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MATRIC NO: 17/MHS01/254

COLLEGE: MEDICINE AND HEALTH SCIENCES

DEPARTMENT: MEDICINE AND SURGERY

COURSE: GROSS ANATOMY OF HEAD AND NECK

COURSE CODE: ANA 301

LEVEL: 300

QUESTION

1. Write an essay on the cavernous sinus
2. Discuss the walls of the nose

ANSWERS

1. CAVERNOUS SINUS

Structure

The cavernous sinuses are one of several drainage pathways for the brain. They are 1cm wide cavities that extend a distance of 2cm. They are bilaterally paired collections of venous plexuses that sit within the middle cranial fossa, on either side of the sella turcica of the sphenoid bone. Although they are not truly trabeculated cavities like the corpora cavernosa of penis, the numerous plexuses, however, give the cavities their characteristic sponge-like appearance. The borders of the cavernous sinus are as follows:

The cavernous sinuses are bounded anteriorly, by the superior orbital fissure. Posteriorly, by the petrous part of the temporal bone. Medially, by the body of the sphenoid bone. Laterally, by the meningeal layer of the dura mater running from the roof to the floor of the middle cranial fossa. Roofed by the meningeal layer of the dura mater that attaches to the anterior and middle clinoid processes of the sphenoid bone. It is floored by endosteal layer of dura mater that overlies the base of the greater wing of the sphenoid bone.

Contents

Several important structures pass through the cavernous sinus to enter the orbit. They are sub-classified by whether they travel through the sinus itself, or through its lateral wall.

Structures passing through each cavernous sinus are:

- Abducens nerve (CN VI)
- Internal carotid artery (cavernous portion)
- Carotid plexus (post-ganglionic sympathetic nerve fibres)

The cavernous sinus is the only site in the body where an artery (internal carotid) passes completely through a venous structure. Structures in the lateral wall of each cavernous sinus are, from superior to inferior:

- The oculomotor nerve (CN III)
- The trochlear nerve (CN IV)
- The ophthalmic nerve (CN V₁)
- The maxillary nerve (CN V₂)

Communications (Dura Venous Sinus System)

The cavernous sinus is an unconventional venous system in the sense that it does not have a unidirectional flow of blood. Owing to the fact that there are no valves in the sinus and its connected veins, the direction of blood flow is dependent on venous pressure. The veins that communicate with the cavernous sinus are:

- Superior ophthalmic vein – It drains into the anterior part of the sinus via the superior orbital fissure.
- Inferior ophthalmic vein – It drains into the cavernous sinus as well as the pterygoid plexus.
- Superficial middle cerebral vein – At the point where internal carotid artery emerges, this vein pierces the roof of the sinus.
- Sphenoparietal sinus – It drains into the anterior ends of each cavernous sinus. They receive blood from diploic and meningeal veins.
- Hypophyseal veins – Additionally, efferent hypophyseal veins of both adenohypophysis and neurohypophysis drain to the cavernous sinus.

Left and right cavernous sinuses communicate by way of the anterior and posterior intercavernous sinuses. These vessels travel anteriorly and posteriorly (respectively) around the infundibulum of the pituitary gland, deep to the diaphragma sella, between the layers of dura mater.

The cavernous sinus in turn drains to the **superior and inferior petrosal sinuses**. Both sinuses join the sigmoid sinus, which then becomes the internal jugular vein. The internal jugular vein meets with the subclavian vein to become the left (or right) brachiocephalic vein.

