



Case Series

Surgical therapy of occipital (Arnold) neuralgia: A case series

Giorgio Raposio^a, Edoardo Raposio^{a,b,*}^a Department of Surgical Sciences and Integrated Diagnostics (DISC), University of Genova, Italy^b Plastic and Reconstructive Surgery Division, IRCCS Ospedale Policlinico San Martino, Genova, Italy

ARTICLE INFO

Keywords:

Occipital neuralgia
 Arnold neuralgia
 Cervicogenic headache
 Surgical therapy

ABSTRACT

Objective: The idea to treat occipital neuralgia patients with a surgical procedure is relatively recent. The aim of this paper was to describe the surgical techniques and our 12-year experience in this field.

Materials and methods: From June 2011 till February 2022 we have performed surgery over 232 patients with occipital neuralgia.

Results: The surgical procedure elicited a positive response in 86% of the patients.

Conclusions: The described techniques allowed to obtain an high rate of positive results with a minimum percentage of complications.

1. Introduction

Occipital neuralgia (ON) and cervicogenic headache (CGH) are secondary headache disorders with occipital pain as a key feature [1]. Although there can be some clinical overlap between these two entities, distinct additional features can help clinically differentiation. In this paper, we review the surgical management approach related to ON and CGH. Anatomy Headache in ON and CGH relates mechanistically to convergence between the upper cervical nociceptive afferents and the trigeminal nociceptive afferents in the trigeminocervical complex: this allows for pain arising from the upper cervical nerves to be referred to regions of the head innervated by the trigeminal afferents, such as the orbital, frontal, and parietal regions [2–4].

The greater occipital nerve (GON), or Arnold's nerve, is the dorsal branch of the second cervical nerve (C2): it is a mixed nerve (predominantly sensory). In its path, it divides in two branches: the lateral branch, innervating the splenius capitis muscle, and the medial branch, which anastomizes with the branches of C1 and C3 and innervates the semispinalis and lower oblique muscles as well as the cutaneous occipital region.

Since globalized pain in occipital neuralgia is currently explained by convergence between cervical and trigeminal afferents in the spinal cord, several therapeutical approaches involving one or both of these structures have been described. Johnstone et al. used an occipital nerve stimulator, with a pain reduction in the visual analog score (VAS) postimplantation in five of seven patients [5]. Kapural et al. [6] described a case series of 6 patients who had chronic headaches over an

average of 4.9 yr who underwent occipital nerve electrical stimulation lead implantation using a modified midline approach. Significant decreases in pain VAS scores and drastic improvement in functional capacity were observed during the occipital stimulation trial and during the 3-mo follow-up after implantation. Finiels et al. [7] studied a retrospective series of 111 patients, who were offered one or more treatment methods, not mutually exclusive. All patients, who previously had their diagnosis confirmed by undergoing an anesthetic nerve block, were treated by radiofrequency denaturation in 78 cases, injection of botulinum toxin in 37 cases and implantation of a nerve stimulation system in 5 cases. Two serious complications (1 death, 1 permanent hemiplegia) were observed after radiofrequency denaturation, the other methods did not result in any significant complications. Radiofrequency denaturation resulted in 89.4% of good and very good results beyond 6 months, as compared to 80% for the botulinum toxin and 80% after nerve stimulation, no other significant difference occurred between the three techniques, with reservations about the reliability of interpretation for the small sample size in the case of nerve stimulation. The significance of all the above-reported results is anyhow hampered by the small sample size and the lack of long-term data. Local injection with corticosteroid can improve symptoms, though generally only temporarily. More invasive procedures, such as C2 gangliotomy, C2 ganglionectomy, C2 to C3 rhizotomy, C2 to C3 root decompression, and neurectomy have been described [8]. An isolated C2 neurectomy or ganglionectomy has been advised by Janjua et al. [9] for pain relief. According to these Authors, C1-2 instrumented fusion can be considered if extensive facet arthropathy with instability is identified. Stechison and

* Corresponding author. Department of Surgical Sciences and Integrated Diagnostics, University of Genova, L.go R. Benzi 10, 16132, Genova, Italy.

