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CLINICAL ARTICLE

Typical trigeminal neuralgia associated with brainstem white matter lesions on MRI in patients without criteria of multiple sclerosis

Ignacio Arrese · Alfonso Lagares · Rafael Alday · Ana Ramos · Juan J. Rivas · Ramiro D. Lobato

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Abstract
Introduction Although compression of the trigeminal nerve by a vascular loop is thought to be the most common cause of trigeminal neuralgia (TN), other aetiologies, such as multiple sclerosis or brainstem infarction may be associated with this disorder. MRI may detect lesions different from vascular loop compression of the trigeminal nerve that may be related to TN.
Patients and methods The pre-operative MRIs of 68 patients without the diagnosis of multiple sclerosis who were operated for typical TN between 1998 and 2003 were retrospectively reviewed Four of these showed hyperintense lesions in the pons on T2 MRI sequences. No patient had prior surgery. These four patients underwent different operations for the control of pain but in two of them only ablative procedures were effective
Discussion Although it is uncertain whether the occurrence of TN in our patients may be attributed to the brainstem abnormalities seen on MRI, the presence of these lesions appears to be the most convincing explanation for the occurrence of pain. We believe that, in the presence of such imaging changes, a destructive procedure should be regarded as the elective surgical treatment in patients presenting with typical TN with or without apparent vascular loop compression of the trigeminal root.

A. Ramos
Departamento de Neurorradiología,
Hospital 12 de Octubre,
Madrid, Spain

I. Arrese (✉) · A. Lagares · R. Alday · J. J. Rivas · R. D. Lobato
Servicio de Neurocirugía, Hospital 12 de Octubre,
Avda. de Córdoba s/n.,
28041 Madrid, Spain
e-mail: iarrese14@yahoo.es

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Introduction

Typical trigeminal neuralgia (TN) is characterised by recurring attacks of lancinating pain in the distribution of one or more branches of the trigeminal nerve, usually provoked by sensory stimulation within the facial territory. The most common aetiology is compression of the trigeminal root by an overlying artery or vein, which is found in 80–90% of patients [18]. The presence of brainstem lesions on MRI associated with multiple sclerosis (MS and infarction in the pons has been described in patients with TN. Brainstem demyelinating plaques associated with MS have been commonly reported as a cause of typical TN [9, 12]. Brainstem ischaemia has been occasionally seen in patients with atypical facial pain, but to our knowledge, only six patients with typical TN showing infarction in the pons have been reported [1, 5, 10, 16, 20, 24]. We are presenting another four patients with typical TN, who had no diagnostic criteria of MS, but showed small lesions in the dorso-lateral region of the pons which were most likely to be of ischaemic origin. We hypothesise on the possible pathophysiology of pain in these patients and analyse their clinical course following ablative or decompressive surgical procedures on the trigeminal root ganglion.

Patients and methods

Between January 1998 and December 2003, 70 patients with the diagnosis of typical TN underwent surgical

procedures at our unit. All patients were evaluated by neurologists of this hospital and had MRI studies prior to surgery. After excluding two patients with the diagnosis of MS following McDonald's criteria [19], we reviewed the MRI studies of the remaining 68 patients and found four in whom a hyperintense lesion was present in the dorso-lateral area of the pons on T2 MRI sequences.

Patient 1

This 62-year-old woman had been suffering from lancinanting facial pain, distributed over the territory of the left V1 and V2 trigeminal branches for 12 years. Paroxysmal pain was typically triggered by chewing or light touching of the affected area, but also developed spontaneously. Paroxysms lasted about 30 seconds and then displayed a refractory period for variable quantums of time. Carbamazepine was very effective initially, but the patient's low tolerance to increased doses eventually limited its value. Other medications were also used, but with limited effect, and she was sent to our department for neurosurgical treatment.

A 3D-FSE-T2 MRI sequence (Fig. 1) did not show definite vascular compression of the trigeminal root, but disclosed a 5×5 mm hyperintense lesion in the left dorsolateral area of the pons, close to the zone where both the trigeminal tract and nucleus are located.

