Selective Regional Anesthesia Options in Surgical Subspecialties

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Iliohypogastric and Ilioinguinal Nerve Block

Introduction

These two nerves usually lie very close to each other and are frequently blocked together with the same needle insertion. Dr. Harvey Cushing reported in the Annals of Surgery in 1900 that "almost all cases of hernia, with the possible exception of those in young children, could undoubtedly be subjected to the radical operation under local anesthesia" [1]. Block of these two nerves is not commonly used in modern days; some authors claim that the block is truly underutilized for herniorrhaphy [2]. Yilmazlar and colleagues compared the ilioinguinal-iliohypogastric nerve blocks to spinal anesthesia for inguinal herniorrhaphy. They found that patients receiving the ilioinguinal-iliohypogastric nerve blocks had shorter time-to-home readiness, quicker oral intake postoperatively, and no need for recovery room care [3]. Recently, Stav et al. conducted a prospective, randomized, controlled, and observer-blinded clinical trial. They studied 166 adult male patients who were randomly assigned to one of the three groups: a preoperative transversus abdominis plane (TAP) block group, a preoperative ilioinguinal-iliohypogastric block group, and a control group. An intraoperative block of the genital branch of the genitofemoral nerve was performed in all three groups in all patients. Postoperative patient-controlled intravenous analgesia with morphine was available to all patients. The pain intensity and morphine utilization immediately after surgery and first 24 h after surgery were significantly lower in both block groups than the control group. However, during the first 24 h after surgery, morphine consumption in the ilioinguinal-iliohypogastric block group was lower compared with the TAP group. Thus they concluded that ultrasound-guided ilioinguinal-iliohypogastric blocks provided better pain control than ultrasound-guided posterior TAP following the Lichtenstein patch tension-free method of open inguinal hernia repair in men during 24 h after surgery [4].

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Indications

Ilioinguinal-iliohypogastric block is indicated as a treatment for both acute and chronic pain involving the groin area, lower abdominal wall, and inguinal region. If the block is used for herniorrhaphy, the hernia sac needs additional local infiltration because it contains peritoneum and visceral nerves. There is no specific contraindication for this block.

Anatomy

The iliohypogastric nerve may have a small contribution from T12, but it primarily originates from L1. The nerve travels around the body, starting posteriorly, and then heading laterally before emerging anteriorly. At the anterior superior iliac spine (ASIS) area, the iliohypogastric nerve pierces through the posterior portion of the transverse abdominal muscle and then divides into lateral and anterior branches. The lateral branches penetrate both the internal and external oblique muscles and provide sensation to the skin of the posterior lateral gluteal region. The anterior branch penetrates through the internal oblique muscle approximately 2 cm medial to the anterior superior iliac spine and perforates the external oblique muscle, distributing sensory fibers to the skin of the abdomen above the pubis [5] (Fig. 20.1).

The relatively smaller ilioinguinal nerve originates from L1. It emanates from the upper part of the lateral border of the psoas major muscle and runs caudad to the iliohypogastric nerve. The nerve crosses obliquely and anteriorly to the quadratus lumborum and iliacus muscles and then perforates the transverse abdominis muscle near the anterior part of the iliac crest. In the anterior abdominal trunk, the nerve travels between the transverse abdominis and the internal oblique muscles (Fig. 20.1). It occasionally anastomoses with branches of the iliohypogastric nerve at the ASIS level. It pierces the internal oblique muscle and accompanies the spermatic cord through the inguinal ring into the inguinal canal. It provides skin sensation over the root of the penis, to the superior inner aspect of the thigh, to the upper part of the scrotum in males, and to the skin covering the mons pubis and lateral part of labia in females [6].

