Vidian Neurectomy

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Introduction:

Vidius in 1509 identified the vidian nerve in the floor of the sphenoid sinus while performing dissection in that area. This nerve is thought to play a role in the pathophysiology of rhinitis, epiphora, crocodile tears, Sluder syndrome, crainal / cluster headaches.
In 1943 Fowler reported a rather unusual unilateral vasomotor rhinitis following ipsilateral stellate ganglion destruction. He also went to the extent of suggesting that experimental surgeries involving the stellate ganglion could throw light on the fundamental mechanism of vasomotor rhinitis. This was promptly taken up by Philip Henry Golding – Wood who suggested that chronic vasomotor rhinitis should be considered as simple secretomotor hyperactivity of the nasal cavity mucosa. He concluded that emotional stress played a role in the initiation and perpetuation of vasomotor rhinitis.
Wolff in 1950 classified emotional effects on target organs as:
Stomach reactors – Who manifested with gastrointestinal disturbances following emotional stress
Pulse reactors – These patients showed changes in pulse rate in response to emotional stress
Nose reactors – These patients manifested with nasal congestion and discharge following emotional stress.

Wolff also managed to record changes in the nasal mucosa when he interviewed psychiatric patients with chronic rhintis. Turbinate biopsies from these patients revealed hyperplasia of mucosal glands which was filled with secretions. Lymph channels were found to be dilated with predominant eosinophilia.

Sectioning of greater superficial petrosal nerve as a treatement for vasomotor rhinitis was first proposed by Zeilgelmann in 1934. This suggestion was followed by Murray Falconer in 1954.

Murray Falconer

Murray Falconer's petrosal neurectomy:

He performed this surgery under Local anesthesia. The whole procedure was performed while the patient is seated up.

Incision: Vertical incision is made above the zygoma one inch in front of the external auditory meatus. The temporalis muscle was split and the squamous portion of the temporal bone was exposed. A burr hole was performed in the squamous portion of the temporal bone and the opening is enlarged till the floor of the middle cranial fossa is exposed. The middle cranial fossa dura is gently stripped from the floor and retracted with the help of retractors. While stripping the dura from the middle cranial fossa it could be found attached firmly to the formane spinosum. This area could bleed during the dissection. The middle meningeal artery which traverses this foramen was coagulated and cut. The foramen is plugged. From now on the dura strips easily and the mandibular division of trigeminal nerve is identified entering the foramen ovale which lies medial and slightly anterior to foramen spinosum. On stripping the dura from the anteromedial face of petrous bone the greater superficial petrosal nerve can be clearly seen. Without causing any traction the nerve is divided.

Malcomson in 1957 suggested that the vidian nerve had a predominantly parasympathetic effect. He also suggested that vidian neurectomy could offer releif in patients with vasomotor rhinitis.
Malcomson's approach to vidian nerve: This is a rather blind approach. As a first step a submucosal resection of nasal septum was performed. The rostrum of sphenoid is identified. In this area the mucoperiosteum is elevated off the anterior and inferior faces of the body of sphenoid. The mobilization of the mucoperiosteum is continued laterally over to the medial surface of the medial pterygoid plate. The mobilization of mucoperichondrium extends forwards over the perpendicular plate of palatine bone. The sphenopalatine foramen comes into view and is identified and the vidian nerve is blindly cauterized as it exits from the foramen.

Golding – Wood's transantral approach: Inspired by the work of Malcomson Golding wood started to work on the various approaches to vidian nerve. He popularized the transantral vidian neurectomy. He considered it to be a rather safe procedure in comparison to intracranial approach to the nerve popularized by Malcomson.

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Golding-Wood

In this procedure the maxillary antrum is opened via Caldwell Luc approach. The posterior wall of the maxilla is identified and removed. The internal maxillary artery can be controlled using clips. The maxillary nerve is identified and traced up to the foramen rotundum. This foramen serves as the most important land mark in this surgical procedure. On exiting from the foramen rotundum the maxillary nerve gives off branches to the sphenopalatine ganglion. The vidian nerve is identified and resected here. Studies have shown that despite there being an opening in the posterior wall of the maxilla it was not an hinderance to wound management like antral wash etc. According to Golding – Wood even unilateral resection of vidian nerve provided releif on both sides of the nasal cavities.

Golding-Wood in his classic paper on the role of vidian neurectomy in the treatment of crocodile tears in 1963 observed "*The only animal capable of weeping in sorrow is the human with a doubtful exception to elephant*." This was infact the classic observation of Charles Darwin.

Effects of vidian nerve stimulation on nasal mucosa:

"*The parasympathetic innervation of the nasal mucosa play a prominent role in the pathogenesis of chronic hypertrophic non allergic rhinitis*". *Golding-Wood 1961.*

The vidian nerve provides the main parasympathetic supply to the nasal mucosa and maxillary sinus mucosa. Stimulation of this nerve causes secretory and vasodilatory effects in animals.

Histological changes induced due to stimulation of vidian nerve include:

1. Enhanced secretory activity of nasal mucosal glands
2. Intense vasodilatation of deep venous plexus
3. Increase in the periglandular blood supply
4. Intense degranulation of mast cells

Acetylcholine and VIP have been implicated as the chemical mediators for these responses.

Anatomy of vidian nerve:

The vidian nerve is formed by post synaptic parasympathetic fibers and presynaptic sympathetic fibers. This is also known as the “Nerve of pterygoid canal”.