In view of the limitations of medical treatment and the absence of vascular compression in the root entry zone on MRI, we performed a percutaneous microcompression of the Gasserian ganglion. Immediately after the procedure the patient experienced complete pain relief, presenting light facial hypoaesthesia and maseteric weakness. She continues free of pain 3 years after surgery.

Patient 2

A 61-year-old man presented with paroxysmal facial pain distributed over the territory of the left V3 trigeminal

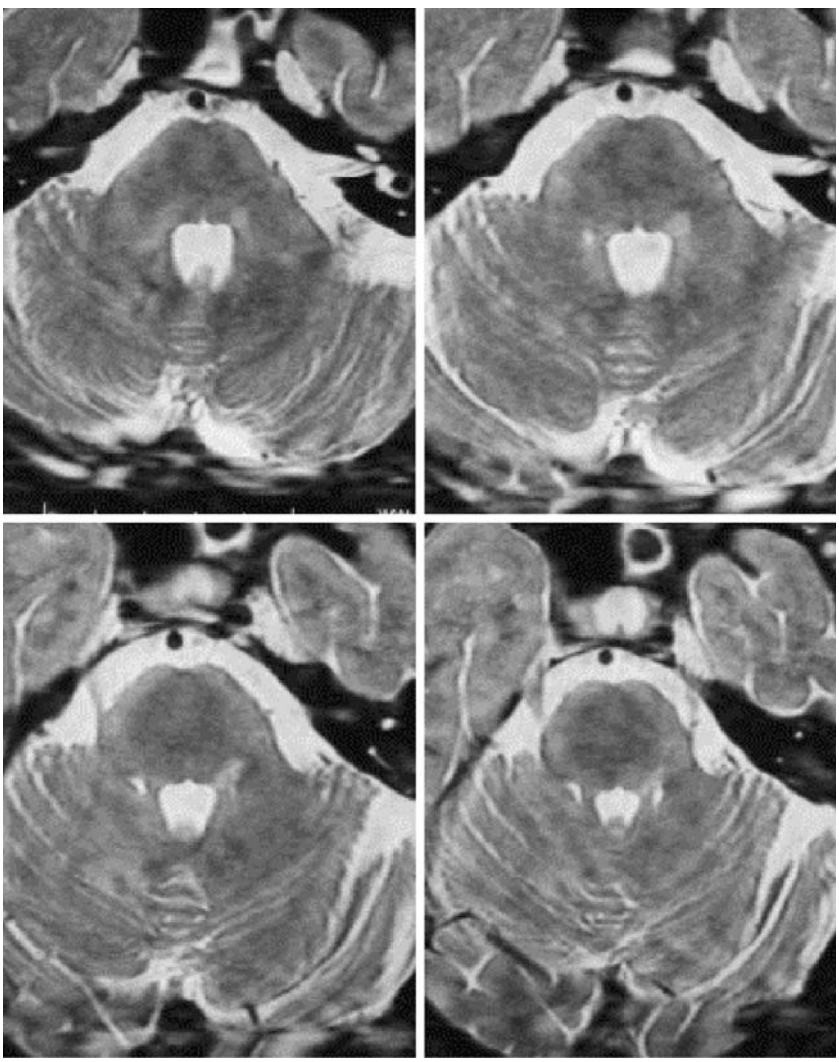

Fig. 1 On 3D FSE T2, a 5×5 mm hyperintense lesion suggestive of infarction at the dorsolateral zone of the pons can be observed. The height of the lesion is 4.8 mm, and the top is at the level of the trigeminal entry. No vascular compression can be seen at the trigeminal root entry zone

branch for 5 years. The pain, which had electrical characteristics, was triggered by light touching of the jaw and lasted a few seconds. Various medications including Carbamazepine were used but their efficacy became progressively limited.

On the 3D–FSE–T2 MRI sequences vascular compression of the trigeminal root was observed together with a hyperintense lesion in the left dorso-lateral area of the pons. Multiple ischaemic lesions in both cerebral hemispheres were also seen on MRI.

The patient underwent a vascular microdecompression in which an anterior inferior cerebellar artery loop compressing the trigeminal nerve root was observed. Unfortunately, the pain was unchanged following surgery, requiring high doses of Carbamazepine. The pain remains poorly controlled two years after the procedure, but the patient has rejected the offer of a percutaneous procedure on the trigeminal ganglion.