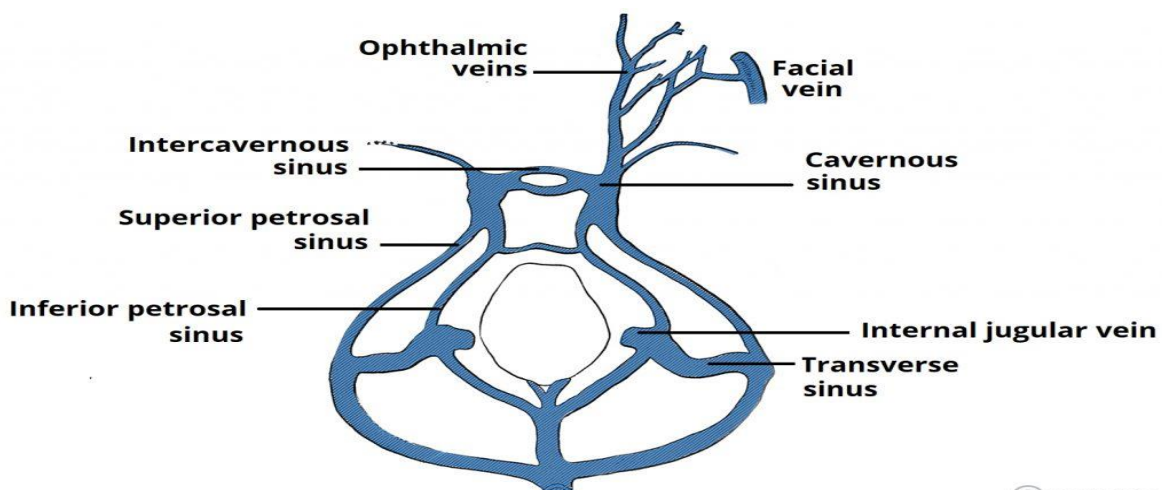


Fig 1. Diagram showing the Cavernous Sinuses and its Communications

Clinical Significance

- It is important to note that the superior ophthalmic vein forms an anastomosis with the facial vein. Therefore, the ophthalmic veins represent a potential route by which infection can spread from an extracranial to an intracranial site
- Carotid-cavernous Fistula: Head trauma resulting in rupture of the cavernous part of the internal carotid artery can produce what is known as a carotid-cavernous fistula. A pulsating exophthalmos can result as the venous pressure in the sinus would increase and reverse the flow of blood in the ophthalmic veins.
- Cavernous Sinus Thrombosis: This refers to the formation of a clot within the cavernous sinus. The sinus also has communicating branches from the sin of the face. Particularly in the 'danger area' (at the nasolabial cause and at the crease between the ala of the nose and the cheek), an infection can spread to the cavernous sinus, which can result in a cavernous thrombosis. This condition can result in internal strabismus (crossed eyes) if the abducens nerve (CN VI) is damaged, double vision while looking downward if CN IV was damaged, or ophthalmoplegia (paralysis or weakness in muscles of movement of the eye). Treatment is typically with antibiotic therapy. Where the cause is infection, thrombosis of the cavernous sinus can rapidly progress to meningitis.

2. WALLS OF THE NOSE

The nasal cavity is divided into right and left halves (each of which may be termed a nasal cavity) by the nasal septum. Each has a roof, a floor, and medial lateral walls.

LATERAL WALL OF THE NASAL CAVITY

The lateral wall is uneven and complicated. It is uneven due to the presence of three shelf-like bony projections called conchae. This is a region of the nasopharynx essential for humidifying and filtering the air we breathe in nasally. The lateral wall separates the nose; from the ethmoidal sinuses above; from the maxillary sinus below; from the lacrimal groove and nasolacrimal canal in front.

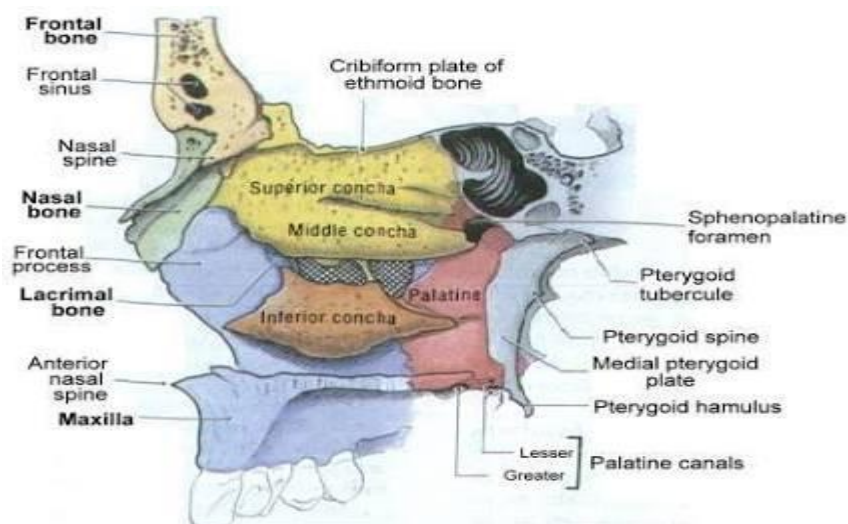


Fig 2. Diagram showing the Lateral Wall of the Nasal Cavity

Parts

The lateral wall is subdivided into three parts:

- Vestibule

This is a small depressed area in the anterior part. It is lined by modified skin containing short, stiff, curved hairs called vibrissae.

