

# Treatment of Intractable Hip Pain after THA and GTB Using Peripheral Nerve Field Stimulation: A Case Series

Alexander E. Yakovlev, MD; Beth E. Resch, APNP; Sergey A. Karasev, MD

## ABSTRACT

**Objective:** It has been estimated that 10%-35% of patients who undergo total hip arthroplasty (THA) have chronic postoperative pain, most often located at the greater trochanter. After greater trochanteric bursectomy (GTB), patients also may continue to experience chronic surgical site pain. Chronic pain has a neuro-pathic component, which often responds poorly to opioids. In an attempt to provide increased pain relief for patients with intractable chronic pain, unconventional agents and interventional management approaches have received considerable attention. Peripheral nerve field stimulation (PNFS) has been used with increased frequency as a minimally invasive and safe intervention for the management of intractable neuropathic postoperative pain. The objective of this retrospective study was to evaluate the efficacy of PNFS for treatment of chronic hip pain after THA and GTB.

**Methods:** Twelve patients with chronic post-operative pain after THA and GTB underwent an uneventful PNFS trial with percutaneous placement of 2 temporary 8-electrode leads (Medtronic Inc, Minneapolis, Minn) positioned in the subcutaneous tissue in the area of greatest pain, parallel to postoperative scar over the affected upper lateral thigh.

**Results:** After experiencing excellent pain relief over the next 2 days, the patients were implanted with permanent leads and rechargeable or non-rechargeable generator 2-4 weeks later. They reported sustained pain relief at 12-month follow-up visits.

**Conclusion:** PNFS provides an effective alternative treatment option for select patients with chronic postoperative pain after THA and GTB who have failed conservative treatment.

## INTRODUCTION

The incidence of chronic pain as an outcome of surgery following many procedures—including amputation, mastectomy, thoracotomy, sternotomy, cholecystectomy, inguinal hernia repair, dental procedures, vasectomy, prostatectomy, knee meniscectomy and total joint replacement—is well documented.<sup>1,2</sup> More than 10% of patients who undergo joint replacement continue to experience pain at the affected joint.<sup>3,4</sup> A study including more than 1200 patients who had undergone total hip arthroplasty (THA) reported that 28% of patients had ongoing pain at the surgical site at 12 to 18 months follow-up, and more than 12% had pain that limited their daily activities to a moderate, severe or very severe degree.<sup>3</sup> Another study of patients who had undergone THA reported the incidence of chronic post-operative pain to be as high as 16% when patients were seated and 35% when walking, with a duration of post-operative follow-up ranging from 42 to 171 months.<sup>5</sup>

The etiology of chronic pain in THA, like other chronic pain syndromes, is multifactorial and presumably due to neuropathic,<sup>1</sup> nociceptive,<sup>6</sup> and psychosocial<sup>7</sup> components. Pain following greater trochanteric bursectomy (GTB) and THA is most often located in the trochanteric area and is described as neuropathic burning with dysesthesia and allodynia.<sup>3</sup> Neuropathic pain is known to respond favorably to neuromodulation therapy and poorly to opioids. Peripheral nerve field stimulation (PNFS) has been used to treat a variety of neuropathies,<sup>8</sup> including ileoinguinal,<sup>9</sup> occipital,<sup>10-13</sup> post-herpetic,<sup>14</sup> intercostals,<sup>15</sup> trigeminal postherpetic neuralgia and trigeminal

---

**Author Affiliations:** Comprehensive Pain Management of the Fox Valley, SC, Appleton, Wis (Yakovlev, Resch); Samara Medical University, Department of Neurosurgery, Samara, Russia (Karasev).  
**Corresponding Author:** Alexander Yakovlev, MD, Comprehensive Pain Management of the Fox Valley, SC, 820 E Grant St, Suite 335, Appleton, WI 54911; phone 920.733.7230; fax 920.733.7231; e-mail aeyakovlev@yahoo.com.



**Figure 1.** Post-surgical scar at upper lateral thigh at the area of maximal pain.

posttraumatic neuropathic pain,<sup>16-18</sup> headaches,<sup>19</sup> and back pain<sup>20-24</sup> with excellent relief of pain and reduced need for oral pain medications.

