

# Percutaneous Radiofrequency Denervation in Patients With Contraindications for Total Hip Arthroplasty

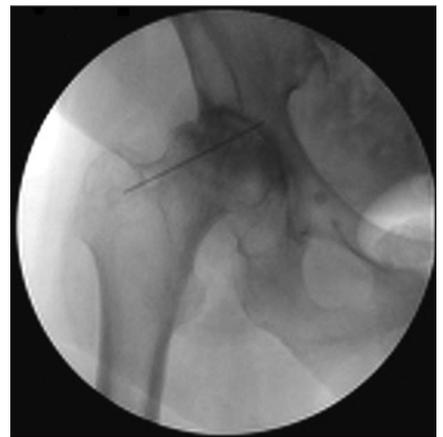
FABRIZIO RIVERA, MD; CARLO MARICONDA, MD; GIOVANNI ANNARATONE, MD

## abstract

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Multiple comorbidities sometimes represent a contraindication for total hip arthroplasty (THA). Major symptoms of patients with hip pain include groin, thigh, and trochanteric pain. Groin and thigh pain arise from sensory branches of the obturator nerve, whereas trochanteric pain arises from sensory branches of the femoral nerve. Between January 2009 and October 2010, eighteen patients with chronic hip pain with several contraindications for THA were selected for a prospective study. Predenervation diagnosis was osteoarthritis in 16 patients and prolonged postoperative hip pain in 2 (1 THA, 1 Girdlestone). Hip joint pain was treated by percutaneous radiofrequency lesioning of the sensory branches of the obturator and femoral nerves. Six-month follow-up data revealed a statistically significant decrease in visual analog scale (VAS) scores and Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) scores, and a statistically significant increase of Harris Hip Score. Before radiofrequency and at 6-month follow-up, mean VAS scores were 9.52 (range, 7-10; standard deviation [SD], 0.79) and 6.35 (range, 3-10; SD, 2.17), respectively; mean Harris Hip Scores were 28.64 (range, 19-41; SD, 6.98) and 43.88 (range, 23-71; SD, 16.38), respectively; and mean WOMAC scores were 75.70 (range, 92-59; SD, 9.70) and 63.70 (range, 78-44; SD, 11.37), respectively. All values were statistically significant ( $P < .05$ ) for Student's *t* test and Wilcoxon signed-rank test. Eight patients reported  $\geq 50\%$  pain relief at 6-month follow-up. No side effects were reported.

Use of this technique for hip pain control is controversial. In our experience, percutaneous radiofrequency lesioning of the sensory branches of the nerves innervating the hip joint can be an option for patients with intractable hip joint pain.



**Figure:** Fluoroscopic image showing the the tip of the needle placed below the inferior anterior iliac spine near the anterolateral margin of the hip joint (approach to sensory branches of the femoral nerve).

*Drs Rivera, Mariconda, and Annaratone are from the Department of Orthopedic Trauma and Rehabilitation Sciences, Presidio Sanitario Gradenigo, Torino, Italy.*

*Drs Rivera, Mariconda, and Annaratone have no relevant financial relationships to disclose.*

*Correspondence should be addressed to: Fabrizio Rivera, MD, Presidio Sanitario Gradenigo, Via Servais 200 A 16, Torino, Italy (rivgio@libero.it).*

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Despite total hip arthroplasty (THA) becoming the most common surgical method for the treatment of arthritis pain of the hip joint, the presence of multiple comorbidities sometimes represents a contraindication for THA. In these patients, conventional drugs have too many side effects or are ineffective. Several methods of neurolysis are available: surgical, chemical, and radiofrequency thermocoagulation. Percutaneous radiofrequency neurolysis is unique among these methods; the lesion is controlled and the morbidity is low. Radiofrequency denervation has been applied in patients affected by chronic articular pain, including facet joint pain and shoulder pain. Although percutaneous denervation of the hip joint was introduced in 1981,<sup>1</sup> few reports in the literature describe the results of the procedure,<sup>2-6</sup> probably due to the progressive improvements in surgical and anesthesiological techniques in THA that have decreased contraindications for surgery.

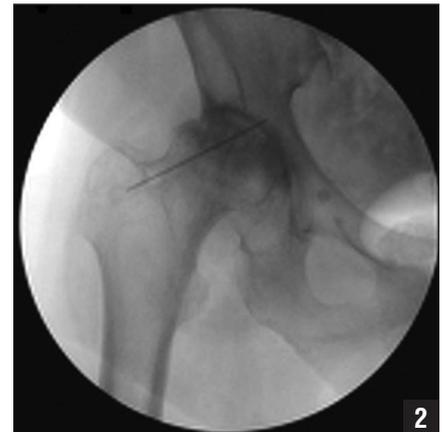
To eliminate pain in patients with several contraindications for THA, we performed a prospective, randomized study of 18 patients. Hip joint pain was treated by percutaneous radiofrequency lesioning of the sensory branches of the obturator and femoral nerves.

