

## **Ultrasound Guided Sciatic Nerve Block: The Popliteal Approach**

**Brian D. Sites, MD**  
Dept of Anesthesiology  
Dartmouth-Hitchcock Medical Center

Welcome to Ultrasound Guided Sciatic Nerve Block: The Popliteal Approach

### **VIDEO OBJECTIVES**

- Define important gross and ultrasound anatomy.
- Describe a supine, in-plane technique.
- Distinguish between successful and unsuccessful spreads of local anesthetic.
- Identify potential challenges and pitfall errors.

### **GROSS ANATOMY**

- The sciatic nerve originates from both the lumbar and sacral plexus (L4-S3).
- It exits the pelvis through the greater sciatic foramen.
- It runs beneath and midway between the greater trochanter and the ischial tuberosity.
- The sciatic nerve continues down the leg to ultimately divide into the common peroneal

and tibial nerves proximal to the popliteal crease.

Here we see the sciatic nerve exiting the greater sciatic foramen. The sciatic nerve travels down the leg and exists slightly lateral to the biceps femoris tendon. The greater trochanter is also labeled.

This is the same cadaver as in the prior slide. However, it demonstrates that the sciatic nerve travels down the legs and dives down the biceps femoris muscle proximal to the popliteal crease. This is indicated by the arrow.

Here is a close-up shot of the division of the sciatic nerve into the tibial nerve and the common peroneal nerve. Note that the common peroneal nerve is more lateral than the tibial nerve.

Here we see the tibial nerve and common peroneal nerve more distally in the leg. Note that they have been stained with the blue dye during a simulated injection into the cadaver. It is important to note that the popliteal fossa quite a significant amount of adipose tissue, which can actually help facilitate needle nerve imaging. This concept is further described in the introductory ultrasound video.

### **Critical Background Information**

- The division of the sciatic nerve into the common peroneal and tibial nerves is quite variable.
- The block should not be considered a perivascular block in which local anesthetic is injected around a blood vessel.
- Good ergonomics are important for this block. This is secondary to the sometimes fatiguing nature of the position needed to perform this procedure.

### **TWO COMMON APPROACHES FOR A POPLITEAL BLOCK**

Depicted in this slide are two approaches to performing a popliteal sciatic nerve block. On the right-hand side you see the prone position, in which the patient lies on his or her stomach. On slide left, we see the supine approach, in which the ankle is elevated on a set of towels or pillows. This is the technique that is preferred by the authors and is described in the rest of this instructional video.

## **ERGONOMIC ISSUES**

- The operator should be sitting.
- The ultrasound machines should be on the contralateral side.
- It is helpful to rest your scanning arm on the bed or support structure. This will help prevent fatigue.

## **SONOANATOMY AND SCANNING TECHNIQUE**

- Place the transducer in the popliteal crease.
- the first objective is to identify the popliteal vessels and the tibial nerve.
- Identification of the popliteal vessels can be facilitated by color Doppler.

Here we see the anesthesiologist scanning the popliteal crease looking for the popliteal vessels.

The popliteal vein is indicated by PV; popliteal artery by PA. The tibial nerve is indicated by TN.

The tibial nerve at the popliteal crease is generally an oval or round hyperechoic structure with internal hypoechoic fascicles.

## **Sonoanatomy**

- Next, slide the transducer in a proximal direction.
- Visualize the common peroneal nerve joining the tibial nerve from the lateral aspect of the ultrasound screen.
- Use your P.A.R.T. maneuvers to optimize image quality. These P.A.R.T. maneuvers were discussed in the introductory video.

Here, in this still image, we see the common peroneal nerve (CPN) and the tibial nerve (TN). Both are round, hyperechoic structures. Screen-right is lateral.

The two arrows refer to these nerve structures. As the transducer is moved proximally, we can see that the nerves come together to form the sciatic nerve.

As previously mentioned, adipose tissue can greatly facilitate the performance of peripheral nerve blocks. This is because

## **Adipose Tissue**

- Adipose tissue forms an important interface with muscle and the nerve.
- In thin and muscular patients, the sciatic nerve can be very hard to image.
- Adipose tissue has different acoustic impedance than the sciatic nerve, thus maximizing ultrasound reflection.

