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THE ROLE OF CRYOTHERAPY (CRYOANALGESIA) IN THE MANAGEMENT OF PAROXYSMAL TRIGEMINAL NEURALGIA: A SIX YEAR EXPERIENCE

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Summary. One hundred and forty-five patients with paroxysmal trigeminal neuralgia were treated with cryotherapy and followed up from 1 month up to 6 years. The mean nerve relief pain period was 13 months for the long buccal, 17 months for the mental and 20 months for the infra-orbital nerves and patients regained normal sensation long before the return of pain.

Introduction

Although paroxysmal trigeminal neuralgia (PTN) has been recognised for centuries the aetiology remains unknown; consequently there is no completely successful treatment.

Initial management is usually medical. Since Blom (1962) reported the efficacy of carbamazepine (*Tegretol*) it has become the drug of choice. Sillanpaa (1981) found it effective in 70 to 80% of cases. However, long term studies of carbamazepine are less encouraging. Taylor *et al.* (1981) studied 143 patients over a 16-year period and found that 56% were still controlled 2 months to 10 years later. Failures were due either to adverse effects or inadequate pain control.

Various surgical procedures are undertaken when medical treatment fails. Peripheral techniques include injection of alcohol; (Grant, 1936; Horrax & Poppen, 1935), phenol, streptomycin and lignocaine; (Sokolovic *et al.*, 1986), neurectomies; (Grantham & Segerberg, 1952), peripheral radiofrequency thermolysis; (Gregg & Small, 1986), and removal of jaw cavities (Ratner *et al.*, 1979).

Neurosurgery includes radiofrequency thermocoagulation of the trigeminal ganglion; (Mittal & Thomas, 1986), glycerol injection; (Lunsford & Bennett, 1984), posterior fossa surgery either microvascular decompression; (Jannetta, 1976) or partial rhizotomy; (Piatt & Wilkins, 1984). Unfortunately, as the recurrence rate falls so the mortality and morbidity rise. Many patients are unwilling, or medically unfit, to undergo major surgery. They are usually prepared to accept peripheral procedures to give relief. Most peripheral techniques have resulted in sensory loss, neuritis or neuroma formation and consequently, other methods were looked for. Lloyd *et al.* in 1976 first reported the use of cryoanalgesia (cryotherapy) in various forms of chronic facial pain. In 1981, Barnard *et al.* used it on 24 patients with PTN. These patients had a median relief period of 186 days and at the end of 1 year, 16% had full pain relief. Since 1978 cryotherapy for the relief of PTN has been used extensively at the Eastman Dental Hospital/Institute of Dental Surgery (Nally, 1984; Nally *et al.*, 1984; Zakrzewska *et al.*, 1986; Zakrzewska, 1987).

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Materials and methods

A total of 145 patients have been followed up from 1 month up to 6 years. Twenty-four were initially treated with the nitrous oxide system (BMS 40)* and the others with the liquid nitrogen system (DFS 30)*.

Of the 145 patients, 15 have been lost to follow up, 7 have died and 6 have had neurosurgery.

The group was made up of 88 females and 57 males. The majority were between 40 and 70 years of age at the time of onset of the disease (Fig. 1). In common with other series 57% of patients had pain on the right side, 41% on the left and 3% were bilateral. The right maxillary and mandibular divisions were the most frequently involved (Table I). Over 60% suffered pain for under 5 years. Only 2 patients had multiple sclerosis all others being idiopathic.

