Title
Ultrasound-guided Posterior Tibial Nerve Block for Frostbite of the Plantar Surfaces

Permalink
https://escholarship.org/uc/item/9kt5z4xs

Journal
Clinical Practice and Cases in Emergency Medicine, 0(0)

Authors
Burl, Taylor
Latshaw, Parker
Dreyfuss, Andrea

Publication Date
2022-10-24

Copyright Information
Copyright 2022 by the author(s). This work is made available under the terms of a Creative Commons Attribution License, available at https://creativecommons.org/licenses/by/4.0/

Peer reviewed
Introduction: Frostbite is a painful condition that requires rapid identification and wound care to optimize outcomes. The Posterior Tibial Nerve (PTN) block, however, has yet to be described in the literature for pain control of frostbite injuries on the plantar surfaces.

Case Series: In this case series we discuss three patients who presented with bilateral frostbite on the plantar surfaces. Ultrasound-guided PTN blocks were performed on these patients and pain control was achieved in under 10 minutes, facilitating burn care. No patient experienced adverse effects. All patients had been scheduled for future debridement that was either not performed or performed using intravenous (IV) medications due to pain control issues.

Conclusion: The ultrasound-guided PTN block facilitated proper wound debridement that was previously intolerable with oral and IV pain medications. This case series highlights the efficacy, safety, and accessibility of this block for frostbite pain control in the emergency department. Additionally, it emphasizes the potential role of ultrasound-guided PTN blocks as part of a multimodal pain control strategy in other clinical settings. [Clin Pract Cases Emerg Med. XXXX;X(X):X–X.]

Keywords: frostbite; ultrasound-guided nerve block; posterior tibial nerve block; case series.
Ultrasound-guided Posterior Tibial Nerve Block for Frostbite of the Plantar Surfaces

Burl et al.

CPC-EM Capsule

What do we already know about this clinical entity?
Frostbite injuries are debilitating, painful and require rapid identification and appropriate pain control and wound care to optimize outcomes.

What makes this presentation of disease reportable?
Data is limited on the use of the posterior tibial nerve (PTN) block to effectively provide pain control for frostbite injuries of the plantar surfaces.

What is the major learning point?
The PTN block can be used to provide pain control for patients with plantar surface frostbite in the emergency department.

How might this improve emergency medicine practice?
Emergency physicians can utilize the PTN block for plantar surface frostbites to improve pain control and wound management.

Surface area (TBSA) partial-thickness burns that occurred approximately 24 hours prior (Image 1). Patient 2 was an 18-year-old female with 5% TBSA partial-thickness burns from a more recent exposure (Image 2). Patient 3 was a homeless male with 4% TBSA partial-thickness burns who frequently walked outside barefoot. The patients reported their pain from 7/10 to 10/10 prior to pain medication, with only modest improvement after receiving oral analgesia. The specific oral analgesia given and subsequent pain scores are delineated in the Table.

Ultrasound-guided PTN blocks were performed using the same technique for each patient (Image 3), blocking the left PTN for patient 1 and bilateral PTNs for patients 2 and 3. Using a linear transducer, the PTN was identified adjacent to the medial malleolus, keeping the posterior tibial artery and vein in view. The needle was advanced using an in-plane approach and normal saline was introduced to confirm location at the nerve and away from surrounding structures. Following confirmation, five milliliters of local anesthetic was injected and observed to surround the nerve. After 10 minutes the patients were re-evaluated, and each patient reported significant improvement in their pain, all scoring 0/10 on the pain scale. Table 1 highlights the type of local anesthetic and post-block pain scores for each patient. Successful blister debridement was performed in the ED for patients 1 and 3. Patient 2 had her burn care performed on the burn surgery service floor immediately following PTN block in the ED. There were no reports of local or systemic toxicity from the anesthetic.

Patient 1 was discharged home after debridement in the ED, while patients 2 and 3 were admitted for further management. None of the patients underwent repeat PTN

Image 1. Bilateral partial-thickness frostbite on patient 1 with a broken serous blister on the left.

Image 2. Bilateral partial-thickness frostbite present on patient 2. Large serous blisters are present.
blocks for wound care while outpatient or inpatient. Patient 1 was seen in the burn clinic three days after his ED visit. In that visit, the tissue of his left foot was pink and moist, and the team planned to debride a serous blister on his right foot. He was given oral (PO) oxycodone but was unable to tolerate the procedure due to pain. Patient 2 had multiple repeat debridements on the burn surgery service where IV opiate medications were utilized for pain management. She described these debridements as “unbearable” and “so painful.” On hospital day #5, the patient required procedural sedation with propofol for proper dressing changes and additional debridement. Once she was able to tolerate dressing changes without intravenous pain medications, she was deemed safe for discharge. Patient 3 required a 10-day hospital admission for co-management of frostbite pain and alcohol withdrawal.