## MATERIALS AND METHODS

Ethical Committee approval was obtained for this prospective study. Between January 2009 and October 2010, eighteen patients with chronic hip pain with several contraindications for THA were selected. Written informed consent was obtained from each patient. All patients underwent a common protocol designed for this study: inclusion criteria, Harris Hip Score,<sup>7</sup> visual analog scale (VAS), Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC),<sup>8</sup> block test, and denervation. Predenervation diagnosis was osteoarthritis in 16 patients and prolonged postoperative hip pain in 2 (1 THA, 1 Girdlestone).



**Figure 1:** Fluoroscopic image showing the tip of the needle placed at the site below the inferior junction between the ischium and the pubis (medial approach to sensory branches of the obturator nerve).



**Figure 2:** Fluoroscopic image showing the tip of the needle placed below the inferior anterior iliac spine near the anterolateral margin of the hip joint (approach to sensory branches of the femoral nerve).

Inclusion criteria were contraindications for THA, radiographic Tönnis grades I and II,<sup>9</sup> and groin, thigh, and trochanteric pain. An articular branch block test using 3 mL of ropivacaine hydrochloride 10 mg/mL was performed in all 18 patients under fluoroscopic control using the same technique of denervation described below. Intra-articular hip blocks were not performed. Pain disappeared immediately in 17 of 18 patients. One patient (prolonged hip pain in THA) was excluded from the study. The efficacy of anesthetic block in the remaining 17 patients was transient (1-3 days). After a variable period from 5 to 16 days, percutaneous radiofrequency lesioning of the sensory branches of the obturator and femur was performed.

Patients were placed in the supine position. The first step was denervation of the sensory branch of obturator nerve. 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. Under fluoroscopy, the tip of the needle was placed at the site below the inferior junction between the ischium and the pubis, which is teardrop shaped in the anteroposterior view (Figure 1). A 22-gauge

electrode with a 5-mm exposed tip (Baylis Medical Company Inc, Montreal, Quebec, Canada) was used for denervation using a current supplied by the radiofrequency generator (Baylis Medical Company Inc). The precise tip of the needle was verified by electrical stimulation of the target nerve. A sensory stimulation at 50 Hz, up to 0.7 V, was made to cause paresthesia and elicit groin and thigh pain similar to the usual pain of the patient to confirm the exact position of the tip. Then, a growing motor stimulation at 2 Hz, up to 0.9 V, was made to exclude muscle contractions for the presence of motor branch near the electrode. After 1 cc of 1% lidocaine, radiofrequency thermocoagulation was performed at 90°C for 90 seconds.

The second step was denervation of the sensitive branch of femoral nerve. The needle was inserted by anterolateral approach, and the tip was placed below the inferior anterior iliac spine near the anterolateral margin of the hip joint (Figure 2). Sensory test and motor test to exclude femoral muscle contraction were performed. After 1 cc of 1% lidocaine, radiofrequency thermocoagulation was performed.

Patients were evaluated preanesthetic block, prelesioning, and at 1- and 6-month follow-up using VAS scores, Harris Hip

Scores, and WOMAC scores. The standard deviation (SD) was calculated for each parameter preanesthetic block and at 6-month follow-up. Student's *t* test and Wilcoxon signed-rank test were used for paired comparisons when the data were normally distributed.

## RESULTS

Before radiofrequency and at 6-month follow-up, mean VAS scores were 9.52 (range, 7-10; SD, 0.79) and 6.35 (range, 3-10; SD, 2.17), respectively; mean Harris Hip Scores were 28.64 (range, 19-41; SD, 6.98) and 43.88 (range, 23-71; SD, 16.38), respectively; and mean WOMAC scores were 75.70 (range, 92-59; SD, 9.70) and 63.70 (range, 78-44; SD, 11.37), respectively. All values were statistically significant ( $P < .05$ ) for Student's *t* test and Wilcoxon signed-rank test. Eight patients reported  $\geq 50\%$  pain relief at 6-month follow-up. No side effects were reported. Three hematomas in the inguinal zone and internal groin zone were observed 1 day postoperatively.

## DISCUSSION

The sensory nerves supplying the hip joint include the articular branches of the obturator, femoral, and superior gluteal nerve (the articular branch of the nerve to the quadratus femoris) from the sciatic nerve. Sensory anterior capsular branches can be present in the anteromedial portion of the capsule.<sup>10</sup> Major symptoms of patients with hip pain include groin, thigh, and trochanteric pain. Groin and thigh pain arise from sensory branches of the obturator nerve, whereas trochanteric pain arises from sensory branches of the femoral nerve.<sup>3,4,10</sup>

