Peripheral nerve blocks for headache disorders

Linford Fernandes, Marc Randall, Luis Idrovo

ABSTRACT

Headache is a common neurological referral and a frequent cause for acute hospital admissions. Despite peripheral nerve blocks being widely used in headache and pain services to treat patients with headache disorders, there is no readily accessible resource with instructions for the delivery of peripheral nerve blocks. Here we provide a practical approach for administering peripheral nerve blocks and cover the current evidence base for such procedures in different headache disorders. We provide instructions and an audiovisual guide for administering greater and lesser occipital, supratrochlear, supraorbital and auriculotemporal nerves blocks, and give information on their adverse effects and potential complications. This information will provide a reference for headache practitioners when giving peripheral nerve blocks safely to people with headache.

INTRODUCTION

Headache is one of the most prevalent, disabling and undertreated conditions in neurological clinical practice. Headache practitioners commonly administer peripheral nerve blocks to treat various headache disorders both in the acute and outpatient setting, often with rewarding results. There is no current national consensus on the technical aspects of delivering peripheral nerve blocks. However, a recent survey among UK headache practitioners showed that blocks have become relatively popular transitional treatments for cluster headache and chronic migraine. Here we aim to provide practical instructions for effective and safe delivery of the most common peripheral nerve blocks used in headache medicine. We briefly outline the evidence base for common indications and describe the peripheral nerve block method, including injection location, technique, drug constituents and potential pitfalls. This, together with the supplementary illustrative videos, should provide a comprehensive guide on nerve block delivery. This guide should be used to support, but not to replace, the experience obtained from clinical supervision by practised healthcare professionals.

EVIDENCE BASE FOR PERIPHERAL NERVE BLOCKS

Headache practitioners frequently target the greater occipital nerve (GON), but the treatment of both primary and secondary headaches might target other cervical and cranial nerves. Despite headache specialists seeing positive results in clinical practice, there is little high-quality information to support their widespread use. Several recent randomised controlled trials and cohort studies have studied the efficacy of peripheral nerve blocks, particularly GON blocks. The level of evidence for the effectiveness of peripheral nerve blocks for managing different headache disorders varies depending on the pericranial nerve targeted and the outcome measure used (table 1). GON blocks for the acute and preventative treatment of migraine and cluster headaches reduce headache days and give high levels of patient-reported efficacy. Furthermore, peripheral nerve blocks have been effective in managing acute or prolonged migrainous episodes that commonly present to the emergency department. The rapid onset of pain relief provided by anaesthetic nerve blocks makes them ideal for acute headache presentations, where timely management is essential, reducing the need for opiate-based therapies.

Although it is difficult to predict which patients will benefit significantly from peripheral nerve blocks, headache practitioners have developed a wealth of clinical experience in maximising their efficacy. In the trigeminal autonomic cephalalgias—predominantly unilateral headaches including cluster headache and hemicrania continua—ipsilateral greater and lesser occipital nerve (LON) blocks as first-line treatments may avoid the need for corticosteroids or indomethacin. Patients with headache who have reproducible pain with palpation over...
Peripheral nerve blocks are also demonstrably effective in the older population with headache disorders, whose comorbidities might preclude the use of first-line preventative medications. There are conflicting results about adding corticosteroid to nerve blocks in people with migraine, but evidence to support its efficacy in cluster headache. Greater occipital neuralgia with or without another coexisting headache disorder is not uncommon. Giving a GON block to a patient with suspected GON neuralgia can be both diagnostic and therapeutic, usually conferring prolonged relief. The evidence base for using peripheral nerve blocks in other cranial neuralgias, such as auriculotemporal and supraorbital neuralgias, is predominantly anecdotal, from published case series. Pregnant women with troublesome headaches can often be managed throughout pregnancy and the postpartum period with anaesthetic nerve blocks without corticosteroid, reducing the need for medications. The frequency of the nerve blocks can be tailored to the individual’s response duration but is usually 3 months or more. If the benefit lasts less than 2 months, then clinicians might consider other headache medications or interventions.

Some headache practitioners inject only the occipital nerves during the first session, which reduces the number of injections and allows for an assessment of initial response. If the patient reports some benefit but has residual facial pain, then at a subsequent session, the trigeminal nerves can be blocked as well as the occipital nerves. Consensus recommendations by the American Headache Society and the Spanish Headache Study Group have used this evidence base to provide guidance on the administration of peripheral nerve blocks for different headache disorders.