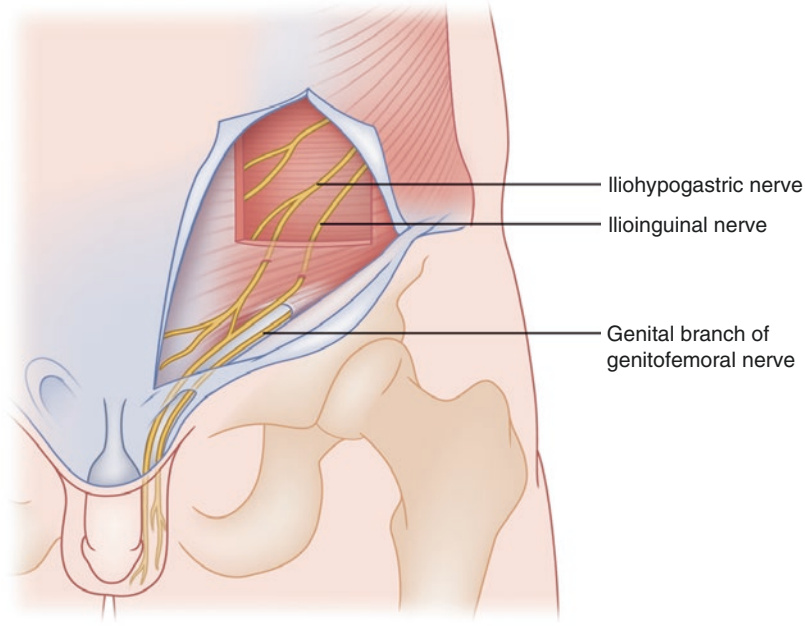

Fig. 20.1 Three nerves (iliohypogastric nerve, ilioinguinal nerve, and genitofemoral nerve) starting from spinal cord to exiting inguinal canal

Technique

Ultrasound-Guided Technique

The patient is usually in a supine position. After locating and labeling the ASIS and the umbilical button, a line is drawn between the ASIS and the umbilical button. A linear high- frequency (7–13 MHZ) ultrasound probe is usually used for this block. By adjusting the ultrasound setting (depth is usually better at 1–3 cm), the differential muscle layers can be visualized, and the nerves can sometimes be imaged. Unfortunately, the nerves are often very difficult to consistently identify. The ilioinguinal nerve is usually located in the plane between the transverse abdominal muscle and the internal oblique muscle above the ASIS, while the iliohypogastric nerve usually is located between the internal oblique muscle and the external oblique muscle. We typically use a 22-gauge or 23-gauge needle and inject locally throughout the needle's path with 5–8 mL of local anesthetic agent directly deposited to each nerve if possible. The total local anesthetic volume is 20–30 mL.

Ideally, one should identify and target the individual nerve; however, the nerves cannot always be identified. In this case, the reliable end points for the ilioinguinal-iliohypogastric nerve blocks are the transverse abdominal/internal oblique muscle plane where the ilioinguinal nerve is reported to be found in 100% of patients [7], and the plane between the internal oblique muscle and the external oblique muscle, which contains the iliohypogastric nerve (Fig. 20.2).

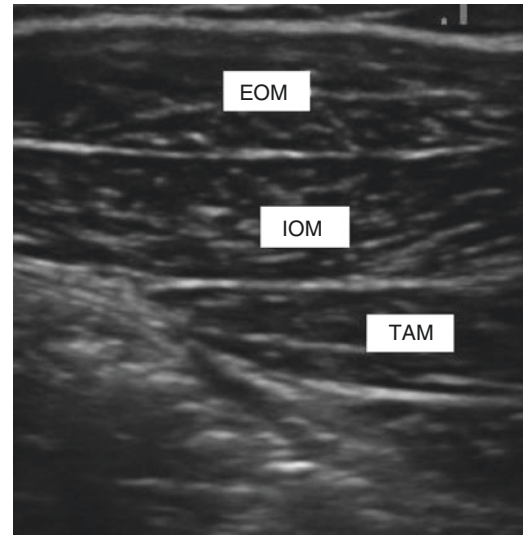

Fig. 20.2 Ultrasound image showing the layers of abdominal muscles. *EOM* external oblique muscle, *IOM* internal oblique muscle, *TAM* transverse abdominal muscle [5]

