Chapter 56

Pudendal Nerve Blockade

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Contents

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Introduction

The pudendal nerve is a branch of the sacral plexus, originating from the ventral rami of S2, 3, and 4 nerve roots. It provides sensory innervation to the skin of the perineum and mucosa of the anal canal. It also provides motor control of the external anal sphincter, urethral sphincter, and perineal musculature [1–6].

Blockade of the pudendal nerve has been used to facilitate anesthesia and analgesia for surgical procedures involving the perineum. Blockade can also aid in the diagnosis and therapy of pelvic pain syndromes, specifically pudendal neuralgia.

A range of nerve block techniques have been described from landmark-guided approaches to the use of magnetic resonance neurography (MRN).

Pudendal Nerve Anatomy

Once the pudendal nerve is formed from its nerve roots, it briefly exits the pelvis to enter the gluteal region, beneath the piriformis muscle via the infrapiriform notch (Figs. 56.1, 56.2, and 56.3). The nerve will then course between the sacrospinous and sacrotuberous ligaments, adjacent to the ischial spine. It reenters the pelvis through the lesser sciatic foramen to continue its course anteriorly through a fascial tunnel formed along the medial border of the obturator internus muscle known as Alcock's canal. The nerve provides three branches to innervate the perineum along its path that include the inferior rectal nerve, perineal branch, and dorsal branch.

The anatomical course of the pudendal nerve has been the subject of numerous investigations, and studies continue to report novel anatomic variations. These studies challenge the originally held belief of the pudendal nerve as a singular nerve with a consistent pathway through the pelvis. In contrast, this nerve can be quite complex with a number of well-described variations. Knowledge of these variances can aid in the appropriate management of patients requiring intervention through nerve blockade or surgery.

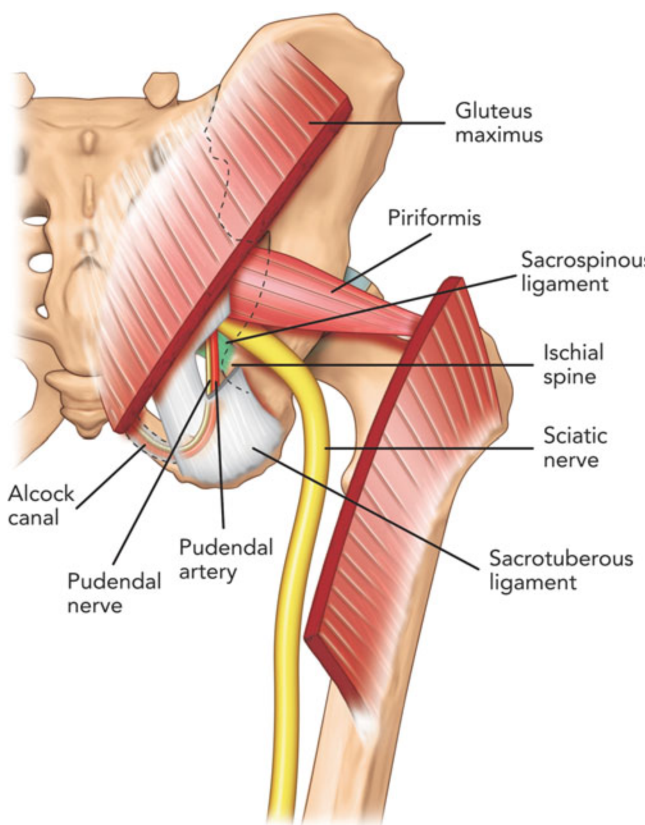

Fig. 56.1 Posterior view of pelvis, showing the piriformis muscle and the neurovascular bundle deep to it. The pudendal nerve and artery run between the sacrospinous and sacrotuberous ligaments (Reproduced with permission from Philip Peng Educational Series)

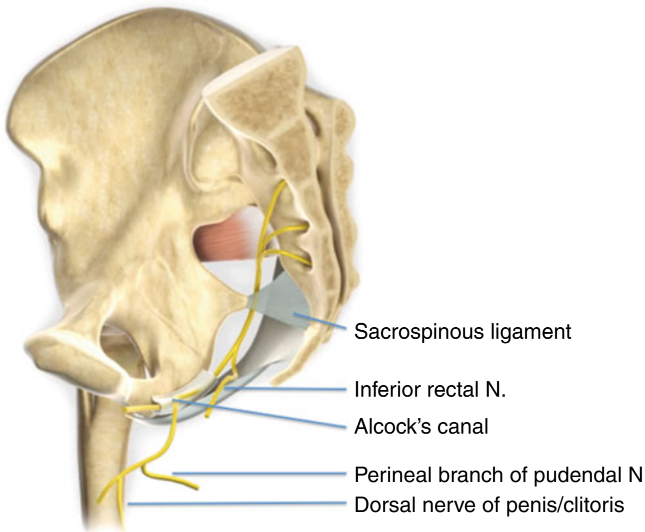

Fig. 56.2 Pudendal nerve is seen arising from S2–S4 and exiting pelvis to enter gluteal region through the greater sciatic foramen. The nerve gives rise to the inferior rectal nerve, perineal nerve, and the dorsal nerve of the penis or clitoris. The inferior rectal nerve branches from the pudendal nerve prior to Alcock's canal. *N* nerve (Reproduced with permission from Philip Peng Educational Series)

