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ORIGINAL ARTICLE

Functional neuroctomy in tumor-related and idiopathic trigeminal neuralgia

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Summary

Purpose: *Concerning neuralgias -except the cases characterized as idiopathic- frequent causes include inflammations, trauma, and also tumors that are involved in this painful procedure in the cervix – face area. We describe a surgical modified technique -"functional" neuroctomy (electroplexy) - for encountering trigeminal neuralgia and restoring its clinical image.*

Methods: *According to the current technique, the overall number of neuralgic cases we handled was three hundred - eighty (n=380). Among them, 205 were located on the third trigeminal branch, 158 on the second branch, whereas the rest of them (n=17) cases were located on the first branch. In the 162 out of the aforementioned 266 cases, the affection occurred only in one branch, in 64 cases the affection occurred in different branches, and in 107 cases the affection occurred in the same branch, in more than one terminal.*

Results: *In all surgically operated cases the expected results were appropriate. Specifically, we applied neuroctomy, through the oral cavity, to the terminal branches of the trigeminal, and especially to the buccinator, the inferior alveolar, the mandibular, the ofraorbital and the lingual nerve, except the cases regarding the ophthalmic branch (1st branch), in other words, the frontal and supraorbital nerve (intracoutaneous approach). both the first and the second branch suffered (infraorbital and inferior alveolar nerve), or both suffered, that is the infraorbital and the palatine anterior nerve of the same, the second branch, whereas in the most cases, in 152 out of 266 cases, only one terminal suffered in only one branch (mandibular or nasopalatine nerve).*

Conclusions: *The application of "functional" neuroctomy (electroplexy) to the stem of the responsible branch –which is the terminal for the treatment of trigeminal neuralgia - proves that it provides a satisfactory therapeutic result (removal of pain), it restores the sensibility of the area sooner than the treatment with amputation neuroctomy, while the percentages of the recurrence remain the same.*

Key words: *malignancy, neuralgia, trigeminal, surgery, cervicofacial*

Introduction

As idiopathic trigeminal neuralgia we characterize the painful disorder in the cervicofacial (neck & face) area, which is the region of the nerve distribution, whose principal and predominant clinical symptom is the keen, sharp, stabbing pain and the intermittent periods of rest intervals with varied duration [1]. In fact, as major idiopathic neuralgias we consider the ones of the trigeminal and tongue – cervix nerve, while the minor neuralgias are those related with the genicular ganglion, the vagus nerve (laryngeal), the occipital nerve, etc. Novel molecular knowledge has been established

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for the genetic mechanisms that are responsible in part for the syndrome (mutations, polymorphisms, deregulated regulatory mechanisms [2]. The release of pain occurs automatically and without warning, though it is often preceded by an introductory aura, as it is called, which makes the experienced patient communicant of the occurrence of the forthcoming painful crisis. A wide diversity of opinions have been proposed about the pathogenetic causes, such as the inculpation of the peripheral branches the optic thalamus, the gasserian ganglion, the trigeminal nucleus the nerve's roots, the disseminated sclerosis, or even a variety of other induced causes (injuries, tumors, and mainly the pressure on the basis of mesiris). In neuralgias -besides the cases of the idiopathic form whose causes are unknown- belong also painful situations, which are called coincidental, and are generated by a specific detectable cause, inflammatory, traumatic, autoimmune diseases (ie multiple sclerosis) or secondary to head and neck malignancies [3-5]. Firstly, the conservative mode of the therapeutic treatment is concerned, where "carbamazetini", also known as "Degretol", is attempted to be granted to megitable forms of painful clinical image, in doses of 100, 200 or 300 mg/ 12h, and for 20 successive days, so that it is possible to exist a propitious result, whose incidence is about 60%.

In all cases (malignant or not) that are diagnostically characterized as trigeminal neuralgia, the treatment is radical and surgical, utilizing alcohol effusion (impregnation) 90-95 as an intermediary means of intervention in the area of the sore nerve or phenol effusion. In some cases the neural stem is placed in an osteal duct (mandibular nerve, palatine anterior nerve, infraorbital nerve), where the liquid (alcohol) remains -even for a while- in the osteal cavity. Obviously, the application of the alcohol effusion method to the lingual or buccinator nerve, whose excursions are free through soft tissues, is prohibited, because of the resulting combustion of the area [6,7]. In the current paper we describe our experience of a surgical modified technique -"functional" neuroctomy (electroplexy) - for encountering trigeminal neuralgia and restoring its clinical features in malignant and non malignant cases.

