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Percutaneous Controlled Radiofrequency Rhizotomy in the Management of Patients with Trigeminal Neuralgia due to Multiple Sclerosis

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Summary

Between the years 1974 and 1999, 1,672 patients with medically intractable trigeminal neuralgia (TN) were treated by percutaneous controlled radiofrequency (RF) rhizotomy by the senior author and co-workers at the Department of Neurosurgery, Ankara University School of Medicine. Sixteen hundred cases (95.7%) were found to have idiopathic TN, while 72 cases (4.3%) were classified as symptomatic. In the latter group, TN was found to be caused by multiple sclerosis (MS) in 17 cases (23.6%), one of whom had bilateral TN. All patients having TN with MS (17 cases) underwent percutaneous controlled radiofrequency rhizotomy (25 procedures) as the procedure of choice. The MS patients were followed for an average of 60 months (range: 6–141 months). Complete pain relief was achieved with a single procedure in 12 of the 17 MS cases (70.6%). Early (less than 2 weeks) pain recurrence was seen in two patients (11.8%), while the overall recurrence rate was 29.4%. A second procedure was required to control TN in three cases (17.6%), a third in one (5.9%), and twice for each side for the case with bilateral TN (5.9%). Pain was completely relieved in 14 cases (82.4%) with single or multiple RF rhizotomies. In three cases (17.6%), partial pain control was achieved with RF rhizotomy, and the patients continued to receive adjunctive medical therapy. No complications were observed. All 17 patients (100%) were classified to have done well with RF rhizotomy.

Satisfactory results and good long-term pain control were obtained in patients having TN due to MS with percutaneous controlled RF rhizotomy. The authors propose that RF rhizotomy may be a safe and effective procedure in the neurosurgical armamentarium for the treatment of patients having TN due to MS.

Keywords: Trigeminal neuralgia; multiple sclerosis; surgical treatment; percutaneous radiofrequency rhizotomy.

Introduction

Trigeminal neuralgia (TN) is characterized by paroxysmal lancinating and very severe facial pain in the territory of the Vth cranial nerve. The pain is usually unilateral and associated with a cutaneous trigger zone. The etiology of TN and the corresponding treatment of choice continue to generate controversy in neurosurgical practice [1, 10, 16]. The clinical association of trigeminal neuralgia (TN) with multiple sclerosis (MS) is well known, with nearly 2% of MS patients having TN [5, 13, 15]. Most MS patients suffer from acute or chronic pain syndromes at some time during their disease [20]. Chronic pain is a common feature of well-established MS, and is usually associated with degenerative demyelinization. When TN in patients with MS is considered, the etiology, epidemiology, symptomatology and treatment rationales have specific features to be kept in mind at all times for successful therapy. This study comprises an overview of these specific features and comparison with the results of other cases in our series.

Patients and Methods

Patient Population

The surgical records of the Department of Neurosurgery, Ankara University School of Medicine, were reviewed retrospectively to uncover all procedures for the treatment of trigeminal neuralgia from 1974 to 1999; 1,672 patients with medically intractable TN treated by percutaneous controlled radiofrequency (RF) rhizotomy were identified. All the data available from previous hospital records were processed and stored on a specially designed computer data base and than matched with the data acquired from a questionnaire regarding the degree and duration of pain relief, need for further therapy, the presence of surgical sequelae and a subjective assessment of the patients' overall degree of improvement. Of the 1,672 cases treated by percutaneous controlled RF rhizotomy, 1,600 cases (95.7%) had idiopathic TN. Seventy-two cases (4.3%) having TN due to central nervous system disease or tumors were classified as symptomatic. Seventeen cases (23.6%) with MS were identified in the latter group, and these cases constitute the main domain of interest of this report.

This study was presented at the Congress of the European Society for Stereotactic and Functional Neurosurgery in Freiburg, 1998.

Of the 17 cases, 11 (64.7%) were male and six (35.3%) were female. The youngest patient was 32, and the oldest was 66 years old (average age: 45). The mean age of onset of MS among the patients was 41.8 years, and the average symptom duration before treatment was 42 months. In two patients, ages 45 and 47, TN was the presenting symptom that led to clinical investigation and thus to the diagnosis of MS. One patient had bilateral TN. Eight patients had some degree of facial hypalgesia, while nine had neurological manifestations of MS such as nystagmus (n : 3), ataxia (n : 3), paresis (n : 3), and optic nerve atrophy (n : 1) before treatment. When the pain distribution according to the branches was reviewed, four patients had pain in the IInd, four in the IIIrd, two in the Ist + IInd, five in the IInd + IIIrd, and one case in all three branches of the trigeminal nerve.