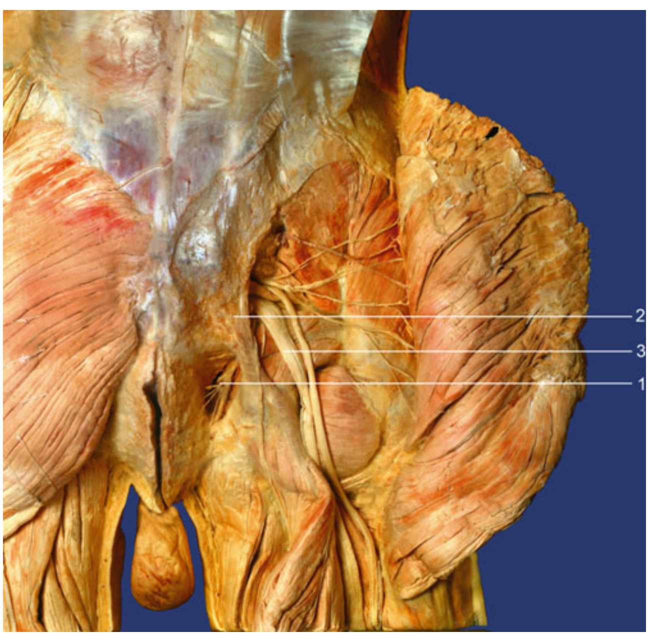

Fig. 56.3 Anatomic specimen. (*1*) Pudendal nerve and pudendal vessels in the ischiorectal fossa, (*2*) sacrotuberous ligament, (*3*) sciatic nerve (With permission from Dr. Danilo Jankovic)

Nerve Roots

The ventral rami of S2, 3, and 4 commonly form the pudendal nerve, yet contributions from S1 and S5 nerve roots have been documented [4, 6–10].

Frequently, the L4 nerve root of the lumbosacral plexus is divided between the lumbar and sacral plexuses, acting as a boundary root. On occasion, the L3 or L5 nerve root may serve as the boundary root, leading to a shift in the nerve roots composition of the plexus involving upper or lower nerve roots or prefixed or postfixed plexus, respectively. These alterations could influence nerve root contributions to pudendal nerve formation. This is exemplified in an anatomic study of 20 adult cadaveric specimens that sought to clarify the nerve root formation of the pudendal nerve in these plexus variations [11].

Of 20 cadaveric specimens, 9 normal lumbosacral plexuses were found, in which the S2 and S3 nerve roots contributed to pudendal nerve formation. In 8 prefixed plexuses, S1 and S2 nerve roots predominated the formation of the nerve, while in the postfixed plexus type, S3 and S4 nerve roots predominated nerve formation. Overall, the S2 nerve root participated in pudendal nerve formation in 17 of 20 cases [11].

A separate anatomical investigation by O'Brichere revealed that the S2 and S4 nerve roots are major contributors to formation of the pudendal nerve [10]. Conversely, Robert et al. discovered that the pudendal nerve is usually formed by S3, with contributions from S2 and 4 [8]. Clearly, variation in pudendal nerve formation is common. This can influence the success of interventions aimed to affect pudendal nerve function at the level of the nerve roots.

Nerve Trunks

The notion that foundational nerve roots consistently combine to form a single pudendal nerve is mistaken. In fact, much of what has been described in anatomical studies reveals that contributing nerve roots may either combine to form a single pudendal nerve or form between two and three “trunks,” which may or may not combine to form the pudendal nerve and its terminal branches (inferior rectal, perineal, and dorsal branches) [9].

The frequency of occurrences of trunk types within the gluteal region has been investigated in several anatomical studies [2–4, 9, 10, 12–16]. Although separate research groups propose different classification schemes of the trunks, some generalizations can be drawn. The occurrence of the pudendal nerve as a single common trunk has been reported with the most frequency, occurring between 29 and 96 % of anatomical dissections. The occurrence as two trunks has been reported between 4 and 45.5 % and that of three trunks between 6 and 19.5 % in the literature [3].

Morphology and Anatomical Relationships at the Ischial Spine

A comprehensive knowledge of the nerve’s anatomy at the level of the ischial spine is important when performing pudendal nerve blocks. This is a possible site of pudendal nerve entrapment and an accessible area for pudendal nerve blockade through either blind or image-guided approaches.

After exiting the pelvis from the infrapiriform notch, the pudendal nerve crosses over the posterior aspect of either the sacrospinous ligament or the ischial spine. Pirro et al. studied the pudendal nerves of 20 cadaveric specimens and observed that the nerve crosses the sacrospinous ligament in 80 % of cases, while in 15 % of cases it crossed the ischial spine. The remaining specimens contained multi-trunked nerves crossing both the ischial spine and the sacrospinous ligament [3].

The relationship of the pudendal artery to the nerve has also been examined. In 80 % of cases, the pudendal nerve lay medial to the artery, while in 10 % of cases, the nerve lay lateral to the artery. Remaining anatomical relationships observed include having the artery lie between two trunks, and in 7.5 % of cases, the artery crossed the nerve [3]. Knowledge of the pudendal nerve’s position relative to the pudendal artery is useful when using ultrasound to guide neural blockade as the nerve itself is typically not easily visualized through a transgluteal approach. Identification of the artery as a pulsatile structure or via Doppler imaging can help clarify the most likely location of the nerve.

The pudendal nerve’s mean diameter at the level of the ischial spine has been reported between 2 and 6 mm [3].

Nerve Branches

The pudendal nerve divides into three branches: the inferior rectal branch, the perineal branch, and the dorsal nerve of the penis/clitoris (Fig. 56.4a, b) [17].

The inferior rectal branch descends from its origin in the pelvis to occupy the lower half of the ischiorectal fossa. It further subdivides into cutaneous branches, which supply sensory innervation to the anal canal and the skin around the anus. Sensory innervation may also include the skin of the scrotum. The inferior rectal branch provides the main motor innervation to the external anal sphincter, and investigations have also documented occasional motor innervation to the levator ani muscle as well, through an “accessory rectal nerve” [6, 18]. The inferior rectal branch has been observed to pierce through the sacrospinous ligament as it proceeds to the ischiorectal fossa, which can be a possible site of entrapment [2].

The perineal branch of the pudendal nerve divides into superficial and deep branches. The superficial branch provides sensory innervation through the posterior scrotal/posterior labial nerve, which contributes to the innervation of the posterior aspect of the scrotum or labia majora [9]. This branch may join the sensory branches of inferior rectal branch [17]. The deep branch supplies motor innervation to the muscles of the pelvic floor and the deep perineal pouch. The external urethral sphincter receives voluntary innervation from this branch. Other muscles that receive motor innervation include the transverse perinei, bulbospongiosus, and ischiocavernosus muscles [19, 20]. Motor innervation has also been reported to include the anterior part of the external anal sphincter and the levator ani muscle [20].