Nerves that gets involved in the formation of vidian nerve:

1. Greater petrosal nerve (preganglionic parasympathetic fibers)
2. Deep petrosal nerve (post ganglionic sympathetic fibers)
3. Ascending sphenoidal branch from otic ganglion

Vidian nerve is formed at the junction of greater petrosal and deep petrosal nerves. This area is located in the cartilagenous substance which fills the foramen lacerum. From this area it passes forward through the pterygoid canal accompanied by artery of pterygoid canal. It is here the ascending branch from the otic ganglion joins this nerve.

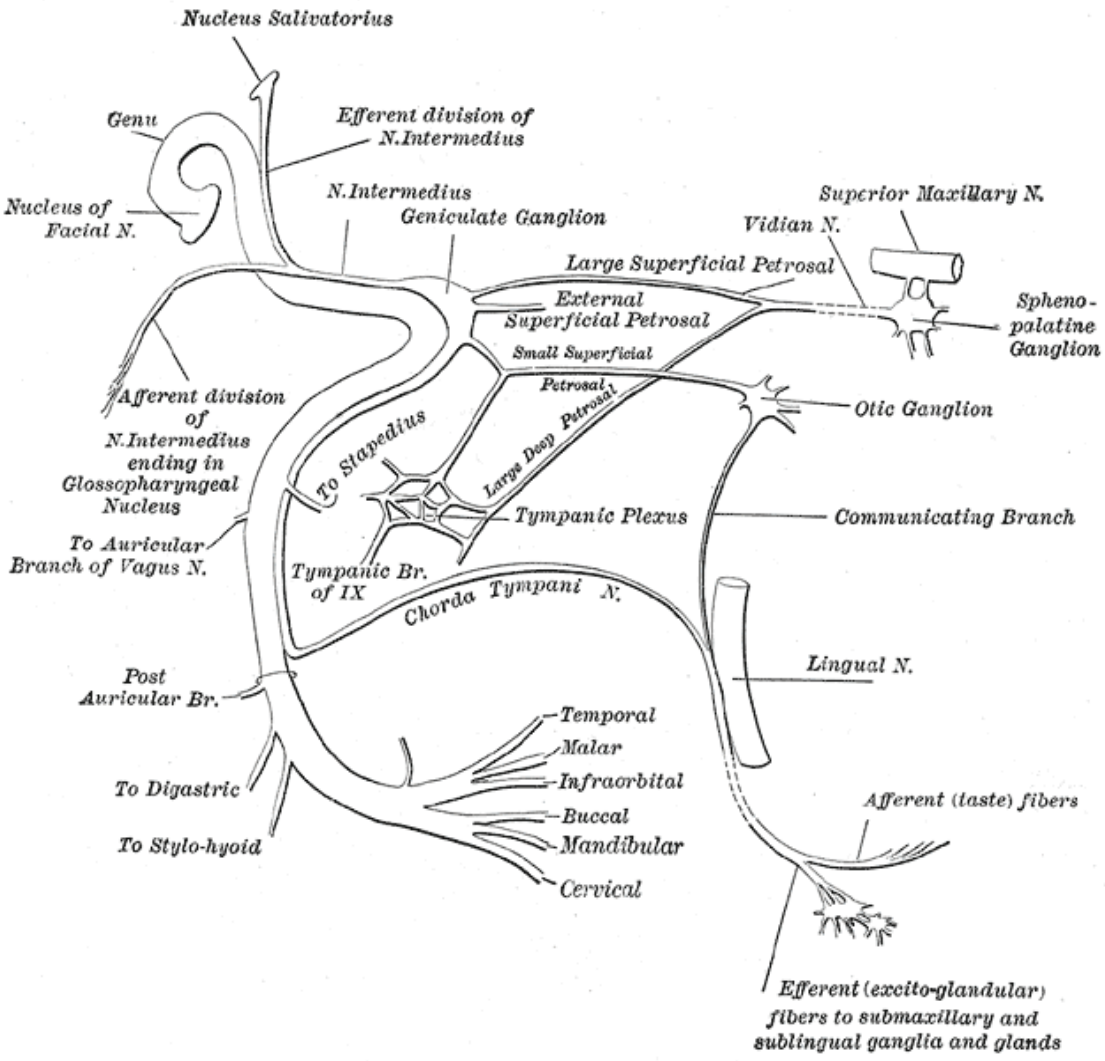
The vidian nerve exits its bony canal in the pterygopalatine fossa where it joins the pterygopalatine ganglion.

Vidian canal:
It is through this canal the vidian nerve passes. This is a short bony tunnel seen close to the floor of sphenoid sinus. This canal transmits the vidian nerve and vidian vessels from the foramen lacerum to the pterygopalatine fossa.
According to CT scan findings the vidian canal is classified into:

