

Shaving Skin at Grounding Pad Site to Avoid Skin Burns in Radiofrequency Ablation Procedures: A Case Report

Leah Goehring¹, Charles Siegel², Johnny Dang³, Pranamya Suri⁴ and Akhil Chhatre^{4*}

Abstract

Radiofrequency ablation is a minimally invasive procedure used to treat chronic back and neck pain. The procedure has been used for decades, yet the procedural guidelines and steps remain inconsistent. The preparation of skin by shaving hair when placing the grounding pad is a necessary step that can avoid harmful implications for the patient. This case report highlights the successful avoidance of a skin burn by thoroughly shaving the skin at the grounding pad site and the need to incorporate this step in universal perioperative guidelines for radiofrequency ablation procedures to optimize patient safety.

Keywords: Radiofrequency; Spinal; Temperature; Joint pain; Pigmentation.

Introduction

Radiofrequency ablation (RFA) is a common procedure used to treat facet-joint pain [1]. The indications have recently expanded to treat peripheral nerves [2]. Techniques have also evolved to include pulsed and cool RFA [2]. The mechanisms are similar which involve nociceptive pathway disruption via the application of a high-frequency electrical current that destroys peripheral nerve origins along the spinal cord with thermal energy, leading to pain relief [1]. While complications arising from RFA are rare and typically

involve local swelling and pain at the needle insertion site, skin burns have been increasingly reported at the grounding pad site [3-7]. A grounding pad is a dispersive electrode that is placed at a separate well-vascularized tissue site, usually the thigh, to complete the electrical circuit through a low-resistance pathway [6,8,9]. Maximal contact between the skin and the grounding pad is important, as a disruption between the skin-pad interface such as with hair increases the

¹Texas College of Osteopathic Medicine, Fort Worth, Texas, USA

²Sidney Kimmel Medical College, Thomas Jefferson University, Philadelphia, PA, USA

³Department of Physical Medicine & Rehabilitation, Johns Hopkins Hospital, 1800 Orleans St, Baltimore USA

⁴Johns Hopkins University School of Medicine, Department of Physical Medicine and Rehabilitation, MD, USA

*Corresponding Author: Akhil Chhatre, Department of Physical Medicine and Rehabilitation, Johns Hopkins University School of Medicine, Baltimore, MD, USA.

Received Date: 03-06-2024

Accepted Date: 03-10-2024

Published Date: 03-27-2024

Copyright© 2024 by Goehring L, et al. All rights reserved. This is an open access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

voltage across the circuit which can lead to thermal burns at the grounding site [6,8,10]. The procedural guidelines of RFA including electrode size, needle position, and temperature are consistent in the literature [11].

However, no universal guidelines highlight the need to shave hair before placing a grounding pad in preparation for RF ablation procedure [12]. This case report examines a patient who reported feeling burning at the site of the grounding pad placement during RFA procedure which resolved after replacing the pad on an area that was shaved.

Case report

The Authors reported a case of a 24-year-old male with cervical spondylosis presenting for a Right Third Occipital Nerve and C₃-C₄ Medial Branch Radiofrequency Neurotomy with fluoroscopic guidance. Prior to the start of the procedure, universal protocol with a time-out was completed. The patient was positioned prone, a grounding pad was secured to the right thigh, and the skin was prepped in the usual sterile manner.

The fluoroscope was then positioned to provide a caudal and slightly oblique view. Using fluoroscopic guidance, a sterile 20-gauge 100 mm radiofrequency cannula was positioned at the right third occipital nerve, C₃ and C₄ medial branch nerves. A radiofrequency probe was then inserted into the cannula. With 0.5 volts of 1.0 ms duration, 2 Hz stimulation multifidus muscle twitching was palpated only in the neck to confirm optimal needle placement. To numb the tissues in preparation for thermal ablation, an additional 1 mL of 1% lidocaine was slowly

injected. Next, a continuous lesion was applied at 80 degrees Celsius for 90 seconds.

