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CLINICAL PAPER

Peripheral Neurectomy: Minimally Invasive Surgical Modality for Trigeminal Neuralgia in Indian Population: A Retrospective Analysis of 20 Cases

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Abstract
Objective To evaluate the efficacy of peripheral neurectomy in 20 cases of trigeminal neuralgia as minimally invasive surgical treatment modality.
Materials and methods Twenty (12 males and 8 females) patients with trigeminal neuralgia aged between 35 and 68 years (mean 48 years), who had undergone peripheral neurectomy, were retrospectively analyzed for relief of pain, complications, recurrence of pain, and any additional procedure required to treat recurrence, in a follow-up period of 36 months postoperatively.
Results There was no significant intra-operative and post-operative complications. There was recurrence of pain in two patients (10 %) in 24 and 28 months post-operative follow-up respectively, whereas, rest of the 18 patients were symptom free during 36 months follow-up.
Conclusion Peripheral neurectomy is one of the minimally invasive and expeditious forms of surgical modality for the treatment of trigeminal neuralgia. This treatment option is cost effective and provides long term relief from neuralgic pain.

Keywords Trigeminal neuralgia · Neurectomy · Tic douloureux · Facial pain

Introduction

Trigeminal nerve is fifth cranial nerve, and responsible for sensation of the face including certain motor functions. It has three major branches the ophthalmic nerve (V1), the maxillary nerve (V2), and the mandibular nerve (V3). The ophthalmic and maxillary nerves are purely sensory. The mandibular nerve has both sensory and motor functions. It transmits sensory sensation to the face, oral, and nasal cavities and most of the scalp and carries motor supply to the muscles of mastication. Those diseases which involve the nerve can cause trigeminal neuralgia (TGN) or loss of sensory or motor function in the distribution of the nerve. It can cause sharp shooting intense pain along its distribution. Neuropathy can affect the nerve from its origin in brainstem to its peripheral branches. John Fothergill gave the first full and accurate description of trigeminal neuralgia in 1773, also called as Fothergill's disease [1]. As per his study the most common cause is vascular compression of superior cerebellar artery, sometimes an inflammatory condition like meningitis can also cause trigeminal neuralgia [2]. Usually treatment is initiated with a conservative modality including carbamazepine, but daily dose has to go on increasing as the years pass with no relief. When conservative modality fails to provide relief, then surgical treatments are advocated to relieve the excruciating neuralgic pain. Numerous surgical procedures are mentioned for TGN [3]. The aim of our study is to investigate the efficacy of peripheral neurectomy, and to evaluate the results obtained by this procedure in terms of reduction of pain and recurrence of neuralgic pain if any, for a period of 36 months post-operatively.

Materials and Methods

Retrospective analysis of 20 patients (12 males and 8 females) aged between 35 and 68 years (mean 48 years), with trigeminal neuralgia, who underwent peripheral neurectomy from June 2004 to July 2007 were carried out

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Table 1 Post operative result of peripheral neurectomy among 20 patient

Sl. no	Age	Sex	Side	Nerve involved	Follow up period (months)	Result
1	40	M	Right	Inferior alveolar	36	Good
2	56	F	Right	Infra orbital	36	Good
3	36	M	Right	Inferior alveolar	36	Good
4	42	M	Right	Inferior alveolar	36	Good
5	48	M	Right	Infra orbital	36	Good
6	56	F	Left	Inferior alveolar	36	Good
7	58	F	Right	Inferior alveolar	36	Good
8	36	M	Right	Infra orbital	36	Good
9	40	M	Right	Inferior alveolar	36	Good
10	65	M	Left	Infra orbital	36	Good
11	47	F	Right	Supraorbital	36	Good
12	39	M	Left	Inferior alveolar	36	Good
13	35	F	Right	Inferior alveolar	24	Fair
14	68	M	Left	Infraorbital	36	Good
15	62	M	Right	Inferior alveolar	28	Fair
16	40	F	Left	Infraorbital	36	Good
17	49	M	Right	Inferior alveolar	36	Good
18	37	F	Left	Inferior alveolar	36	Good
19	36	F	Right	Inferior alveolar	36	Good
20	68	M	Left	Infra orbital	36	Good