Type I: The vidian canal lies completely within the floor of sphenoid sinus

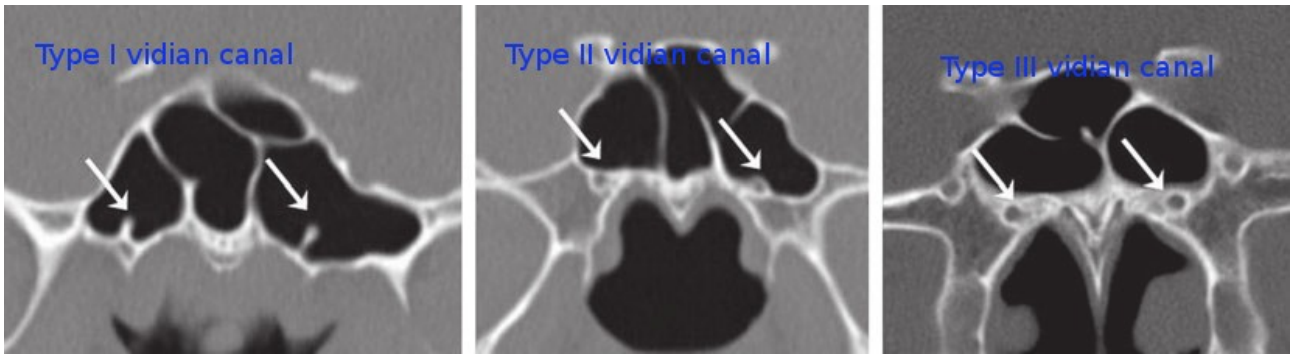
Type II: In this type the vidian canal partially protrudes into the floor of sphenoid sinus

Type III: Here the vidian canal is competely embedded in the body of sphenoid bone



Gray's anatomy depiction of vidian nerve

Study of these anatomical differences of vidian canal in relation to the floor of sphenoid sinus helps in deciding the surgical approach to the nerve.



CT scan axial cuts showing the three types of vidian canal.

The parasympathetic fibers to the nasal mucosa enters the nose through the sphenopalatine foramen. At the level of sphenopalatine ganglion the parasympathetic fibers synapse. Post synaptic parasympathetic fibers from the sphenopalatine ganglion arise at the pterygopalatine fossa. These post synaptic fibers are three in number. They are:

1. Nasal nerve – innervating the nasal mucosa
2. Lacrimal nerve – innervating the lacrimal gland
3. Greater palatine nerve – innervating the palate.

Anatomy of sphenopalatine foramen:

Detailed understanding of the anatomy of sphenopalatine foramen is a must before performing vidian neurectomy. This foramen is formed by the articulation of the body of sphenoid and perpendicular plate of palatine bone.

Boundaries:

Superior – Body of sphenoid

Anterior – Orbital process of palatine bone

Posterior – Sphenoid process of palatine bone

Inferior – Upper border of perpendicular plate of palatine bone

This foramen is semicircular in shape and about a quarter of an inch in diameter. This foramen has a small notch inferiorly which transmits the sphenopalatine artery. The nasopalatine and superior nasal nerves also pass out through the sphenopalatine foramen and lie above the sphenopalatine artery.

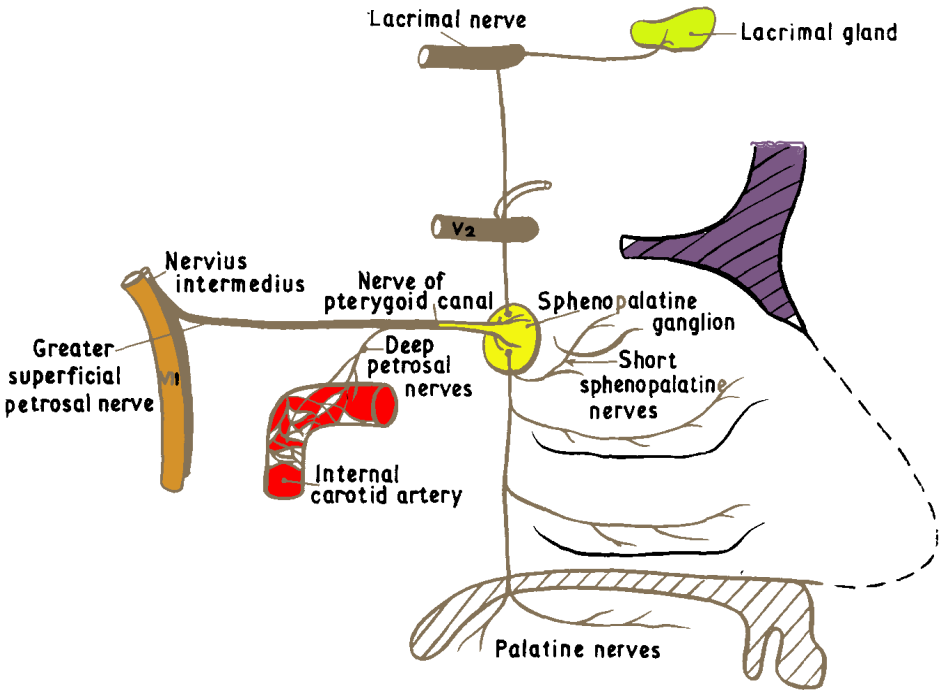


Diagram showing anatomy of sphenopalatine foramen

Indication for vidian neurectomy:

1. Vasomotor rhinitis
2. Intrinsic rhinitis
3. Crocodile tears

Types of vidian neurectomy:

Trans septal vidian neurectomy Malcomson's procedure is still practiced in some centers.

Transpalatal vidian neurectomy:

This procedure is performed under general anesthesia using orotracheal intubation. A Boyle Davis mouth gag is used to keep the mouth open. The incision used over the hard palate is a curved one. It starts in the midline about 2 cms anterior to the posterior edge of the bony hard palate. The incision passes laterally and posteriorly towards the last lower molar tooth. The incision is deepend up to the bone. This deepening is done except in the lateral portion of the incision in order not to damage the greater palatine vessels. The mucoperiosteal lining is dissected off the bone till the palatal aponeurosis becomes visible.

