Doctor.021

no. 4

RS

ANATOMY

Writer: Mohammad Al-Shamasneh & Rama Harb

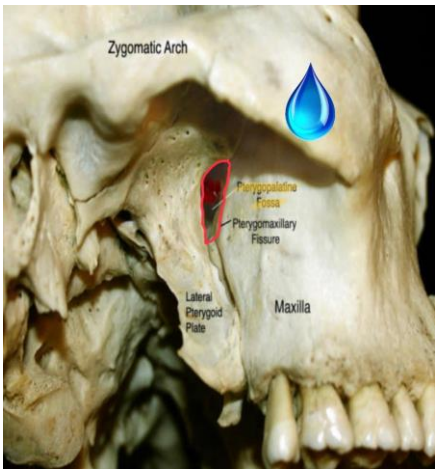
Corrector:

Doctor: Mohammad Al-Mohtaseb

Hello doctors, give me your attention and let's ROCK this simple lecture.

Our topic for today is mainly about the pterygopalatine fossa, its bony skeleton and nerves. In addition to the maxillary artery and its branches. Finally, a little bit information about the veins related to pterygopalatine fossa. Let's start emphasizing each one of these topics:

The Pterygopalatine fossa



pterygopalatine fossa is the red-coloured encircled space in the adjacent picture.

- **Inverted 'tear-drop' shaped space**
- **Between bones on the lateral side of the skull**
- **Immediately posterior to the maxilla**
- Pterygopalatine fossa between maxilla and sphenoid bone.
- **Small in size**

Pterygopalatine fossa is an important space due to its communications with surrounding organs: orbit, nasopharynx, oral cavity, nose (by spheno-palatine foramen), middle cranial fossa and infra temporal fossa→ so it has 6 communications.

These communications play a major role in carrying blood supply and innervation to the surrounding organs.

Our interest today is to know each foramen that connects between pterygopalatine fossa and other organs and the type of supply (nerve, artery or vein) that pass through that foramen.

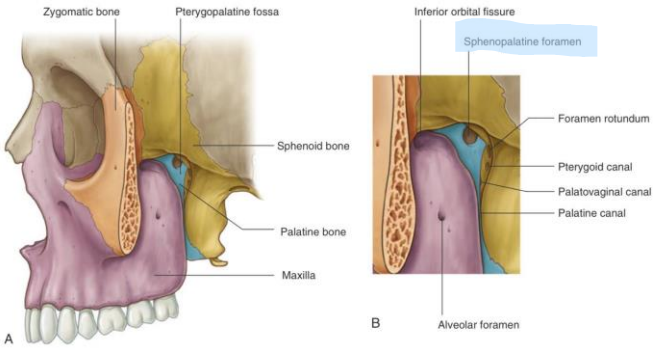
Again, pterygopalatine fossa located between sphenoid bone, maxilla and palatine bone.

Skeletal framework

The walls of the pterygopalatine fossa are formed by:

- **The anterior wall is formed by the posterior surface of the maxilla** (purple area).
- **The medial wall is formed by the lateral surface of the palatine bone** (blue area).

To the right, you can notice a foramen, spheno-palatine foramen that contains sphenopalatine artery and nerve, the nerve divides into long and short branches to supply nasal cavity.



- **The posterior wall and roof are formed by parts of the sphenoid bone.** (yellow area).

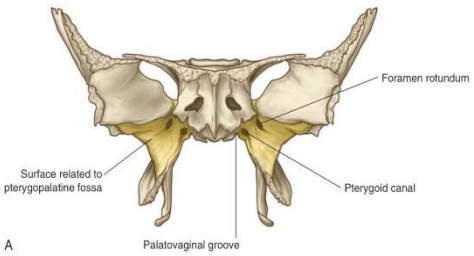
Laterally there is <u>pterygomaxillary fissure</u> which is a space opens into the infratemporal fossa. Its job?

- To allow for the maxillary artery (a branch of external carotid artery) to reach the pterygopalatine fossa from infratemporal fossa.

The maxillary nerve (a branch of trigeminal nerve) reaches pterygopalatine fossa through foramen rotundum.

Sphenoid bone

- **The part of bone that contributes to the formation of the fossa is the anterosuperior surface of the pterygoid process.**
- **Opening onto this surface are two large foramina:**



1.The Foramen rotundum (maxillary nerve passes though it).

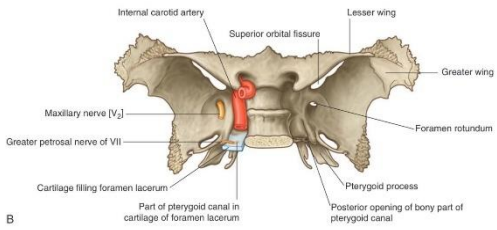
2. Pterygoid canal at the roof of foramen lacerum, it contains the nerve to the pterygoid canal (that carries sympathetic and parasympathetic fibers).