The dorsal nerve of the penis or clitoris is the final branch of the pudendal nerve. It supplies the erectile tissue of the corpus cavernosum and of the crus penis/clitoris. This branch supplies sensory innervation to the skin over the dorsal and lateral aspects of the penis and clitoris [9].

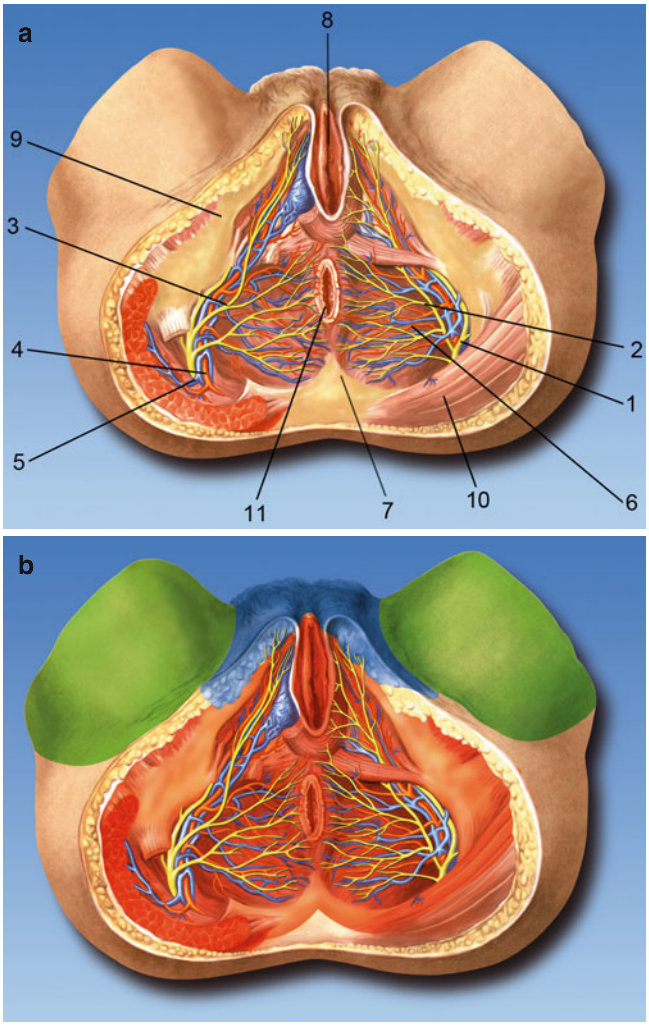

Fig. 56.4 (**a**) Anatomy. (*1*) Pudendal nerve, (*2*) inferior rectal nerves, (*3*) perineal nerves, (*4*) internal pudendal artery, (*5*) internal pudendal veins,(*6*) inferior rectal artery, (*7*) ischiorectal fossa, (*8*) vaginal orifice, (*9*) ischial tuberosity, (*10*) gluteus maximus muscle, (*11*) anus. (**b**) Skin innervations area of the pudendal nerve (*red*), ilioinguinal and genitofemoral nerves (*blue*), and obturator nerve (*green*) (With permission from Dr. Danilo Jankovic)

Alcock's Canal

Distal to the sacrotuberous and sacrospinous ligaments, the pudendal nerve reenters the pelvis through the lesser sciatic foramen and enters Alcock's canal [21]. This canal lies medial to the obturator internus muscle and is formed by a splitting of the muscle's fascia into a medial and lateral layer. The medial layer covers the pudendal neurovascular bundle and fuses below with obturator fascia. The lateral layer is continuous with the obturator fascia [5]. The length of the canal has been measured from 1.4 to 1.8 cm in adults, ending at a distance of 2–3 cm from the inferior border of the symphysis pubis [5]. The canal has been described to lie 2.5–4.5 cm from the inferior border of the ischial tuberosity.

Early anatomical studies report that the pudendal nerve and its branches course together through Alcock's canal and exit by piercing its fascial walls [5, 21]. As described by Shafik et al., the dorsal and perineal branches of the pudendal nerve exit the canal by piercing the obturator fascia at the canal's distal end [5]. The inferior rectal nerve showed some variation in that it either did not enter the canal or entered the canal, but then pierced the proximal aspect of the canal to enter the ischioanal fossa.

A more recent cadaveric study has challenged the previous anatomical descriptions of Alcock's canal. Furtmuller et al. performed dissections of 12 formalin-embedded cadavers, using a medial intrapelvic approach to map the course of the pudendal nerve and its branches [9]. Contrary to the classical description of the exiting pattern of the perineal and dorsal branches, they found that these branches do not exit the canal together at its distal end. Instead, it was discovered that the dorsal branch of the pudendal nerve exited 15–18 mm more anterior along the inferior pubic ramus than the perineal branch did, with its own distinct second exit from the canal. Furthermore, the dorsal nerve branch was found to take a higher course within the pelvis than the perineal branch. Rather than exiting the pelvis at the base of the urogenital diaphragm, the dorsal branch typically exited 12 mm lateral to the pubic symphysis in the parasymphyseal space [9]. This higher course of the dorsal nerve extends this branch in a horizontal fashion from the ischial spine to the parasymphyseal space, traveling separately from the perineal branch in the most superior aspect of Alcock's canal.

Urogenital Diaphragm

The dorsal branch of the pudendal nerve pierces through the superior fascia of the urogenital diaphragm once it reaches the inferior pubic ramus. Beyond this point, the nerve travels in a pouch that is defined by the crus of the penis/clitoris anteriorly and inferiorly. The inferior pubic ramus forms the posterior and superior border. The branch may then pierce either the inferior fascia of the urogenital diaphragm or pierce above the inferior transverse pubic ligament. Once exited the pelvis at this point, the nerve travels anterior to the pubic bone in a groove known as the "sulcus nervi dorsalis penis/clitoris." It then deflects ventrally to innervate the penis or clitoris [9, 22].