A few minutes after beginning the radiofrequency ablation, the patient reported that his right “leg felt hot”. The procedure was immediately stopped for examination of the grounding pad. The pad was completely adherent to the hairy skin on the right posterior thigh. A decision was made to shave the hair on the posterior left thigh and place the grounding pad here. There was no sign of thermal injury or skin blanched observed on the right posterior thigh once the grounding pad was removed. Once the grounding pad was secure on the left posterior thigh, the ablation resumed. The patient had no further feelings of warmth and the procedure was completed without issues.

Discussion

Radiofrequency ablation (RFA) was developed in the 1950s as a minimally invasive and relatively safe way to treat lumbar facet joint pain [13]. The treatment modality uses conventional thermal radiofrequency at 60-80 degrees Celsius at the lumbar medial branches for 60-90 seconds [14]. Its use has expanded to treat other spinal areas and peripheral nerves [15]. Adverse effects of RFA include bleeding, infection, nerve damage, procedural discomfort, pigmentation changes, and skin burns [1]. The most common complications of facet interventions include vascular penetration and injury, RFA-related pain or numbness, injury to localized nerve structures, and tissue burns [11]. The risks of complications can be avoided by using sterile technique, fluoroscopic guidance, and procedural checklists with proper skill [1].

Despite these recommendations, skin burns remain a rare complication of RFA procedures due to the high-power energy [16]. There is no clear evidence on how to prepare the skin for the use of the grounding pad. One case report of a woman undergoing a cool-tip RF ablation described a large flaccid bulla at the grounding pad site after firmly placing a grounding pad without shaving the skin [5]. Shaving hair is especially important when patients are sedated during the procedure. Sedation use for RFA, including opioids and benzodiazepines, can increase the risk of a false-positive block and the chance of skin burns and is typically not recommended [11]. However, sedatives are often used for RFA in order to improve patient comfort and reduce anxiety [11]. There may be other ways to mitigate the likelihood of severe burns. In animal models, the use of multiple, large-surface-area foil pads placed on well-prepped skin and oriented on the longest surface can help minimize severe burns [17]. Schutt, et al., discussed how multiple grounding pads can reduce skin temperatures thereby protecting the skin from burns and allowing a higher RF generator power if needed [18].

To avoid skin burns, Cohen et al. also recommend the use of a large grounding pad that is properly positioned along a dry and clean-shaven lower extremity without scars and tattoos [11]. Despite these suggestions to

avoid skin burns and well-studied procedural guidelines in place, this is the first report to specifically bring awareness to shaving hair off the skin at the grounding pad site.

This case report presents a patient with a completely adherent grounding pad to skin with hair which resulted in subjective burning of the skin. After the grounding pad was placed entirely on shaven skin, there was no burning sensation. If this patient had been sedated during the procedure, he likely would have acquired at minimum a first-degree burn.

Conclusion

Radiofrequency ablation is a treatment option for intractable nerve pain. The technique involves the use of heat sent through an electrode to target and disrupt nociceptive pathways using fluoroscopic guidance. Although the use of conventional thermal radiofrequency is standardized, there are no universal guidelines for skin preparation at the grounding pad site. Shaving hair is an easy way to reduce the likelihood of skin burns.

This case report highlights the necessity to shave hair when placing the grounding pad and how it should be included as part of the universal protocol during a radiofrequency ablation procedure.

References

1. Wray JK, Dixon B, Przkora R. Radiofrequency Ablation. 2023. [PubMed](#)
2. Lee DW, Pritzlaff S, Jung MJ, Ghosh P, Hagedorn JM, Tate J, et al. Latest Evidence-Based Application for Radiofrequency Neurotomy (LEARN): Best Practice Guidelines from the American Society of Pain and Neuroscience (ASPN). *J Pain Res.* 2021;14:2807-2831. [PubMed](#) | [CrossRef](#)
3. Rhim H, Dodd III GD, Chintapalli KN, Wood BJ, Dupuy DE, Hvizda JL, et al. Radiofrequency Thermal Ablation of Abdominal Tumors: Lessons Learned from Complications. *Radiographics.* 2004;24(1):41-52. [PubMed](#) | [CrossRef](#)