(Table 1). The diagnosis was based on a detailed clinical, medical history and clinical examination. All these patients were taking Tab Carbamazepine (average 600–800 mg/day) for 2–3 years. The branches of nerve involved was identified according to the site of pain and confirmed by diagnostic block with 2 % Lignocaine (Table 2). All patients were investigated pre-operatively with OPG/computerized tomography scanning (CT scan) or magnetic resonance imaging (MRI), to check any underlying structural abnormality. Informed written consent was obtained from all the patients for peripheral neurectomy of the involved branch of the trigeminal nerve. Intra and post-operative complications, relief and recurrence of pain, in case of recurrence, if any, additional procedure to be used or not, were noted during the 36 months follow-up period.

Table 2 Involved branches of trigeminal nerve among 20 patients

S. no	Branch involved	Total	Percentage
1	Inferior alveolar	12	60
2	Infra orbital nerve	7	35
3	Supra orbital	1	5

Inclusion Criteria

All patients of either gender, presenting with the features of trigeminal neuralgia, especially those having persistent pain even after conservative treatment or intolerance to tab carbamazepine such as nausea, drowsiness or fatigue and those who could not afford the cost of the drug were selected for peripheral neurectomy.

Exclusion Criteria

1. The patients below 35 years.
2. Previously treated cases with neurectomy.
3. Patients unfit for local and general anesthesia.

The surgical techniques used were as follow:

1. Infra orbital neurectomy—Infra orbital nerve was approached through intra oral vestibular incision under local anesthesia with adrenaline 1:200,000 (Fig. 1A). Mucoperiosteal flap was reflected, infra orbital foramen was visualized and infra orbital nerve and its peripheral branches were identified, dissected and avulsed from the soft tissues and from the infra orbital canal by reeling on hemostat (Fig. 1B, C). Foramen was blocked by bone wax (Fig. 1D). Layerwise suturing was done.
2. Inferior alveolar nerve was approached intra orally by Dr Ginwalla's incision [4]. Supra periosteal dissection was done. Neurovascular bundle was identified, dissected, ligated and transected. Vestibular incision in premolar region was placed; the mental nerve was identified, dissected and avulsed from the mental foramen and from the soft tissues. Avulsion of inferior alveolar nerve was done from the distal end. Mental foramen was blocked by bone wax. Layer wise suturing was done. Procedure was performed under general anesthesia.
3. Supra orbital nerve was approached extra-orally by upper eyebrow incision, the nerve was identified and peripheral neurectomy was performed by avulsing the nerve. Supraorbital foramen was blocked by bone wax and layerwise suturing done. This procedure was performed under local anesthesia.

Post-operative antibiotics and anti inflammatory medications were prescribed for 5–7 days. The patients were reviewed post-operatively on 2nd day, 7th day, 1 and 6 month, up to 36 months. The outcome and complications were assessed in terms of relief of pain, recurrences of pain (if any), need of any additional procedure required to control recurrent pain. The complications specifically sought were infection at the site of operation, bleeding,

