-quartile range, or distance between the first and third quartiles). The lower whisker extends from the hinge to the smallest value at most 1.5 * IQR of the hinge. Data beyond the end of the whiskers are called "outlying" points and are plotted individually as black dots. **(c)** Box plot for WOMAC score. The solid horizontal black line inside the box corresponds to the median WOMAC and the solid black circle inside the box corresponds to the mean WOMAC. The lower and upper hinges correspond to the first and third quartiles (the 25th and 75th percentiles). The upper whisker extends from the hinge to the largest value no further than 1.5 * IQR from the hinge (where IQR is the inter-quartile range, or distance between the first and third quartiles). The lower whisker extends from the hinge to the smallest value at most 1.5 * IQR of the hinge. Data beyond the end of the whiskers are called "outlying" points and are plotted individually as black dots.

Post-diagnostic block (post-DB), there was a significant improvement in the mean NRS scores (7.4 vs. 1.8; the mean difference (MD) [95% CI]=-5.6 [-6.5–-4.7]) (p<0.001), mean HHS (29.6 vs. 84.9; MD=55.3 [46.8–63.8]) (p<0.001) and WOMAC score (62 vs. 36.4, MD=-25 [-32.8– -18.4]) (p<0.001) (Table 1).

The mean (SD) NRS score of the patients after RFA on the first day was 2 (0.7), the HHS score was 86.6 (5.7), and the WOMAC score was 41.9 (8.8). The post-DB NRS score was similar to the post-RFA NRS scores on day 1 with no statistically significant difference between the scores (1.8 vs. 2; MD=0.2 [-0.7–1.1], p=0.98), HHS score (84.9 vs. 86.6; MD=1.7 [-6.8–10.2]) (p=1.0) and WOMAC score (36.4 vs. 41.9; MD = 5.5 [-1.7–12.7]) (p=1.0).

Between post-RFA day 1 and post-RFA 1st week, there was no significant difference in the NRS score (2 vs. 2.1; MD=0.1 [-0.8–1], p=1.000), HHS score (86.6 vs. 84.1; MD=-2.5 [-11–6], p=1.000) and WOMAC score (41.9 vs. 45.6; MD=3.7 [-3.5–10.9], p=0.67).

Between the 1st week and 6th week, there was no significant difference in the NRS scores (2.1 vs. 2.3, MD=0.2 [-0.7–1.2], p=0.98); however, HHS (84.1 vs. 71.4, MD=-12.6 [-21.1– -4.2], p<0.001) and WOMAC scores (45.6 vs. 58.8; MD=13.2 [6–20.4], p<0.001) demonstrated decreasing and increasing trends respectively.

Between the 6th week and until 6 months, the NRS (2.3 vs. 3.1; MD = 0.8 [-0.1–1.7], p=0.1) were similar; however, HHS (71.4 vs. 62.9; MD=-8.5 [-17– -0.1], p=0.047) and WOMAC (58.8 vs. 69.2; MD = 10.4 [3.2–17.6], p<0.001) worsened with time (Fig. 2, Table 2). No side effects in the form of hematoma, motor weakness, or dysesthesia were reported.

Discussion

The present study results revealed a significant improvement in pain scores, HHS, and WOMAC scores from post-RFA day-1 until the 6th week. However, from the 6th week until the 6th month, the HHS and WOMAC scores worsened in patients with severe hip osteoarthritis who were experiencing severe pain and disability due to CHP. No motor weakness was seen after this selective sensory block, and no block-related adverse effects were observed.

Patients included in the study had severe osteoarthritis as assessed by their pre-block HHS and WOMAC scores. HHS is a reliable tool for the evaluation of hip osteoarthritis patients to evaluate their pain, activity, and function, with higher scores signifying lesser disability. The average baseline HHS (pre-DB) increased by approximately 55 points from the baseline post-giving the DB.

Table 2. Comparison of the mean (CI) of NRS scores, HHS and WOMAC scores at various time points

