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Lesson 19 Volume 39

The Use of Local Anesthetics for Urogenital Pain*

Learning Objective: At the conclusion of this continuing medical education activity, the participant will be able to describe the uses and indications for peripheral nerve blocks in urological practice.

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INTRODUCTION

Medical use of local anesthetic agents dates back to late 19th century Russia, with descriptions of cocaine as a lingual and subcutaneous injection. The first published description of the anesthetic amino ester procaine (Novocain®) came from Germany in 1905, and development of novel local anesthetics expanded over the next several decades.[1] Use of these agents for peripheral nerve blocks has become increasingly common in the operative and office settings. **From a urological standpoint peripheral nerve blocks have 3 important roles in clinical practice: to provide surgical anesthesia, to aid in the diagnosis of urological related pain conditions and to provide therapy in a select group of patients.** Regardless of the type of block, the performing urologist must have adequate knowledge of the local anatomy, the indication for each block and the possible adverse effects.[2] This Update discusses the indications for peripheral nerve blocks, the fundamentals of performing them within a urological setting, the types of local anesthetics and their indicated uses, and the role of peripheral nerve blocks in the diagnosis and potential treatment of urological conditions. It by no means provides an exhaustive description of peripheral nerve blocks, but rather aims to provide a fundamental base that one can use to further education and application of nerve blocks in urology.

INDICATIONS FOR NERVE BLOCKS

Surgical anesthesia. Peripheral nerve blocks are an important component of multimodal anesthesia in the perioperative setting, and they are being increasingly adopted. **PNB use results in improved postoperative outcomes, including enhanced postoperative pain control, reduced total intraoperative and postoperative opioid use, decreased postoperative nausea and vomiting, shorter hospital stay, earlier participation in physical therapy and increased patient satisfaction.**[3] With an estimated 2 million people in the United States alone suffering from opioid addiction, coupled with the increased drive to reduce postoperative narcotic use, the role of PNBs is of increased importance and interest.[4]

PNBs may be used via either a single dose injection to the targeted area or an indwelling catheter for continuous infusion of local anesthetic.[3] In certain instances PNBs can serve as the primary mode of anesthesia, such as in high risk patients who cannot undergo general anesthesia or infants undergoing simple, same day procedures. Wipfli et al reported using ultrasound guided spermatic cord block to successfully perform subcapsular orchiectomy or vasovasostomy in 38 of 40 patients without general anesthesia, emphasizing the high effectiveness of PNBs when used as unimodal anesthesia.[5]

Peripheral block of the pudendal nerves and/or its branches has been particularly useful within the field of pediatric urology. These blocks have allowed anesthesiologists to decrease, if not eliminate, opioid requirements during common pediatric urological procedures.[6-8] Such reduction in opioid use may lower the incidence of complications such as hypoventilation, postoperative nausea/vomiting, pruritus and somnolence.[6] Although children and infants require greater precision in the administration of PNBs due to their smaller size, there are many benefits of local anesthetic administration, including easy palpation of anatomical landmarks, a thinner myelin sheath and loose perineural connective tissue—all of which allow for improved application of the nerve blockade.

Diagnosis/prognosis. Differentiation between a primary and a referred source of pain is a frequently encountered dilemma in urological practice. A common example is the patient who presents with chronic orchalgia with an unremarkable scrotal ultrasound. Such pain may be localized to the scrotal contents but it may also be derived from extrascrotal sources as varied as inguinal hernia, ureteral calculus, and abdominal and pelvic aneurysms. When the source of pain remains unclear after a detailed history and physical examination, one may consider performing a spermatic cord block to further aid diagnosis. Significant pain relief after administration of a spermatic cord block suggests a source of pain distal to or at the site of injection.[9] When all forms of conservative management have failed, chronic orchalgia may be treated surgically by either microsurgical spermatic cord denervation or orchiectomy.

Heidenreich et al retrospectively reviewed 35 patients who underwent microsurgical spermatic cord denervation for chronic testicular pain.[10] Preoperatively all patients had a normal scrotal ultrasound. Additionally each patient underwent a diagnostic spermatic cord block with 10 cc lidocaine and 1 cc methylprednisolone. To be included in the surgical intervention, a patient had to have complete resolution of pain with the block. During a mean follow-up of 34 months 97% of patients (34 of 35) remained pain-free.

Larsen et al performed a similar retrospective review of 68 patients with chronic testicular pain who underwent microsurgical spermatic cord denervation.[9] Of note, 30 of these patients had undergone failed surgical attempts for correction of chronic scrotal pain. The authors performed a cord block with 20 cc 0.25% bupivacaine at the pubic tubercle. Patients were eligible for microsurgical cord denervation if they experienced >50% relief of pain from the diagnostic block. Postoperatively the surgery naïve patients experienced a 79% reduction in scrotal pain compared to baseline, and patients with previous failed surgical attempts had an average 67% decrease in pain. Of the surgery naïve patients 64% experienced complete resolution of scrotal pain postoperatively, compared to 50% of those who had undergone previous surgical attempt(s). The authors conclude that men with chronic orchalgia who experience improvement in pain after a cord block may benefit from microsurgical spermatic cord denervation, even if they have previous failed surgeries for chronic orchalgia.

