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Journal of Medical Case Reports and Case Series ISSN: 2692-9880

Research article Volume 4 Issue 10

Combined Greater Occipital, Lesser Occipital, and Auriculotemporal Nerve (GLOAT) Block to Reduce Pain After Scalp Degloving Trauma

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Received date: 17 May 2023; **Accepted date:** 31 May 2023; **Published date:** 15 June 2023

Citation: Sinha V, Gibson C, Grekos V, Stormking D, Jones J, et al. (2023) Combined Greater Occipital, Lesser Occipital, and Auriculotemporal Nerve (GLOAT) Block to Reduce Pain After Scalp Degloving Trauma. J Med Case Rep Case Series 4(10): https://doi.org/10.38207/JMCRCS/2023/JUN04100360

Abstract

Currently, there is a limited number of regional anesthetic techniques used in scalp avulsion traumas which includes greater occipital nerve (GON), lesser occipital nerve (LON), and auriculotemporal nerve (AOT) blocks. A 48-year-old female with no past medical history presented to a level one trauma center after being involved in an industrial incident where her hair caught in machinery resulting in total avulsion of her hair-bearing scalp extending from the nape of the neck anteriorly to the upper eyelids and laterally to the superior auricular creases. To perform the combined nerve block, an 18-gauge Tuohy needle was bent to facilitate manipulation to the final destination. Initial needle insertion was deep to the cervical aspect of the trapezius muscle near the base of the skull, where 5 mL of .25 % bupivacaine was injected. The needle was then directed lateral and superior, ultimately being placed superficially to the sternocleidomastoid muscle. At this point, 25 mL of .25 % bupivacaine was bloused to attempt to drive the local anesthetic to the anterior aspect of the ear. The catheter was threaded to allow for continuous infusion. The post-anesthesia care unit (PACU) admitted the patient for pain relief over the posterior scalp, posterior ear, and temporal region. There was a significant reduction in opioid requirements for the remainder of her hospital course. Our protocol is feasible and practical, similar to the individual GON, LON, and AOT blocks, and provides reliable pain management in a setting where a patient may have a combination of injuries.

Keywords: Combined Nerve Block, Regional, Anesthesia, Scalp Injury, Greater Occipital Block, Lesser Occipital Block, and Auriculotemporal Nerve Block

Introduction

Total scalp avulsion is a low incidence but severe injury, occurring mainly as a work-related accident **[1]**. In order to increase the chances of replantation of the avulsed tissue, immediate surgical repair is required, as well as adequate preservation of the scalp **[2]**. The scalp comprises 5 main tissue layers, including skin, connective tissue, aponeurosis (galea), loose areolar tissue, and periosteum or pericranium **[2]**. The skin adheres to the underlying subcutaneous connective tissue and galea by muscle and fibrous bands **[2]**. With an extensive degloving injury, all five scalp layers may detach from the underlying fascia and bone. This causes local tissue and severe neurovascular injuries with massive blood loss, which can render the degloved skin and soft tissue effectively dead **[3]**.

To achieve an effective scalp blockade, it is necessary to anesthetize multiple peripheral nerves **[4,5]**. This technique is commonly used to treat chronic headaches and minimize stimulation and stress during surgical procedures **[4,5]**. Partial blockade of one or more of these nerves can also be beneficial **[4,5]**. Currently, there is a limited number of regional anesthetic techniques used in scalp avulsion traumas which includes greater occipital nerve (GON), lesser occipital nerve (LON), and auriculotemporal nerve (AOT) blocks. Using neural blockade on the scalp can complement general anesthesia or act as the primary anesthetic for intracranial and extracranial medical procedures **[4]**. These emerging nerve blocks in scalp avulsion trauma have sparked interest due to the ease of performing under ultrasound guidance and low risks of adverse events **[6]**.

This case demonstrates the effectiveness of a combined ultrasound-guided block of the greater occipital, lesser occipital, and auriculotemporal nerves. This report aims to assess the outcome of continuous, combined GON, LON, and AOT nerve blocks using a single incision to provide analgesia for a patient with total scalp avulsion extending superior to the eyebrows after a machinery accident. The protocol not only achieved pain control in a case in

which site-specific analgesia is critical for patient comfort but also reduced the usage of opioids and their associated risks.