E-mail address: edoardo.raposio@unige.it (E. Raposio).

<https://doi.org/10.1016/j.amsu.2022.104237>

Received 3 June 2022; Received in revised form 14 July 2022; Accepted 20 July 2022

Available online 6 August 2022

2049-0801/© 2022 The Authors. Published by Elsevier Ltd on behalf of IJS Publishing Group Ltd. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Mullin [10] reported their case series with the surgical treatment of ON. Two patients were treated with atlanto-episthophic ligament decompression of the C2 dorsal root ganglion and nerve; four patients had C2 ganglionotomy performed. All patients had immediate complete relief of pain following surgery. Patients were followed for a mean of 24 months (range 7–33 months). One patient had a recurrence of her original pain after 26 months following atlanto-episthophic ligament decompression and required re-operation in the form of bilateral C2 ganglionotomy. All patients experienced transient nausea and dizziness in the several days following surgery. One patient had an incisional cerebrospinal fluid leak. Gille et al. studied the results of the surgical treatment of GO neuralgia in 10 patients consisting of neurolysis of the great occipital nerve and section of the inferior oblique muscle [11]. The mean pre-operative VAS was 70%. At 3 months, the mean VAS was 30%, and it decreased to 20% at last follow-up.

In our experience [12–28], the GON is the nerve more frequently (about 70% of the cases) involved in patients with occipital neuralgia. The lesser occipital nerve (LON) is located more laterally and is usually compressed near the mastoid process. The third occipital nerve (TON) is rarely (if ever) irritated. In the last 12 years, we have adopted a minimally invasive approach (consisting in only neurolysis of the GON and LON). The aim of this paper was to describe our surgical approach and the results in 232 patients.

2. Materials and methods

Surgical technique: The purpose of the surgical treatment of occipital (Arnold) neuralgia is mainly to remove the potential compression points of the greater occipital nerve (GON) along its course in the medial part of the posterior neck to the subcutaneous tissue of the occipital scalp. This study was conducted in compliance with the Declaration of Helsinki and the Guidelines for Good Clinical Practice; all enrolled patients provided written informed consent before inclusion in the study. The study was a retrospective, single-centre, non-consecutive case series performed in a teaching hospital (unique identifying number: researchregistry8095). All patients had previously undergone a full examination by neurologists to confirm the diagnosis of migraine headache in accordance with the guidelines established by the International Headache Society. All participants suffered from unilateral (68%) or bilateral (32%) chronic refractory occipital neuralgia and had failed multiple preventative medications; women were not pregnant or nursing. None of the patients had ever undergone local treatments such as nerve blocks, botulinum toxin or corticosteroid infiltrations. The procedures were performed by the senior author (ER). In each case, we performed an extensive surgical decompression of the involved trigger point with myotomies, neurolysis, arterectomies (ipsilateral occipital artery) and removal of the surrounding fibrous soft tissues. Our surgical GON + LON decompression technique were performed, with the patient prone under local anesthesia, without the need of shaving the hairs. No peri- or postoperative antibiotic were administered. After injecting of 40 cc Carbocaine 1% + 40 cc NaCl 0.9% and 20 cc sodium bicarbonate 8.4%, a horizontal occipital scalp incision of about five cm were performed along the superior nuchal line (Fig. 1) to expose the subcutaneous structures and isolate the GON and LON. The postoperative scar resulting from the incision will be easily covered by the patient's hair. Dissection of the occipital, trapezius, and semispinalis muscles were then performed. The occipital neurovascular bundle is isolated from the surrounding structures. It is usual to find a very close relationship between a dilated, ectasic branch of the occipital artery intertwining with the GON and/or LON (Fig. 2). The relationship between the occipital nerves and arteries causes, in most of the patients, a pain that is characteristically throbbing and pulsating. Neurolysis of both GON and LON, followed by coagulation of the arteries, is then performed (Fig. 3). The procedure is completed by a continuous nylon suture, without the need of any drainage. Since the avulsion of the TON during surgery does not improve clinical outcomes, it is never performed. This case series has been reported in line with the