Surgical Technique

The patients were given low-dose midazolam (1–2 mg) and fentanyl (100–150 μg) by slow IV infusion over two minutes for analgesia and sedation before the procedure. The foramen ovale was punctured percutaneously using electrodes with 5 mm. open tips (TIC or TEW; Radionics Inc., Burlington, MA, USA). The direction and final position of the needle electrode were confirmed by x-rays in submentovertical and lateral projections. As selective RF thermocoagulation of the desired branch of the Vth nerve is essential, localization within the nerve was confirmed by electrical stimulation at 0.2–1 Volts (50 Hz, 0.2 msecs.). Fourteen of the 17 patients had appropriate and localizing sensory results upon stimulation. A controlled RF lesion at 60–70 °C for one minute was then made amidst continuous and careful monitoring of the ciliary reflex and other neurological functions. Patients were awake and cooperative throughout the procedure in order to facilitate the observation of neurological functions during electrical stimulation and lesioning. General anesthesia was not given, as neuroleptic anesthesia enables good patient co-operation during the whole procedure and facilitates controlled and selective lesioning. An average of five consecutive lesions were created in the painful divisions of the Vth nerve during the first RF procedure until slight hypalgesia was achieved and neuralgic pain could not be provoked by individual triggering factors. The first lesion was made at 55–60 °C, after which hypalgesia and pain provocation were tested. Two more lesions in the target area as well as two lesions, one situated 2 mm. distal and one 2 mm. proximal from the target area, were made to complete the procedure. This number of lesions is more than that required for idiopathic TN cases.

Results

A total of 25 RF procedures were performed on 17 patients. The patients were followed for an average duration of 60 months (range: 6–141 months). TN was effectively controlled for more than six months in 16 cases after RF rhizotomy, yielding an initial success rate of 94.1%. Complete pain relief, without any medication, was achieved with a single procedure in 12 cases (70.6%). Recurrences were observed in five patients (29.4%) at an average of 25 months. A second procedure was required in three (17.6%) of these cases, and a third in one patient (5.9%). The patient with bilateral TN was managed initially with two single rhizotomies, performed with a one-week time interval for safety purposes, and then needed repeat procedures for both sides. Table 1 shows the overall results after RF rhizotomy in cases with idiopathic and MS-related TN.

Post-operative hypalgesia and hypoesthesia were observed in 13 cases (76.5%) but were well tolerated. Neither dysesthesia nor anesthesia dolorosa was observed in any of our patients. No other major complications were observed and there was no mortality.

Fourteen patients (82.4%) had complete pain control, that is with no need for medication in the follow-up period. Three cases (17.6%) experienced partial pain control, but required medication at a lower dose than in the pre-operative period for adequate pain relief, and their pain was now controllable with medication. Thus, all of the patients (100%) were considered to have had satisfactory pain control with RF procedures.

Discussion

Many hypotheses have been postulated regarding the pathophysiology of TN. They can be divided into groups of those favoring a peripheral and those describing a central mechanism for the origin of this severe paroxysmal pain [1, 10].

Demyelinative processes are proposed to contribute to TN, Kerr emphasized that TN is a segmental demyelinative neuropathy, and concluded that demyelination is the common denominator in the various causes of TN, including MS [17]. Concerning the etiology of TN in MS, sclerotic plaques in the central nervous system or demyelination due to MS could result in increased excitability of the trigeminal cau-

Table 1. *Results After RF Rhizotomy of Cases with Idiopathic and MS-Related TN*

TN	(n) Cases	Number of RF procedures	Average follow-up (month)	Initial success (%)	Overall recurrence (%)	Complete pain relief (5 years)
Idiopathic	1600	2138	68	97.6	25.1	92.7
With MS	17	25	60	94.1	29.4	82.2

dalis nucleus; however, neither clinical nor neuropathological findings suggest that TN is directly due to involvement of the trigeminal nuclei complex in the brain stem [14, 15].

The clinical association of TN with MS is well known. A review of large series of MS patients revealed an average TN incidence of 2% [5, 13, 15]. Sweet reviewed 17 reports concerning 11,120 patients and found similar rates, although in his own surgical series of TN the MS rate was 16% [26]. TN usually begins 10 years after the first MS symptom, but in some patients TN may be the first or only symptom of MS. The age of onset of TN is the same or slightly younger than in idiopathic TN except when TN is the only MS symptom [5, 13]. The average symptom duration before the onset of diagnosis and treatment of TN was 38 months in our series. Facial pain in MS is usually indistinguishable from that of clear-cut TN, but a substantial number of patients fall into the atypical category [11]. In patients less than 40 years of age with TN not previously known to have MS, this diagnosis should at least be entertained, particularly if there is evidence of trigeminal sensorimotor dysfunction.