Baseline variable	Comparison variable	Mean diff (adjusted CI)	p value (adjusted)
NRS scores			
Pre-DB	Post-DB	-5.6 (-6.5– -4.7)	<0.001
	1 day after RFA	-5.4 (-6.3– -4.5)	<0.001
	1 week after RFA	-5.3 (-6.2– -4.4)	<0.001
	6 weeks after RFA	-5.1 (-6– -4.2)	<0.001
	6 months after RFA	-4.3 (-5.2– -3.4)	<0.001
Post-DB	1 day after RFA	0.2 (-0.7–1.1)	0.98
	1 week after RFA	0.3 (-0.6–1.2)	0.9
	6 weeks after RFA	0.5 (-0.3–1.4)	0.49
	6 months after RFA	1.4 (0.5–2.2)	<0.001
Post-RFA day 1	1 week after RFA	0.1 (-0.8–1)	1
	6 weeks after RFA	0.3 (-0.6–1.2)	0.9
	6 months after RFA	1.1 (0.2–2)	0.004
Post-RFA after 1 week	6 weeks after RFA	0.2 (-0.7–1.2)	0.98
	6 months after RFA	1 (0.1–1.9)	0.01
Post-RFA after 6 weeks	6 months after RFA	0.8 (-0.1–1.7)	0.1
HHS scores			
Pre-DB	Post-DB	55.3 (46.8–63.8)	<0.001
	1 day after RFA	57 (48.5–65.5)	<0.001
	1 week after RFA	54.5 (46–62.9)	<0.001
	6 weeks after RFA	41.8 (33.3–50.3)	<0.001
	6 months after RFA	33.3 (24.8–41.7)	<0.001
Post-DB	1 day after RFA	1.7 (-6.8–10.2)	1
	1 week after RFA	-0.8 (-9.3–7.6)	1
	6 weeks after RFA	-13.5 (-22– -5)	<0.001
	6 months after RFA	-22 (-30.5– -13.6)	<0.001
Post-RFA day 1	1 week after RFA	-2.5 (-11–6)	1
	6 weeks after RFA	-15.2 (-23.6– -6.7)	<0.001
	6 months after RFA	-23.7 (-32.2– -15.2)	<0.001
Post-RFA after 1 week	6 weeks after RFA	-12.6 (-21.1– -4.2)	<0.001
	6 months after RFA	-21.2 (-29.7– -12.7)	<0.001
Post-RFA after 6 week	6 months after RFA	-8.5 (-17– -0.1)	0.047
WOMAC scores			
Pre-DB	Post-DB	-25 (-32.8– -18.4)	<0.001
	1 day after RFA	-20.1 (-27.3– -12.9)	<0.001
	1 week after RFA	-16.4 (-23.6– -9.2)	<0.001
	6 weeks after RFA	-3.2 (-10.4–4)	0.79
	6 months after RFA	7.1 (-0.1–14.3)	0.054
Post-DB	1 day after RFA	5.5 (-1.7–12.7)	0.25
	1 week after RFA	9.2 (2–16.4)	0.004
	6 weeks after RFA	22.4 (15.2–29.6)	<0.001
	6 months after RFA	32.7 (25.5–39.9)	<0.001
Post-RFA day 1	1 week after RFA	3.7 (-3.5–10.9)	0.67
	6 weeks after RFA	16.9 (9.7–24.1)	<0.001
	6 months after RFA	27.3 (20.1–34.5)	<0.001
Post-RFA after 1 week	6 weeks after RFA	13.2 (6–20.4)	<0.001
	6 months after RFA	23.5 (16.4–30.7)	<0.001
Post-RFA after 6 weeks	6 months after RFA	10.4 (3.2–17.6)	<0.001

NRS: Numeric rating scale; DB: Diagnostic block; RFA: Radiofrequency ablation; HHS: Harris hip score; WOMAC: Western Ontario and McMaster Universities Arthritis Index.

Similarly, the average HHS post-RFA day 1 was higher by 57 points from the baseline, which remained significantly high until 6 months when it was still found to be 33 points higher than the baseline.

The WOMAC is another valid, reliable, and sensitive instrument widely used for the evaluation of hip osteoarthritis.[5] Higher scores signify worse CHP, stiffness, and disability.[6] The average WOMAC decreased by 25 points post-DB from the baseline. Similarly, post-RFA, the average score was 20 points lower than the baseline and remained low until 6 weeks after RFA, where it was 2 points lower than the baseline.

Local anesthetic blocks of HAN and intra-articular blocks have been found effective but only for short-term relief of hip pain. We used local anesthetic with steroids as a diagnostic block and found a 75% fall in the NRS scores post-DB. A review concluded that intra-articular injection of steroids alone or with local anesthetic provided short-term incomplete pain relief with potential adverse effects, but no long-term benefit.[7]

Denervation procedures are based on anatomical studies of sensory and articular nerves innervating the hip joint. In cadaveric studies, the superomedial quadrant and inferomedial part of the anterior hip capsule were found to be most commonly innervated by proximal articular branches of the femoral and obturator nerves, which are not covered by conventional procedures targeting the distal articular nerves.[3,8] Thus, fluoroscopic placement of the needle tip inferior and medial to the anterior inferior iliac spine (AIIS), midway between the AIIS and the ilio-pubic eminence for the articular femoral branches, and the ilio-pubic eminence and the bony thinning of the junction of the ischium and the pubis (teardrop silhouette) have been proposed.[9] Electric fields generated around sensory nerves decrease the afferent impulse conduction, enhance descending inhibition, and decrease neuroglial activity and expression of neuron activation transcription factor 3. These molecules encourage the formation of pre-prodynorphin, an RNA messenger resulting in increased production of endorphin, conferring a prolonged analgesic effect.[10,11]