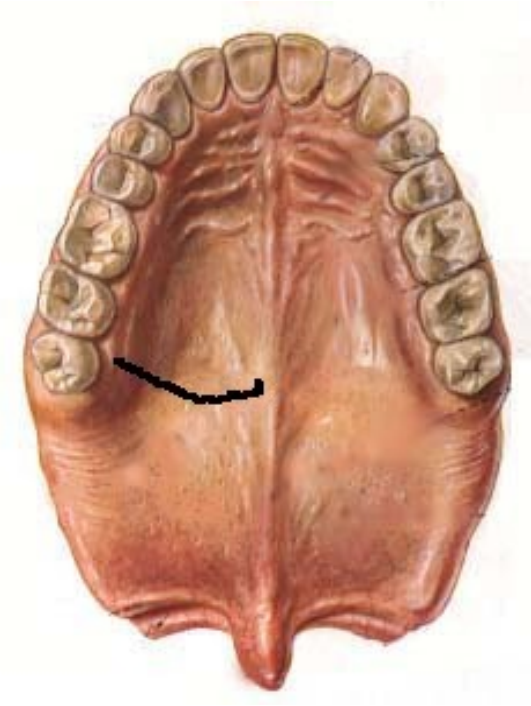


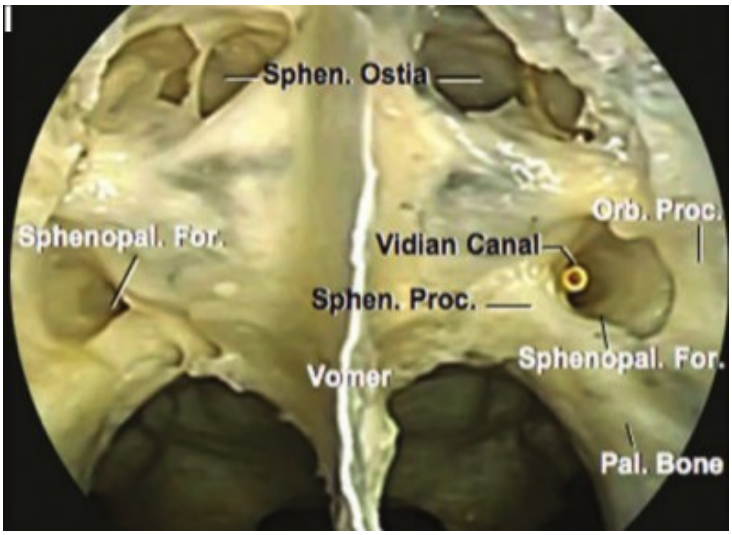
Diagram showing the incision

The bleeders are controlled using adrenaline soaked pledgets. Cautery is avoided as there is always a danger of development of palatal fistula. The soft palate is incised from the posterior end of hard palate and the nasopharynx is entered. The mucosa over tubal elevation is infiltrated with 1 in 10,000 units adrenaline in order to avoid excessive bleeding from this area. L shaped incision is given with the long limb above the tubal elevation in a postero anterior direction. The short limb of the incision is sited between the posterior and lateral wall of nasopharynx. Mucosal elevation in this area exposes the medial pterygoid plate till its junction with the basi occiput. This junction is of anatomical and surgical importance because the foramen lacerum which contains the carotid artery lies directly lateral and posterior to this location. The bone in the medial pterygoid plate is drilled using a contra angled handpiece. A bar of bone is left at the junction of basi occiput and pterygoid plate in order to avoid damaging the internal carotid artery at foramen lacerum. The pterygoid canal appears as an ivory bone within the cancellous bone. This canal is usually 2-3 mm deep. The canal is opened the nerve is elevated, cut and cauterized. The palatal wound is closed in layers.

Dangers of this procedure:

1. Foramen lacerum with its internal carotid artery lie close to the area of dissection
2. Palatal fistula is a real danger if excessive cautery is used in that area.

3. The surgery should always be performed under continuous vision if possible microscope should be used. 300 mm objective is preferred in order to have an optimal working distance.



Vidian canal as seen in trans septal approach

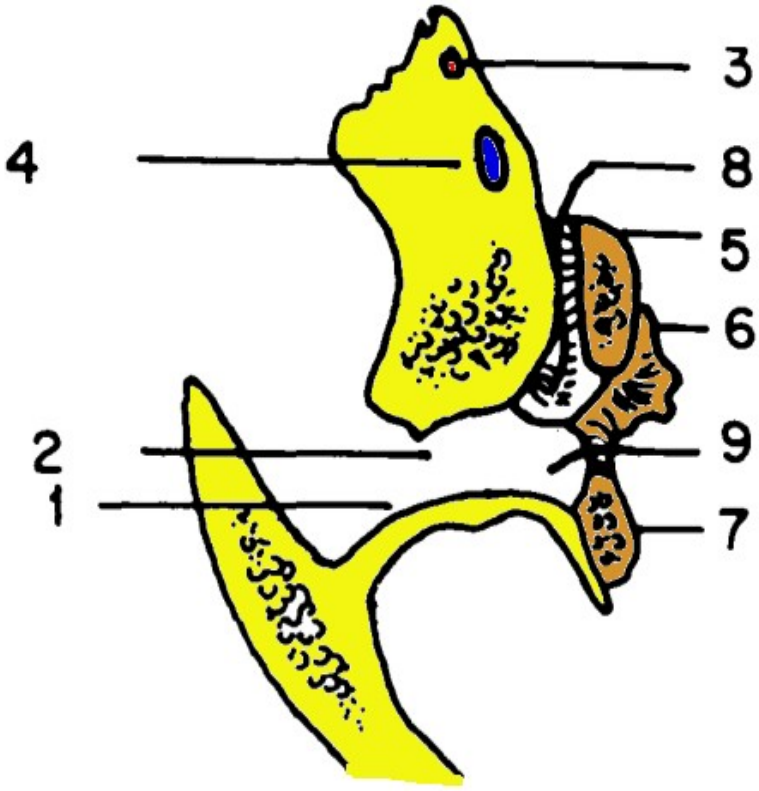
Transnasal preganglionic vidian neurectomy:

In this approach the pterygopalatine fossa should be accessed.

Anatomy of pterygopalatine fossa:

This is a small pyramidal space present behind the posterior wall of maxilla, under the orbital apex. The posterior wall of pterygopalatine fossa which is formed by the medial pterygoid plate has two important openings i.e. Foramen rotundum situated supero laterally and the funnel shaped opening of pterygoid canal infero medial to it. The opening of the pterygoid canal is situated close to the medial wall of pterygopalatine fossa. This medial wall of the pterygo palatine fossa is formed by the

perpendicular plate of palatine bone which separates this space from the nasal cavity. The perpendicular plate of palatine bone has two processes, the orbital process anteriorly and sphenoidal process posteriorly with a V shaped notch between them. Since these two processes articulate above with the body of sphenoid bone this notch gets converted into sphenopalatine foramen. It is this foramen which is important in transnasal vidian neurectomy.



Transverse section through right pterygopalatine fossa showing:

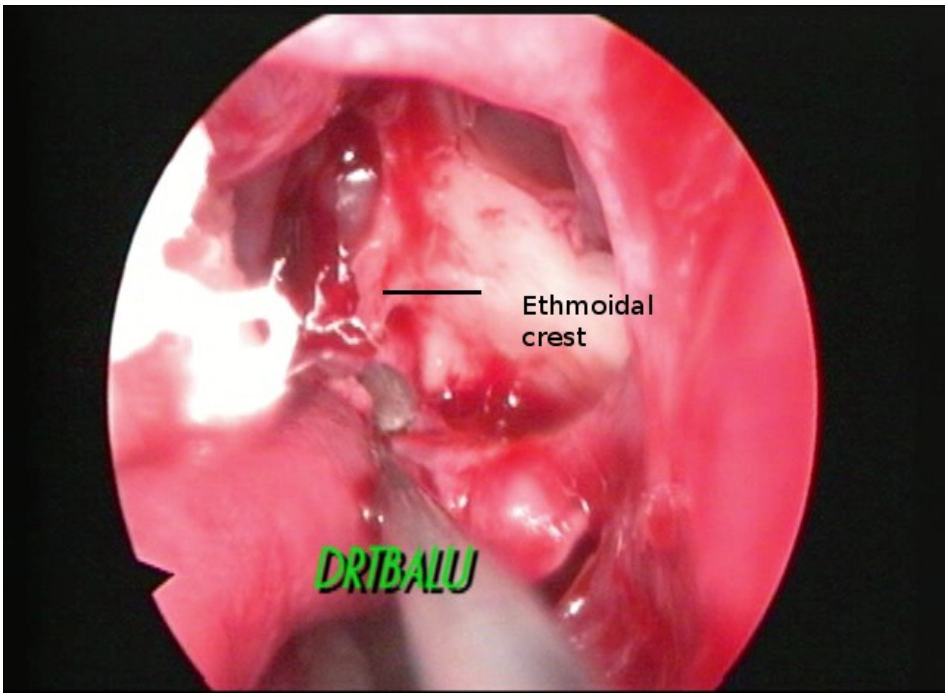
1. Posterior wall of maxillary antrum, 2. Pterygomaxillary fissure, 3. Foramen rotundum, 4. Foramen ovale, 5. Pterygoid process, 6. Sphenoid process of palatine bone, 7. Orbital process of palatine bone, 8. Vidian canal, 9. Sphenopalatine foramen.

The opening of the pterygoid canal and the sphenopalatine foramen are situated in the same horizontal plane. The pterygoid canal lies in the posterior wall while the sphenopalatine foramen lies in the medial wall of the pterygopalatine fossa. These two foramen are separated by small amount of bone which forms the corner between the two walls.

Another important land mark that is important in trans nasal vidian neurectomy is the ethmoidal crest. This lies at the posterior end of bony attachment of middle turbinate.

Just behind this crest lies the sphenopalatine foramen. This relation ship between the crest and the foramen is always constant.

Note: The fleshy portion of the middle turbinate often extends a little beyond the posterior end of the middle turbinate.



Endoscopic view of Ethmoidal crest

Transnasal vidian neurectomy is performed using an operating microscope. This has been now replaced with nasal endoscope. While using the operating microscope the objective should be changed to that of 300 mm. This is a necessary step in order to ensure that the working distance is adequate. The patient is placed supine with head slightly elevated. The nasal mucosa and turbinates are decongested using cotton pledgets soaked in 4% xylocaine mixed with 1 in 10,000 adrenaline. A killians self retaining retractor is inserted under the middle turbinate and is opened fracturing the middle turbinate medially. This step is important as it provides wider access to the middle meatus. The speculum is advanced anteriorly till the posterior end of the

fleshy middle turbinate is visualised. About a quarter cc of 2% xylocaine mixed with 1 in 100,000 units adrenaline is injected submucosally in the lateral nasal wall. Blanching of the area indicates adequate infiltration.