Indications

Surgical Anesthesia and Analgesia

There have been a number of investigations evaluating the utility of this block for hemorrhoidectomy, as the postoperative pain of this procedure can be very severe [23–29]. Pudendal nerve blockade has been found to confer substantial benefits for pain control over other types of analgesia, such as neuraxial blocks, general anesthesia, or nonspecific local anesthetic infiltration to the soft tissues of the perineum [23, 24, 26, 29]. Additionally, the use of this block is associated with reduced length of patient stay in hospital, reduced oral analgesic consumption, and improved patient satisfaction over other methods of analgesia [23, 24, 28, 29]. Urinary retention after hemorrhoidectomy is a common and undesirable side effect of anal surgery, as well as with neuraxial anesthetic techniques [30, 31]. The use of pudendal nerve blockade has been shown to significantly reduce this particular postoperative complication [26, 28, 32].

The evaluation of benefits of pudendal nerve blockade has also been investigated for urological procedures such as penile prosthesis surgery [33, 34], hypospadias repair, and circumcision in pediatric population [35, 36], prostate biopsy [37–39], and placement of prostate HDR brachytherapy [40].

The use of pudendal nerve blockade has been described for gynecologic surgical procedures such as placement of suburethral tape and colpoperineorrhaphy [41, 42], yet reports of its use are not as robust as for its use in obstetrical practice. Pudendal nerve blockade, however, has not proven useful to reduce pain after transvaginal pelvic reconstructive surgery [43].

Obstetrical Anesthesia and Analgesia

The use of pudendal nerve blockade during labor has typically been reserved for the second stage of labor. During this stage, pain is experienced in the perineum and becomes somatic, innervated by the S2 to S4 nerve roots and the pudendal nerves.

Pudendal nerve block was likely more commonly used prior to the introduction of epidural anesthesia techniques. However, it can still be employed when neuraxial techniques are contraindicated or if sacral sparring occurs during epidural catheter use. This nerve block has been described for facilitating instrumented deliveries, episiotomies, repair of perineal tears, and McDonald cerclages for incompetent cervices [44–48].

Pudendal Neuralgia

Pudendal neuralgia is an uncommon cause of perineal pain that may result from compression of the nerve or its trunks along its course through the pelvis. Patients will typically describe pain in the perineal area that can include the clitoris, penis, vulva, and perianal area. This may be accompanied by a foreign body sensation within the vagina or rectum. Sitting on a flat surface, which transfers pressure from the soft tissues within the perineum to the pudendal nerve, may exacerbate pain. Conversely, pain may be relieved by standing or sitting on a toilet seat, which relieves that pressure [49].

Diagnosis of this pelvic pain syndrome is challenging, given the lack of a commonly accepted diagnostic test. To assist in identification of the subset of pudendal neuralgia-pudendal entrapment neuropathy (PNE), the Nantes criteria have been proposed which list clinical inclusion and exclusion criteria. Essential criteria include: (1) pain in the anatomical territory of the pudendal nerve, (2) symptoms worsened by sitting, (3) patient is not woken at night by pain, (4) no objective sensory loss on clinical examination, and 5) positive anesthetic pudendal nerve block [50].

Pudendal nerve blockade may satisfy the last essential Nantes criterion if the pain is relieved for the duration of the local anesthetic. However, as described in the original article, a positive diagnostic block may not be specific for pudendal neuralgia, as alternative causes of the perineal pain will be anesthetized if they are situated within the nerve's territory. The typical clinical practice is to inject both local anesthetic and steroid around the nerve. For patient with entrapment neuropathy, the duration of relief will be expected to outlast the effect of local anesthetic.

A negative diagnostic block may not rule out pudendal neuralgia if the nerve is anesthetized distal to the site of entrapment. For example, one may not achieve pain relief through a block performed at Alcock's canal when the site of entrapment is more proximal at the ischial spine [50].

Block Techniques

Transvaginal Technique

The pudendal nerve can be blocked transvaginally through a "blind" technique using the ischial spine as an anatomical landmark (Fig. 56.5). To perform the block, the distal end of an introducer is used to guide the needle toward the pudendal nerve, which allows for infiltrating needles to be advanced 1.0–1.5 cm beyond their distal openings. Introducers described in the literature include the Iowa trumpet or Kobak needle and needle guide [51].

The introducer is first placed against the vaginal mucosa, inferior to the ischial spine. In obstetrical anesthesia literature, the guide is to be held parallel to the delivery table [51]. The needle is advanced into the vaginal mucosa and 1 mL of local anesthetic is infiltrated. The needle is then advanced further until contact is made with the sacrospinous ligament, where another 3 mL of local anesthetic is injected. Care should be taken at this point to first aspirate for blood to help exclude intravascular injection prior to injection as the pudendal vessels will be in close proximity. The needle is then passed through the ligament into the loose areolar tissue posterior to it, where another 3 mL of local anesthetic is deposited prior to aspiration. These steps are then repeated, but with the introducer placed superior to the ischial spine so as to ensure adequate spread around the pudendal nerve [52].

Transperineal Technique

This approach has been described in the literature together with the use of nerve stimulation and has mainly focused on providing analgesia for either perineal surgical procedures or for management of pudendal neuralgia.

The techniques described commonly include stimulation of the pudendal nerve adjacent to the ischial spine to elicit a contraction of the external anal sphincter and perineal muscles. The ischial spine can be localized by palpation of the ischial spine by inserting a finger through the vagina or rectum. Once this anatomical landmark is identified, a needle is guided to this point through the skin overlying the ischiorectal fossa (Fig. 56.6). The skin entry point can vary between descriptions. However, maintaining anal sphincter and perineal muscle contraction while diminishing the stimulating current to 0.5–0.6 mA is typically used to optimize the final needle tip position [25, 27, 53].