Methods

The overall number of neuralgic cases we have confronted is significant (n=380). Among them, 205 were located on the third trigeminal branch, 158 were located on the second branch, and the rest of them (n=17) were located on the first branch (Table 1). The 310 out of the 380 cases were confronted until 2000, whereas the last 70 cases were confronted after 2000. Idiopathic trigeminal neuralgia characterized 266 cases, due to the fact that the painful situations were derived from different branches, that is the first, the second, and the third, for instance on the mandibular and the ophthalmic nerve, or from the same branch in its various terminals, for example the inferior alveolar and the lingual nerve (Table 1). The rest of them (n=114) were combined with malignancies of the anatomical region (metastatic Head & Neck Squamous Cell Carcinomas-HNSCC, lymphomas, meningiomas). In the 162 out of the aforementioned 266 cases, the affection occurred only in one branch, in 64 cases the affection occurred in different branches, and in 107 cases the affection occurred in the same branch, in more than one terminal (Table 2). In other words, both the first and the second branch suffered (infraorbital and inferior alveolar nerve), or both suffered, that is the infraorbital and the palatine anterior nerve of the same, the second branch, whereas in the most cases, in 152 out of 266 cases, only one terminal suffered in only one branch (mandibular or nasopalatine nerve).

Table 1. Neuralgia of the trigeminal nerve (according to neural branch and terminal)

Neural terminal	*3rd Branch*	*2nd Branch*	*1st Branch*	*Total number of neuralgies*
Inferior alveolar	100			
Ototemple	10			
Mandibular	38			
Lingual	14			
Buccinator	43			
Infraorbital		135		
Posterior superior alveolar		5		
Palatine anterior		14		
Nasopalatine		4		
Frontal			11	
Supraorbital			6	
Total amount of neuralgias	205	158	17	380

Table 2. Localization of neuralgia in neural terminals in various branches

Localization (nerve)	*Solitary in one branch*	*In various branches*	*Several terminals of the same branch*	*Total number*
Inferior alveolar	35	31	34	100
Ototemple	2	3	5	10
Mandibular	9	6	23	38
Lingual	6	2	6	14
Buccinator	13	11	19	43
Infraorbital	84	40	11	135
Posterior superior alveolar	2	1	2	5
Palatine anterior	4	5	5	14
Nasopalatine	2	-	2	4
Frontal	3	5	3	11
Supraorbital	2	3	1	6
Total anmount of neuralgias	162	107	111	380

Results

In all surgically operated cases the expected results were appropriate. Specifically, we applied neuroctomy, through the oral cavity, to the terminal branches of the trigeminal, and especially to the buccinator, the inferior alveolar, the mandibular, the ofraorbital and the lingual nerve, except the cases regarding the ophthalmic branch (1st branch), in other words, the frontal and supraorbital nerve (dermatic approach). Especially, for the cases of the buccinator and the lingual nerve, their simple dissection is sufficient, without the need of detaching them, as they are found free and can be easily removed inside the soft tissues (great void between the neural colobomas). Using this method, the sensibility of the sacrificed terminal does not revert, but a "relapse" of neuralgia has emerged, followed by less or more intense pain in an adjoining nerve of the same or different branch. The reappearance of the sensibility is not usually escorted by any neuralgic relapse of the same, cured, nerve. Applying alcohol impregnation, the sensibility of the nerve reverts after time intervals of varying length -months or even years- with or without neuralgic clinical symptoms. Approaching the palatine duct (palatine anterior part) in a blind way, we intervene in the second trigeminal branch or in the internal area of the infraorbital nerve, before its entrance to the infraorbital duct, by diathermoplexia or alcohol effusion, in case the neuralgic relapse takes place after the peripheral neuroctomy of this terminal.

Discussion

Neuralgia occurs in two forms. In the mild form, the pain occurs as a short powerful numbness in the affected area, lasting with long intermediate time intervals. In contrast, in the severe form the pain occurs in continuous repetitive waves, as a chronic situation, attributing to the patient the characteristic fearful mask, especially when controlled by examination the sensitive areas of the skin where the neural branch is distributed. Differential diagnosis should be from the various symptomatic neuralgias (pulpitis, radix apex infections, salivalithiasis, temporomandibular or muscle pain, etc.), in which cases the neural amputation surgery is not necessary [8].

A significant clinical point of the presence of this disease is the absence of teeth (emendation of varying lengths) in the area of the manifestation of the pain, due to the incorrect export from the dentist who tried to treat the painful crisis as a dental problem. It is interesting to note that often the pain resides from several nerves, with dominant pain the pain emanating from the most affected area, so that in the case of its elimination (neuroctomy), the effect of the pain continues from the nearby area, which is a cause of ambiguity for the therapeutic treatment. The precise diagnosis for the localization of the responsible terminal branch is always defined by the selective anaesthetization (stem anesthesia), commenced peripherally. For instance, the examination of the mandibular nerve takes place at the very beginning, and then it is extended to the centre (inferior alveolar nerve). Any radical, therapeutic offer is not attempted without first precisely locating the sore neural branch, neither a surgical or an alcohol impregnation, and this is the reason for imposing an examination on the aching patient, for avoiding an erroneous intervention that is an operation on a healthy nerve. Interestingly, micro-vascular decompression (MVD) surgery

seems to be an effective therapy in approximately 83% of cases, although persistent neuropathic pain after MVD surgery may require reintroduction of pharmacotherapy [9].

