# Injury to Perineal Branch of Pudendal Nerve in Women: Outcome from Resection of the Perineal Branches

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## Abstract

**Background** This study describes outcomes from a new surgical approach to treat "anterior" pudendal nerve symptoms in women by resecting the perineal branches of the pudendal nerve (PBPN).

**Methods** Sixteen consecutive female patients with pain in the labia, vestibule, and perineum, who had positive diagnostic pudendal nerve blocks from 2012 through 2015, are included. The PBPN were resected and implanted into the obturator internus muscle through a paralabial incision. The mean age at surgery was 49.5 years (standard deviation [SD] = 11.6 years) and the mean body mass index was 25.7 (SD = 5.8). Out of the 16 patients, mechanisms of injury were episiotomy in 5 (31%), athletic injury in 4 (25%), vulvar vestibulectomy in 5 (31%), and falls in 2 (13%). Of these 16 patients, 4 (25%) experienced urethral symptoms. Outcome measures included Female Sexual Function Index (FSFI), Vulvar Pain Functional Questionnaire (VQ), and Numeric Pain Rating Scale (NPRS).

**Results** Fourteen patients reported their condition pre- and postoperatively. Mean postoperative follow-up was 15 months. The overall FSFI, and arousal, lubrication, orgasm, satisfaction, and pain domains significantly improved ($p < 0.05$). The VQ also significantly improved ($p < 0.001$) in 13 (93%) of 14 patients. The NPRS score decreased on average from 8 to 3 ($p < 0.0001$). All four patients with urethral symptoms were relieved of these symptoms.

**Conclusion** Resection of the PBPN with implantation of the nerve into the obturator internus muscle significantly reduced pain and improved sexual function in women who sustained injury to the PBPN.

**Keywords**
- pelvic pain
- pudendal nerve injury
- neuroma



Women experiencing unilateral or bilateral pain in the perineum, labia, vestibule, and/or vagina have been diagnosed with the term "pudendal neuralgia"[1–3] or "vulvodynia."[4–6] Recently, this nonspecific terminology has been challenged on the grounds that both the anatomical tissues involved plus the nerve that innervates those tissues should be considered in the diagnosis of this form of pelvic pain.[6] For example, the transgluteal surgical division of the sacrotuberous ligament is the approach to treat "pudendal neuralgia," regardless of whether posterior symptoms from the

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rectal branch are present or not.[7,8] More recently, an anterior approach has been reported in men,[9,10] and preliminary surgical results have been reported with a paralabial approach in women without rectal symptoms.[11] A pudendal branch-specific approach would permit therapeutic trials with outcome-specific analysis.

The vestibule is a unique anatomical site in contrast to the more encompassing term, vulva. Anatomical specificity, such as choosing the vestibule as a site, permits targeted diagnostic and therapeutic approaches for pain at this location.[12–17] Similarly, understanding where along the anatomical pathway of the pudendal nerve an injury has occurred permits targeted diagnostic and therapeutic approaches for this nerve.[3,12,18,19] Furthermore, the pudendal nerve branch can be injured directly or be compressed compression to form a neuroma.[18] Using the anatomical site-specific, pudendal branch-specific, and mechanism-specific classifications, vestibular pain following childbirth[20] would be best described as pain due to neuroma of the perineal branch of the pudendal nerve (PBPN).

The hypothesis tested and reported on in this study is that injury to the PBPN causes pain that can be relieved by resecting the neuroma of that perineal branch and implanting the proximal end of that nerve into an adjacent muscle. The aim of our study was to determine whether pain and sexual function improve after an anterior approach to resection of neuromas of the PBPN in women with pudendal neuralgia.

## Methods

### Ethics Approval

This study received Institutional Review Board approval from the Johns Hopkins Medical Institutes, Baltimore, MD.