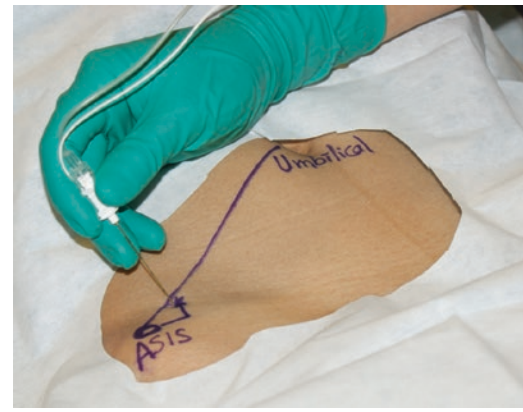

Fig. 20.3 Illustrating the ilioinguinal/iliohypogastric nerve block needle entry point: 3 cm medial and 3 cm above ASIS [5]

Using Anatomical Landmarks

The ultrasound-guided technique has gained so much popularity; this block is rarely done by just using anatomical landmarks in modern practice. The patient is usually placed in a supine position. After marking the ASIS and drawing a line between the ASIS and the umbilical button, the patient's lower quadrant should be sterilely prepared. The injection site is located 3 cm medial to the ASIS and 3 cm above the ASIS (Fig. 20.3). As aforementioned, the key to adequate blockade is injecting sufficient local anesthetic agent into the two planes: the plane between the transverse abdominal muscle and the internal oblique muscle (the ilioinguinal nerve) and the plane between the internal oblique muscle and the external oblique muscle (the iliohypogastric nerve). Using a 22-gauge or 23-gauge needle, advance the needle at a right angle to the skin in all planes. A "click" is usually felt as the needle passes through the external oblique muscle. Before advancing further, inject 8–10 mL of local anesthetic agent into this plane. Then, advance the needle until a

second "click" is felt. This indicates that the needle has advanced through the internal oblique muscle. At this point, another 8–10 mL of local anesthetic agent is injected. One should inject 8–10 mL into each plane and along the needle path. We usually limit our total dose to less than 40 mL in volume and under toxic drug dose.

Some anesthesiologists use two separate needle entry points for ilioinguinal and iliohypogastric blockade. To access and block the iliohypogastric nerve, a needle is directed 3 cm medial and 3 cm superior to the ASIS. Blockade of the ilioinguinal nerve can be accomplished by placing a needle 2 cm medial to the ASIS and 2 cm inferior to the entry point for the iliohypogastric nerve. Next, the needle is directed toward the pubic symphysis in a fanlike manner, piercing through the fascia of the external oblique muscle and depositing local anesthetic along its path. Because the ilioinguinal and iliohypogastric nerves are located at different fascial planes among the three muscles (IO, EO, and TA), these blind techniques have a low success rate.

Anesthetic Agents

Our groups typically use 0.5% bupivacaine or 1% ropivacaine for surgical anesthesia and 0.25% bupivacaine or 0.5% ropivacaine for postoperative analgesia or chronic pain analgesia. Beaussier et al. reported that adding clonidine (75 μg) to local anesthetic (ropivacaine) can reduce motion pain but may increase the chance of orthostatic hypotension [8]. Popping et al. analyzed multiple studies and they concluded that adding clonidine to intermediate- or long-acting local anesthetics for single-shot peripheral nerve or plexus blocks prolongs the duration of analgesia and motor blockade by about 2 h [9]. The increased incidence of hypotension, fainting, and sedation may limit its use and there is a considerable additional cost for this adjuvant medication. After comparing three concentrations (0.125, 0.25, and 0.375%) of levobupivacaine, Disma et al. reported that 0.25% levobupivacaine provided satisfactory postoperative analgesia with the fewest side effects [10].