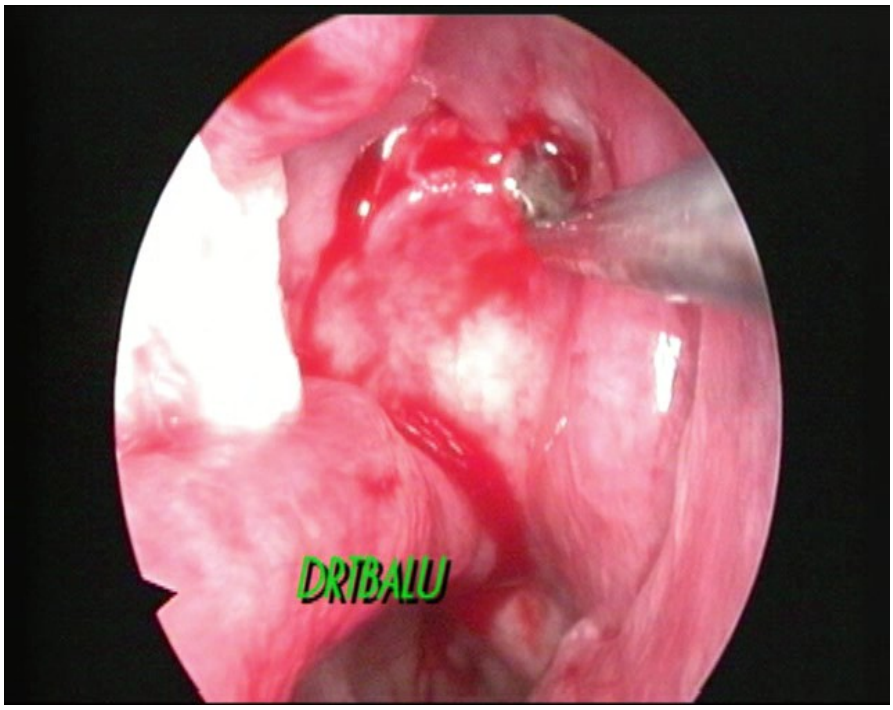


Figure showing incision

Mucoperiosteum is incised from the lateral nasal wall using Rosen's knife. The incision is a curved one extending from the superior surface of inferior turbinate in the lateral nasal wall extending up to the posterior end of middle turbinate. The ethmoidal crest is identified and removed exposing the sphenopalatine foramen. The insulated cautery is advanced into funnel shaped opening of the pterygoid canal cauterizing the nerve of pterygoid canal. One major complication of this surgical procedure is the development of opthalmoplegia. This is due to the probe sinking deep into the pterygoid canal damaging the near by abducent nerve.

Endoscopic intrasphenoidal vidian neurectomy:

The preparation of patient for this procedure is similar to that of Endoscopic sinus surgery. The nasal cavity is decongested using a mixture of 4% xylocaine with 1 in 10,000 adrenaline soaked pledgets.

Infiltration using 2% xylocaine mixed with 1 in 100,000 units adrenaline is performed in the following areas:

Anterior wall of sphenoid sinus

Superior turbinates

Posterior end of middle turbinate

Step I : Lateralization of middle turbinate

This is performed under direct vision of 0 degree 4 mm nasal endoscope. This is a very important step in this procedure. A Freer's elevator is used for this purpose.

Step II : Perforation of anterior wall of sphenoid sinus. This step is usually performed using a Freer's elevator. This opening is widened inferiorly and laterally using Kerrison's punch forceps.

The opening over the anterior face of sphenoid sinus is widened till the vidian canal is identified.

Step III : The paper thin wall of the vidian canal is perforated and the nerve is severed under direct vision. Bleeders if any are cauterized.

It is mandatory to study the position of the vidian canal within the sphenoid sinus by doing a CT scan. If this is not done then the variations in the position of vidian canal inside the sphenoidal sinus will create problems during surgery.

Endoscopic posterior nasal neurectomy:

In this procedure which is performed under direct endoscopic vision the posterior superior and posterior inferior nasal nerves are resected when they come out of the sphenopalatine foramen.

The preparation is the same as for other endoscopic sinus surgical procedures.

Incision: A curved incision about 1.5 cms long is made in the middle meatus from the posterior end of superior margin of inferior turbinate to the horizontal portion of the ground lamella of the middle turbinate. The dissected mucoperiosteal lining is folded back until the sphenopalatine foramen and the superior portion of the perpendicular plate of palatine bone is exposed. The sphenopalatine artery is identified and separated out of the way. The posterior superior and postero inferior nasal nerves are sectioned and bleeders if any are cautrized.

