

In the previous lecture we talked about the anatomy of the nasal cavity, today we will talk about its blood supply, venous drainage, innervations, and finally about the paranasal sinuses.

When we describe the blood supply of the nose, we divide it into 2 parts, the blood supply of the lateral wall of the nose and the blood supply of the medial wall of the nose which is the septum. but at first we will talk about each artery alone and what does it supply in the nose and at the end of the blood supply topic there will be a summary that shows arteries that supply the lateral wall of the nose in all its parts (upper anterior, upper posterior, lower anterior, lower posterior) and the supply of the medial wall (septum).

## **Blood supply:**

\*in general the blood supply of the nose comes from branches of the internal and external carotid arteries.

Now let's start with each artery and what does it supply:

- Anterior and posterior ethmoidal arteries :-

The internal carotid artery gives the ophthalmic artery that gives the anterior and posterior ethmoidal arteries (we said before that the ophthalmic artery goes through the optic foramen along with the optic nerve, then the ophthalmic artery in the orbital cavity gives supratrochlear and supraorbital arteries) now, the anterior ethmoidal artery supplies the upper anterior quadrant of the lateral wall and also supplies the septum and at the end it will give the external nasal artery that will supply the external nose, while the posterior ethmoidal artery will supply the upper posterior quadrant.

- Sphenopalatine artery :-

It's a branch from the maxillary artery in the pterygopalatine fossa, it reaches the nasal cavity by the sphenopalatine foramen, that is located in the pterygopalatine fossa, and along the artery sphenopalatine nerve enters the nasal cavity as well. now, when the sphenopalatine artery enters the nasal cavity it divides to long sphenopalatine (which is also known as the nasopalatine) and short sphenopalatine artery. the short sphenopalatine will supply the upper posterior quadrant of the lateral wall (posterior lateral nasal). while the long sphenopalatine artery will supply the septum and here it's important to remember that the most important blood supply to the septum is the long sphenopalatine (nasopalatine), after it reaches the septum it will go through the incisive foramen in order to supply the hard palate.

- Palatine artery :-

It's a branch of maxillary in the pterygopalatine fossa, it descends in palatine canal to reach the roof of the oral cavity and there it will divide to greater palatine and lesser palatine, the greater palatine will go through the greater palatine foramen and the lesser in lesser palatine foramen. the lesser palatine will go to the soft palate and supplies it, while the greater will go to the hard palate and

then enters the incisive foramen going to the nasal cavity both septum and inferior quadrant of the lateral wall anterior and posterior .

- Branches of facial artery :-

Facial artery is one of the blood supplies to the nose by its branches mainly by the superior labial .

\*\* remember that the facial artery gives mandibular, lower labial, and superior labial. \*\*

Now this superior labial will supply the nose by giving a septal branch and an alar branch to the ala and will supply the lateral wall , also the facial will give lateral nasal arteries.

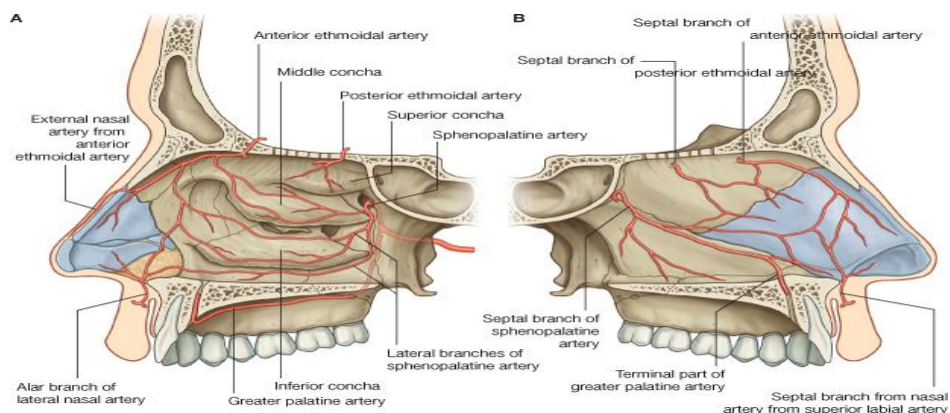
## Epistaxis:

It's defined as bleeding through the nose , and it happens frequently in children in which any minor trauma will cause bleeding , the major site of this bleeding is on the septum between the lower third and the upper two thirds . this area is called Kiesselbach's area in which we find an anastomose between the nasopalatine (long sphenopalatine) and a branch of facial which is the septal branch of superior labial .

