Chapter 39
Regional Anesthesia

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Case 1

A 13-year-old is scheduled for a prolonged penile reconstruction to correct a long-standing cosmetic issue related to severe hypospadias. He is otherwise healthy. He would like optimal pain management for the surgery and the immediate perioperative period.

Case 2

A 15-year-old broke her right forearm 1 year ago. She now has reflex sympathetic dystrophy for which you have been asked to give the first of a series of stellate ganglion blocks.

Case 3

You administer a Bier block to a 16-year-old having a plastic surgery procedure on her left hand. Within a minute of injecting 30 mL of 0.5 % lidocaine into a vein on the dorsum of her left hand, you notice a dramatic wheal and flare reaction with swelling of the entire extremity distal to the tourniquet.

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R.S. Holzman et al. (eds.), *Pediatric Anesthesiology Review*,
DOI 10.1007/978-3-319-48448-8_39

Case 4

You are asked to provide anesthesia for an 18-year-old male who has been working on a commercial fishing boat. He has a large fishhook deeply implanted in the plantar surface of his right foot. There are multiple lacerations to repair as well. The hook needs to be removed, but it will take a significant amount of dissection over a wide area. Due to the nature of the injury, local anesthesia alone is likely not going to be sufficient. The patient has a family history of malignant hyperthermia and does not want sedation or anesthesia.

Case 5

A 20-year-old male requires a Bankart repair for chronic habitual right anterior shoulder dislocation. This is to be done as an outpatient.

Case 1

Questions

1. Is it appropriate to do this surgery under just regional anesthesia? What form of regional anesthesia would you choose? Would your choice be different if the patient was 1-year-old? Does the block need to be performed while the patient is awake in either case? What agents would you choose to use for this block?

Case 1

Answers

1. Depending on the exact length of the case, it would be possible to perform this surgery under spinal or epidural anesthesia alone. On the other hand, it is exceedingly rare that a 13-year-old would want to lay supine for 3–5 h while a case like this is performed – so this is really not a viable option. Psychologically, operations of the perineum are difficult to perform on an awake adolescent. The choice would be to accomplish the case with regional anesthesia plus monitored anesthesia care/deep sedation or provide a general anesthetic in addition to the chosen block. Either method would be acceptable; I would choose general anesthesia with the regional block. A dorsal penile nerve block could be performed by directing a block needle perpendicularly at the level of the symphysis pubis and inserting local anesthesia just under Scarpa's fascia approximately 1.5 cm lateral to midline bilaterally. This could be done with ultrasound guidance or by landmarks alone. This block does not provide as complete nerve blockade (in general) as an epidural or spinal block. For a case of this duration, I would choose to simply provide GA with an LMA in addition to the nerve blockade. I would choose epidural anesthesia to allow for the duration of the surgery and to provide the option of using the block for postoperative pain control. If the child were only 1-year-old, I would choose a caudal block with a catheter insertion. There is excellent data to support the safety of "asleep" nerve blocks in pediatric age patients. While it is helpful to be able to receive feedback on paresthesias, etc.

2. On awakening the patient has bilateral foot drop. He is otherwise neurologically intact. What are the possible causes and what is your management?

during the block placement, several large observational studies of central and peripheral nerve blocks in pediatric age patients have not shown a significant incidence of injury from blocks performed while patients are anesthetized. I would place an epidural catheter at L4–5, and I would choose 0.25 % bupivacaine or ropivacaine – 0.2 % for this block. To maintain the block, an infusion of bupivacaine could be continued at 0.4 mg/kg during the case.

