udendal nerve entrapment is a recognized cause of chronic perineal pain [1, 2], typically presenting as pain in the penis, scrotum, labia, perineum, or anorectal region. Pudendal nerve entrapment is a clinical diagnosis made in patients with the typical history of perineal pain aggravated by sitting, relieved by standing, and absent when recumbent or sitting on a toilet seat. No widely accepted confirmatory test is available, although a neurophysiologic examination may confirm nerve damage.

The symptoms of pudendal nerve entrapment overlap considerably with those ascribed to chronic nonbacterial prostatitis, which is the most common symptomatic type of prostatitis, or chronic pain syndrome. In the United States, chronic prostatitis is the reason for an estimated 7.8 million physician visits per year [3]; approximately 95% of men with chronic prostatitis do not have an infection [4]. The cause of chronic nonbacterial prostatitis–chronic pelvic pain syndrome remains unclear, but the syndrome has never been scientifically shown to be primarily a disease of the prostate or the result of an inflammatory process [5]. Chronic nonbacterial prostatitis causes substantial morbidity and affects the health of a patient to the same degree as do conditions such as acute myocardial infarction, unstable angina, and acute ulcerative colitis [6]. Proper diagnosis and treatment of pudendal nerve entrapment with CT-guided pudendal nerve perineural injection offer some patients with chronic nonbacterial prostatitis–chronic pelvic pain syndrome a chance of long-term pain relief.

Anatomy

The pudendal nerve enters the gluteal region through the lower part of the greater sciatic foramen (Figs. 1 and 2). The nerve is accompanied by the internal pudendal artery and is surrounded by a venous complex; together this group of structures is referred to as the neurovascular pudendal bundle. The pudendal bundle hooks around the sacrospinous ligament near its attachment to the ischial spine; the pudendal bundle first enters the perineum through the lesser sciatic foramen (Figs. 2A and 2B) and courses through the ischiocanal fossa and then through the pudendal (Alcock’s) canal that is formed by the duplication of the obturator fascia on the lateral wall of the ischiocanal fossa. Either just before entering the pudendal canal or just within it, the pudendal bundle gives rise to the inferior rectal (inferior anal) nerve, which crosses the ischiocanal fossa toward the anal canal and the external anal sphincter muscle. Within the pudendal canal, the pudendal nerve divides into two terminal branches, the perineal nerve and the dorsal nerve of the penis or clitoris (Figs. 2A and 2B).

Mechanism of Pudendal Nerve Entrapment

The pudendal nerve is predisposed to entrapment at the level of the ischial spine and within the pudendal canal [1, 2]. At the ischial spine, the nerve can be compressed between
Fig. 1.—Schematic anatomy of deep dissection of gluteal region. Most of gluteus maximus and medius muscles have been removed. Segment of sacrotuberous ligament also has been removed, revealing pudendal nerve. Pudendal nerve emerges from pelvis inferior relative to piriformis muscle and enters gluteal region medial relative to sciatic nerve, superficial relative to sacrospinous ligament, and deep relative to sacrotuberous ligament. After coursing around sacrospinous ligament, pudendal nerve re-enters pelvis. (Courtesy of the Mayo Foundation)

Fig. 2.—Schematic anatomy of pudendal nerve. (Courtesy of the Mayo Foundation)
A, Drawing illustrates pudendal nerve arising from sacral nerve roots S2–S4, exiting pelvis to enter gluteal region through lower part of greater sciatic foramen and reentering pelvis through lesser sciatic foramen. Pudendal nerve gives rise to inferior rectal nerve, perineal nerve, and dorsal nerve of penis or clitoris.
B, Drawing shows pudendal nerve in pudendal (Alcock's) canal. Inferior rectal nerve arises from pudendal nerve before entering canal. Note location of falciform process of sacrotuberous ligament, which is possible site for pudendal nerve entrapment.
Fig. 3.—Cadaver of 77-year-old man with diabetes mellitus. CT scans were obtained with cadaver prone.

A and B, Thin-slice CT scans obtained at level of ischial spine show sacrospinous (short arrows, A) and sacrotuberous (long arrows, A) ligaments and calcified internal pudendal artery (arrowhead, A) marking location of pudendal bundle. In B, transgluteal needle is visible, and injected contrast agent is seen filling interligamentous space.

