CHAPTER **24**

PEARLS OF REGIONAL ANESTHESIA BLOCKS

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INTRODUCTION

In the past, patients were commonly admitted to the hospital for observation and pain management for even minor outpatient type procedures such as bunionectomy.[1] Today, increasing numbers of outpatient surgeries are performed. Preemptive analgesia and regional anesthetic blocks are of great importance for procedures ranging from hallux valgus and hammertoes to reconstructive foot and ankle surgery. Foot and ankle surgeries often induce moderate to even severe pain acute postoperative pain, which can often cause lengthened hospital stays.[1] Anesthetic blocks decrease the need for general anesthetic drugs that often cause unwanted side effects such as nausea and vomiting. They also allow for faster patient recovery and discharge home. Blocks may be underutilized for fear of difficulty in procedure performance, time of performance, and concern for inadequate anesthesia to the area as well as concerns about complications. This review will discuss available regional anesthesia blocks, techniques, and indications, with a focus on popliteal blocks.[1]

LITERATURE REVIEW

Sciatic nerve blocks have been described in the literature since 1923.[2] In considering the vast expanses of the literature on the subject of popilteal nerve blocks for foot and ankle surgery, several key topics can be discussed. The first of these is anatomic considerations. Volka et al did several studies examining these anatomic implications for popliteal blocks. Volka et al, found that upon gross and histologic examination of sciatic nerve specimens of cadavers that a common epineural sheath enveloped the tibial and common peroneal nerves.[3] This discovery had important clinical implications for nerve blocks within the popliteal area. As Volka et al explained, anesthesia is often obtained in both divisions but frequently identified with only one division of the sciatic nerve. Thus due to an injection intraepineurally, the presence of a common epineural sheath allows for successful popliteal blocks when response to nerve stimulation is obtained in one branch. Another study by Volka et al looked at the level of division of the sciatic nerve. It is known that the site of division of the sciatic nerve into its branches varies among individuals. This fact accounts for frequent reported failures of popliteal blocks within the popliteal fossa.[4] Volka et al preformed an examination of 28 cadaver leg specimens and found that the mean distance was 60.5 ± 2.7 mm from the popliteal crease with some divisions occurring as high as 110 mm and as low as 20 mm.[4] According to this model, Volka concluded that if a site is chosen at 50 mm to 70 mm above the popliteal crease, the chance that the tip of the needle will be proximal to the division of the sciatic nerve is 46-57%. To improve success rates, Hadzic et al suggested a double injection technique to identify both branches.[5] Volka et al recommended an injection site at 100 mm above the popliteal crease, which will virtually insure placement above the division.

Another aspect of anatomic consideration is the approach. Traditionally there have been 2 approaches for popliteal blocks: the classic posterior approach to the popliteal fossa and the lateral approach. Success rates with all approaches is typically 90-95%, with approximately 5% of patients requiring supplemental anesthesia.[6] In another study from Hadzic and Volka, 50 patients underwent lower extremity surgery. They concluded that the lateral approach took longer to accomplish, however both techniques resulted in acceptable anesthesia of the sciatic nerve.[7] An additional study looking at the lateral approach as the sole technique for control of postoperative pain found that 398 patients had complete anesthesia as compared with 77 that had incomplete anesthesia. The study also found a 97.7% patient satisfaction rate with postoperative pain control from the lateral approach.[8,9]

Another anatomical issue present with popliteal blocks is the saphenous nerve. To obtain total analgesia of the foot one must perform a saphenous nerve block. Donohue et al state that the combined nerve block offers significant advantages over spinal and general anesthesia and requires only appropriate training.[10] From these anatomic studies it can be concluded that with the varying level of sciatic divisions, a more proximal approach will improve the success rate of the block. This, along with the fact that an intraeurial injection will anesthetize both divisions, will yield better results for postoperative pain control using either the posterior approach or lateral approach. One must also remember to perform a saphenous nerve block to obtain a total foot block.

Trying to improve upon the success of popliteal blocks, with regard to anatomic considerations, new methods have been developed to accurately place injections and catheters. The use of nerve stimulation and ultrasound guidance are 2 of these methods being implemented. In a study by Perlas et al, 74 patients undergoing elective foot or ankle surgery received sciatic nerve blocks at the popliteal fossa guided by nerve stimulation or ultrasound. The study found that those guided with ultrasound had a significantly higher block rate success than those with the nerve stimulator. They concluded that ultrasound guidance improves the quality of popliteal nerve block as compared with a single injection and nerve stimulator use.[11] In another study in 1999, using a multiple injection technique and using the nerve stimulator in 3,996 patients, Fanelli et al, found a 94% successful nerve block with less than 30 ml of local anesthetic used.[12] Yet another study using a combined ultrasound and nerve stimulator technique found an increased success rate of the popliteal block, but did not increase block time.[13] From these results it becomes clear that the use of ultrasound and nerve stimulator has an effect of increased successful popliteal block.