Foramen rotundum

- **Lateral and superior foramen**
- **Communicates posteriorly with the middle cranial fossa.**
- **The maxillary nerve [V2] passes through it.**

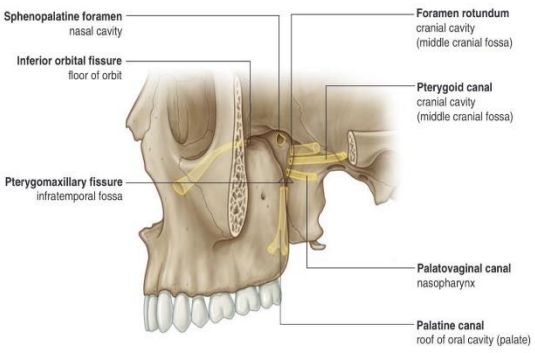
Pterygoid canal

- **Medial and inferior foramen**
- **Bony canal opening onto the posterior surface of the pterygoid process.**
- **Continuing superomedially for a short distance in the cartilage that fills the foramen lacerum.**
- **Opens into the middle cranial fossa just anteroinferior to the internal carotid artery.**
- **The greater petrosal** (parasympathetic, branch of facial nerve and preganglionic to pterygoid ganglion) **and sympathetic fibers** (called deep petrosal nerve, postganglionic) **from the internal carotid plexus, join to form the nerve of the pterygoid canal.**



Gateways

- **Seven foramina and fissures provide apertures through which structures enter and leave the pterygopalatine fossa:**
- **Foramen rotundum** (maxillary nerve passes through it) **and pterygoid canal communicate with the middle cranial fossa.**



2. Palatovaginal canal opens onto the posterior wall and leads to the nasopharynx, give innervation and blood supply to nasopharynx.

3. Palatine canal (palatine artery that divides into greater and lesser palatine passes through it) **leads to the roof of the oral cavity (hard palate) and opens inferiorly.**

4 Sphenopalatine foramen (sphenopalatine artery and nerve pass though it) **opens onto the lateral wall of the nasal cavity and is in the medial wall.**

5. Pterygomaxillary fissure (maxillary artery passes though it to the fossa, maxillary nerve passes though it from the fossa) **between lateral aspect of the pterygopalatine fossa and the infratemporal fossa.**

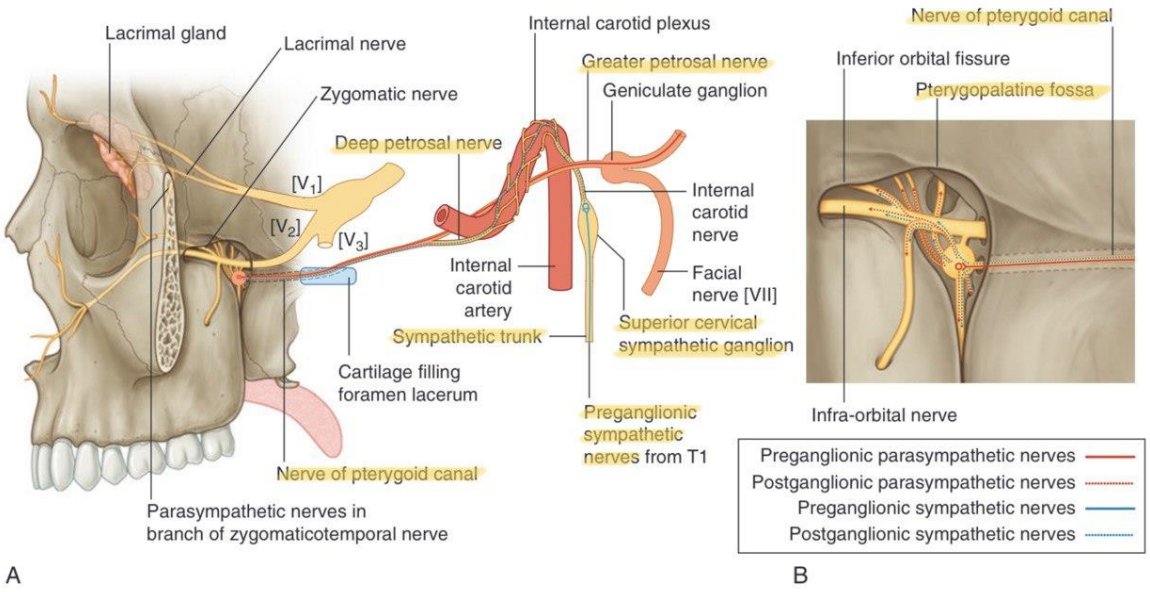
6. Inferior orbital fissure (terminal parts maxillary nerve and artery pass through it) **between the superior aspect of the fossa into the floor of the orbit.**

Contents

1. The maxillary nerve [V2], through foramen rotundum from middle cranial fossa.
2. Terminal part of the maxillary artery, from infratemporal fossa to pterygoid fossa
3. Nerve of the pterygoid canal, sympathetic and parasympathetic fibers from middle cranial fossa to the ganglion.
4. The pterygopalatine ganglion, parasympathetic ganglion.
5. Veins and lymphatics also pass through the pterygopalatine fossa.

Pterygopalatine ganglion

The nerve to pterygoid canal contains mixed sympathetic and parasympathetic fibers.