### Patient Demographics

Sixteen sequential female patients from 2012 to 2015 were identified who had pudendal neuralgia but who did not have rectal symptoms. All underwent diagnostic pudendal nerve blocks and resection of the PBPN. The mean age at surgery was 49.5 years (standard deviation [SD] = 11.6 years) and the mean body mass index was 25.7 (SD = 5.8). One patient (6.3%) had hypertension and none had diabetes. Mechanisms of injury were episiotomy in 5 (31%), athletic injury in 4

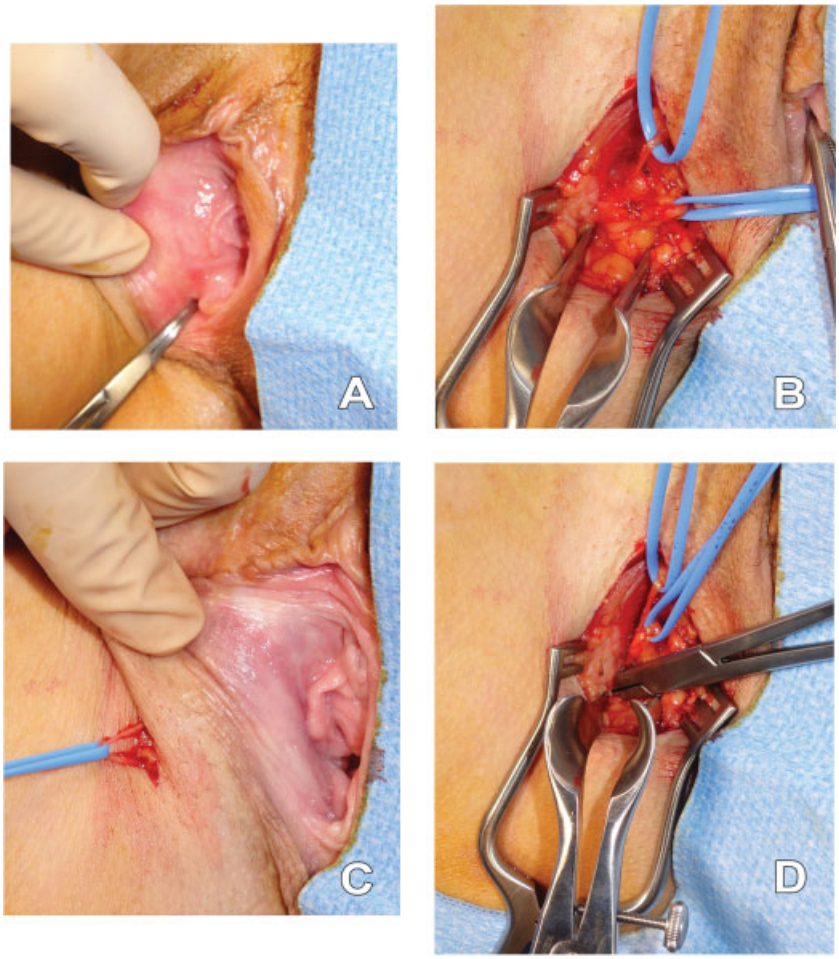


**Fig. 1** Intraoperative views. Right-sided vaginal tear and hematoma requiring drainage during delivery of first baby 1 year postpartum. (**A**) Scar from tear and drainage. (**B**) Blue loops around two perineal branches of the pudendal nerve, with nasal speculum inserted for dissection/visualization into the ischiorectal fossa. (**C**) Pulling upon the perineal branch causes movement of the painful scar. (**D**) Tonsil clamp inserted into exit of the Alcock canal, into which the proximal end of divided perineal branches will be inserted into the obturator internus muscle.

(25%), vestibulectomy in 5 (31%), and falls in 2 (13%). The mean amount of time with pudendal neuralgia symptoms was 8.6 years (SD = 6.8 years). Of the 16 patients, 4 (25%) had urinary symptoms (i.e., pain with urination) before surgery. Eleven (69%) of 16 underwent unilateral resection of the PBPN; the remainder underwent bilateral resection.

