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# Controlled thermocoagulation in trigeminal neuralgia

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SUMMARY Results of 280 radiofrequency lesions on 229 patients with trigeminal neuralgia are presented with three months to eight years (average 3·8 years) follow up. The patients were aged from 18–91 years. There was a high overall success rate of 94%. The complication rate has been low, with sensory paraesthesiae the commonest (15%) and cranial nerve palsies very rare (2·4%) compared to other reported series.

Ever since Fallopius recognised the occurrence of trigeminal neuralgia, many investigators have studied this condition.[1] The trigeminal nerve and trigeminal neuralgia have been the subject of controversy up to the present.[2–4] Treatment with drugs,[5] various percutaneous procedures such as injections of alcohol,[6] boiling water,[7] phenol,[8] glycerol,[9–11] as well as radiofrequency lesioning[12] and different surgical techniques[13–15] have been commonly employed for the treatment of trigeminal neuralgia.

At the National Hospitals for Nervous Diseases, controlled thermocoagulation of the trigeminal ganglion using a radiofrequency generator has been the principal form of treatment for trigeminal neuralgia after failure of drug treatment since 1977. In this paper we present the experience with this procedure from 1977 to 1985.

## Material and methods

*Patients*

During the years 1977 to 1985 at the National Hospitals, 247 patients were admitted with facial pain of trigeminal origin. Two hundred and twenty-nine of them were treated with thermocoagulation of the trigeminal ganglion. A total of 280 procedures were carried out. All the patients previously had had a trial drug treatment with carbamazepine and in many cases phenytoin in addition. The decision to recommend thermocoagulation of the trigeminal ganglion had been made when, either the drugs had failed to relieve the pain, or there had been serious side effects such as gastritis, tremors, ataxia, blurring of vision, allergic skin response and changes in haematological indices and liver function tests, or when after an initial good response, the pain recurred despite drug treatment. Several patients especially in the first year of this series had been treated previously with alcohol injections in the trigeminal ganglion or peripheral trigeminal nerve avulsions such as supraorbital and infraorbital nerve avulsions. Dental extractions had also been undertaken in many patients. But, as the results of thermocoagulation became known, this procedure superceded alcohol injection and nerve avulsion. Eighteen patients, who had been referred for this procedure, did not proceed to thermocoagulation of the trigeminal ganglion, either because the diagnosis of trigeminal neuralgia was in doubt, or because the patient decided to continue drug treatment and declined thermocoagulation.

The majority of patients (77%) belonged to sixth, seventh and eighth decades. The youngest patient was aged 18 years and the oldest patient 91 years. Average age was 60·5 years (table 1). There was a slight preponderance of females, 141 (57·1%), over males, 106 (42·9%).

In this series the most common anatomical distribution of pain was in the maxillary and mandibular divisions together (table 2). Pain in the distribution of maxillary division was the commonest distribution in a single division followed by the mandibular. Right sided facial pain was a little more common (57%) than the left side (43%). The incidence of bilateral trigeminal neuralgia in this series was 2·8%.

Duration of pain prior to the procedure varied from 3 months to 32 years. However, the majority of the patients

Table 1 *Age and sex of patients*

| *Age groups (yr)* | *No of patients* |
|---|---|
| 11–20 | 1 |
| 21–30 | 5 |
| 31–40 | 9 |
| 41–50 | 34 |
| 51–60 | 56 |
| 61–70 | 87 |
| 71–80 | 47 |
| 81–90 | 7 |
| 91–100 | 1 |
| Female | 141 (57·1%) |
| Male | 106 (42·9%) |
| Total | 247 |

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Table 2 *Distribution of trigeminal nerve involvement*

| *Divisions* | *No of patients* | *Percentage* |
|---|---|---|
| I | 17 | 7 |
| II | 57 | 22 |
| III | 41 | 16 |
| I & II | 45 | 18 |
| II & III | 72 | 28 |
| I, II & III | 22 | 9 |
| Right side | 144 | 57 |
| Left side | 110 | 43 |
| Bilateral | 7 | 2·8 |

I: Ophthalmic; II: Maxillary; III: Mandibular.

Table 3 *Duration of pain (three patients of bilateral "tic" had different times of onset)*

| *Age groups (yr)* | *No of patients* | *Percentage* |
|---|---|---|
| 1 | 12 | 5 |
| 1–5 | 113 | 45 |
| 6–10 | 66 | 26 |
| 11–15 | 34 | 14 |
| 16–20 | 14 | 6 |
| 21–25 | 4 | 1·5 |
| 26–30 | 5 | 2 |
| 31 | 2 | 0·8 |

Table 4 *Secondary trigeminal neuralgia*

| *Cause* | *No of patients* |
|---|---|
| 1. Multiple sclerosis | 13 |
| 2. Tumours & space occupying lesions | 7 |
| Meningioma—suprasellar | 1 |
| —tentorial | 1 |
| Cerebello-pontine angle | 1 |
| Astrocytoma temporal lobe | 1 |
| Pituitary tumour | 1 |
| Acromegaly | 1 |
| Internal carotid artery aneurysm | 1 |
| 3. Post-herpetic neuralgia | 5 |
| 4. Syringomyelia/bulbia | 1 |
| Total | 26 (10·5%) |

(72·5%) had pain of one to ten years duration. Average duration of pain was 7·5 years (table 3).