The pre-ganglionic parasympathetic fiber is the greater petrosal nerve (a branch of the facial nerve) travel to the pterygopalatine ganglion where it synapses with the post-ganglionic parasympathetic branches that are distributed along with branches of the maxillary nerve and artery to innervate the nose, palate, lacrimal gland, orbits…etc

The preganglionic sympathetic nerve originates from the lateral horn of the thoraco-lumbar and synapse in the superior cervical sympathetic ganglion with the post-ganglionic sympathetic fiber which is the deep petrosal nerve.

Fill some gaps:

- ✓ The nerve of pterygoid canal, is it sympathetic or parasympathetic? Mixed
- ✓ What is the preganglionic parasympathetic fiber? Greater petrosal nerve.
- ✓ What is the postganglionic parasympathetic fiber? Some branches distributed along with the maxillary artery and nerve.
- ✓ Where does the preganglionic synapse with the postganglionic fiber (remember here we're talking about parasympathetic)? In the pterygopalatine ganglion.

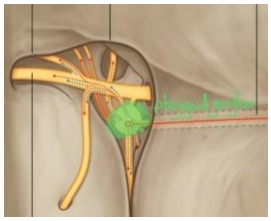
- ✓ What is the preganglionic sympathetic fiber? Fibers from the thoraco-lumber sympathetic trunk.
- ✓ what is the postganglionic sympathetic fiber? Deep petrosal nerve
- ✓ Where does the preganglionic synapse with the postganglionic fiber (remember here we're talking about sympathetic)? In the superior cervical sympathetic ganglion. **GOOD JOB**

Revise more from the slides:

Nerve of the pterygoid canal

- **Formed in the middle cranial fossa by the union of:**
  1. The greater petrosal nerve (a branch of the facial nerve [VII]).
  2. The deep petrosal nerve (a branch of the internal carotid plexus).
- **Joins the pterygopalatine ganglion.**
- **Carries mainly preganglionic parasympathetic (great petrosal) and postganglionic sympathetic (deep petrosal) fibers.**

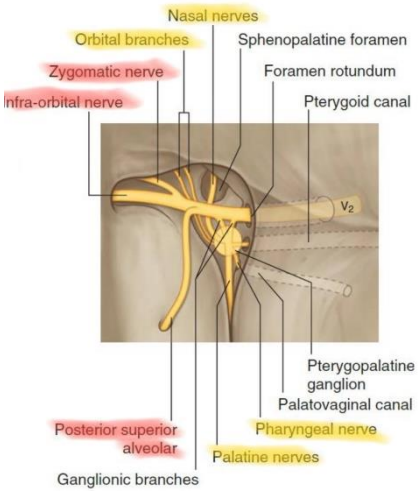
Pterygopalatine ganglion



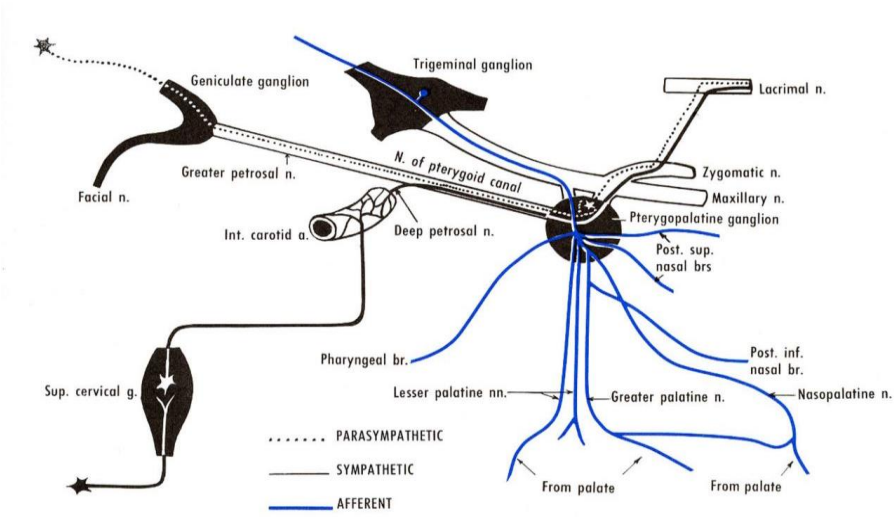
- **Largest of the four parasympathetic ganglia in the head.**
- **Formed by the cell bodies neurons associated with:**
  1. Preganglionic parasympathetic fibers of the facial nerve carried by the greater petrosal nerve and the nerve of the pterygoid canal.
  2.Sensory and ganglionic branches of the maxillary nerve.
  3.Postganglionic sympathetic fibers (deep petrosal).

The post-ganglionic sympathetic fiber as we mentioned is the deep petrosal nerve, passing through the pterygopalatine ganglion without synapse, because it has synapsed earlier in the superior cervical ganglion, as we said.

- **The pterygopalatine ganglion gives off orbital, palatine, nasal, and pharyngeal branches, which leave the ganglion.**
- **Other fibers pass superiorly through the ganglionic branches of the maxillary nerve to enter the main trunk of the maxillary nerve.**
- **And then distributed with the zygomatic, posterior superior alveolar, and infra-orbital nerves.**



Pterygopalatine ganglion

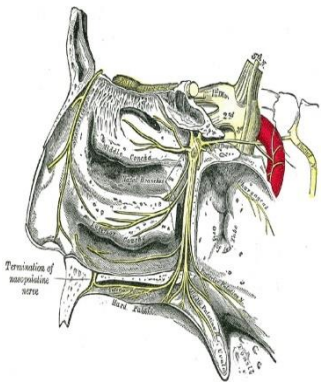


important pic.