In addition to anatomic effects, another topic to be discussed is the type and quantity of local anesthesia. Most often a 22 G needle is used for injection.[9] The ideal anesthetic for a local block of the popliteal fossa would have rapid onset, a long duration of action, high potency, and low toxicity.[14] The most commonly used local anesthetics are lidocaine, for its quick onset of action, bupivacaine, for its long duration of action, and ropivacaine, for its long duration and decreased cardiotoxicity.[14] A study from 2004, looking at current recommended doses of local anesthetics, found that the maximum doses presented in text books or by pharmaceutical companies are not evidence-based.[15] These recommendations have been based on animal studies and clinic experiences. Current recommendations place the toxic doses of lidocaine with and without epinephrine at 500 mg and 300 mg, respectively, and bupivacaine with and without epinephrine at 225 mg and 175 mg, respectively.[15] The study goes on to state that as a rule conditions such as end-stage pregnancy, or diseases such as uremia that may increase the rate of uptake of the local anesthetic are reasons to reduce the dose in comparison with a healthy adult. The reduced clearance associated with renal, hepatic, and cardiac disease states is the most important reason to reduce the dose.[15]

As far as the effective volume of local anesthetic is concerned, a trial from 2006 showed that in 56 patients, complete loss of sensation in the sciatic nerve distribution required 30 ml using mepivacaine. The authors concluded that a larger volume of local anesthetic is necessary to block the sciatic nerve at a more distal site as compared with a more proximal site.[16] Yet, another study found that 20 ml of ropivacaine 0.5% injected through an indwelling lateral popliteal catheter is the optimal dose for foot surgery. Higher doses of 30 ml or 40 ml did not provide any further advantage.[17] Another author states that he continually uses 20 ml to 30 ml of a local anesthetic.[18]

Comparisons of the use of different types of local anesthetics yielded similar results. One study found that 0.75% ropivacaine was the most suitable choice of local anesthetic for popliteal blocks, showing that patients for the first postoperative 24 hours required less supplemental analgesia as compared with 2% mepivacane.[19] Another study found that among 1,078 patients surveyed who were discharged postoperatively with long acting nerve blocks, 85% were given a long acting block with excellent postoperative pain control.[20] Another area of contention was a single injection targeting the tibial branch versus a double injection technique. A study from 2007 showed that a lateral popliteal block obtained with a single 30 ml injection of ropivacaine at the tibial nerve as compared with multiple injections of both the tibial and common peroneal nerve is as effective.[21] Again, this is most likely due to the common epineural sheath shared by the 2 branches. From this information, it can be concluded that each surgical block must be considered on a case-by-case basis and the local anesthetic must be customized to the patient and their medical problems.

The topic of local anesthesia provides another area of debate concerning the use of continuous popliteal nerve blocks provided with catheter placement. Use of continuous peripheral nerve blocks has shown prolonged analgesia and has greatly increased patient satisfaction and lowered dependence on opiates.[22] In a study performed by White et al, 24 patients undergoing foot or ankle surgery were studied. They concluded that a continuous infusion of 0.25% bupivacaine decreased postoperative pain and the need for opioids.[23] In a more recent review by Capdevila et al, continuous peripheral nerve blocks prolonged local anesthetic delivery allowing optimal analgesia, minimal side effects, and lasted longer than that of a single injection.[24] All of these studies showed improved patient satisfaction and quality of recovery. As compared with intravenous analgesia and placebo infusions, use of a catheter reduces pain scores and opioid use, and successful catheter placement has been reported with both lateral and posterior approaches.[25] With the information provided from these studies, it is clear that a continuous popliteal infusion has its advantages and can be used as a viable method for postoperative pain management. Again, however, its use must be customized to the patient.