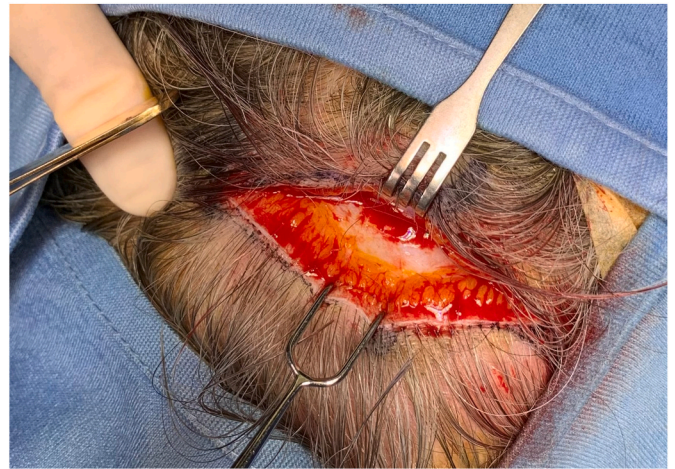


Fig. 1. Horizontal scalp incision along the superior nuchal line.

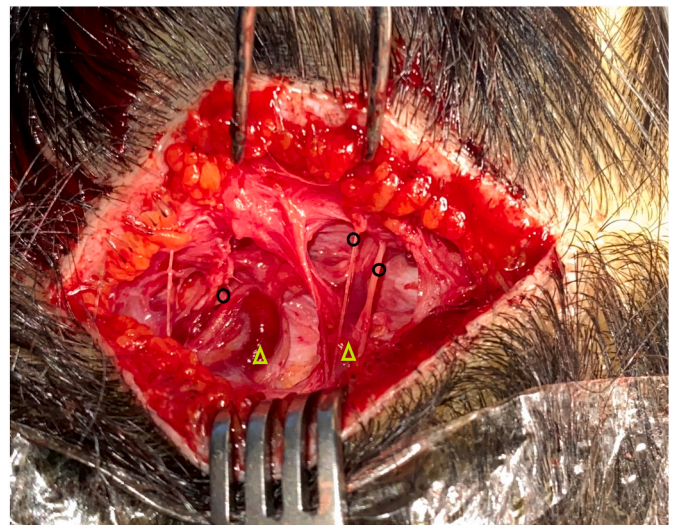


Fig. 2. Close relationship between dilated, ectasic branches of the occipital artery (yellow triangle) intertwining with the greater occipital nerve (black circle). (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)

PROCESS Guideline [29].

3. Results

From June 2011 till February 2022, we have performed surgery for ON and CGH on 232 patients. We obtained a remarkable improvement in 95% of patients (86% complete recovery).

The final results were fully achieved within three months, a period in which the attacks were progressively less and less frequent, lasting, and intense. The complication rate was low. Such complications were transient and minor: cutaneous numbness, paresthesia, and itching of the undermined area, lasting one to several months and occurring in about 8% of cases. We reported the onset of secondary trigger sites in 42% of patients (79% temporal, 31% frontal).

4. Conclusions

The described techniques allowed to obtain an high rate of positive results with a minimal complication rate. The important role of the close relationship between the nerves and vessels should be stressed, since, to obtain a positive result, it is of paramount importance the complete

