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ORIGINAL RESEARCH

Pain Management

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The Efficacy of Ultrasound-Guided Transgluteal Sciatic Nerve Blocks for Sciatic Radiculopathy Pain in the Emergency Department: A Multicenter Prospective Study

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Abstract

Objectives: Pain from acute sciatic radiculopathy (sciatica) can be debilitating, frequently leading to emergency department (ED) presentations. The primary objective of this study was to evaluate the efficacy of transgluteal sciatic nerve blocks (TGSNBs) for ED-based pain control in patients presenting with acute sciatica.

Methods: In this prospective, multicenter, observational study, a convenience sample of patients presenting to the ED with acute sciatica were recruited between January 2022 and August 2023. All patients underwent TGSNB. Patients' self-reported pain scores and timed up and go test results were recorded. Pain scores at 24 and 48 hours post-ED disposition were also recorded. Descriptive statistics, Wilcoxon signed rank, and χ^2 tests were utilized for statistical analysis.

Results: In total, 63 patients were enrolled. The median pain score was 9 (IQR, 8-10) prior to TGSNB, decreased to 5 (IQR, 3-7; $P < .001$) post-TGSNB, and remained at 4 (IQR, 2-6.5; $P < .001$) at approximately 48 hours after disposition. On arrival, 27% (n = 17/63) of patients were unable to ambulate, which decreased to 11% (n = 7/63) post-TGSNB. The proportion of patients who

abstract continues

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Abstract (continued)

completed the timed up and go test in under 10 seconds significantly increased to 33% (n = 19/63) at ED disposition compared to 1.6% (n = 1/63; *P* = .003) on presentation. One complication (1.6%, n = 1/63) of a transient foot drop was noted which resolved without further sequelae.

Conclusion: Among the specific study population, patients with acute sciatica who elected to have an ultrasound-guided TGSNB in the ED showed significant improvements in pain scores and function. Future studies comparing the efficacy of TGSNB versus standard medical therapy are needed.

Keywords: *nerve block, transgluteal sciatic nerve block, opioids, ambulation, ultrasound, pain-control*

1 INTRODUCTION

1.1 Background

Pain secondary to acute sciatic radiculopathy (sciatica) accounts for up to 2.4% of emergency department (ED) visits across the United States annually.[1] Untreated, sciatica contributes to significant patient functional disability, loss of productivity, and mental health disorders, all leading to considerable burden to health care systems worldwide.[2,3]

Effective treatments for acute sciatica are limited. Opioids, once a common analgesic used to treat sciatica in the ED, now have limited utility both due to their indeterminate clinical and functional efficacy and their high potential for misuse when used for chronic pain.[4–6] Nonsteroidal anti-inflammatory drugs (NSAIDs) have been shown to reduce acute sciatica pain compared to a placebo[7]; however, in isolation, they rarely provide sufficiently effective and rapid pain relief to allow for a return to baseline functional status.[8–10] With increased ED stewardship to limit opioid use for pain control, optimal therapeutic techniques need to be developed so that patients can achieve safe and reasonable analgesia for an often disabling condition.[11]

Ultrasound-guided nerve blocks (UGNBs) have become fundamental to modern emergency medicine (EM) and acute care practice. Since 2016, UGNBs have increased in both use and breadth for analgesia-related indications in the ED setting.[12,13] In 2021, the American College of Emergency Physicians issued a policy statement identifying UGNB as a core skill for ED clinicians and a critical skill for managing acute pain in the ED.[14] Since then, additional ED-based data have emerged on the safe and efficacious use of UGNBs for pain control in the ED setting.[15]

1.2 Importance

The transgluteal sciatic nerve block (TGSNB) is a well-established approach to sciatica-related pain used by anesthesiologists in postoperative and pain clinic settings. Although well-described in anesthesia literature, data on TGSNB for treating acute sciatica in the ED are limited, primarily consisting of small case reports and series that suggest potential benefits of its use in the acute setting.[16–19] As sciatica contributes to a large patient population in the ED, new innovative techniques are high yield in the ED.

1.3 Goals of this investigation

The primary objective of this study was to prospectively describe the pain management efficacy and outcomes associated with performing TGSNB for acute sciatica in the ED. The secondary outcome was to evaluate the safety of performing this procedure in the ED.

