

# Surgical and anatomical landmarks for the perineal branch of the posterior femoral cutaneous nerve: implications in perineal pain syndromes

## Laboratory investigation

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**Object.** The perineal branch of the posterior femoral cutaneous nerve (PBPFCN) has received little attention in the literature. Because perineal pain syndromes can be disabling and pudendal nerve surgical decompression/block is often not efficacious, an anatomical study of this cutaneous nerve of the perineum seemed warranted.

**Methods.** The authors dissected 20 adult cadavers (40 sides) to identify the branching pattern and landmarks for the PBPFCN.

**Results.** This branch arose directly from the posterior femoral cutaneous nerve in 55% of sides and from the inferior cluneal nerve in 30% of sides. It was absent in 15% of sides. On average, the nerve coursed 4 cm inferior to the termination of the sacrotuberous ligament onto the ischial tuberosity. No PBPFCN was found to pierce the sacrotuberous ligament. The PBPFCN provided 2–3 branches to the medial thigh that continued on to the scrotum and labia major. In general, 2 small ascending branches were identified. In males, one ascending branch traveled inferior to the corpora cavernosum and anterior to the spermatic cord to cross the midline. The other ascending branch traveled to skin at the junction of the perineum and adductor tendon. A single descending branch, approximately 2 mm in diameter, traveled to the inferior scrotum anterior to the testicle in the male specimens and the lower labia majora in the female specimens. Communications between the PBPFCN and the perineal branch of the pudendal nerve were common.

**Conclusions.** Entrapment of the PBPFCN may be the cause of some forms of the perineal pain syndrome. Specific knowledge of the PBPFCN may assist surgeons in releasing and anesthetizing this cutaneous nerve of the perineum. (DOI: 10.3171/2008.11.JNS081248)

**KEY WORDS** • anatomy • perineum • pain • thigh • skin • cadaver

NEUROSURGEONS are often confronted with the need to treat various pain syndromes including carpal tunnel syndrome, meralgia paresthetica, and greater occipital nerve entrapment. Perineal pain syndrome may fall into this category and, although rare, can be very disabling. Therefore, for effective treatment, knowledge of the structures that are potentially entrapped in perineal pain syndrome is necessary.

The perineum is separated from the pelvic cavity by the pelvic diaphragm and is bordered by the pubic sym-

physis, inferior pubic rami, ischial rami, ischial tuberosities, sacrotuberous ligaments, sacrum, and the coccyx.<sup>12</sup> Innervation to the perineum is predominantly derived from the sacral plexus. The pelvic and perineal branches of the sacral plexus consist of the PFCN (S1, S2, and S3/4),<sup>12</sup> the pudendal nerve (S2, S3, and S4), nervi erigentes (S2, S3, and S4), and pelvic somatic efferents (S2, S3, and S4).<sup>4,10</sup> The pudendal nerve is predominantly responsible for perineal innervation and consists of 3 terminal sensory branches.<sup>11,12</sup> The inferior rectal branch supplies the integument around the anus and communicates with the PBPFCN.<sup>2</sup> This communication between the PFCN and the pudendal nerve is believed to be one of the reasons that sensory impairment is usually not seen with

Abbreviations used in this paper: PFCN = posterior femoral cutaneous nerve; PBPFCN = perineal branch of the PFCN.

## Perineal innervation

entrapment of the pudendal nerve.<sup>10</sup> The pudendal nerve also consists of a perineal branch and the dorsal nerve of the penis/clitoris.

The PFCN arises from the ventral rami of S1–S3/S4 and consists exclusively of cutaneous nerve fibers and may exist from 1 to 3 nerves.<sup>13</sup> After reaching the subgluteal area, the PFCN gives rise to the inferior cluneal and perineal branches.<sup>14</sup> The inferior cluneal branch provides cutaneous innervation to the inferior buttock whereas the perineal branch innervates the lateral perineum, the proximal medial thigh, the posterolateral aspect of the scrotum/labium majus, and a portion of the penis/clitoris.<sup>14</sup>

The anatomy and clinical significance of the perineal branch of the PFCN is poorly characterized in the medical and surgical literature. A mounting body of evidence has demonstrated the involvement of the pudendal nerve in pain syndromes involving the perineum but the role of the PBPFCN in pudendal neuralgia has yet to be elucidated. The pelvis and perineum are complex anatomical areas and a greater understanding of their regional anatomy has led to improvements in medical and surgical therapies for conditions afflicting them. Because perineal pain can be life altering, additional anatomical knowl-

edge of its innervation is warranted. To the best of our knowledge, no studies, to date, have been performed to localize the PBPFCN.