Kawaguchi et al.[12] described RFA of femoral and obturator nerves (ON) in 14 patients, with 86% of patients achieving more than a 50% reduction in pain scores. Many other series and observational studies documented a 30-70% reduction in pain scores till 3 months.[10,13] In our series, the baseline median NRS score was 8, and the 1st day post-RFA median NRS was 2 (IQR- 1.5–2.5), i.e., a 75% reduction in pain scores. The effect was persistent for the 6-month observation period (Table 1). Our results coincide with a recent study which reported an 80% fall in pain scores following pulsed RFA.[14] The high analgesic efficacy observed in the present study could be due to the use of pulsed RFA, in contrast to many previous studies which used continuous ablative RFA, which is said to be less efficacious and more damaging. Furthermore, we used a modified lateral approach wherein the RFA needle is placed parallel instead of perpendicular to the ON as practiced conventionally with pulsed RFA. Optimal heat (thermo) coagulation requires electrodes to lie parallel to the nerves, while a perpendicular approach purportedly produces only a minimal lesion.[15]

In our study, we observed a remarkable improvement in the functional status of the patients as assessed by HHS (190% improvement post-treatment) and WOMAC scores (40% reduction), which could be related to the good analgesic efficacy of the blocks. Rivera et al.[16] reported a 34% improvement in HHS and a 16% reduction in WOMAC scores, which is much lower than our results. They had achieved only a 33% lower pain scores by use of continuous RFA, which could be the reason for the meager improvement in their functional status. Our results agree with those of other previous authors who used pulsed RFA treatment of HAN.[10,14] However, the change of trends in HHS and WOMAC (between the 6th week and the 6th month) is incomprehensible.

One of the potential risks of hip joint PRF is puncturing a major vascular structure such as the femoral vessels. Rivera et al.[16] reported hematomas in the inguinal area with the use of a direct anterior approach for RFA of the articular branches of the obturator nerve, which led to the modification of their practice to the lateral approach. In their series of 14 patients, Tinnirello et al.[17] reported 2 cases of femoral artery puncture during needle placement for pulsed RFA,

which responded to the application of a compression bandage. In our study, we did not report any vascular puncture, hematoma, motor deficit, neuritis injury, or other complications. The possible reason could be that for pulsed RFA-HAN, RF needle placement perpendicular to the target is required, which may increase the potential for neurovascular injury. We used a modified lateral approach instead for the articular branch of the obturator nerve, thus avoiding vascular puncture. In a study by Kapural et al.[18] on PFA-HAN of 23 patients, one patient developed neuritis, while none of our 32 patients reported neurological symptoms.

Further, we used both sensory stimulation for improving block effectiveness and motor stimulation to improve safety, in contrast to many previous studies where only sensory stimulation was elicited.[15]

Limitations

Our study has certain limitations. Though we discerned immediate pain relief after HAN ablation in our study, and it persisted for the 6-month follow-up, this period of observation may not be enough to elucidate the long-term pain relief. Another key limitation was its retrospective design and not having a control group for comparison. Further randomized comparative trials of RFA-HAN are required to elucidate the long-term safety and efficacy of PRF-HAN compared to various conventional modalities and other interventional therapies, and this can be the direction of future research. Moreover, the data regarding rescue analgesics required and the impact of the intervention on patient satisfaction could not be ascertained in our study. The analgesic efficacy of the blocks, as demonstrated by our study, however, can provide a firm ground for more widespread adoption of the technique in patients with intractable chronic disabling hip pain. The strength of our study is the same-subject design where the pain scores and functional status of the patient on conventional analgesics were compared with the scores post-interventional treatment, which means that patients served as their own controls. The use of 2 valid and reliable scores (HHS and WOMAC scores) documented significant functional improvement (first 6 weeks) compared to conventional treatment. Additionally, we had a reasonably long follow-up period of 6 months.

Conclusion

Radio-frequency ablation of the femoral and obturator nerve's articular branches can be a primary treatment modality for patients with intractable hip joint pain who do not qualify for total hip arthroplasty (THA). It provides excellent pain relief and near-normal functional activity secondary to a decrease in pain scores, and thus, a decreased requirement for pain medications.

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