It cannot be overstated that under-treated pain can result in psychological, physical, and economic loss, as well as poor post surgical results and patient satisfaction. Understanding the importance of preemptive analgesia in foot and ankle surgery in the form of a popliteal block can greatly improve all of the previously mentioned negative results. Clinical trials directed at providing support for this statement are numerous. In a study by Rorie et al examining the success of pain control with the use of a popliteal block in 130 patients, 88% expressed overall satisfaction with the analgesia provided by the block. The satisfaction rate of the anesthesiologists for those same 130 patients was 82.7%.[26] Grosser et al evaluated the effectiveness of a preoperative popliteal block in 25 patients undergoing foot and ankle procedures and found a 100% reduction in patient pain immediately post-operative and extended pain control for another 14 hours.[27] They suggested that a popliteal block saves time, provides excellent postoperative pain control, and has a high patient satisfaction.[27] Hansen et al showed in their case study that a blockade at the popliteal fossa can be used as the sole technique for foot and ankle anesthesia. They found that this provided excellent anesthesia during the procedure and the time preceding the procedure, and allowed for a more proximal calf tourniquet in 95% of their 48 trial patients. It was also shown to be a quicker method, needing only 15 minutes to provide excellent anesthetic coverage and all of the patients tolerated the pneumatic calf tourniquet.[28]

Another study involving 86 patients in 1996 using a popliteal blockade with 30 ml of bupivacaine with epinephrine and the use of a nerve stimulator showed that the block lasted 20 hours on average postoperative. No patients had complications related to the block and they reported a 95% satisfaction rate. Many of the patients stated that if they needed foot or ankle surgery again that they would have the block again.[29] In a comparison of a popliteal block versus a peripheral foot blockade, Migues et al did a prospective, randomized study of 51 patients under going forefoot procedures. They found that the group that received the foot block had a 92% successful postoperative analgesia as compared with the popliteal group with a 96% success rate. These data showed that both methods are safe and effective anesthetic techniques, well suited for foot surgery.[30]

Alternatively, another study that compared the efficacy of a combined popliteal and ankle block in forefoot procedures illustrated a significantly better pain relief than just an ankle block alone. These patients had less pain at 6 hours, 24 hours, and upon discharge and also had a higher satisfaction with pain relief.[31] Finally, a review article in which the popliteal nerve blocks were used as an adjunct to postoperative analgesia showed reduced amounts of postoperative opiods. The authors used 10 ml of 0.5% sensorcaine in a posterior popliteal block and 5 ml of 0.5% sensorcaine in a saphenous nerve block. The authors found that their technique was easy to perform and offered a longer period of postoperative pain control with little need for opioids. Examining the blockade of the popliteal fossa has demonstrated reliable results. Regardless of the means of the block, its effective control of postoperative pain as shown by these clinical results proves that the popliteal block should be considered where patients are undergoing foot and ankle surgery.

The final aspect of the analysis is the topic of potential complications associated with popliteal blocks. However, most of the studies examined in this inspection have shown little if any complications.[8] The most common complication as cited was an incomplete or partial block occurring 4-21% of the time.[8] This most often occurs when a saphenous block is missed. Intraneural injections have also been cited as a source of complication. Another major complication is a cardiac response from intravascular injection, but is cited as a very low possibility.[8] Provenzano et al reviewed 834 patients who underwent foot and ankle surgery and reported no complications associated with the block. They concluded that the performance of the block is a safe and effective anesthetic technique for foot and ankle surgery. A long-term study of neurologic complications of peripheral nerve blocks showed 13 patients out of 1,065 had a persistent postoperative neuropathy with an overall incidence of 0.22%. Authors recommend follow up of all such blocks to assess for complications and to allow for early intervention.[32] These studies have shown that popliteal blocks are not only safe to use but also efficacious. However, complications are a part of any procedure or intervention and must therefore be assessed.

NERVE ANATOMY

Sciatic Nerve

The sciatic nerve the largest nerve in the body and measures approximately 2 cm in width.[33] Its origin is from the sacral plexus and lumbosacral trunks (L4, L5) and anterior divisions of the sacral plexus (S1-S3). It takes a directional route from the pelvis through the sacrosciatic foramen following under the level of the piriformis muscle and continuing between the tuberosity of the ischium and greater trochanter of the femur. It becomes superficial at the border of the gluteus maximus muscle, then continues down the posterior thigh. It then divides at the posterior knee area to give off the tibial and common peroneal nerves. These are initially bound together for a small distance in connective tissue.

At the level of the posterior knee, the tibial portion of the nerve is medial and anterior in orientation and the common peroneal nerve is lateral and posterior in orientation. The sciatic nerve lies posterolateral to the popliteal artery and vein (continuation of the femoral artery vein). The division into tibial and common peroneal nerve components occurs approximately 6 ± 3 cm above the popliteal crease, but may be up to 11 cm above. It provides motor branches to the hamstring muscles and the muscles below the knee as well as sensory innervation to the posterior thigh and the entire leg and foot, aside from the medial aspect, which is supplied by the saphenous nerve.[3,4,25,33] It is important to note that in 10% of the population the common peroneal nerve divides 8 or more centimeters above the knee.[29]