## Methods

Twenty adult formalin-fixed cadavers (40 sides) in the prone position underwent dissection of the PFCN and its perineal branches. The cadavers were 55 to 98 years of age at death (mean 78 years). There were 11 male and 9 female specimens. The gluteus maximus was removed on all sides. No specimen had signs of previous surgical scars to the region dissected. Measurements of the nerve branches and distances between the nerve and surrounding landmarks were made with calipers and rulers (Figs. 1–3).

## Results

The PBPFCN was absent on 6 sides (15%; 4 left and 2 right). When identified, this branch arose from the PFCN (22 sides [55%]) or inferior cluneal nerve (12 sides [30%]).

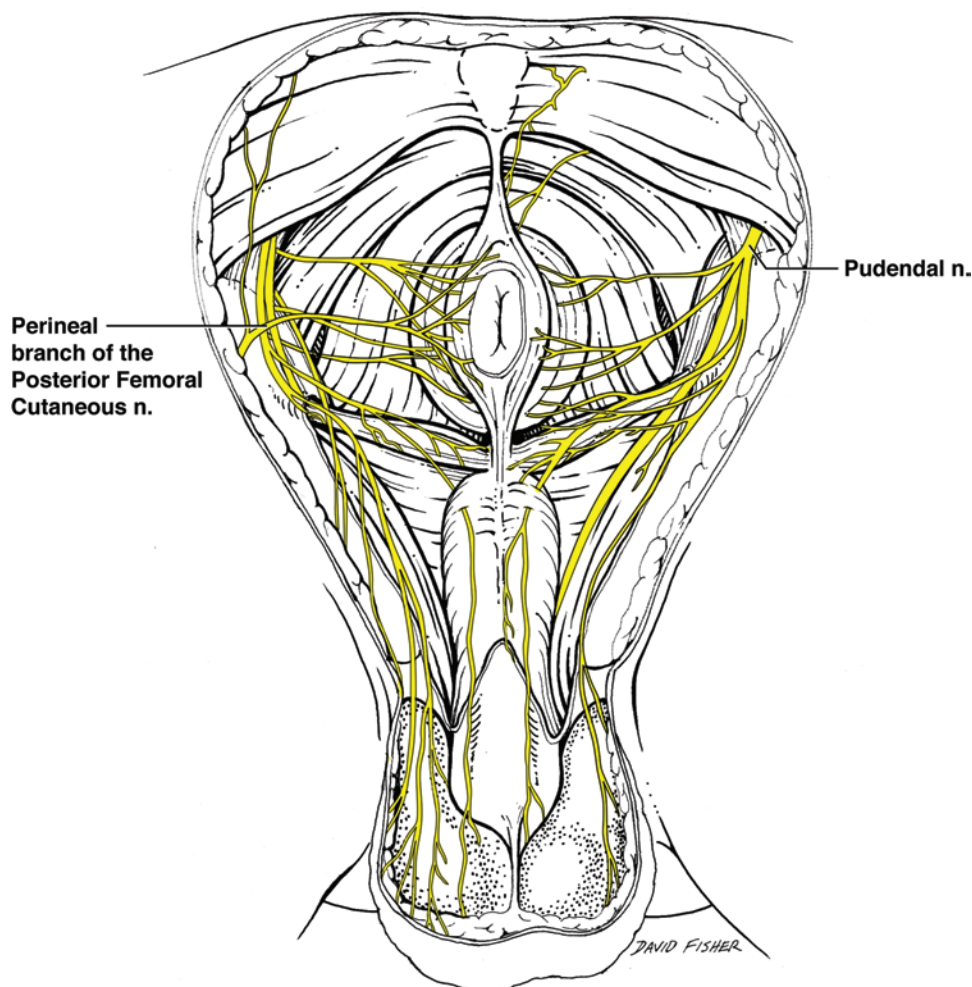


FIG. 1. Schematic drawing illustrating the cutaneous innervation of the perineal region. n. = nerve.