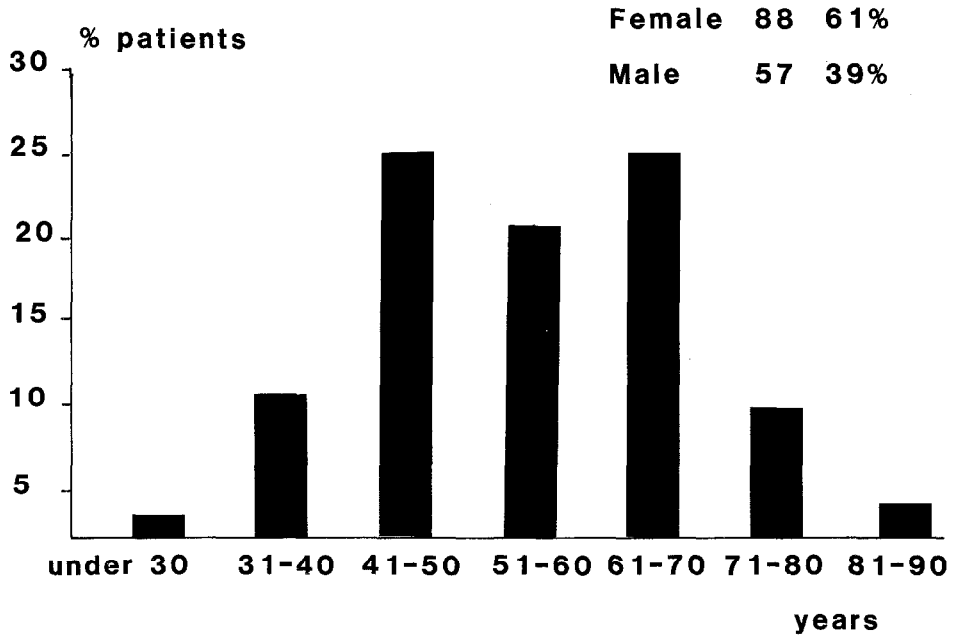

Fig. 1

Figure 1—Age of onset of disease.

Table I
Distribution of Pain in 145 Patients

Side	Total %	Nerve division V2	V3	V2+V3
Right	57	23	23	10
Left	41	19	12	10
Bilateral	3			

*Spembley Ltd., Guildford, Surrey.

The following diagnostic criteria were used:
Pain in the distribution of the trigeminal nerve.
Pain of 'electric shock', shooting or stabbing character of short duration.
Presence of trigger zones.
Paroxysmal pain with episodes of complete remission.
Pain provoked by innocuous stimuli, for example, light touch and vibration.
No objective sensory deficit on standard neurological examination.
Complete abolition of pain by a local anaesthetic injection into the trigger zone or by a regional block.
Symptomatic relief with a therapeutic trial of carbamazepine (*Tegretol*) or phenytoin (*Epanutin*).

Some patients also had features of mild atypical facial pain at the time of presentation. The pain control period was judged to have come to an end when the patient presented with PTN which necessitated the consistent use of carbamazepine 200 mgs t.d.s. for 2 weeks or equivalent dose of phenytoin. If this regimen was inadequate repeat cryotherapy was done.

Cryotherapy technique

Pain abolition, demonstrated by localised injections of a local anaesthetic solution determined which nerves required cryotherapy. Using intravenous sedation and local anaesthesia, the affected nerves were exposed by an intra-oral approach where possible. At any one session 1 to 3 nerves were frozen. Those treated included the infra-orbital, mental, long buccal, lingual, greater palatine and posterior-superior dental. Only two inferior dental nerves have been treated. The exposed nerve was frozen with the DFS 30 system with a thermostatically controlled temperature of −140°C. The cycle of a 2-min freeze followed by a 5-min thaw was performed three times taking care not to inflict a crush injury. Thirty-six nerves were treated using the BMS 40 system with temperatures of −60°C.