Femoral Nerve

The femoral nerve is the largest nerve of the lumbar plexus. It is formed by dorsal divisions of anterior rami L2-L4. It emerges from fascial tissue of psoas muscle and illiacus muscles where it provides branch innervations to hip. At the level of the hip, it begins to enter the thigh posteriorly to the inguinal ligament then enters laterally and posteriorly to the femoral artery, as it passes into the thigh, it divides into anterior and posterior divisions. The anterior branches innervate the anterior thigh and posterior branches innervate the quadriceps muscles. It then continues below the knee as the saphenous nerve to give supply to the medial calf and the medial malleolus.[29]

Tibial Nerve

The tibial nerve lies posterior and lateral to the popliteal vessels in the popliteal fossa. As it descends in the lower fossa, it gives off branches to major ankle plantar flexors, the gastroc and the soleal muscles. It continues to course onto the posterior surface of the tibialis posterior muscle along with the posterior tibial artery and vein. At the ankle, the nerve and vessels enter the compartment beneath the flexor retinaculum. It then passes to the plantar aspect of the foot and gives rise to the lateral and medial plantar nerves.

Common Peroneal Nerve

The common peroneal nerve continues from the popliteal fossa and diverges laterally as it crosses the lateral head of the gastroc muscle. It lies in the subcutaneous tissue just behind the fibular head. As it continues around the fibular head, it divides into terminal branches, giving rise to the deep peroneal and superficial peroneal nerve. The deep peroneal nerve continues distally following the anterior tibial artery along the distal interosseous membrane. The deep portion of nerve and the artery then emerge on the dorsum of the foot located between the extensor hallucis longus and the tibialis anterior. At this level it is located lateral to the dorsalis pedis artery.[3,4,25,33]

POPLITEAL BLOCK TECHNIQUE/APPROACH

For the block it is important that the patient remains conscious in order that he or she may provide feedback regarding painful parasthesias and painful injection. The indications for this block are any foot and ankle surgery of long duration (3 hours or longer) This block lasts 3 times longer than an ankle block. For comfort purposes, the patient is given sedation usually 1-2 mg intravenous (IV) midozalam and a narcotic such as 50-150 ug IV fentanyl. The block is contraindicated in patients that have had recent lower extremity trauma, if there is a concern about compartment syndrome, neurologic and neuromuscular disease, and patients that are allergic to local anesthetics or have cellulits/abscess in the injection area.

Posterior Approach

The patient is placed in a prone position for the posterior approach. The knee should be flexed slightly on a pillow approximately 20 degrees.[29] The next step is landmark identification. A horizontal line is drawn across the popliteal crease on the posterior knee.[28,29] The line extends between the tendons of the biceps femoris laterally and semimembranosus medially. This line divides the fossa in superior and inferior portions. The midline of the crease is found and a line is drawn from the midline 5-10 cm proximally (approximately 4 finger breadths is usually adequate) but for accuracy, due to nerve divisional variations, 10 cm can be used (Figure 1) because the

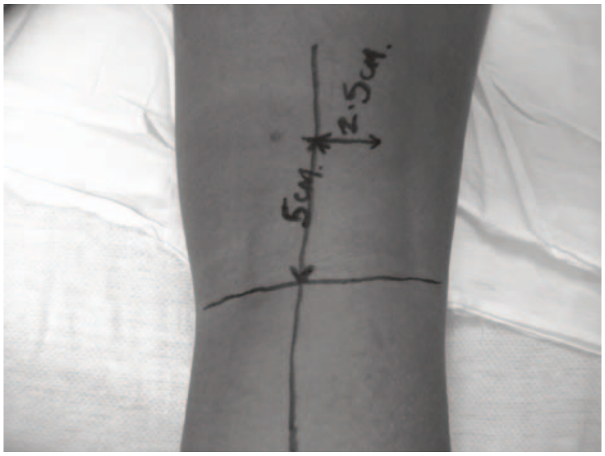

Figure 1.

Figure 2.

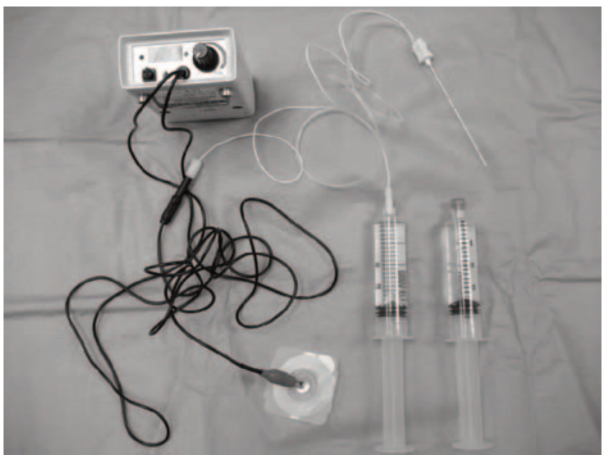

Figure 3.