Since the advent of phenytoin, carbamezapine, more recently baclofen and clonazepam, nearly all TN patients are initially managed by one or a combination of these agents. However, particularly older patients and those with MS are prone to develop drug intolerance and/or toxicity. This is especially true of the most effective of the four agents: carbamezapine [25]. In three of our cases, medical therapy seemed to exacerbate MS symptoms. We have also noticed that baclofen is slightly better tolerated than other drugs. This may create a rationale for considering surgery earlier in the course of management in patients having TN due to MS. In our series; all patients having TN with MS were first given medical treatment for an adequate time, and were then considered as surgical candidates with medically "intractable" TN because of inadequate pain relief or difficulty with the side effects of medical treatment. Standard medication doses do not always provide adequate pain relief in patients having TN due to MS. When the dose is increased to control pain, MS symptoms tend to worsen. This is thought to be related to the degenerative process in MS and was seen in three patients in our series.

Despite many published reports and series regarding the best way to treat TN, the subject remains controversial [1, 16]. Both patients and their physicians often consider any invasive procedure to be riskier than medical treatment. In fact, maximal reduction of risk can be achieved by the use of the percutaneous approaches. As MS is a progressive disease, these patients constitute a problematic group that may not respond well to standard treatment protocols and are more prone to recurrence. Here, the ideal treatment must be simple, safe, easily repeatable, controlled and yet effective. In our own 25-year experience we performed 2,138 RF procedures on 1,600 patients with idiopathic TN. As percutaneous controlled RF rhizotomy is our invasive treatment of choice, we also prefer this method in TN patients with MS. We achieved 100% satisfactory pain relief with RF rhizotomy in our MS patients. In this group, our initial success rate with a single RF procedure was 94.1%, achieving long-term pain control without any medication in 82.4% with an overall recurrence rate of 29.4%. In our idiopathic TN series of 1,600 patients, the overall recurrence rate was found to be 25.1%. As our MS patients were followed for an average of five years, our results of this particular group was compared with our five-year follow-up results in the idiopathic TN series, demonstrating a slightly higher overall recurrence rate. Broggi and Franzini also report higher recurrence rates in MS patients than idiopathic cases [6]. Several other authors have reported similar results in idiopathic TN, and the number of patients being treated by this method indicates that many other neurosurgeons also find RF rhizotomy acceptable as the invasive procedure of choice [7, 23, 24].

Bilateral TN is significantly more common in MS patients [4, 5, 15]. Tew *et al.* reported a 5% incidence of bilateral TN in the normal population, while this rate reaches 18% in MS patients [29]. Treatment modalities for this patient group vary among authors. Brisman advocates somewhat milder lesioning of the ganglion to reduce the complications of bilateral rhizotomy [4, 5]. Sweet postulated that the best way to achieve more controlled denervation in bilateral cases is to use controlled and selective RF heat lesions [24]. However, bilateral RF lesioning of the trigeminal ganglion may lead to severe difficulty in swallowing, chewing and eating due to masseter paresis and loss of tactile sensation in the mouth. Therefore, controlled lesioning at relatively low temperatures should be performed to avoid such complications. The sole bilateral case in our own series was managed successfully with two separate RF lesions for each side.

The complications of RF rhizotomy are minimal in patients having TN due to MS. The well-known com-

plications of RF rhizotomy for the treament of TN in the first division, such as loss of ciliary reflex and keratitis, were absent in our series. This outcome may be attributable to smooth neuroleptic anesthesia, which enables good patient co-operation and continuous neurological monitoring during the selective lesioning procedure. In our whole TN series, with respect to complications, we achieved the best results in MS patients and in bilateral TN cases. This is probably due to the excessive caution exerted for truly 'selective' lesioning during the RF procedure in these cases. Nevertheless, the number of such patients was to make a definite conclusion. Additionally, neuralgical pain in MS patients may persist for some time after an RF procedure, so one must wait longer before considering an RF procedure a "failure" in an MS patient.

The retrogasserian glycerol injection technique of Hakanson is worth mentioning in a discussion of minimally invasive surgical alternatives for the treatment of TN with MS [12]. In the long run, glycerol rhizotomy does not prove to be better than RF, as it is somewhat uncontrolled and unpredictable as to the amount of destruction in the ganglion and may result in undesired sequelae [18]. The success rates of glycerol rhizotomy in MS patients are obviously lower than in idiopathic TN cases. Glycerol rhizotomy does not prove to be a rational alternative to RF thermorhizotomy in patients with TN and MS because of a lower long-term rate of pain relief as well as uncontrollable and unpredictable sensory loss [28].

Percutaneous microcompression is another alternative for the treatment of TN [21]. According to Brown, the technique is best suited for elderly and medically infirm patients at greater risk for morbidity from a posterior fossa procedure, but can also be chosen for young patients without a trigeminal deficit who want a percutaneous procedure as well as for those who have previously undergone destructive procedures and do not have major dysesthesias [28]. Belber and Rak reported successful pain relief in multiple sclerosis patients with microcompression, including two bilateral cases [3]. These enthusiastic accounts will undoubtedly prompt much wider use of the method, but it does not presently seem to be the first-line percutaneous procedure for patients having TN with MS.

