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# Ultrasound guided transgluteal sciatic nerve hydrodissection for the treatment of acute sciatica in the emergency department

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ABSTRACT

Radicular pain due to sciatica is a common occurrence with a lifetime incidence of up to 40%. Typical approaches to treatment vary and may include topical and oral analgesics, such as opioids, acetaminophen, and non-steroidal anti-inflammatory drugs (NSAIDs); however, these medications may be contraindicated in some or result in untoward effects in others. The use of ultrasound-guided regional anesthesia is an important component of multimodal analgesia in the emergency department. Transgluteal sciatic nerve block has been described as an effective method to treat patients with sciatica but carries risk of injury and falls due to its resultant loss of motor function and potential for systemic toxicity when higher volumes are used. Ultrasound-guided peripheral nerve hydrodissection with D5W has been shown to be an effective treatment of various compressive neuropathies in the outpatient setting. Here we present 4 cases of patients who presented to the emergency department with severe acute sciatica and were treated successfully using an ultrasound guided transgluteal sciatic nerve hydrodissection (TSNH). This technique may offer a safe and effective approach to treating patients with sciatica, but more studies are needed to assess its utility on a larger scale.



## 1. Introduction

Sciatica is a term often used to describe lumbar radicular pain originating from the lower back or gluteal region that radiates down the leg along the course of the affected nerve roots [1]. It is a common condition with a lifetime incidence of up to 40% [2]. Treatment options typically involve use of NSAIDs, often in combination with acetaminophen, opioids, systemic steroids, muscle relaxants, and/or topical analgesics [3,4]. In the wake of the opioid epidemic, regional anesthesia has gained traction as a safe, effective means to provide non-opioid analgesia in the emergency department (ED) where therapy with other typical medications is unsuccessful or contraindicated. The American College of Emergency Physicians wrote a policy statement which describes ultrasound-guided regional anesthesia as being within the scope of emergency physicians, and represents an important component of multimodal pain control for ED patients [5]. A recent study has described an ultrasound-guided Transgluteal Sciatic Nerve Block (TSNB) as a viable means for managing acute sciatica [6]. In this and prior studies TSNB had been performed using long acting local anesthetics such as ropivacaine and bupivacaine [6,7]. Concerns, however, have been raised regarding temporary motor dysfunction that can occur with this block and its associated fall and injury risk [7]. Long acting local anesthetics may also lead to local anesthetic systemic toxicity (LAST). Recently there have been randomized controlled trials that demonstrated the effectiveness of nerve hydrodissection with D5W for controlling symptoms of carpal tunnel syndrome in the outpatient setting [8,9] as well as other forms of compressive neuropathy with radicular symptoms [10]. Briefly, nerve hydrodissection is a technique involving the injection of fluid (D5W or NS) to separate a nerve from its surrounding tissue, thereby alleviating compression [10]. Since D5W is not a local anesthetic, there would be no associated risk of temporary motor dysfunction or LAST. To the best of our knowledge, the use of ultrasound-guided sciatic nerve hydrodissection with D5W for sciatica has not yet been described in the emergency medicine setting. Here we present 4 cases of patients who presented to the ED with sciatica who had significant relief after ultrasound-guided Transgluteal Sciatic Nerve Hydrodissection (TSNH).

## 2. Case presentations

### 2.1. Case 1

A 57-year-old male with a history of lumbar radiculopathy presented for evaluation of 10 days of debilitating 10/10 pain on a numeric rating scale (NRS), which began after he went from sitting to standing and felt a sudden "pop" in his right lower back. He soon developed intense right lower back pain that radiated down his right

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posterior thigh and calf similar to prior flares of his sciatica. His primary care physician prescribed 800 mg ibuprofen three times daily and a prednisone taper 5 days prior to arrival, but these had only helped his symptoms minimally. On physical exam, the patient had an antalgic gait but normal sensation and 5/5 strength to both lower extremities. The patient was consented for and underwent an ultrasound guided TSNH using 20 mL of D5W. On reassessment 10 min later, he reported relief of his radicular pain to 1/10 and was able to ambulate without difficulty. He was discharged home with medication for breakthrough pain and remained pain free on a 48-h telephone follow-up. The patient eventually did have recurrence of pain around 72 h later after an accidental misstep on his stairs and was seen at urgent care and referred to the ED for emergent spine imaging. There were no "red flag" symptoms or exam findings, and he had an outpatient referral to pain management. An MRI showed an L4/5 central disc extrusion and L4 nerve root compression.

### 2.2. Case 2

A 61-year-old female with no significant past medical history presented for evaluation of 9/10 low back pain with radiation down her posterior thigh. The pain had been present for the past 2 weeks and had been refractory to a trial of diclofenac 25 mg twice daily and acetaminophen 650 mg three times per day. On physical exam the patient had symmetric and full 5/5 strength and sensation bilaterally but showed difficulty transferring from wheelchair to gurney secondary to pain. In the ED she was given 1000 mg of acetaminophen and consented for an ultrasound guided TSNH. The nerve was hydrodissected with 20 mL of D5W and on reassessment 10 min later the patient had significant relief and rated her pain a 3/10. On a 24-h telephone follow up she remained at 3/10 pain.

