European Review for Medical and Pharmacological Sciences 2022; 26: 6110-6113

Principles and techniques of migraine surgery

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Abstract. – OBJECTIVE: The idea to treat migraine patients with a surgical procedure is relatively recent. The aim of this paper was to describe the surgical techniques and our 11-year experience in migraine surgery.

PATIENTS AND METHODS: From June 2011 till December 2021, we have performed MH decompression surgery over 527 patients with either frontal (90 pts), occipital (232 pts) or temporal (205 pts) migraine trigger sites.

RESULTS: The surgical procedure elicited a positive response in: (a) occipital trigger site, 95% of patients (86% complete recovery); (b) frontal trigger site, 87% of patients (32% complete recovery); (c) temporal trigger site, 88% of patients (50% complete recovery).

CONCLUSIONS: The described techniques allowed us to obtain a high rate of positive results with a low percentage of minor complications.

Key Words:
Migraine treatment, Migraine surgery, Headache therapy.

Introduction

Recently, the etiopathogenetic theory that identifies the involvement of some extra-cranial nerves in the genesis of migraine headaches (MH) has aroused increasing consensus[1-5]. Dealing with endoscopic forehead surgery, in 2000 Guyuron et al[6] first reported – in a retrospective study – the association between corrugator supercilii muscle resection and significant improvement in MH attacks. This study supported the hypothesis that MH was determined by peripheral activation of branches of the trigeminal nerve. These branches were defined as trigger points, with subsequent central and peripheral sensitization. By this perspective, the trigger site was identified as the point where the MH starts; the trigger sites corresponded to the anatomical area of irritation and inflammation of the extracranial nerve(s).

Since, in our experience[7-22], the vast majority of patients (>95%) presented with frontal, temporal or occipital trigger sites, we limited our description to these regions.

Rigorous patient screening and selection, as well as proper identification of trigger sites are mandatory for obtaining a successful surgical outcome. Similarly, a meticulous knowledge of local anatomy is essential to ensure complete nerve release and prevent postoperative complications.

Patients and Methods

Frontal Trigger Site

In the frontal trigger site, the supraorbital and supratrochlear nerves are mechanically irritated by the contraction of the supercilii muscles: the depressor, the corrugator, and the procerus muscles. The goal of the technique is eliminating this trauma by selective myotomies of the aforementioned muscles through an endoscopic or transpalpebral approach. Although we have used for many years an endoscopic approach, recently we shifted to a transpalpebral access since, in our opinion, it allowed a better visualization and exposure of all the involved neuromuscular structures. The incision was located in the medial two-thirds of the supratarsal crease (Figure 1). A cutaneous-muscle flap (comprising the orbicularis oculi muscle) was then cephalically elevated, to expose the muscles and the nerves. The superciliary muscles were exposed and sectioned, allowing to perform a complete neurolysis of the supratrochlear and supraorbital nerves. The lateral margins of the procerus muscle were sectioned as well.

At the end of the procedure, after an accurate hemostasis was performed, the cutaneous access was closed with absorbable suture, without any drainage. A compressive bandage was positioned around the orbicular area.

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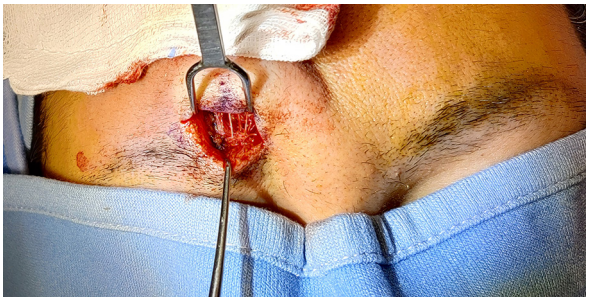

Figure 1. Open approach to visualize the right supraorbital nerve.

Temporal Trigger Site

Headaches starting from the temples are usually characterized by a unilateral and pulsating pain. In our experience, by far the most affected nerve in the temporal region is the auriculotemporal nerve. This nerve is usually irritated by the mechanical micro-traumatism determined by the pulsations of a near-by vessel (branches, usually dilated, of the superficial temporal artery).

To achieve complete neurolysis, we first determined the location of the vessel by means of a hand-held Doppler. A horizontal 3-cm incision (in local anesthesia) is then performed in the hair-bearing scalp just cranial to the auricle. Blunt dissection allowed to identify and isolate the auriculotemporal nerve and the contiguous, dilated branch(es) of the superficial temporal artery (Figure 2), just above the superficial temporal fascia. Great care must be taken not to damage the temporal branch of the facial nerve. The vessel was then coagulated, the fibrous tissue surrounding the nerve removed. No drainage was necessary. The skin incision was sutured with single, resorbable stitches.

Figure 2. Neurovascular bundle of the right temporal region: dilated branch of the superficial temporal artery (*above*), right auriculotemporal nerve (*below*).

Occipital Trigger Site

The end-goal of the surgical treatment of the occipital trigger site is the decompression and neurolysis of the greater (GON) and lesser (LON) occipital nerves. As always, these surgeries were performed under local anesthesia, as one-day surgery procedures, and without shaving the hairs. The horizontal incision, about 6-cm long, might be mono- or bi-lateral, according to patients' symptoms. The cutaneous incisions are performed along the superior nuchal line. Blunt dissection of the muscles (occipital, trapezius, semispinalis, splenius, sternocleidomastoid) allowed to identify the GON and LON. Usually, one or more ectasic vessels are found in close proximity of the nerves (Figure 3), intertwining them. The vessels were meticulously coagulated. An accurate neurolysis was then performed. A continuous nylon suture completed the procedure.

Figure 3. Right greater occipital neurovascular bundle.

Results

From June 2011 till December 2021, we have performed MH decompression surgery over 527 patients with either frontal (90 pts), occipital (232 pts) or temporal (205 pts) migraine trigger sites. The surgical procedure elicited a positive response in:

a. Occipital surgery: remarkable improvement in 95% of patients (86% complete recovery);
b. Frontal surgery: remarkable improvement in 87% of patients (32% complete recovery);
c. Temporal surgery: remarkable improvement in 88% of patients (50% complete recovery).

We reported the onset of secondary trigger sites in 42% of patients.

The final results were fully achieved within three months, a period in which the attacks were less and less frequent, lasting and intense. The complication rate was low. The complications were transient and minor: cutaneous numbness, paresthesia and itching of the undermined area, lasting one to several months. Patients needed to be informed when signing the informed consent that deactivation of a MH trigger site may unmask secondary site(s) in almost 60% of patients, and that more than one surgery may be needed.

Discussion

The described techniques allowed to obtain a high percentage of positive results with a minimal complication rate.

Regarding the etiopathogenesis of migraine, one important unanswered question is: migraine attacks are triggered by mechanical irritation of the nerves by the near-by pulsating vessels or nociceptive stimuli from vasa nervorum of the dilated vessels? Further clinical studies are needed to clarify this point.

Conclusions

Today, migraine surgery has been widely accepted as an effective surgical solution for chronic headaches refractory to medical treatment, with a success rate close to 90%. Indeed, in the past two decades, extra-cranial trigger deactivation for migraine headaches has been used more and more routinely in surgical practice. The described minimally invasive approach allows to avoid all major complications encountered when applying a more invasive approach (neck stiffens, scalp anesthesia, Morton's neuroma).

Conflict of Interest

The Authors declare that they have no conflict of interests.

Acknowledgements

None.

Funding

None.

Informed Consent

All patients provided written informed consent.

Data Availability Statement

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

Authors' Contribution

GR has designed the study and written the paper, ER has provided the data and supervised the study.

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