- Atrium of the middle meatus

This is the middle part. It is a shallow depression just in front of the middle meatus and above the vestibule of the nose. The atrium is limited above by a faint ridge of mucous membrane called agger nasi. The agger nasi is also referred to as the nasoturbinal concha or nasal ridge. The agger nasi is located midway along the anterior aspect of the middle nasal conchae.

- Nasal Conchae

The nasal conchae are curved bony projections directed downwards and medially. They increase the surface area of the nose for effective air-conditioning of the inspired air. The spaces separating the concha are called meatuses. There are three conchae in the nasal cavity:

- Superior Nasal Concha: It is also a projection from the medial surface of the ethmoidal labyrinth. It is the smallest concha. The superior meatus lies below the superior concha. It is the shortest and shallowest of three meatuses. It has openings of the posterior ethmoidal air sinuses. The spheno-ethmoidal recess is a triangular fossa just above the superior concha. It has openings of the sphenoidal air sinus.
- Middle Nasal Concha: It is a projection from the medial surface of the ethmoidal labyrinth. It is found between the superior and middle conchae. It plays a role in humidifying and clearing inspired air of micro-particles such as dirt. The middle meatus lies beneath the middle concha. It is part of the ethmoidal complex as it drains the maxillary, frontal and anterior ethmoidal sinuses. It has the following features:
 - The ethmoidal bulla – It is a rounded elevation. The opening of the middle ethmoidal air sinus at the upper margin of the bulla.
 - The hiatus semilunaris – It is a deep semi-circular sulcus below the bulla. The opening of the frontal air sinus at the anterior part of the hiatus semilunaris. The opening of the maxillary sinus at posterior part of the hiatus semilunaris.
 - The infundibulum – It is a short passage at the anterior end of the hiatus.
 - The sphenopalatine foramen – It is found in the posterior most region of the nasal cavity, at the back of the middle meatus. It connects the nasal cavity to the pterygopalatine fossa, and thus transmits the sphenopalatine artery and vein as well as the superior nasal and nasopalatine nerves.

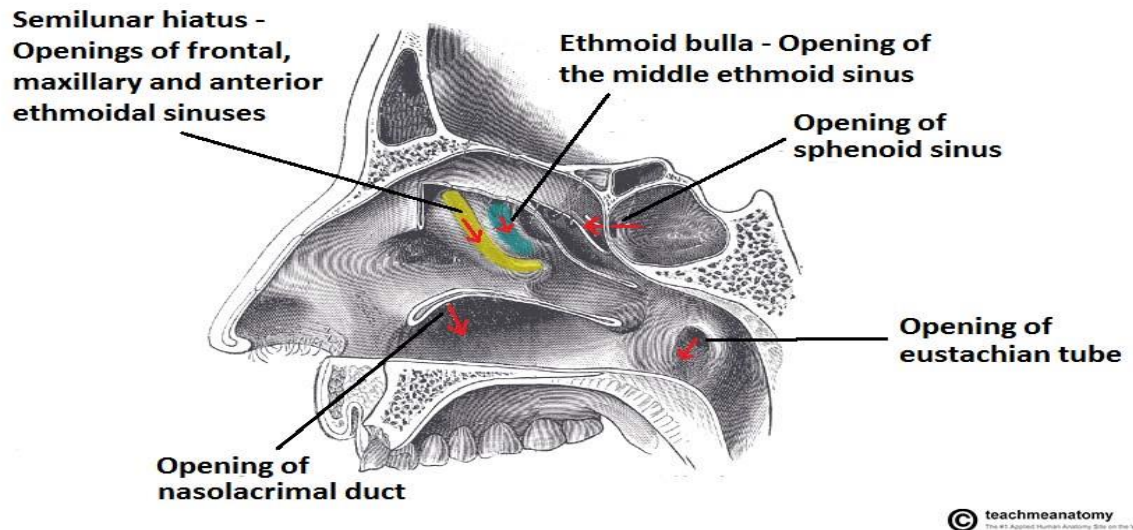


Fig 3. Diagram showing the Opening in the lateral wall of the Nasal Cavity

- **Inferior Nasal Concha:** It is an independent bone. It is the longest and broadest of the conchae. The concha is covered by a mucous membrane that contains large vascular spaces. Lying beneath the inferior nasal concha is the inferior meatus. The inferior meatus is the largest of the three meatuses. The nasolacrimal duct opens into it at the junction of its anterior one-third and posterior two-thirds. The opening is guarded by the lacrimal fold or Hassner's valve.