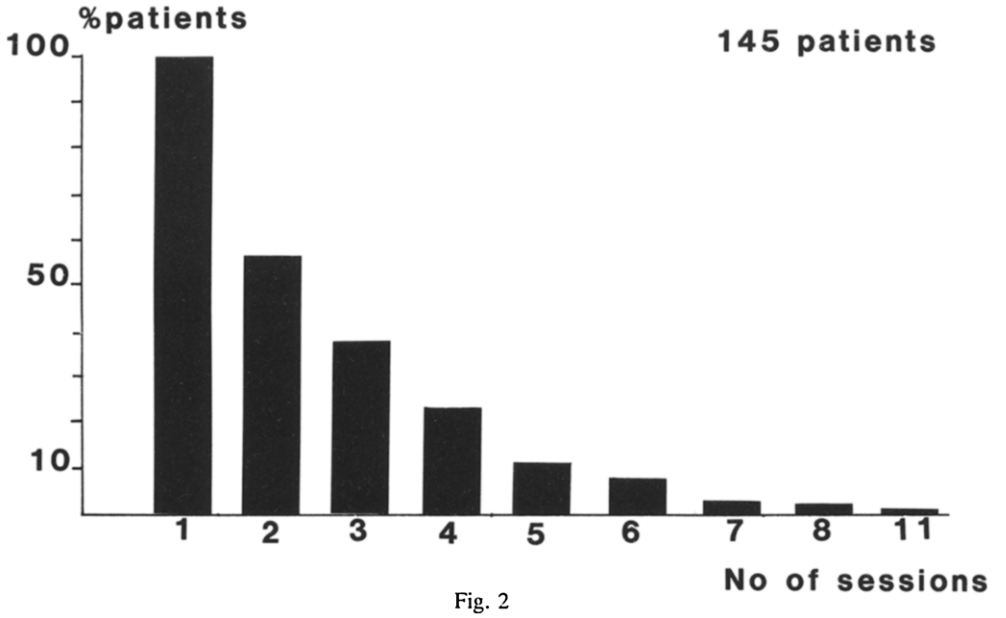

Fig. 2
Figure 2—Number of cryotherapy sessions per patient.

Results

A total of 145 patients underwent 348 cryotherapy sessions of which 56% had more than one session and one patient had 11 sessions (Fig. 2). A second session was required by 38% of patients due to migration of their pain. Most patients had immediate pain relief. The results were analysed using Kaplan-Meier survival tables. Although the results were calculated up to 6 years most patients had a recurrence by 48 months and these are illustrated in the figures. In each group analysed there were 1 or 2 patients who were still pain free at 6 years. When considering the total pain control period of patients it was found that at 1 year 27% were pain free. The mean time to recurrence was 10 months. These results are not an accurate assessment of cryotherapy of individual nerves because in 38% of

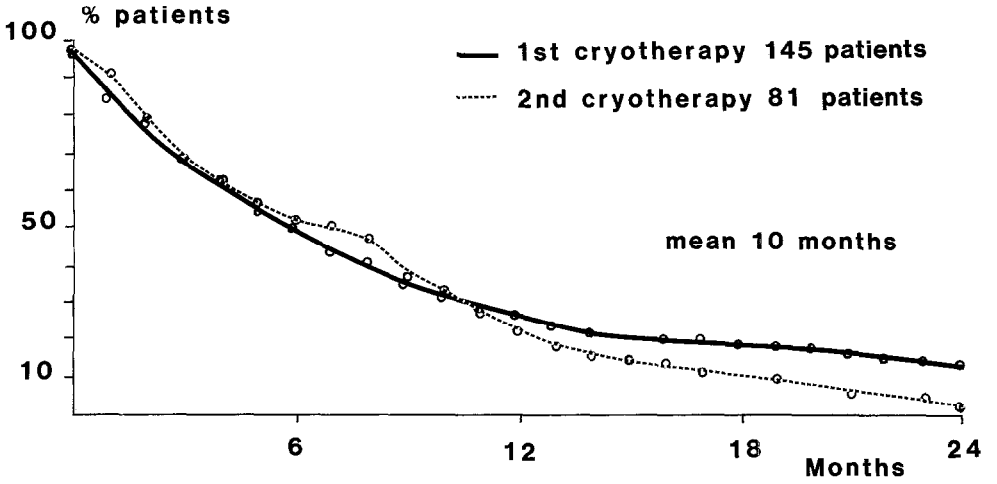

Fig. 3

Figure 3—Total pain control.