## MATERIALS AND METHODS

Twelve patients with persistent post-operative pain after THA and GTB underwent a PNFS trial between April 2006 and May 2008. The objective of this retrospective study was to evaluate the efficacy of PNFS for treatment of chronic hip pain after THA and GTB. Ten patients were female (83.3%), and 2 were male (16.6%). Their ages ranged from 57 to 72 years, with a mean age of 65 years. All of the patients had over 12 months pain duration. No patients were involved in active litigation. A distant history of drug and alcohol abuse was noted in 3 (25%) patients. All patients had previously failed conservative therapies including physical therapy, Transcutaneous electrical nerve stimulation (TENS), opioid and non-opioid pain medications, and trigger point injections. Four patients (33.3%) had Botox® injections at the hip area. No further surgical interventions were indicated.

The patients described their pain as being constantly burning, aching, and stabbing over the upper lateral thigh in the area of the post-surgical scar (Figure 1). On physical examination, all of the patients had tenderness on palpation over the involved area, with allodynia and hyperpathia along the post-operative scar. Chronic pain medication regimens before and during the trial included 1 or more of the following: gabapentin, pregabalin, darvocet, oxycodone, hydrocodone, morphine, hydromorphone, fentanyl patch, nonsteroidal anti-

inflammatory medications, lidocaine patches, and topical ointments. None of these regimens gave the patients significant pain relief. The patients did not use any alternative pain modalities, such as acupuncture. Each patient was counseled on treatment options including continuing with current treatment or trying PNFS therapy. Patients elected to proceed with PNFS therapy.

All patients underwent a successful 2-day trial of percutaneous placement of 2 8-electrode Standard Octad Leads (Medtronic Inc, Minneapolis, Minn) after passing a psychological evaluation for an implantable device and signing informed consent. After local infiltration of 1% lidocaine, 2 14-gauge Tuohy needles were advanced in the subcutaneous tissue in the area of greatest pain, parallel to the postoperative scar over the affected lateral thigh. Leads were advanced through the Tuohy needles, and then the needles were removed while the leads stayed in position. Leads were then connected to a temporary external stimulator via an extension cord. During the 2-day PNFS trial, the patients reported >50% reduction in visual analog scale (VAS) pain scores.

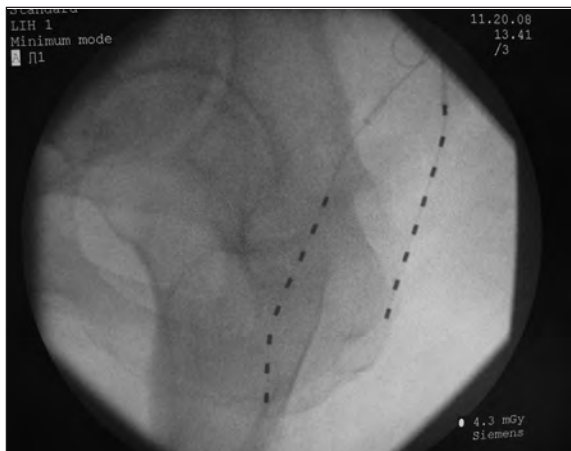
Two to 4 weeks later, the patients underwent implantation with permanent leads (Figure 2) and generators. Each of the 2 permanent leads were anchored to fibroaponeurotic tissue in the wound, created along the superior aspect of the post-operative THA scar with 2-0 nonabsorbable suture of braided polyester (Ethibond) and Titan Anchors (Medtronic Inc, Minneapolis, Minn). The leads were tunneled to the left or right supragluteal area (based on patient choice) where the subcutaneous pocket was created for the generator (Figure 3). Leads were then connected to RestorePRIME non-rechargeable or RestoreULTRA (Medtronic Inc, Minneapolis, Minn) rechargeable generators. The procedures were performed in an ambulatory surgery center with intravenous sedation and local anesthesia administered by the surgeon. The post-operative courses were uneventful for each patient. Patients reported no side effects from PNFS therapy.

The implanted stimulators were programmed using an alternating electrode configuration with a pulse width of 400 to 450 microseconds and a rate of 50 to 60 Hz. The amplitude use ranged from 0.5 to 5.3 volts.

Electrode polarities were set as follows:

- First lead: 0(+) 1(-) 2(+) 3(-) 4(+) 5(-) 6(+) 7(-)
- Second lead: 8(-) 9(+) 10(-) 11(+) 12(-) 13(+) 14(-) 15(+)

The patients each reported that the stimulation covered 100% of their painful areas following the initial programming.