The lacrimal nerve carries parasympathetic fibers to the lacrimal gland from the zygomaticotemporal branch of the maxillary nerve.

Orbital branches

- **Pass through the inferior orbital fissure.**
- **Supply of the orbital wall (periosteum) and lacrimal gland**
- **Supply the sphenoidal and ethmoidal sinuses.**



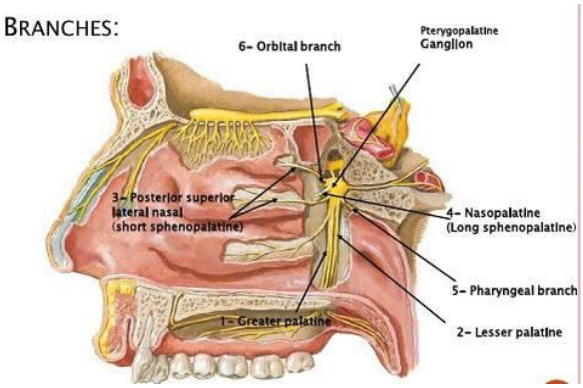
Pharyngeal nerve

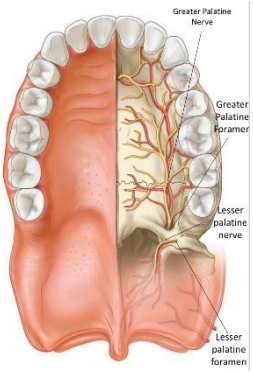
- **Passes posteriorly from the pterygopalatine ganglion.**

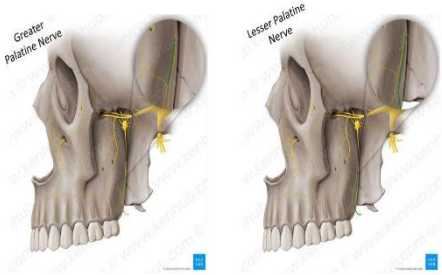
- Leaves the fossa through the palatovaginal canal.
- Supply the mucosa and glands of the nasopharynx, posteriorly.

Greater and lesser palatine nerves

- Pass through the palatine canal.
- Enter the oral surface of the palate through the greater and lesser palatine foramina.
- Lesser palatine (Middle, Post, palatine) nerve passes posteriorly to supply the soft palate.
- The Greater palatine (Ant.palatine) nerve passes forward on the roof of the oral cavity.
- Innervate mucosa and glands of the hard palate and the adjacent gingiva, almost as far forward as the incisor teeth.
- Also supply the mucosa over the middle and lower part of the lateral wall of the nasal cavity.
- Joins the long sphenopalatine nerve.







Nasal nerves.

- Seven in number.
- Pass medially through the sphenopalatine foramen to enter the nasal cavity.
- Short sphenopalatine (Post.Superior Lateral nasal) supply the mucosa of the Post, superior quadrant of the nasal cavity.
- The Nasopalatine nerve (long Spheno- palatine) is the largest of the nasal nerves, Passes anteriorly grooving down the

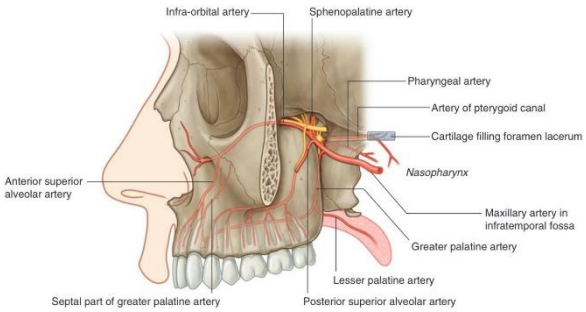
nasal septum, Through the incisive canal and fossa in the hard palate, Supply mucosa, gingiva, and glands adjacent to the incisor teeth, Join the greater palatine nerve.

Maxillary nerve [V2]

- Purely sensory.
- Originates from the trigeminal ganglion in the middle cranial cavity.
- Exits the middle cranial fossa, and enters the pterygopalatine fossa through the foramen rotundum.
- It terminates as the infra-orbital nerve through the inferior orbital fissure.
- Branches in pterygopalatine fossa:
    1) Meningeal (before it enters the Fossa).
    2) Two ganglionic branches pass through the pterygopalatine ganglion (Postganglionic parasympathetic fibers and sensory).
    3) Zygomatic nerve.
    4) Posterior superior alveolar nerve.
    5) Infra-orbital.

Ophthalmic nerve is purely sensory too, but the mandibular is mixed (sensory & motor)

Zygomatic nerve



- Originates directly from the maxillary nerve in the pterygopalatine fossa.
- Enter the orbit through the inferior orbital fissure.
- Divides into zygomaticotemporal and zygomaticofacial branches.
- Zygomaticotemporal branch enter the temporal fossa and passes superficially to supply skin over the temple.