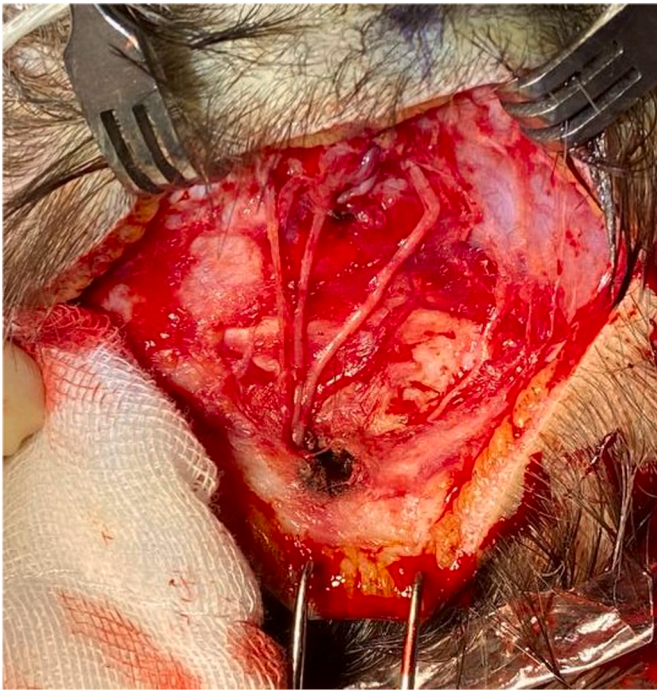


Fig. 3. Complete neurolysis of the right greater occipital nerve.

neurolysis of the nerves, coagulating the ectasic, dilated vessels.

5. Discussion

In our opinion, neurolysis of the GON and LON is advocated as the preferred surgical treatment of greater occipital (Arnold) neuralgia of idiopathic origin.

Ethical approval

N/A.

Sources of funding

None.

Declaration of competing interest

The authors have no conflicts of interest.

Author contribution

Giorgio Raposio designed the study and wrote the paper, Edoardo Raposio performed the surgeries, supervised the project and validated it.

Registration of research studies

1. Name of the registry: Research Registry.
2. Unique Identifying number or registration ID: 8095.
3. Hyperlink to your specific registration (must be publicly accessible and will be checked): <https://www.researchregistry.com/register-now#home/registrationdetails/62cfea78cab117001e44a3ad/>

Consent

Written and signed consent has been obtained by all the patients.

Guarantor

Edoardo Raposio.

Data availability statement

All data generated or analyzed during this study are included in this published article.

Provenance and peer review

Not commissioned, externally peer-reviewed.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.amsu.2022.104237>.