## Surgical Technique

Under general anesthesia, the patient is placed into lithotomy position. Surgical loupe magnification (3.5 × ) is used. An incision, approximately 4 cm in length, is made cephalad to the ischial tuberosity going just lateral to the labia. This site is infiltrated with 1% xylocaine with 1:100,000 epinephrine. Incision is made into the ischiorectal fossa. Hemostasis is obtained with a bipolar coagulator set at the lowest energy level consistent with obtaining coagulation. A small blunt, self-retaining retractor spreads skin edges and then spreads progressively deeper into the ischiorectal fossa, looking for branches of the perineal portion of the pudendal nerve. These go from the exit of the Alcock canal, just proximal to the ischial tuberosity, and lie in a transverse direction to the incision as they innervate the vestibular structures. When the first branch is found, it is encircled with a vessel loupe and then followed proximally to its exit from the Alcock canal. A nasal speculum helps this dissection. There are often two or three branches, unless the perineal nerve divides quite distally, in which case the one branch will be much larger. When the nerve is clearly identified, the local anesthetic is injected into the nerve to block it prior to its division. A long tonsil clamp is inserted with its blunt end to gently follow the nerve into the canal, gently opening the canal. When individual branches are identified, it is possible to place gentle traction on them and see the painful portions of the labia, or the vestibule, or the periurethral mucosa move, confirming the innervation of that particular branch. A distal segment of the nerve is cauterized at either end of the segment and removed as a specimen for pathology. The proximal end of the nerve (or of the branches) is turned, and, being held in the longer tonsil clamp, is placed into the Alcock canal and finally implanted into the obturator internus muscle. (This is done blindly as the muscle cannot be seen directly.) After checking for hemostasis, the wound is closed with interrupted 4–0 monocryl intradermal sutures, and interrupted and continuous 5–0 nylon sutures to the skin (►**Figs. 1–4**).

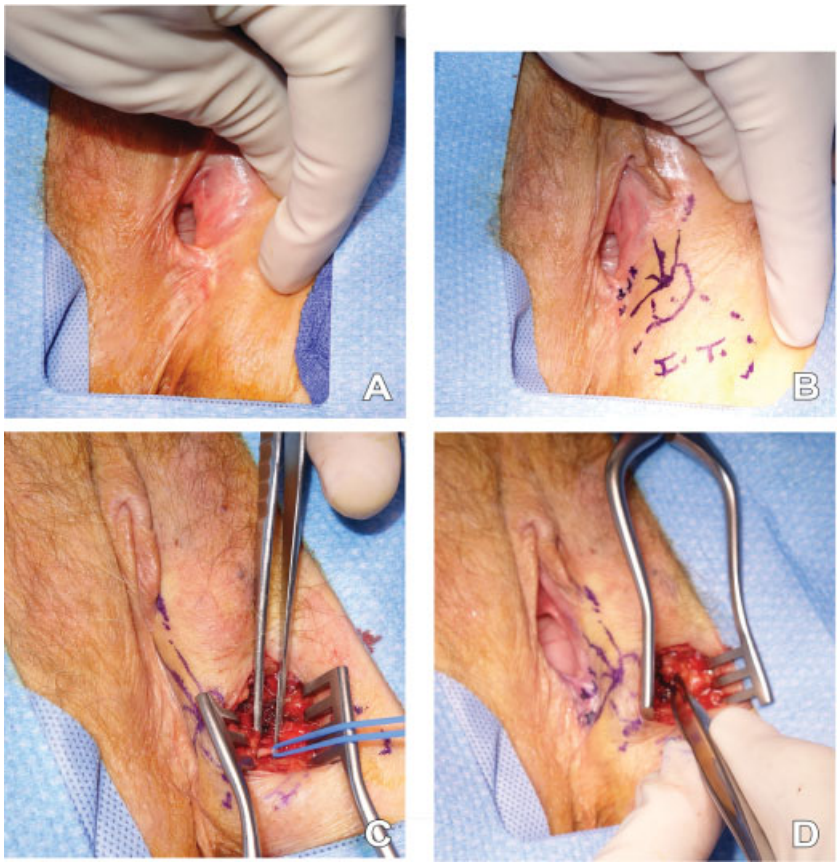


**Fig. 2** Intraoperative views. Episiotomy 5 years before with painful scar. (**A**) Left-sided, white, episiotomy scar outlined. (**B**) Marking of ischial tuberosity (IT), with circle representing the exit of the Alcock canal, and theoretical outline of the perineal branches of the pudendal nerve radiating toward the labia and vestibule. The brief outline of inferior pubic ramus seen superiorly extending from the IT. (**C**) The blue loop is around the main perineal branch of the pudendal nerve. (**D**) After injecting nerve with local anesthetic, it is placed under traction (black arrow), drawing the scar toward it.