2 MATERIALS AND METHODS

2.1 Study Design and Setting

This was a prospective, multicenter, observational study of ED patients presenting with sciatica who received a TGSNB. The study was conducted at Brigham and Women's Hospital, Highland Hospital, and Massachusetts General Hospital, all level 1 trauma center EDs each with EM residency programs and emergency ultrasound fellowship programs. The only community ED did not have either an EM residency or ultrasound fellowship (ie, Faulkner Hospital). EM attendings with fellowship training in emergency ultrasound and advanced training in UGNB attend at all study sites. A convenience sample of patients presenting between January 2022 and August 2023 with acute sciatica was considered for enrollment. The study was approved by the local institutional review board at Mass General Brigham, and informed consent was obtained prior to enrollment.

2.2 Selection of Participants

Patients 18 years of age or older presenting to the ED with clinical symptoms consistent with acute sciatica requiring medication for pain relief were considered eligible for enrollment. The clinical assessment and diagnosis of sciatica was determined by the primary clinical care team. Suggested clinical symptoms of sciatica included features such as pain originating in the unilateral lower back or buttocks with unilateral radiation down the posterior leg with or without isolated paresthesias in the lower leg. Patients presenting with

The Bottom Line

In our multicenter site convenience sampling of patients undergoing transgluteal sciatic nerve block, we observed a significant pain reduction and ambulatory improvement compared to baseline. Future studies will need to examine this novel therapy compared to standard medical therapy to ensure effect.

clinical symptoms concerning for pathology other than sciatica, including, but not limited to, bilateral radiculopathy, new objective neurological deficits, history of recent trauma, infectious symptoms, or signs of acute spinal cord compression or cauda equina syndrome, were excluded. Patients with documented allergy to local anesthetic were also excluded. The decision to perform a TGSNB was determined by the treating clinical team after discussing treatment options with the patient. Written consent was obtained prior to the procedure.

2.3 Study Protocol and Procedure

Ultrasound-guided TGSNBs were performed by clinicians trained and credentialed in performing UGNBs at their respective clinical sites. To become credentialed in performing TGSNB, clinicians with experience in performing point-of-care ultrasound underwent a short didactic session and 1-hour hands-on training session on the procedure. The procedure was not limited to clinicians with ultrasound fellowship training. Resident physicians were able to perform the UGNB if directly supervised by an attending credentialed and trained in the study protocol.

For all patients, TGSNB was performed with the patient positioned in the lateral decubitus position. A curvilinear probe with 1 to 5 MHz frequency was used to identify the sciatic nerve using the greater trochanter, ischial tuberosity, and gluteus muscle as sonographic landmarks.[19] A skin wheal of local anesthetic was administered at the injection point, and then under dynamic ultrasound guidance, an anesthetic solution consisting of 10 mL of 0.5% bupivacaine combined with 8 mg of dexamethasone, to improve duration of analgesia, was injected adjacent to the sciatic nerve (Fig 1).[19,20] Specific attention was made to never exceed a dose of 2 mg/kg of bupivacaine.

Before and after the TGSNB, patients were allowed to receive additional pain medication as needed and as dictated by their clinical care team. No patients received additional patients' medication prior to disposition decision after a TGSNB was performed. No opioid or muscle relaxant prescriptions were given on discharge. Disposition postblock was determined by the clinical care team.

2.4 Outcome Measures

The patient and the clinical team were asked a series of questions by research team members for data collection before