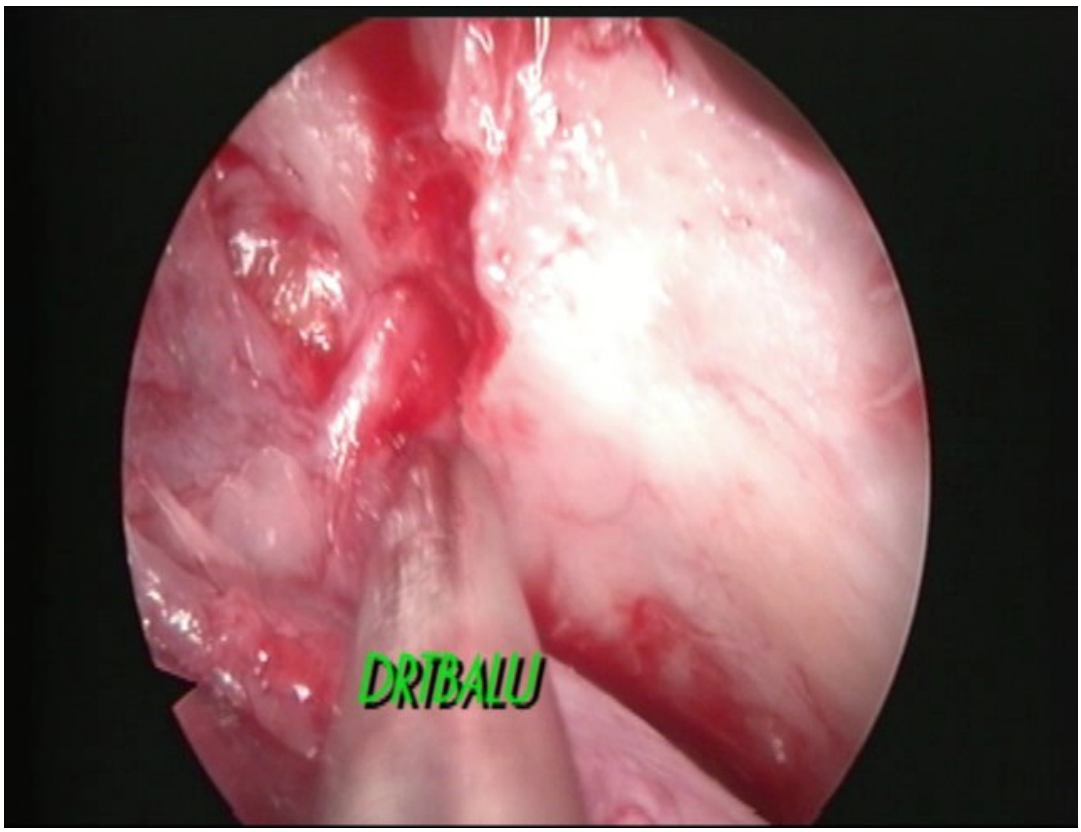
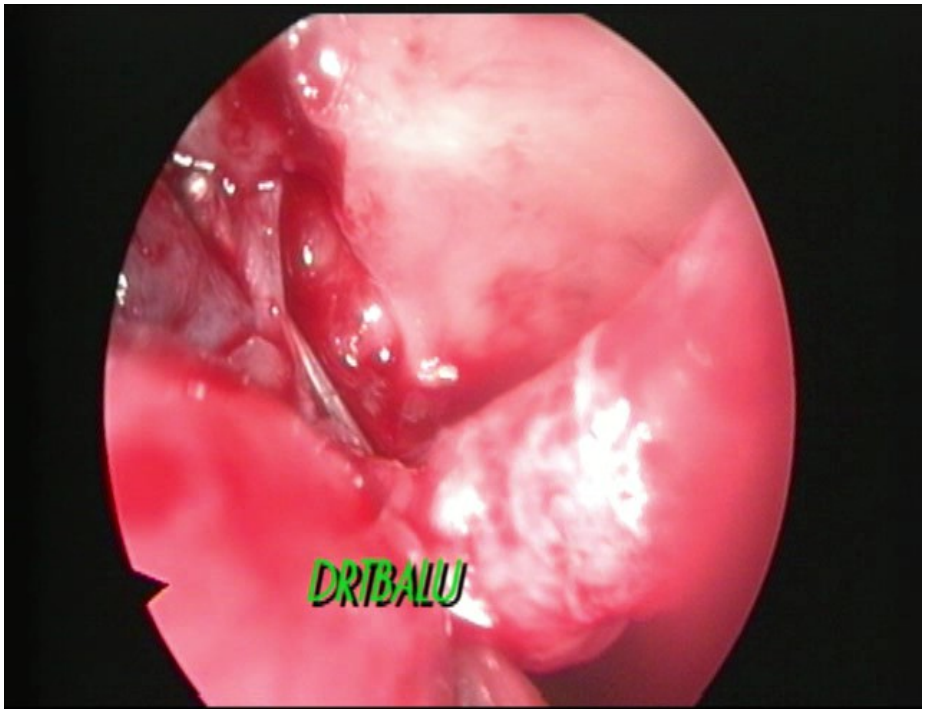
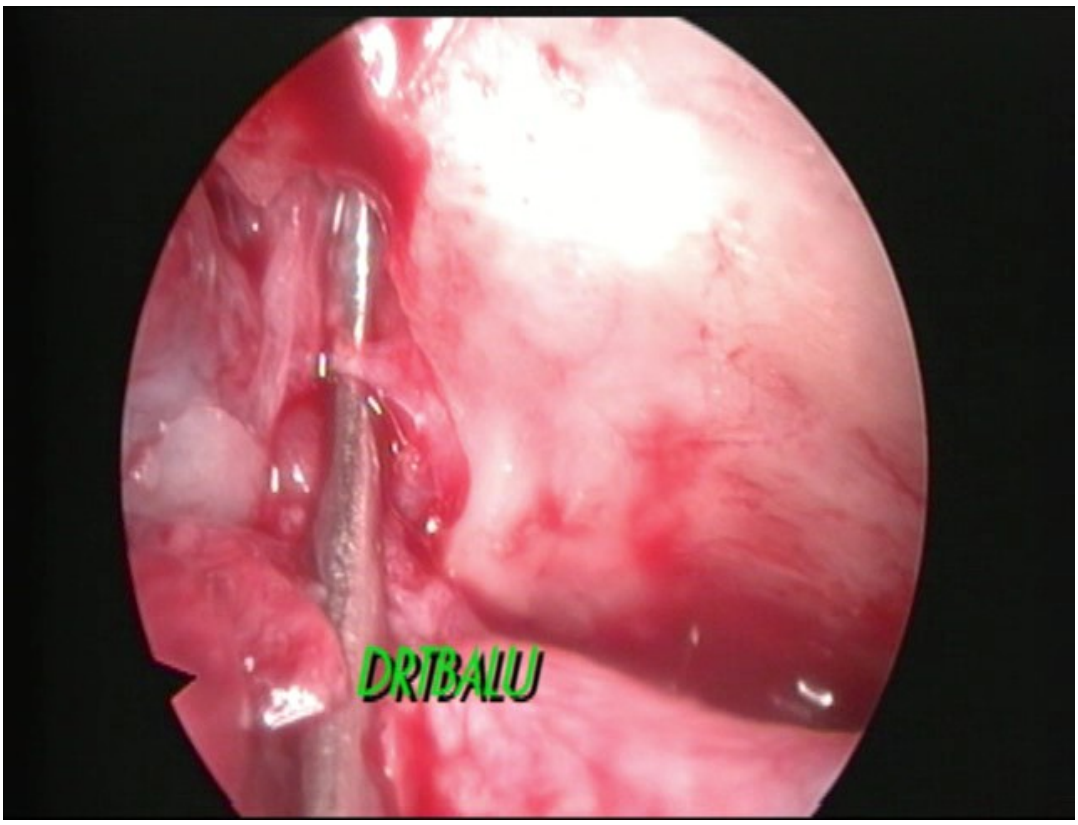