In the majority of the cases the pain was diagnosed as idiopathic trigeminal neuralgia (89·5%). In 26 cases (10·5%), the trigeminal pain was secondary to a known cause, for example multiple sclerosis (table 4). Cases where a clinical diagnosis of atypical facial pain was made were not submitted to thermocoagulation.

*Technique*

The anterior approach to the foramen ovale was used as described by Hartel.[16] Sweet and Wepsic[17] originally described the method of controlled thermocoagulation which has two advantages. Firstly, it is a very high frequency energy source that can be precisely controlled and in addition, by incorporating a thermistor in the tip of the probe, the heat production can be accurately monitored. These two factors give a much greater control of the size of the lesion produced, but to gain full advantage from this greater control it is necessary to be able to change the patient's conscious level between full alertness and anaesthesia at various times during the procedure. The anaesthetic technique for sedation and anaesthesia has been described earlier.[18]

## Results

The patients were assessed after operation and at the time of discharge from the hospital. They were examined again after three months, as out-patients. They were asked directly about the degree of pain relief, the extent of numbness of the face, and about any abnormal sensory symptoms or any symptoms of anaesthesia dolorosa. On examination, corneal sensation as well as touch and pain sensation over the face were tested and evidence of eye infection was looked for. Any evidence of involvement of other cranial nerves was recorded. All the patients with absent corneal reflex were given paraffin eye drops and instructed to protect the eye against dust by wearing spectacles with a protective eye shield.

Out of a total of 280 procedures, 254 brought about satisfactory relief (table 5). Twenty-five patients (9%) either had no relief or were relieved for a few days only. Of them nine patients had a repeat procedure and showed good relief of pain. Thus, overall relief was obtained in 263 (94%) procedures. There was one death in this series. This patient was a 66-year-old female who had had excision of a right temporal lobe astrocytoma in 1941 followed by radiotherapy post-operatively. Thirty-eight years later she was admitted with right sided pain in the mandibular division of 6–7 years duration. She was blind with bilateral optic atrophy. Thermocoagulation of the right trigeminal ganglion was performed in October 1979. She did not regain consciousness after the procedure. CT scan revealed diffuse intracranial haemorrhage on the right side with bleeding in the right lateral ventricle. She remained unconscious and died 19 days later. Necropsy was not performed.

For the assessment of long term results in this study, a questionnaire was circulated to the patients, who were provided with a stamped addressed envelope for return of the completed form. The following questions were asked:—

1. Are you free of facial pain? .... Yes/No
2. If not, when did the pain recur?
3. What treatment are you taking for the pain?
4. Is one side of your face (or part of that) numb? .... Yes/No

Table 5 *Early results*

| | *No of procedures* | *Percentage* | |
|---|---|---|---|
| No relief | 15 | 5·4 | 5 repeated with good relief |
| Few days' relief | 10 | 3·6 | 4 repeated with good relief |
| Satisfactory relief | 254 | 90·7 | |
| Death | 1 | 0·3 | |

Table 6 *Final results of 280 procedures*

| | *Number* | *Percentage* |
|---|---|---|
| Satisfactory relief for more than 1 year | 246 | 88 |
| Relief for less than 1 year | 17 | 6 |
| No relief or relief for a few days only | 17 | 6 |

Table 7 *Distribution of sensory impairment following thermocoagulation for trigeminal neuralgia*

| *Divisions of V nerve* | *Site of pain (%)* | *Sensory impairment after thermocoagulation (%)* |
|---|---|---|
| II | 77 | 78 |
| III | 53 | 75 |
| I | 34 | 34·5 |
| Nil | — | 7 |

I: Ophthalmic; II: Maxillary; III: Mandibular.

5. If yes, what part of your face?
   (a) around the eye
   (b) cheek, nose, upper lip
   (c) chin, lower lip
6. Are there any complaints such as burning sensation etc.? .... Yes/No
7. If yes, what are they and for how long have you had them?
8. Is the eye on the operated side all right? .... Yes/No
9. If not, describe the condition of your eye.
10. Is there anything else you would like to inform us of?

Nearly all the patients replied (93·3%). Seven patients have moved without leaving any fowarding address. Sixteen patients were found to have died due to intercurrent causes, but their relatives completed and returned the questionnaires.