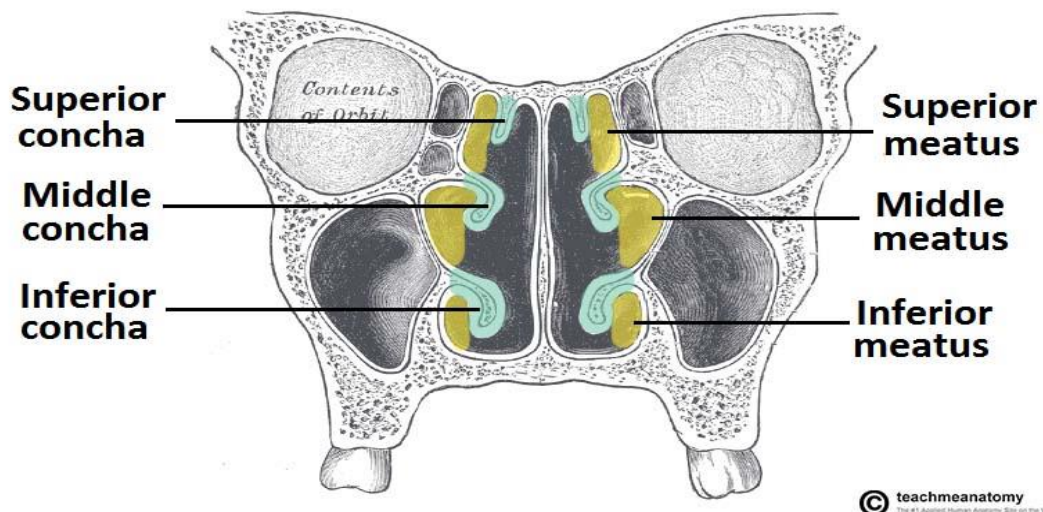


Fig 4. Diagram showing the Conchae and Meatuses of the Nasal Cavity

Bony Framework of the Lateral Wall

The skeleton of the lateral wall is partly bony, partly cartilaginous and partly made up of soft tissue. The bony part is formed by:

- Nasal bone
- Frontal process of maxilla
- Lacrimal bone

- Labyrinth of ethmoid with superior and middle conchae
- Inferior nasal concha
- Perpendicular plate of palatine bone
- Medial pterygoid plate of the sphenoid bone.

Cartilaginous part formed by:

- Lateral process of septal cartilage
- Major ala cartilage
- Minor ala cartilage

Arterial Supply

The anterosuperior quadrant is supplied by the anterior ethmoidal artery assisted by the posterior ethmoidal and facial arteries. The anteroinferior quadrant is supplied by branches from the facial and greater palatine arteries. The posterosuperior quadrant is supplied by sphenopalatine artery. The posteroinferior quadrant is supplied by branches from the greater palatine artery which pierce the perpendicular plate of the palatine bone.

