Trigeminal nerve peripheral branch phenol/glycerol injections for tic douloureux

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Object. Trigeminal neuralgia or tic douloureux is a disease affecting older individuals, and thus, office-based “minimally invasive” therapy is inherently attractive. The author sought to determine whether injection of peripheral trigeminal branches with neurolytic solutions offers a simple, less invasive therapy, with low risk for patients with one- or two-division trigeminal neuralgia that is unresponsive to pharmacotherapy.

Methods. This retrospective study focused on a review of case charts from 18 patients treated for tic douloureux. Sixty injections of 10% phenol in glycerol were given to the 18 patients, six of whom had undergone other neurosurgical procedures. The median patient age was 74 years, ranging from 36 to 94 years. There were nine women and nine men. Forty-six injections were administered into the infraorbital nerve in its canal in the midface, 11 percutaneous injections were administered into the mandibular nerve just proximal to the mandibular canal in the ramus of the jaw, and three injections were administered into supraorbital nerves. Eighty-seven percent of injections brought marked or total relief initially. Of those injections that provided initial relief, 37% still provided relief after 1 year and 30% after 2 years, with relief lasting for a median of 9 months after each injection. Most patients whose pain recurred after months of relief requested a repeated procedure, rather than undergo a ganglion nerve block procedure or open surgery. There were no serious complications or dysesthetic pain. Facial sensory loss generally recovered within 6 months and was well tolerated.

Conclusions. Office-based injection of trigeminal branches is a useful technique for neurosurgeons who treat trigeminal neuralgia. It is easily repeated and can provide immediate pain relief of intermediate duration.

KEY WORDS • tic douloureux • trigeminal neuralgia • trigeminal branch injection

Tic douloureux is a disease that predominantly occurs in older individuals. It is characterized by lancinating and often repetitive bursts of severe pain in the territory of the trigeminal nerve and is almost always associated with a cutaneous zone from which pain can be triggered by even light sensory stimuli. Onset of the disease is rare in patients younger than 40 years of age except in those with multiple sclerosis or tumors, many of whose symptoms differ from “classic” tic douloureux by having an associated area of facial sensory loss. The most common age of onset is 40 to 60 years; however, it is not uncommon for years or even decades to pass before the initially brief episodes of pain become intractably severe or frequent and unresponsive to medication. A very large proportion of patients are in their eighth decade of life before they first seek neurosurgical intervention for their tic douloureux, and many patients this age or even older continue to seek neurosurgical assistance when their tic douloureux fails to respond to initial neurosurgical intervention or recurs after transient success.

Trigeminal neuralgia can affect either a single division or multiple divisions of the nerve.7 In single-division trigeminal neuralgia, the second or third division is more commonly involved (17% and 15% of cases, respectively). Involvement of all three divisions (17% of cases) or involvement of lower divisions simultaneously (32% of cases) is equally or more common. Isolated involvement of the first division and bilateral simultaneous involvement occur more rarely (4% and 1% of cases, respectively). Later development of contralateral trigeminal neuralgia is well known (5% of cases).8

Clinical Material and Methods

Using a retrospective chart review of patients treated by the author, a series of 18 patients with trigeminal neuralgia were identified as having undergone a total of 60 trigeminal nerve peripheral branch injections with 10% phenol in anhydrous glycerol. Inadequate follow-up review led to the exclusion of three other patients treated by this technique during the same time period. Follow-up information was obtained from personal encounters between patients and physicians (including attending neurosurgeons and neurologists as well as house staff) or nurse practitioners, as recorded in the patient’s medical record.

Fifteen patients suffered from refractory single-division trigeminal neuralgia and three from two-division trigeminal neuralgia. All patients received their initial injection treatment between 1988 and 1997. In each case, antineuralgia drug therapy had failed after having been escalated...
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to the point of intolerable side effects without control of the tic douloureux.

All patients were given a typed patient information sheet on which the range of available invasive neurosurgical treatment options for trigeminal neuralgia was described. After the patients had discussed the options with the neurosurgical staff, all requested peripheral branch injection as a treatment option because it was simpler than most of the other procedures, albeit with a more limited expected success rate and expected duration of relief. There were nine men and nine women in the study population. The median patient age was 74 years, ranging from 36 to 94 years, and including eight patients aged 81 to 94 years. Three patients suffered from severe cardiovascular disease. One patient who received long-term coumadin therapy was advised to stop taking the drug several days in advance of each injection; this was well tolerated.