It should be noted that anal sphincter contraction alone might not be sufficient for a satisfactory pudendal nerve block, as this may indicate that only the inferior rectal nerve branch is being stimulated. Contraction of the pelvic floor muscles is more desirable as it indicates that the perineal branch is also being stimulated, signifying that the pudendal nerve itself, rather than individual branches, is being contacted.

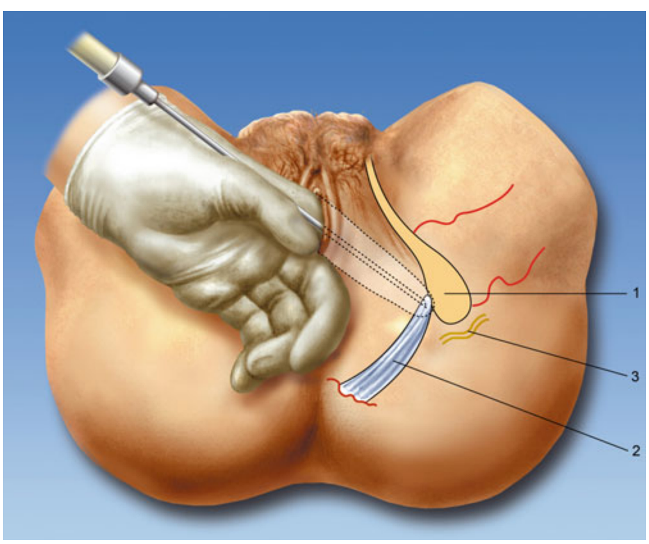

Fig. 56.5 Transvaginal access. (*1*) Ischial spine, (*2*) sacrospinous ligament, (*3*) pudendal nerve (With permission from Dr. Danilo Jankovic)

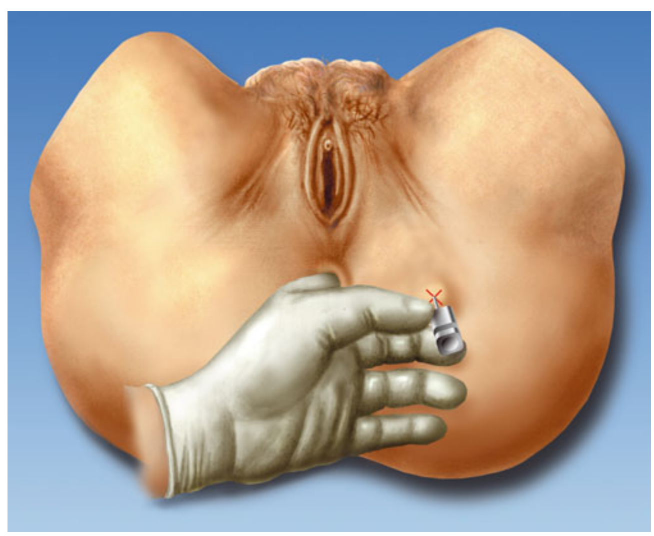

Fig. 56.6 Transperineal access. Rectal palpation of the ischial spine with the index finger. The needle is introduced into the ischiorectal fossa (With permission from Dr. Danilo Jankovic)

Transgluteal Approach

Fluoroscopic Guided

Blockade of the nerve is accomplished by targeting the nerve within the gluteal region as it courses adjacent to the ischial spine (Fig. 56.7).

Patients are placed in a prone position. A fluoroscope is then positioned over the targeted side of blockade to obtain an oblique view 5-20° to the side to be blocked. This view exposes the ischial spine more clearly, avoiding the overlapping with the pelvic brim [54, 55]. Once the ischial spine is identified, a skin entry point on the buttock is marked at the tip of the ischial spine. After skin infiltration with local anesthetic is achieved, a spinal needle can be advanced, coaxial to the fluoroscopic beam, until it contacts the bony surface of the spine. At this juncture, a lateral fluoroscopic view can be obtained to confirm appropriate needle depth and contact with the spine. Once satisfied, 1 mL of contrast medium can be injected to confirm appropriate soft tissue spread [54, 55]. Once complete, injection of the chosen solution can take place.

Contrast spread patterns described include spread in an irregular or round pattern at the tip of the ischial spine. Additionally, spread can occur along the ipsilateral obturator internus muscle, sacrotuberous ligament, or sacrospinous ligament. Investigators have not described any particular correlation between pattern of spread and success of sensory blockade [54].

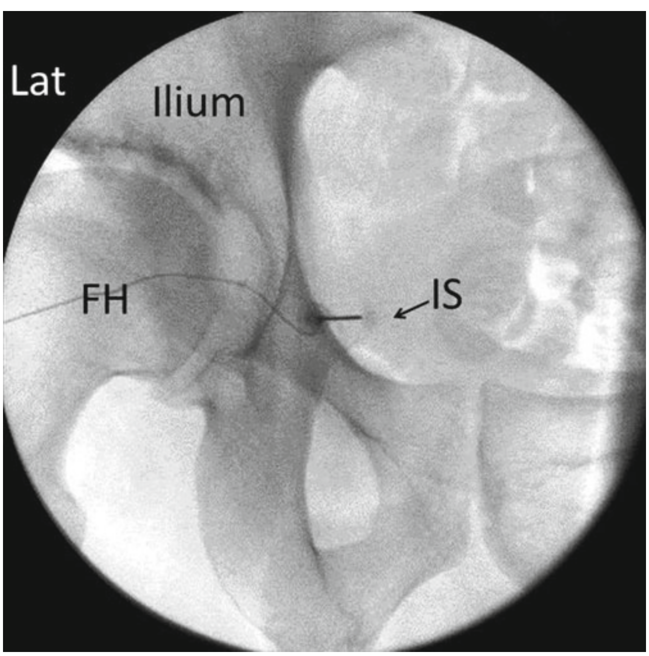

Fig. 56.7 Fluoroscopy guided pudendal nerve block. *FH* femoral head, *Lat* lateral, *IS* tip of the ischial spine (Reproduced with permission from Philip Peng Educational Series)

Ultrasound Guided

The use of an ultrasound-guided approach to block the pudendal nerve has been described in the literature [12, 14, 56, 57]. The use of ultrasound allows for the visualization of soft tissues, needle advancement, and live spread of injectate around the target structures. The target at the level of ischial spine is the interligamentous plane, which is defined by soft tissue, not bony, landmark.