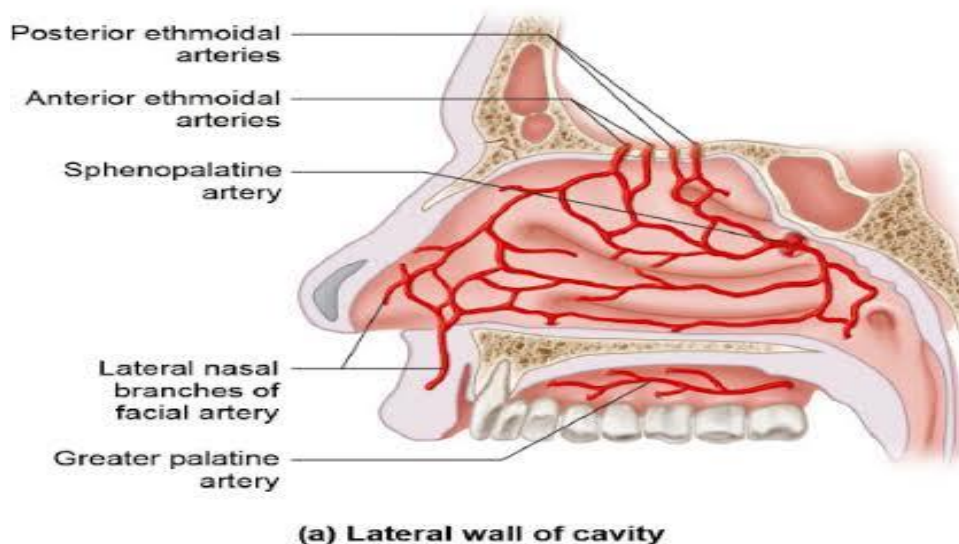


Fig 5. Arterial Supply of Lateral Wall of Nasal Cavity

Venous Drainage

The veins form a plexus which drains anteriorly into the facial vein. Posteriorly into pharyngeal plexus of veins. From middle part to the pterygoid plexus of veins.

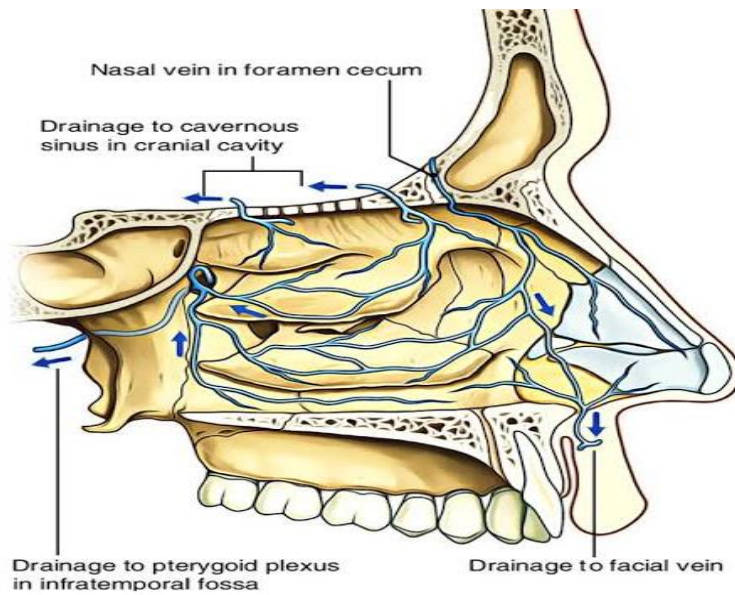


Fig 6. Venous Drainage of Lateral Nasal Wall

Innervation

General sensory nerves derived from the branches of trigeminal nerve (CN V);

- Anterior ethmoidal nerve branch of ophthalmic nerve,
- Anterior superior alveolar nerve, branch of maxillary nerve.
- Posterior superior lateral nasal branches from the pterygoid ganglion suspended by the maxillary nerve.
- Greater palatine branch from the pterygopalatine ganglion suspended by the maxillary nerve.

Special sensory nerves or olfactory – upper part of the lateral wall just below the cribriform plate of the ethmoid up to the superior concha.

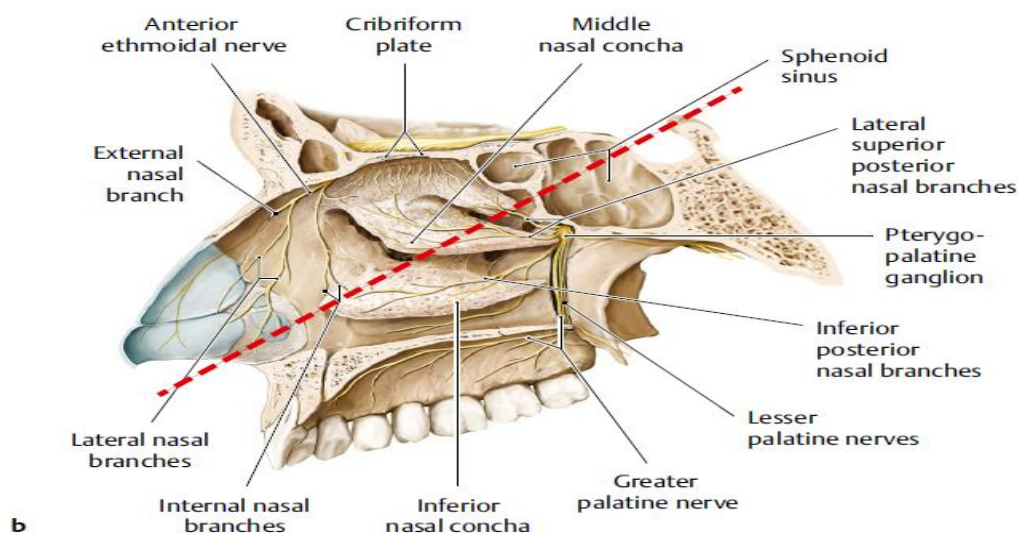


Fig 7. Diagram Showing Innervation of the Lateral Wall of Nasal Cavity

Lymphatic Drainage

Anterior half of the lateral wall pass to the submandibular nodes. The posterior half, to the retropharyngeal and upper deep cervical nodes.

