Surgery of the pterygopalatine fossa

II. Surgery for facial pain

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SUMMARY

The anatomy and surgery of the neural contents of the pterygopalatine fossa are discussed. Indications for surgery are: Section of the maxillary nerve in intractable secondary neuralgias of that nerve, and cluster headaches, not responsive to the usual forms of therapy, in which extirpation of the pterygopalatine ganglion may provide relief.

INTRODUCTION

In a previous paper (Wentges, 1972) the vascular contents of the pterygopalatine fossa and their surgery have been discussed. In the present paper the neural contents will be reviewed, following which indications for, and the technique of, surgery for the relief of facial pain will be described. In a later issue of "Rhinology", the technique of, and indications for vidian neurectomy for vasomotor rhinitis will be discussed.

ANATOMY

The neural contents of the pterygopalatine fossa are situated in a plane dorsal to the vascular contents. All the sensory nerves are derived from the second division of the trigeminal nerve, whilst the autonomic fibers enter via the pterygoid canal from the pterygoid (vidian) nerve. The sensory and autonomic fibers intermingle in the pterygopalatine (Meckel's) ganglion and from there spread to the various structures which they supply. As a consequence, most, if not all, nerves in the pterygopalatine fossa should be considered as mixed nerves, containing sensory, parasympathetic, and sympathetic fibers. A possible exception might be the infraorbital nerve (Lammers, 1972).

It should be stressed that, just as with the vascular contents of the fossa, the neural elements are subject to considerable anatomical variation. Although occasionally a nice triangular or stellate ganglion, as depicted in most anatomy books, is seen, generally a criss-cross of fibers is found, arranged against the posterior wall of the pterygopalatine fossa.

The maxillary nerve, i.e. the second division of the trigeminal nerve, emerges from the foramen rotundum, which is situated cranial and medial in the posterosuperior wall of the fossa (Fig. 1). It crosses the fossa in a lateral and ventral

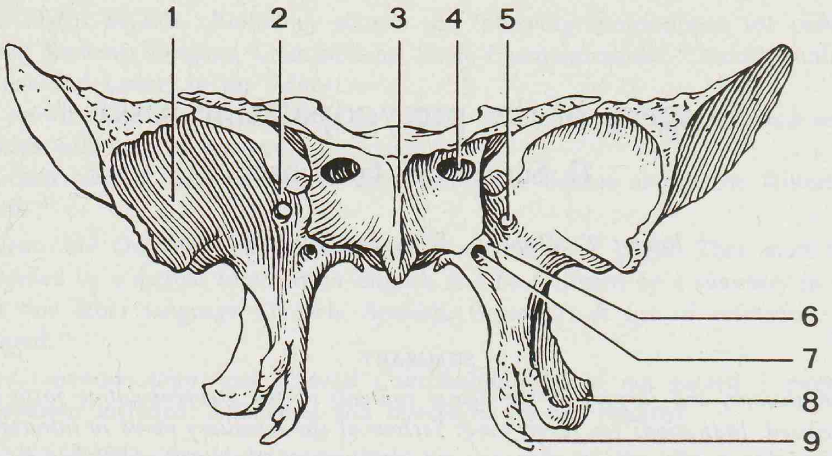

Figure 1. The sphenoid, ventral aspect.
1. facies orbitalis, 2. facies maxillaris, 3. sphenoidal crest, 4. ostium of the sphenoidal sinus, 5. foramen rotundum, 6. ridge between foramen rotundum and vidian canal, 7. vidian canal, 8. lateral wing of the pterygoid process, 9. medial wing of the pterygoid process with hamulus pterygoideus.

