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Postherpetic Craniofacial Dysaesthesiae: Their Management by Stereotaxic Trigeminal Nucleotomy

By

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With 3 Figures

Postherpetic craniofacial neuralgias present a real challenge to neurosurgery. Facial involvement occurs in about 15% of all postherpetic neuralgias (Stookey and Ransohoff 1959), making this site second only in frequency to the trunk. Although any portion of the head or face can be involved (Engström and Wohlfart 1949), the most commonly affected area is the territory served by the ophthalmic division of the fifth nerve (Tatlow 1952).

Postherpetic painful phenomena have certain peculiar characteristics (Noordenbos 1959, 1972). They do not occur in cases of shingles without sensory loss. There is no exception to this. However, they do not occur in all cases with sensory loss, but only in a few of them. Nevertheless, the dysaesthesiae are more intense as the sensory loss is greater. These spontaneous sensations closely resemble those arising from areas denervated by other causes, and they can probably be equated with other deafferentation states.

Therefore, further attempts at interruption of the primary afferent neuron at any level are unlikely to be successful. Indeed, this is the common experience (Stookey and Ransohoff 1959, White and Sweet 1969). Nevertheless, they sometimes remove the hyperaesthesia or the hyperpathia (Hitchcock and Schvarcz 1972), but on the other hand they can intensify the deep background pain. This also holds true for postherpetic neuralgia in other places (Schvarcz 1976). Curiously enough, more central attacks on mesencephalic, diencephalic, or telencephalic structures have also been disappointing (Cassinari and Pagni 1969, White and Sweet 1969).

Hitchcock first performed a stereotaxic trigeminal tractotomy in 1968, and in 1970 reported seven cases with intractable facial pain. Crue has independently developed an almost similar technique, reporting in 1970 six such cases (Crue *et al.* 1970, Todd *et al.* 1969). More recently, Fox (1972) has introduced a percutaneous approach. I have used the technique described here since 1971 (Schvarcz 1972), emphasizing the importance of lesioning the oral pole of subnucleus caudalis in certain cases of facial central pain (Schvarcz 1974, 1975, 1977).

In 1972 Hitchcock and I reported three patients with postherpetic ophthalmic neuralgia who had undergone this procedure (Hitchcock and Schvarcz 1972). The results were satisfactory, and warranted further exploration. Six additional cases of craniofacial postherpetic dysaesthesiae, out of a series of 94 consecutive stereotaxic trigeminal nucleotomies, are now reported.

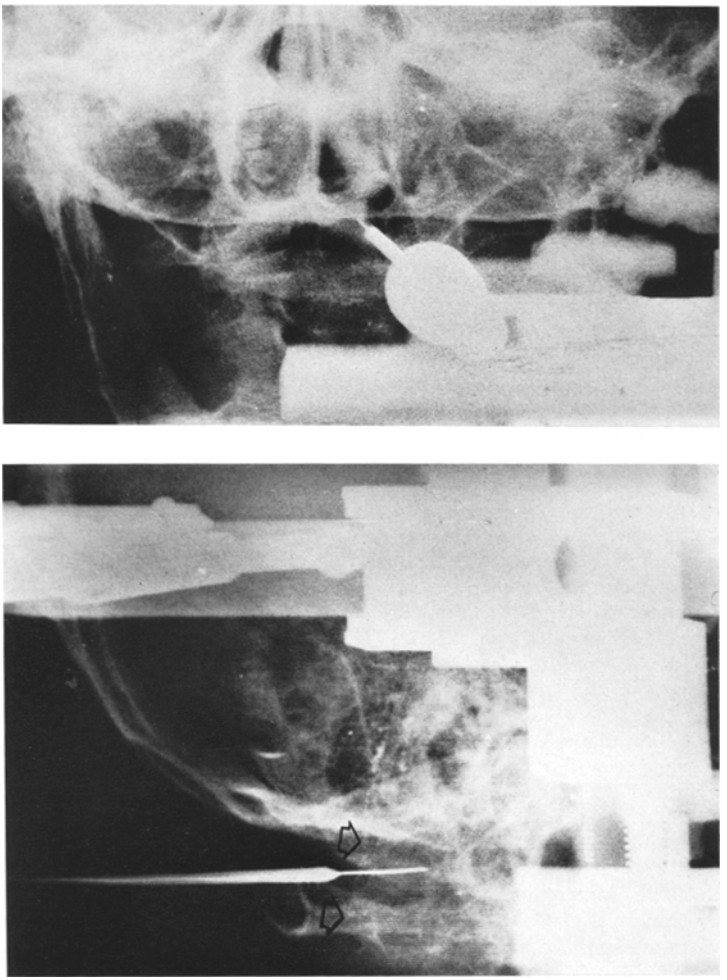
Material and Methods

All patients were operated on under local anaesthesia, using a modified Hitchcock apparatus, with the head fully flexed within the stereotaxic frame and holder, thus reducing the mobility of the cord (Hitchcock 1972, Schvarcz 1974). The midline of the odontoid process was assumed to lie over the midline of the spinal cord, provided there was no rotation. The spinal cord was outlined with positive contrast (Pantopaque or Conray in CSF) injected by cisternal puncture, and its dorsal border was then used as a baseline for target construction. The spinal cord was approached through the atlanto-occipital interspace, by a posterior route, with an external cannula which was advanced until CSF was aspirated. Tungsten electrodes of 0.5 mm diameter were used, with a 2 mm bare end and the tip electrolytically sharpened (Figs. 1 and 2).