- Carries postganglionic parasympathetic and sympathetic fibers and form a special autonomic nerve to join the lacrimal nerve.
- The Zygomaticofacial branch opens on the anterolateral surface of the zygomatic bone, and supply the adjacent skin.

Posterior superior alveolar nerve

- Passes laterally out of the fossa through the pterygomaxillary fissure.
- Enter the posterior surface of the maxilla approximately midway between the last molar tooth and the inferior orbital fissure.
- Supplies the molar teeth and adjacent buccal gingivae.
- contributes to the supply of the maxillary sinus.

Infra-orbital nerve

- Anterior continuation of the maxillary nerve.
- Leaves the pterygopalatine fossa through the inferior orbital fissure.
- First in the infra-orbital groove in the floor of the orbit and then continues forward in the infra-orbital canal.
- While in the infra-orbital groove and canal, the infra-orbital nerve gives origin to middle and anterior superior alveolar nerves, They Join the superior alveolar plexus to supply the upper teeth.
- Middle superior alveolar nerve also supplies the maxillary sinus.
- Anterior superior alveolar nerve also gives origin to a small nasal branch Infra-orbital nerve.
- The infra-orbital nerve exits the infra- orbital canal through the infra-orbital foramen.
- Divides into nasal, palpebral, and superior labial branches.
    1) Nasal branches supply skin over the lateral aspect of the external nose and part of the nasal septum.
    2) Palpebral branches supply skin of the lower eyelid.

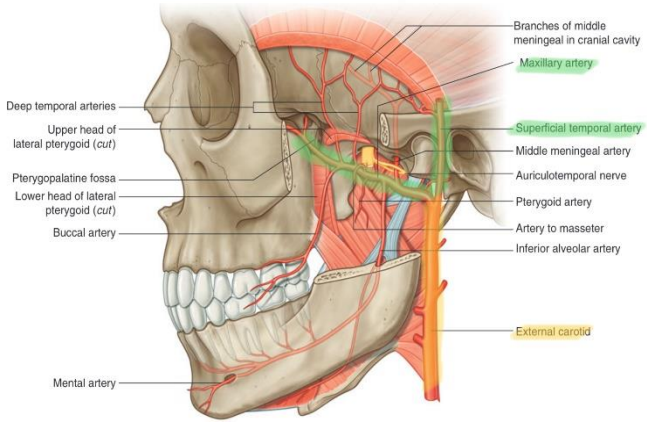
3) **Superior labial branches supply skin over the cheek and upper lip, and the related oral mucosa.**

Maxillary Artery

Look at the picture form below. first, we have the external carotid artery which is divided within the substance of the parotid gland into:

1.superficial temporal artery to supply different parts of the skull.

2.maxillary artery



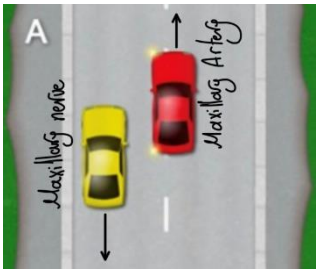
The maxillary artery can be divided into 3 distinct segments by the lateral pterygoid muscle (this muscle is usually located posteriorly to the artery but in some cases, it becomes anterior to the artery).

First segment of the maxillary artery is located just before the muscle.

Second segment is related to the muscle (whether it is related posteriorly or anteriorly as we mentioned).

Third segment is located after the muscle (it leaves the infra-temporal fossa passing through the pterygomaxillary fissure reaching the pterygopalatine fossa).

The maxillary artery's pathway is the opposite of the maxillary nerve, that originate in the middle cranial fossa, penetrate the foramen rotundum, arriving to the pterygopalatine fossa, passing through the pterygomaxillary fissure to reach the infra-temporal fossa, so the maxillary artery and nerve meet each other in the pterygomaxillary fissure.



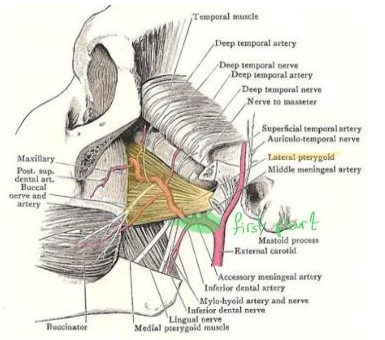
Why would the maxillary nerve go to the infra-temporal fossa?

to give a branch called the posterior superior alveolar nerve that innervate the last 3 molars.

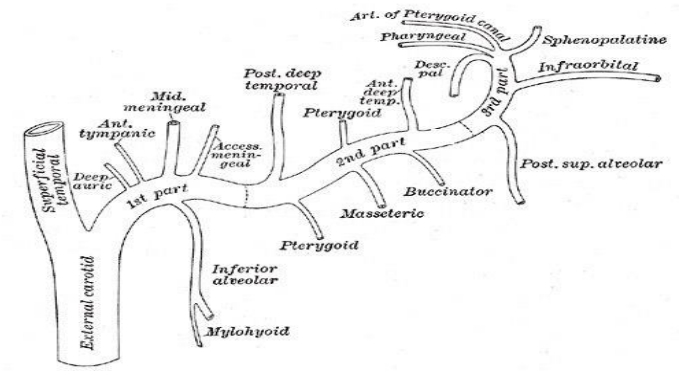
What is written in the slide is below:

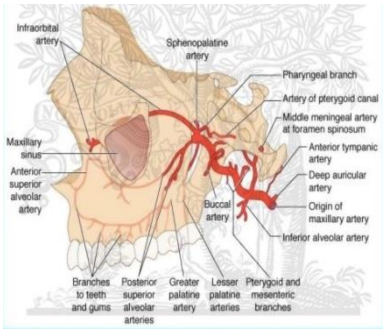
Maxillary artery

- **Major branch of the external carotid artery in the neck**
- **Originates adjacent to the neck of mandible.**
- **Originates within the substance of the parotid gland.**
- **Passes forward through the infratemporal fossa.**
- **Enters the pterygopalatine fossa through the pterygomaxillary fissure (the third part).**



The lateral pterygoid muscle is inserted into the neck of the mandible. ملاحظة عالهامش





The first part of the maxillary artery gives off **5 branches** all of them pass through foramina, for example:

<u>The inferior alveolar artery</u> passes through the mandibular foramen to enter the mandible to supply all lower teeth in the lower jaw along with the inferior alveolar nerve (a branch of mandibular nerve).

<u>Middle meningeal artery</u> passes through the foramen spinosum to enter the middle cranial fossa.

<u>Accessory middle meningeal</u> artery passes through the foramen ovale then goes intracranially.

Deep auricular & anterior tympanic arteries to enter the auricle.

First part

- **The first part of the maxillary artery is the part between the neck of mandible (Lat.) and the sphenomandibular ligament (Med.)**
- **Also related to the auriculo.temporal nerve (above) and the maxillary vein (below).**
- **Gives origin to two major branches (the middle meningeal and inferior alveolar arteries)**
- **Smaller branches (deep auricular, anterior tympanic, and accessory meningeal).**

The second part of the maxillary artery gives off **5 muscular branches** for the muscles of mastication:

Deep temporal branch for temporalis muscle.
Masseteric branch for masseter muscle.
Pterygoid branches for medial pterygoid & lateral pterygoid muscle.
Buccal branch to supply the buccinator muscle.

Second part

- **The second part of the maxillary artery the part related to the lateral pterygoid muscle.**
- **Gives origin to deep temporal, masseteric, buccal, and pterygoid branches (muscles of mastication).**
- **Course with branches of the mandibular nerve.**

The third part (terminal part) enters the pterygopalatine fossa and gives origins to **5 branches** distributed along with the branches of the pterygopalatine ganglion and the maxillary nerve. These 5 branches are as follows:

Sphenoplatine artery which divides into long and short branches.

Palatine artery which gives greater palatine and lesser palatine.

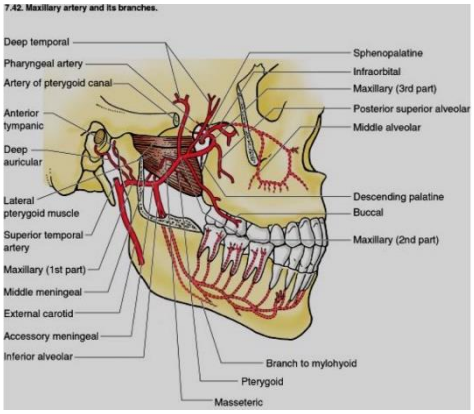
Infra-orbital artery (represent the end of the maxillary artery) which is also divides into 3 smaller branches: palpebral, nasal, labial arteries.

Terminal (3rd) part

- **In the pterygopalatine fossa**
- **Anterior to the pterygopalatine ganglion**
- **Gives origin to branches that accompany branches of the maxillary nerve [V2] and the pterygopalatine ganglion.**
- **These branches supply much of the nasal cavity, the roof of the oral cavity, nose and all upper teeth.**
- **In addition, they contribute to the blood supply of the sinuses, oropharynx, and floor of the orbit.**

Branches of the 3rd part maxillary artery:

1. **The posterior superior alveolar** for the last molar teeth.
2. **Infra-orbital.**
3. **Greater &** lesser **palatine.**
4. **Pharyngeal passes through palatovaginal foramen to the nasopharynx.**
5. **Sphenopalatine arteries, long & short.**
6. **The artery of the pterygoid canal.**



Posterior superior alveolar artery

- **Originates from the maxillary artery as it passes through the pterygomaxillary fissure.**
- **Meets the posterior superior alveolar nerve.**
- **Accompanies it through the alveolar foramen on the infratemporal surface of the maxilla.**
- **Supplies the molar and premolar teeth, adjacent gingiva, and the maxillary sinus.**

Infra-orbital artery

- **Passes forward with the infra-orbital nerve and leaves the pterygopalatine fossa through the inferior orbital fissure.**
- **With the infra-orbital nerve, it lies in the infra-orbital groove and infra-orbital canal.**
- **Emerges through the infra-orbital foramen to supply parts of the face.**
- **In the orbital canal gives :**
- **1. Branches that contribute to the blood supply of structures near the floor of the orbit-the inferior rectus and inferior oblique muscles, and the lacrimal sac.**
- **2. Anterior superior alveolar arteries, which supply the incisor and canine teeth and the maxillary sinus.**

The orbit has orbital canal, orbital groove and orbital foramen. The infra-orbital artery passes initially through the canal then through the groove after that through the foramen to give origins for the anterior superior and middle superior arteries, but before the orbit within the intra-temporal fossa it gives origin for the posterior superior alveolar artery. All these 3 alveolar arteries supply the upper jaw. The posterior alveolar artery supplies the molars, middle alveolar artery supplies the premolars, the anterior alveolar artery supplies the canines and incisors.