C–E, In thin-section CT scans obtained at level of pudendal canal, calcified internal pudendal artery (arrowhead, C) marks site of pudendal bundle in canal, and fat plane between neurovascular bundle and obturator internus muscle is clearly seen (arrow, C). Scan (D) obtained 2.5 mm caudal to C shows transgluteal needle in fat plane lateral relative to neurovascular bundle. Contained medially by obturator fascia, injected contrast agent fills pudendal canal, obliterating fat plane (E).
Fig. 4.—Photograph of model shows view of bony pelvis from below, with sacrotuberous ligament (arrowhead) and ischial tuberosity (asterisk) displayed.

Fig. 5.—Photographs of gross dissection of cadaveric pudendal canal.
A, Photograph of dissection of cadaveric pudendal canal acquired from below (same viewpoint as in Figure 4) shows ischial tuberosity (asterisk) and sacrotuberous ligament (arrowhead). Obturator fascia is lifted by forceps. Pudendal canal and pudendal bundle (arrow) are stained with methylene blue.
B, Close-up of dissection shown in A with obturator internus fascia reflected, showing methylene blue–stained pudendal bundle and embolization coil (arrow) that was placed in contact with neurovascular bundle under CT guidance.

Fig. 6.—Images of frozen cadaveric left hemipelvis.
A, Photograph of axial section acquired at level of ischial spine after CT-guided injection of fluorescein dye and insertion of embolization coil shows sacrospinous (short arrow) and sacrotuberous (long arrow) ligaments and pudendal neurovascular bundle stained yellow in interligamentous space. At this level, sciatic nerve (asterisk) is close to pudendal nerve.
B, Radiograph of axial slice shown in A reveals embolization coil (arrow) adjacent to calcified pudendal artery in interligamentous space at level of ischial spine.
the sacrotuberous and sacrospinous ligaments. Sometimes, the nerve is ensheathed by ligamentous expansions that form a perineural compartment. At the pudendal canal, the pudendal nerve can be compressed by the faliform process of the sacrotuberous ligament (Fig. 2B). If thickened, the duplication of the obturator fascia also may act as an entrapment site [1].

CT-Guided Treatment of Pudendal Nerve Entrapment

At the Mayo Clinic, patients with symptoms of pudendal nerve entrapment who still have persistent, significant pain after receiving 6 weeks of conservative therapy (including amitriptyline hydrochloride, antiinflammatory medication, and self-care) are referred for pudendal nerve perineural injection. A CT-guided technique is used because it is more accurate than fluoroscopically guided or free-hand clinical techniques.

The needle tip is positioned adjacent to the pudendal nerve at the ischial spine in the interligamentous space or at the pudendal canal. A long-acting local anesthetic (bupivacaine hydrochloride) and a corticosteroid (methylprednisolone) are injected to provide immediate pudendal anesthesia. The injections may also bring a long-term response because the antiinflammatory effects of the steroid and steroid-induced fat necrosis can reduce inflammation in the region around the nerve and decrease pressure on the nerve itself. This treatment may be effective in 65–73% of patients [1, 7]; however, to our knowledge, no prospective studies on this topic have been published. Surgical treatment with pudendal nerve neurolysis and fasciotomy of the pudendal canal also may benefit patients with this condition [1, 8].

Anatomic Study

We undertook an anatomic study to ensure that we had a correct understanding of the anatomy of the pudendal nerve and to confirm that we could accurately localize the pudendal nerve with CT guidance. The unembalmed cadaver of a 77-year-old man who had had diabetes mellitus was scanned with CT (slice thickness, 2.5 mm) in the prone position. With CT guidance, we advanced 18-gauge needles to the expected location of the pudendal nerve at the ischial spine (Figs. 3A and 3B) and placed the needles bilaterally at the pudendal canal (Fig. 4).