**GENERAL CONSIDERATIONS**

Knowledge of the anatomical landmarks of the occipital and superficial branches of the trigeminal nerve is important for effective nerve blockade, and to avoid possible complications such as nerve trauma, bleeding or inadvertent arterial injection of anaesthetic drug. People with headache disorders often describe pain over the forehead, behind their eyes, temples, occipital and upper cervical areas. The forehead and upper periorbital areas are innervated by peripheral branches of the first division of the trigeminal nerve (V1), mainly the supraorbital and the supratrochlear nerves. The temples are largely innervated by the auriculotemporal nerve branch from the mandibular division of the trigeminal nerve (V3). The upper cervical and occipital region is innervated by C2/C3 posterior cervical branches, mainly the supraorbital and the supratrochlear nerves. The temples are largely innervated by the auriculotemporal nerve branch from the mandibular division of the trigeminal nerve (V3). The upper cervical and occipital region is innervated by C2/C3 posterior cervical branches, mainly the greater, lesser and third occipital nerves.

Having identified someone as suitable for a peripheral nerve block, we find it helps to show them an illustration of the peripheral cranial nerve to be injected (figure 1). The written consent should include the known complications of any invasive procedure, such as bleeding or infection at the injection site, and some may find the procedure painful. Peripheral nerve blocks are contraindicated at any previous surgical site, for example, previous burr hole or previous craniotomy.

**Table 1** Evidence base for the efficacy of peripheral nerve block in treating different headache disorders

<table>
<thead>
<tr>
<th>Headache disorder</th>
<th>Type of nerve block studied</th>
<th>Evidence level*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute migraine</td>
<td>GON</td>
<td>2B</td>
</tr>
<tr>
<td>Chronic migraine</td>
<td>GON</td>
<td>2A</td>
</tr>
<tr>
<td>Cluster headache</td>
<td>GON, suboccipital</td>
<td>1B</td>
</tr>
<tr>
<td>Occipital neuralgia</td>
<td>GON</td>
<td>2B</td>
</tr>
<tr>
<td>Chronic daily headache</td>
<td>GON</td>
<td>2B</td>
</tr>
<tr>
<td>Other trigeminal autonomic cephalalgias</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SUNCT/SUNA</td>
<td>Supraorbital, supratrochlear</td>
<td>4</td>
</tr>
<tr>
<td>Paroxysmal hemicrania/ hemicrania continua</td>
<td>Supraorbital, supratrochlear</td>
<td>4</td>
</tr>
<tr>
<td>Other painful cranial neuralgias</td>
<td>Supraorbital, auriculotemporal</td>
<td>4</td>
</tr>
</tbody>
</table>

*Based on the Oxford Centre for Evidence-based Medicine Levels of Evidence.

GON, greater occipital nerve; SUNCT, short-lasting unilateral neuralgiform headache attacks with conjunctival injection and tearing; SUNA, short-lasting unilateral neuralgiform headache attacks with cranial autonomic features.

**Figure 1** Illustrative drawings of the anatomical course of the peripheral cranial nerves. These are used during the consent process to demonstrate the location of the nerves to be injected. Adapted with permission from Blumenfeld et al.
cranial nerve, as there is a risk of anaesthetic infiltration into the central nervous system. Blocks should also be routinely avoided in patients with implants such as nerve stimulators or shunts, although in exceptional circumstances can be used in skilled hands with appropriate consent for risks. Following the informed consent process, patients are asked either to lie in a supine position on the examination bed or to sit on a chair, depending on the superficial nerve being injected. Patients should also be advised to eat and drink before attending for the procedure, to reduce the chances of a syncopal episode. As with any invasive procedure, clinicians should take care to confirm the patient’s details and site to be blocked, while adhering to the local personal protection equipment guidance. Topical anaesthetic cream a few minutes before the procedure can be used to numb the skin around the injection site, especially for the supraorbital, supratrochlear and auriculotemporal nerve injection sites. Most people develop numbness in the distribution of the nerve injected within a few minutes after the procedure, and warning patients of this anticipated effect can alleviate postprocedure anxiety. Furthermore, numbness in the dermalatomal distribution of the nerve injected is a sign that the procedure has infiltrated the targeted nerve. The constituents of the nerve block differ with the cranial nerve injected and between headache centres (table 2). Corticosteroids are commonly used only for GON blocks, but some headache centres use them to infiltrate the LON as well. We recommend avoiding corticosteroids for any of the trigeminal nerve blocks, particularly due to unwanted cosmetic side effects such as localised alopecia and lipoatrophy. Systemic effects of corticosteroids in peripheral nerve blocks are not negligible and there have been reported cases of iatrogenic Cushing’s syndrome both in the literature and anecdotally among headache centres. For this reason, it is important to ask the patient about other corticosteroid medications they might be receiving; patients already taking corticosteroids should not receive a repeat corticosteroid-containing nerve block within 3 months or longer. Peripheral nerve blocks appear generally safe, but there are other contraindications and possible complications to take into account, depending upon which cranial nerve is being blocked (table 3).