Continuous ilioinguinal-iliohypogastric nerve block with ultrasound-guided placement of bilateral catheters has been reported [1]. This block provides intraoperative and postoperative analgesia for procedures using a Pfannenstiel incision. Also, this block provides a good option for patients when epidural analgesia is contraindicated. The technique involves inserting an 18-gauge Tuohy epidural needle at the same entry point as single-shot block (3 cm medial and 3 cm above the ASIS). With ultrasound guidance, after penetrating the external oblique muscle and internal oblique muscle, a multi-orifice catheter is threaded through the Tuohy needle into the plane between the internal oblique muscle and the transverse abdominal muscle. The catheter should be directed medially about 3 in. This block should be performed bilaterally. Once placed, each catheter is connected to a continuous infusion of 0.5% ropivacaine or 0.2–0.25% bupivacaine set at a flow rate of 2 mL/h. This technique is very similar to TAP but differs from TAP block in two ways: (1) the needle entry for the ilioinguinal-iliohypogastric continuous block is more medial than the technique for the TAP block and (2) this technique aims for blockade of L1 and T12, while the TAP technique blocks sensory fibers from T10 to L1, or even higher. Gucev et al. placed continuous catheters into the plane between the internal oblique muscle and the transverse abdominal muscle. Ilioinguinal-iliohypogastric block with 0.2% ropivacaine plus oral ibuprofen for postoperative analgesia after cesarean delivery resulted in low pain scores postoperatively, minimal use of opioid supplement, and no report of nausea and vomiting [11]. This suggests that continuous ilioinguinal-iliohypogastric nerve blockade deserves further clinical studies to validate this technique to be an important component of multimodal analgesia after cesarean delivery.

Complications

1. Hemodynamic changes are usually minimal because this block does not cause sympathetic blockade. Patient may develop hypotension if clonidine is added to the local anesthetic solution.

2. Local anesthetic toxicity is always a concern, especially when it is done bilaterally. But the possibility in this block is very small, even though this block involves multiple-point injections. The volume is small, and the blood circulation at the injection sites is less luxurious than the epidural or intercostal spaces. The total dose is significantly lower than the toxic dosage.
3. There are reports of small and large bowel perforations, so a blunt needle is recommended for this block. When inserting the needle, try to avoid being too deep or inserting without assurance of needle location. In most patients, the needle is inserted no more than 1.5 cm after passing through the external oblique muscle layer.
4. Subcutaneous hematoma can occur after this block.
5. Pelvic hematomas have been reported, so have bowel hematomas in pediatric patient [12].
6. Transient femoral anesthesia was reported to occur in about 3.5–7% of the patients who received ilioinguinal/iliohypogastric nerve block and occurs more frequently when the injection site is located lower than the ASIS and the needle tip is deep [13].

Genitofemoral Nerve Block

Introduction

The genitofemoral nerve block is utilized as a treatment for chronic pain of the pelvis, the perineal area, and the upper thigh and can be combined with ilioinguinal/iliohypogastric nerve blocks for surgical procedures involving the groin area.

Indications

1. Performed with ilioinguinal and iliohypogastric nerve blocks for inguinal hernia repair, orchiopexy, and hydrocelectomy.
2. As a nerve block supplementing femoral nerve block for long saphenous vein stripping.
3. For the diagnosis of genitofemoral neuralgia.
4. For chronic pain syndromes in the pelvic or groin areas, such as border nerve syndrome [14].
5. The genitofemoral block can also be used for hemiscrotal anesthesia and pain treatment [15].

There are no specific contraindications for this block.

Anatomy

The genitofemoral nerve originates from the L1 and L2 ventral rami and is formed within the psoas major. The nerve, primarily sensory in function, contains a small motor component and descends obliquely, advancing through the psoas muscle to emerge at its abdominal surface near the medial border. There, the genitofemoral nerve divides into femoral and genital branches at various distances from the inguinal ligament. The femoral branch joins the femoral artery and travels underneath the inguinal ligament, penetrating the fascia lata. It supplies sensation to a small area of skin immediately below the inguinal ligament. The genital branch enters the inguinal canal through the deep ring and travels with the spermatic cord to supply the cremaster and dartos muscles and sends small terminal sensory fibers to the skin of the scrotum in males. It runs inside the inguinal canal with terminal fibers to the round ligament of the uterus and the skin of labium majus in females [5].

