

iPACiK Block

Pain Management for Total Knee Arthroplasty

BEST PRACTICES IN HEALTHCARE



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Total knee arthroplasty (TKA) or total knee replacements (TKR) are among the most commonly performed surgical interventions for orthopedics and are projected to increase 143% by the year 2050 (Inacio et al., 2017). In order to match the exponential growth of TKAs, new methods of pain management will need to be explored to minimize recovery time for patients.

Osteoarthritis is the most common reason for a patient to undergo a TKA. Osteoarthritis is a degenerative disease that often occurs due to the “wear and tear” of the joint. Patients are referred to an orthopedic surgeon by their primary care physician only after noninvasive interventions such as weight loss, medication, or physical therapy have failed. Regardless of any pathophysiologies, patients eventually undergo the surgery to seek pain relief, regain joint functionality, and ultimately improve their quality of life. With the goal of improving quality of life in mind, studies show that patients who ambulate sooner after surgery will likely see more positive outcomes (Wainwright et al., 2020).

The challenge with patients diagnosed with osteoarthritis is that the disease is often coupled with cardiovascular disease, diabetes, obesity, and hypertension (Losina et al., 2013). Due to these common comorbidities, combining various medications can adversely affect hemodynamic stability and respiratory function. Therefore, patients undergoing TKAs could benefit from minimizing the use of inessential medication. Under general anesthesia, the

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provider will typically administer a combination of different agents to induce and maintain unconsciousness. The use of muscle relaxants and opioids will also be needed to immobilize and reduce pain for the patient. Additionally, each of these agents will come with side effects which the provider will need to monitor. This is where multimodal anesthesia can be more effective. *Multimodal anesthesia* is a strategy used by anesthesia providers to reach safe and adequate levels of anesthesia. Different agents and methods are used to target various sensory pathways and control pain instead of relying solely on general anesthesia. Multimodal anesthesia also produces fewer side effects that general anesthesia would typically cause (e.g. nausea, vomiting).

According to the Enhanced Recovery After Surgery Society (ERAS), neuraxial anesthesia is the preferred method over general anesthesia when it comes to TKAs (Wainwright et al., 2020). When opting for neuraxial anesthesia, the anesthesia provider will administer an anxiolytic or sedative in combination with a lower dose analgesic. Of course, this option may not be suitable for all patients. Patients who are too anxious may be a better candidate for general anesthesia or monitored anesthesia care with a supraglottic airway device. Patients will additionally receive a peripheral nerve block preoperatively. This will aid their recovery and postoperative pain management.

Peripheral nerve blocks are an important tool for pain management, allowing patients to begin ambulating sooner and can also decrease dependence on opioids. Peripheral nerve blocks commonly used for a TKA include the Adductor Canal Block, Femoral Nerve Block, and Popliteal Nerve Block. More recently, a newer block called the 'iPACK' block was introduced in 2012 and is increasing in popularity. iPACK, short for **I**nfiltration between **P**opliteal **A**rtery and **C**apsule of the **K**nee, is considered a periarticular injection (PAI), also known as a local infiltration analgesia (LIA). When administering the iPACK block, the provider will take a local anesthetic and inject it into the posterior area of the knee with a high concentration of pain fibers to effectively anesthetize the region. The iPACK block was developed by Dr. Sanjay Sinha from Hartford, Connecticut.

"A selective tibial nerve block in the popliteal fossa is an alternative to sciatic nerve block and can provide analgesia without causing a foot drop."

~ Dr. Sinha ~

iPACK Block

The iPACK block can be effective at controlling posterior knee pain post operatively. This is achieved by selectively anesthetizing the distal ends of the articular branches while sparing the proximal portions of the common peroneal nerve and sciatic nerve. Using the iPACK block in conjunction with the femoral block or adductor canal block will provide adequate analgesia without loss of motor function often seen when combining a femoral block with a popliteal block or sciatic block. As Dr. Sinha (2012) states, "A selective tibial nerve block in the popliteal fossa is an alternative to sciatic nerve block and can provide analgesia without causing a foot drop." This means the patient will have use of their foot and will be able to stand or possibly put weight on it with assistance. Since the block is increasing in popularity, here is some basic information on how the block is performed and our role as technologists.

Certified Anesthesia Technologist's Role

At the start of the procedure, Anesthesia Technologists begin by assisting with positioning the patient as well as prepping the affected leg. The most common position for the patient to be in is supine with the knee flexed. It may be helpful to use towels as a footrest to help position the leg. The medial portion of the affected leg will need to be cleaned with chlorhexidine preparation and the surrounding area should be draped with sterile towels to maintain sterility.

