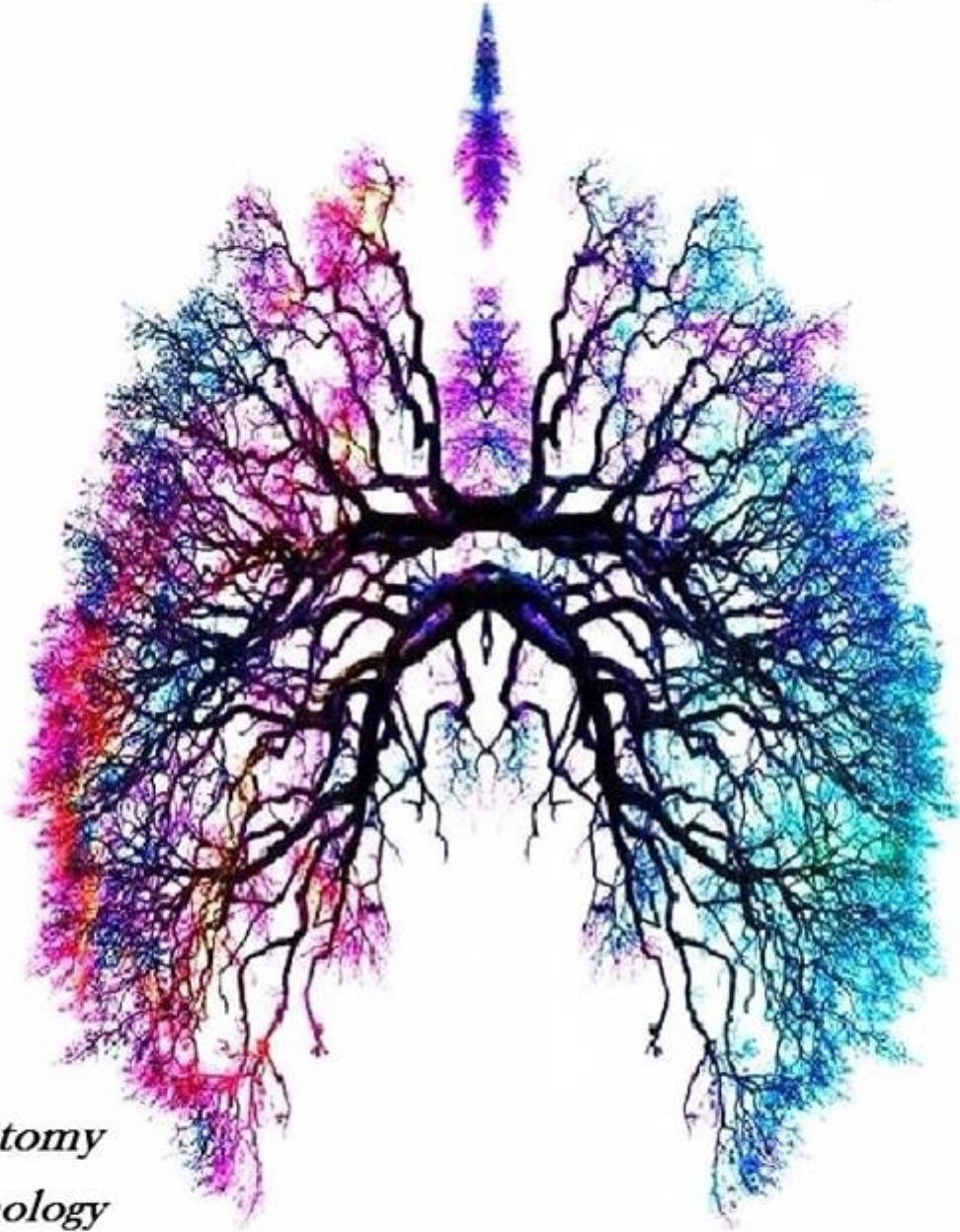


RESPIRATORY SYSTEM

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- Anatomy*
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Lecture # 3 (2-anatomy)
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Sheet

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Pterygopalatine fossa

The pterygopalatine fossa (also called sphenopalatine fossa) is an inverted 'tear-drop' shaped space that lies between bones in the skull [bones like: the lateral pterygoid plate, posterior wall of maxilla and sphenoid bone]. It's very important because it has contents that give blood supply and nerve supply [sensory, parasympathetic and sympathetic] to the nose, palate, orbit and pharynx.