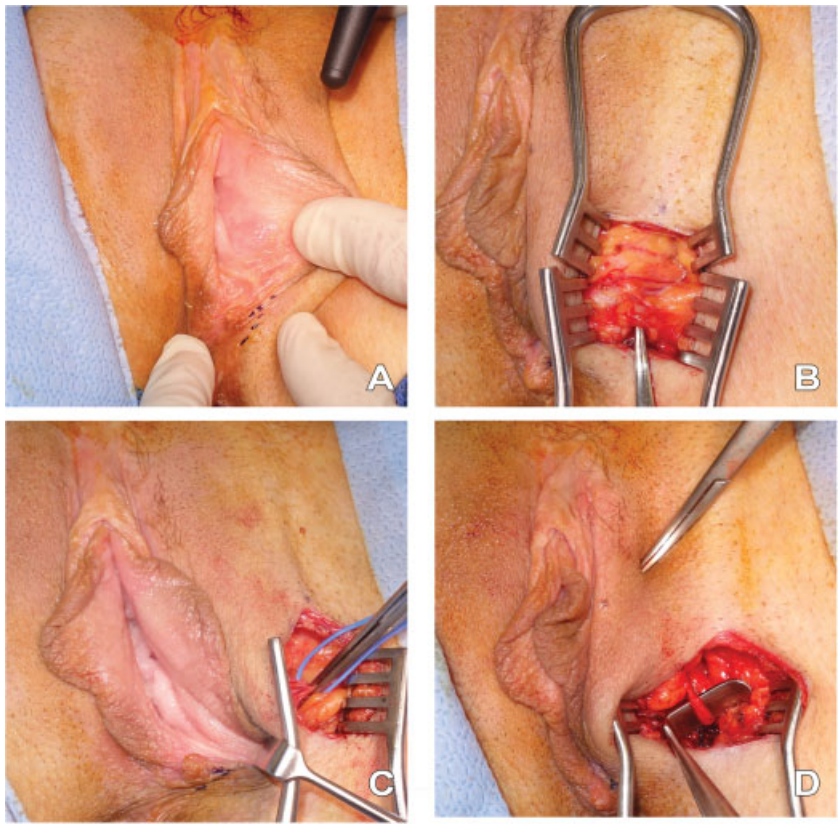


**Fig. 3** Intraoperative views. Episiotomy 2 years before with painful scar. (**A**) Left-sided white, episiotomy scar. (**B**) White scar tissue within the yellow fat of the ischiorectal fossa. (**C**) Perineal branch of pudendal nerve is demonstrated going inferior/medial toward vestibule. (**D**) Dorsal branch of pudendal nerve, in contrast, is demonstrated going superior/medial toward the clamp at the base of the clitoris.

The surgical technique is illustrated schematically in ►**Fig. 5**.

### Outcome Measurements

Functional and pain outcomes were measured with the Female Sexual Function Index (FSFI), the Vulvar Pain Functional Questionnaire (VQ), and the Numeric Pain Rating Scale (NPRS). Patients were asked to complete these questionnaires pre- and postoperatively. These were administered by a "third" party, authors E. W. in Baltimore and H. T. in New York, who were not the surgeons.

### Statistical Analysis

Preoperative and postoperative scores from the FSFI and its domains, the VQ, and the NPRS were analyzed using Prism 5 (GraphPad Software.) and paired one-tailed *t*-tests. The FSFI domain scores were included if the patient reported sexual activity after surgery.

## Results

Of the 16 patients, 14 (87.5%) returned for follow-up. Mean postoperative length of follow-up was 15 months (range: 6–43 months). In 10% of patients, the only complication after surgery involved significant bruising.

Mean pain ($n = 14$) before surgery was an 8.2 (SD: 1.7) out of 10 on the NPRS. After surgery, pain scores significantly decreased on average 5.3 points ($p < 0.0001$; 95% confidence interval [CI]: 3.7–6.9; $n = 14$), resulting in a mean pain of a 2.9 (SD: 2.5) after surgery.