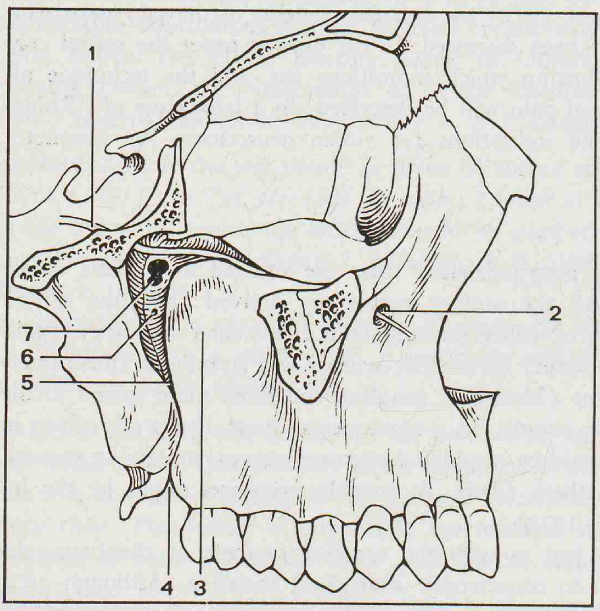

Figure 2. The right pterygopalatine fossa and the course of the maxillary nerve, lateral aspect. The zygoma, part of the sphenoid and the lateral orbital wall have been removed.
1. maxillary nerve, 2. infraorbital nerve, 3. tuber maxillae, 4. greater palatine foramen, 5. greater palatine canal, 6. connection with the inferior meatus, 7. sphenopalatine foramen.

direction towards the infraorbital sulcus in the anterior wall of the fossa. From this point the maxillary nerve is called the infraorbital nerve (Fig. 2). It crosses the floor of the orbit and emerges from the infraorbital foramen at the cranial border of the canine fossa and innervates the skin on the lateral side of the nose,

the upper lip, the cheek and the inferior eyelid, and also the upper incisors and the canine by means of middle and anterior superior alveolar branches.
During its course in the pterygopalatine fossa the maxillary nerve gives off several branches, the most important of which are:

1. *The pterygopalatine nerves* run close to or through the ganglion in a caudal direction, after which their fibers join the sphenopalatine artery and run a medial course through the sphenopalatine foramen. Here they divide into lateral branches, which supply the lateral wall of the nasal cavity, and medial branches, which cross the roof of the nose, and supply the septum. The most important septal branch is the nasopalatine nerve, which also supplies the anterior palatal mucosa via the incisive canal.

2. *The greater and lesser palatine nerves* are also derived from the pterygopalatine nerves. They run a course in a caudal direction and leave the fossa via the greater and lesser palatine canals. They innervate the mucosa of the hard palate and the soft palate respectively.

3. *The pharyngeal nerve* is a quite small branch, running through the palatovaginal canal and supplying the mucosa near the orifice of the Eustachian tube.

4. *The orbital branches,* which are supposed to innervate the periosteum of the orbit and the lining of some ethmoidal cells. Possibly they also send some secretory fibers towards the lacrimal gland.

5. *The zygomatic nerve.* This nerve leaves the fossa through the inferior orbital fissure and divides into a zygomaticotemporal and zygomaticofacial branch. The zygomatic nerve anastomoses with the lacrimal nerve and in this way takes autonomic fibers to the lacrimal gland.

INDICATIONS FOR SECTION OF THE MAXILLARY NERVE

1. *Trigeminal neuralgia (tic douloureux)* confined to the second division of the trigeminal nerve. This is a well-known clinical entity. The pain occurs in attacks lasting only a few seconds, and has a stabbing, excruciating character. The age of onset is generally the sixth or seventh decade of life. The pain usually starts in the second, but sometimes in the third division of the trigeminal nerve; there are typical trigger areas.
A revolutionary change in the treatment of this disease has taken place by the introduction of carbamezapine (Tegretol). The great majority of patients are relieved by the administration of this drug. In patients unresponsive to this form of therapy or those who develop untoward side-effects, sensory root section in the middle fossa is generally performed with good results.
In patients with trigeminal neuralgia confined to the maxillary nerve, peripheral division at the foramen rotundum via a transantral approach could be considered; however, it appears that the pain recurs 18-24 months after section (Golding-Wood, 1971). With this limitation in mind, the procedure might exceptionally find a place in therapy.

2. *Persistent neuralgia of the maxillary nerve.*

Continuous pain in the area supplied by the maxillary nerve can occur after Caldwell-Luc operations or any other form of trauma. If other causes of this pain (dental neuralgias, nasal abnormalities) have been excluded, maxillary nerve section will provide relief in most patients.