The Technique

Ultrasound-Guided Technique

For the block of the genital branch, we will use the technique described by Peng [14]. The probe is placed perpendicular to the inguinal ligament. By adjusting the probe position we can identify the femoral artery. It serves as a reference structure. Next, we identify the internal ring and spermatic cord, which is oval or circular in shape and contains one or two arteries (the testicular artery and the artery to the vas deferens). The vas deferens is often seen as a thick tubular structure within the spermatic cord. The probe is then moved medially and caudally to a

final location approximately 1 in. lateral to the pubic tubercle. We usually use out-of-plane technique with the needle approaching the skin from the lateral aspect of the probe. Local anesthetic without epinephrine is used to avoid the possible vasoconstriction effect on the testicular artery. Because of the anatomical anomalies found with the location of the genital branch in the genitofemoral nerve, we suggest injecting 5 mL of local anesthetic agent inside and another 5 mL outside the spermatic cord to provide adequate blockade [14, 16].

The femoral branch can usually be visualized with the ultrasound probe immediately lateral to the femoral artery. It sometimes appears attached to the femoral artery lateral wall. Block of the femoral nerve can also block this nerve.

Anatomical Landmark Technique

The femoral branch is blocked by locating the femoral artery pulse. After inserting a 25-gauge needle just lateral to the femoral artery pulse, inject 5 mL of local anesthetic solution. Next, inject 5 mL of local anesthetic in a fanlike pattern along a 5–7 cm path inferior to femoral pulse. The genital branch is blocked by identifying the pubic tubercle and inserting a 25-gauge needle 1 in. lateral to the pubic tubercle and below the inguinal ligament. A total local anesthetic volume of 10 mL, without epinephrine, is needed to achieve this block (Fig. 20.4).

Complications

1. Local pain.
2. Local anesthetic toxicity is always a concern, but with this block risk is low because the total local anesthetic dose is significantly below the toxic dose. Also, blood flow is not as rich as in the epidural or intercostal spaces.
3. Subcutaneous hematoma can occur after this block.

Penile Block

For many years, the penile block has been widely used for circumcisions and other penile surgeries. However, the anatomy of the penile block still confuses many anesthesiologists and contributes to variations of technique.

Indications

1. Circumcision
2. Phimosis and paraphimosis reduction
3. Dorsal penile skin surgery
4. Distal hypospadia repair
5. Postoperative analgesia in penile surgery

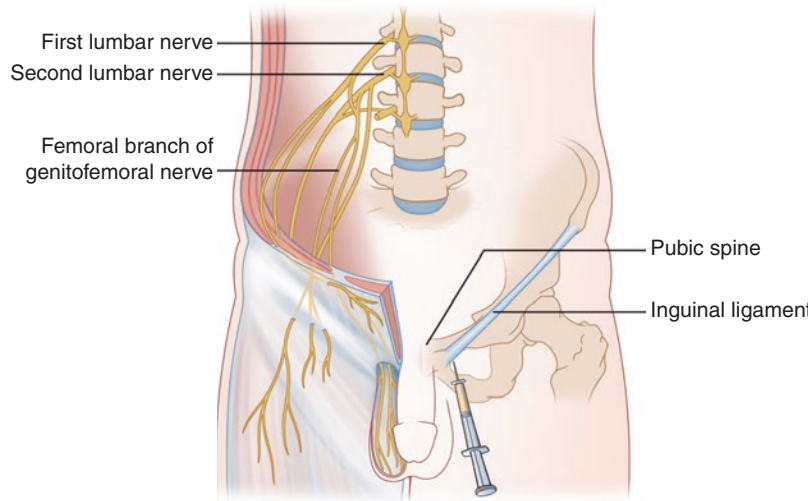

Fig. 20.4 Anatomic landmark of genital branch of genitofemoral nerve

Contraindications

1. Suspected testicular torsion
2. Infection of the skin at the proposed injection site

Anatomy

The penile nerve is derived from the pudendal nerve (S2–4). The penile nerve usually divides into the right and left dorsal nerves of the penis and courses under the pubis symphysis. Then it travels under Buck's fascia to supply sensory innervations to the penis. Both left and right penile nerves travel lateral to the penile arteries (Fig. 20.5).

Technique

Although many variations in blockade technique exist, the most common approach targets the two dorsal penile nerves for local anesthetic injection as well as subcutaneous local administration circumferentially. Recent studies indicate that to achieve adequate foreskin analgesia, supplemental dorsal nerve blocks with ventral subcutaneous infiltration just proximal to the incision line will improve surgical anesthesia and avoid inconsistency [17]. Metzelder found that the penile block for hypospadias repair in children works better than caudal anesthesia (significantly less impaired micturition) [18].