This technique has been validated using sensory change as endpoint [56] and compared against the use of the fluoroscopic guided approach in a randomized trial [57]. The use of ultrasound has proven to be as accurate as the use of fluoroscopy, yet ultrasound guidance requires more procedure time.

Patients are placed in a prone position, and a curvilinear transducer with a low frequency (2–5 MHz) is required because of greater tissue depths. The transducer is first positioned over the ilium at the level of posterior superior iliac spine (PSIS). The ilium appears as a straight, hyperechoic line descending laterally (Figs. 56.8 and 56.9). As scanning continues caudally at the level of greater sciatic notch, the hyperechoic line of the ilium starts to regress from the medial aspect of the screen. The lateral aspect of the ultrasound screen transitions to a curved hyperechoic line revealing the posterior aspect of the acetabulum. At this point, two muscular layers can be identified: the gluteus maximus and the piriformis muscles.

Moving the probe in the caudal direction to the ischial spine reveals four changes in sonographic image: the curved posterior portion of the acetabulum transitions to the straight ischial spine, disappearance of the piriformis muscle, appearance of a dense hyperechoic line extending medially from the ischial spine, and appearance of the pudendal artery. The most likely location of the pudendal nerve is medial to this artery, and careful scanning may reveal its fascicular structure.

Once the anatomy is identified as best possible, a needle is advanced medial to the probe at a steep angle, using an in-plane approach. Owing to the steep angle of needle advancement, the needle insertion point should be 2 cm away from the probe. Movement of the tissues or spread of injectate may be used to act as surrogate markers for locating the needle tip position.

The needle will eventually pierce through the sacrotuberous ligament, which may provide sturdy resistance to advancement. One may feel a "pop" sensation as the needle passes through. At this juncture, injection can begin under direct ultrasound visualization. Ideally, spread of the injectate is medial to the pudendal artery and is contained between the sacrotuberous and sacrospinous ligaments. If the injectate does not follow this pattern, the needle can be repositioned. There is no investigation on the optimal injectate. The authors preferred plain bupivacaine (to avoid jeopardizing circulation to the entrapped nerve) and steroid, e.g., 4 mL 0.25 % bupivacaine and 40 mg Depo-Medrol®.

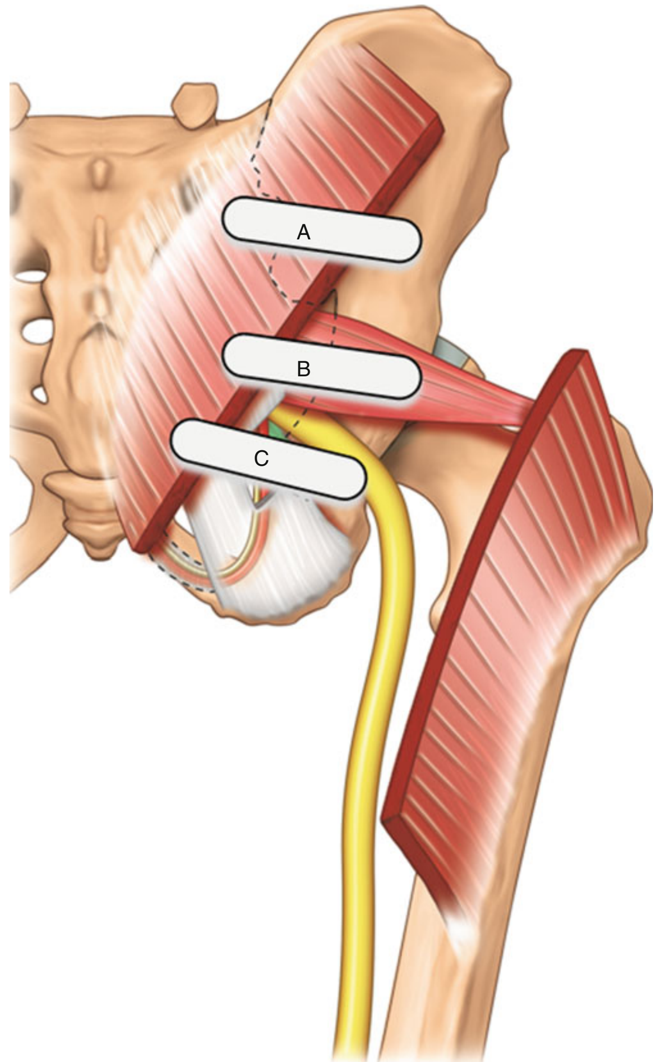

Fig. 56.8 Three positions of the ultrasound probe: (*A*) the ilium at the level of the posterior superior iliac spine, (*B*) at the level of the greater sciatic notch, and (*C*) at the level of the ischial spine (Reproduced with permission from Philip Peng Educational Series)