Figure 4.

variations may cause inadequate nerve blocks. From this point, a horizontal line is drawn 1 cm laterally to the line at midline, which indicates the puncture site. Two lines can also be drawn upward from each side of crease to form a triangular superior quadrant meeting the midline. An EKG grounding lead/pad is applied 5 cm superior to the fossa on the ipsilateral leg. The skin is then prepped with sterile technique and as common practice, 1% lidocaine is used to create a small wheal on the skin to decrease pain at injection. A 50 – 100 mm 22-gauge, 2-inch insulated Stimuplex block needle with Stimuplex–S nerve stimulator is used (Figures 2-4). Insulation of the needle decreases the risk of nerve injury during injection. The needle is introduced at a 15 degree cephalic direction to the skin (Figure 5). It is advanced slowly, with periodic aspiration as to avoid intravascular injection.

The Stimuplex Nerve Stimulator is started at an output of 1-3.0 mA. The needle is advanced until the gastro-soleus muscle or the toe flexors are stimulated, at which time the Stimuplex Nerve Stimulator is decreased to

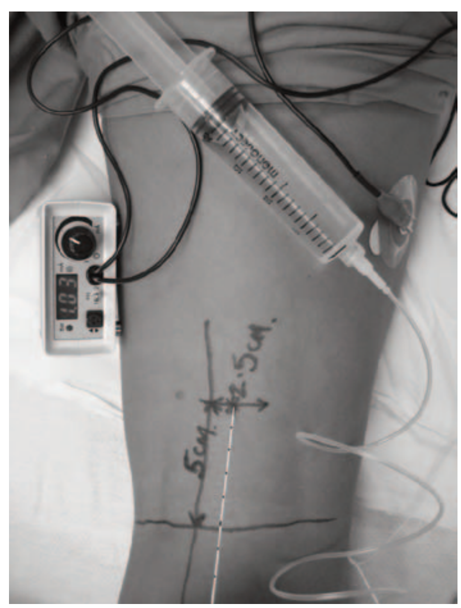

Figure 5.

0.5mA to maintain constant twitch. Then 30-40 ml of bupivicaine plain or with epinephrine (1:200,000) is injected. Epinephrine is used to prolong the effects of anesthesia. The average time to perform the block is approximately 10 minutes. If a successful block is performed, then no supplemental anesthesia, either local anesthetic or adjunct general anesthesia medications should need to be given.[28]

An additional injection for the saphenous nerve will be indicated as it is the terminal branch of the femoral nerve and is not anesthetized in the divisions of the popliteal block. Anesthesia produced by popliteal block varies anywhere from 14-18 hours and can even last up to 20 hours. Other studies by White et al also indicate the efficacy of continuous nerve block as an adjunct as the popliteal block wears off and pain becomes difficult to manage. In these circumstances, the popliteal block is performed as discussed, but a 20 gauge epidural catheter is inserted approximately 2-3 cm below the needle tip and the needle in removed. The catheter is secured in place and 0.25% bupivicaine 5 ml/hour is infused 48 hours post surgery by use of a disposable elastomeric pump, connected to a catheter containing 270 mls of local anesthetic.[3,4,7,23,28,29]

Lateral Approach

The lateral approach block is given to patients that are unable to be placed in the prone position due to inhibiting circumstances such as pregnancy morbid obesity, spinal and hemodynamic instability, and mechanical ventilation issues.[10] The patient is maintained in a supine position with the leg extended. A 10-pound sandbag is placed under the proximal aspect of the calf to act as fulcrum to increase tension on the biceps femoris when viewing the leg. The patella should be in a neutral position with 10 degrees of internal rotation of the leg. The patient again should be given sedation as in the posterior approach for comfort. Landmarks are oriented by palpating the proximal aspect of the patella and fibular head, which is palpated and traced proximally to the biceps femoris to the proximal patella. An imaginary axial line is drawn from the proximal patellar pole directly posteriorly. Another line is drawn horizontally from the fibular head proximally. Both of these lines are drawn to intersect and the point is marked. The intersection of lines should be 5-7 cm above the knee. As in the posterior approach, an EKG pad is placed on the ipsilateral leg, which should be prepped using sterile technique.

An insulated needle is then introduced 5-7 cm above the knee in a groove between the anterior border of the biceps femoris tendon and vastus lateralis muscle and is advanced medially at 30 degrees proximally and downward in the horizontal plane (Figure 6).

