

# Clinical Case: 3 Tesla MR Neurography-Guided Posterior Femoral Cutaneous Nerve Block

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## Background

The posterior femoral cutaneous nerve (PFCN), formerly known as the small sciatic nerve, is a sensory nerve formed by the sacral plexus (Fig. 1). It provides innervation to the posterior thigh into the popliteal area via its descending cutaneous branch and innervation to the proximal medial thigh, the perineum, scrotum/labia, and penis/clitoris via its perineal branch. Additionally, the inferior cluneal branches innervate the inferior buttocks.

Posterior femoral cutaneous neuropathy is an important differential consideration in the setting of posterior thigh, perineal, and gluteal pain. Causes include repetitive trauma such as from cycling or irritation in the setting of hamstring tendinopathy at the ischial tuberosity. Neuropathy

can affect the nerve at different levels throughout its course: Involvement of the cluneal branches manifests as clunealgia, the descending cutaneous branches as posterior thigh pain, and the perineal branches as pelvic pain. Isolated neuropathy of the perineal branch of the PFCN is difficult to distinguish from pudendal neuropathy due to the overlapping innervation of the perineum [1].

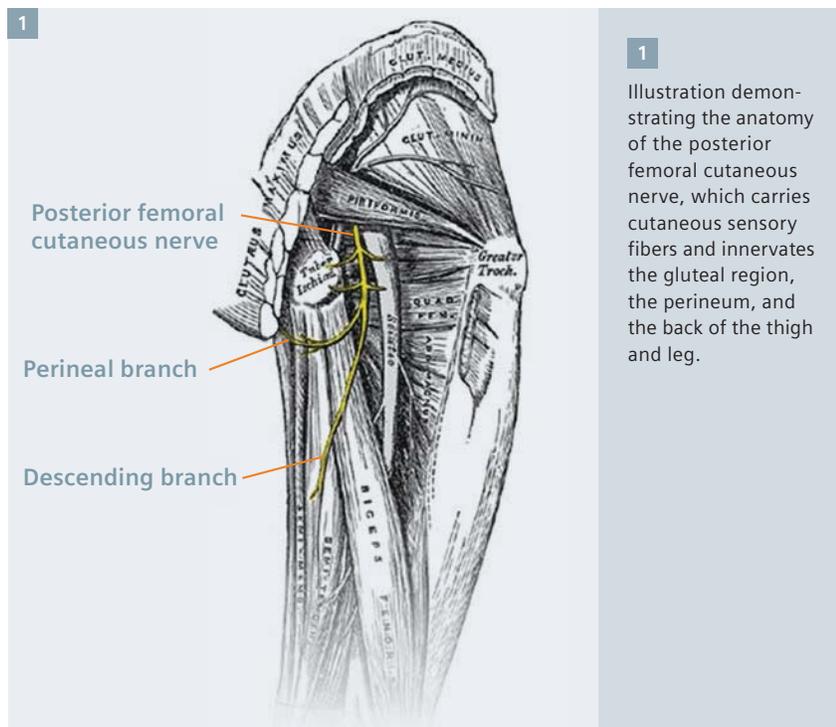
Selective diagnostic blocks of the PFCN can be helpful in this setting to assess the contribution of the nerve to patient symptoms and to localize a surgical target. Early injection techniques have been based on targeting near the ischial tuberosity without imaging guidance. While techniques utilizing computed tomography (CT) have also been described, high-reso-

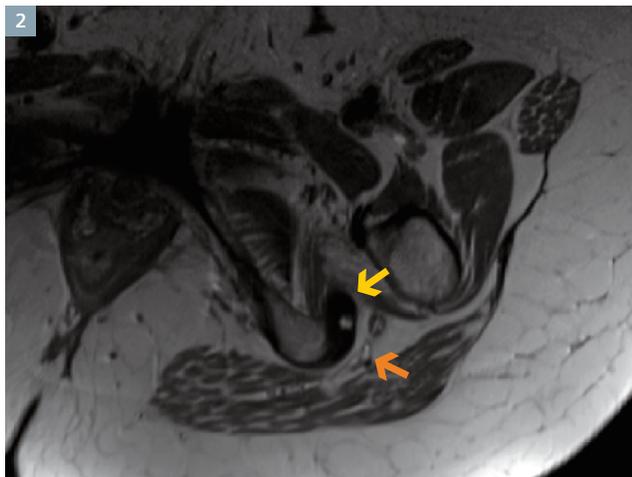
lution 3 Tesla (T) magnetic resonance neurography (MRN) enables highly accurate visualization of the PFCN [2]. As such, an MR-conditional needle can be utilized for precise targeting and monitored perineural drug delivery. The gains in signal-to-noise at 3T when compared to 1.5T or lower field open scanners, enable rapid acquisition of high-resolution MR images for definite identification, guidance and targeting of the PFCN, thus facilitating technically successful and highly valid injection.