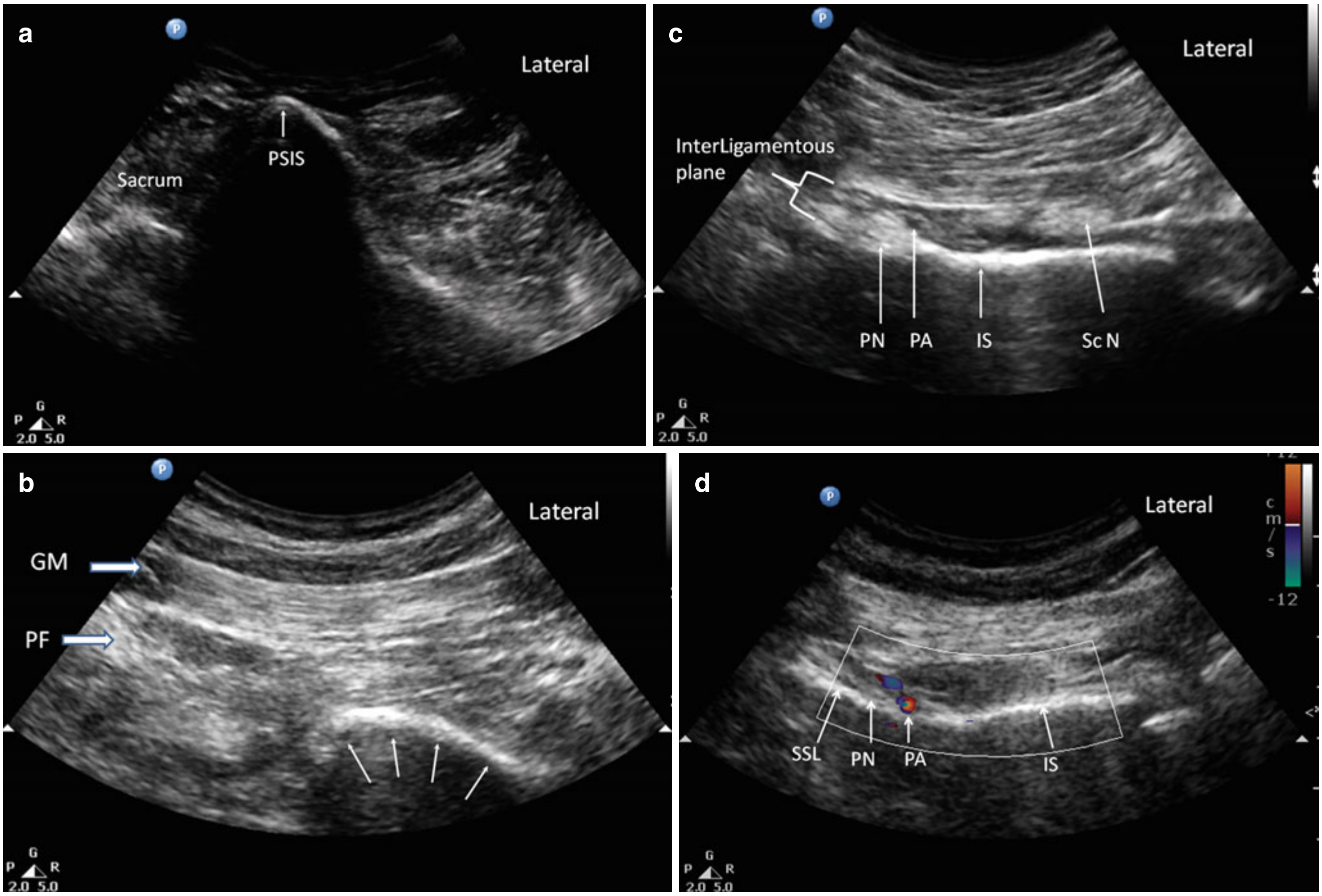

Fig. 56.9 (**a**) Ultrasound image at probe position A. (**b**) Ultrasound image at probe position B. *Line arrows* indicate the ischium, which is curved as it forms the posterior portion of the acetabulum. (**c**) Ultrasound image at probe position C. (**d**) Color-flow Doppler to show pudendal artery. *GM* gluteus maximus, *IS* ischial spine, *PA* pudendal artery, *PF* piriformis muscle, *PN* pudendal nerve, *PSIS* posterior superior iliac spine, *ScN* sciatic nerve, *SSL* sacrospinous ligament (Reprinted with permission from Philip Peng Educational Series)

CT Guided

This technique is more resource intensive compared to previously described methods. However, the advantage in using CT lies in its ability to more clearly define the anatomy of the pelvis. Use of CT scanning can not only block the pudendal nerve at the ischial spine, but also within Alcock's canal which other previously described techniques cannot accomplish owing to the canal's depth within the pelvis.

To perform a block at the level of the ischial spine, patients are placed in a prone position. Scanning can be performed using 2.5–5-mm-thick scans of the pelvis from the acetabular roof to the pubic symphysis. This can provide identification of the ischial spine, sacrotuberous and sacrospinous ligaments, pudendal bundle, and the falciform ligament of the sacrotuberous ligament [58–61]. Needles are passed transgluteally toward the caudal portion of the ischial spine, near the pudendal neurovascular bundle. One may feel the tip of the needle traverse the sacrotuberous ligament. Once the needle tip is in satisfactory position, contrast is injected to confirm appropriate spread. Ideally, contrast will surround the pudendal bundle between the sacrotuberous and sacrospinous ligaments. Once this is confirmed, the pudendal block can be performed [58–61].

To block the pudendal nerve within Alcock's canal, CT scanning is performed at the level of the pubic symphysis, which allows visualization of the obturator internus muscle inferior to the ischial spine. The pudendal neurovascular bundle can be identified on the medial aspect of the obturator internus muscle. A needle is passed in a transgluteal approach and placed in the fatty tissue immediately lateral to the obturator fascia. Contrast is injected to visualize the pudendal nerve at the entrance of Alcock's canal [58–61].

MRI Guided

Pudendal nerve blockade through magnetic resonance neurography (MRN) has been described [63–65]. As with CT-guided techniques, using MRI is resource intensive which limits it use. However, the advantage again lies with excellent tissue resolution to image the target nerve for accurate needle placement and injection. MRI also allows for the visualization of oblique needle paths through the use of multiplanar imaging capabilities [64]. Studies using MRN for pudendal nerve blockade have been limited to the diagnosis and therapy of chronic pelvic pain syndromes.