Coordinates for the mandibular division are 3 mm ventral to the dorsal aspect of the cord and 6 mm lateral to the midline. For the ophthalmic division, they are 5 mm in front of the dorsal border and 7.5 mm lateral. Maxillary fibers lie in between. The seventh, ninth, and tenth nerves component is located medially and dorsally to the mandibular division, between it and the cuneatus (Fig. 3).

However, physiological corroboration of the target placement is considered mandatory. The impedance changes indicated cord contact and penetration, and whether this was complete. So far, electrical stimulation gave the most valuable surgical information, while depth recordings were less practical. Radiofrequency lesions were fractionally produced, while checking the quality and extent of the sensory changes.

Six patients were operated on. All had ophthalmic zona, one with an additional second cervical and auricular involvement. They all suffered severe, incapacitating dysaesthesiae, with both hyperpathia and deep burning pain. Their pain histories ranged between 8 and



Figs. 1 and 2. Anteroposterior and lateral radiographs with the electrode in place. Arrows: Dorsal border of the spinal cord

24 months. All had received extensive medical treatment, including carbamazepine and tricyclic antidepressants, without improvement. Two had trigeminal alcohol injections performed elsewere. These had

failed, and indeed added a dysaesthesic component of the previously unaffected second and third divisions in one case.

The hyperpathia was relieved, and the deep pain was eliminated or markedly reduced in all cases. None of them required analgesics. The follow up period was 6 months in one case, ranged between 12 and 24 months in 3 cases, and was between 24 and 30 months in the remaining 2. A longer time, however, is required for evaluating late failures. Facial touch sensation and the corneal reflex were always preserved. Although slight contralateral hypalgesia, due to encroachment on the spinothalamic tract, sometimes accompanied destructions of the ophthalmic area of the fifth nerve, there were no other side effects whatsoever.

Case Report

This 70 years old patient developed pain immediately after a second cervical, auricular, and ophthalmic herpes zoster attack, in February 1974. On admission, nine months later, she had hyperpathia and deep burning pain over the whole second cervical dermatome as well as in the ear and, with less intensity, in the ophthalmic area of the fifth nerve. The pain was severe and unresponsive to medical treatment, confining her to bed in darkness, with the right side of her face protected from draughts or touch. There was no other neurological deficit except hypaesthesia over the scarred second cervical, seventh, ninth, tenth, and ophthalmic nerves distribution.

In November 1974 a stereotaxic trigeminal nucleotomy was performed. A target 3 mm in front of the dorsal aspect of the cord and 5.5 mm from the midline was selected and approached by a posterior suboccipital track. With placement of the electrode, she complained of pain deep inside the ear. Stimulation with 1 msec pulses, 50 Hz, 0.5 v, produced a feeling like electricity in the caudal trigeminal dermatome and in the ear. This spread to the throat with 0.75 v and to the right side of the tongue with 1 v. A lesion was therefore made at target and at a point 0.5 mm beyond, where the stimulation responses were similar. Although no sensory loss could be demonstrated, the hyperpathia was abolished and it was possible to touch and rub the affected area. The patient stated that her deep burning pain was also relieved. At a point 2 mm beyond the target stimulalation with 50 Hz, 0.5 v, produced paraesthesia over the right frontal region. Stimulation 3 mm beyond the target with 0.5 v produced paraesthesiae in the left leg, and with 1 v these spread to the ophthalmic area. This was regarded as the result of stimulation of the lumbosacral segments of the spinothalamic tract. The electrode was therefore withdrawn to a point 2 mm beyond the target, and another lesion was made. At the end of this procedure, there was slight hypalgesia over the whole right side of the face, down to and including the second cervical dermatome.

Two days later, the hypalgesia and thermanalgesia were more evident and were also demonstrable intraorally, but the corneal reflex and facial touch sensation were preserved. There was no other neurological deficit, and the patient was pain free.

Reviewed in January 1976, she had neither hyperpathia nor deep pain. Nevertheless, to direct questioning she admitted some occasional dull sore sensations which, however, did not require any medication. The sensory loss remained unchanged.