A block of the pterygopalatine fossa should be performed before operation. This serves two purposes: firstly one can check whether the pain really is abolished by blocking of the maxillary nerve — if this is not the case operation is, of course, useless; secondly the patient is made aware of the anaesthesia that will be caused by the nerve section. Infiltration of the pterygopalatine fossa can be done in several ways:

1. External method: The needle is inserted 0,5 cm below the zygoma, with the teeth in occlusion, and directed around the posterior wall of the antrum towards the pterygopalatine fossa (Fig. 3). A full description of the technique of this injection can be found in most handbooks on oral surgery.

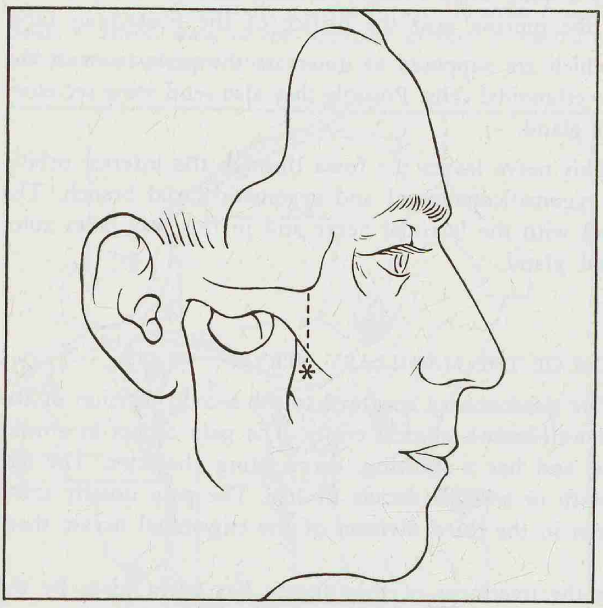

Figure 3. Infiltration of the pterygopalatine fossa by a lateral approach, point of insertion of the needle.

2. Transnasal method: The needle is introduced into the pterygopalatine fossa via the sphenopalatine foramen, which is found just posterior to the posterior tip of the middle turbinate. This technique has been very well described by Sluder (1920) (Fig. 4).

3. Transpalatine method: In our hands this has proved to be the simplest and the most reliable method. The pterygopalatine fossa is reached by way of the greater palatine foramen, which is found near the posterior border of the hard palate, just medial to the third molar tooth (Fig. 5). A small quantity of a suitable

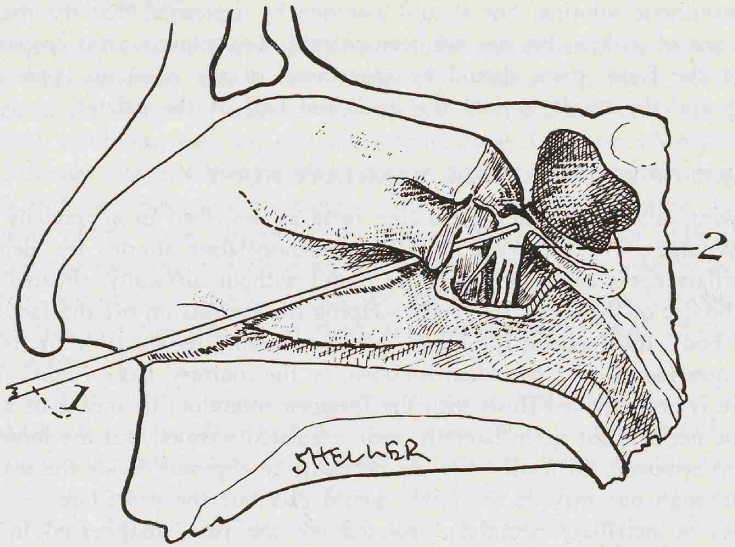

Figure 4. Transnasal injection of the pterygopalatine fossa (Sluder, 1920).