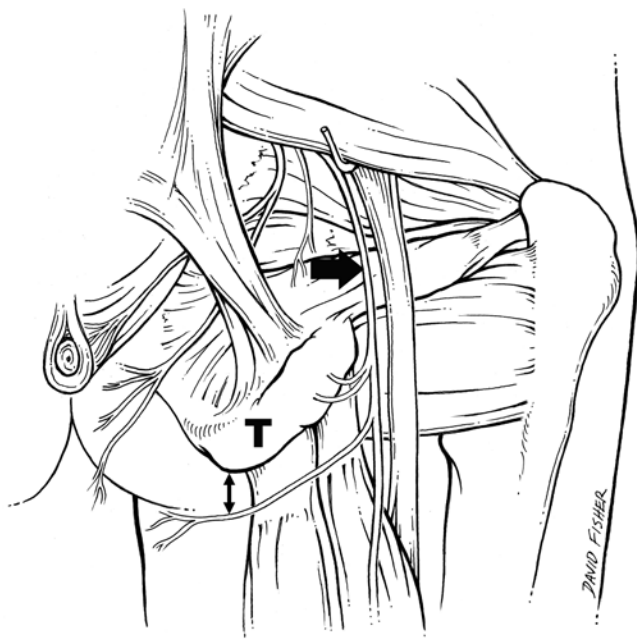


FIG. 2. Schematic drawing of the right PBPFCN. Note the distance (2-headed arrow) between this nerve and the ischial tuberosity (T). The posterior femoral cutaneous nerve is seen at the arrow.

On average, the nerve coursed 4 cm (range 3–5.5 cm) inferior to the termination of the sacrotuberous ligament onto the ischial tuberosity (Figs. 1–3). No PBPFCN was found to pierce the sacrotuberous ligament.

The PBPFCN provided 2–3 branches to the medial thigh that continued on to the scrotum or labia majora. Of these, 2 were ascending branches approximately 1 mm in diameter. In males, one traveled inferior to the corpora cavernosum and anterior to the spermatic cord to cross the midline. In females, this branch traveled to the upper aspect of the labia majora but did not cross the midline. The more superior of these ascending branches traveled to the skin at the junction of the perineum and adductor longus tendon. A single descending branch (~ 2 mm in diameter) traveled to the inferior scrotum anterior to the testicle in males and to the lower labia majora in females. Communications between the PBPFCN and the perineal branch of the pudendal nerve were common, specifically between the ascending branches of this former nerve.

### Discussion

The course of the pudendal nerve and the PBPFCN from the sacral plexus to the perineum has implications in terms of functional entrapment syndromes and iatrogenic injuries following invasive interventions.<sup>2,11</sup> The pudendal nerve and the PFCN leave the pelvis through the greater sciatic foramen after passing through the infra-piriform canal.<sup>12,15</sup> The pudendal nerve then passes around the ischial spine, between the sacrospinous and sacrotuberous ligaments, and enters the perineum through the pudendal canal. The PBPFCN, instead of following the pudendal nerve, passes inferior to the ischial tuberosity to gain ac-

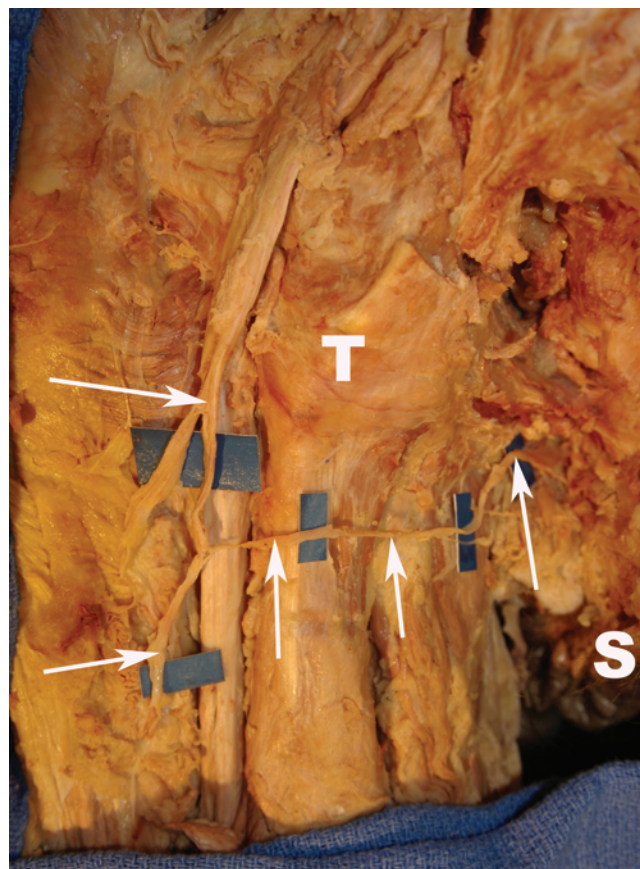


FIG. 3. Cadaveric image obtained in a male demonstrating the left PBPFCN (vertical arrows) as it arises from the posterior femoral cutaneous nerve (horizontal arrows). For reference, note the ischial tuberosity (T) and scrotum (S).

cess to the superficial fascia of the perineum. Goddard<sup>6</sup> has stated that this nerve curves around the tuberosity and ascends in a direction parallel to the ramus of the ischium and pubic bone to the scrotum, where it communicates with the superficial perineal nerve and divides into an internal and external branch. The internal branch passes down upon the inner side of the testis to the scrotum and the external branch to its outer side, and both terminate in the skin of the under-border of the penis. Interestingly, in 1900, Cushing<sup>5</sup> proposed that the pain felt following ligation of the veins at the lower pole of the testicle may be conveyed by branches of the PFCN. Interestingly, some surgeons have blocked the PFCN concomitantly with pudendal nerve blocks.<sup>8</sup>