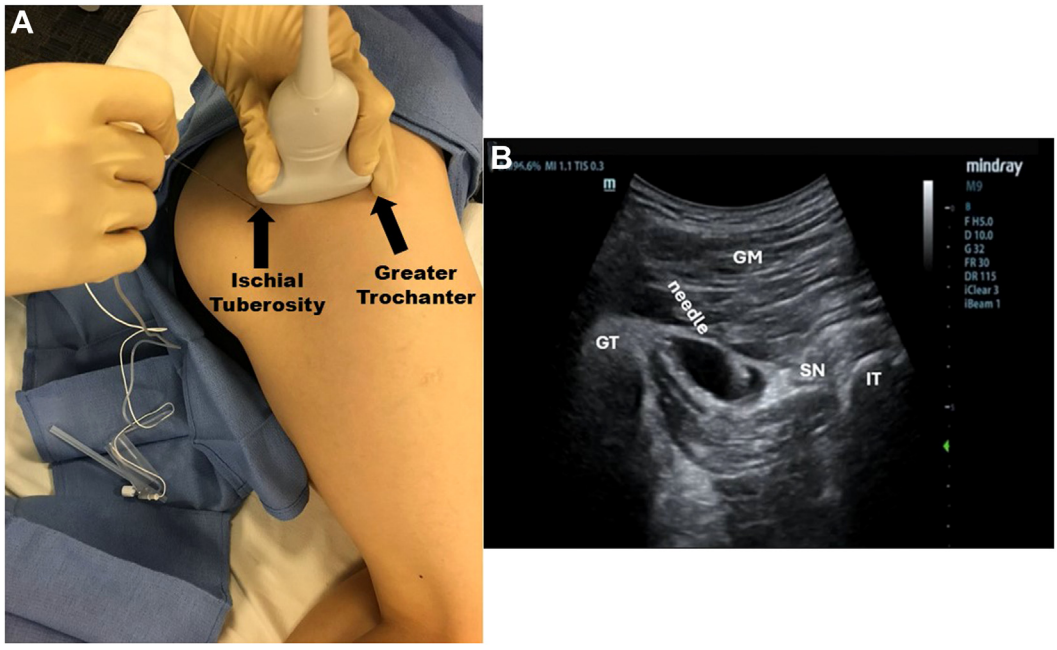

FIGURE 1. Patient positioning and technique for performing TGSNB. (A) Positioning patient in a lateral decubitus position with a curvilinear probe over the greater trochanter (GT) and ischial tuberosity (IT). (B) The needle is inserted 1 to 2 cm away from the probe at approximately 75° angle toward the IT. Anesthestic (ie, anechoic fluid) is injected adjacent to the sciatic nerve (SN), but below the gluteus maximus (GM) fascial layer. Figure 1A is reprinted with permission from Goldsmith et al.[19] TGSNB, transgluteal sciatic nerve block.

and after the TGSNB (Fig 2). Before TGSNB, the clinical team was asked to predict the patient's disposition, and patients were asked to rate their pain using a 0 to 10 visual analog scale (VAS; with 0 representing no pain and 10 representing the worst pain imaginable). Before the TGSNB, patients performed a timed up and go (TUG) test.[21] Research team members recorded the number of seconds needed for patients to complete the TUG test (to stand up from a sitting position, walk a distance of ~10 feet, walk back, and then sit down again on the bed). An "unable to perform" was determined if the patient was unable to ambulate secondary to pain.

After the TGSNB, patients were asked to rate their pain score on the same VAS at approximately 30 minutes postblock and at the time of disposition by study staff. Patients also received automated text messages (Twilio) asking about their current pain scores, and self-reported ambulatory status 24 and 48 hours postblock. In addition, patients recorded if they missed work as a result of their pain. TUG test scores were also recorded for patients 30 minutes postblock. No patients in the study were discharged with opioid prescriptions. The ED disposition was subsequently recorded. Complications from the TGSNB were reported by the clinical care team and also assessed by research assistants via retrospective chart review 30 days post-ED visit. Further, patients were asked if their pain required them to miss work as a result of their condition. The time of the procedure from setup to completion was also recorded. All variables collected were stored and managed using REDCap electronic data capture tools hosted at each hospital.[22]

2.5 Data Analysis

Descriptive statistics with continuous variables reported as medians and IQR and categorical variables reported as frequencies and percentages were calculated. Wilcoxon signed-rank tests were used to compare baseline to follow-up pain scores, and χ^2 tests were used to compare TUG tests and ambulatory status from baseline to disposition. All analyses were conducted using Stata IC 15.1 (StataCorp, LLC) at the $\alpha = 0.05$ level.

3 RESULTS

3.1 Characteristics of Study Subjects

A total of 63 patients participated in the study with 56 (Site 1: 28, Site 2: 16, and Site 3: 12) enrolled from the 3 academic sites and 7 from the community site. Of these, 95% (n = 60/63) responded to the surveys at the time of disposition, 64% (n = 40/63) at 24 hours, and 48% (n = 30/63) at 48 hours after disposition. TGSNB procedures were performed by 12 unique physicians (4 residents, 2 ultrasound fellows, 2 attendings, and 4 ultrasound-trained faculty) ranging from residents to ultrasound-trained faculty.