MRN can be especially useful to block the pudendal nerve within Alcock's canal, if clinically indicated [64]. The sensitivity of MRI at 1.5 T can allow operators to identify if an injection to Alcock's canal occurred inside or outside of the canal. If the injectate were seen to spread medial to the canal, it would be unlikely that the nerve was appropriately anesthetized, as the obturator internus fascia would protect the nerve from any drug effects. As such, the needle can be repositioned to facilitate a successful block.

Equipment and Solutions

Reports describing the use of pudendal nerve blockade have tremendous variability in the types and volumes of injectates used. Needle types are also inconsistent, but typically depend on the type of guidance employed to perform the block (e.g., transvaginal with introducer, ultrasound, or MRN).

Table 56.1 provides a brief survey of needle types and injectates used to perform pudendal nerve blocks according to the approach used.

Table 56.1 Technical details of various approaches of pudendal nerve blockade

Approach	Indication	Needle gauge and type	Injectate
Transvaginal	Obstetrical analgesia	22-gauge, 150-mm needle via tubular introducer	9 mL 1 % lidocaine [52]
	Obstetrical analgesia	Not specified	20 mL 1 % lidocaine [66]
	Obstetrical analgesia	Not specified	20 mL 1 % mepivacaine [67]
	Obstetrical analgesia	Not specified	5 mL 2 % prilocaine [44]
Transperineal	Coloperineorrhaphy	100-mm stimulating needle	10 mL 0.25 % bupivacaine [42]
	Episiotomy analgesia	100-mm stimulating needle	15 mL 0.75 % ropivacaine [47]
	Chronic pelvic pain and anorectal surgery	22-gauge, 100-mm stimulating needle	5 mL 0.25 % bupivacaine [53]
	Transrectal ultrasound guided prostate biopsy	22-gauge spinal needle	10 mL 1 % prilocaine [38]
Transgluteal fluoroscopy	Chronic perineal pain	25-gauge, 3.5″ spinal needle	3 mL 0.38 % ropivacaine and 20 mg triamcinolone [54]
Transgluteal ultrasound	Pudendal neuralgia	22-gauge, 120-mm insulated stimulating needle	5 mL 0.25 % bupivacaine in 1:200,000 epinephrine and 40 mg methylprednisolone [68]
Transgluteal CT	Pudendal neuralgia	22-gauge spinal needle	4 mL 1 % lidocaine and 1 mL triamcinolone [62]
	Pudendal neuralgia	22-gauge spinal needle	1 mL 2 % lidocaine and 1 mL methylprednisolone [59]
	Pudendal neuralgia	22-gauge spinal needle	3 mL 0.25 % bupivacaine and 1 mL of 40 mg/mL methylprednisolone [60]
Transgluteal MRI	Pudendal neuralgia	20-gauge, 100-mm MRI Chiba needle	1.5 mL of 0.25 mL triamcinolone 40 and 1.25 mL 0.5 % bupivacaine [65]

Complications

When performing pudendal nerve blockade for obstetrical anesthesia, the most frequently observed complication reported has been block failure [51]. When used during the second stage of labor, failure rates of the block have ranged from 10 to 50 % in the literature [45]. This may be due to failure of the local anesthetic to reach the nerve or improper timing of the block placement. If the block is placed as the fetal head is crowning, nerve blockade may not be effective in time for an episiotomy and may only be fully established in time for the repair [51].

Other more common complications can include unintended blockade of adjacent nerves. If pudendal nerve blockade is performed at the ischial spine, local anesthetic spread to the sciatic nerve may lead to sensory and motor blockade of the lower limb [57, 60]. Depending on the patient setting, this could lead to delays in ambulation, risk of falls, or delayed discharge from hospital or clinic. A randomized controlled study comparing fluoroscopic and ultrasound-guided pudendal nerve blockade through a transgluteal approach revealed an incidence of sciatic nerve sensory loss in 7/23 fluoroscopic guided procedures and 3/23 ultrasound-guided procedures. Motor weakness in the form of foot drop was noted in two patients for each group [57].

The posterior femoral cutaneous nerve is another nerve in close proximity to the pudendal nerve at the level of the ischial spine that also provides sensory innervation to the perineum. If a pudendal nerve blockade is being used to assist in the diagnosis of a pelvic pain syndrome, local anesthetic spread to the posterior femoral cutaneous nerve may lead to false-positive results [64].

The pudendal nerve provides motor innervation to the urethral sphincter and external anal sphincter, and loss of muscle tone may lead to temporary incontinence of bladder or bowel function. In the study comparing fluoroscopic to ultrasound-guided techniques of pudendal nerve blockade, only one patient of 23 experienced bladder incontinence with bilateral pudendal nerve blockade [57]. Although this may be an infrequent occurrence, patients should be made aware of this possibility.

Practitioners and patients should also be made aware of the uncommon, yet serious complications that are possible through pudendal nerve blockade. When used for labor analgesia, cases of fetal distress and neonatal local anesthetic toxicity have been documented. Presentations of the neonates with local anesthetic toxicity have included hypotonia, apnea, bradycardia, cyanosis, prolonged QT interval, and seizure activity [69, 70]. Factors that may increase the risk of this event include fetal ion trapping in the presence of acidosis and increased local anesthetic vascular uptake from the perineum during labor [69, 70].

Introduction of infection after transvaginal blocks for labor analgesia has been reported due to seeding of bacteria into soft tissues from vaginal mucosa. This can lead to serious morbidity and mortality, with two deaths having been reported in the literature [71, 72]. Abscess formation has been reported posterior to the hip joint, into the gluteal musculature, or the retropsoal space [71]. Of note, authors of these reports have highlighted the risk of delays in diagnosis as the clinical presentation can be initially confused with normal postpartum pain from sacroiliac joint strain or trochanteric bursitis [52, 71, 73].

The formation of significant hematoma after pudendal artery puncture has also been described in the literature in conjunction with infection [52, 73]. After blind infiltration for labor analgesia, an infected retroperitoneal hematoma along the iliac and psoas muscles has been reported, which extended from the midpelvis to the infrarenal fossa [73]. Infection rather than blood loss was the principal concern in this case, however.

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