Ultrasound-Guided Penile Dorsal Nerve Block

Sandeman described this ultrasound-guided penile block in children under general anesthesia [19]. They used real-time scanning to guide bilateral injections of local anesthetics into the subpubic space, deep to Scarpa's fascia either side of the midline fundiform ligament. Scanning can confirm that the local anesthetic has spread to contact the deep fascia on each side. A subcutaneous wheel of local anesthetic along the penoscrotal junction completes the block. Gurkan et al. described ultrasound-guided penile block in adult patient [20].

Complications

1. Inadequate block is common.
2. Hematoma occurs.
3. Penile ischemia is very rare.

Clinical Pearls

Iliohypogastric and Ilioinguinal Nerve Block

- Sedate the patient before proceeding with the block.
- The reliable end point for the inexperienced practitioner using ultrasound guidance for the

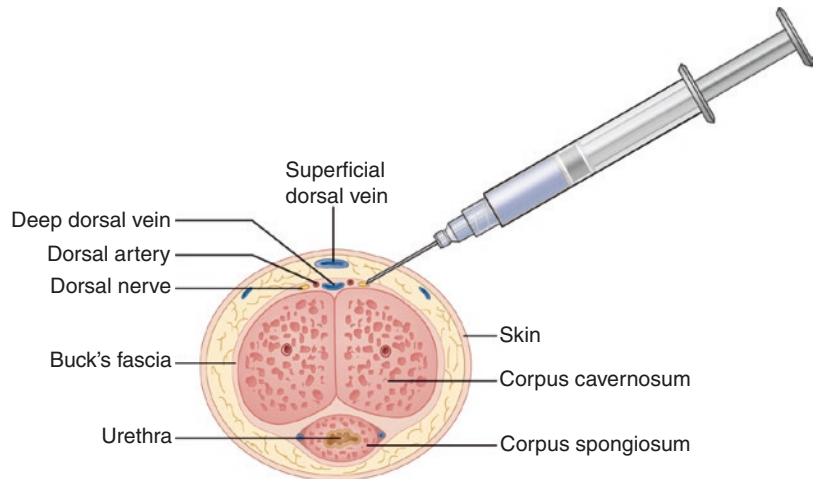

Fig. 20.5 Penile block

block of the ilioinguinal-iliohypogastric nerves is the plane between the transverse abdominal and the internal oblique muscles. The nerves are located in this plane in almost 100% of patients [7].
- One should feel resistance while moving through muscle tissue and a loss of this resistance when exiting the muscle. A blunt needle will usually make the loss of resistance more appreciable.
- Regardless of the technique, if the nerves are not easily identifiable, target the anatomic plane where the nerves lie to inject the local anesthetic solution.
- If you can locate the target nerves, try to keep them in the middle of the ultrasound image.
- Pay attention to the needle insertion depth. Do not insert the needle too deep and avoid getting into peritoneal cavity. This will reduce the incidence of bowel perforation and hematoma.
- Adding a genitofemoral nerve block to the ilioinguinal-iliohypogastric nerve block may not offer any extra benefit to pediatric patients undergoing hernia repair [18].

Genitofemoral Nerve Block

- Successful injection of the genitofemoral branches requires appropriate volume, typically requiring 10 mL or more of local anesthetic solution.
- A multi-direction infiltration will help the adequacy of the block.
- Just use plain local anesthetics; do not mix with epinephrine.
- Sterile preparation is important because the area is a breeding ground for pathogens.

Penile Block

- If possible, try to feel the pulse of the penile artery. The needle insertion site is less important because of the skin mobility; inject lateral to the pulse. The superficial dorsal vein can serve as a landmark for midline. Deposit local anesthetics under Buck's fascia where the penile nerves travel.
- Because the superficial and deep dorsal veins are both located at the dorsal midline, try to avoid a straight-down midline approach. This will significantly minimize the occurrence of hematoma.
- Penile ischemia can be prevented by avoiding puncture of the penile arteries, avoiding a larger than necessary volume of local anesthetic, and avoiding hematoma formation.