The median (IQR) age of participants was 50 (38-59) years old (range, 24-93), and 46% (n = 29/63) were male. In this cohort, 44% (n = 28/63) had obesity, 19% (n = 12/63) had a known disc herniation, and 13% (n = 8/63) had undergone spinal surgery. Among the patients, 37% (n = 23/63) reported having lost a minimum of 1 day of work within 72 hours prior to the procedure (Table 1).

3.2 Main Results

Prior to the procedure, 65% (n = 41/63) of patients were already on pain medications before their ED arrival. NSAIDs were the most commonly used, taken by 63% (n = 26/41), followed by acetaminophen 56% (n = 23/41), opioids 20% (n = 8/41), and gabapentin 15% (n = 6/41) (Table 1).

TGSNB procedures had a median (IQR) time of completion reported as 10 (5-15) and a mean (SD) of 11.6 (6.5) minutes. After the procedure, 88% (n = 55/63) of patients were discharged, whereas 12% (n = 8/63) required extended ED observation. No patients were admitted to the hospital. Pain management outcomes showed a significant reduction in pain scores post-intervention. The initial median (IQR) pain score at ED presentation was 9 (8-10) and a mean (SD) was 8 (1.4); this decreased to 5 (3-7) and 4.8 (3.0) postprocedure, representing a median change in pain score of −4 (−6 to −2; $P < .001$ compared to baseline) and mean −4 (3.1, $P < .001$). The pain relief was sustained over time, with further evaluations showing median

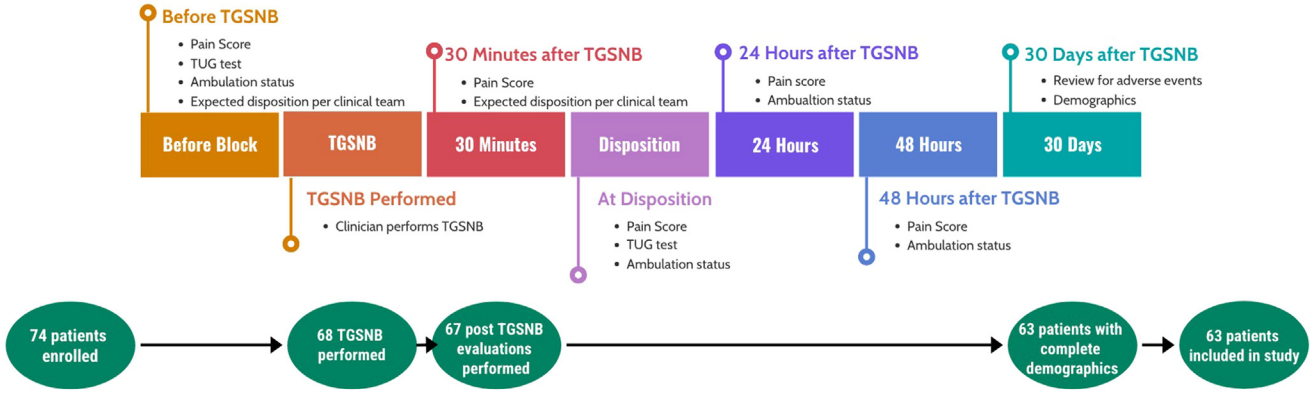

FIGURE 2. Timeline of research activities from pre-TGSNB to 30 days post-TGSNB was performed. TGSNB, transgluteal sciatic nerve block.

TABLE 1. Characteristics for patients who received the TGSNB (n = 63).