All patients were treated in an office setting with no systemic sedation or analgesia, and all tolerated the procedure extremely well. Forty-six injections were made into the infraorbital nerve just within its canal in the midface; 11 injections were made percutaneously from behind the ramus of the jaw into the mandibular nerve just before it enters the mandibular canal on the medial aspect of the ramus of the jaw; and three injections were made into supraorbital nerves. Before phenol/glycerol injection, the patient’s nerve was carefully and incrementally anesthetized using 1% plain lidocaine followed by 0.5% bupivacaine (up to 3 ml total, usually given in equal aliquots). After the nerve had been completely anesthetized, 10% phenol in anhydrous glycerol was injected through a short 22-gauge needle. Injection volumes varied from 0.5 to 1 ml for infraorbital and supraorbital injections and from 0.75 to 1.5 ml for mandibular nerve injections. All patients were discharged home with their families immediately following the injection. The patients were advised to continue a therapeutic level of their antineuralgia medications until they were free of pain for a full week before beginning to taper medication usage.

Six of the 18 patients had undergone prior neurosurgical procedures for their tic douloureux, five on the ipsilateral and one on the contralateral side, and were experiencing severe recurrent or contralateral pain. One patient had undergone extensive contralateral gasserian ganglion radiofrequency lesioning several decades earlier, with permanent severe contralateral facial sensory loss in all three divisions. Because of his age and debility, office-based infraorbital nerve injection was elected rather than a gasserian ganglion nerve block injection or balloon compression treatment. Two patients developed recurrent pain following gasserian ganglion injection procedures and two others after posterior fossa neurovascular decompression. The sixth patient elected to undergo gasserian ganglion balloon compression after first enjoying 6 months and then 2 months of relief from two phenol/glycerol injections. When her pain recurred only 3 months after the balloon compression, she underwent a third phenol/glycerol injection; she was still free of pain when lost to follow-up review 32 months later.

Results

Fifty-two (87%) of the 60 injections produced immediate marked or total pain relief lasting for at least 24 hours. Of the eight injections (six patients) that failed to produce initial good relief, four also failed to provide lasting facial sensory loss and were considered to be failures of technique. Each of these four injections was followed by a repeated injection. Two of the repeated injections produced good sensory loss, but no pain relief, and two provided both good sensory loss and lasting pain relief. Two of the unsuccessful injections were given after, respectively, three and four successful injections that had provided progressively shorter periods of relief. Both of these injections produced good sensory loss but failed to provide pain relief. The four injections that failed to provide pain relief, despite good facial sensory loss in the expected distribution of that peripheral branch, were followed by gasserian ganglion balloon compression, in one case after no relief was obtained from infraorbital neurectomy.

Five patients received only a single peripheral branch phenol/glycerol injection; four of these patients obtained excellent long-term pain relief and one opted for balloon compression treatment when pain recurred. Ten patients received two to five injections each. The remaining three patients received six to nine injections each into one or two divisions over periods ranging from 4.5 to 6.5 years; all were free of pain at the time of the last follow-up contact (Fig. 1).

Fourteen (78%) of the 18 patients remained free of significant facial pain as of their last follow-up visit. Eight patients were not taking any antineuralgia medications. Three patients took occasional doses of carbamazepine or diphenylhydantoin of their own volition when they feared that occasional formications might erupt into pain, and three continued low doses of either carbamazepine or baclofen because of intermittent annoying paresthesias that had been present before injection therapy. Pain relief persisted in these 14 patients until they were lost to follow-up review after a median of 24 months following their last injection, and five remained free of pain when seen 36 months following injection. Six of the eight patients who were lost to follow-up, after being still relieved of pain 2 or more years following their last injection, had received more than one peripheral branch injection and had suffered pain relapses before receiving their long-lasting injection.

Of the 52 injections that produced initial pain relief, the median duration of pain relief was 9 months in patients available for follow-up review (Fig. 2). Thirty-seven percent of injections resulted in more than 1 year of pain relief before patients suffered pain relapse, and 30% of injections provided pain relief lasting for more than 2 years (Fig. 3).

There were no serious complications, and all patients tolerated the procedure extremely well in an office setting without the need for systemic sedation or analgesic medication. One patient was annoyed by a drooping left upper lip, which persisted for 3 months, and two patients experienced extensive ecchymosis, which was cosmetically offensive for 1 or 2 weeks. There were no instances of disfiguring soft-tissue necrosis, diplopia, lasting tongue numbness, painful dyesthesias, or anesthesia dolorosa. At least partial facial sensory awareness returned in nearly all patients between 3 and 12 months following injection. All patients tolerated the facial sensory loss that was pro-
duced. All but one patient who enjoyed pain relief for at least several months duration before suffering pain relapse opted for repeated peripheral branch injection, rather than the invasive neurosurgical options offered. These patients cited the ease, minimal discomfort, immediate relief, and effectiveness of the technique as the bases for their decisions.

**Discussion**

The technique of administering trigeminal peripheral branch injections, usually using absolute alcohol, has been well described in standard neurosurgical texts. I prefer to use 10% phenol in anhydrous glycerol for these injections because the injections seem less painful to the patient and because the more viscous solution seems to stay more localized in the vicinity of the nerve and does not spread as widely across the face, thus reducing the likelihood of soft-tissue necrosis. I also prefer to use a percutaneous retromandibular injection technique to treat the mandibular nerve. In my practice, this has been technically successful, and it obviates the need for injecting through the mouth, which at times can be technically challenging in older and more uncooperative patients.