Therapy. Peripheral nerve blocks often generate a therapeutic effect that lasts far longer than one would expect given the relatively short half-lives of the anesthetic agents. This phenomenon has been the basis for incorporating PNBs into the treatment algorithm for various forms of headache.[11-13] Singh et al suggest that PNB may have a role in the treatment of pelvic pain, specifically for patients suffering from pudendal neuralgia.[14] They further suggest a possible role for PNB in the prevention of "centralized" pain. Although we have seen

ABBREVIATIONS: MFTrP (myofascial trigger point), PNB (peripheral nerve block)

pudendal nerve blocks provide significant long-lasting reductions in pelvic pain secondary to pudendal neuralgia and pelvic floor myalgia, no randomized, placebo controlled study has examined the therapeutic role for these and similar conditions.

One must be concerned about a strong placebo effect for any patient who appears to have a therapeutic response to a PNB. In an attempt to detect a placebo response for a PNB Curatolo and Bogduk described a triple block, in which a placebo and a therapy were both administered in either order, followed by a randomization of either therapy to determine the true efficacy of the treatment.[2] They further suggested using short vs long acting agents to interrogate the patient regarding duration of symptom relief as such strategies are helpful when there are concerns for malingering behaviors or a factitious disorder. Given the intensity of such a regimen, as well as ethical concerns outside the realm of an institutional review board approved clinical investigation, these studies are rarely performed. Instead, the clinician must rely on accurate patient reporting with a keen sense of clinical judgement.

Trigger point injections. **Pelvic pain may be generated by myofascial trigger points, which are described as discrete, focal, hyperirritable spots located in a taut band of skeletal muscle**. When palpated, pain is usually elicited at that site or a referred site. MFTrPs of the pelvic floor, along with high tone or hypertonic pelvic floor dysfunction, may be identified in as many as 85% of patients with urological, colorectal or gynecologic pelvic pain syndromes, with symptoms including bowel, bladder and sexual dysfunction.[15] These regions may enhance the pain of the initial pathology or be the primary pain generator. Therefore, identification and therapeutic intervention for MFTrPs are essential for optimal patient care.

First line treatments for MFTrPs include conservative measures such as behavioral modifications, physical therapy, topical heat, aggressive constipation control and skeletal muscle relaxants. **Injections of small doses of anesthetic agents directly into trigger points may be considered as adjunctive therapy or if conservative measures fail.** Although there are few controlled studies on the use of MFTrP injections for pelvic pain, these injections are slowly becoming a mainstay in the treatment of refractory myofascial pelvic pain. Interestingly previous studies have shown that the placement of a needle into the trigger point without injection—a practice known as "dry needling"—has shown clinical efficacy.[16,17] Nevertheless, most experts advocate the use of small local anesthetic doses into the MFTrPs to reduce local muscle spasm and postprocedural discomfort.[18] Although the exact mechanism of action is still unknown, several theories regarding inactivation of active MFTrPs after injection with a local anesthetic have been proposed, including 1) mechanical disruption of muscle fibers and nerve endings leading to depolarization of nerve endings, 2) interruption of the positive feedback loop that perpetuates pain, 3) dilution of nociceptive substances by the infiltrated anesthetic, 4) vasodilation effect of anesthetic to remove excess metabolites, 5) release of endorphins, thereby decreasing pain perception and 6) release of various nociceptive/inflammatory biochemical substances.[18-20] Injections with a local anesthetic can inactivate trigger points and provide immediate symptomatic pain relief that may last for a few hours to several weeks, although long-lasting relief can only be achieved when mechanical and systemic perpetuating factors are also corrected.[21]

Trigger point injections to the pelvic floor muscles are commonly delivered through a transperineal approach in the male and a transvaginal or extravaginal approach in the female (fig. 1, *A*). As with a standard nerve block, even temporary relief of pain after injection suggests that all or a portion of the pain is related to the injected muscle group(s). The trigger points are