The nerve stimulator should be started at 5.0 mA.[7,8,27] The needle is advanced slowly with periodic aspiration.The biceps femoris muscle is stimulated and encountered first as it begins to contract. As the muscle contracts, the needle is advanced until it passes completely through the muscle.The needle is then continued to be advanced and then comes into contact with the common peroneal nerve branch of the sciatic nerve. This will cause everison and dorsiflexion to be seen in the foot. At this point the needle is advanced further medially until stimulation of the tibial nerve is caused. This will cause stimulation of the flexor muscles. The Stimuplex Stimulator is then reduced to 1.0 mA. The mean depth for needle advancement is 4.4 cm. Then 20-30 ml of local anesthetic is injected. If persistent contraction is seen, the needle may be in the nerve sheath, in which case it should be retracted to avoid nerve damage.[8,27]

The saphenous nerve block is again used for a medial block. There is no significant difference between the 2 approaches. Both have high success rates, and patient satisfaction, if the block is performed correctly. It has been found that the lateral approach may take 1-2 more attempts in comparison with the posterior approach but the common peroneal nerve was stimulated more frequently with the lateral approach as should be expected in this position.[7] If another attempt needs to be performed, the needle must be withdrawn to the skin to localize a new path. The time for performance of block is same – approximately 10 minutes.[27]

Ultrasound guidance can also be discussed as a new adjunct to nerve blocks. Studies by Perlas et al[11] show that there is improved success with guidance of ultrasound in comparison with that of a nerve stimulator when

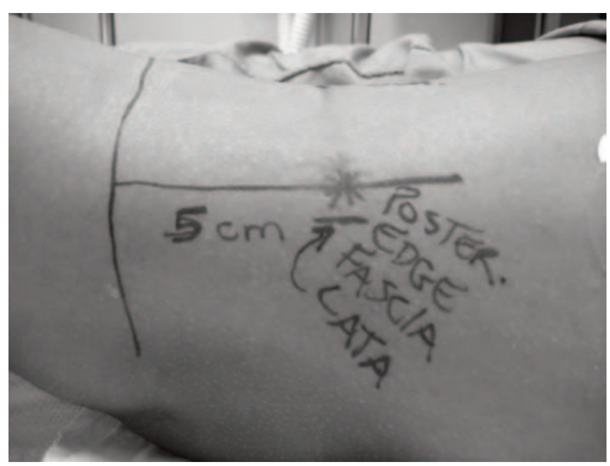

Figure 6.

performing nerve blocks, although studies are limited with regard to results. The technique is performed posteriorly, as previously discussed. The sciatic nerve is scanned in a transverse plane and followed distally until its bifurcation into tibial and common peroneal nerve segments. The block is performed proximal to the bifurcation using a 22 gauge 50-100 mm insulated needle, which is placed along the long axis of the probe in the same direction as the ultrasound beam until the tip of the needle is seen to contact the sciatic nerve. Then stimulator is turned on at 2-3 mA to start, until muscle twitch is attained. The stimulator is then turned off and local anesthetic is injected. Success was found to be variable, 56-94% adjunct to exactness.[11]

LOCAL ANESTHETIC

Various types of local anesthetics are used for blocks to achieve different effects and serve a significant role in preemptive anesthesia. The present recommendations for maximum doses of local anesthetics are not all evidence-based. They are usually based on the manufacturer's recommendations, but increased doses may be used and sometimes are required.[15] Preemptive analgesia is 21st century pain management, the goal of which is to minimize discomfort but keep physiologic nocioceptive, and protective mechanisms intact. The benefits of preemptive analgesia include decrease in postoperative opiod use, decrease length in hospital stay, early mobilization, and decrease in illeus. It prevents noxious somatic impulses from reaching the brain in a patient under general anesthesia and controls pain in the perioperative period. The efficacy of local anesthetics depends on uptake, distribution, and elimination. Specifically, this relates to factors such as lipid solubility and protein binding.[15]

Pharmacokinetics and Physiology

A brief overview of the physiology of local anesthetics is important in understanding its functions. A nerve is stimulated by a noxious event. The sodium ion channels open within the nerve cell membrane, and sodium rushes in. This event decreases the transmembrane potential and an action potential is generated. The impulse is then propagated and travels along the nerve fiber to the spinal cord dorsal horn. A local anesthetic acts by binding to the sodium channels therefore inhibiting the influx of sodium, which prevents propagation of action potential and eliminates impulse. The local does not act on resting membrane potential and is actually more effective on a nerve undergoing repeated action potentials. A local anesthetic blocks pain, temperature, and light touch sensation first. Deep pressure and vibratory sense is dissipated later. Motor fibers disappear last. The most effective local anesthetic is lipid soluble that also has some water solubility. Tetracaine and bupivicaine are high in lipid solubility. This is what causes an increase in duration and potency. Locals that have high protein binding capacities increase binding with the cell membrane. These include tetracaine, etidocaine, and bupivicaine. This again, increases potency and duration as it aids in transmembrane perfusion and intracellular binding. It is also important to remember that the presence of infection causes acidic tissues and decreases efficacy of the blocks. This occurs because the local picks up charges and this results in a cationic form of drug that decreases its transport across the membrane.