\*\* if the Dr asks about the most common cause of epistaxis then it's the facial artery through its branch.

So if a patient comes with epistaxis we apply pressure to the area of bleeding , we do not let the patient lie on his/her back because if we do so the patient will swallow the blood and this blood will get digested in the stomach causing problems . so the best thing to do is for the patient to sit on a chair and to apply pressure on the area of bleeding , if this does not work we stuff the cavity that is bleeding with gauze which will cause the bleeding to stop , now if the bleeding happened a lot and for a long time we do cauterization which is either electrical or by silver nitrate that causes a permanent clot at the area of bleeding .

The right picture is the septum and the one on the left is the lateral wall of the nasal cavity that we divide into upper anterior, upper posterior, lower anterior and lower posterior .and the blood supply of each .

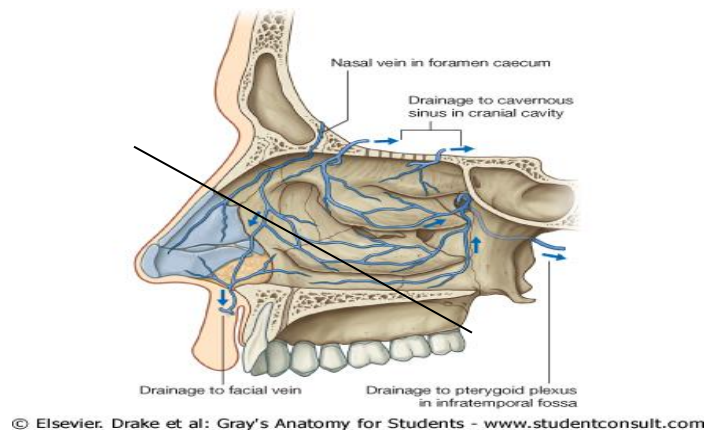


Summary: lateral wall of the nose is divided into: a) upper anterior supplied by anterior ethmoidal artery. b) Upper posterior supplied by posterior ethmoidal and short sphenopalatine. c) Lower anterior supplied by greater palatine. d) Lower posterior supplied by greater palatine.

The septum is supplied mainly by long sphenopalatine, it is supplied as well by anterior ethmoidal, greater palatine, branches of facial and posterior ethmoidal according to the slides .

## Venous drainage of the nasal cavity:

Here we divide the nose into anterior and posterior in which the anterior is (anterior and inferior) while the posterior is (posterior and superior) as the following picture :



We notice that the drainage of the anterior part is by the facial vein . the facial vein ends in common facial and then in internal jugular vein . while the posterior part the drainage will go to the pterygoid plexus of veins that is found around the lateral pterygoid muscle .

Note about the lateral pterygoid muscle :

Remember when we took the muscles of mastication we talked about this muscle . this muscle has 2 important features :

The maxillary artery is divided by it into 3 parts , first , second and third . let's explain this point :

- Maxillary artery is one of the terminal branches of the external carotid artery that we find in the parotid gland , then this maxillary artery will go to the infratemporal fossa then to pterygopalatine fossa , this artery will be divided into 3 parts by lateral pterygoid muscle , the first part is before the lateral pterygoid and it gives 5 branches , then the second part is related to the muscle either superficial or deep and it also gives 5 branches , and a 3<sup>rd</sup> part in the pterygopalatine fossa gives the branches that goes to the nasal cavity as the sphenopalatine and the palatine artery .
- Around the lateral pterygoid muscle we find plexus of veins called pterygoid plexus of veins that drains the nose , the end of this plexus is the maxillary vein that goes to the parotid

gland and meets with the superficial temporal forming the retromandibular vein in the parotid gland .