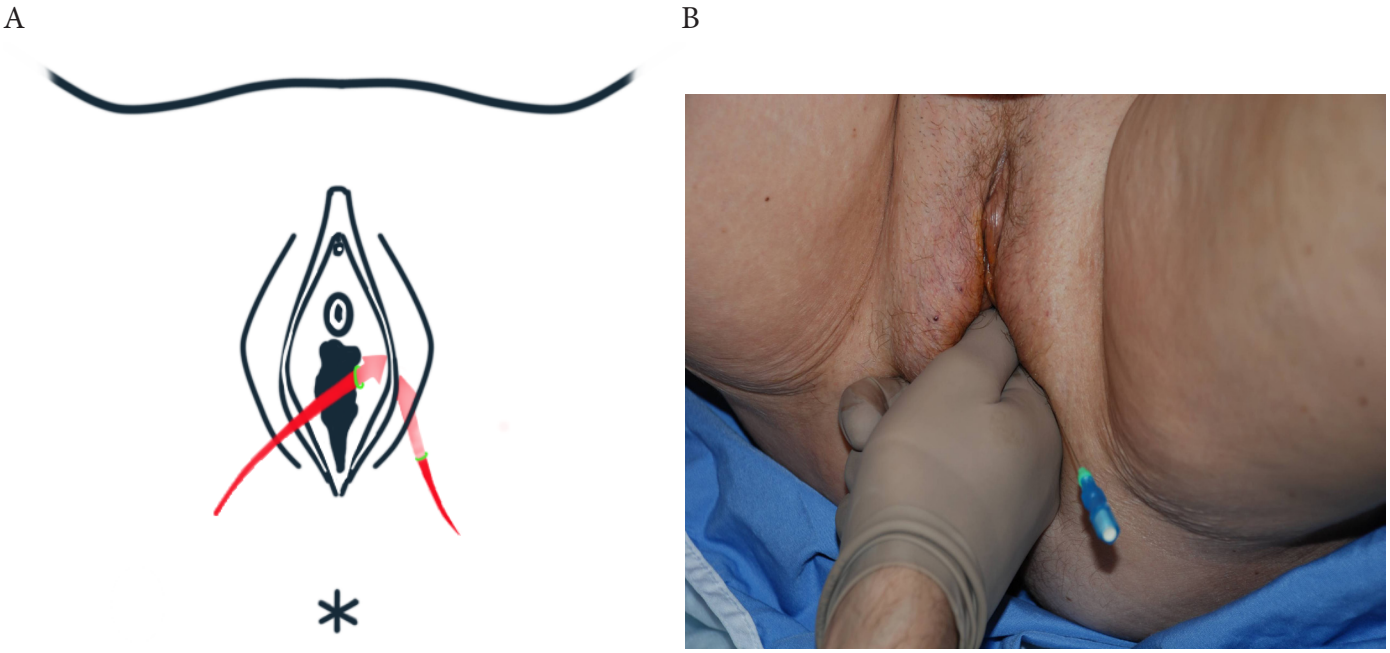

Figure 1. *A*, transvaginal and extravaginal approaches for trigger point injections to pelvic floor muscles. *B*, transvaginal trigger point injection to levator ani muscle group using 8-inch 25 gauge nerve block needle. In this instance trigger point is first palpated. Examiner's finger is reintroduced alongside needle. Needle is then advanced directly into trigger point and small amount of anesthetic agent (~0.5 cc) is introduced. We usually work from deeper sites to more superficial as injections are technically easier to perform and patients have progressive decrease in discomfort with each injection.

identified by palpation (fig. 1, *B*) and a small gauge needle (eg 25 gauge) is introduced directly into the trigger point with injection of 0.25 to 1 cc local anesthetic. A successful disruption of the targeted trigger point is identified by tissue relaxation and/or resolution of pain. Multiple trigger points may be treated in a single procedure.[15] Procedural complications are uncommon but may include infection, hematoma, syncopal episode, permanent worsening of pain, intravascular injection (systemic toxicity) and intraneural injection (nerve damage).[22-24] Before the procedure patients should be educated on realistic expectations regarding this treatment option. Initial increased pain at the injection site after the procedure may occur and last up to 24-48 hours.

PERFORMING PERIPHERAL NERVE BLOCKS

Successfully performing peripheral nerve blocks requires a thorough understanding of regional anatomy and nerve distribution. Common target nerves and sensory regions are presented in Appendix 1. **Somatic sensory innervation of the lower abdomen and thigh, including the groin and testis, is supplied by 3 nerves, the iliohypogastric, ilioinguinal and genitofemoral nerves**. Despite being described individually herein, there is a significant amount of overlap in their sensory distributions (fig. 2).[9]

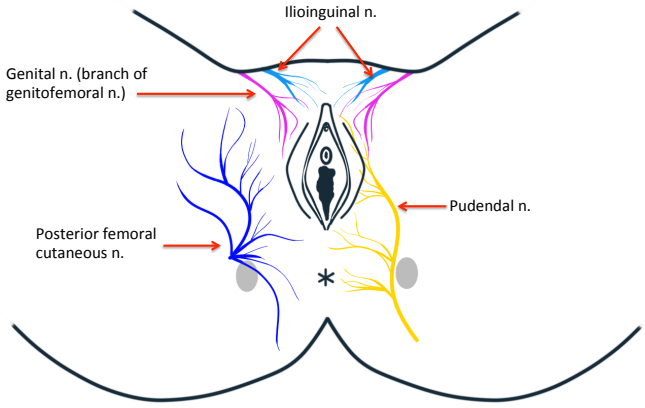

Figure 2. Sensory innervation to perineum. Note overlapping nerve (*n.*) distribution between branches of posterior femoral cutaneous nerve/pudendal nerve and ilioinguinal/genital nerves.

The ilioinguinal and iliohypogastric nerves originate from T12-L1 nerve roots via the lumbar plexus, exit laterally through the psoas and pass diagonally over the ventral surface of the quadratus lumborum before piercing the transversus abdominis, internal oblique and external oblique muscles. They continue toward the deep inguinal ring and into the inguinal canal.[5] Together these nerves provide sensory innervation for the lower anterior abdominal wall, mons pubis, penile shaft, clitoral hood, upper medial thigh, anterior scrotum and anterior labia majora.

The genitofemoral nerve arises from L1-L2 and passes retroperitoneally over the anteromedial surface of the psoas posterior to the ureter. The genital branch continues downward and enters the inguinal canal through the deep inguinal ring. Terminal branches run within the spermatic cord to innervate the parts of the scrotum and their contents. Testicular sensation is also provided by the autonomic nerves, which travel with the gonadal vessels and vas deferens. Notably some intestinal fibers from the intermesenteric plexus travel to the testicle and may explain the "kick in the stomach" sensation accompanying testicular injury.[25] Some of this sensation can be reduced with a cord block.