Summary

In summary, these blocks are valuable for a wide range of indications. Appreciation of anatomy and proper technique with ultrasound can improve efficacy of these selective nerve blocks and reduce potential side effects. In this regard, many groups have moved away from bupivacaine because of its potential toxicity with intravascular injection; however, other groups still utilize bupivacaine, making good technique that is much more significant for ensuring best outcomes and patient safety.

Review Questions

1. The primary nerve root supplying the ilioinguinal and iliohypogastric nerves is:
   (a) L3
   (b) L2
   (c) L1
   (d) T12
2. All the following are advantages of ilioinguinal and iliohypogastric blocks compared to spinal except:
   (a) Quicker postoperative discharge
   (b) Faster postoperative oral intake
   (c) Less need for recovery room
   (d) Less postoperative surgical complications
3. The ilioinguinal nerve supplies sensation to all the following areas except:
   (a) Skin covering the base of the penis
   (b) Skin covering the upper scrotum

(c) Skin covering the mons pubis
(d) Skin covering the posterior aspect of the upper thigh

4. The ilioinguinal and iliohypogastric nerves are commonly located between:
   (a) The transverse abdominal muscle and the internal oblique muscle
   (b) The internal oblique muscle and the external oblique muscle
   (c) The transverse abdominal muscle and the rectus sheath
   (d) The rectus sheath and aponeurosis of the external oblique muscle
5. Continuous ilioinguinal and iliohypogastric blocks for Pfannenstiel incisions:
   (a) Place catheter unilaterally
   (b) Place bilateral catheters between the transverse abdominal and the internal oblique muscles
   (c) Place bilateral catheters between the external and the internal oblique muscles
   (d) Place bilateral catheters between the internal and the external oblique muscles aiming medially
6. Complications to the ilioinguinal and iliohypogastric block include all except:
   (a) Hemodynamic instability
   (b) Bowel perforation
   (c) Subcutaneous hematoma
   (d) Pelvic hematoma
7. Indications for genitofemoral nerve block include all except:
   (a) Supplemental block for hernia surgery
   (b) Aid in diagnosis of genitofemoral neuralgia
   (c) Treatment of some chronic pelvic pain syndromes
   (d) Primary block for orchiopexy surgery
8. The genitofemoral nerve originates from:
   (a) Dorsal rami of T12 and L1
   (b) Dorsal rami of L1 and L2
   (c) Ventral rami of L1 and L2
   (d) Ventral rami of T12 and L1
9. The genital branch of the genitofemoral nerve:
   (a) Enters the inguinal area through the deep ring
   (b) Travels with the spermatic cord
   (c) Supplies the cremaster and dartos muscles
   (d) All of the above
10. Anatomical landmarks used for ultrasound block of the genital branch include all except:
   (a) ASIS
   (b) Umbilical button
   (c) Inguinal ligament
   (d) Quadriceps muscle
11. Clinical pearls for genitofemoral block include all except:
   (a) Use epinephrine mixed with local anesthetic
   (b) Use multidirectional infiltration
   (c) Sterile preparation extremely important
   (d) Use local anesthetic without epinephrine
12. Indications for penile block include:
   (a) Cystoscopy
   (b) Retrograde urethrogram
   (c) Circumcision and distal hypospadias repair
   (d) Testicular torsion
13. Contraindications for penile block:
   (a) Dorsal penile skin surgery
   (b) Postoperative analgesia for penile surgery
   (c) Penile skin infection
   (d) Phimosis surgery
14. All of the following concerning the penile nerve are true except:
   (a) Derived from S2–4
   (b) Courses under the pubic symphysis
   (c) Travels under Buck's fascia
   (d) Blocked with local anesthetic containing epinephrine
15. Complications from penile block:
   (a) Inadequate block
   (b) Penile ischemia is common
   (c) Hematomas are rare
   (d) Local anesthetic toxicity from large-volume doses

Answers

1. c
2. d
3. d

4. a
5. b
6. a
7. d
8. c
9. d
10. d
11. a
12. c
13. c
14. d
15. b

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