The FSFI, for patients reporting having sexual activity after surgery ($n = 8$), also demonstrated a significant improvement ($p < 0.05$). Mean FSFI before surgery was 14 (SD: 8) and after surgery increased to 23.7 (SD 9.9). Average improvement was 9.6 (95% CI: 0.3–19.5). The FSFI organizes sexual functioning into six domains: desire, arousal, lubrication, orgasm, satisfaction, and pain. When the scores of individual FSFI domains for patients reporting sexual activity after surgery were examined, it was found that only the desire domain did not demonstrate a significant change ($p = 0.26$). The arousal, lubrication, orgasm, satisfaction, and pain domains all demonstrated significant improvements after surgery ($p < 0.05$).

Four patients were administered the FSFI prior to surgery; three of them later returned for follow-up at which time they were administered surveys to complete with regard to their pre- and postoperative states. The FSFI results of the 4 patients, when administered prior to and after surgery, did not significantly differ from the 10 patients whose FSFI ($p = 0.51$) scores when administered just after surgery in reference to their preoperative condition. This was also true when examining the NPRS scores. The NPRS results of the 4 patients, when administered prior to and after surgery, did not significantly differ from the 10 patients whose NPRS

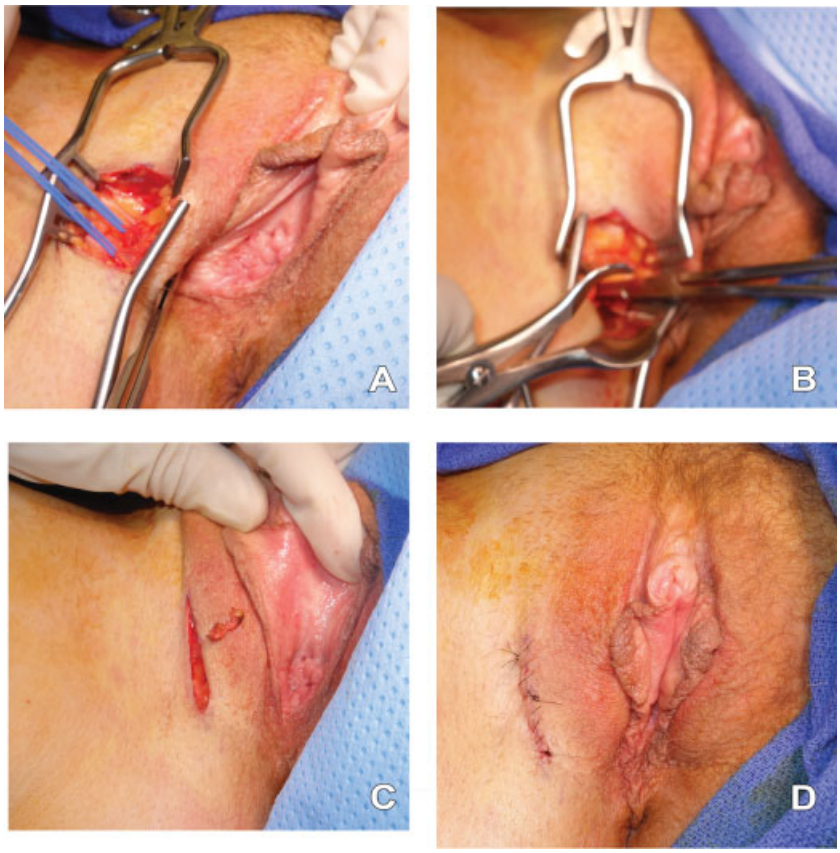


**Fig. 4** Intraoperative views. Vestibulectomy 2 years before with painful scars. (**A**) Pudendal nerve branches are pulled, demonstrating their innervation of the junction of the advanced vaginal mucosa with the edge of the vestibule. (**B**) Proximal end of the right perineal branches of the pudendal nerve are implanted into the obturator internus muscle with the tonsil clamp. (**C**) Excised distal end of the perineal nerves are sent for pathology. (**D**) The closed incision.

($p = 0.74$) scores when administered just after surgery in reference to their preoperative condition.