Demographics		
Age (y)	Age(y), median (IQR)	50 (38, 59)
	Mean (SD)	49 (14.2)
	Range (minimum-maximum)	24-93
Sex, *n* (%)	Male	29 (46%)
	Female	34 (54%)
Race/ethnicity, *n* (%)	Non-Hispanic White	19 (30%)
	Non-Hispanic Black	12 (19%)
	Hispanic	28 (44%)
	Other	4 (6%)
Physical measurements		
	Weight in kg, median (IQR)	83.9 (74.6, 98.9)
	Weight in kg, SD	88.2 (23.1)
	Missing weight	2
	Height (cm), median (IQR)	165.1 (160.0, 175.3)
	Height (cm), mean (SD)	167.4 (11.0)
	Missing height	4
	BMI, median (IQR)	29.8 (26.1, 35.5)
	Mean (SD), BMI	167.4 (11.0)
	Missing, BMI	4
	Loss of work 72 h prior to block, *n* (%)	23/63 (37%)
	Physical therapy 14 d prior to block	5/63 (8%)
Clinical information (n = variable)		
	Obesity	28/63 (44%)
	Disc herniation	12/62 (19%)
	Spinal surgery	8/62 (13%)
	Hip surgery	3/63 (5%)
	Knee surgery	9/62 (15%)
	Recreational drug use	16/59 (27%)
	Substance use disorder	5/59 (8%)
Substance use (n = 17)		
	Marijuana	11 (65%)
	Amphetamines	4 (24%)
	Cocaine	3 (18%)
	Opioids	2 (12%)
	Benzodiazepines	1 (6%)
	Tobacco	1 (6%)
	Alcohol	2 (12%)
Medication trial prior to Block (n = 41)		
	Any medication trial prior to block	41 (65%)
	Nonsteroidal anti-inflammatory	26 (63%)
	Acetaminophen	23 (56%)
	Opioid	8 (20%)
	Gabapentin	6 (15%)
	Lidocaine patch	1 (2%)

(Continues)

TABLE 1. (Continued)

Demographics		
	Methadone	1 (2%)
	Flexeril	1 (2%)
	Prednisone	1 (2%)
	Marijuana	1 (2%)

BMI, body mass index.

pain scores of 4 (2-5; $P < .001$) and mean (SD) 4.0 (2.5) at the time of ED disposition, 5 (3-7; $P < .001$) and 5.1 (2.5) approximately 24 hours after disposition and 4 (2-6.5; $P < .001$) and 4.4 (2.8) approximately 48 hours after disposition (Fig 3).

Ambulation status improved following the TGSNB. On arrival, 27% (n = 17/63) of patients were unable to ambulate. This decreased to 7% (n = 4/63; $P = .03$) at the time of ED disposition (Table 2). At baseline, 40% (n = 25/63) of patients were unable to perform the TUG test (Table 3). A similar number of patients, 37% (n = 23/63), completed the test in more than 20 seconds, indicating compromised mobility. Postintervention, the number of patients unable to perform the TUG test dropped from 40% to 11% (n = 6/63, $P = .002$), whereas those completing the test in more than 20 seconds decreased from 37% to 21% (n = 12/63; $P = .003$). The proportion of patients who completed the test in under 10 seconds increased significantly to 33% (n = 19/63) at disposition.

Clinicians suspected 94% (59/63) of patients to require ED observation and/or admission for pain control upon their initial assessment. At the time of disposition, 79% (50/63) of patients were ultimately discharged from the ED. The remainder of the patients were placed in ED observation, and none were admitted to the hospital. This represents an up to a 4.7% (3/63) admission rate.

Of the 63 patients who received the block, only one patient (1.2%) experienced a self-resolving foot drop, and there were no return visits to the EDs for further evaluation within 30 days following the procedure.

4 LIMITATIONS

Despite being a multi-institutional study, this work was observational and included a small sample size, which limits the findings. Further, the absence of a control group consisting of non-TGSNB patients limits any comparison of the absolute effect of the TGSNB compared to standard of care in managing acute sciatica. Specifically, it is difficult to determine how TGSNB compares to alternative analgesics or the natural progression of pain improvement over time via these observational methods. In addition, patients were allowed to take medications at their discretion after disposition from ED, potentially skewing the pain scores after leaving the treatment area.

There was a relatively high rate of missing follow-up data at 24 and 48 hours which may have introduced sampling bias into our postdischarge data. We had approximately 65% response rate at 24 hours and 50% at 48 hours post-TGSNB. We suspect this may have been due to our automated text message follow-up protocol. Another important limitation to consider is the potential for underreporting procedure-related complications.