Prior to the start of the procedure, it is important that we make sure the patient already has intravenous (IV) access established, as well as supplemental oxygen and monitors applied (continuous pulse oximetry, blood pressure monitoring, and electrocardiogram). A significant part of our role as technologists and technicians is to always be prepared for the worst-case scenario— so in addition to having access to extra supplies, make sure that the emergency resuscitation equipment is nearby. Most importantly, we want to ensure we have the 20% lipid emulsion solution available in the rare case that the patient were to experience symptoms of Local Anesthetic Systemic Toxicity (LAST). Once the patient is connected to



Figure 1: Patient in supine position with leg flexed and transducer on the popliteal fossa (NYSORA, 2020)



Figure 2: Patient with the transducer positioned on the medial side of the leg (NYSORA, 2020)

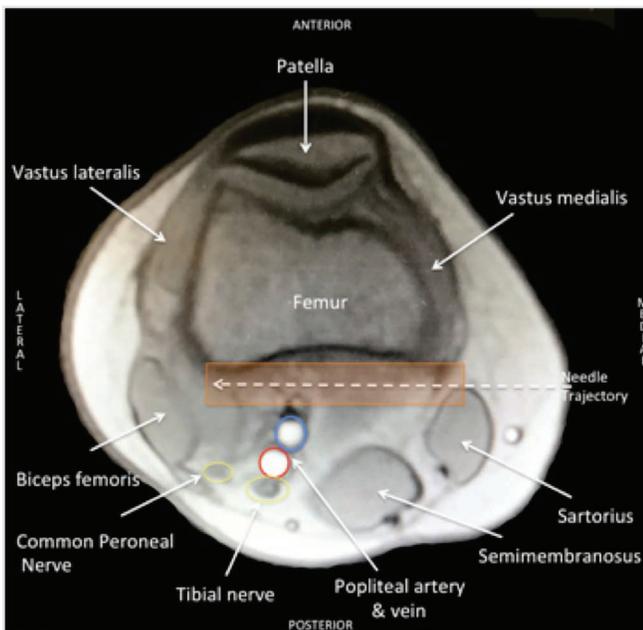


Figure 3: Cross sectional view of the leg (Sinha, 2019)

the monitors, we should participate in *time out* to ensure patient safety by properly identifying the patient, reviewing allergies, medications, confirming patient consent, and also confirming that the correct block is being performed on the correct leg.

Next the Anesthesia provider should don sterile gloves and put on the sterile probe cover. He or she will then position the ultrasound probe at the popliteal fossa to identify the femur, popliteal artery, and popliteal vein (**Fig. 1**). The femur is often identified when the provider slides the transducer proximally and distally to see a curved hyperechoic structure. When compressed, the pressure of the transducer will help identify the popliteal vein and the pulsatile popliteal artery next to it. The technologist may suggest the use of the color doppler to confirm the location of the popliteal vessels. The common peroneal nerve and tibial nerve should also be identifiable if the ultrasound transducer is positioned towards the distal end of the femur. Alternatively, some providers may prefer to position the ultrasound transducer on the medial portion of the thigh (**Fig. 2**). Once the needle is inserted in the desired position, the local anesthetic will then be injected. If your facility and job description allows for technologists to perform the mechanical function of infusing local anesthetics, always make sure it is done under the direction and supervision of the anesthesia care provider.

Fig. 3 shows a cross sectional view of the thigh. Notice the trajectory of the needle and its close proximity to the popliteal artery and popliteal vein. It is critical that we always make sure to aspirate and check for blood before infusing the local anesthetic. Technologists exist as a part of the anesthesia care team to provide safe patient care, so we must be vigilant about aspirating every 5ccs to keep the patient safe and to prevent intravascular injection that may lead to LAST.

It is also good practice to frequently communicate with the anesthesia provider. You should verbalize when you begin infusing, when you are aspirating, and the total amount of local anesthetic that the patient has received. If increased resistance is felt when infusing the anesthetic, it is important to let the provider know so they can reposition the needle to avoid any complications. Finally, we should keep an eye on the patient and monitor vital signs throughout the process. If the patient is experiencing pain or if there are any abnormal values on the vital sign monitor, we should stop, assess, and decide if it is safe to continue. When administered correctly, the local anesthetic should be seen dispersing between the femur and popliteal vessels.

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Complications

While the iPACK block has facilitated faster recovery for many patients, there are risks of complications that come with using the block such as infection. While infection from a peripheral nerve block is very rare, it is still important to practice proper hand hygiene and aseptic technique.

The potential risk for traumatic nerve injury should also be kept in mind. There can be a significant nerve injury that occurs when the needle penetrates the perineurium and enters the fascicle. For this reason, we must infuse the local anesthetic in fractions, communicate increasing resistance to the provider, and look at the patient for any signs of pain when performing the block.