Anatomically, the PBPFCN (inferior pudendal nerve, pudendal longus inferior, or long pudendal nerve or nerve of Soemmering [1755–1830]) winds around the ischial tuberosity to perforate the deep layer of the superficial fascia an inch external to the tuberosity to pass forward and inward to the scrotum in males and integument of the inner and upper part of the thigh in females to the labia majora.<sup>7</sup> This origin from the PFCN and then the distribution to the perineal skin has been highlighted in a case report by Iyer and Shields,<sup>9</sup> who noted that an injection injury into the gluteal region resulted in right-sided thigh

## Perineal innervation

and scrotum pain. Arnoldussen and Korten<sup>1</sup> reported on compression neuropathies against the ischial tuberosity of the PFCN.

We found that the PBPFCN was on average located 4 cm inferior to the ischial tuberosity, and this would be the best location at which to inject an anesthetic to block this nerve. Interestingly, Bergman et al.<sup>3</sup> have stated that the PBPFCN may pierce the sacrotuberous ligament. Therefore, one could envision compression of this nerve at this location as has been described for the pudendal nerve at this same site.

### Conclusions

Because perineal pain syndromes can be disabling, additional anatomical information regarding the nerves potentially involved in pain generation may be useful in the development of new treatment strategies. Our hopes are that the data presented herein may be useful in such circumstances.

### Disclaimer

The authors report no conflict of interest concerning the materials or methods used in this study or the findings specified in this paper.

### References

1. Arnoldussen WJ, Korten JJ: Pressure neuropathy of the posterior femoral cutaneous nerve. **Clin Neurol Neurosurg** **82**: 57–60, 1980
2. Benson JT, Griffis K: Pudendal neuralgia, a severe pain syndrome. **Am J Obstet Gynecol** **192**:1663–1668, 2005
3. Bergman RA, Afifi AK, Miyauchi R: Posterior femoral cutaneous nerve. <http://www.anatomyatlases.org/AnatomicVariants/NervousSystem/Text/PosteriorFemoralCutaneous.shtml> [Accessed 23 March 2009]
4. Brooks JD: Anatomy of the lower urinary tract and male genitalia, in Wein A, Kavaoussi LR, Novick AC, Partin AW, Peters

- CA (eds): **Campbell-Walsh Urology, ed 9**. Philadelphia: WB Saunders, 2007, pp 56–68
5. Cushing H: The employment of local anaesthesia in the radical cure of certain cases of hernia, with a note upon the nervous anatomy of the inguinal region. **Ann Surg** **31**:1–34, 1900
6. Goddard PB (ed): **A System of Human Anatomy: General and Special, ed 2**. Philadelphia: Lea & Blanchard, 1844
7. Haynes IS: **A Manual of Anatomy**. Philadelphia: WB Saunders, 1896
8. Hughes PJ, Brown TC: An approach to posterior femoral cutaneous nerve block. **Anaesth Intensive Care** **14**:350–351, 1986
9. Iyer VG, Shields CB: Isolation injection injury to the posterior femoral cutaneous nerve. **Neurosurgery** **25**:835–838, 1989
10. Labat JJ, Riant T, Robert R, Amarenco G, Lefaucheur JP, Rigaud J: Diagnostic criteria for pudendal neuralgia by pudendal nerve entrapment (Nantes Criteria). **NeuroUrol Urodyn** **27**:306–310, 2008
11. Loukas M, Louis RG Jr, Hallner B, Gupta AA, White D: Anatomical and surgical considerations of the sacrotuberous ligament and its relevance in pudendal nerve entrapment syndrome. **Surg Radiol Anat** **28**:163–169, 2006
12. Moore K, Dalley A: **Clinically Oriented Anatomy, ed 5**. Philadelphia: Lippincott Williams & Wilkins, 2006, p 357, p 379
13. Nakanishi T, Kanno Y, Kaneshige T: Comparative morphological remarks on the origin of the posterior femoral cutaneous nerve. **Anat Anz** **139**:8–23, 1976
14. Reid V, Cros D: Proximal sensory neuropathies of the leg. **Neurol Clin** **17**:655–667, 1999
15. Robert R, Prat-Pradal D, Labat JJ, Bensignor M, Raoul S, Rebai R, et al: Anatomic basis of chronic perineal pain: role of the pudendal nerve. **Surg Radiol Anat** **20**:93–98, 1998

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