The VQ ($n = 14$) demonstrated a mean improvement of 10.9 points ($p < 0.001$; 95% CI: 5.3–16.4), decreasing from more severe 19.9 (SD: 8) to a less severe 9 (SD: 7.5) after surgery. This is an approximately 40% improvement in impairment. Improvements reported by the NPRS, FSFI, and VQ did not significantly differ between patients who had unilateral PBPN resection and those who had bilateral PBPN resection ($p > 0.05$). Improvement in the VQ and NPRS were positively correlated (Pearson $r = 0.64$), as was improvement in FSFI and NPRS (Pearson r = 0.65) and improvement in FSFI and VQ (Pearson $r = 88$). Of the four patients who reported urinary symptoms (pain with urination and/or frequency) before surgery, all had resolution of these symptoms after surgery.

Wound healing is demonstrated at 3 and 4 months postoperatively (►**Fig. 6**).

## Discussion

This is the first, female-only cohort study consisting of women with neuroma of the PBPN treated by nerve resection and implantation into muscle using the anterior approach. Previously, the senior author of this paper (A. L. D.) had reported a retrospective study addressed anterior and posterior surgical approaches to the pudendal nerve that had included both men and women. That study examined the postoperative results of 23 patients who underwent resection of the PBPN with implantation into the obturator internus muscle. A total of 32 female patients were included in that study.[12] An 11-point Likert pain scale was collected from each patient, with only a small subgroup of those patients having information related to the FSFI and VQ. The female-only cohort represented by our current study includes patients subsequent to those included in our 2015 report[12]; all patients in our study were evaluated with the FSFI, the VQ, and the NPRS.

In 2005, Robert et al reported the first description of the anterior location for pudendal nerve entrapment in the inferior pubic ramus canal.[9] Subsequently, Hruby et al described neurolysis of the perineal and dorsal branches of the pudendal nerve in men with diabetes, attempting to restore sensation to the penis.[11] Our 2015 study[12] demonstrated that an anterior surgical approach that resects the injured nerve branches and implants them into the obturator internus muscle can provide significant reduction of symptoms and improved function in both men and women.

The results of our prospective study build upon the observations of the 2015 retrospective study that described