Innervation of the scrotal skin varies based on the scrotal location (fig. 3). The anterior scrotal nerves, which branch off the ilioinguinal nerve, supply the anterior scrotal skin. The genital branch of the genitofemoral nerve provides sensation to the anterolateral surface.[25] The posterior surface is innervated by the posterior scrotal nerves, which branch off the perineal nerve (derived from the pudendal nerve). The overlapping innervation helps explain why the scrotal skin must be anesthetized using a field block rather than blockade of a single nerve.[5]

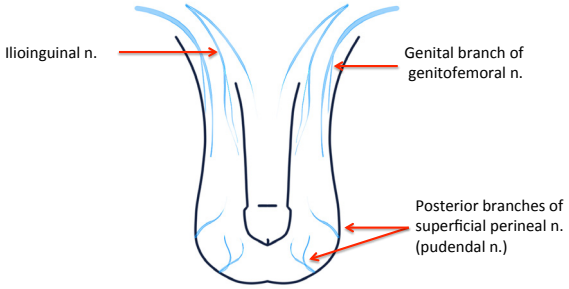

Figure 3. Overlapping innervation of scrotum. *n.*, nerve.

The pudendal nerve arises from the ventral rami of S2-S4 and is both sensory and motor.[26] The nerve initially courses through the superior aspect of the pelvis between the piriformis and coccygeus muscles before exiting via the greater sciatic foramen. The nerve remains ventral to the sacrotuberous ligament while crossing the posterolateral aspect of the sacrospinous ligament, and thereby continues ventrocaudally back into the pelvis via the lesser sciatic foramen.[27,28] **The ischial spine is an important landmark for image and tactile guided blocks of the pudendal nerve**.

The nerve then follows the lateral edge of the ischiorectal fossa within a sheath of the obturator internus fascia, called the Alcock canal. The first branch is the inferior rectal nerve, which arises just before entering the canal or exits early.[28, 29] This nerve provides sensation to the distal anal canal and perianal skin, and also provides motor innervation to the external anal sphincter.[27] The Alcock canal can be approximated medial to the ischial tuberosity and posterior to the sacrospinous ligament.[30]

The remaining branches are the perineal and dorsal nerves of the penis or clitoris.[26] The perineal nerve enables sensory input from the perineum and posterior scrotum or labia majora. Motor branches are for the perineal muscles, ie the superficial and deep transverse perineal muscles, bulbospongiosus, ischiocavernosus, urethral sphincter (pubourethralis in males and pubovaginalis in females) and levator ani muscles. The dorsal nerve provides sensation from the glans penis or clitoris. Sympathetic fibers that travel with the pudendal nerve contrib-

ute to the erectile and ejaculatory mechanisms via the perineal and dorsal nerves (fig. 4).

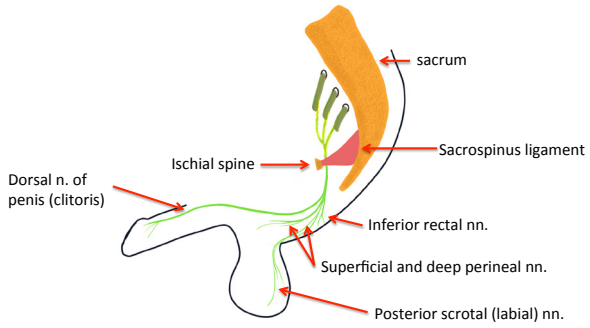

Figure 4. Schematic course of pudendal nerve (*n.*). *nn.*, nerves.

"Pudendal neuralgia" is a term used to describe a constellation of signs and symptoms to suggest pudendal nerve dysfunction at some point along its course. Complaints may include pain (burning, shocks, paresthesias, abnormal temperature sensations) along the sensory distribution of the pudendal nerve. Bowel, bladder and sexual dysfunction complaints are also common. Well described etiologies include obstetric injuries, transvaginal prolapse procedures involving the sacrospinous ligament, traumatic fracture of the ischial spine, nerve entrapment between the sacrotuberous and sacrococcygeal ligaments, and compression of the nerve within the pudendal canal.[26]

ANESTHETIC AGENTS

The commonly used local anesthetics, including lidocaine, bupivacaine and ropivacaine, function as sodium and calcium channel blockers. They appear to affect the small unmyelinated fibers first, such as the A-delta and C-fibers involved in the transmission of pain.[31, 32] Epinephrine is generally avoided in peripheral nerve blocks to prevent vasoconstriction of the vasa nervorum and subsequent nerve ischemia.[2]

The typical duration of action of each local anesthetic and the maximal safe doses with and without epinephrine in adults are presented in the table. The addition of epinephrine allows a higher total dose of anesthetic to be used. However, given the risk of nerve damage, we do not advocate epinephrine use when performing peripheral nerve blocks. Of note, maximal dosing of local anesthetic in children differs from adult dosing based on mg/kg of agent used.[33] The pediatric maximum safety dosing is not addressed in this Update.

TYPES OF BLOCKS

Dorsal penile nerve block. This simple procedure effectively blocks a branch of the pudendal nerve at a point easily accessible to the urologist. The paired dorsal penile nerves enter at the 10 and 2 o'clock positions. It is important to recognize that the superficial and deep dorsal veins are in the midline. The technique involves palpating the space between the base of the penis and mid pubic symphysis and piercing the skin with a high gauge needle pointed posteriorly. In children the needle should be advanced 2.5 to 5 mm, while in adults it should be advanced about 5 mm deep to the edge of the pubic symphysis.