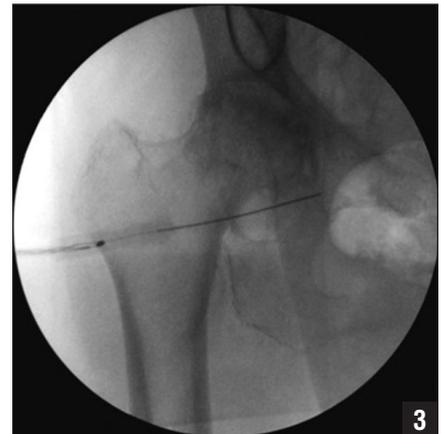
Denervation of the hip for pain relief in chronic arthritis is not a new surgical strategy. Prior to the introduction of THA in orthopedic practice, denervation was used to relieve pain in hip osteoarthritis. Many open surgical approaches were proposed to obtain sections of the capsular branch, particularly neurotomy of the ob-

turator nerve and the section of the nerve to the quadratus femoris.<sup>7</sup>

Anesthetic obturator nerve block was used to eliminate pain in the arthritic hip. In 1 pilot study, computed tomography guidance was used in 15 patients with chronic hip pain and osteoarthritis to perform obturator block.<sup>11</sup> The study reported pain relief in 7 of 15 patients for 3 to 11 months with lidocaine 1%.<sup>11</sup> This study has not been reproduced, but local anesthetic does not cause long-term neurolysis, and to obtain long-term effects, other neurolytic procedures would be necessary. Other studies using a blind anatomical approach to the obturator nerve and to the quadratus femoris nerve as a means to alleviate pain in the arthritic hip reported a decrease in pain within 2 weeks of injection, but the pain subsequently increased to preinjection levels.<sup>2,6</sup> These authors concluded that the hip nerve regional blockade offers no useful relief of osteoarthritis pain of the hip joint.<sup>2</sup>

In the past 20 years, the use of radiofrequency has become popular. Denervation of the hip was proposed in 1981 in the Japanese literature,<sup>1</sup> but in 1993, Okada<sup>5</sup> reported on 15 patients undergoing radiofrequency lesioning of the sensory branches of the obturator, femoral, and sciatic nerves. In most cases, patients obtained pain relief after the procedure.

The exact mechanisms of action of radiofrequency denervation are unknown. Radiofrequency is a neurolytic technique that uses heat to produce controlled tissue destruction (thermocoagulation). The tip of the electrode is usually placed near the target nerve. An electric current is then passed through the electrode, which heats up the surrounding tissue (because of the resistance produced by the body) and causes the lesion around the hip. Two types of radiofrequency are used. Continuous radiofrequency uses a constant output of high-frequency electric current to produce a high temperature, and pulsed radiofrequency uses brief pulses of high-voltage electric current to



**Figure 3:** Fluoroscopic image showing the tip of the electrode placed at the site below the inferior junction between the ischium and the pubis (lateral approach to sensory branches of the obturator nerve).

produce the same voltage fluctuation as conventional radiofrequency but without heating to a degree that causes tissue coagulation.<sup>12</sup> Continuous radiofrequency is indicated in the treatment of hip arthritis with contraindications for THA to obtain permanent sensory nerve damage and thereby stop nociceptive conduction.

Use of this technique for hip pain control has become popular recently. Reports in the literature have increased in the past 10 years due to improvements to radiofrequency instruments.<sup>3,4,13</sup> Kawaguchi et al<sup>1</sup> reported a series of 14 patients with non-operable hip arthritis treated by femoral and obturator lesion. In this series, 86% of patients reported  $\geq 50\%$  pain relief from 1 to 11 months. No side effects or motor weaknesses were observed.<sup>1</sup> Malik et al<sup>4</sup> reported on 4 patients with anterior or lateral hip pain who underwent percutaneous lesioning of the sensory branches of femoral and obturator nerves at 60°C to 80°C for 90 seconds. Function improved and pain decreased in all patients.<sup>4</sup> Because the use of thermal coagulation can represent a potential risk of neuritis or neuroma formation,<sup>14</sup> Wu and Groner<sup>13</sup> proposed the pulsed radiofrequency method as an alternative to thermal lesion of the articular branches of the obturator and femoral nerves. They treated 2 patients, and by

3-month follow-up,  $\geq 50\%$  pain relief was reported by both.

By using the motor test to exclude muscle contraction, hip denervation is a safe procedure. In our series, we observed 1 complication: 3 cases of transitory hematoma caused by vessel puncture. The original technique describes a perpendicular approach to the articular branch of the obturator nerve. This type of electrode positioning can cause puncture of the femoral artery or vein. According to Locher et al,<sup>15</sup> after our complications, we began to use a lateral approach, introducing the electrode at a 70° angle with the sagittal plane and 20° with the transverse plane to always avoid the vessels (Figure 3). Another advantage of the lateral approach to the articular branch of the obturator nerve is the possibility to place the electrode almost parallel to the target nerve, theoretically the most effective positioning to obtain denervation.<sup>15</sup> Using the lateral approach to the articular branch of the obturator nerve in the last 9 of 18 patients in our series, hematomas were not observed.

## CONCLUSION

Percutaneous radiofrequency lesioning of the sensory branches of the nerves innervating the hip joint can be an option for patients with intractable hip joint pain and

an alternative treatment of hip arthritis with contraindications for THA (eg, medically contraindicated patients, avascular necrosis, failed THA, patients with end-stage disease). A percutaneous approach allows for minimal discomfort to patients during treatment. By performing sensory and motor testing before radiofrequency, major complications can be avoided. 

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