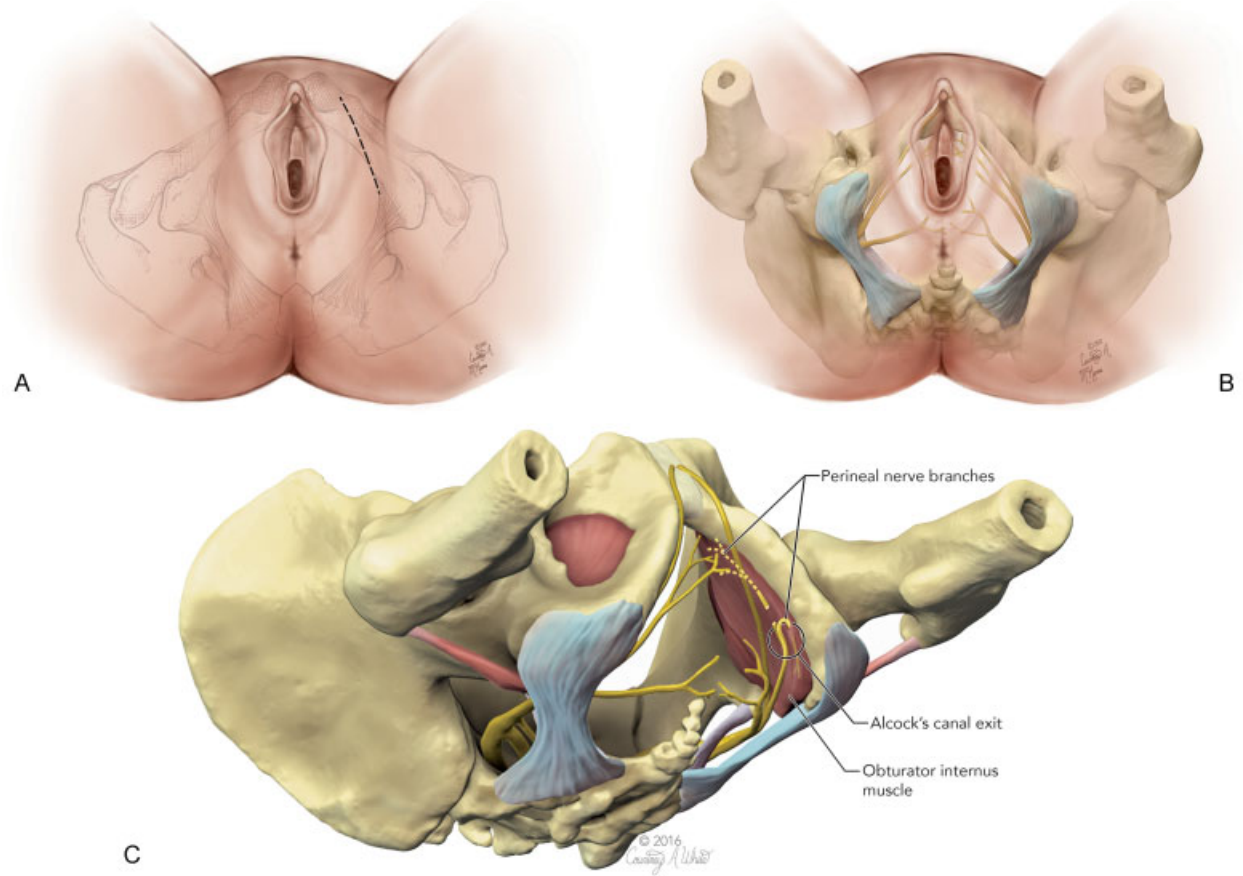


**Fig. 5** Illustration of surgical technique. (**A**) Variations in anatomy are demonstrated. On the left side of the drawing (right side of the specimen), dorsal and perineal branches exit from the Alcock canal together, whereas on the contralateral side, the dorsal branch exits more anteriorly. A nerve block can be done at this exit point. The posterior portion of the vestibule is innervated by the perineal branch, which may also have an extension toward the anterior anus. (**B**) In the lithotomy position, the preferred incision is shown in dotted lines, placed just lateral to the labia majora, to gain entry to the ischiorectal space. A more posterior incision may be required to remove a perineal branch extending toward the rectum. (**C**) The obturator internus muscle is shown in pink, and in this view, the perineal branch is divided distally in the ischiorectal fossa, and the proximal end turned and implanted into the obturator internus muscle.


**Fig. 6** Incisions are shown at 3 months (**A**) and 4 months (**B**) after surgery.

the first experience with using an anterior surgical approach to the inferior pubic ramus canal to treat chronic pelvic pain related to the pudendal nerve.[12] The 2015 study reported surgical outcomes primarily in terms of the NPRS, stratifying the outcomes according to the each of the years of patient data accrual and experience: excellent results in 0% (0/6), 70% (7/10), and 72% (5/7) in the first, second, and third years, respectively. The greatest predictor of failure in that study was "undertreated anxiety/depression." In this study, all patients were adequately treated for anxiety and depression prior to surgery. In the 2015 study, the technical cause for failure was an inability to identify and resect all the PBPN.[12] In this study, a methodical search was performed for all identifiable branches of the perineal nerve and correlating relationship to the site of pain by placing traction upon the nerve and observing movement of the painful labial/vestibular/vaginal site of pain. As in the retrospective study,[12] success was driven by the inclusion criteria, which required positive response to a preoperative pudendal nerve block.

Urethral pain is included in the Nantes criteria[1] for "pudendal neuralgia by pudendal nerve entrapment" as an "associated sign that does not exclude the diagnosis." Of course, prior to considering a neural etiology for urethral pain, all women were evaluated extensively for urinary tract infections and bladder pain syndrome. Is it possible that perception of urethral pain is mediated by the PBPN? In the earlier work cited,[12] urethral symptoms were not discussed. In this study, each of the four women presenting with urethral symptoms related to neuroma of the PBPN had palliation of symptoms following resection of these pudendal nerve branches. Intraoperatively, a branch of the perineal nerve can be identified by gentle traction as innervating the periurethral mucosa. Understanding of the perception of urethral pain requires increasing correlation between clinical observations and basic science,[21–25] all of which continues to implicate the PBPN with this type of pain.

Funding
None.

Conflict of Interest
None of the authors have a conflict of interest.

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