**GON BLOCKS**

The GON arises as the medial branch from the dorsal primary ramus of the second cervical nerve. It emerges below the oblique capitis inferior muscle and passes through the semispinalis muscle, before ascending to innervate the posterior scalp to the vertex. The GON can be localised superficially by identifying a point one-third (medially) of the way between the occipital protuberance (inion) and the mastoid process, approximately 2 cm lateral and 1.5–2.0 cm below the inion (figure 2). The occipital artery usually

<table>
<thead>
<tr>
<th>Nerve</th>
<th>Constituents per injection (volume injected, mL)</th>
<th>Methylprednisolone can be omitted and volume made up with lidocaine and/or bupivacaine if using a combination of the both lidocaine and bupivacaine, the recommended volume ratio (lidocaine/bupivacaine) is 1:1–1:3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Greater occipital</td>
<td>Methylprednisolone 40 mg/mL* (2 mL) Lidocaine 2%† (1 mL) Bupivacaine 0.5%† (1 mL) Total injection volume=4 mL</td>
<td></td>
</tr>
<tr>
<td>Lesser occipital</td>
<td>Lidocaine 2% (1 mL) Bupivacaine 0.5% (1 mL) Total injection volume=2 mL</td>
<td></td>
</tr>
<tr>
<td>Auriculotemporal</td>
<td>Supraorbital Lidocaine 2% (0.5 mL) Bupivacaine 0.5% (0.5 mL) Total injection volume=1 mL</td>
<td></td>
</tr>
<tr>
<td>Supratrochlear</td>
<td></td>
<td></td>
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</tbody>
</table>

* Methylprednisolone acetate maximum dose 160 mg per session. † Lidocaine maximum dose: 4.5 mg/kg, not to exceed 300 mg per session (without vasoconstrictor). ‡ Bupivacaine maximum dose: 2.5 mg/kg, not to exceed 175 mg per session (without vasoconstrictor).
and hence a sudden decrease in cerebral perfusion pressure.

LON BLOCKS
The LON arises from the ventral primary rami of the second and third cervical nerves. It passes superiorly along the posterior border of the sternocleidomastoid muscle, dividing into cutaneous branches that innervate the lateral portion of the posterior scalp. The LON is localised by identifying a point two-thirds of the way between the inion and the mastoid process (figure 2). It is commonly injected along with the GON.

Injection technique
The procedure is broadly similar to the GON injection with the patient seated and clinician standing behind. Having located the LON, use a suitable 25-gauge needle, entering perpendicular to the skin, stopping once the periosteum is reached. After gentle aspiration to ensure no arterial entry, the injection is delivered (figure 3) (online supplemental file 2).

SUPRATROCHLEAR NERVE BLOCKS
The supratrochlear nerve is one of the terminal cutaneous branches of the frontal nerve, which in turn arises from the ophthalmic division of the trigeminal nerve (V1). The supratrochlear nerve exits the orbital cavity anteriorly and ascends the forehead to innervate the upper eyelid, forehead and anterior scalp. The nerve is located superficially at the superomedial aspect of the supraorbital ridge, which is the injection site (figure 2).

Injection technique
Position the patient supine with their head in a neutral position. From here, the clinician, standing beside the patient, has easy access to the supratrochlear nerve. Use a 1.0 or 2.5 mL syringe with a 30-gauge needle. Locate the nasal bridge and the medial aspect of the corrugator muscle, just lateral to the procerus and above the eyebrow line to a depth of 4–5 mm. Gently aspirate to ensure no arterial flashback and then inject the solution, which will produce a small weal under the skin (figure 3) (online supplemental file 3).
How to do it

SUPRAORBITAL NERVE BLOCKS
The supraorbital nerve is the larger of the terminal cuta-
neous branches of the frontal nerve and runs through the
supraorbital notch to innervate the upper eyelid and
conjunctiva. It then ascends the forehead, being closely
associated medially with the supraorbital artery. The
supraorbital nerve is located just above the supraorbital
notch (figure 2).