Skeletal framework

As we said, the pterygopalatine fossa lies between bones:

The **sphenoid bone** forms the **roof and the posterior wall** of the fossa. **Posteriorly is the lateral pterygoid plate, anteriorly we can find the posterior wall of maxilla.** Whereas the **lateral surface of the palatine bone** forms its **medial wall**.

Communications

As we said, the pterygopalatine fossa is very important because of its contents. That's why it has different communications with other parts of the skull through which its contents can enter and leave.

The first communication:

Pterygopalatine fossa communicates with **infratemporal fossa** through the **pterygomaxillary fissure** (*it's called pterygomaxillary fissure because it lies between pterygoid and maxilla*). **Maxillary nerve and maxillary artery** pass through it but opposite to each other. The **third part of maxillary artery** passes through it to the pterygopalatine fossa, but maxillary nerve is coming from the pterygopalatine fossa to the infratemporal fossa. (*To be discussed further later in this sheet*)

The second communication:

The palatine bone has a very important foramen called **sphenopalatine foramen** (*the largest foramen medial to the pterygopalatine fossa*). Nerves and arteries enter through this foramen to the **nasal cavity**.

The third communication:



The **sphenoid bone** provides the communication between pterygopalatine fossa and **middle cranial fossa** by two foramina : the **foramen rotundum** and ,directly inferior to it, is the **pterygoid canal**.

The **maxillary nerve** passes from the middle cranial fossa to the pterygopalatine fossa through the **foramen rotundum**.

Pterygoid canal also starts from the middle cranial fossa to the pterygopalatine fossa. **Nerve of pterygoid canal** passes through it with sympathetic and parasympathetic fibers.

The Pterygoid canal and foramen lacerum:

Foramen lacerum is a foramen that lies at the base of the skull. Its roof is made of **cartilage** (it's closed by cartilage) and the **Internal carotid artery** occupies this roof.

The pterygoid canal is in this cartilage (part of the pterygoid canal is in the cartilage of foramen lacerum). So, what fills it superiorly? The Internal carotid artery that goes to the **cavernous sinus** (so ,note that here there's a content of the cavernous sinus) . [*these are important information.*]

The fourth communication:

The pterygopalatine fossa communicates superioposteriorly with the **nasopharynx** through the **palatovaginal canal**- a small canal that can't be seen, **pharyngeal branches** of arteries and nerves coming from the pterygopalatine ganglion pass through it to the nasopharynx-.

**** NOTE THAT..** Foramen rotundum and pterygoid canal are also two posterior communications. so, there are three communications posteriorly :foramen rotundum and pterygoid canal with the middle cranial fossa, and palatovaginal canal with the nasopharynx.

The fifth communication:

Palatine canal is the canal, between the pterygopalatine fossa and oral cavity through which passes the **palatine nerve and palatine vessels**, each give greater and lesser palatine; the lesser palatine is for the soft palate, and the greater is to the hard palate and nose.



The sixth communication: inferior orbital fissure

The communication between pterygopalatine fossa and the **orbital cavity** is through the **inferior orbital fissure** which the **maxillary nerve and maxillary artery** enter, become in the orbital cavity and end as the **infraorbital nerve and vessels**.

Contents

As we said at the beginning of the lecture, the pterygopalatine fossa has important contents, these contents are:

- 1) maxillary nerve
- 2) terminal part of maxillary artery
- 3) nerve of pterygoid canal
- 4) pterygopalatine ganglion
- 5) veins & lymphatics.

This can be a very easy exam question.

Now, let's talk about each one of them in details:

Maxillary Nerve:

Maxillary nerve is a pure **sensory** branch of the **trigeminal** ganglion and it's the main nerve supply to the nose. It also supplies orbit, pharynx and palate.