Discussion

Postherpetic craniofacial dysaesthesiae are difficult to manage. Standard techniques have yielded unsatisfactory results, whether they were directed to the primary afferent neuron or to the central connections (Stookey and Ransohoff 1959, Cassinari and Pagni 1969, White and Sweet 1969).

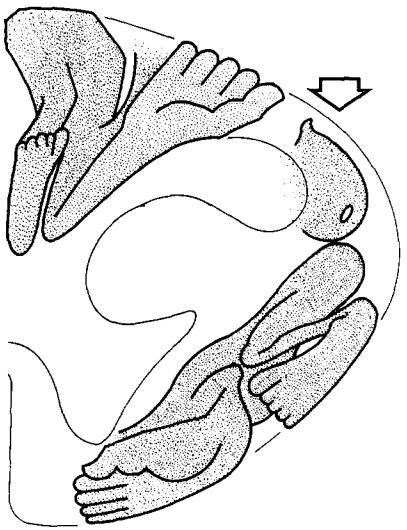


Fig. 3. Somatotopic organization of the high cervical cord, in the light of stimulation data. The arrow indicates the trigeminal region, which is centred at 6.5 mm from the midline and at 4 mm from the dorsal border of the cord, between the dorsal column homunculus and the spinothalamic homunculus

The curious intractability of postherpetic facial dysaesthesiae may be related to their pathological mechanism as well as to the particular organization of the descending trigeminal complex.

The inflammatory lesions, which were first described by Head and Campbell (1900), have been amply confirmed since (Lhermitte and Vermes 1930, Denny Brown *et al.* 1944). They affect the sensory ganglia, the entry zone of the root, and the posterior horn and, although they can have a widespread distribution, they are more prominent in those segments related to the cutaneous eruption. Furthermore, Perier *et al.* (1964) have demonstrated a somatotopic involvement of both the descending trigeminal tract and nucleus.

Stereotaxic trigeminal nucleotomy shares some of the features of open tractotomy, but has some of its own (Schvarcz 1974, 1975).

As the nucleus caudalis represents the substantia gelatinosa, the postulates of Melzack and Wall's (1965) theory could also be applied to it. Hassler and Bak (1970) have shown the ultrastructure of synapses of A δ and C fibres and their circuit arrangement, as well as axo-axonal contacts (Westrum and Black 1968), which represent the anatomical substrate of presynaptic inhibition (Darian Smith and Yokota 1966). There is an extensive overlap between facial and high cervical afferents in the nucleus caudalis, which is a nodal point. Indeed, Kerr has demonstrated convergence of both on a single trigeminal neuron (Kerr 1961, Kerr and Olafson 1961). This overlapping is clinically demonstrated by the facility with which analgesia and thermanalgesia are obtained over the whole fifth, seventh, ninth, and tenth nerves distribution, down to and including the second cervical dermatome (Hitchcock 1970, Schvarcz 1975). There are also important connections between the nuclear masses, which form a polysynaptic ascending intranuclear pathway (Stewart *et al.* 1964). The quantitative importance of C fibres have been further clarified by Young and King (1973).

Noordenbos (1959) has strongly emphasized the importance of the postherpetic sensory loss, demonstrating that in such cases the fibre loss is predominantly in the A δ range, with the C fibres preserved, a situation that he has named "fibre dissociation syndrome" (Noordenbos 1972). Black (1970) has impressively demonstrated that deafferentation by retrogasserian rhizotomy was gradually followed by hyperactivity of the nucleus caudalis, which was similar to that of an experimental epileptogenic focus. Furthermore, simple teeth removal produced localized spots of hyperactivity, with prolonged after-discharges following peripheral stimulation (Black 1970, Anderson *et al.* 1971). Similar changes have also been reported by Loeser *et al.* (1967, 1968) in other chronically isolated neuronal populations of the spinal cord.

All the previous data point to the significance of the nucleus caudalis attack. We attribute particular importance to the destruction of its oral pole, which probably acts on the pathology site, removes the pool of neuronal hyperexcitability, eliminates convergence, and severs the ascending intranuclear polysynaptic pathways. The results of this nuclear lesion are in contrast to those of open trigeminal tractotomy which has failed to alleviate postherpetic painful phenomena (Kunc 1970).

Stereotaxic nucleotomy resulted in abolition of the hyperpathia and disappearance of, or marked reduction in, the deep background pain. Postherpetic neuralgias of extensive distribution, such as the Ramsay Hunt syndrome or the occipitocervical forms, can be dealt

with by a single lesion. Furthermore, troublesome anaesthesia is avoided, and both the corneal reflex and facial touch sensation are preserved.

Trigeminal nucleotomy is a safe and reasonably simple stereotaxic procedure, which allows accurate target placement by electrophysiological control prior to lesion making. It seems to be, for the time being, the procedure of choice for postherpetic craniofacial dysaesthesiae.

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