Concerning surgical treatment, amputation or the functional inactivation of the nerve are the two main approaches. The amputation neuroctomy constitutes the "exenterosis" of the sore nerve, a method we have firstly applied systematically. The functional inactivation of the nerve, apart from alcohol or phenol impregnation, is performed in cases in which we are aiming at the transient removal of sensibility, that is the cessation of the pain, which lasts for months or even more, through "electropligia" (electroplexy) of the invalid stem. This is a method we apply successfully, without damaging the peripheral nerve, for the last 10 years. As it is commonly known, this technique is implemented, though not always successfully, in the electroplexy of the trigeminal's roots by neurosurgeons who also use the techniques of the nerve roots' decompression, as well as laser beams and gamma rays [10]. The method of electroplexy, when compared with the aforementioned method, brings about inactivation of the neural function (sensibility) for longer time intervals. Depending on the intensity and the duration of the application of the electric energy, given that the nerve will be completely and permanently damaged, if the intensity and the duration of electroplexy are applied exceedingly, we observed the "re-function" of the nerve appears to occur sooner (6-24 months), if the tissue's esharosis does not occur at the point of application of the electrodes. Also, the "re-function" appears to occur sooner if the sore stem of the terminal is contained into an angioneurotic bundle, whose cover surrounds the inferior alveolar nerve, the mandibular nerve, as well as it does not head solitarily into the tissues, as the lingual nerve.

Trigeminal neuralgia in malignancies of the head and neck anatomic region - especially in oropharyngeal cancer metastasized to areas within near the carotid sheath- could be confused with other rare pain syndromes including glossopharyngeal neuralgia caused by glossopharyngeal nerve compression. This syndrome is idiopathic characterized by syncope and/or arrhythmia (vagal episodes) [11]. Interestingly, trigeminal nerve compression that leads to disabling trigeminal neuralgia is observed also in petroclival meningiomas. In these cases, surgical treatment is based on tumor resection that provides in parallel nerve decompression leading to pain relief in sub-groups of the corresponding patients. Alternatively, applied stereotactic radiosurgery -which is an effective meningioma surgical operation- provides improved results [12]. Similarly, a very rare lesion in the nervous system - brainstem cavernous malformation- demonstrates also clinical features of trigeminal neuralgia as a secondary condition. In these cases -mainly with cerebellopontine involvement- implementation of gamma knife-based radiosurgical management has significantly reduced the levels of pain [13,14]. Additionally, trigeminal neuralgia could be a result of vestibular schwannomas treated by stereotactic radiosurgery. In fact, trigeminal neuralgia in some of these cases appears as a tethered effect of tumor shrinkage after the previous referred surgical procedure [15,16]. Perineural invasion leading to neuralgia -including the trigeminal- is also associated with cutaneous squamous cell carcinoma (cSCC) of the head and neck as an aspect of cranial neuropathy [17]. In contrast to carcinomas, primary lymphoma of the oral cavity is rare. But, in some cases trigeminal neuropathy has been identified as a result of extensive perineural spread [18]. Similarly, extra-axial lymphoma affecting the trigeminal nerve -although an uncommon clinicopathologic feature- may be misdiagnosed as trigeminal schwannoma [19]. Interestingly, although not frequently demonstrates distant brain metastasis in renal cell carcinoma spreading to the cranial nerves and their occurrence is extremely rare, causing trigeminal neuralgia [20].

Conclusions

The application of "functional" neuroctomy (electroplexy) to the stem of the responsible branch, that is the terminal, for the treatment of trigeminal neuralgia proves that although it results to a satisfactory therapeutic result, that is the removal of pain, it restores the sensibility of the area sooner than the treatment with amputation neuroctomy, while the percentages of the recurrence remain the same. It is implied that the basic consequence of each radical treatment, such as a surgical operation or alcohol impregnation, that is the permanent or transient anesthesia of the painful area, is unavoidable, and we have to emphasize to the patient that the advent of anesthesia is certain. There are patients at the post-surgical stage who show more difficulty to the forthcoming anesthesia than the pre-existent painful situation. Thus, the patient has to be persuaded that the loss of the sensibility, performed for the diagnosis control or for the sake of the operation, shall last for a long post-surgical period.

Conflict of interests

The authors declare no conflict of interests.

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