DISCUSSION

This case series demonstrates the severity of frostbite pain and the challenge it creates to receiving appropriate wound care. Ultrasound-guided PTN blocks bypass this challenge and achieve effective analgesia in the ED, allowing for optimal wound debridement as shown in these patients’ experiences.

There are multiple strengths and limitations in our approach. The most clinically relevant benefit of the PTN block is the analgesia it provides. Pain is a significant barrier to treating frostbite injuries, originating from the burn itself as well as from rewarming and debridement. All patients reported pain scores of 7/10 to 10/10 with PO medications only. Following the PTN block, patients reported drastic improvement in their pain levels and tolerated debridement without additional medications. This outcome aligns with prior studies that have shown pain control success rates of 95-100% when using the PTN block for foot surgeries. Later attempts at repeat debridement were either unsuccessful or performed under procedural sedation for patient one and patient two, highlighting the superiority of the PTN block analgesia.

The addition of ultrasound guidance further improved the PTN block. Peripheral nerve blocks performed with ultrasound provide better pain control, require fewer additional pain medications, and have fewer complications as compared to landmark guidance. A study by Kakhi et al revealed shorter time to onset and longer duration of analgesia with ultrasound guidance. Shah et al demonstrated the superior accuracy of ultrasound for targeting the posterior tibial nerve and avoiding surrounding structures. Each of our patients reported significant pain relief that was achieved in less than 10 minutes, and no patient experienced adverse effects.

Our experience using the PTN block for these patients demonstrates the accessibility and relevance of this block for future patient encounters. The PTN block is a well described and thoroughly examined nerve block that is accessible to clinicians of different training levels and experience. In the series we report, it was performed by first- and third-year emergency medicine residents under the guidance of an ultrasound-trained faculty member. Emergency departments in colder climates frequently see frostbite as a chief complaint, and this case series can help guide the use of PTN blocks for pain control in such patients.

Despite the accessibility of the PTN block, clinician comfort with nerve blocks and the availability of ultrasound-trained faculty could limit its use. The ultrasound-guided block is also more time intensive when compared to PO or IV.

<table>
<thead>
<tr>
<th>Patient</th>
<th>% TBSA burn</th>
<th>PO medications</th>
<th>Pain score after PO medications</th>
<th>Local anesthetic used for PTN block</th>
<th>Pain score after PTN block</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4%</td>
<td>Acetaminophen, ibuprofen, oxycodone, olanzapine</td>
<td>6/10 – 10/10</td>
<td>5 mL 0.25% bupivacaine</td>
<td>0/10</td>
</tr>
<tr>
<td>2</td>
<td>5%</td>
<td>Acetaminophen, ibuprofen, oxycodone</td>
<td>7/10</td>
<td>5 mL 0.5% ropivacaine</td>
<td>0/10</td>
</tr>
<tr>
<td>3</td>
<td>4%</td>
<td>Ibuprofen</td>
<td>10/10</td>
<td>5 mL 0.25% bupivacaine</td>
<td>0/10</td>
</tr>
</tbody>
</table>

TBSA, total body surface area; PO, oral medication; PTN, posterior tibial nerve; mL, milliliter.
Ultrasound-guided Posterior Tibial Nerve Block for Frostbite of the Plantar Surfaces

Burl et al.

pain medications. Lastly, our case series only focuses on the experiences of three patients with second-degree frostbite of bilateral plantar surfaces. Patients with other levels and locations of frostbite injury may have different outcomes.

CONCLUSION

This case series demonstrates that the ultrasound-guided PTN block provides superior pain relief, has low risk of systemic toxicity, allows for necessary wound care, and is accessible to clinicians of varying training levels. Ultrasound-guided PTN blocks have the potential to play a major role within a multi-modal pain control strategy for frostbite management. This role is unequivocally applicable within the emergency department. The case and accessibility of the block also lends its use to other clinical contexts, including outpatient wound clinics and inpatient burn units. These potential applications of the PTN block warrant further research on its use for frostbite management in different clinical scenarios.

The authors attest that their institution does not require Institutional Review Board approval. Patient consent has been obtained and filed for the publication of this case report. Documentation on file.

Address for Correspondence: Andrea Dreyfuss, MD, Hennepin County Medical Center, Department of Emergency Medicine, 701 Park Ave, Minneapolis, MN 55404. Email: adreyfus@umn.edu

Conflicts of Interest: By the CPC-EM article submission agreement, all authors are required to disclose all affiliations, funding sources and financial or management relationships that could be perceived as potential sources of bias. The authors disclosed none.

Copyright: © 2022 Burl. This is an open access article distributed in accordance with the terms of the Creative Commons Attribution (CC BY 4.0) License. See: http://creativecommons.org/licenses/by/4.0/

REFERENCES