This video demonstrates how adipose tissue can highlight the sciatic nerve. Notice how the adipose tissue, labeled as “fat” in this video, is a hypoechoic area that outlines the sciatic nerve. If the adipose tissue did not exist, the nerve would blend into the surrounding muscle, making it very difficult to image. SN stands for sciatic nerve.

## **IN-PLANE NEEDLE INSERTION TECHNIQUE**

- Optimize the sciatic nerve image quality using the P.A.R.T. maneuvers.
- The goal is to insert your needle exactly parallel to the faceplate of the transducer.
- The needle will not have to be angulated once it is under the skin.
- This will produce the clearest image of the needle.

### **To Determine Your Needle Entry Site**

- Simply use your calipers on the ultrasound machine (which is part of the standard software package on most machines) to measure the distance from the nerve to the skin.
- Then mark this same distance on skin with a pen.

This is demonstrated in the video. Here we see the blue calipers revealing the depth to be 2.17 cm with respect to the sciatic nerve and skin. This depth is used to place onto the patient as a reference point for where to insert the needle.

[Here we see the operator using this measurement to plan the needle insertion site.]

Next...

- Place a skin wheal of local anesthetic.
- Advance a 100 mm block needle.
- When the needle is adjacent to the nerve, inject the local anesthetic.
- The author's preference is to inject in several locations around the nerve in order to generate circumferential spread of local anesthetic.

Here we see the skin wheal being placed at the site marked by the pen. Next, the 100 mm block needle is advanced using the in-plane needle insertion technique. This is the video in which the needle is clearly seen as it is approaching the sciatic nerve, labeled SN. PA stands for popliteal artery. Local anesthetic appears as a hypoechoic solution coming out of the needle here. As you watch this video, note that the operator injects in

several locations around the sciatic nerve in order to generate circumferential spread.

## **VARIATION IN APPEARANCE OF INJECTION**

It should be noted that there are different characteristics for the spreads of local anesthetic. Here is an example of an injection that separates the common peroneal nerve from the tibial nerve.

The central hypoechoic structure is the sciatic nerve. The needle can be seen advancing toward the sciatic nerve. Following in the injection of local anesthetic, we now see two separate structures, occurring here. On screen left, CPN, we see the common peroneal nerve, separating from TN, the tibial nerve, on screen right.

## **WHERE TO INJECT?**

- This is not a simple question.
- Active research is occurring in this area.
- The author's opinion is that there needs to be circumferential spread around the sciatic nerve to get a complete block.
- It should be noted that there are several distinct (non-neural\_ tissue layers that are adherent to the sciatic nerve.
- These layers are evident in the gross dissection, but are generally not evident during ultrasound imaging.
- The author's opinion is that the needle must penetrate this outer non-neural tissue layer in order to generate a surgical type block.

This gross image reinforces the concept of this extra non-neural tissue layer, indicated by the white arrow. This tissue is tightly adherent to the sciatic nerve. A bifurcation of the sciatic nerve is also obvious in the gross anatomical dissection.

In this following video, the viewing can actually appreciate a distinct pop that represents this outer tissue layer. In this video, the needle can be seen on screen left as it approaches the sciatic nerve. The pop is visualized now. The spread of local anesthetic commences; and it is clear that the local anesthetic spreads circumferentially around the sciatic nerve.

## **INTRANEURONAL INJECTION**

The following injection represents an obvious intraneuronal injection. The author recommends avoiding such an injection. Of interest, notice that the operator keeps injecting as the needle is pulled out of the nerve. The needle is visualized; it is now withdrawn as the injection commences. Now the needle is in the correct location. Also evident in this video is that the intraneuronal injection has caused the sciatic nerve to swell.

## **CLINICAL PEARLS**

- The supine approach is ergonomically more challenging.
- However, given the relationship of the needle to the ultrasound beam, it is usually much easier to see the needle.
- When the needle is not visualized, the best transducer maneuver is alignment (as described in the introductory video).

## **IN SUMMARY**

- Ultrasound can facilitate the performance of a popliteal sciatic nerve block.
- good ergonomics can the in-plane needle insertion technique facilitate the performance of this block.

- Try to generate circumferential spread of local anesthetic around the sciatic nerve.
- Learn to recognize nerve swelling and possible intraneural injection.