**\*\*is there any communication between the pterygoid plexus of veins and the cavernous sinus?**

Yes , by emissary veins , so it is possible that if there is any pus or abscess in the dangerous area of the face (triangle from the corners of the mouth to the bridge of the nose) and this abscess get squeezed it can go through the pterygoid plexus to the cavernous sinus causing thrombosis that can be fatal . and the way is considered indirect way of transmission .

There is a direct way for the infection to go to the cavernous sinus without passing through the plexus and that is by passing through the emissary veins to the superior ophthalmic veins

### **Lymphatic drainage :**

The anterior part of the nose will drain into the submandibular lymph nodes so any infection in the nose anteriorly will cause enlargement of the submandibular lymph nodes . while the upper posterior drainage will go to retropharyngeal lymph nodes to the upper deep cervical lymph nodes . then all reach deep cervical lymph node around the internal jugular veins .

### **Innervations :**

Innervations is as important as the blood supply .

The passage of nerves is along the corresponding artery, example : when we say sphenopalatine nerve then it's along the sphenopalatine artery .

We divide the nerves here into :

1- Olfactory nerve 2- branches of ophthalmic and maxillary nerves 3- parasympathetic fibers

- Olfactory nerve :-

Starts from the olfactory region of the nose , that is located on the roof and upper part of the septum and above the superior meatus . here we find different epithelium in which it has bipolar cells and these cells have hairlets , nerve fibers that form the olfactory filaments , and these filaments pass through cribriform plate of ethmoid , then reach the anterior cranial fossa and forms synapses in the olfactory bulb then after that comes the olfactory tract , then the olfactory centre . now the function of the olfactory nerve is to carry the smell sensation as impulses , and these impulses are in the form of codes , each smell has a specific code that will go through the nerve to the centre that will translate the code and give the meaning of it (smell of perfume , food ,...).

- Branches of the ophthalmic and maxillary nerves :-

Ophthalmic nerve will give the nasociliary that will give the anterior and posterior ethmoidal nerves , the anterior ethmoidal nerve will pass with its corresponding artery so it will go to the upper anterior quadrant then it will give the external nasal nerve to the external nose , while the

posterior ethmoidal nerve will go through the orbital cavity mainly to the ethmoidal air sinuses to supply the mucosa of ethmoidal air cell and will also go to sphenoidal air sinus . \*\*pay attention here that the posterior ethmoidal nerve did not go with the corresponding artery to the lateral wall

Sphenopalatine nerve branch of the maxillary nerve will go through the sphenopalatine foramen to the nasal cavity and also as the artery will give long and short , so the short will go posterior superior lateral while the long will go to the septum as the artery .

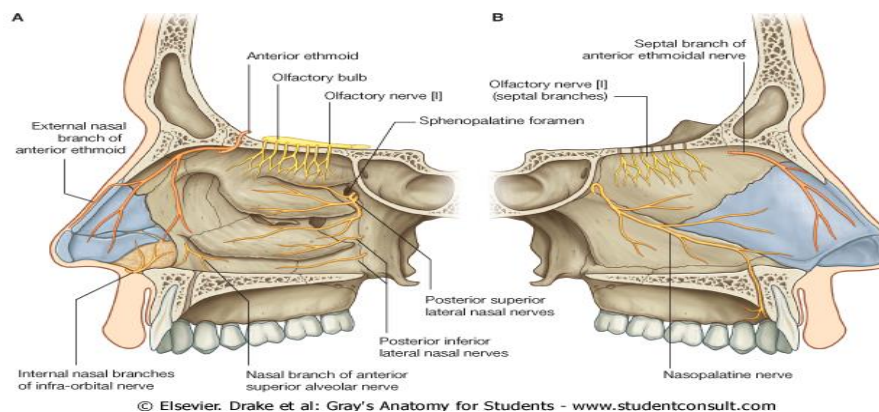
Also the maxillary (general sensation to the nose) will give posterior inferior nasal from greater palatine , also there is anterior superior alveolar .