Materials and Methods

Patient informed consent was obtained based on exclusion criteria from the University of Tennessee Health Science Center (UTHSC), and this manuscript adheres to the applicable Enhancing the Quality and Transparency of Health Research guideline. Written Health Insurance Portability and Accountability Act authorization has been obtained from the patient to publish this case report.

Case Description

A 48-year-old female with no past medical history presented to a level one trauma center after being involved in an industrial incident where her hair caught in machinery resulting in total avulsion of her hair-bearing scalp extending from the nape of the neck anteriorly to the upper eyelids and laterally to the superior auricular creases. The patient's scalp was in the machine and unable to recover from the scene. She received fentanyl while in transit for pain. Upon arrival at the trauma center, the patient was alert and had stable vital signs. Her scalp wounds were covered in pressure dressings and were moderately bleeding. She complained of severe pain in her head and neck, exacerbated by touching. She denied loss of consciousness, numbness, tingling, chest pain, abdominal pain, and back pain. Her vision was also intact. In the shock trauma bay, she received intravenous (IV) hydromorphone, ketamine, and midazolam for pain control and mild sedation. She then was given 22 mL of 1 % lidocaine with epinephrine for local pain control with subsequent silver nitrate cauterization to attain hemostasis of her wounds, which were then re-covered with pressure dressings. Due to the extent of the bleeding, she was given one unit of packed red blood cells. The patient underwent further work-up due to the mechanism of injury and was found to have no other traumatic injuries. She was admitted to the hospital for further management of her scalp injury.

Over the patient's hospital course, she required numerous debridement’s and skin grafts to treat her injury. The Otolaryngology (ENT) team elected to proceed to the operating room for scalp debridement and irrigation, split-thickness skin grafting from bilateral thighs, and application of Integra to the scalp on hospital stay day zero. Ophthalmology was consulted, and they planned to return to the operating room for bilateral upper eyelid full-thickness skin grafts, skin graft harvest from the clavicular region, and temporary tarsorrhaphy to the right eye. The Acute Pain Service (APS) was consulted before this surgery on hospital stay day two for pain control for skin graft sites and scalp pain.

At the initial APS consultation, the patient complained of burning pain in the bilateral lateral thighs where skin grafts were taken and persistent, throbbing pain in her scalp. At this time, she required oral oxycodone 7.5 mg and oral gabapentin 300 mg three times per day as well as IV hydromorphone (0.25 mg) twice daily for pain with inadequate relief. The patient desired a continual peripheral nerve block in her head. The APS team decided to implement a multi-modal analgesia plan, which included combined GON, LON, and AOT nerve block bilaterally. Of note, the proposed nerve blocks would also increase blood flow to the patient's head to enhance healing. Treatment options were discussed with the patient, and informed consent for regional anesthesia was obtained. The patient underwent the combined nerve block under general anesthesia for her ophthalmology procedure on hospital stay day eight.

An 18-gauge Tuohy needle was bent to facilitate manipulation to the final destination. Initial needle insertion was deep to the cervical aspect of the trapezius muscle near the base of the skull, where 5 mL of .25 % bupivacaine was injected. The needle was then directed lateral and superior, ultimately being placed superficially to the sternocleidomastoid muscle. At this point, 25 mL of .25 % bupivacaine was bloused to attempt to drive the local anesthetic to the anterior aspect of the ear. The catheter was threaded to allow for continuous infusion. This procedure was performed bilaterally in the operating room.

The patient was admitted to pain relief in the PACU over the posterior scalp, posterior ear, and temporal region. She complained of pain at the inferior border of her wound, where Ophthalmology placed staples, which resolved with a bolus of 5 mL of 1 % bupivacaine in each peripheral nerve catheter. She also reported a more profound decrease in temperature sensation after the bolus. A physical exam revealed decreased temperature sensation in the posterior upper neck and anteriorly to her ears bilaterally.