References

- [1] R. Barmherzig, W. Kingston, Occipital neuralgia and cervicogenic headache: diagnosis and management, *Curr. Neurol. Neurosci. Rep.* 19 (5) (2019 Mar 19) 20.
- [2] N. Bogduk, The neck and headaches, *Neurol Clin N Am* 22 (1) (2004) 151–171.
- [3] N. Bogduk, Cervicogenic headache: anatomic basis and pathophysiologic mechanisms, *Curr. Pain Headache Rep.* 5 (4) (2001) 382–386.
- [4] P.J. Goadsby, T. Ratsch, On the functional neuroanatomy of neck pain, *Cephalalgia* 28 (suppl 1) (2008) 1–7.
- [5] C.S. Johnstone, R. Sundaraj, Occipital nerve stimulation for the treatment of occipital neuralgia-eight case studies, *Neuromodulation* 9 (1) (2006 Jan) 41–47.
- [6] L. Kapural, N. Mekhail, S.M. Hayek, M. Stanton-Hicks, O. Malak, Occipital nerve electrical stimulation via the midline approach and subcutaneous surgical leads for treatment of severe occipital neuralgia: a pilot study, *Anesth. Analg.* 101 (1) (2005 Jul) 171–174.
- [7] P.J. Finiels, D. Batifol, The treatment of occipital neuralgia: review of 111 cases, *Neurochirurgie* 62 (5) (2016 Oct) 233–240.
- [8] I. Choi, S.R. Jeon, Neuralgias of the head: occipital neuralgia, *J. Kor. Med. Sci.* 31 (4) (2016 Apr) 479–488.
- [9] M.B. Janjua, S. Reddy, T.Y. El Ahmadi, et al., Occipital neuralgia: a neurosurgical perspective, *J. Clin. Neurosci.* 71 (2020 Jan) 263–270.
- [10] M.T. Stechison, B.B. Mullin, Surgical treatment of greater occipital neuralgia: an appraisal of strategies, *Acta Neurochir.* 131 (3–4) (1994) 236–240.
- [11] O. Gille, B. Lavignolle, J.M. Vital, Surgical treatment of greater occipital neuralgia by neurolysis of the greater occipital nerve and sectioning of the inferior oblique muscle, *Spine* 29 (7) (2004 Apr 1) 828–832.
- [12] G. Caruana, N. Bertozzi, E. Boschi, et al., Endoscopic forehead surgery for migraine therapy Personal technique, *Ann. Ital. Chir.* 85 (2014) 583–586.
- [13] G. Caruana, E. Grignaffini, E. Raposio, Endoscopic forehead muscle resection for nerve decompression: a modified procedure, *Plast Reconstr Surg Glob Open* 3 (3) (2015 Apr 7) e342.
- [14] E. Raposio, G. Caruana, Frontal endoscopic myotomies for chronic headache, *J. Craniofac. Surg.* 26 (3) (2015) e201–e203.
- [15] S. Polotto, F. Simonacci, E. Grignaffini, M.P. Grieco, E. Raposio, Surgical treatment of frontal and occipital migraines: a comparison of results, *Plast Reconstr Surg Glob Open* 4 (3) (2016 Mar 18) e653.
- [16] E. Raposio, G. Caruana, Tips for the surgical treatment of occipital nerve-triggered headaches, *Eur. J. Plast. Surg.* 40 (3) (2017) 177–182.
- [17] N. Bertozzi, F. Simonacci, G. Lago, C. Bordin, E. Raposio, Surgical therapy of temporal triggered migraine headache, *Plast Reconstr Surg Glob Open* 6 (12) (2018 Dec 17), e1980.
- [18] E. Raposio, N. Bertozzi, Trigger site inactivation for the surgical therapy of occipital migraine and tension-type headache: our experience and review of the literature, *Plast Reconstr Surg Glob Open* 7 (2019), e2507.
- [19] F. Simonacci, G. Lago, N. Bertozzi, E. Raposio, Surgical deactivation of occipital migraine trigger site, *Chirurgia* 33 (3) (2020) 143–149.
- [20] E. Raposio, F. Simonacci, Frontal trigger site deactivation for migraine surgical therapy, *Plast Reconstr Surg Glob Open* 8 (4) (2020), e2813.
- [21] I. Baldelli, M.L. Mangialardi, E. Raposio, Site V surgery for temporal migraine headaches, *Plast Reconstr Surg Glob Open* 8 (6) (2020), e2886.
- [22] I. Baldelli, M.L. Mangialardi, M. Salgarello, E. Raposio, Nummular headache and its surgical treatment, *Plast Reconstr Surg Glob Open* 8 (7) (2020) e2989.
- [23] M.L. Mangialardi, I. Baldelli, M. Salgarello, E. Raposio, Decompression surgery for frontal migraine treatment, *Plast Reconstr Surg Glob Open* 8 (10) (2020), e3084.
- [24] I. Baldelli, M.L. Mangialardi, M. Salgarello, E. Raposio, Peripheral occipital nerve decompression surgery in migraine headache, *Plast Reconstr Surg Glob Open* 8 (2020), e3019.
- [25] K. Cortese, E. Tagliatti, M.C. Gagliani, et al., Ultrastructural imaging reveals vascular remodeling in migraine patients, *Histochem. Cell Biol.* (2022 Jan 29), <https://doi.org/10.1007/s00418-021-02066-w>.
- [26] E. Raposio, *Atlas of Endoscopic Plastic Surgery*, Springer, New York, USA, 2015.

- [27] E. Raposio, *Atlas of Surgical Therapy for Migraine and Tension-type Headache*, Springer, New York, USA, 2019.
- [28] G. Raposio, E. Raposio, Temporal surgery for chronic migraine treatment: a minimally-invasive perspective, *Ann Med Surg* 76 (2022), 103578.
- [29] R.A. Agha, C. Sohrabi, G. Mathew, T. Franchi, A. Kerwan, O'Neill N for the PROCESS Group, The PROCESS 2020 guideline: updating consensus preferred reporting of CasE series in surgery (PROCESS) guidelines, *Int. J. Surg.* 84 (2020) 231–235.