Pathway:

-It lies in the middle cranial fossa and reaches the pterygopalatine fossa through the foramen rotundum.

-It then goes to the infratemporal fossa through the pterygomaxillary fissure to give **the posterior superior alveolar branch** (found on the posterior wall of the maxilla) that supplies the molar and premolar teeth in the upper jaw, buccal gingivae and maxillary air sinus.

-After that it returns to the inferior orbital fissure to enter the orbital cavity and there it gives the **middle superior alveolar** branch (it's an occasional branch, when it's found it goes to the premolars) and **anterior superior alveolar branch** (goes to the canines and incisors).

-and don't forget that when the zygomatic branch enters orbit through the inferior orbital fissure it gives 2 branches: zygomaticotemporal branch (carries sympathetic and parasympathetic fibers that it gives to the lacrimal nerve that's going to the lacrimal



gland before it reaches the skin of temporal –this will be discussed later in this sheet) & zygomaticofacial nerve (sensory nerve to the skin of zygome).

-it continues in the orbital cavity .It passes in the floor of the orbital cavity and then through a groove called orbital groove then orbital canal and exit from the infraorbital foramen to terminate as the infraorbital nerve .

-The **infraorbital nerve** gives 3 branches :palpebral (to the lower eyelid) ,nasal(to the external nose) , and superior labial nerves(to the skin of the upper lip).

****NOTE :** some books say that the maxillary nerve turns into infraorbital nerve once it enters the orbital cavity. That's why they consider the middle and anterior superior alveolar nerves branches of infraorbital nerve. But the doctor believes that the infraorbital nerve is the termination of the maxillary nerve after it enters the infraorbital foramen. (same for maxillary artery)

Maxillary Artery:

Maxillary artery is a branch of **external carotid artery** ,it's one of the two terminal branches in the **parotid gland**.

It passes deep to the neck of mandible. Then, in the infratemporal fossa, the **lateral pterygoid muscle** divides the artery into three parts: 1st part before the lateral pterygoid muscle, 2nd part superficial or deep to the lateral pterygoid muscle and 3rd part after the lateral pterygoid muscle (which is the most important part here) .

1st part :

Relations :before the lateral pterygoid muscle . Medial to this part is the sphenomandibular ligament and lateral to it is the neck of mandible. above it there is auriculotemporal nerve and below it the maxillary vein.

Branches :it gives five branches, all of them pass through fissures or foramina [i.e. bony openings] :

- inferior alveolar nerve : enters in the **mandibular foramen** then the mandibular canal to the lower teeth.
- middle meningeal nerve(goes upwards and enters the **foramen spinosum**) and accessory middle meningeal (enters **foramen ovale**) and they go to the middle cranial fossa [from the base of skull to the middle cranial fossa] .
- other two arteries pass to the ear through the **external auditory meatus**

2nd part:

Relations : superficial or deep to the lateral pterygoid muscle



Branches : it also gives five branches to the **muscles of mastication** (like temporalis muscle , masseter muscle , lateral pterygoid muscle and medial pterygoid muscle)

3rd part :

Relations: after lateral pterygoid muscle .it passes from the infratemporal fossa through the pterygomaxillary fissure to reach the pterygopalatine fossa .

In the pterygopalatine fissure the nerve and the artery are **opposite to each other** .the artery is going from infratemporal to the pterygopalatine fossa while the nerve goes from pterygopalatine to the infratemporal fossa. So they meet in the pterygomaxillary fissure with opposite pathways .

Branches : it gives branches to the ganglion and branches that pass with the nerves [branches of maxillary nerve] :

orbital branches, pharyngeal branches , sphenopalatine artery [especially long sphenopalatine which is called nasopalatine that goes to the septum and one of the causes of epistaxis] and palatine [greater to the hard palate and lesser to the soft palate] .

The continuation of maxillary artery is same as continuation of maxillary nerve: it continues in the orbital cavity then passes through the orbital groove then the orbital canal and exit from the infraorbital foramen to become the infraorbital nerve and artery.