MEDIAL WALL OF NASAL CAVITY

The medial wall of the nasal cavity is the nasal septum. It is a median osseo-cartilaginous partition between the two halves of the nasal cavity. It is covered by the mucoperiosteum. The nasal septum is formed primarily by the perpendicular plate of the ethmoid bone, vomer, and septal cartilage. It is also formed by processes of the palatine, maxillary, frontal, sphenoid and nasal bones. The septum has superior, inferior, anterior and posterior borders. It also has right and left surfaces. The cartilages that contribute to the nasal septum are:

- Septal cartilage
- Greater alar cartilages

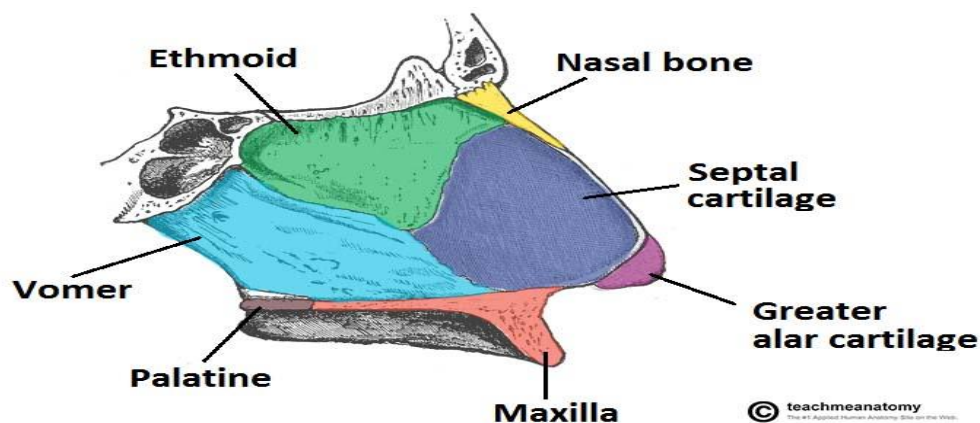


Fig 8. Diagram Showing the skeletal Makeup of the Nasal Septum

Arterial Supply

Anteroinferior part of the septum contains anastomoses between septal ramus of superior labial branch of facial artery, branch of the sphenopalatine artery (from the maxillary artery) and anterior ethmoidal artery (from the ophthalmic artery). These form a large capillary network called **Kiesselbach's plexus**. This is a common site of bleeding from nose or epistaxis and known as **Little's area**.

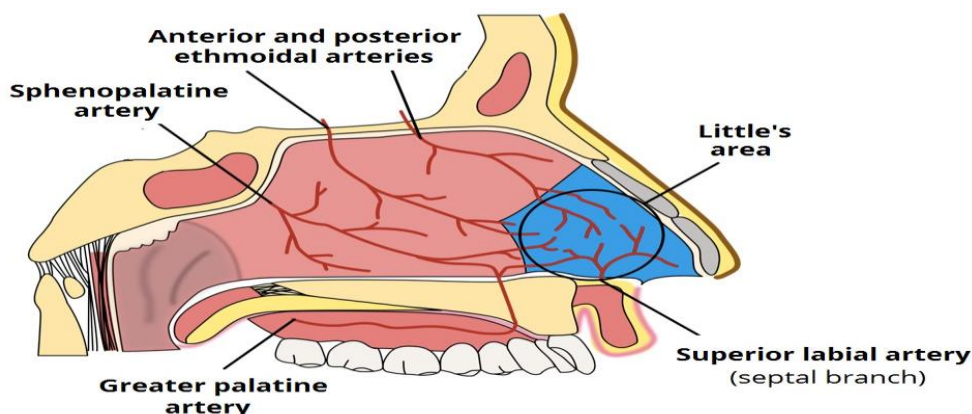


Fig 9. Diagram showing arterial supply to the atrium

Venous Drainage

From Little's area plexus drains anteriorly into facial vein. Posteriorly through the sphenopalatine vein to the pterygoid plexus.