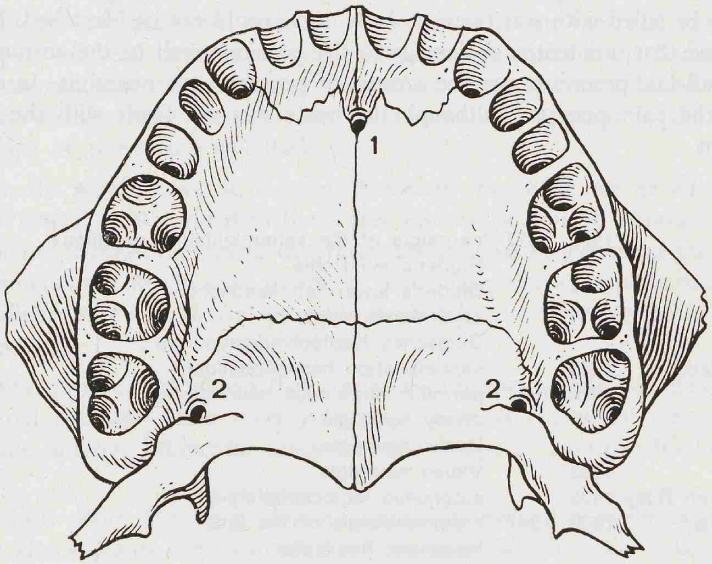

Figure 5. Transpalatine injection of the pterygopalatine fossa.
1. incisive foramen, 2. greater palatine foramen.

local anaesthetic is injected at the approximate site of the greater palatine foramen, after which the foramen is searched for with a slightly curved needle. The needle will follow the pterygopalatine canal, but should not be introduced much further than 3½ cm, otherwise the orbit might be entered. Before injecting 1 cc

of the anaesthetic solution, one should ascertain by aspiration that the maxillary artery or one of its branches has not been entered. Ten minutes after proper infiltration of the fossa, there should be anaesthesia of the nasal ala, part of the upper lip and the cheek, and of the ipsilateral half of the palate.

TECHNIQUE OF SECTION OF THE MAXILLARY NERVE

After having entered the pterygopalatine fossa as described in a previous publication (Wentges, 1972) the maxillary and sphenopalatine arteries are identified. The maxillary nerve can now usually be found without difficulty, situated at the superior border of the fossa. By gently scraping the periosteum off the face of the sphenoid body, the foramen rotundum, which is readily recognizable by its sharp edges, is now identified (the vidian foramen, on the contrary, has a funnel shape). The nerve is now divided flush with the foramen rotundum by means of a sickle knife. The nerve is cut again laterally with angulated scissors, and the loose piece of nerve is removed. Generally it is not necessary to clip and divide the maxillary artery, although one may do so if this would facilitate the procedure.

In 7 cases of maxillary neuralgia operated on, the pain disappeared in 3. In another 3 cases the posterior wall of the antrum had been opened during a previous Caldwell-Luc operation; as a consequence the pterygopalatine fossa was found to be filled with scar tissue and the nerve could not be identified. It should be stressed that unintentional damage to the posterior wall of the antrum during a Caldwell-Luc procedure may be a cause of postoperative neuralgia. In one case, finally, the pain persisted, although the nerve was cut flush with the foramen rotundum.

Sluder	1908, 1927	neuralgia of the sphenopalatine ganglion
		Sluder's syndrome
		Sluder's lower-half headache
Bing	1913	erythroprosopalgie
		Bingsches Kopfschmerzsyndrom
Valléry-Radot	1925	vasodilatation hémicéphalique
Harris	1926, 1937	periodic migrainous neuralgia
		ciliary neuralgia
		Harris neuralgia
Vail	1932	Vidian neuralgia
Brickner en Riley	1935	autonomic faciocephalalgia
Horton e.a.	1939, 1941	erythromelalgia of the face
		histaminic headache
		histamine cephalgia
		Horton syndrome
Kunkle	1952	cluster headache
Other terms:		Bing-Horton syndrome
		vascular headache
		algie faciale vasculosympathique
		petrosal neuralgia

Figure 6. Various terms in use for "cluster headaches".

CLUSTER HEADACHES

This syndrome has been described by many authors under as many names (Fig. 6). The patients generally give a very characteristic history: In nearly all cases they are men in the second or third decade of life, who are subject to attacks of excruciating, throbbing pain on one side of the face. The pain is localized in or behind the eye and in the supraorbital region. It may radiate to the maxilla, teeth and ear and sometimes to the occiput, to the neck and to the temple. The attacks are always of the same pattern in one patient. They very often start about two o'clock in the morning and recur nightly, always at the same time. Some patients also have one or more attacks during the daytime. The attacks last one hour on average although they can be as short as a quarter of an hour or can last for several hours.