2. Bilateral foot drop could result from either epidural hematoma, direct trauma to the spinal cord, or compression neuropathy related to intraoperative positioning. The occurrence of epidural hematoma is less likely in patients who are not anticoagulated, and the placement of epidural catheter is atraumatic. The presence of arteriovenous malformation of the epidural vessels poses a risk. Needle or catheter trauma of the epidural vein can result in excessive bleeding and development of hematoma that may compress the spinal cord and cause neurologic deficit. If epidural hematoma is suspected, the epidural infusion should be stopped to allow complete sensory and motor recovery. If neurologic impairment persists, CT and/or MRI should be obtained immediately because the epidural hematoma should be decompressed within 6–12 h to avoid permanent neurologic deficit. MRI can rule out direct spinal cord trauma as well. Prolonged intraoperative positioning in lithotomy may predispose to lumbosacral plexus stretch neuropathy particularly in obese and very slender patients or in the presence of subcutaneous edema. This is usually associated with severe pain in the buttocks and legs. Foot drop can also occur from the compression of the common peroneal nerves against the fibula heads due to abnormal positioning of the legs in stirrups rather than straps in lithotomy position. The presence of bilateral foot drop with the preservation of perineal sensation and sphincter function (without severe pain) favors the diagnosis of bilateral common peroneal nerve palsy. Bilateral foot drop associated with urinary and fecal incontinence results from either lumbosacral plexus stretch neuropathy, cord trauma, or cord compression from hematoma. In this case, with isolated foot drop, the patient should be referred for supportive services, physical therapy, and close follow-up.

Case 2

Questions

1. How do you perform a stellate ganglion block? Three minutes after your injection of 10 mL of 0.25 % bupivacaine with epinephrine, she complains of shortness of breath. What is the differential for her SOB? How would you manage the problem?

2. Fifteen seconds after your injection, she has a seizure. What is the likely cause and what is your treatment? Ten minutes after recovery, she complains of facial flushing, nasal congestion, and a funny feeling in her eye. What is the likely cause?

Case 2

Answers

1. The block is performed with the patient supine and the neck slightly extended. The C6 transverse process tubercle is identified with the index and middle fingers placed at the level of cricoid ring between trachea and sternocleidomastoid muscle. An ultrasound probe can be placed in a transverse orientation to identify the boney and vascular structures. It can also be used to directly observe the needle and the local anesthetic spread during the block. A short beveled 25-gauge needle is introduced perpendicular to the skin and advanced until the needle tip makes a contact with the C6 or C7 transverse process. The needle is withdrawn few millimeters and immobilized. After negative aspiration for blood or CSF, a total of 8–10 mL of a local anesthetic is injected without resistance and incrementally.

   The complaints of shortness of breath after stellate ganglion block could be due to something as simple as a feeling of a lump in the throat as result of block of recurrent laryngeal nerve. These symptoms could also be due to more worrisome issues such as an intradural (epidural/intrathecal) injection of local anesthetics or (uncommonly) due to paresis or paralysis of phrenic nerve and pneumothorax. Shortness of breath due to recurrent laryngeal paralysis is best managed by reassurance and offering supplemental oxygen. SOB due to subdural injection, if severe, would be indicated by progressive loss of neurological function and may require ventilatory support and sedation. The management of pneumothorax depends on the severity of the condition. A chest X-ray and close follow-up is indicated. A pneumothorax of 10 % or less does not require specific treatment. More severe pneumothorax with impaired oxygenation or cardiovascular changes will require monitoring in the hospital and (likely) placement of intrapleural drain.

2. The vertebral and carotid arteries lie in close proximity to the neural structures at C6–7. Injection into one of these vessels will lead to an almost immediate seizure. Fortunately the seizures caused by such an injection will be extremely brief in nature because the drug is eliminated from the brain very quickly. Even when performed with ultrasound guidance, this is a reason to inject the local anesthesia slowly and in a fractionated manner when performing one of these blocks. Treatment other than general support is rarely needed. Facial flushing and dryness are typical signs of Horner's syndrome which is common with this block – particularly when the injection is made at C6. No treatment is needed other than reassurance. It is helpful to warn patients that this is a possibility prior to starting the block.

Case 3

Questions

What is your diagnosis? What is your management?

Case 4

Questions

What would be the best option for this case?

Case 3

Answers

The observed manifestation is consistent with a local allergic reaction to either lidocaine or (less likely) due to latex gloves. In either case, all latex containing products should be disposed. Secure large bore intravenous access. There should be a call for help, and preparation should be made for full support including intubation/ventilation as needed. The tourniquet should not be released until after prophylactic measures are taken. Prophylactic measures should include rapid fluid administration to assure hydration, diphenhydramine, and epinephrine just prior to gradual tourniquet release. The tourniquet should be deflated gradually and intermittently to avoid severe systemic analphylaxis and allow effective antagonism of systemically released antigens.