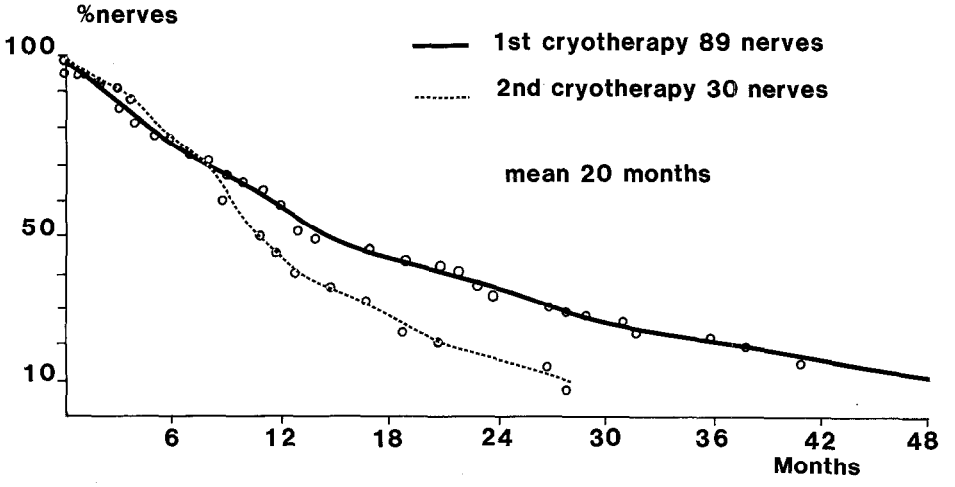

Fig. 4

Figure 4—Infraorbital nerve pain control period.

patients the outbreak of pain occurred in an entirely different nerve to the previously treated one. The 81 patients undergoing a second freeze had similar results (Fig. 3).

If one analysed individual nerves the results were more promising. Differences between a first or a second freeze were not significant. Eighty-nine infra-orbital nerves were treated and 30 of these underwent a second treatment. At 1 year 58% were pain free and the mean time to recurrence was 20 months (Fig. 4). The 85 mental nerves treated for the first time had a mean recurrence of 17 months and at 12 months 36% were pain free.

Forty-one underwent a second freeze and the results were similar (Fig. 5). Of the 66 long buccal nerves 45% were pain free at 1 year and the mean recurrence time was at 13 months. Of these 23 underwent a second freeze (Fig. 6).

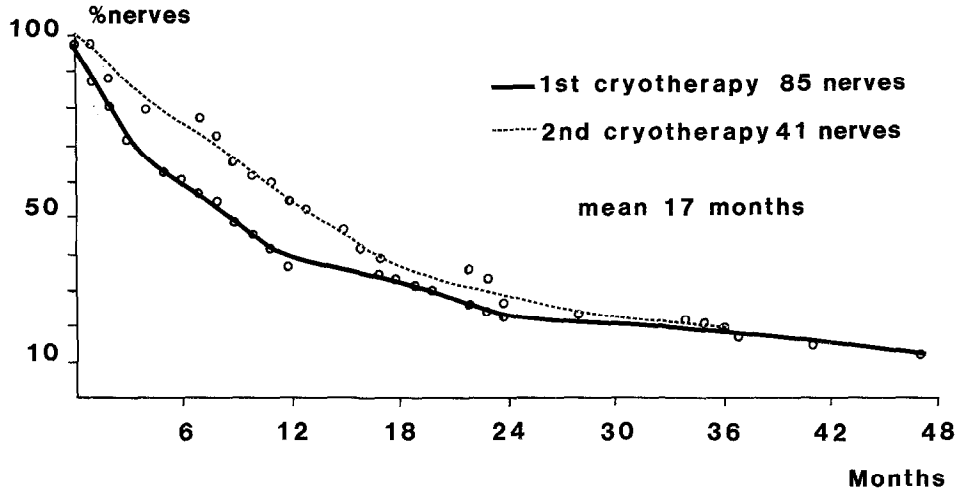

Fig. 5

Figure 5—Mental nerve pain control period.