## Case scenario

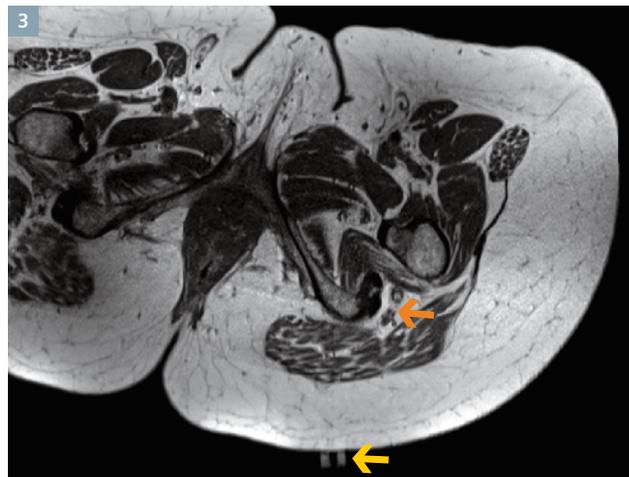
This 48-year-old African American woman with 9 out of 10 left buttocks pain that radiated into the perineum and posterior left thigh was referred by a peripheral nerve surgeon for a diagnostic perineural injection of the left posterior femoral cutaneous nerve with a long-acting local anesthetic agent. Leading differential diagnoses included PFCN and pudendal neuropathy. The PFCN block was requested to be performed proximally along the nerve's course near the ischial tuberosity, prior to the origin of the perineal branch of the PFCN.

The procedure was performed on a 3T MR imaging (MRI) system (MAGNETOM Skyra). For pre-procedural planning, high-resolution MR neurography was performed through the pelvis including the PFCN. Non-fat saturated proton density (PD) turbo spin echo (TSE) images (TR 7110 ms, TE 28 ms, matrix 640 × 400, FOV 35 × 28 cm, GRAPPA iPAT 2, slice thickness 2 mm) were acquired to evaluate and localize the posterior femoral cutaneous nerve using the body matrix coil and elements of the in-built spine matrix for signal reception posterior femoral

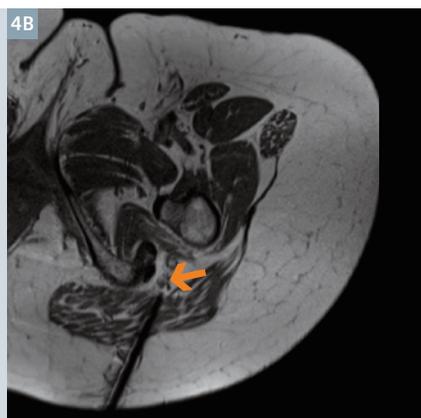




**2** Axial proton density-weighted MR image obtained for pre-procedural planning demonstrates tendinopathy at the left hamstring origin from the ischial tuberosity (yellow arrow) in addition to focal hyperintensity within the left posterior femoral cutaneous nerve (orange arrow). The latter finding is consistent with the patient's history of posterior femoral cutaneous neuropathy.



**3** Axial proton density-weighted MR image performed for skin entry site localization demonstrating the position of the skin marker (yellow arrow) relative to the posterior femoral cutaneous nerve (orange arrow).



**4** Sequential proton density-weighted MR images demonstrate advancement of the needle to the posterior femoral cutaneous nerve (orange arrows). In the final image (4B), the needle tip (yellow arrow) is located adjacent to the posterior femoral cutaneous nerve.

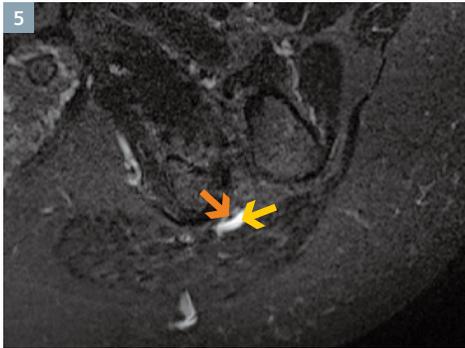
cutaneous (Fig. 2). On these initial images, an intermediate grade partial thickness tear of the left hamstring origin was noted as well as minimal hyperintensity involving the left posterior femoral cutaneous nerve. A modified PD TSE pulse sequence images (TR 2500 ms, TE 20 ms, matrix 512 × 384, FOV 35 × 22 cm, GRAPPA iPAT 2, slice thickness 2 mm) aforementioned sequence was repeated for identification of the skin entry point and for subsequent monitoring of the needle position (Fig. 3)\*. Optimization of scan

parameters and reduction of the number of slices to 5 resulted in a scan acquisition time of 20 seconds.