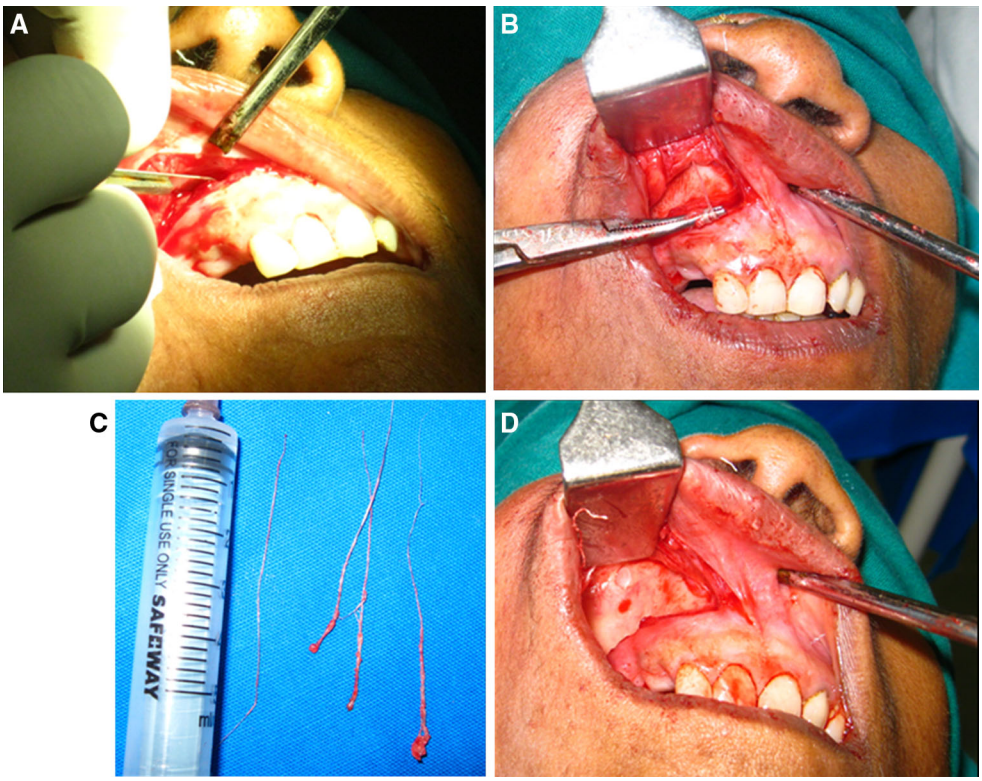

Fig. 1 Right infraorbital neurectomy; **A** vestibular incision, **B** exposure and dissection of infraorbital nerve branches, **C** avulsed branches of right infraorbital nerve, **D** right infraorbital foramen blocked with bone wax

suture dehiscence, recurrence of neuralgic pain. They were graded as good, fair and poor.

- Good when there was no recurrence of pain,
- Fair when there was recurrence of pain after certain period of time
- Poor when there was no improvement in pain episodes even after neurectomy.

Results

Twenty patients (12 males and 8 females) age ranging from 35 to 68 years, suffering from TGN, underwent 20 neurectomies (12 inferior alveolar nerve, 7 infraorbital nerve and 1 supraorbital nerve). Twelve inferior alveolar neurectomies were done under general anaesthesia and the other 7 infraorbital and 1 supraorbital neurectomies were performed under local anaesthesia. The third division (inferior alveolar) was most commonly affected by the disease, in 12 patients (60 %). The second division (infra orbital) was afflicted in 7 patients (35 %), first division (supraorbital) was involved in only one patient (5 %). Right side was affected in 13 patients (65 %), and left side in 7 patients (35 %). The total follow-up period was 36 months. There were no intra-operative or post-operative complications. None of the patients had postoperative infection, suture dehiscence and hematoma.

All patients were relieved from neuralgic pain and had discontinued the medications. Only 2 patients (10 %) revealed recurrence of neuralgic pain after a period of 24 and 28 months respectively. In these cases, one patient responded well to carbamazepine 200 mg 8 hourly, whereas other was referred to neurosurgeon for microvascular decompression as there was no response to medication.