Patient 3

This 53-year-old woman suffered from paroxysmal and lancinanting facial pain which had been medically controlled with increasing doses of different medications for 10 years until the last 6 months before admission, when it became untreatable. The pain was located in the right V2 and V3 areas and had the typical characteristics of TN.

A T2 MRI sequence showed a hyperintense lesion in the right dorso-lateral area of the pons as the only finding.

A posterior fossa craniectomy aimed to perform a vascular microdecompression was made, but no definite vascular compression was found; thus, a partial trigeminal rhizotomy was performed. After surgery, the patient was pain free and presented light hypoaesthesia on the right side of her face. She continues to be asymptomatic one year after the procedure.

Patient 4

This 51-year-old man had been suffering from typical TN triggered by touching over the left V2 and V3 territories for 1 year. He was treated with different medications. Carbamazepine was the only one which improved the pain, but low tolerance led to its withdrawal.

A 3D–FSE–T2 MRI sequence showed a definite vascular compression of the trigeminal root as well as a 5×5 mm hyperintense lesion in the left dorso-lateral area of the pons. No other findings were demonstrated.

A vascular microdecompression was performed in which a superior cerebellar artery loop compressing the trigeminal root was observed. However, pain remained unchanged and persists six months after surgery. The patient is awaiting a percutaneous destructive procedure.

Discussion

Our patients did not have the diagnosis of MS but all of them had hyperintense brainstem white matter lesions on MRI. In the absence of histopathological samples, the nature of these lesions remains unknown, but demyelination or ischaemia are the most likely causes. Brainstem ischaemic lesions had been thought to be involved in atypical facial pain in which the symptom is not usually provoked by stimulation of trigger areas [22]. These lesions have also been reported in scans of patients who had undergone microvascular decompression procedures [11]. We have found only six reported cases of typical TN associated with infarction in the brainstem. Golby et al. [10] and Balestrino et al. [1] simultaneously reported the first two examples. Golby et al. [10] described a patient who developed typical TN after he recovered from hemifacial numbness; this patient had an infarction which was attributed to cardiac embolism at the root entry zone on MRI. Development of trigeminal pain was hypothetically related to the formation of a glial scar, but there was no histopathological confirmation. Later, Kim et al. [16] reported a similar patient, hypothesising that ischaemic injury might have led to increased neuronal activity in the trigeminal fascicles and nucleus, but again their explanation was not supported by any evidence. Delitala et al. [5] reported the only case of TN associated with brainstem infarction in which a microsurgical posterior fossa exploration was performed. Based on the theory of the "double

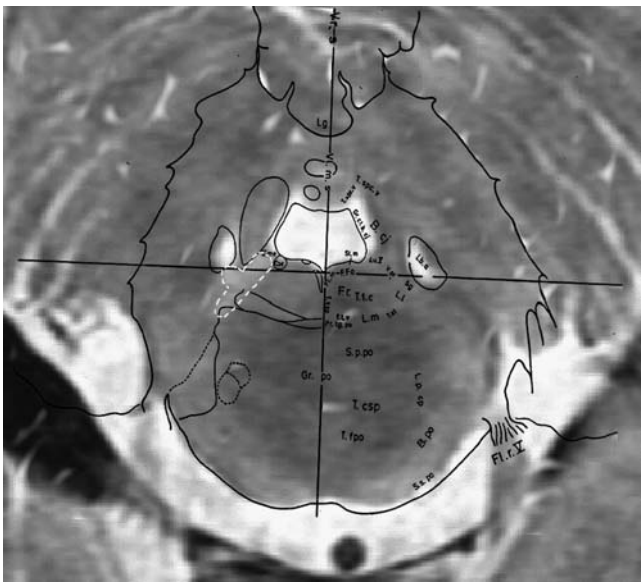

Fig. 2 By superimposing the location of the lesion in our patient on an anatomical drawing of the brainstem [21], the location of the hyperintense signal along the proximity of trigemino-spinal nucleus in the pons can be observed. The *white discontinuous line* points out the limits of the lesion