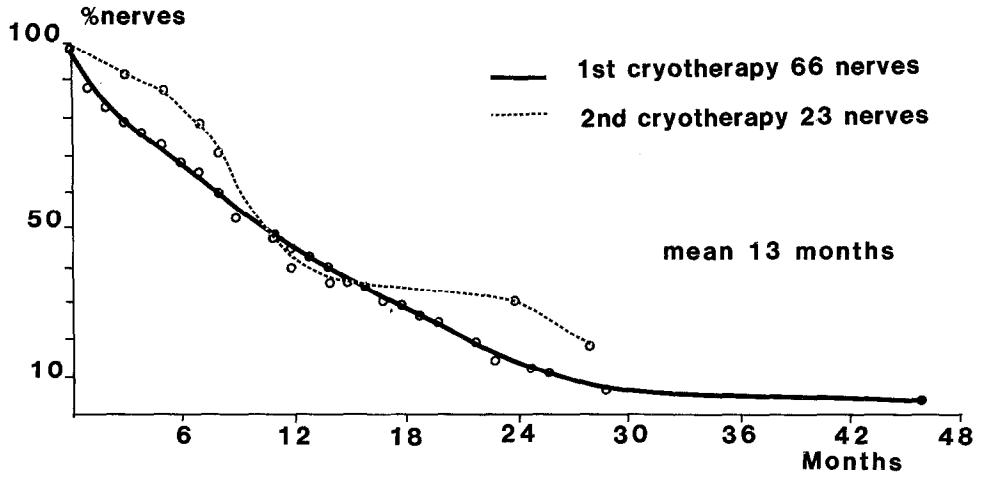

Fig. 6

Figure 6—Long buccal nerve pain control period.

Only 23 lingual nerves were treated and these were too few to analyse with any statistical significance. The result did not follow the same pattern and at 12 months 66% were pain free. The posterior superior dental nerve was not assessed as it was never identified and only a submucosal freeze was performed.

Using the BMS 40 system 36 nerves were treated; 14 were infra-orbital, 15 mental, 6 long buccal and 1 lingual nerves. Due to the small numbers the results are probably not statistically significant. In this group the recurrence time was found to be at 34 months for the infra-orbital, 28 months for the mental and 8.8 months for the long buccal nerves.

Sensation appeared to be clinically normal within 2 to 3 months. However, further investigations are currently being undertaken to determine objective sensory recovery.

Only 4% of patients developed local infections which necessitated antibiotic treatment. Forty % (58) described some form of facial pain which had no characteristics of PTN or anaesthesia dolorosa. The symptoms ranged from burning sensation, pins and needles to a dull ache and these have been labelled as mild atypical facial pain and many benefited from a short course of tricyclic antidepressants.

The post-operative requirements for carbamazepine in 128 patients varied: 39% came off all medication; 20% remained on 200 mgs or less; 27% took between 300 and 500 mgs of carbamazepine daily and 14% required over 600 mgs of carbamazepine daily. All patients were on reduced doses when compared with pre-operative levels.

Discussion

Although it is recognised that neurosurgery in the posterior fossa or on the Gasserian ganglion can give a longer remission in PTN there is still a place for peripheral techniques which have the important advantages of no mortality and low morbidity. Alcohol nerve injections are successful for 11 to 16 months (Grant, 1936; Horrax & Poppen, 1935). They are, however, painful to perform, result in sensory loss and may produce temporary nerve palsies (Horrax & Poppen, 1935). A second injection is rarely as successful as the first one. Peripheral neurectomies appear to give better results with relief ranging from 26.5 to 33.2 months (Grantham & Segerberg, 1952; Freemont & Millac, 1981). Invariably the technique results in sensory loss and neuroma and/or neuritis may also occur. Gregg *et al.* (1978) first reported the use of radiofrequency thermoneurolysis of peripheral nerves and have now followed up their patients for several years. Their latest results (Gregg & Small, 1986) report a recurrence rate of 68% at 1 year with an average effectiveness of 9.2 months. Sensory loss is less severe than in radiofrequency thermocoagulation of the Gasserian ganglion. However, the technique is complicated and requires specialised equipment.

Cryotherapy with its mean nerve relief period of 13 months for the long buccal, 17 months for the mental and 20 months for the infra-orbital nerves compares favourably with these techniques.

Any comparison between liquid nitrogen and nitrous oxide is impossible due to the small numbers who have undergone treatment with nitrous oxide. The nitrous oxide group appear to have a low recurrence rate which is not supported by other workers (Barnard *et al.*, 1981).

It must however be pointed out that 61% of patients remain on some form of medication after treatment. A study is now in progress to ascertain whether the

technique should be considered as an adjunct to drug therapy or whether it is effective in its own right. Patients are willing to undergo repeated cryotherapy and feel that the technique does improve the quality of their lives. The major advantage of cryotherapy lies in the fact that nerve damage is totally reversible as borne out both experimentally (Carter *et al.*, 1972; Whittaker, 1974; Barnard, 1980) and also clinically (Nally *et al.*, 1984; Barnard, 1980).

It would appear, therefore, that cryotherapy when correctly carried out can give unique results in the management of PTN and is particularly valuable in the earlier stages of the condition when high dose drug therapy is no longer adequate or is causing unacceptable side effects.

Acknowledgements

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