Aspiration of the needle is performed to ensure it is not in an intravascular position. Some prefer to angle the needle laterally toward the nerves to avoid the midline veins, as well as a more superficial injection to avoid vascular injury while still allowing a successful block. The local anesthetic agent should be deposited in this space. In children an option is 1 ml/kg 0.25% bupivacaine.[6] In adults the literature commonly describes 10 ml 0.5% bupivacaine, and we usually use approximately 10 cc of a 1:1 solution of 2% lidocaine and 0.5% bupivacaine. Complications include localized hematoma, systemic toxicity and penile ischemia, which can be minimized by adherence to good technique.

Caudal block. The caudal block technique is most often described in the pediatric literature because anatomical landmarks are more easily palpable. However, caudal block may have applications in some chronic pain conditions for adults, which are described primarily in the anesthesia literature. An

Table. Pharmacokinetics of commonly used local anesthetic agents

		Duration		Max Recommended Dose for Adults	
	Onset (mins)	Without Epinephrine	With Epinephrine	Without Epinephrine	With Epinephrine
			Amides		
Articaine	2-4	30-120	60-240	5.0 mg/kg or 350 mg	7.0 mg/kg or 500 mg
Bupivacaine	2-10	120-240	240-480	2.5 mg/kg or 175 mg	3.0 mg/kg or 225 mg
Etidocaine	3-5	200	240-360	4.5 mg/kg or 300 mg	6.5 mg/kg or 400 mg
Lidocaine	<1	30-120	60-400	4.5 mg/kg or 300 mg	7.0 mg/kg or 500 mg
Mepivacaine	3-20	30-120	60-400	6.0 mg/kg or 400 mg	7.0 mg/kg or 550 mg
Prilocaine	5-6	30-120	60-400	7.0 mg/kg or 400 mg	10.0 mg/kg or 600 mg
			Esters		
Chloroprocaine	5-6	30-60	—	11.0 mg/kg or 800 mg	14.0 mg/kg or 1000 mg
Procaine	5	15-90	30-180	10.0 mg/kg	14.0 mg/kg
Tetracaine	7	120-240	240-480	2.0 mg/kg	2.0 mg/kg

epidural via a caudal approach produces a saddle-like block by depositing local anesthetic near the sacral nerve roots, from which the pudendal nerve arises, providing anesthesia to the perineum and buttock that would touch a saddle while riding a horse. Patients with pain in this distribution may benefit from a consultation with anesthesiologists familiar with performing this block.

The sacral cornua provide a critical landmark for identifying the sacral hiatus, the injection site, which is found in the midline. In the adult population the sacral cornua are unilaterally palpable in only 25% of patients and are bilaterally impalpable in 54%, making blind passage difficult. Under fluoroscopy with the patient prone a lateral image demonstrates the sacral hiatus as an abrupt drop-off at the end of S4. Contrast material can be injected into the sacral epidural space to confirm needle position. On ultrasound the sacral cornua, sacrococcygeal ligament and base of the sacrum can be seen in a single view to help guide a needle into the hiatus.[7] In children the paired sacral cornua are palpated and a 21 gauge needle is used to pierce the sacrococcygeal ligament, after which local anesthetic is deposited (fig. 5).[6]

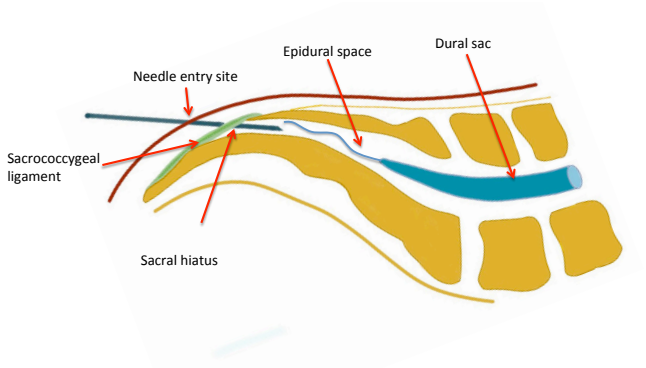

Figure 5. Key anatomy and landmarks for caudal block needle insertion.

Spermatic cord block. The goal of the spermatic cord block is to infiltrate branches of the ilioinguinal and genitofemoral nerves.[32] Its effectiveness has an anatomical basis, as investigators have found that the greatest concentration of nerves in the spermatic cord is found around the vas deferens and internal spermatic arteries as well as within the cremaster muscle and cord fascia.[34, 35] This block is relatively common and easy to perform without imaging being required. Typically the cord is grasped firmly at the upper edge of the scrotum between the middle finger and thumb while the index finger holds the scrotal skin taut. The vas deferens is isolated and a high gauge needle is used to deliver local anesthetic to the perivasal tissue after an aspiration test.[5, 34]

Patients with chronic orchalgia experience a diagnostic and therapeutic benefit with spermatic cord blocks by differentiating primary orchalgia from referred pain. A cord block using any of these techniques not only enables localization of the pain, but also helps select patients who may benefit from microsurgical denervation procedures. Larsen et al describe a treatment algorithm whereby patients whose testicular pain improves by 50% with a spermatic cord block are recommended for microdenervation.[9] Those whose pain has been localized to the testicle by thorough history and physical but improves less than 50% after a block are referred for psychological evaluation and support, pulsed radio frequency and acupuncture, serial cord blocks and pelvic physical therapy.