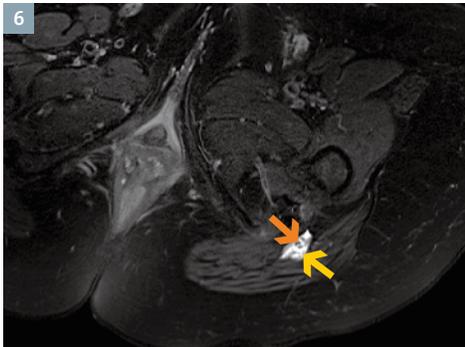
Once the skin entry site was selected, the skin over the left posterior proximal thigh was prepared and draped using sterile technique. Local anesthesia was achieved with a subcutaneous injection of 1% lidocaine. Under intermittent MRI guidance utilizing the aforementioned PD TSE sequence, a 10 cm 20 gauge needle was advanced adjacent to the left posterior femoral cutaneous nerve

(Fig. 4). A test injection of 0.5 ml of sterile normal saline was performed followed by axial STIR images (TR 3500 ms, TE 68 ms, matrix 384 × 275, FOV 35 × 22 cm, GRAPPA iPAT 2, slice thickness 4 mm) demonstrating appropriate fluid distribution around the PFCN (Fig. 5). Subsequently, circumferential perineural drug delivery was accomplished utilizing 3 ml of ropivacaine and 1 ml of Kenalog 40 as confirmed on post-procedural fat saturated T2-weighted images confirmed accumulation of fluid around

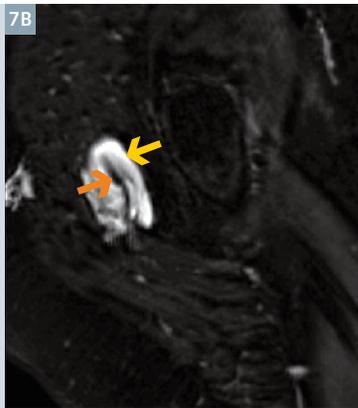
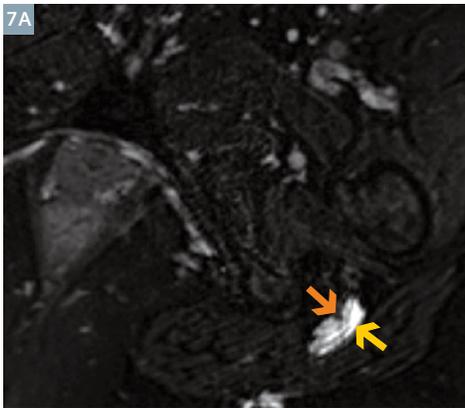
\*Metal: The MRI restrictions (if any) of the metal implant must be considered prior to patient undergoing MRI exam. MR imaging of patients with metallic implants brings specific risks. However, certain implants are approved by the governing regulatory bodies to be MR conditionally safe. For such implants, the previously mentioned warning may not be applicable. Please contact the implant manufacturer for the specific conditional information. The conditions for MR safety are the responsibility of the implant manufacturer, not of Siemens.



**5** Axial STIR MR image acquired following the injection of 0.5 ml of sterile normal saline demonstrate appropriate fluid distribution (yellow arrow) around the posterior femoral cutaneous nerve (orange arrow).



**6** Post-procedural T2-weighted images obtained with spectral fat saturation demonstrate the PFCN (orange arrow) bathing in ropivacaine and steroid following the injection of a total of 4 ml of the solution (yellow arrow).



**7** Three-dimensional fat saturated T2-weighted (TR 1600, TE 120) SPACE images with isotropic voxel sizes enables multi-planar reconstructions in any arbitrary plane. For post-injection imaging, this is useful as the nerve (orange arrows) can be evaluated both in standard planes (**7A**) and oblique planes along its longitudinal course (**7B**). The yellow arrows indicate the injectant.

the PFCN (TR 4000, TE 70, 488 × 384, FOV 35 × 22 cm, GRAPPA iPAT 2, 3 mm slice thickness) (Figs. 6, 7).

Following the procedure, the patient demonstrated exclusive anesthesia in PFCN distribution with post-procedural loss of light touch and pain sensation, confirming the technical success of the injection. The patient's pain improved to 2 out of 10, representing a positive pain and identifying the PFCN as a major contributor to the patient's pain syndrome. The patient was discharged the same day in excellent condition. No complications occurred.

### Discussion

The high signal-to-noise ratio available with a state-of-the-art 3T MR imaging system provides the unprecedented ability to perform high-resolution MR neurography-guided perineural injections for highly accurate visualization of small nerve as well as needle targeting and perineural injection. This case report demonstrates how this techniques facilitates accurate targeting of the PFCN. High-resolution MR neurography is advantageous because of its unparalleled pairing of high contrast and spatial resolution, which is in contradistinction to blindly performed blocks or blocks performed under fluoroscopic or CT guidance. MRI is the preferred techniques due to exquisite nerve visualization, visualization of the injectants without the need of an additional contrast agent, unrestricted multiplanar imaging and finally the lack of ionizing radiation.

### Acknowledgement

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### References

- 1 Fritz, J., et al., Magnetic resonance neurography-guided nerve blocks for the diagnosis and treatment of chronic pelvic pain syndrome. *Neuroimaging Clin N Am*, 2014. 24(1): p. 211-34.
- 2 Fritz, J., et al., High-resolution magnetic resonance-guided posterior femoral cutaneous nerve blocks. *Skeletal Radiol*, 2013. 42(4): p. 579-86.



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