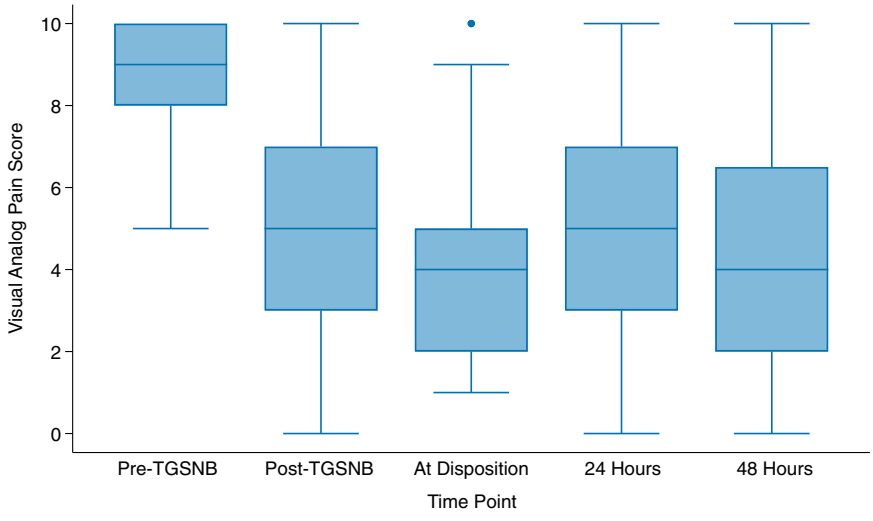

FIGURE 3. Median visual analog pain scores of patients pre- and post-TGSNB as well as days 1 and 2. Visual analog pain score (0-10). TGSNB, transgluteal sciatic nerve block.

TABLE 2. Ambulation status of patients receiving transgluteal sciatic nerve block (TGSNB).

	Pre-TGSNB (n = 63)	Disposition[a] (n = 54)	Day 1 (n = 31)	Day 2 (n = 27)
Ambulation, *n* (%)				
No	17 (27)	3 (6)	1 (3)	1 (4)
Yes, with difficulty	34 (54)	14 (26)	13 (42)	10 (37)
Yes, with assistance	9 (14)	3 (5)	8 (26)	5 (19)
Yes	3 (5)	34 (63)	9 (29)	11 (41)
Missing	0	9	32	36

[a] $P = .03$ from χ^2 test compared to pre-TGSNB.

Patients may have gone to other institutions for postblock care, potentially underreporting our complication rate. Although the research protocol was designed to capture complications such as transient foot drop in the survey template, there remains a possibility that subtle or delayed complications may have gone undetected in this study. Further, given that all sites in this study retain dedicated research and training interest in UGNBs and that study staff involved in this study received standardized hands-on and didactic training, generalization of our findings may be limited to academic medical centers with physicians who have had such specialized training.

5 DISCUSSION

Among this specific study population, we demonstrate that patients who elected to have a TGSNB performed for acute sciatica were associated with significantly decreased pain scores and improved ambulatory status in this limited observational study. This is the largest observational case series in the ED setting, highlighting the potential effectiveness of TGSNBs for acute sciatica management. The sustained decrease in pain scores suggests that this approach may also provide longer-term pain management in addition to immediate relief. In comparison to anesthesia and pain literature, we reflect on acute management rather than postoperative or chronic pain disease states. Further, the clinician's need for suspicion for admission and/or ED observation for pain control was reversed after TGSNB.

Part of the extended pain relief associated with TGSNB in this study is likely attributable to the added adjunct dexamethasone in the solution. As dexamethasone increases bupivacaine's half-life by 8 to 16 hours, it is possible that the TGSNB anesthetic mixture with included adjunct can lead to prolonged pain relief.[23,24] However, TGSNB is likely not solely responsible for a patient's pain relief 48 hours postprocedure. Given that the majority of the patients in this cohort report already taking NSAIDs prior to ED arrival, we posit that the TGSNB block likely provided enough pain relief to stop a patient's pain cycle, providing a window for a patient to "catch up" to improve their pain.[25] Future studies examining total medication use including opioid use both before and after intervention may provide useful information on opioid reduction.