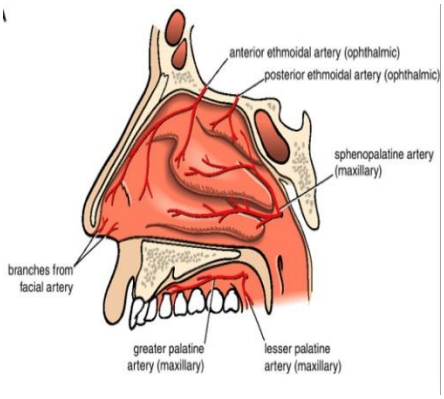
Pharyngeal artery

- **Travels posteriorly and leaves the pterygopalatine fossa through the palatovaginal canal with the pharyngeal nerve.**
- **Supplies the posterior aspect of the roof of the nasal cavity, the sphenoidal sinus, and the pharyngotympanic tube.**

The Greater palatine is one of the two branches of the palatine artery that travel within the palatine canal to reach the oral cavity supplying the hard palate, then if passes through the incisive foramen to return

backward to the nose, supplying the posterior inferior quadrant of the lateral wall of the nose.

The doctor missed the following slide by mistake while he was turning the slides, READ it anyway.



Sphenopalatine artery

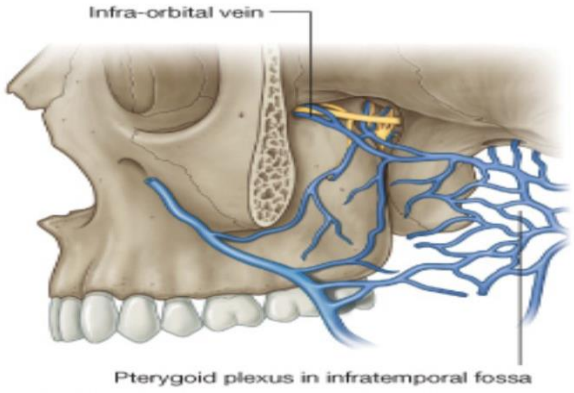
- **The terminal branch of the maxillary artery.**
- **Leaves the pterygopalatine fossa medially through the sphenopalatine foramen.**
- **Accompanies the nasal nerves, giving off:**
- **1. Posterior lateral nasal arteries, which supply the lateral wall of the nasal cavity and contribute to supply of the paranasal sinuses.**
- **2. Posterior septal branches, which supply the nasal septum- the largest of these branches passes anteriorly down the septum to anastomose with the end of the greater palatine artery. Artery of pterygoid canal.**
- **Passes posteriorly into the pterygoid canal and supplies surrounding tissues.**
- **Passing inferiorly through cartilage filling the foramen lacerum.**
- **Terminates in the mucosa of the nasopharynx.**

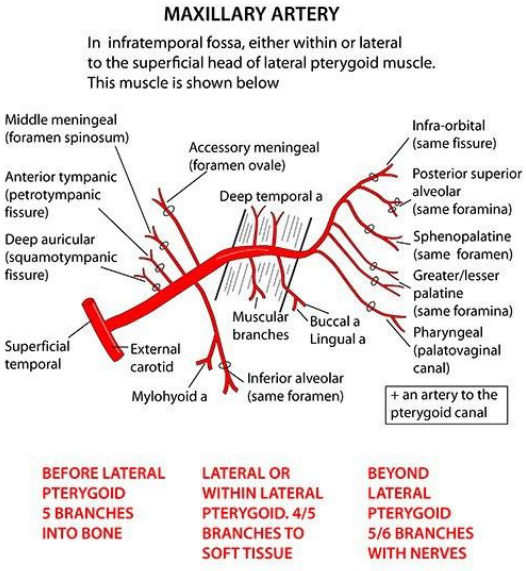
Now the Doctor continues…

Artery of pterygoid canal

- **Passes posteriorly into the pterygoid canal and supplies surrounding tissues.**
- **Passing inferiorly through cartilage filling the foramen lacerum.**
- **Terminates in the mucosa of the nasopharynx.**

According to its name, it supplies the pterygoid canal and its structures.