lesion", in which not only the pontine lesion, but also the vascular compression over the trigeminal root is regarded as a cause of TN, these authors resorted to microsurgical decompression. However, as no vascular loop was found in the surgical field, they performed partial sensory rhizotomy with a good therapeutic response. Two other patients have been reported in which brainstem infarction is regarded as the cause of TN. One was medically controlled [20] and the other by performing a pre-pontine rhizotomy [24]. In the former, reported by Perker et al. [20], the lesion was not located at the root entry zone but in the central trigeminal pathways. As occurred in our patients, all the above mentioned patients had a good initial response to Carbamazepine but, in four a posterior fossa approach to the tigeminal nerve root was eventually needed. Moreover, Chang et al. reported two patients with TN treated with gamma knife radiosurgery in which hyperintense pontine lesions were observed. However, they postulated that these findings were the result of an old viral neuritis [4].

Both peripheral and central pathophysiological mechanisms have been proposed to explain the occurrence of pain in patients with TN. The central theory [6, 8, 17] supports that it is the nucleus itself which suffers secondary changes due to injury to the nerve, generating impulses able to induce pain. According to the peripheral theory [14, 15, 18], pain results from a disorder located before the entry of the sensory fibres into the trigeminal nucleus. In contrast to most previously reported patients with TN and brainstem ischaemic lesions or MS, in whom lesions were located at the root entry zone, all of our patients showed damage involving the dorso-lateral zone of the brainstem. It has been suggested that patients with lesions located at the root entry zone would present with typical T.N., while those with lesions located at other areas of the brainstem would tend to present with atypical facial pain [22]. The anatomical relationship of the trigeminal tract and nuclei may explain the occurrence of TN in our patients. After entering the brainstem, trigeminal sensory fibres run down in parallel to the length of the trigeminospinal nucleus, forming the trigeminal tract [23]. Though the exact location of infarction remains to be determined in our patients, by superimposing the location of the lesion of the first patient on an anatomical drawing of the brainstem (Fig. 2), damage to the trigeminal tract seems very likely and it should be noted that in patients with lesions at the root entry zone, it is also the trigeminal white matter which is involved, while the nuclei are mostly spared.

The high prevalence of ischaemic lesions found following the advent of MRI may lead to consider them as the cause of symptoms when they represent only an incidental finding. However, it can also be argued that visualisation of ischaemic lesions may actually explain some disorders whose aetiology passed unnoticed in the pre-MRI era. Although we cannot be certain of the real nature of the lesions seen in our patients, ischaemia seems a more convincing cause than demyelination because of their ages and the absence of diagnostic criteria of MS.

The posterior fossa was not surgically explored in patient 1, but the MRI did not show a vascular loop compressing the nerve root. Although the presence of an offending vessel cannot be absolutely ruled out by MRI, the sensitivity of this technique for detecting vascular compression of the trigeminal root is over 90% at the present time [2]. Patient 3 was surgically explored, but no clear vascular compression was found, reinforcing the role of a central lesion. In the other two patients, a vascular loop compressing the trigeminal nerve was found. The role of vascular compression as a cause of TN in situations in which other factors may contribute to create pain, as occurs with MS, is controversial. Several studies assessed whether microvascular decompression is an efficient treatment for TN occurring in patients with MS. All the nine patients in the series of Eldridge et al. [7] suffering from MS who underwent microvascular decompression for the control of TN had excellent initial pain relief, but good long-term results were obtained only in four patients. In a recent paper, Broggi et al [3] have also reported the poorer results of microvascular decompression when applied to patients with MS, indicating that central mechanisms must play a major role in pain genesis in this subset of patients with TN. Moreover, the few case reports of TN associated with brainstem infarction also reinforce this opinion when ischaemic lesions are thought to be the cause of the pain. Regarding the value of destructive procedures, Kanpolat et al [13] reported good results in patients with MS with percutaneous radiofrequency rhizotomy. Likewise, favourable results have been obtained with glycerol injection and microcompression of the trigeminal ganglion. These data suggest that a destructive procedure may be a safe and effective treatment for patients having TN associated with MS or brainstem ischaemia. Therefore, we believe that in patients with typical TN showing brainstem white matter lesions on MRI, a destructive procedure should be the elective surgical treatment.

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