It gives posterior , middle and anterior superior alveolar branches and then it terminates as infraorbital artery (its branches contribute to the blood supply of the floor of the orbit .they're 3 branches palpebral , nasal, superior labial).

Artery of pterygoid canal accompanies the nerve of pterygoid canal and terminates in the mucosa of the nasopharynx.

Nerve Of Pterygoid Canal:

it's a plexus of nerves that are found around the internal carotid artery (*remember* : the relation of pterygoid canal, foramen lasserum and internal carotid artery which we have mentioned early in this sheet) . It contains two types of fibers : parasympathetic fibers (from the greater petrosal nerve) & sympathetic fibers (from deep petrosal nerve) . These two together pass in the pterygoid canal from the middle cranial fossa to the pterygopalatine fossa and ends in the pterygopalatine ganglion.

So, the origin of the nerve of the pterygoid canal is:

1) deep petrosal (sympathetic) , which has started from the superior cervical sympathetic ganglion ,



2) greater petrosal (parasympathetic), which has started from the geniculate ganglion of facial nerve in the brain.

Pterygopalatine ganglion

It's called parasympathetic ganglion. Why?

Because the greater petrosal nerve which carries the parasympathetic fibers synapse in this ganglion (so, the greater petrosal has preganglionic fibers and postganglionic fibers that synapse in this ganglion)

While the deep petrosal which carries the sympathetic fibers is postganglionic only. It can't synapse in the pterygopalatine ganglion because it has already synapsed. It just passes through it.

That's why it's called parasympathetic ganglion, because there is synapse for the parasympathetic fibers.

Both, the postganglionic parasympathetic fibers of greater petrosal (after the synapse in the ganglion) and the postganglionic sympathetic deep petrosal pass through the branches of the maxillary nerve (are distributed with the branches of maxillary nerve).

The maxillary nerve provides the sensory fibers in the ganglion. When it reaches the pterygopalatine fossa it gives two nerves called **twigs** of nerves (branches) which are sensory nerves. Then, branches of the maxillary nerve together with the fibers from the ganglion (sympathetic and parasympathetic) go to:

- the orbital cavity as orbital branches through inferior orbital fissure (to the periosteum, sphenoidal and ethmoidal sinuses)
- to the nasopharynx as pharyngeal branches, sympathetic, parasympathetic and sensory (goes posteriorly through palatovaginal canal, supplies mainly the mucosa and glands of the nasopharynx)
- to the nose through sphenopalatine foramen (sphenopalatine nerve) it gives long and short sphenopalatine nerves. The short is sensory to the superior posterior quadrant of the lateral wall. The long sphenopalatine is also called nasopalatine – largest branch – goes to the septum. (The artery is important in epistaxis)
- palatine nerve that passes through the palatine canal till it reaches the roof of the oral cavity. It divides into **lesser palatine** which goes to the soft palate through the lesser palatine foramen (found in the posterior wall of hard palate) and **greater palatine (sometimes it's called anterior palatine)** which goes to the hard palate through the greater palatine foramen (also found in the posterior wall of hard palate), then it enters the incisive foramen and goes to the nose. Note that the nasal nerves are different from the greater palatine – sphenopalatine –) and lesser palatine goes (to the soft palate).



- To the inferior orbital fissure as zygomaticotemporal and zygomaticofacial nerves :Zygomaticotemporal is very important because it delivers the parasympathetic secretomotor fibers to the lacrimal nerve that supplies the lacrimal gland at the roof of the orbit of the lateral side as we said before . It receives parasympathetic fibers for the secretion of tears. So, what's the innervation of lacrimal gland ?**lacrimal nerve** that receives the parasympathetic and sympathetic fibers through **the zygomaticotemporal branch** of maxillary nerve.

Always remember : the ganglion has parasympathetic from greater petrosal , sympathetic from the deep petrosal and sensory from the maxillary nerve.