Case 4

Answers

I will perform an ankle block and anesthetize specifically the posterior tibial nerve that innervates the plantar aspect of the foot. The posterior tibial nerve runs behind the medial malleolus, under the flexor retinaculum, and lies posterior to the pulsation of the posterior tibial artery. With the patient supine in bed, the knee is flexed and the medial malleolus area is prepped. An ultrasound probe, if available, could be used to identify the posterior tibial artery, accompanying veins, and posterior tibial nerve in the position posterior to the medial maliolus. (The nerve will be most posterior.) A skin wheal is made with a 25-guage needle over the area of the nerve. Under direct ultrasound visualization, the needle is advanced posterior to the vascular structures, near the nerve, but not touching the nerve. After negative aspiration for blood, a total of 2 mL of the local anesthetic solution is injected provided there is no resistance to injection. The injection should be painless.

Case 5

Questions

1. What regional technique would you use to maximize analgesia during the case and provide pain control for the immediate time frame after surgery? How is it performed? Are there specific contraindications to your block? What medications will you use for rapid onset and long duration? How long is the analgesia likely to last and what will you inform the patient about with regard to transitioning to oral analgesics when the block wears off?

2. After surgery the patient complains of persistent numbness in the fourth and fifth digits of his right hand? What is your differential diagnosis? What do you tell the patient to do?

Case 5

Answers

1. I would perform an interscalene nerve block. The patient should be placed in a semi-upright position with a pillow under the shoulder. The patient's head is turned in the opposite direction of the shoulder to be blocked. The ultrasound probe can be placed along the clavicle where the brachial plexus should be easily visible. The probe can then be moved cephalad and rotated so the that the anterior and medial scalene muscles are in view along with the brachial plexus nerves in the groove in between. Local anesthetic can be deposited by a needle that is placed "in plane" with the ultrasound probe. Prolongation of the block can be accomplished by placing a catheter adjacent to the nerves and providing a continuous infusion of local anesthetic for 24 h. Catheters are not generally available for outpatients, but some centers have created the infrastructure for this as well. Outpatient catheters can only be provided in a well-coordinated system of care for close perioperative follow-up. If a catheter is not placed, the patient should be given multimodal pain medications to manage pain, and these medications should be started before the block wears off to avoid extreme pain and a difficult "catch-up" time where the patient is extremely uncomfortable and systemic medications have not yet taken effect. These blocks are contraindicated in patients who are anticoagulated or who have a neurological deficit on the side that you are placing the block. In addition, these blocks are commonly associated with phrenic nerve paralysis, Horner's syndrome, and recurrent laryngeal nerve paralysis. As such, they are not recommended for patients who have severe respiratory impairment or contralateral phrenic nerve paralysis or recurrent laryngeal nerve paralysis.

2. Nerve injury after a brachial plexus nerve block and surgery is rare and could have many sources. In this case, injury in the distribution of the ulnar nerve is particularly unusual since the nerve is often "spared" with this particular block. Nerve injury is more likely to be from the block if there was pre-existing nerve injury or if there was a paresthesia or pain at the time of the nerve block. The injury in this case could also have occurred from traction of the arm during the surgery or from direct injury to the nerve during surgery. It is somewhat helpful to determine if there is pure sensory involvement or if there is motor and sensory injury. Motor involvement portends a more guarded prognosis, but most of these injuries improve with time and simple physical therapy. If the symptoms are persistent it is appropriate to have the patient seen by a neurologist who is familiar with post-anesthesia/surgical injuries of this type. It is rare that a specific intervention is undertaken to treat the injury, but nerve conduction and EMG findings can (sometimes) help define the extent and timing of the injury.

Suggested Readings

1. Tsui B, Suresh S. Ultrasound imaging for regional anesthesia in infants, children, and adolescents: a review of current literature and its application in the practice of neuraxial blocks. Anesthesiology. 2010;112(3):719–28.
2. Ecoffey C. Safety in pediatric regional anesthesia. Pediatr Anesth. 2012;22:25–30.