The modern-day role of trigeminal peripheral branch ablative procedures for the treatment of tic douloureux is somewhat controversial. Two chapters specifically address the treatment of trigeminal neuralgia in the work by North and Levey. This volume presents the report of a consensus conference on pain management sponsored by the AANS/CNS Section on Pain. Burchiel and Burgess discuss three techniques for the surgical management of trigeminal neuralgia that they consider to be "currently the main stays of surgical therapy: trigeminal gangliolysis, microvascular decompression of the trigeminal nerve and peripheral trigeminal neurectomy"; the authors reiterate this by stating that, "there are many other surgical options for patients with trigeminal neuralgia [but] these simply reflect the most commonly performed at present."

Even more forcefully, both peripheral branch neurectomy and peripheral branch injection therapy are dismissed by Apfelbaum. Apfelbaum's opinion, which he included in this chapter despite some contrary discussion from his audience, is as follows:

The most peripheral procedures likewise are rarely used nowadays, but for different reasons. Although they are generally considered safe, the duration of effectiveness is short, usually less than a year, and repetition results in even shorter periods of relief. In addition, with a larger degree of denervation produced by peripheral nerve destruction, more numbness occurs than with other destructive procedures. Patients often find this unpleasant. Peripheral denervation also is accompanied by a higher incidence of dysesthesic sensations than more centrally performed ablative procedures. Thus, division or avulsion of one or more branches of the trigeminal nerve, or destruction with caustic chemoneurolytic agents like alcohol or phenol is rarely the procedure of choice. An exception to this would be the rare elderly or infirm patient with isolated first division tic douloureux [sic] in whom a peripheral de-innervation might be offered in an attempt to produce pain relief without risking corneal sensation and secondary keratitis.

**Fig. 1.** Flow chart showing outcomes of trigeminal nerve peripheral branch injections in individual patients. Three patients had two-division trigeminal neuralgia, two of whom required injection in both divisions.
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The results of the present series refute some of Appelbaum's statements. In a number of my patients, second injections provided the patients with even more long-lasting relief than their first injections. None of my patients experienced permanent sensory loss and all tolerated the limited area of temporary sensory loss very well. Some of my patients who were relieved of severe neuralgic pains continued to experience minor formations or annoying paresthesias, but none developed painful dysesthesias or anesthesia dolorosa (which seem most likely to develop following dense radiofrequency trigeminal lesions). The value of the injection procedure and its acceptance by patients is emphasized by the fact that most of my patients who experienced recurrence of trigeminal neuralgia pain after a few months of relief opted for a repeated peripheral branch injection administered during an office visit. They eschewed the other invasive neurological options that were offered, even though many of the other options offered a better chance of a longer duration of relief.

Within a year after the consensus conference an alternative opinion was offered by Murali and Rovit regarding the value of peripheral trigeminal nerve surgical resection. They reviewed 40 patients with peripheral trigeminal neurectomies who were treated over a decade: five with ophthalmic, 14 with maxillary, one with mandibular, and 20 with pain in two adjacent areas. Twenty-eight of their patients had developed recurrent pain after prior radiofrequency gangliolysis. Twenty-eight of their patients had developed recurrent pain after a median of 9 months of relief, it is notable that one third of these injections provided patients with pain relief lasting longer than 1 year. Seven (39%) of the 18 patients, who had received a total of 19 injections, were still free of pain more than 2 years after their last injection. Four of the eight patients who enjoyed more than 1 year of relief had originally suffered pain relapses after shorter periods of relief provided by earlier phenol/glycerol injections into the same peripheral branch. Four of the eight injections that failed to provide initially good pain relief also failed to produce good sensory loss and were considered to be technical failures. There were no serious complications in this series and only a few instances of minor and annoying formations or paresthesias. Patients generally recovered facial sensory loss within 6 months, even though pain relief often persisted, and localized sensory loss was well tolerated by all patients. The procedure was sufficiently...
well tolerated that nearly all patients who obtained a sustained period of relief following one injection requested a repeated injection at the time of pain recurrence rather than proceeding to a surgical peripheral neurectomy, a gasserian ganglion compression, or a posterior fossa operative procedure.

When the procedures of peripheral trigeminal branch phenol/glycerol or alcohol injection were discussed at a meeting of the New England Neurosurgical Society (June 1997), it was noteworthy that several older neurosurgeons reported that they still use these techniques in their office practice and continue to find them valuable, but many of the younger neurosurgeons seemed unaware that these procedures existed.

**Conclusions**

Trigeminal nerve peripheral branch phenol/glycerol injection offers a simple, office-based neurosurgical option for treating intractable and pharmacologically unresponsive trigeminal neuralgia. This procedure is especially attractive for elderly or debilitated patients with single-division tic douloureux.

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**References**


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