Pudendal nerve block. The pudendal nerve block may be performed with a key understanding of pelvic anatomy and landmarks, as described previously. A wide array of image guided techniques including ultrasound, computerized tomography, magnetic resonance imaging and fluoroscopy have also been described in the literature.[36-38]

Multiple nerve block techniques have been described to treat pudendal neuralgia with the goal usually being to block the pudendal nerve at the level of the ischial spine where the nerve usually divides. The effectiveness is well established, with a recent review indicating 77%-87% immediate improvement from pudendal neuralgia with local infiltration.[39] However, the durability trails off quickly, with 3-month rates of success dropping to 13%-62% and 1-year rates dropping to 6.8%-12%. Alternatively, selective distal branches of the pudendal nerve, ie perineal nerve, may be accessed along the medial aspect of the ischial tuberosities (fig. 6). Pudendal blocks may be performed in toddlers undergoing penoscrotal procedures when caudal block landmarks are not easily identified.[6]

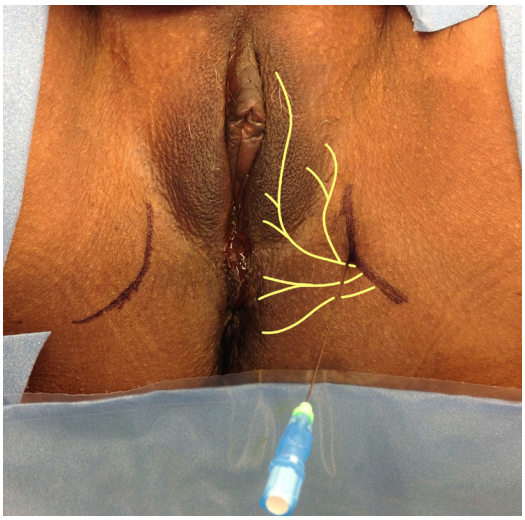

Figure 6. Pudendal/perineal nerve block. Perineum medial to ischial tuberosities provides access to distal branches of pudendal nerve for regional anesthesia.

Iliohypogastric/ilioinguinal/genitofemoral nerve blocks. These nerves and their many branches can be successfully blocked with palpation of anatomical landmarks with haptic feedback or under ultrasound guidance. The ilioinguinal nerve and medial branch of the iliohypogastric nerve cross the muscles to run within the inner surface of the external oblique fascia. The genital branch of the genitofemoral nerve lies in the same fascial plane.

Without image guidance Ng and Hausman identified a site of puncture located at the point one-quarter lateral and three-quarters medial on the line connecting the umbilicus and anterosuperior iliac spine.[40] They inserted a 22 gauge 3.5-inch spinal needle aimed toward the midpoint of the inguinal ligament. Haptic feedback indicates when the external oblique fascia is pierced with a subtle popping sensation, and local anesthetic is injected in a fan-shaped manner, half above and half

below the fascia, anesthetizing all 3 nerves in the same plane.

Alternatively using ultrasound (7 MHz probe), local anesthetic is deposited in the 2 planes formed between the external oblique, internal oblique and transversus abdominis muscles. As a 22 gauge needle is advanced under ultrasound, the operator should see the fascial layers easily sliding independent of one another. The needle can be advanced deep to this point until a discernible "pop" or "give" is felt. Anesthetic agents can then be injected, thus spreading the muscle layers apart without injecting within the muscle belly.[41] Alternatively the transversus abdominis plane block is done with ultrasound in the coronal plane cephalad to the iliac crest in the midaxillary line. A needle is advanced anterior to the probe and directed posteriorly until the operator can deposit a local anesthetic agent between the transversus abdominis and internal oblique muscles at the level of the anterior axillary line. The genitofemoral nerve can be blocked by infiltrating local anesthetic just lateral to the pubic tubercle below the inguinal ligament.[40, 42] All of these nerve blocks may be tailored to the specific clinical indication. We typically find injections to block the ilioinguinal and iliohypogastric nerves with separate injections for genital nerve coverage to be useful for most clinical circumstances (fig. 7).

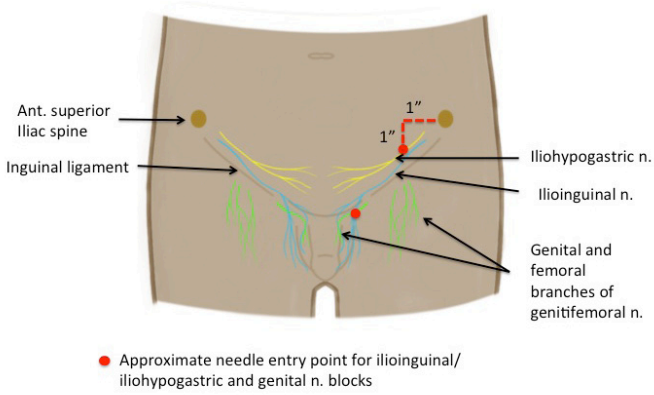

Figure 7. Lower tract peripheral nerve (*n.*) blocks. Ultrasound guidance is helpful for more precise deposition of anesthetic agent. *Ant.*, anterior.