Discussion

Trigeminal neuralgia, also known as tic douloureux or Fothergill disease, is a clinical syndrome distinguished by brief paroxysms of unilateral lancinating facial pain that is characteristically triggered by cutaneous stimuli, such as a breeze on the face, chewing, talking, or brushing of teeth [5–7]. Many of those who are affected experience multiple attacks daily and, although they are free of pain between attacks, they live in constant fear of recurrences [7]. Various non-surgical and surgical treatment modalities are available in literature; however most of the authors agree

that the management of TGN should begin gradually from pharmacological therapy to very invasive, intracranial procedures [4, 7–10]. Currently available surgical options include various noninvasive and invasive techniques such as:

1. Non-invasive technique
   (a) Peripheral neurectomy,
   (b) Alcohol injections,
   (c) Cryotherapy,
   (d) Selective radio frequency thermocoagulation
2. Invasive technique
   (a) Open: microvascular decompression,
   (b) Percutaneous:
      (i) Radiofrequency rhizotomy,
      (ii) Retrogasserian glycerol rhizotomy,
      (iii) Balloon compression of trigeminal nerve,
      (iv) Sterostatic radiosurgery—Gamma knife [11].

Any treatment of idiopathic neuralgia is successful as long as it eliminates the pain [12, 13]. Surgical intervention is required, if pharmacological or other non-invasive procedures are unsuccessful in controlling the neuralgic pain [13–16]. Injections of alcohol nerve block are also considered as minimally invasive procedures but they can cause local edema, risk of recurrent pain combined with moderate risk of dysaesthesia and necrosis of the surrounding tissues [14]. As per our experience, neurectomy of the peripheral branches of the trigeminal nerve is the simplest, safest and minimally invasive surgical method. Craniotomy and neurosurgical procedures are costly, skillful, highly invasive, available at select centers, and have more rate of mortality and morbidity.

Peripheral neurectomy is the most simple, expeditious and minimally invasive surgical modality available for the treatment of TGN. Most of the studies done for neurectomy were published 20–50 years ago [17, 18]. Quinn [19] reported a retrospective case series of 63 patients with 112 neurectomies. A follow-up period of 0–9 years was noted, and the pain relief period of 24–32 months was reported. Grantham [17] also reported on 55 patients who had 55 neurectomies, follow-up was for 6 months to 8 years. Average pain relief period was 33.2 months.

In our analysis, the surgical access to the infraorbital and inferior alveolar nerve is intra orally, as we consider this access to be better, primarily due to avoidance of post-operative facial scars. Some authors use trans-facial access to the V2 division [20, 21] mostly to minimize post-operative wound and edema.

Several authors discuss the number of repeated neurectomies of peripheral divisions of the trigeminal nerve [3]. In our series, there were 2 cases of recurrence of neuralgic pain after a period of 24 months in one patient and 28 months in another patient. Both were prescribed carbamazepine 200 mg 8 hourly following which the symptoms were relieved in one patient and the other patient was further referred to neurosurgeon for microvascular decompression. Some authors state that the response of the patients to low doses of carbamazepine when the recurrence of pain appears is better after neurectomy [3, 18]. There were no major complications of these procedures other than some facial swelling, trismus and bruising in the early post-operative period which concurred with other studies [18].

Conclusion

In orofacial region, trigeminal neuralgia is the most common neuralgic cause of facial pain. Accurate diagnosis and initiation of low dose carbamazepine, with upward titration to relieve pain is the first step in the treatment of TGN. Surgery is advised for the patients whose pain is refractory to drug therapy or adverse effect sufficient to mandate drug cessation. In our series, 80 % of patients had excellent pain relief lasting 36 months without any medication post-operatively.

Peripheral neurectomies are having minimal chances of recurrence of neuralgic pain over period of time. Loss of sensation along the branch of the trigeminal nerve is one of disadvantage. This is one of the minimally invasive forms of surgery, well tolerated by the patient and can be done-under local anesthesia to curb the expenses, especially in developing country like ours. Peripheral neurectomy is an acceptable surgical procedure which is more expeditious, economical and less morbid. With the limitations of small sample size and short term follow-up in our series, long term studies with large sample size are required to authenticate the results.

Conflict of interest None declared.

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