The presence of vascular compression in the posterior fossa has been proposed as a cause of TN in patients with MS, but this has not been a consistent finding [9]. Due to the known polycentric demyelinative nature of MS, open surgical intervention such as MVD to alleviate this compression may not be as effective as in the normal population [8]. In patients with MS, MVD alone usually fails to provide adequate pain relief, and exploration of the cerebellopontine angle should be combined with partial sectioning of the nerve [22]. When the efficacies of RF rhizotomy and MVD for the treatment of TN have been compared, similar rates of initial pain relief have been reported. On follow-up, the recurrence rates are lower than those of other percutaneous procedures, and similar to or slightly higher than those of MVD [2, 28]. Similarly, the recurrence rates after RF and MVD treatments were found to be similar in TN patients with MS [5, 8]. In our experience, RF rhizotomy was not inferior to MVD. In case of a failure, RF rhizotomy can be repeated easily and safely. When MVD fails, RF rhizotomy proves to be an effective second operation [27]. Thus, it seems wiser to put the less invasive treatment first in the surgical ladder. When major morbidity and mortality rates are considered, MVD creates a considerably higher risk for all patients in comparison with RF rhizotomy [2, 28].

External beam radiosurgery may be an alternative treatment for TN [19]. Although there have been promising reports, the follow-up period of these patients has been relatively short with respect to other surgical treatment alternatives. Moreover, the long-term recurrence rates and incidence of radiation-induced complications for radiosurgery are not exactly known. Finally, the radiosurgical treatment of TN costs much more than do percutaneous procedures.

Conclusion

During the last 25 years, we utilized all the currently accepted methods for surgical treatment of TN in our patients. We performed, 2,138 RF's, 82 MVD's, 17 glycerol rhizolysis, three CT guided trigeminal tractotomy-nucleotomies, one trigeminal DREZ-otomy, 15 alcohol neurolysis, and four peripheral neurectomies on idiopathic TN patients. We preferred to treat our MS patients having TN only with percutaneous controlled RF rhizotomies. We affirm that the most important considerations in treating TN must be safety and efficacy. With patients having systemic or CNS diseases, such as MS, the surgeon must be more cautious and less aggressive in the surgical management plan. Percutaneous procedures must be the first invasive treatment alternative, with RF rhizotomy as the first choice. This procedure is simple, safe, easily

repeatable and yet effective for patients having TN with MS.

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Comments

This work is an important contribution by the Turkish authors to demonstrate the usefulness and safety of the percutaneous RF-thermocoagulation for treating trigeminal neuralgia (TN) due to multiple sclerosis (MS).

In a series of 47 cases of TN secondary to MS (out of a personal total series of 1300 patients who had a trigeminal thermorhizotomy from 1973 to 1999) we obtained about the same results in terms of pain relief and recurrences.

Although we are very much in favour of the Microvascular Decompression technique for patients with idiopathic TN, at least for the younger ones (our series amount at 720 of those), we agree with Kanpolat and coworkers to prefer for MS patients a percutaneous method rather than an open approach. As a matter of fact we are not convinced that in MS patients a neurovascular conflict plays a significant role in pain genesis, and we do not see the interest – if not the justification – of using an open approach, even microsurgical, for doing a coagulation of the root.

Concerning the choice of the best percutaneous destructive technique to treat MS patients, in spite of our preference for using thermorhizotomy we still remain convinced that the best prodecure is the one the surgeon is used to perform currently.

Perhaps in the future, when neurosurgeons experencied with radiosurgery will have a sufficient follow-up, provided their results remain long-lasting without secondary side-effects, radioneurosurgery will take an important place in the lesioning armamentarium for TN due to MS.

Whatever the neurosurgical technique chosen, there is a general agreement among the neurological community to consider neurosurgery very helpful for patients with TN due to MS, the more so as medications at high doses usually increase the intensity of neurological disorders and generate severe asthenia.

My only objection to this paper is that some statements are without serious proofs and that data from the literature have been somewhat distorted by the authors to "affirm" that RF rhizotomy with best for everything.

Marc Sindou

I find this to be an interesting and important paper since for most of us who are dealing with trigeminal neuralgia, the MS patients with this symptom often present with special problems. The authors report on the very favourable outcome of RF rhizotomy in a relatively small series of MS patients. In a way, it is surprising that the results of the treatment are as good as in patients with idiopathic TN in spite of the fact that the MS patients suffer from a progressive disease which would be associated with a relatively higher incidence of recurrence.

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