Injection technique
With the patient supine and their head in a neutral
position, palpate the supraorbital notch. Use a 1.0 or
a 2.5 mL syringe with a 30-gauge needle. Insert the
needle perpendicularly, just above supraorbital notch
(avoid injecting into the supraorbital notch), to a depth
of 4–5 mm. Gently aspirate to confirm no arterial entry
and then inject the solution (figure 3) (online supple-
mental file 4).

AURICULOTEMPORAL NERVE BLOCKS
The auriculotemporal nerve arises as a posterior
division of the mandibular branch of the trigeminal
nerve. It innervates the temples and the temporo-
mandibular joint. Its superficial branches innervate
the tragus and the auricle of the ear; its proximal
trunk is located superficially just anterior to the tragus
(figure 2).29

Injection technique
The positioning for this nerve injection can be with the
patient seated and physician standing beside them, or
with the patient supine and their head in a neutral
position. At the point just anterior to the tragus, use a
5 mL syringe with a 30-gauge needle to infiltrate
1–2 mL into the subcutaneous tissue to a depth of
about 4–6 mm. After gentle aspiration to exclude any
arterial flashback, inject the solution (figure 3) (online
supplemental file 5).

CASE STUDIES
Case 1
A 26-year-old woman was referred to the headache
clinic when 4-weeks pregnant. She had a lifelong his-
tory of episodic migraine headaches with and without
aura, which had transformed into daily headaches in the
previous 3 weeks. She also described shooting
pains over the right occipital region. The headaches
were predominantly right sided associated with allo-
dynia over the right forehead and the right occipital
region was tender. Her headaches had previously
responded poorly to propranolol and she had stopped
her current prophylactic, amitriptyline, on finding she
was pregnant. Her Headache Impact Test (HIT6)
score was 72 on presentation. The HIT6 score is
a headache score between 36 and 78, which measures
headache burden, with higher scores demonstrating
a worse outcome.

After discussion, she opted for peripheral nerve
blocks as a transitional migraine treatment. She
underwent bilateral GO N blocks with anaesthetic
only, and right-sided supraorbital, supratrochlear
and auriculotemporal blocks. There was sustained
improvement in her migraine for 7 weeks, with an
HIT6 score of 48 after 4 weeks. She continued the
same combination of peripheral nerve blocks every
3 months throughout her pregnancy.

Case 2
A 40-year-old man was referred to the nerve block
clinic with a 5-year history of seasonal stereotyped
left hemicranial stabbing pains lasting about 2
hours, with occasional neuralgia affecting the left
trigeminal nerve maxillary division (V2). There
were associated left trigeminal autonomic symptoms
including conjunctival injection, eye redness, lacri-
mation and nasal congestion. He was restless during
these episodes, which occurred up to three times a
day during the winter months, over a few weeks.
Oxygen treatment and triptans had previously helped. He also had a history of left temporoman-
dibular joint pain and previous episodic migraine.
He had tried topiramate, verapamil and propanolol
but had stopped this due to symptomatic bradycardia. Investigations were normal, including intracra-
nial imaging looking for secondary causes. On
examination, there was tenderness of the left greater
and LON area, as well as left temporomandibular
joint clicking and tenderness. We established the
diagnoses of cluster headache and co-existing left
temporomandibular joint dysfunction. The baseline
HIT6 score was 78.

Due to his frequent cluster attacks and temporo-
mandibular joint pain, we offered a left GON block
with corticosteroid, and left lesser occipital, supraor-
bital, supratrochlear and auriculotemporal nerve
blocks. On follow-up at 12 weeks, he reported a
favourable response with only three further cluster
attacks that had responded to sumatriptan injection
rescue therapy.

CONCLUSION
Peripheral nerve blocks are effective in the acute and
preventative management of several headache disor-
ders. It is difficult to identify those who will respond
best, but the procedures allow an interventional
approach for those with troublesome and refractory
headache. Neurologists can administer these blocks as
da day procedure, in clinic or the emergency depart-
ment, where quick pain relief can provide a satisfactory outcome.
How to do it


Supplemental material
Funding
the manuscript for intellectual content. LI produced the illustrative videos, edited and revised
LF drafted the manuscript, edited and narrated the
Supraorbital, supratrochlear and auriculotemporal nerve blocks involve a combination of lidocaine and/or bupivacaine.
Uncommon but important adverse effects include transient dizziness, light-headedness, transient headache exacerbation, and rarely localised lipoatrophy and alopecia with corticosteroids.

FURTHER READING

Contributors
LF drafted the manuscript, edited and narrated the illustrative videos, and revised the manuscript for intellectual content. MR edited and revised the manuscript for intellectual content. LI produced the illustrative videos, edited and revised the manuscript for intellectual content.

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REFERENCES
How to do it