\*\*Note : we know that maxillary nerve in the orbital cavity will give posterior superior alveolar , middle superior alveolar , and anterior superior alveolar . now these will descend in order to supply the upper jaw and teeth , in which the molars are supplied by posterior superior alveolar , the premolars are supplied by middle superior alveolar , and the incisors and canines by anterior superior and on the way this anterior superior alveolar will give the nose and it will supply the anterior inferior quadrant .

The nasopalatine (long sphenopalatine) nerve and the anterior ethmoidal nerve will innervate the septum .

Posterior superior medial nerve comes from short sphenopalatine .supplying the posterior superior aspect of the septum as the name indicates .

-The picture on the right shows the innervations of the septum , while the left shows the innervations of the lateral wall :



\*\*see the summary about blood supply and innervations of the nasal cavity in the slides .

- Parasympathetic fibers :-

Parasympathetic supply is to the glands (secretomotor) coming from facial nerve by greater petrosal nerve . in which the greater petrosal nerve is a presynaptic parasympathetic nerve .

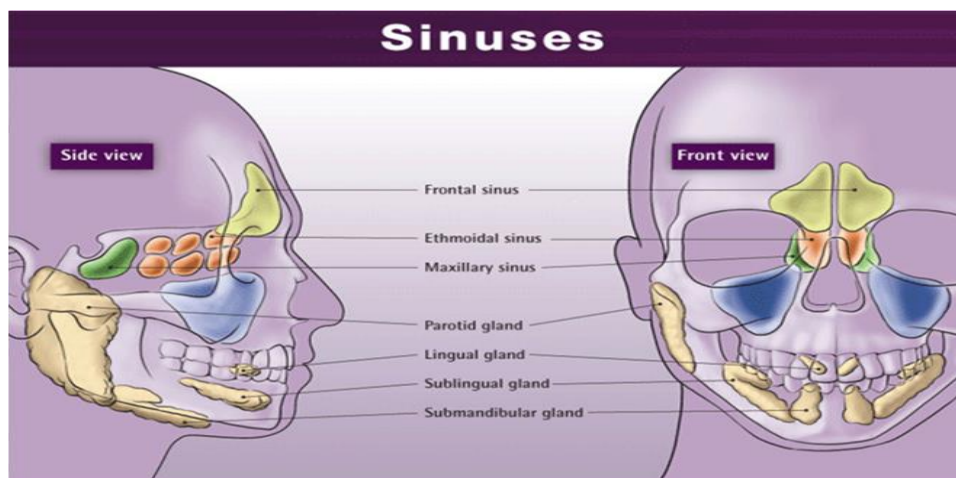
Note : the nucleus of the facial that gives the parasympathetic is found in the medulla oblongata and is known as superior salivary nucleus and for the facial specifically is the geniculate nucleus .

Now the greater petrosal carries presynaptic parasympathetic fibers and it forms a synapse in the pterygopalatine ganglia that is found in the pterygopalatine fossa and this ganglia is parasympathetic ganglia , now the post ganglionic fiber is distributed with the branches of maxillary nerve .

while the sympathetic comes with deep petrosal nerve that comes from the superior cervical sympathetic ganglia and this does not form a synapse in the pterygopalatine ganglia , it only passes through without synapse then the post ganglionic fibers will be distributed with branches of maxillary nerve , so the branches of maxillary nerve carry 3 types of fibers (sensory , parasympathetic ,and sympathetic) . (this topic will be discussed with details in the next lecture) .