Nerve Supply

General sensory nerves, arises from trigeminal nerve (CN V), and distributed to whole of the septum. The following shows the parts of the nasal septum and their nervous supply:

- Antero-superior part: Internal nasal branch of the anterior ethmoidal nerve.
- Posteroinferior part: Nasopalatine branch of the pterygopalatine ganglion.
- Posterosuperior part: Medial posterior superior nasal branches of the pterygopalatine ganglion.

Special sensory nerve or olfactory nerve are confined to the upper part or olfactory area.

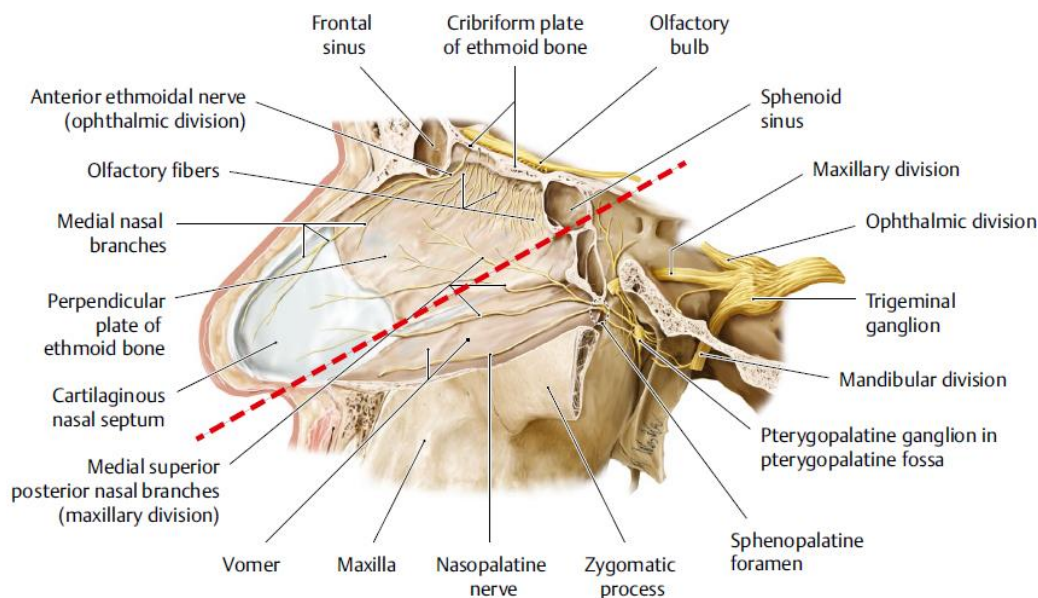


Fig 10. Diagram Showing Innervation of the Nasal Septum

Lymphatic Drainage

Anterior half drains to submandibular nodes. Posterior half drains to retropharyngeal and deep cervical nodes.

CLINICAL SIGNIFICANCE

- Epistaxis: This is the medical term for a nosebleed. Due to the rich blood supply of the nose, this is a common occurrence. It is most likely to occur in the anterior third of the nasal cavity – this area is known as the Kisselbach area. The cause can be local (such as trauma), or systemic (such as hypertension).
- Nasal Polyps: These are growths in the nasal cavity. They often look like grapes or small balloons within the structures of the nasal cavity. It may be caused by asthma, sinusitis, cystic fibrosis and even sensitivity to aspirin. It may be treated by steroid therapy and surgical excision.

- Rhinitis/Common Cold: it is also known as stuffy nose, it is the irritation and inflammation of some internal areas of the. The inflammation results in the generating of excessive amounts of mucus. It may be caused by rhinovirus, coronavirus, bacterial infection or even allergic reactions (hay fever). Infections of the nasal cavities may spread to the:
 - Anterior cranial fossa through the cribriform plate
 - Nasopharynx and retropharyngeal soft tissues
 - Middle ear through the pharyngotympanic tube (auditory tube), which connects the tympanic cavity and nasopharynx
 - Paranasal sinuses
 - Lacrimal apparatus and conjunctiva

Its symptoms may present as rhinorrhea, sore throat (pharyngitis), cough, congestion, and even headache.