The patients had a follow up of between 3 months to 8 years (average 3·8 years). Successful outcome was observed in 88% of the thermocoagulation (table 6). Seventeen patients (6%) had a satisfactory relief initially but the pain recurred within a year. Seventeen patients (6%) had either a short-lived relief or no relief at all. This includes a single death in this series which has been described earlier. Overall successful outcome was, therefore, observed in 94% procedures.

Post-operative sensory impairment on the side of trigeminal neuralgia varied from patient to patient depending upon the distribution of the original pain. Since more often the pain was present in more than one division and with maximum involvement of maxillary division, the sensory loss was also observed to be more common in this division (78%), followed by mandibular (75%) and ophthalmic divisions (34·5%). The sensory impairment over the face diminished in severity and extent with time. A smaller number of patients (7%) had no sensory impairment (table 7).

*Complications (table 8)*

Twenty-two patients (8·9%) complained of anaesthesia dolorosa and fifteen (6·1%) had moderately severe sensory paraesthesiae. Ten (4%) had corneal ulcers and eye infections such as repeated conjuctivitis and iritis. Six patients (2·4%) developed cranial nerve palsies, two had motor V palsy, two had VI nerve palsy, one had V, VI and VII nerve palsy and one developed deafness due to VIII nerve involvement. One patient developed generalised seizures during the procedure and sustained a fracture of the humerus. One death due to intracranial haemorrhage has been referred to earlier. Apart from these significant complications, 28 patients reported minor symptoms such as tingling, altered sensation, discomfort, soreness, burning tongue, itching, ringing in the ear, nasal stuffiness, trophic changes in the nasal septum and pain in the temporo-mandibular joint. However, they were not distressed by these complaints and were doing their normal work.

## Discussion

The theoretical rationale of controlled trigeminal thermocoagulation is based on experimental studies which indicate that noxious stimuli are conducted by the small A delta and C fibres and that, as Letcher and Goldring demonstrated in cats, the effect of radiofrequency current and heat is first on small A delta and C fibres before the larger myelinated A alpha and beta fibres are affected.[19] Although there is no histological confirmation that the larger

Table 8 *Complications*

| | | *No of patients* | *Percentage* |
|---|---|---|---|
| 1. | Anaesthesia dolorosa | 22 | 8·9 |
| 2. | Sensory paraesthesia | 15 | 6·1 |
| 3. | Eye infections (corneal ulcer, conjunctivitis, iritis) | 10 | 4 |
| 4. | Cranial nerves involvement | 6 | 2·4 |
| | motor V | 2 | |
| | VI | 2 | |
| | V, VI, VII | 1 | |
| | VIII | 1 | |
| 5. | Epilepsy & fracture humerus | 1 | 0·3 |
| 6. | Intracranial haemorrhage & death | 1 | 0·3 |

Table 9 *Comparative analysis of the results*

| | | *Present series 1985 (247 cases)* | *Tew et al*[23] *1977 (400 cases)* | *Sweet et al*[17] *1974 (274 cases)* |
|---|---|---|---|---|
| 1. | Follow up, years | 3 mon–8 yrs (mean 3·8) | 4 | 4 |
| 2. | Recurrence | 21% | 14% | 22% |
| 3. | Relief of pain | 94% | 98% | 91% |
| 4. | Mortality | <1% (1 case) | 0 | 0 |
| 5. | Corneal ulcer | 4% | 20% | not reported, one blind |
| 6. | Facial palsy | <1% (1 case) | 0 | 0 |
| 7. | Ocular palsy | 1% | 2% | 0 |
| 8. | Motor V palsy | 1% | 22% | 43% |
| 9. | Sensory paraesthesia & anaesthesia dolorosa | 15% | 19·3% | 3% |

myelinated fibres are preserved in patients subjected to percutaneous thermocoagulation, the experience of Sweet and others clearly indicates that a complete loss of pain perception can be produced while touch is preserved.[20]

Percutaneous thermocoagulation of the Gasserian ganglion in patients with trigeminal neuralgia has several advantages. It is safe and well tolerated. It can be used in any age group and in patients with other illnesses which might contra-indicate a craniectomy. The patient has a very brief hospitalisation and it is easily repeatable if needed. This technique has achieved wide spread acceptance and continues to be used extensively up to the present time.[21–23]

Table 9 compares the results of our series with two others. The pain recurs in one-fifth of the patients. Tew *et al* achieved relief of pain in 98% of the cases. Our series had 94% relief of pain. There is very low mortality and little morbidity associated with this procedure. The incidence of corneal ulcer in our series is low. This is despite the fact that the incidence of pain involving ophthalmic division (alone or associated with other divisions) in our series was 34% compared with 21% in Tew *et al*'s series. Similarly the incidence of motor V nerve palsy in our series is very low (1%) compared with others (22% and 43%). Paraesthesia and anaesthesia dolorosa are the principal adverse side-effects of trigeminal thermocoagulation. Although many patients readily adjust as the paresthesiae diminish with time, some patients continue to be disabled by them.

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