### 2.3. Case 3

A 46-year-old female with a history of morbid obesity, hypertension, and hyperlipidemia presented to the ED complaining of low back pain radiating down the left leg. The patient reported that the pain started the day prior when she stood up from her desk at work and had progressively gotten worse. On arrival, the patient endorsed 8/10 pain and her exam was without motor or sensory deficit. She was treated with 5 mg hydrocodone, 650 mg acetaminophen, and a 5% topical lidocaine patch with only modest improvement in her symptoms. The patient consented for an ultrasound-guided TSNH, which was performed with 20 mL of D5W. On reassessment 10 min later, her pain markedly improved to 2/10. She ambulated without difficulty and was discharged home with a prescription for 4% lidocaine patches and ibuprofen. Three days later at her primary care follow up appointment the patient continued to rate her pain as markedly improved at a 3/10.

### 2.4. Case 4

A 70-year-old male with a history of hypertension, hyperlipidemia, and obesity presented to the emergency department with 1 week of progressive, 9/10 atraumatic lower back pain with radiation to the buttocks and proximal thigh. The pain was most severe with ambulation. In the ED, the patient was given ibuprofen 400 mg and a 5% lidocaine patch with minimal relief. The patient was consented for and underwent an ultrasound guided TSNH with 20 mL of D5W. After the procedure the patient was able to walk without significant pain or assistance. At a 24 h follow up telephone appointment, the patient endorsed minimal 2/10 pain.

## 3. Description of technique

With the patient in the lateral decubitus position with the side contralateral to the pain down, the ipsilateral knee is flexed to 90°. Using a low frequency curvilinear probe placed in a transverse orientation, the bony landmarks of the greater trochanter and the ischial tuberosity are identified (Fig. 1). The sciatic nerve will appear as a flattened, round, or triangular hyperechoic structure situated in a fascial plane between the gluteus maximus (superficial) and the quadratus femoris (deep) muscles (Fig. 2). Tracing this nerve 1–2 cm in both the cranial


**Fig. 1.** Demonstration of patient and operator positioning for TSNH. The model is positioned with hip and knee flexed at 90°. The operator stands behind the patient with the ultrasound machine in direct line of sight on the opposite side of the bed. The transducer is orientated transversely, between the greater trochanter (medial) and the ischial tuberosity (lateral). The needle is inserted in-plane from lateral to medial.

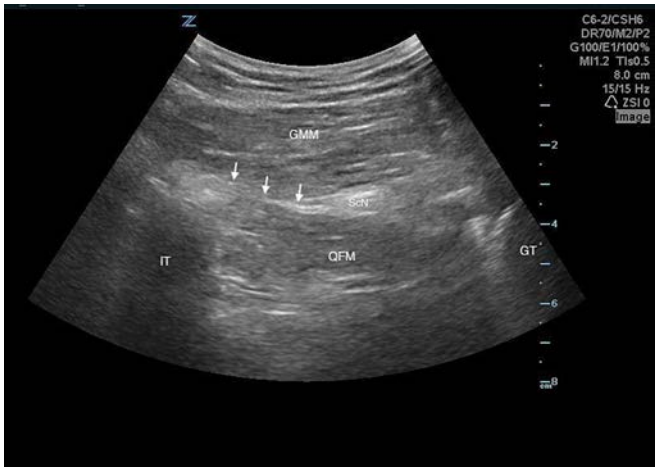


**Fig. 2.** Sonographic appearance of the right sciatic nerve within its fascial plane (arrows). Transducer is oriented in the transverse plane, probe marker toward the operator. Bony anatomical landmarks and corresponding muscle layers are also seen. SCn = sciatic nerve, GMM = gluteus maximus muscle, QFM = quadratus femoris muscle, IT = ischial tuberosity, GT = greater trochanter.

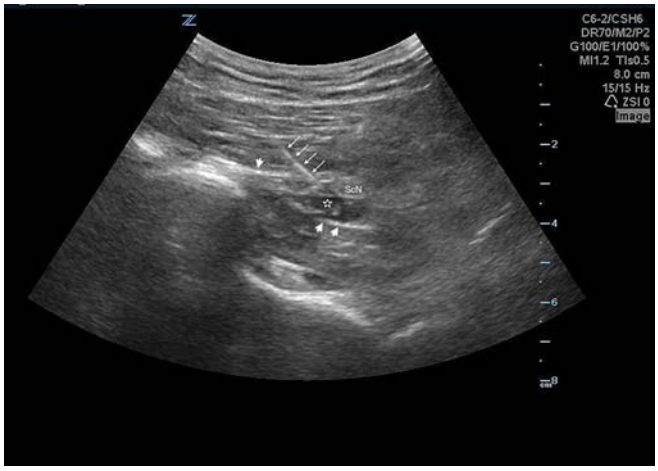


**Fig. 3.** Hydrodissection of the sciatic nerve. The needle (thin arrows) is inserted within the fascia layer (arrowheads) between the two muscles. D5W (star) is injected within the fascial plane and around the sciatic nerve to "peel" it away from its surrounding tissue.