### **Paranasal sinuses :**

This picture shows the frontal air sinus , Sphenoid air sinus , maxillary air sinus And the 6 ethmoidal air sinus .



We said before that the air sinuses are cavities inside some skull bones as the frontal bone the ethmoid , the sphenoid and the maxilla .

These spaces are filled with air and there mucosa is thin and the lining is ciliated psuedostratified columnar epithelium , and the sub mucosa is attached to the periosteum of the bone . each air sinus has a duct that opens in the lateral wall of the nose . there function is resonance of voice,decrease the weight of the skull (because they are filled with air) and they do protection by warming and moisturizing the air .

There are 2 frontal, 2 maxillary, 2 sphenoidal, while the ethmoidal are 6 . and they contain air cells and actually the ethmoidal air sinus are small containing one or two air cells (and as the Dr said air cell is a cell that contains air) .

- frontal air sinus :-

found in frontal bone usually unequal , at birth they are rudimentary (of small size) and they get larger with the enlargement of the face and skull . the drainage of the frontal sinus is easy because the sinus is upward and the duct is going downward in which the frontonasal duct opens in the infundibulum at the level of middle meatus .

If sinusitis happen in frontal sinus it is very rare to convert from acute to chronic because the drainage is easy and is fast and continuous .

The nerve supply to this sinus is supraorbital nerve that emerges from the supraorbital foramen that is a branch of frontal nerve of ophthalmic .

- Ethmoidal air sinus :-

Are 6 : anterior , middle and posterior cells , the anterior opens in the anterior part of hiatus semilunaris in the middle meatus , and the middle opens in bulla ethmoidalis which is also found in middle meatus , the posterior opens in superior meatus .

The nerve supply are the anterior and posterior ethmoidal (mostly by posterior) branches of nasociliary of ophthalmic nerve .

- Maxillary air sinus :-

The most important , the largest , found in maxilla one on the right and one on the left , it is pyramidal in shape , rudimentary at birth and enlarges with the enlargement of face and skull

The sinus gets large in size at the age of 8 years , the apex is directed laterally and the base deep to the lateral wall of the nasal cavity , so the base is found in the wall of the nasal cavity , while the apex is on the zygomatic arch .

The sinus is innervated by the infraorbital and alveolar branches of maxillary nerve as anterior superior alveolar nerve .

### **Why it is the most important one ?**

Due to "bad drainage" but what does that mean ?

We notice that the opening of the maxillary air sinus is highly up and that makes the drainage (bad) (the Dr did not mention what bad means but he explained it as it = bad ) so the drainage of this area is bad due to the mentioned reason . sinusitis of maxillary air sinus causes severe pain and tenderness by applying pressure on the maxilla or when you pray and you put your head on the ground you feel throbbing pain and that indicates infection and here drainage should be quickly done to prevent it from getting chronic and the patient should be covered with antibiotics . now to do drainage there are 2 choices: either for the patient to keep his head on the ground between his legs which is impossible or to drain it by making an opening on the base and do suction .

### Other complications related to the maxillary air sinus:

Extraction of one of the molars or premolars can form a fistula with the sinus (between the sinus and the oral cavity) due to their location that is directly below the sinus, this fistula will cause drainage continuously and might lead to sinusitis.

### Relationships of maxillary air sinus :

Related above to the orbit, related below to the roots of the upper molars and premolars, related behind to the infratemporal fossa, related medially to the lower part of the nasal cavity.

- Sphenoid air sinus :-

Found in the body of sphenoid, below the sella turcica that contains the pituitary gland, this is why when a person has a tumour in the pituitary, and he /she does an X-RAY you find that the sphenoidal air sinuses are small because of the enlarged sella turcica (important).

On the lateral side of the sinus we find the cavernous sinus because the cavernous sinus is on both sides of sella turcica.

The drainage goes to the sphenoethmoidal recess that is above the superior conchae.

Innervation: is by posterior ethmoidal branch of ophthalmic nerve and by the orbital branches of maxillary.

The end

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