Image showing sphenopalatine artery exiting out of sphenopalatine foramen



Posterior superior and posterior inferior nasal nerves held under the probe



Vidian nerve seen under the probe

Complications of vidian neurectomy:

1. Dry eye due to decreased lacrimation
2. Neurotorphic keratopathy
3. Ocular movement disturbances
4. Blindness

Endoscopic vidian neurectomy:

This procedure is performed under endoscopic vision. Patient preparation is the same as for other endoscopic sinus surgical procedures. A curved suction tip is used to palpate the lateral nasal wall behind the uncinate and above the insertion of the inferior turbinate in order to identify the soft membranous portion of the posterior fontanelle of the maxilla. On moving the suction tip posterior to the posterior fontanelle, the hard bony anterior edge of palatine bone can be identified. A C shaped incision is made using a 15 blade at the junction between the posterior fontanelle and the palatine bone. The incision starts just below the horizontal portion of the basal lamella and ends just above the insertion of inferior turbinate in the lateral nasal wall.

Caution: The incision should not extend into the maxillary sinus via the posterior fontanelle.

A posterior based mucoperiosteal flap is raised using a Freer's elevator, exposing the palatine bone. During 3-4 mm of dissection the flap is raised over the entire length of the incision. After this level the flap is raised only along the lower third of the incision i.e. just above the insertion of the inferior turbinate. This dissection is continued posteriorly till the anterior face of sphenoid sinus is reached. Now the dissection proceeds upwards exposing the ethmoidal crest and the underlying sphenopalatine artery. The posterior rim of the sphenopalatine foramen is widened towards the anterior face of sphenoid. The thin anterior wall of sphenoid sinus is penetrated using the Freer's elevator. The floor of the sphenoid sinus should be visualized to study the course of the vidian nerve.

The vidian canal lies at the junction between the floor of the sphenoid sinus and the lateral nasal wall. The vidian canal should not be confused with that of palatovaginal canal. Palatovaginal canal which contains pharyngeal branches of the maxillary artery and pterygopalatine ganglion lies inferomedial to the vidian canal. The vidian nerve is exposed, resected and bleeders if any is coagulated.

Treatment of crocodile tears with vidian neurectomy:

This term crocodile tears was coined by Bogorad to describe the unusual phenomenon of profuse lacrimation which occurs during eating only. He coined this term because it was believed crocodiles shed tears before devouring their prey. This condition could be a sequel to facial palsy.

Other causes of crocodile tears include:

1. Head injury
2. Operative trauma
3. Syphilitic lesion of geniculate ganglion

This condition occurs due to anamolous regeneration causing the secretomotor fibers from the corda tympani nerve reaches the lacrimal gland via the greater superficial petrosal nerve.

Is vidian neurectomy really useful?

This question is yet to be categorically answered. In my personal experience I have performed about 10 vidian neurectomies. Out of this number about 6 patients had questinable releif of symptoms.

Interesting questions to be answered.

Should you perform bilateral vidian neurectomy for significant releif of symptoms?

If performed there is a significant risk of dryness of eye due to diminished lacrimation.

The only advantage of this procedure is that this makes the operating surgeon more competent in performing endoscopic skull base surgical procedures.