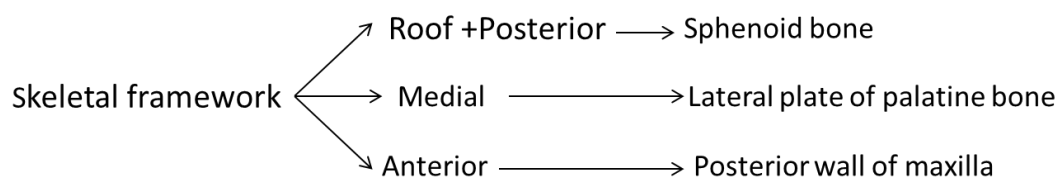
Veins (Veins follow opposite direction to the arteries)

pterygoid plexus of veins surrounding the lateral pterygoid muscle in the infratemporal fossa. it may end as the maxillary vein posteriorly .the maxillary vein meets in the parotid gland with superficial temporal and unite to form retromandibular vein which's one of the contents of the parotid gland.

Retromandibular vein divides into anterior division and posterior division; the posterior division unites with the posterior auricular to form external jugular vein. The anterior division unites with the facial to form the common facial vein.

Pterygoid plexus may communicate through emissary veins with the cavernous sinus which is dangerous, any pus cell reaches the pterygoid plexus may reach the cavernous sinus and this may be fatal because the drainage is in the dangerous area of the face. Upper part may also reach the cavernous sinus through the ophthalmic vein. (important)

Summary :



Communications:

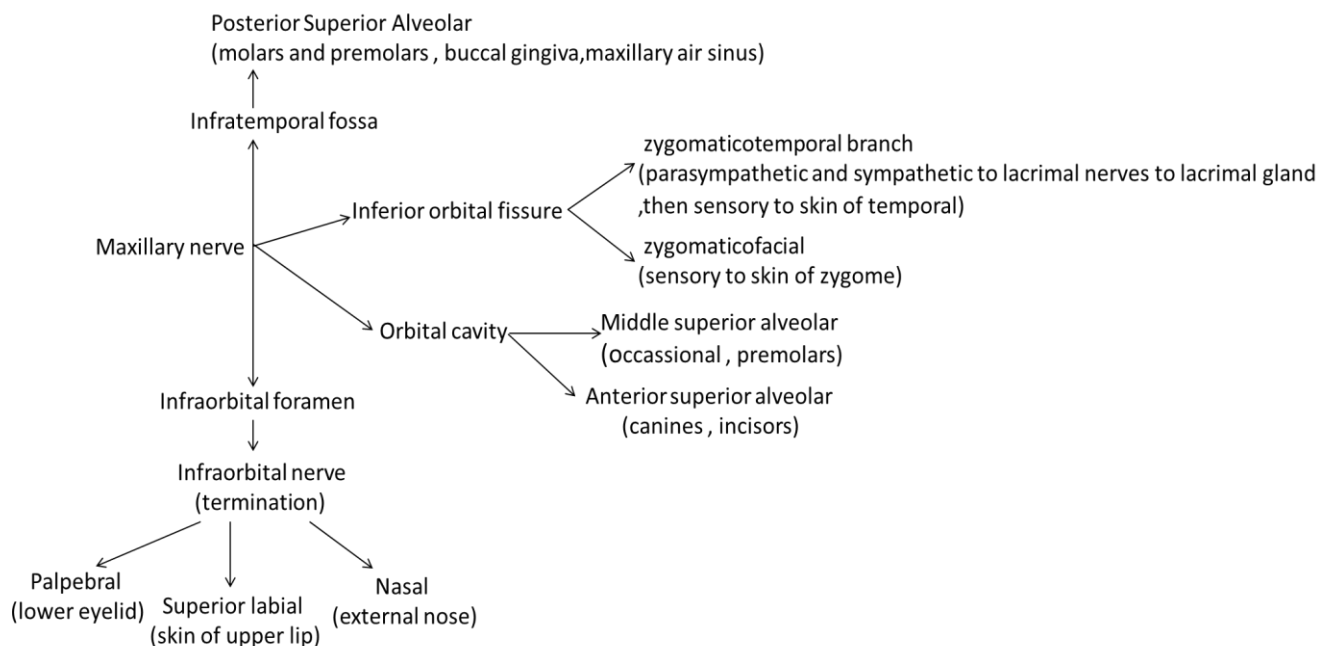
Pterygomaxillary fissure	Infratemporal fossa	Maxillary nerve and maxillary artery opposite to each other
Sphenopalatine foramen	Nasal cavity	Nerves and arteries to the nasal cavity