**Figure 2.** Final position of implanted leads over affected lateral thigh.



**Figure 3.** The subcutaneous pocket made in supragluteal region for RestoreULTRA rechargeable generator.

## RESULTS

No complications were reported during the PNFS trial, permanent implantation and post-operative period. All patients had at least a 50% reduction in pain as assessed by VAS score, where 0 is no pain and 10 is the worst pain imaginable, at 48 hours after PNFS trial. A 50% reduction in VAS was considered clinically significant. Patients were implanted with permanent leads and rechargeable and non-rechargeable generator within 2-4 weeks. Patients reported sustained pain relief at 12 months. Eight patients had reprogramming of PNFS in the first 6 weeks after the surgery. Four patients needed additional training sessions about the use of their recharging devices postoperatively.

VAS scores prior to implant ranged from 6 to 9, with a mean pain score of 7.5. At 12-month follow-up, all patients reported significant pain relief with the permanent stimulator; their VAS scores ranged from 1 to 4, with a mean pain score of 2 (>50% reduction in VAS).

Stimulator parameters were in the same range during PNFS trial. Ten patients (83.3%) were using the PNFS 24 hours per day, adjusting stimulation intensity for changes in intensity of pain with good pain relief. The other 2 patients (16.6%) were turning on the PNFS only during the day hours. All patients were able to decrease or discontinue use of pain medications. Two patients (16.6%) continued to use lidocaine patches, and 1 patient (8.3%) continued to use pregabalin. Patients also reported other positive outcomes, including the ability to return to social, recreational, and sporting activities.

## DISCUSSION

PNFS alleviates pain by subdermal stimulation of the peripheral fibers, which may prevent transmission of

painful impulses to the central nervous system. The neuromodulating effects of electrical stimulation are based on the tenets of the “gate-control theory” of pain proposed by Melzack and Wall in 1965.<sup>25</sup> Based on this theory, it is hypothesized that PNFS “closes the gate” to pain transmission by activating large-diameter afferent fibers via application of an electric field. PNFS may also alter local blood flow, cause release of endorphins, affect neurotransmitters and axonal conduction, and block cell membrane depolarization.<sup>25</sup> The mechanism of action of PNFS and neuromodulation in general continues to be investigated, since there may be a multitude of ways in which neuromodulation affects pain transmission. A limitation of the study is that this retrospective study design does not include a nonintervention group (control) or quality-of-life measurements, and therefore we cannot decisively determine that the measurable outcome is a result of the PNFS alone.

This retrospective study demonstrates that PNFS may provide a safe, effective, and convenient treatment option for patients suffering from chronic neuropathic pain after THA and GTB. This novel approach for the treatment of this condition may find a niche in the treatment of select patients. PNFS has a number of advantages over many conservative treatments and more-invasive techniques, including a lack of side effects. One reason for the high success rate of PNFS may be that patients are able to test the efficacy of the device prior to implantation. The therapy is completely reversible if for some reason therapy becomes contraindicated or is no longer needed. Additionally, manual programming permits patients to control the level of

stimulation required to control their degree of pain. This enables patients to take a more active role in their pain management.

## CONCLUSION

We present the treatment of chronic post-operative pain following THA and GTB that has been successfully treated with PNFS. This technique may be a safe and effective treatment for patients who have failed to find relief with more conservative measures or who are not appropriate candidates for more invasive interventional pain or surgical procedures based on their comorbid health conditions. PNFS has provided patients with satisfactory pain relief without the side effects of previous medication therapy. In our opinion, PNFS offers a safe and effective treatment method that is completely reversible should a patient lose its pain-alleviating effect. These patient outcomes provide support for PNFS as an alternative treatment option for patients with chronic postoperative hip pain and hopefully will inspire interest in prospective studies comparing peripheral nerve field stimulation to other therapies.