On postoperative day (POD) 1 from her Ophthalmology procedure, the patient endorsed significant pain relief and complained only of some posterior auricular pressure and tenderness relieved with a bolus of 30 mL of .5 % bupivacaine in each peripheral nerve catheter. On exam, she had no occipital pain with palpation. Of note, there was a significant reduction in opioid requirements for the remainder of her hospital course. On POD 2, she was off scheduled narcotics and on scheduled acetaminophen of 925 mg every 8 hours. She required her as-needed oral oxycodone 7.5 mg and IV hydromorphone 0.25 mg once for severe pain. Her GLOAT catheters were removed on POD 2. She has subsequently been discharged with oral oxycodone 5 mg as needed for severe pain. She followed up in the ENT clinic 1 month after discharge, where she reported occasional throbbing of the scalp but no persistent pain.

Discussion

With an extensive degloving accident, all five scalp layers may detach from the underlying fascia and bone. This causes local tissue and severe neurovascular injuries with massive blood loss, which can render the degloved skin and soft tissue effectively dead **[3]**. Goals in managing these types of injuries include adequate pain control, prompt revascularization of the tissue to prevent necrosis and aesthetic reconstruction of the scalp. Minor lacerations that require acceptable cosmetic outcomes are commonly anesthetized using a regional scalp block by infiltrating the larger nerves supplying sensation to the injured tissue **[7]**. Emerging nerve blocks have sparked interest due to the ease of performing under ultrasound guidance and lower risks of adverse events **[5]**.

Total scalp avulsion is an infrequent but potentially devastating injury requiring immediate microsurgical reconstruction for patient satisfaction and significantly reducing morbidity and mortality **[1]**. There are limited regional anesthetic techniques used in scalp avulsion traumas, and it is documented that prolonged anesthesia and postoperative complications remain significant limitations to this reconstruction procedures **[6]**. However, pain management in this setting requires anesthetizing multiple peripheral nerves; for example, selective nerve blocks have been used to attenuate sympathetic stimulation and decrease surgical stress in cranial surgeries **[5,8]**. A different research study revealed that performing a scalp nerve block before surgery decreased the inflammatory response to craniotomy for cerebral aneurysms, mitigated the hemodynamic response to scalp incision, and provided better pain management after the operation compared to local anesthetics or standard pain relief methods **[9]**. These techniques provide postoperative analgesia and significantly reduce the need for opioids during the first 24 hours postoperatively **[5]**. Some regional blocks in the head and neck can be challenging to perform as they require a deep understanding of nerve anatomy and careful assessment of the patient's condition through imagery and physical exam of the injury **[10,11]**.

This case is the first combined nerve block of the greater occipital, lesser occipital, and auriculotemporal nerves reported in the literature. Our protocol is feasible and practical, similar to the individual GON, LON, and AOT blocks, and provides reliable pain management in a setting where a patient may have a combination of injuries. Additionally, it can be performed in the supine position with one needle to provide analgesia to the posterior scalp, posterior ear, and temporal regions of the head. Other benefits include a decrease in opioid consumption and an increase in patient comfort, suggesting further utility in patients with severe scalp or head injuries.

While additional clinical trials and instances utilizing this approach are necessary to evaluate its viability, our study underscores the effectiveness and benefits of a combined ultrasound-guided block. Increased research on this technique's safety, utility, and potential uses is advised, especially regarding its application in different clinical settings.

Author contributions

Vijay Sinha: This author helped write the abstract, introduction, case description and discussion.

Corinne Gibson: This author helped write the abstract, introduction, case description and discussion.

Valentina Grekos: This author helped write the abstract, introduction, case description and discussion.

David Stormking: This author helped write the abstract, introduction, case description and discussion.

Jerry Jones: This author helped write the abstract, introduction, case description and discussion.

Arvind Chandrashekar: This is the corresponding author and helped write the abstract, introduction, case description, and discussion.

Abbreviations: GON: Greater Occipital Nerve; LON: Lesser Occipital Nerve; AOT: Auriculotemporal Nerve; PACU: Post Anesthesia Care Unit; UTHSC: University of Tennessee Health Science Center; IV: Intravenous; APS: Acute Pain Service; POD: Postoperative Day; ENT: Otolaryngology; GLOAT: Greater Occipital, Lesser Occipital, and Auriculotemporal Nerve

Financial Disclosures: None

Conflicts of interest: None

Acknowledgements: None

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