Chapter 48
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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Case 4

You are asked to provide anesthesia for a 15-year-old female soccer player who requires reconstruction of a left anterior cruciate ligament. The surgery is planned with a graft taken from the hamstring of the same side.

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?

Answers

1. Depending on the 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 hours while this case is performed – so regional anesthesia alone is really not a viable option. Psychologically, operations of the perineum are difficult to perform on an awake adolescent. The logical choice would be to accomplish the case with regional anesthesia plus monitored anesthesia care 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. There are many potential regional anesthesia options for this case. While natural airway sedation would be possible, for a case of this duration, I would choose to provide GA with an LMA in addition to the nerve blockade. I would choose epidural anesthesia to allow analgesia for the duration of the surgery and to provide the option of using a catheter infusion in this block for postoperative pain control. If the patient were only 1 year old, I would choose a caudal block with a catheter insertion largely because the caudal space is generally much easier to access in infants than in adolescents. 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. during the block placement, several large series of peripheral and neuraxial nerve blocks in pediatric age patients have failed to find a significant incidence of injury from blocks performed while patients are anesthetized. I would place an epidural catheter at L4–L5, and I would choose 0.2% ropivacaine or 0.25% bupivacaine for this block. To maintain the block, an infusion of bupivacaine could be continued at 0.4 mg/kg/h during the case. Peripheral nerve blocks can also be used to provide analgesia in this case. To perform this block,

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

an ultrasound probe can be used to guide a block needle just medial to the ischial tuberosity, and 0.3–0.5 mL/kg of 0.2% ropivacaine can be injected on each side. Nerve stimulation could be added to assure appropriate location of the needle tip by observing for contraction of the anal sphincter with stimulation. One other option would be the dorsal penile nerve block which 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 the midline bilaterally. This could be done with ultrasound guidance or by landmarks alone. It should be noted that the peripheral nerve blocks do not provide as complete nerve blockade (in general) as an epidural or spinal block.

2. Bilateral foot drop after an epidural block 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 in whom the placement of the epidural catheter is atraumatic. The presence of an arteriovenous malformation of the epidural vessels could also pose a risk. Needle or catheter trauma of the epidural vein can result in excessive bleeding and the development of a hematoma that may compress the spinal cord and cause a 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 hours 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?

Answers

1. The block is performed with the patient supine and the neck slightly extended. The C6 transverse process tubercle (Chassaignac's tubercle) is identified with the index and middle fingers placed at the level of the cricoid ring between the trachea and the 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 contact with the C6 or C7 transverse process. The needle is withdrawn a 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 the 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 the phrenic nerve and pneumothorax. Shortness of breath due to recurrent laryngeal nerve 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 are 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–C7. 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 anesthetic slowly 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

1. What nerve block(s) would you plan in order to augment this anesthetic and/or provide postoperative pain control? Explain your choices.

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 anaphylaxis and allow effective antagonism of systemically released antigens.

Answers

1. It is possible to provide analgesia for ACL reconstruction in many ways. A peripheral nerve block is not an absolute requirement. The use of multimodal analgesics such as acetaminophen and nonsteroidal anti-inflammatory drugs, along with a modest amount of opioid medications, could be employed during and after this surgery. In addition, the injection of intra-articular local anesthetic and opioid has been shown to provide a modest amount of pain control in the immediate postoperative time period. Furthermore, local anesthesia injected in the sites of the graft harvest could provide analgesia for a limited time. For an adolescent undergoing a surgery as painful as this, a peripheral nerve block, or a combination of techniques that block sensation from the knee, has been shown to provide improved analgesia and decrease the need for opioid administration. When considering a peripheral nerve block, it should be recognized that analgesia for an ACL reconstruction requires coverage of the dermatomes that involve the anterior knee. In this case, with a graft from the hamstring planned, there is a need to consider pain control for the posterior portion of the knee as well. Coverage of the anterior portion of the knee can be provided by a femoral nerve block or adductor canal block. The femoral nerve block is performed under ultrasound guidance by focusing the transducer on the femoral nerve, artery, and vein on the side of the block. The femoral nerve lies lateral to the femoral artery. It is hyperechoic and triangular in shape. The needle is passed under direct (in plane) visualization from the lateral aspect of the leg. Once the needle tip is adjacent (above, below, or lateral) to the nerve, aspiration should be performed and local anesthetic injected. For the adductor canal block, the transducer is placed transversely on the medial thigh, at the midpoint of the upper leg. At this point, the

2. Three months after the surgery, the patient is weak in the left quadriceps. Could this have been due to the nerve block you provided?

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?

femoral artery is visualized deep to the sartorius muscle. The needle tip is positioned deep to the fascia of the sartorius muscle and anterolateral to the artery. Injection of local is done after aspiration.

As mentioned above, the pain from the graft harvest from the hamstring can be managed with local anesthesia at the site or by providing a subgluteal sciatic nerve block in addition to the nerve block applied for anterior knee analgesia. The addition of a sciatic nerve block has been associated with improved pain control in the immediate postoperative time frame.

2. It has been suggested that because the femoral nerve block includes motor innervation as well as sensory innervation whereas the adductor canal block is predominantly a sensory block, the adductor canal block is preferable since patients lose less of their motor ability with the block in place. In addition, some researchers have suggested that femoral nerve blocks may be associated with long-term weakness of the quadriceps muscle; however, this claim is not supported by studies of large populations of these patients. Long-term weakness is most closely related to the type of surgery performed and the adherence to physical therapy regimens in the postoperative time period.

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 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 hours. 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

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?

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 preexisting 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 postanesthesia/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.

Further Reading

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