There are 2 different types of anesthetic groups: amides and esters. Esters are metabolized to para-aminobenzoic acid, which is responsible for allergic reactions.[14] Metabolism starts mainly in the blood stream by esters before the distribution phase. Therefore, from a toxicity standpoint they are safe, and more can be used.[15] The other group consists of amides, which are metabolized by microsomal enzymes in the liver. These have a longer duration of action and less incidence of allergy. Toxicity is caused by unbound (free) local in the plasma.[15]

Common Local Anesthetics

Lidocaine has a quick onset of 3-5 minutes. It comes in concentrations of 1-2% strength and is relatively inexpensive. It is good for short procedures. It has duration of 1-3 hours and with added epinephrine 2-3 hours. Dosage is 4.5 mg/kg with a maximum dosage of 300 mg plain and 500 mg with epinephrine.

Bupivicaine has a slightly longer onset of 5-10 minutes. It is available in concentrations of 0.25% and 0.5%. The duration is up to 14 hours. The maximum dosage is 175 mg plain and 225 mg with added epinephrine. It does have increased systemic absorption and cardiotoxicity

Ropivicaine is a newer anesthetic that is longer acting with a greater therapeutic ratio then other anesthetics[19] It is similar to bupivicaine with a similar onset and it is available in concentrations of 0.5% and 0.75%. Dosages is 2mg/kg and it has a duration of action of 8-18 hours. It has decreased cardiotoxiocity and longer motor and sensory blockade.

The dosage of mepiviacaine is 7mg/kg. It is available in 2% and has onset of action that is between bupiviaine and ropivicaine. It does have vasoconstrictive potential.[12,15]

Levobupiviacaine is equaipotent and an isomer of bupivicaine. It has a slower onset than bupivicaine with decreased toxicity. It is used for spinal and continuous postoperative blocks.

There are several adjuncts to local anesthesia. Epinephrine increases the duration of action. Common dosage is 1:200,000 or 5 ug/ml. Epinephrine causes vasoconstriction and limits systemic absorption, which keeps the drug in the vicinity of the nerve fibers for a longer period of time. When added to lidocaine, it increases the duration of action by 50% and decreases systemic toxicity by 33%; however, when added to bupivicaine and etidocaine, it has less of an effect. Caution should be used in patients with cardiac conditions, where it can cause hypertension. It has a better effect if mixed fresh 15-30 minutes prior to a procedure as opposed to using premixed solutions.[14] Sodium bicarbonate is an adjunct to local anesthesia that shortens the onset of a block. Clonidine prolongs the duration of anesthesia and analgesia longer then epinephrine. A dosage of 0.5 ug/kg is optimal.[33]

Toxicity

Signs of toxicity to local anesthesia include numbness of the tongue, restlessness, vertigo, tinnitus, slurred speech, twitching, seizures, hypotension, and decreased cardiac output.[13] Certain precautionary measures should be taken with nerve blocks. They should be avoided in patients that have neuromuscular disease or neurologic disorders, previous substance abuse, infection/cellulitis at the injection site, concern for compartment syndrome, and any allergy to local anesthesia, unstable cardiovascular disease, hepatic disease, diabetes, and pregnancy.[23]

There are very few complications (1%) seen with nerve blocks, none of which are serious and most are often self-resolving. Topics of concern along with blockade are loss of proprioception and protective reflex of pain. These may place the patient at risk for accidents and cause some difficulty with daily activities.[20] Some long-term parasthesias may be noted along with altered sensation to the operative site after the first postoperative week, but most resolve within the first week.[32] There is also a concern for the potential for cardiotoxcity with injection of local anesthetics. There may also be instances of partial nerve block due to a lack of the correct approach in technique (4-12%). Along with this there can be direct damage to the nerve if the needle is in direct contact with the nerve sheath, causing extreme pain and cramping.[8] Patients may also experience some discomfort with needle penetration, anesthetic infiltration, and twitching along with the possibility of hematoma formation and ecchymosis/tenderness to the area of injection.[29] Lastly, a concern with continuous block complications relates to the concern for maintaining the catheter in the correct position as well as its displacement and possibility of infection, catheter damage and shearing, which would leave behind portions of catheter that act as a nidus for infection.[16, 23]