NEW FRONTIERS: NERVE BLOCKS FOR TRANSRECTAL AND TRANSPERINEAL PROSTATE BIOPSY

Ultrasound guided transrectal prostate biopsy is a standard procedure in urological practice. Local anesthetic is typically delivered to the prostatic pedicle arising from the inferior hypogastric plexus just lateral to the junction between the prostate and seminal vesicle. Operators have also targeted the prostatic apex at the 4 and 8 o'clock positions (as biopsy in this region tends to produce the most discomfort, perhaps due to its close association with the external sphincter), allowing the local anesthetic to spread under Denonvilliers' fascia along the posterior aspect of the prostate and seminal vesicles. All types of blocks are superior to placebo, although the combined approach has not been shown to be better than each block individually. The types and amounts of anesthetic agent are all equally efficacious, with the most common being 10 ml 1% lidocaine.[43]

Office based transperineal prostate biopsy has added new anesthetic challenges. The perineum is richly innervated compared to the rectal mucosa, which has lower sensitivity to pain.[44] Using a biplanar transrectal ultrasound probe, a similar periprostatic nerve block can be achieved by guiding a longer needle through the perineal skin 1.5 to 2.0 cm above the rectum and directing it at a 30-degree angle from midline toward the junction of the prostatic base and seminal vesicles. To simplify the procedure, the anesthetic can be delivered to the apex of the prostate, which is located just deep to the levator muscles and is easily visible on ultrasound.

To decrease the pain of the anesthetic block itself, several options may be considered.[44] One simple approach is to perform a subcutaneous perineal nerve block (fig. 8), infiltrating the perineal skin with 1% lidocaine in a fan-like distribution from a single puncture site. The needle can then be advanced to the prostatic apex to provide additional local anesthetic (fig. 9). Use of a needle with increased echogenicity at the tip affords improved ease of identification on ultrasound.

Figure 8. Infiltration of perineum with local anesthetic before transperineal prostate biopsy.

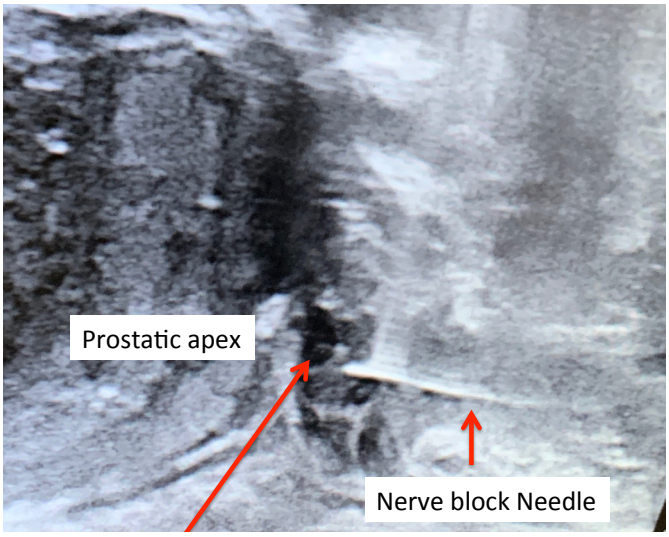

Figure 9. Advancement of echogenic nerve block needle under ultrasound guidance.

Iremashvili et al performed bilateral pudendal nerve block plus prostatic block in 75 patients before transperineal biopsy, compared to 75 controls who received only prostatic block.[45] The role of pudendal nerve block in this instance was to anesthetize the perineal skin and decrease rectal sensation of the probe. Visual analogue pain scale scores showed the anesthetic infiltration itself was more painful in the combination group, while probe insertion, biopsy punctures and 1-hour postprocedural pain were better in the combination group. Notably the pudendal block failed in about 15% of patients and additional anesthetic was required to provide analgesia.

Smith et al described their experience with 50 patients, in whom they infiltrated the perineal skin with 15 ml 1% lidocaine, and then the pelvic floor muscles and prostatic apex with 35 cc local anesthetic using a 22 gauge spinal needle.[46] Mean visual analogue scale (pain range 0-10) was 3.29 for the anesthetic delivery, 3.08 for probe insertion and 2.88 for biopsies. Of the patients 42 had previously undergone transrectal ultrasound guided biopsy, of whom 25 said it was comparable, 11 said it was more tolerable and 6 said it was worse. These promising results suggest that urologists can perform a safer biopsy while providing acceptable levels of comfort.

SAFETY

Peripheral nerve blocks are generally considered safe when delivered by experienced hands. However, there are small but attributable risks to performing PNBs.[24] Local anesthetic delivery may result in infection, hematoma, syncope, intravascular injection and systemic toxicity or intraneural injection causing nerve damage.[15] Use of ultrasound to perform PNBs has demonstrated a decreased risk of vascular puncture.[3] Regardless of ultrasound use, one should always aspirate before the injection of local anesthetic and after each 3-5 ml injection volume to confirm extravascular location.[2]

Risk of nerve damage from inadvertent puncture of the nerve with the needle is reported to occur in 0.5% to 1% of cases. Usually such injuries are transient and result in temporary neuropathy that completely resolves. Approximately 1.5 in 10,000 total injections can result in permanent nerve damage, and patients should be counseled regarding this risk.[24] The risk of local anesthesia in prostatic blocks has not been explored, but there is no suggestion of increased rates of infection, fibrosis, or loss of planes during radical prostatectomy from needle puncture or local anesthetic.[43, 47]

