ILIOINGUINAL NERVE BLOCK

Surgical Specialty:	Regional Anesthesia
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Background:

- ***General Considerations***
  - The ilioinguinal nerve arises from T12 and L1 on the lateral side of psoas major before piercing the transversus abdominis and coursing between it and the internal oblique muscle in the anterior abdominal trunk. [1] It then travels with the spermatic cord into the genital region. [2]
  - It provides sensory innervation to the lower abdomen, upper hip, and upper thigh. [1]
  - The ilioinguinal nerve block is indicated for postoperative pain associated with inguinal hernia repairs, similarly anatomically located surgeries (hydrocelectomy, orchiopexy), and suprapubic incisions. [3-4]
  - Chronic postoperative pain associated with inguinal herniorrhaphy occurs in the adult population, worsening with complications and in the younger age demographic. [5] Similar cases in adolescents have been reported, with encouraging response to ilioinguinal nerve blocks. [6]
  - Alternatively, landmark-based techniques by surgeons, such as truncal blocks (quadratus lumborum, transversus abdominis plane) or neuraxial procedures, may be performed for lower abdominal surgery. [7] One meta-analysis demonstrated similar efficacy and postoperative opioid use in transversus abdominis plane vs. ilioinguinal technique in patients undergoing inguinal hernia repair. [8]
    - However, ilioinguinal nerve blocks may afford less local anesthetic requirements than truncal blocks without subjecting a patient to neuraxial procedures and their inherent risks. [8]
- ***Patient Considerations***
  - Millions of outpatient pediatric surgeries occur yearly, placing higher emphasis on adequate postoperative pain control for same-day surgery. [9]
  - Inadequate pain management may result in deleterious long-term effects, including impaired pain perception and structural brain changes. [10]
  - There are better analgesia scores postoperatively than surgeon-administered wound infiltration in healthy ASA 1 & 2 outpatient inguinal hernia repairs with ultrasound-guided ilioinguinal-iliohypogastric nerve blocks. [11]
- ***Associated Comorbidities/Syndromes***
  - The presence of a patent processus vaginalis is present in as high as 80% of male, term infants, possibly leading to sequelae of hydrocele and inguinal hernias. [12]
    - Testicular descent is associated with a patent processus vaginalis, leading to 90% of infant inguinal hernias being diagnosed in boys. [12]
  - 60% of indirect inguinal hernias are on the right due to the involution of left processus vaginalis generally occurring first. [12]
  - 9-11% of premature infants are affected by inguinal hernias, compared to 1-5% born at term date. [13]

Anesthetic Planning:

Pre-Anesthetic Evaluation

- Pre-anesthetic evaluation to determine suitability for surgery and optimization of chronic conditions
- Regional blockade is indicated for postoperative pain relief from surgery in the inguinal region.
    - Additionally, as an adjunct to reduce the amount of opioids administered, especially for at-risk patients (sleep apnea, pulmonary disease, difficult airway) [14]
    - Less risk with coagulopathic disorders than neuraxial procedures [14]
- Contraindications: Allergy to local anesthetic, patient or parent/guardian refusal, active infection at injection site [14]

Additional labs/tests indicated during workup

- Consider coagulation testing for patients on antithrombotic medications.

Discussions to have with surgeon/family

- Appropriateness of peripheral nerve block

Specific or unique room setup requirements

- Drugs/Infusions
    - Local anesthetic of choice (0.2% ropivacaine or 0.25% bupivacaine)
    - 20% lipid emulsion readily available during peripheral nerve block procedure
- Monitors
    - Standard ASA monitors
- Blood Availability (if indicated)
    - Usually not required
- PICU Bed Availability
    - Not generally indicated unless repair occurs in a preterm or young infant
- Other Indicated Resources
    - Ultrasound, syringes, skin prep/cleansing agent, sterile probe cover, sterile ultrasound gel

Intraoperative Considerations:

- ***General***
    - General anesthesia and securement of the airway are indicated to facilitate the placement of the peripheral nerve block.
- ***Induction***
    - Standard induction, consider a rapid sequence induction for related comorbidities (e.g. incarcerated hernia with bowel obstruction)
- ***Positioning***
    - The patient is supine for the nerve block procedure, with adequate padding at pressure points prior to initiation of the block.
- ***Block technique [4,14]***
    - Pre-procedure timeout specifying, at minimum, the patient name, date of birth, medical record number, allergies to medications, block procedure and laterality, consent to the procedure, and others as indicated.
    - Expose the abdomen and prep the target site with an appropriate cleansing solution.
    - Place a high-frequency linear probe just medial and cephalad to the anterior superior iliac spine in line with the umbilicus.
        - The nerves may be visualized as echogenic or hypoechoic structures in the fascia between the internal oblique and transversus abdominis muscles.
    - Examine the area for nearby vascular structures with Doppler, especially the deep circumflex iliac artery.

    - The ilioinguinal nerve is closer to the iliac crest, as opposed to the iliohypogastric nerve which is more medial.
    - Advance a needle using an in-plane technique toward the target nerve
        - If individual nerves are not visualized, target injection into the transversus abdominis plane to create fascial separation
    - Volumes as low as 0.075 mL/kg of 0.2% ropivacaine are described when administered to an individual nerve, otherwise, 0.1 to 0.4 mL/kg of 0.2% ropivacaine or 0.25% bupivacaine if performing a fascial separation in the transversus abdominis plane
        - Adjuvants such as clonidine 1 mcg/kg or epinephrine may be considered while monitoring for side effects (e.g. hypotension, prolonged sedation, tachycardia) with variable clinical effects [15-16]
- ***Hemodynamic/Physiologic goals***
    - As indicated by patient-specific factors, monitor for ECG and blood pressure changes signaling intravascular injection.
- ***Emergence/Disposition***
    - Patients with incarcerated bowel and/or full stomach require awake extubation
- ***Postoperative pain***
    - Titrate opioids judiciously with the presence of ilioinguinal nerve blocks
    - Non-steroidal anti-inflammatory drugs (e.g. ketorolac), acetaminophen, ketamine, and dexmedetomidine are useful intraoperative adjuncts to minimize or eliminate the need for opioids if indicated

Case-Specific Complications/Pitfalls

- ***Intravascular injection and Local Anesthetic Systemic Toxicity (LAST)***
    - Low risk of LAST in pediatric patients, even under general anesthesia (0 cases in 15,000 regional blocks in Pediatric Regional Anesthesia Network although positive test dose in a small number) [17]
    - Higher risk in young infants and neonates (< 4 months of age) compared to older pediatric patients and adults due to lower amount of alpha-1-acid glycoprotein, necessitating dose reduction [18]
    - The max dose should be based on lean body weight, with slow intermittent injection [17]
    - May progress from initial hypertension and tachycardia to hypotension and bradycardia, followed by ventricular arrhythmia and asystole
    - Midazolam administration for seizures, reduced doses of epinephrine 1 mcg/kg for hypotension
    - Avoid propofol and vasopressin
    - 20% lipid fat emulsion 1.5 mL/kg bolus followed by 0.25 mL/kg/min infusion [17]
        - Lipid fat emulsion is thought to act as a "lipid sink" or carrier of local anesthetic to metabolize in other tissues [17]
    - ACLS if needed
- Bowel perforation
- Hematoma
- Quadriceps weakness due to spread to femoral nerve block

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