ALTERNATIVE NERVE BLOCKS

Epidural/Spinal

Epidural and spinal anesthesia provide rapid and complete anesthesia for extemsive lower extremity surgery. Anything from the hip to the foot and ankle can be more easily accomplished. Both of these blocks are used for cases where general anesthesia is contraindicated. Foot and ankle surgery requires adequate anesthesia of the L4, L5, and S1 nerve roots. For these procedures, puncture is performed at L4. If this area is unattainable, then L3 or L5 are used and local anesthetic diffuses into the areas. This block does have side effects, specifically urinary retention, prolonged sensory block,[28] hypotension, and post punctural headaches and backaches. The patient must also often stay in the hospital post surgically for overnight monitoring.[1,34]

Femoral Block

The indications for a femoral block are usually knee surgery but it is used in foot surgery as well because the terminal branch of the femoral nerve is the saphenous nerve and needs to be anesthetized as an adjunct to a popliteal block. The preferred site of injection varies proximally.

The classic approach of Labat is often used. The patient is supine and a line is drawn from the anterior superior iliac spine to the pubic tubercle. A 4 cm needle is inserted at the point of intersection between the line and the marked/identified lateral femoral artery perpendicular to the skin. Local anesthetic (10 ml) is injected. A stimulation device may also be utilized with this block. The most common area of insertion is 2.5 cm below the inguinal ligament and lateral to the femoral artery.[3,4] The anterior branch is first encountered. The stimulation of this branch causes contraction of the sartorius muscle on the medial side of the thigh. The needle should then be directed slightly laterally and with deeper direction to achieve the posterior branch block, which causes patellar ascension as quadriceps contact.[35]

Moving distally to the level of the knee, signifies the area where an adjunctive saphenous nerve block is performed. The patient should remain supine. The saphenous nerve lies relatively superficial at the knee level.

The tibial tuberosity is identified as well as the anterior and medial borders of the gastroc muscle. An intersecting line is drawn at 45 degrees medial and distal to intersect these points. Then 10 ml of local are used to infiltrate the area in an arc.[10]

Sciatic Nerve Block

A sciatic nerve block can also be used in the gluteus maximus and subgluteal areas. Two approaches, anterior and lateral can be used. However, these are beyond the scope of this discussion.

Ankle Block

An ankle block is often used for short duration foot and ankle surgery (1-3 hours). It does not diffuse proximally so is often not adequate to alleviate discomfort from a calf tourniquet. This block is comprised of a series of 5 injections, anesthetizing the superficial peroneal, deep peroneal, posterior tibial, sural, and saphenous nerves. The superficial peroneal nerve (L4, L5, S1, S2) perforates the deep fascia on the anterior aspect of the distal two-thirds of the leg and travels subcutaneously, innervating the dorsum of the foot, but not including the spaces between the hallux and the second digit.

The deep peroneal nerve (L4, L5, S1, and S2) travels down to the anterior aspect of the interosseous membrane of the leg and continues medially below the malleoli innervating the extensors to the digits and the skin between the hallux and second digit. The posterior tibial nerve (L4, L5, S1-S3) runs through the lower leg with the posterior tibial artery, and provides supply to the ankle and sole of the foot. The sural nerve is purely sensory and derived from the branches of the common peroneal nerve and the tibial nerve.

Finally, the saphenous nerve is a terminal branch of the femoral nerve and becomes subcutaneous at the level of the knee and follows the great saphenous vein to the medial ankle. With this block, the patient is supine and the ankle is elevated.

The superficial femoral nerve is blocked with 5 ml of local anesthetic from the anterior border of the tibia and directed to the lateral malleolus. The deep peroneal nerve is blocked at each side of the dorsalis pedis artery at the level of the ankle, deep to the fascia with 3 ml of local anesthetic. The posterior tibial nerve is blocked posterior to the tibial artery after aspiration with 5 ml of local anesthetic. The sural nerve is blocked anterior to the Achilles with the needle directed toward the lateral malleolus with 5 ml of local anesthetic. The saphenous nerve is blocked with 3 ml of local in a fan-like technique around the sapheous vein after aspiration.[33]

In conclusion, regional anesthesia blocks provide many benefits including decreased cost, allowing decreased hospital stay, and they allow the patient to be wheeled directly out of the operating room. They also decrease nausea and opioid use.[11] In most blocks, patients are able to retain control of their hamstring muscles so they can function with crutches or a walker.[8] Preemptive block was found to be more beneficial in treating postoperative pain then no block, and pre-incisional block was also found to decrease postoperative pain and provide more rapid recovery and resume activity quicker. All of these factors increase patient comfort and satisfaction.[14]

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