The pain is intolerable when the patient is lying down, so that he has to get up and pace the room, often with his head in his hands; to witness such an attack is an impressive experience. The patient is virtually desperate; the face on the side of the pain is red; the conjunctiva is congested and the eye waters; the nose is blocked on the side of the pain and there is a copious watery rhinorrhea on that side; the temporal vessels may be dilated and sometimes dilatation of the pupil and sweating on the affected side are noted.

Many patients have their own methods of trying to alleviate the pain. One patient of ours puts his head under streaming cold water and sniffs it up. Some patients have discovered that compression of the carotid artery on the affected side may give some relief. Other patients sleep in a semi-erect position in the (usually false) hope of preventing an attack.

Typically, the attacks come in clusters. A patient may have one or more attacks daily for several weeks and then has a free interval of several months or even a year or more. It sometimes seems that there is a seasonal influence: in the majority of our patients the attacks tend to appear particularly during autumn and winter. Many patients state that alcohol provokes the attacks and have become involuntary teetotallers.

This clinical picture is so typical, that a well-taken history suffices for the diagnosis. Differential diagnosis from other syndromes, such as trigeminal neuralgia, migraine, the anterior ethmoidal syndrome and temporal arteritis should not be difficult.

There is little doubt that the syndrome is caused by distention of the facial vessels and this also explains the localization of the pain, which is not related to the neurological dermatomes of the face. However, knowledge of the arterial supply of the face easily explains its typical localization.

Consequently, the treatment which has proved successful in migraine, has also been tried in cluster headaches.

Ergotamine, either by injection during an attack or taken by mouth in a maintenance dosage may be successful. Cases, which are resistant to ergotamine, can be treated with methysergide (Deseril), but of course the risk of retroperitoneal

fibrosis after long-term therapy should be kept in mind. In exceptional cases Tegretol has been used successfully.

However, a considerable number of patients prove resistant to any form of medical treatment, and surgery may be considered for them. Extirpation of the pterygopalatine ganglion is performed on the supposition that vasodilatation takes place under the control of the sympathetic fibres which pass through this ganglion; it also is probable that pain impulses from superficial blood vessels pass through the pterygopalatine ganglion.

Little has been published on the results of pterygopalatine surgery in cases of cluster headaches.

	No. of patients	Free of pain	Improved	Unsuccessful	Recurrence
Sewall 1937	2	1	0	1	0
Meyer e.a. 1970	13	2	4	2	5
Montgomery e.a. 1970	4	3	1	0	?
Golding-Wood 1972	6	6	0	0	1
Wentges 1972	6*	2	2	2	0

* 7 pterygopalatine fossas, 6 patients. One patient was operated on the right side, whereupon the attacks disappeared completely, only to return after five months on the left side. After extirpation of the left pterygopalatine ganglion the patient has now been free of pain for over two years.

TECHNIQUE OF OPERATION IN PATIENTS WITH CLUSTER HEADACHES

In our clinic a total exenteration of the pterygopalatine fossa is performed. After clipping and division of the vessels and division of the maxillary nerve, as described in the preceding pages, the vidian nerve, the greater and lesser palatine nerves and any other nerve fibers emerging from the ganglion are sectioned and the ganglion is removed.

CONCLUSION

Maxillary nerve section is a very effective procedure in selected cases of facial pain. The efficacy of pterygopalatine ganglionectomy is still a matter of discussion; however, we feel quite justified in trying this relatively minor operation in the unfortunate and sometimes desperate patient with cluster headaches, if all conservative measures have failed.

ZUSAMMENFASSUNG

Diskussion von Anatomie und Chirurgie der nervösen Verbindungen in der Fossa pterygopalatina. Eine Durchtrennung des Nervus maxillaris ist in therapieresistenten sekundären Neuralgien des Nerven angezeigt. In Fällen von Sluderneuralgie, die der üblichen Therapie trotzen, muss die Exstirpation des Ganglion pterygopalatinum in Betracht gezogen werden.

RÉSUMÉ

Exposé de l'anatomie et de la chirurgie du contenu nerveux de la fosse pterygopalatine. La section du nerf maxillaire est recommandée dans les cas de névralgies secondaires rebelles de ce nerf. L'extirpation du ganglion sphéno-palatin est préconisée dans les cas de céphalées de Sluder-Horton (cluster headaches) ne répondant pas à la thérapie conventionelle.

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