and caudal direction can help confirm that the operator has correctly identified the sciatic nerve. Care should be taken to avoid the inferior gluteal artery, often situated lateral to the sciatic nerve. Color doppler can be used to identify this small artery. The needle can be guided in either a medial to lateral or a lateral to medial approach. In our experience, a lateral to medial approach provides better ergonomics. The area is prepped with 2% chlorhexidine and a skin wheal is made with 1–2% lidocaine using a 25–27-gauge needle at the planned insertion site. A 20–22 g blunt tip 100 mm block needle is then inserted under ultrasound guidance with an in-plane technique to reach the sciatic nerve. Negative aspiration followed by small volume (0.5–1 mL) aliquots of D5W is used to ensure proper placement of the needle tip within the fascial plane. Once confirmed, hydrodissection is performed by injecting and repositioning the needle tip carefully until the nerve is surrounded by fluid (Fig. 3). This requires needle manipulation and injection both above and below the nerve to ensure that the D5W completely encompasses the nerve.

## 4. Discussion

Our use of ultrasound-guided TSNH demonstrates an effective opioid-sparing therapy for treatment of sciatica in the ED. In comparison to the ultrasound-guided transgluteal sciatic nerve block (TSNB), our approach offers several unique advantages. First, without using local anesthetic, we were able to provide pain relief that did not result in motor blockade. Second, our approach uses a relatively small volume of D5W and does not pose systemic toxicity risk unlike the long-acting local anesthetics used with the TSNB. Finally, after large volume nerve blockade, continuous cardiac, pulse oximetry, and non-invasive blood pressure monitoring are typically required to monitor for local anesthetic systemic toxicity. [11] Since our approach does not require this prolonged monitoring however, ultrasound-guided TSNH for analgesia could potentially lead to faster, safer patient disposition compared to ultrasound-guided TSNB. Additionally, our patients had significant relief 10 min after procedure completion, suggesting that ultrasound guided TSNH could be a rapid acting therapy. While some patients with sciatica might respond well to oral therapy and be discharged quickly, ultrasound guided TSNH could be a useful treatment modality for patients who do not respond well to usual first line management of sciatica. For this subgroup of patients, ultrasound guided TSNH therapy could also potentially reduce their ED length of stay.

Several considerations should be taken when performing the TSNH technique. The first is that when hydrodissecting, the injected fluid should be injected above and below the nerve so that it is completely surrounded. This is based on the idea that compressed nerves will have buildup of toxins due to obstruction of venous outflow required for clearance. By decompressing these nerves, venous outflow is no longer obstructed. [12] In terms of choice of fluid for injection, we utilized D5W as it outperformed normal saline at 6-month follow-up when hydrodissection was used to patients with carpal tunnel syndrome [8]. Dextrose containing solutions are thought to help pain through several mechanisms, including down-regulation of receptors associated with neuropathic pain, correction of perineural glycopenia, and increasing nerve mobility [13-16].

The only true contraindication to performing this procedure would be infection over the planned site of injection. Like ultrasound guided nerve blocks, the risks of TSNH are pain, bleeding, infection and damage to surrounding structures. While not explicitly studied with regards to hydrodissection, rates of nerve injury are rare. In the anesthesia literature, major complications resulting in permanent nerve damage from peripheral nerve blocks have an incidence of 1.5/1000 [17].

## 5. Limitations

While these cases demonstrate promise for ultrasound-guided TSNH, there are some limitations. To our knowledge, no data currently exists on performing this technique within the ED setting. This technique was performed by ultrasound-trained faculty (Case 1, 4) and an ultrasound fellow (Case 2, 3); ED performance by providers not well versed with in-plane needle guidance is not yet clear. Also, long term effects of TSNH beyond 48 h are not known. Patients included in this case series were non-obese. Large body habitus can be a limiting factor of ultrasound; given its relatively deep location within the gluteal region the sciatic nerve may not be easily visualized or hydrodissected in obese patients, and therefore the success of performing this technique in this population is not known. Also, long term effects of TSNH beyond 48 h are not known. Lastly, additional cases are needed to demonstrate consistent effectiveness of this technique for treatment of sciatica.

## 6. Conclusion

Ultrasound guided transgluteal sciatic nerve hydrodissection could represent a safe, rapid, and effective alternative therapeutic option for the treatment of sciatica in the ED. Further studies are required to demonstrate reproducibility and generalizability of this technique for treating patients presenting with sciatica.

## CRediT authorship contribution statement

**Drew Silver:** Writing – original draft, Data curation. **Dasia Esener:** Writing – review & editing, Data curation. **Gabriel Rose:** Writing – review & editing, Writing – original draft, Supervision, Data curation, Conceptualization.

## Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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