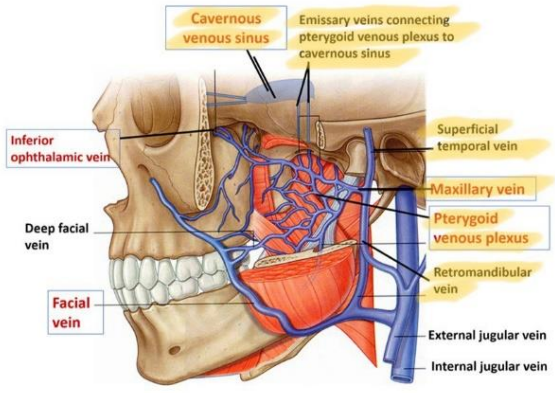


Veins

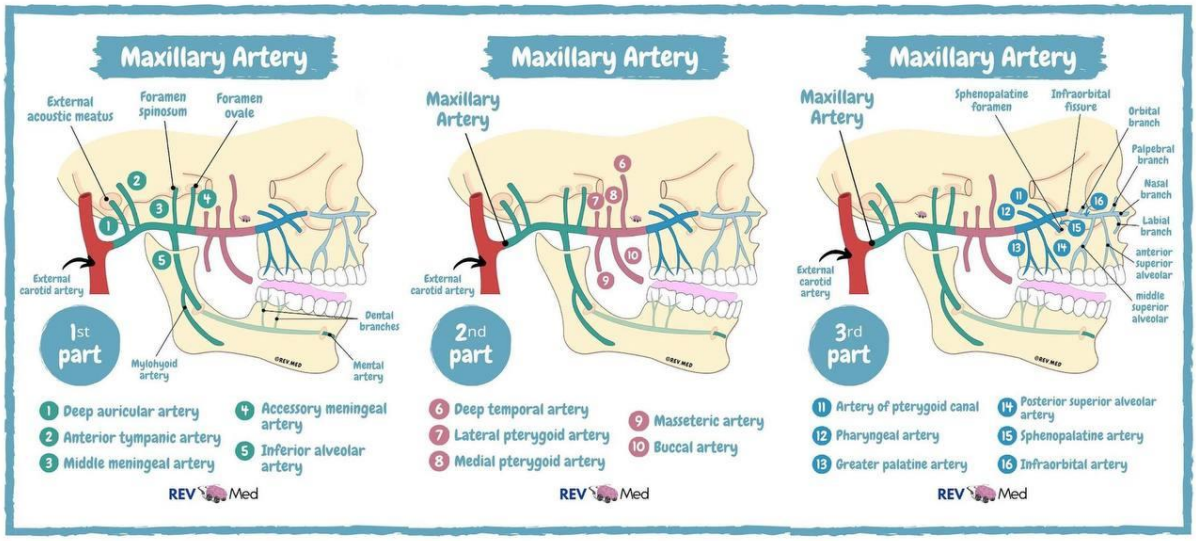
- **Drain areas supplied by branches of the terminal part of the maxillary artery.**
- **Generally, travel with these branches back into the pterygopalatine fossa.**
- **The veins coalesce in the fossa and then pass laterally through the pterygomaxillary fissure to join the pterygoid plexus of veins in the infratemporal fossa, around the pterygoid muscle.**
- **The infra-orbital vein drains the inferior aspect of the orbit.**
- **May pass directly into the infratemporal fossa, so bypassing the pterygopalatine fossa.**

The pterygoid plexus of veins forms the maxillary vein that join the superficial temporal vein in the substance of the parotid gland forming the retro-mandibular vein.

Keep in mind that the pterygoid plexus also has a connection with the cavernous sinus by emissary veins through the foramen spinosum and ovale.



So as a quick recap;



Test yourself!

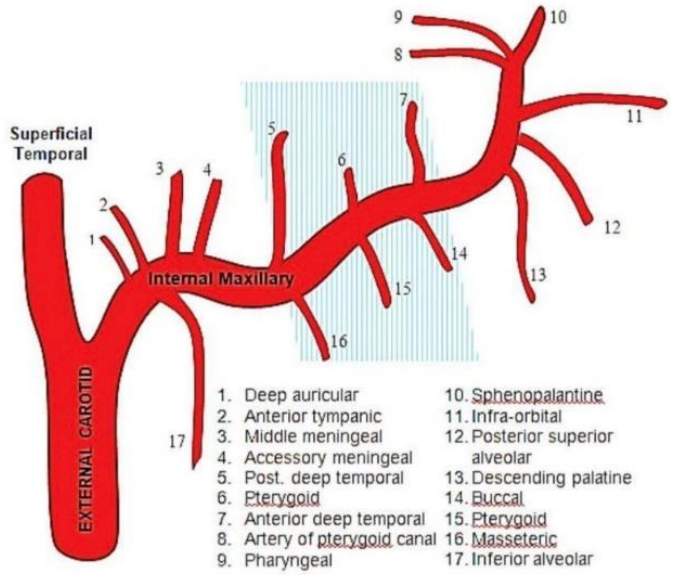


Figure : Branches of internal maxillary artery

Thank you

V3

- ✓ We clarified some points to be easier to understand, about the contents of (nerve to pterygopalatine canal). Back to page 6+7 and make sure that you understand them correctly!

- ✓ Greater palatine artery is one of the two branches of the palatine artery that travel within the palatine canal to reach the oral cavity supplying the hard palate, then it passes through the incisive foramen to return backward to the nose, supplying the posterior inferior quadrant of the lateral wall of the nose.

- ✓ **Pharyngeal artery** (not the greater palatine artery) that travels posteriorly and leaves the pterygopalatine fossa through the palatovaginal canal with the pharyngeal nerve. Supplies the posterior aspect of the roof of the nasal cavity, the sphenoidal sinus, and the pharyngotympanic tube.