4. Won HS, Lee SH, Ahn YJ, Yang M, Kim YD. An Unexpected Complication Resulting from Radiofrequency Ablation for Treating Facet Joint Syndrome: A Case Report. *Medicina*. 2023;59(11):1996. [PubMed](#) | [CrossRef](#)
5. Huffman SD, Huffman NP, Lewandowski RJ, Brown DB. Radiofrequency Ablation Complicated by Skin Burn. *Semin Intervent Radiol*. 2011;28(2):179-82. [PubMed](#) | [CrossRef](#)
6. Bae HS, Lee MY, Park JU. Intraoperative Burn from a Grounding Pad of Electrosurgical Device During Breast Surgery: A Care-Compliant Case Report. *Medicine (Baltimore)*. 2018;97(1):e8370. [PubMed](#) | [CrossRef](#)
7. Bogduk N, Dreyfuss P, Baker R, Yin W, Landers M, Hammer M, et al. Complications of Spinal Diagnostic and Treatment Procedures. *Pain Medicine*. 2008;9(suppl_1):S11-34.
8. Watson AB, Loughman J. The Surgical Diathermy: Principles of Operation and Safe Use. *Anaesth Intensive Care*. 1978;6(4):310-21. [PubMed](#) | [CrossRef](#)
9. 3M Health Care. Reducing Grounding Pad Burns During High Current Electrosurgical Procedures.
10. Cordero I. Electrosurgical Units-How They Work and How to Use Them Safely. *Community Eye Health*. 2015;28(89):15-6. [PubMed](#)
11. Cohen SP, Bhaskar A, Bhatia A, Buvanendran A, Deer T, Garg S, et al. Consensus Practice Guidelines on Interventions for Lumbar Facet Joint Pain from A Multispecialty, International Working Group. *Reg Anesth Pain Med*. 2020;45(6):424-67. [PubMed](#) | [CrossRef](#)
12. Orhurhu V, Hussain N, Karri J, Mariano ER, Abd-Elseyed A. Perioperative and Anesthetic Considerations for the Management of Neuromodulation Systems. *Reg Anesth Pain Med*. 2023;48(6):327-36. [PubMed](#) | [CrossRef](#)
13. Russo M, Santarelli D, Wright R, Gilligan C. A History of the Development of Radiofrequency Neurotomy. *J Pain Res*. 2021;14:3897-3907. [PubMed](#) | [CrossRef](#)
14. Abd-Elseyed A, Anis A, Kaye AD. Radio Frequency Ablation and Pulsed Radiofrequency for Treating Peripheral Neuralgias. *Curr Pain Headache Rep*. 2018;22(1):5. [PubMed](#) | [CrossRef](#)
15. Connors JC, Boike AM, Rao N, Kingsley JD. Radiofrequency Ablation for the Treatment of Painful Neuroma. *J Foot Ankle Surg*. 2020;59(3):457-61. [PubMed](#) | [CrossRef](#)
16. Ertuğrul İ, Karagöz T, Aykan HH. A Rare Complication of Radiofrequency Ablation: Skin Burn. *Cardiol Young*. 2015;25(7):1385-6. [PubMed](#) | [CrossRef](#)
17. Goldberg SN, Solbiati L, Halpern EF, Gazelle GS. Variables Affecting Proper System Grounding for Radiofrequency Ablation in An Animal Model. *J Vasc Interv Radiol*. 2000;11(8):1069-75. [PubMed](#) | [CrossRef](#)
18. Schutt DJ, Swindle MM, Bastarrika GA, Haemmerich D. Sequential Activation of Ground Pads Reduces Skin Heating During Radiofrequency Ablation: Initial *In Vivo* Porcine Results. *Annu Int Conf IEEE Eng Med Biol Soc*. 2009;2009:4287-90. [PubMed](#) | [CrossRef](#)