Foramen rotundum	Middle cranial fossa	Maxillary nerve
Pterygoid canal	Middle cranial fossa	Nerve of pterygoid canal (deep and greater)
Palatovaginal canal	nasopharynx	Pharyngeal branches of arteries and nerves
Palatine canal	Oral cavity	Palatine nerves and palatine vessels
Inferior orbital fissure	Orbital cavity	Maxillary artery and maxillary nerve.

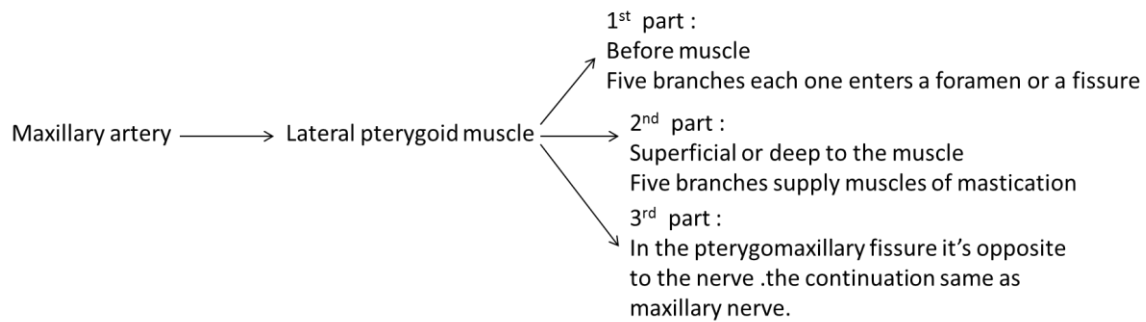
Contents :

1. Maxillary nerve :





2. Maxillary artery :



3. Nerve Of Pterygoid Canal:

parasympathetic fibers (greater petrosal, geniculate ganglion of facial nerve.) & sympathetic fibers (deep petrosal, superior cervical sympathetic ganglion) .

4. Pterygopalatine ganglion (parasympathetic ganglion):

Sympathetic postsynaptic from deep petrosal
Parasympathetic that synapse from greater petrosal
Sensory from maxillary nerve (trigeminal)

5. Pterygoid plexus of veins end up as maxillary vein .have a dangerous communication with cavernous sinus through emissary veins.

6. Lymphatics

*don't forget that the sphenopalatine foramen lies in the medial wall of the fossa in the lateral plate of palatine bone.

*and that the foramen lacerum has a roof made of cartilage, and this roof is occupied by internal carotid artery that reaches the cavernous sinus .The pterygoid canal is in this cartilage and internal carotid artery is superior to it.

Past Papers :

1) All of the following regarding the pterygopalatine fossa are correct EXCEPT:

- (a) The maxillary artery enters it through the pterygomaxillary fissure
- (b) The maxillary nerve enters it through foramen rotundum
- (c) The parasympathetic ganglia receives preganglionic parasympathetic nerve fibers from the facial nerve
- (d) The parasympathetic ganglia receives postganglionic sympathetic nerve fibers through the lesser petrosal nerve
- (e) It communicates with the oral cavity below through the palatine canal

Answer : d



2) which is wrong about pterygopalatine ganglion:

a- receives preganglionic fibers from trigeminal nerve

b- receives postganglionic sympathetic from carotid plexus

c- send pharyngeal nerve through palatovaginal canal to supply glands in the mucosa of nasopharynx

Answer: a

3) nerve to pterygoid canal is made of:

greater and deep petrosal nerves

4) one of the paranasal sinuses is supplied by the superior alveolar nerve :

maxillary air sinus

**please refer to the slides for the pictures.

"خيرُ النَّاسِ أَنْفَعُهُمُ لِلنَّاسِ"

-This sheet is dedicated to **Deem Al-Qawasmeh & Elaf Al-Bataineh**-