Another significant risk that comes with infusing local anesthetics is the possibility of LAST. Despite the occurrence of LAST being low, the risk is still present and it is important to be able to recognize what some of the signs and symptoms are. Throughout the procedure, it is important to communicate with the patient and determine if there is any new onset of confusion or disorientation. Some patients may become agitated or restless. Gittman, Fettiplace, & Weinberg (2020) state that the patient may complain of a metallic taste, visual, or auditory disturbances (tinnitus). More severe manifestations such as tonic-clonic seizures, sudden arrhythmias, and sudden changes in blood pressure may occur. If any of these symptoms are present, the procedure should be stopped immediately. Additional help should be called and if symptoms persist or escalate, the Advanced Cardiac Life Support team should be notified. If the patient is having a seizure, the provider will need to administer midazolam and someone should be managing the airway by providing 100% oxygen and placing an advanced airway if necessary. Providing the 20% lipid emulsion is crucial and should be started right away. According to NYSORA's LAST Protocol, the initial dose of the 20% lipid emulsion should be 1.5 mL/kg and given over one minute. Following the bolus, the rate of infusion for the lipid emulsion should decrease to 0.25 mL/kg/minute. The patient should be continually assessed until stable enough to transfer to an intensive care unit.

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While it is important to understand the symptoms and treatment of LAST, prevention is key. As mentioned time and time again, communicating with the provider and the patient is absolutely vital. The iPACK block is still quite new and the success of the block is dependent on the experience of the anesthesia provider. If the provider is struggling, having a second provider assist may help to avoid putting the patient through any unnecessary pain and danger. Again, when trying to identify the correct position, technologists can offer to turn on the color doppler to help identify the popliteal vessels. It may also be beneficial for the technologist to review ultrasound images to help identify structures as well.

According to Gittman, Fettiplace, & Weinberg (2020), some additional risk identifiers include petite patients, patients with low muscle mass, pre-existing heart

conditions, and geriatric patients. The same authors also note that incidents of LAST greatly decrease with the use of an ultrasound, incremental injection with aspiration, and medication usage at the lowest effective dose. With that being said, none of these preventative measures are fool-proof and it is important to incorporate all of these pieces of information to keep patients safe.

Conclusion

Anesthesia is complex and requires not only knowledge but comprehension of anatomy, physiology, pathophysiology, and pharmacology. With new techniques always in development, technologists play an important role in keeping the patient safe as a part of the anesthesia care team.

Our providers often need to focus their attention in multiple directions simultaneously— from the patient, to the ultrasound monitor, to the pumps and lines. Our job as healthcare professionals is to help our Anesthesiologists, CRNAs, and Anesthesiology Assistants provide the best care possible by keeping our patients comfortable and safe throughout their perioperative experience. Whether help comes in the form of a second set of eyes or a second pair of hands, our assistance and preparation during an emergency or even a routine procedure can be paramount.



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Continuing Education Quiz

To test your knowledge on this issue's article, provide correct answers to the following questions on the form below. Follow the instructions carefully.

1. What should the initial bolus of the 20% Lipid Emulsion be?

- a) 1.0 mL/kg
- b) 0.25 mL/kg
- c) 1.5 mL/kg
- d) 0.5 mL/kg

2. What position is the iPACK block most commonly performed in?

- a) Lateral decubitus
- b) Semi-Fowler
- c) Supine with knee flexed
- d) Prone and Trendelenburg

3. What is not a sign or symptom of LAST?

- a) Arrhythmia
- b) Headache
- c) Tinnitus
- d) Seizure

4. The iPACK block alone is sufficient enough to anesthetize the knee.

- a) True
- b) False

5. Osteoarthritis is a _____ disease of the joint

- a) Pediatric
- b) Genetic
- c) Degenerative
- d) Viral

6. What is the goal of the iPACK block?

- a) To anesthetize the popliteal branches
- b) To anesthetize the sciatic nerve
- c) To anesthetize the articular nerve
- d) To anesthetize the brachial plexus

7. How can we assist with the iPACK block? (Select all that apply)

- a) Familiarize ourselves with what the ultrasound image looks like
- b) Help position the transducer
- c) Suggest the use of the color doppler
- d) All of the above

8. Where will the provider insert the needle?

- a) On the lateral side of the leg
- b) On the medial side of the leg
- c) Directly inferior of the patella
- d) Directly superior to the patella

9. All of these are potential complications of a peripheral nerve block EXCEPT:

- a) Infection
- b) Difficulty urinating
- c) LAST
- d) Traumatic Nerve Injury

10. What is the preferred method of anesthesia for a TKA?

- a) General anesthesia
- b) Light sedation
- c) Neuraxial anesthesia
- d) Peripheral nerve blocks only

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- 1: A B C D
- 2: A B C D
- 3: A B C D
- 4: A B
- 5: A B C D
- 6: A B C D
- 7: A B C D
- 8: A B C D
- 9: A B C D
- 10: A B C D

Quiz 2 of 2

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