According to the FDA (U.S. Food and Drug Administration) label, the adverse reactions for amino-amide local anesthetics (lidocaine, bupivacaine, ropivacaine) are dose related. High plasma levels are inadvertently achieved by excessive dosage, rapid absorption or inadvertent intravascular injection. The most common toxicities affect the central nervous, cardiovascular and neurological systems. Drowsiness is an early sign of systemic toxicity, with the most feared complications being cardiovascular collapse and convulsions. These events should be treated with early oxygen, positive pressure ventilation, circulatory support and barbiturates or benzodiazepines (Appendix 2).[48, 49] In general, to limit the risk of systemic toxicity from local anesthetic, it is recommended that the provider use the lowest amount of drug needed for the targeted therapy, always aspirate before injecting to prevent direct injection into a blood vessel, use incremental amounts of anesthetic as needed and carefully monitor the patient to recognize early signs or symptoms of toxicity.[33]

CONCLUSION

Many urologists have not specifically trained in administering peripheral nerve blocks, but these methods can easily be adapted using known anatomical principles we employ every day. We hope that practitioners will adopt these techniques and continue to expand the literature, as most of the published experience consists of small series and short-term follow-up. Peripheral nerve blocks will offer our patients an improved experience in the perioperative setting and allow treatment of pain syndromes that have eluded many urologists. We hope that this Update serves as a guide for future therapy in the urology practice.

DID YOU KNOW?

- Peripheral nerve blocks have 3 important roles in clinical practice: to provide surgical anesthesia, to aid in the diagnosis of urological related pain conditions and to provide therapy in a select group of patients.
- Patients with chronic orchalgia experience a diagnostic and therapeutic benefit with spermatic cord blocks by differentiating primary orchalgia from referred pain.
- When properly executed, peripheral nerve blocks are relatively safe and well tolerated.

Appendix 1. Nerves frequently targeted for anesthetic blocks

Nerve	Sensory Distribution	Peripheral Location of Nerve
Iliohypogastric (L1)	Skin of lower anterior abdominal wall above pubis	Aponeurosis of external oblique above superficial inguinal ring.
Ilioinguinal (L1)	Skin of groin and anterior scrotum or labia majora, upper medial thigh, root of penis	Caudad to the iliohypogastric nerve. Although the ilioinguinal nerve initially rests between the transversus abdominis and internal oblique, it ultimately projects through the internal and external oblique muscles to the superficial inguinal ring, beside the spermatic cord.
Genitofemoral (L1-L2)	Cremaster muscle (participates in cremasteric reflex) and scrotal contents, upper anterior scrotum	Divides into a genital and femoral branch, which emerges at the inguinal and femoral canals respectively. Within inguinal canal lateral to spermatic cord.
Pudendal (S2-S4)	Anal canal, perineum, lower vagina and vulva, posterior scrotum (perineal branch), clitoris and glans penis. In females innervation of labia majora	Posterior and medial to ischial spine. Also within Alcock's canal (lateral edge of ischiorectal fossa, within obturator internus fascia). The nerve branches off posteriorly as the inferior rectal nerve, then divides caudally as the nerve to the penis/clitoris and the perineal nerve. Variations in anatomy are common.

Appendix 2. Toxicities of amino-amide local anesthetics[48, 49]

Central nervous system: Lightheadedness, nervousness, apprehension, euphoria, confusion, drowsiness, dizziness, tinnitus, blurred or double vision, vomiting, sensations of heat or cold, twitching, tremors, convulsions, unconsciousness, respiratory depression or arrest
Cardiovascular: Bradycardia, hypotension, cardiovascular collapse
Neurological: Positional headaches, hypotension, back ache, shivering, respiratory inadequacy, nausea, double vision

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Study Questions Volume 39 Lesson 19

1. During office vasectomy the urologist injects local anesthetic into the scrotal skin and perivasal tissues. However, the patient complains of a gnawing sensation in his abdomen as the vas is grasped with the ring clamp. This is due to
   a. incorrect needle position
   b. an inadequate amount of local anesthesia
   c. early systemic toxicity of the local anesthetic
   d. vasal and testicular sensation from autonomic nerves and nerves to visceral organs

2. A 65-year-old man with stage 4 chronic obstructive pulmonary disease and a difficult airway has metastatic prostate cancer with bony pain and is booked for a subcapsular orchiectomy. The best method of anesthesia is
   a. deposition of local anesthetic in a fan-shaped manner under the external oblique fascia just lateral to the pubic tubercle
   b. scrotal field block and spermatic cord block
   c. total intravenous sedation with or without laryngeal mask airway
   d. general endotracheal anesthesia

3. During pudendal nerve block the patient notes distinct perineal burning and electric stings as the needle reaches the targeted site. The operator should
   a. proceed with injection as this confirms good nerve localization
   b. withdraw the needle slightly, aspirate and attempt deposition of a small amount of local anesthetic
   c. carefully observe the patient's mental status and vital signs before deciding to proceed or abort
   d. abort the procedure and reschedule after resolution of these symptoms

4. The best local anesthetic option during transperineal prostate biopsy is
   a. pudendal nerve block and perineal infiltration
   b. infiltration of the perineal skin and injection at the prostatic apex
   c. pudendal nerve block and injection at the junction between the seminal vesicles and prostate
   d. injection at the prostatic apex and at the junction between the seminal vesicles and prostate

5. During a ureteral reimplantation with a psoas hitch procedure a nerve is mistaken for the psoas minor tendon. Postoperatively the patient may experience numbness of the
   a. upper anterior scrotum
   b. root of the penis
   c. lateral scrotum
   d. glans penis

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