TABLE 3. All patients TUG test results both pre-transgluteal sciatic nerve block (TGSNB) and post-TGSNB.

TUG test[a], n (%)	Pre-TGSNB	Disposition[a] Post-TGSNB
Unable to perform	25 (40)	6 (11)
>20 s	23 (37)	12 (21)
15-20 s	5 (8)	9 (16)
10-14.9 s	8 (13)	11 (19)
<10 s	1 (2)	19 (33)

TUG, timed up and go.
[a] $P = .002$ from χ^2 test compared to pre-TGSNB.

Improvements in ambulation demonstrated via TUG test scores post-TGSNB were also notable by the time of ED disposition. As stabilization and mobilization techniques improve the function and health of patients, it is critical to improve early mobility.[26] These outcomes indicate that TGSNB may not only alleviate pain but also improve patients' functional mobility, which is essential for the likelihood of a quicker return to daily activities. Moreover, this may predict the possibility of early ED disposition and avoid prolonged observation or admission to the hospital for the common indication of inability to ambulate.

In this study, we observed that the TGSNB was associated with an increase in discharges from the ED compared to the initial clinical impression. The procedure's brief duration and the high discharge rate post-TGSNB suggest that this protocol could be efficiently integrated into ED workflows without causing significant delays. Although not the primary outcome of this study, this data suggest that performing early TGSNB in a patient's ED course may improve patient throughput and subsequently ED resource utilization. The patients were admitted for either pain control or at the clinician's discretion. Further information regarding these decisions will be needed in future studies. Future studies either randomizing patients or using observational cohort methodologies to compare patients receiving TGSNB with nonprocedural patients receiving standard-of-care therapies could provide further data regarding the impact of TGSNB in the ED and potential cost savings.

A secondary outcome of this study was to assess procedural complications associated with TGSNB. In our cohort, we observed a 1% transient foot drop rate, a complication which has been documented to occur in up to 7% of TGSNB cases previously in the anesthesia literature.[27] Importantly, in our

cohort, there were no reported instances of local anesthetic systemic toxicity, the most lethal potential complication of UGNB. Transient foot drop is a possible known outcome within 24 hours of undergoing a dense TGSNB given the expected motor blockade of the sciatic nerve. This is not necessarily considered a complication (ie, concern for peripheral nerve injury) unless symptoms persist for longer than 72 hours postblock. With the low rate of complications, specifically the rare occurrence of transient foot drop, our data suggest that TGSNB performed in the ED by trained physicians for acute sciatica is likely a procedure with a satisfactory safety profile. However, a detailed conversation with patients regarding potential complications and natural process of recovery is warranted. Additionally, it is recommended to counsel patients about the possible effect of transient foot drop and provide appropriate follow-up and crutches if it occurs to reduce long-term sequelae and fall risk.

Among this specific study population, patients presenting to the ED with acute sciatica and elected to have a TGSNB had improved pain scores both postprocedure and up to 48 hours postprocedure. These patients demonstrated improved ambulatory status without any major procedural complications. The findings suggest that TGSNB could be an effective and safe procedure for emergency physicians to perform on ED patients presenting with acute sciatica as part of a multimodal pain management regimen. However, further research, such as a randomized controlled trial or a cohort study comparing TGSNB to standard-of-care approaches, is needed to evaluate the potential clinical and operational benefits of this intervention.

AUTHOR CONTRIBUTIONS

AJG and AN conceived the study and designed the trial. AJG, JMH, LAS, DM, HS, NMD, and AN contributed to data acquisition and interpretation. AJG, JM, JG, NMD, and AN managed data acquisition and dataset maintenance. JMH, JG, and REC were responsible for statistical analysis. JMH, JG, and RC created all the figures and tables. AJG, NMD, and AN drafted the manuscript. All authors contributed to critical revision of the manuscript. AJG, NMD, and AN take responsibility for the manuscript as a whole.

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CONFLICT OF INTEREST

AJG is a consultant for UltraSight Inc, Butterfly, and Exo. JMH reports no disclosures. JG reports no disclosures. LAS reports no disclosures. REC reports no disclosures. DM reports no disclosures. HS reports no disclosures. NMD reports no disclosures. AN is the senior director of clinical education for Exo.

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SUPPLEMENTARY MATERIALS

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