At the ischial spines, we placed an angiographic embolization coil and 1 mL of fluorescent resin; we injected 0.25 mL of iopamidol (Isovue 300, Bracco Diagnostics, Princeton, NJ) on the left side at the ischial spine. At the pudendal canal, a mixture of methylene blue (0.1 mL), Isovue 300 (0.25 mL), and saline (1 mL) was injected on each side, and an embolization coil was inserted on the right (Figs. 3C–3E). The pelvis was then dissected, and the right hemipelvis was dissected for identification of the pudendal nerve at the ischial spine. We then dissected the obturator fascia to identify the pudendal nerve in the pudendal canal (Figs. 4 and 5).

The left hemipelvis was frozen and cut into 5-mm-thick slices that we examined and radiographed (Fig. 6). The tissues deep relative to the obturator internus fascia in the expected position of the pudendal canal were stained with methylene blue. Dissection of the area deep relative to the obturator fascia in the slice of interest confirmed the presence of the pudendal nerve and internal pudendal vessels surrounded by loose connective tissue. We concluded that CT would allow us to accurately identify and localize the pudendal nerve at the ischial spine and at the pudendal canal.

CT-Guided Pudendal Nerve Perineural Injection

Our protocol is to administer three sets of injections 4 weeks apart; the first two sets are given at the level of the ischial spine, and the third is given at the pudendal canal [1]. Usually the injections are bilateral; in some patients with unilateral symptoms, only the symptomatic side is injected.

For injections at the ischial spine (Figs. 7 and 8), the patient is scanned in the prone position with 2.5- to 3-mm collimation from the acetabular roof to the pubic symphysis. The ischial spine, sacrospinous and sacrotuberous ligaments, and pudendal bundle are identified. Using the standard CT-guided needle placement technique, we advance a 22-gauge spinal needle toward the pudendal bundle at the caudal portion of the ischial spine on each side. When each needle tip appears to be correctly positioned in the interligamentous space (between the sacrospinous and sacrotuberous ligaments and as close as possible to the caudal portion of the ischial spine), 0.75 mL of diluted contrast agent (5% solution of Isovue 300) is injected, and the CT examination is repeated. The contrast agent should be seen surrounding the pudendal bundle in the interligamentous space and may track inferiorly and anteriorly into the posterior portion of the pudendal canal. After repositioning and (if necessary) rescanning the patient, we inject a mixture of methylprednisolone (1 mL of 40 mg/mL solution) and bupivacaine (3 mL of 0.25% solution) on each side.

For injections at the pudendal canal (Fig. 9), CT scans are obtained through the level of the pubic symphysis. The pudendal bundle is identified at the medial aspect of the obturator internus. We advance a 22-gauge needle obliquely via a translucral approach, aiming for needle placement in the small fat plane that usually can be seen immediately lateral to the obturator fascia. We confirm that the needle tip is in the correct position by injecting 0.75 mL of diluted contrast agent and then inject the mixture of local anesthetic and steroid.

We have found pudendal nerve perineural injection to be a safe procedure and have en-
countered no serious complications. Minor complications have included bruising at the injection site, transient worsening of pain lasting a few days, and transient sciatic nerve block lasting a few hours. The procedure is easily performed in 20–30 min and has both diagnostic and therapeutic value. Some patients report a dramatic resolution of symptoms immediately after the procedure. Among our patients, 65% have had a distinct short-term response (unpublished data); long-term data are not yet available.

Fig. 8.—Axial CT scans of 31-year-old man obtained during pudendal nerve perineural injection at ischial spine. 
A, Incorrectly positioned needle tip is seen adjacent to ischial spine. 
B, After 0.75 mL of diluted contrast agent has been injected, contrast agent is visible deep relative to sacrospinous ligament. No contrast agent is seen around neurovascular bundle (arrow) in interligamentous space. 
C and D, Needle was withdrawn by several millimeters and diluted contrast agent was again injected. Contrast agent is seen surrounding neurovascular bundle in interligamentous space (C), while on contralateral side, correctly positioned needle is seen with small amount of contrast agent at tip (D).
In conclusion, perineal pain resulting from pudendal nerve entrapment is a disabling condition that can be treated with medication, a self-care program, and CT-guided pudendal nerve perineural injection. The procedure is quick, safe, and easily performed, and it may offer considerable relief of symptoms.

References