**Funding/Support:** None declared.

**Financial Disclosures:** None declared.

## REFERENCES

1. Perkins FM, Kehlet H. Chronic pain as an outcome of surgery. *Anaesthesiology*. 2000;93:1123-1133.
2. Macrae WA. Chronic pain after surgery. *Br J Anaesth*. 2001;87:88-98.
3. Nikolajsen L, Brandsborg B, Lucht U, Jensen TS, Kehlet H. Chronic pain following total hip arthroplasty: a nationwide questionnaire study. *Acta Anaesthesiol Scand*. 2006;50:495-500.
4. Elson DW, Brenkel J. A conservative approach is feasible in unexplained pain after knee replacement: a selected cohort study. *J Bone Joint Surg (Br)*. 2007;89-B:1042-1045.
5. Johnsson R, Thorngren KG. Function after total hip replacement for primary osteoarthritis. *Int Orthop*. 1989;13:221-225.
6. Gwilym SE, Pollard TCB, Carr AJ. Understanding pain in osteoarthritis. *J Bone Joint Surg (Br)*. 2008;90-B:280-287.
7. Woolf AD, Pfleger B. Burden of major musculoskeletal conditions, policy and practice. special theme-bone and joint decade 2000-2010. *Bull World Health Organ*. 2003;81:646-656.
8. Van Buyten J-P, Van Zundert J, Milbouw G. Treatment of failed back surgery syndrome patients with low back and leg pain: a pilot study of a new dual lead spinal cord stimulation system. *Neuromodulation*. 1999;2:258-265.
9. Stinson LW Jr, Roderer GT, Cross NE, Davis BE. Peripheral subcutaneous electrostimulation for control of intractable post-operative inguinal pain: a case report series. *Neuromodulation*. 2001;4:99-104.
10. Slavin KV, Nersesyan H, Wess C. Peripheral neurostimulation for treatment of intractable occipital neuralgia. *Neurosurgery*. 2006;58:112-119.
11. Johnstone CS, Sundaraj R. Occipital nerve stimulation for the treatment of occipital neuralgia-8 case studies. *Neuromodulation*. 2006;9:41-47.
12. Oh MY, Ortega J, Bellotte JB, Whiting DM, Aló K. Peripheral nerve stimulation for the treatment of occipital neuralgia and transformed migraine using a C1-2-3 subcutaneous paddle style electrode: a technical report. *Neuromodulation*. 2004;7:103-112.
13. Weiner RL, Reed KL. Peripheral neurostimulation for control of intractable occipital neuralgia. *Neuromodulation*. 1999;2:217-221.
14. Yakovlev A, Peterson A. Peripheral nerve stimulation in treatment of intractable postherpetic neuralgia: a case report. *Neuromodulation*. 2007;10:373-375.
15. Tamimi MA, Davids HR, Langston MM, Krusch JP, Yakovlev A, Barolat G. Successful treatment of chronic neuropathic pain with subcutaneous peripheral nerve stimulation. *Neuromodulation*. 2009;12:210-214.
16. Johnson MD, Burchiel KJ. Peripheral stimulation for treatment of trigeminal postherpetic neuralgia and trigeminal posttraumatic neuropathic pain: a pilot study. *Neurosurgery*. 2004;55:135-141.
17. Slavin KV, Wess C. Trigeminal branch stimulation for intractable neuropathic pain: technical note. *Neuromodulation*. 2005;8:7-13.
18. Oberoi J, Sampson C, Ross E. Head and neck peripheral stimulation for chronic pain report of 3 cases. *Neuromodulation*. 2008;11:272-276.
19. Yakovlev AE, Resch BE. Peripheral nerve stimulation (PNS) for treatment of intractable headaches associated with lyme disease. *Pain Med*. 2009;10(1):224.
20. Yakovlev AE, Resch BE. Peripheral nerve field stimulation for treatment of pain related to spine deformities. *Pain Med*. 2009;10(1):223.
21. Yakovlev AE, Resch BE. Peripheral nerve field stimulation (PNFS) for treatment of postlaminectomy syndrome in patients with implanted intrathecal pain pumps. *Pain Med*. 2009;10(1):221-222.
22. Krusch JP, McCeney MH, Barolat G, Tamimi MA, Smolenski A. A case report of subcutaneous peripheral nerve stimulation for the treatment of axial back pain associated with postlaminectomy syndrome. *Neuromodulation*. 2008;11:112-115.
23. Bernstein CA, Paicius RM, Barkow SH, Lempert-Cohen C. Spinal cord stimulation in conjunction with peripheral nerve field stimulation for the treatment of low back and leg pain: case series. *Neuromodulation*. 2008;11:116-123.
24. Paicius RM, Bernstein CA, Lempert-Cohen C. Peripheral nerve field stimulation for the treatment of chronic low back pain. preliminary results of long term follow-up: a case series. *Neuromodulation*. 2007;10:279-290.
25. Melzack R, Wall PD. Pain mechanisms: a new theory. *Science*. 1965;150:971-979.

advancing the art & science of medicine in the midwest

**WMJ**

*WMJ* (ISSN 1098-1861) is published through a collaboration between The Medical College of Wisconsin and The University of Wisconsin School of Medicine and Public Health. The mission of *WMJ* is to provide an opportunity to publish original research, case reports, review articles, and essays about current medical and public health issues.

© 2010 Board of Regents of the University of Wisconsin System and The Medical College of Wisconsin, Inc.

**Visit [www.wmjonline.org](http://www.wmjonline.org) to learn more.**