MEDICAL EDUCATION RESOURCE

Nose, Paranasal Sinuses and Pterygopalatine Fossa

Nose – Introduction

- The **nose** functions in **respiration** (air passage) and **olfaction** (sense of smell).
- The **olfactory mucosa** lines the upper one-third of the nasal cavity — including the roof and adjacent medial and lateral walls.
- The **respiratory mucosa** lines the lower two-thirds — highly vascular and ciliated to **warm, moisten, and filter inspired air**.

External Nose

- **Framework:** partly **bony** and partly **cartilaginous**.
    - **Bony part:** nasal bones and frontal process of maxilla.
    - **Cartilaginous part:** septal cartilage, superior and inferior lateral cartilages, and small alar cartilages.
- **Surface features:** root, dorsum, tip, anterior nares, and columella.
- **Skin innervation:** by branches of external nasal, infratrochlear, and infraorbital nerves.
- **Function:** filters and conditions air before it enters the respiratory tract.

Nasal Cavity

- Extends from **external nares** (nostrils) to **posterior nasal apertures** (choanae).
- Divided into two halves by the **nasal septum**, each with roof, floor, medial, and lateral walls.
- **Dimensions:** length ~7 cm, height ~5 cm, width near floor ~1.5 cm.
- **Roof:** formed by nasal bones (anterior), cribriform plate of ethmoid (middle), and sphenoid bone (posterior).
- **Floor:** formed by the palatine process of the maxilla and horizontal plate of the palatine bone.
- **Mucosa:**
    - Upper third ? **olfactory region** (with olfactory receptor cells).
    - Lower two-thirds ? **respiratory region** (rich in blood vessels and glands).

Clinical Anatomy

- **Rhinitis (Common Cold):** inflammation of nasal mucosa due to viral or allergic causes.
- **Sinusitis:** infection spreading from the nasal cavity to paranasal sinuses (especially maxillary).
- **CSF Rhinorrhea:** fracture of the cribriform plate may tear olfactory nerve filaments, causing leakage of cerebrospinal fluid from the nose.
- **Epistaxis (Nosebleed):** common in **Little's area (Kiesselbach's plexus)** on the anterior nasal septum where several arteries anastomose.

- **Deviated Nasal Septum:** causes nasal obstruction, headaches, and predisposes to sinus infections.
- **Spread of Infection:**
    - To **anterior cranial fossa** through cribriform plate.
    - To **lacrimal sac and duct**, leading to dacryocystitis.

Nasal Septum

- The **nasal septum** is a **median osseocartilaginous partition** dividing the nasal cavity into right and left halves.
- **Parts:**
    - **Bony part:** formed mainly by the **vomer** and **perpendicular plate of the ethmoid**, with small contributions from the **nasal spine of frontal bone**, **rostrum of sphenoid**, and **nasal crests of maxilla and palatine bones**.
    - **Cartilaginous part:** formed by the **septal cartilage** and **septal processes of inferior nasal cartilages**.
    - **Cuticular part:** formed by fibrofatty tissue covered by skin, forming the **columella**.
- The septum is **rarely perfectly midline**; mild deviation is common due to unequal growth of its components.

Arterial Supply

- **Anterosuperior:** anterior and posterior ethmoidal arteries.

- **Anteroinferior:** septal branch of the superior labial branch of facial artery.
- **Posterosuperior:** sphenopalatine artery (main supply).
- These vessels form an anastomotic network known as **Kiesselbach's plexus (Little's area)** — a common site for epistaxis.

Venous Drainage

- Veins form a plexus prominent in Little's area.
- Drains **anteriorly** into facial vein and **posteriorly** via sphenopalatine vein to the pterygoid venous plexus.

Nerve Supply

- **General sensation:**
  - Anterosuperior ? internal nasal branches of anterior ethmoidal nerve.
  - Posteroinferior ? nasopalatine branch of pterygopalatine ganglion.
- **Special sensation (smell):** olfactory nerves in the upper part.

Lymphatic Drainage

- **Anterior half ?** submandibular nodes.
- **Posterior half ?** retropharyngeal and deep cervical nodes.

Clinical Anatomy (Nasal Septum)

- **Epistaxis:** Sphenopalatine artery (artery of epistaxis) commonly bleeds from Little's area.
- **Deviated septum:** can cause recurrent **sinusitis**, **rhinitis**, and **nasal obstruction**, requiring surgical correction.

Lateral Wall of Nose

- Highly irregular due to **three conchae (turbinates)** that increase surface area for air conditioning.
- Separates the nasal cavity from:
    - **Orbit** (above, via ethmoidal air sinuses),
    - **Maxillary sinus** (below),
    - **Lacrimal sac and duct** (anteriorly).

Parts of Lateral Wall

1. **Vestibule:** lined by skin with coarse hairs (vibrissae).
2. **Atrium of middle meatus:** small depression behind vestibule.
3. **Posterior part:** contains **superior, middle, and inferior conchae** with their corresponding **meatuses**.

Skeleton of Lateral Wall

- **Bony part:** nasal bone, frontal process of maxilla, lacrimal bone, ethmoidal labyrinth (with conchae), inferior nasal concha, perpendicular plate of palatine bone, medial pterygoid plate.

- **Cartilaginous part:** superior and inferior nasal cartilages and small alar cartilages.
- **Cuticular part:** fibrofatty tissue covered by skin.

Conchae and Meatuses

Conchae

- Curved, thin bony projections directed downward and medially.
- **Inferior concha:** independent bone.
- **Middle and superior conchae:** parts of the ethmoid bone.

Meatuses (Passages beneath the conchae)

1. **Inferior meatus:** below inferior concha; receives **nasolacrimal duct** guarded by **Hasner's valve**.
2. **Middle meatus:** below middle concha; contains:
    - **Ethmoidal bulla:** produced by middle ethmoidal sinuses.
    - **Hiatus semilunaris:** curved groove below the bulla.
    - **Infundibulum:** short passage leading to **frontal sinus** and **anterior ethmoidal sinus** openings.
3. **Superior meatus:** below superior concha; receives **posterior ethmoidal sinuses**.

Clinical Anatomy (Lateral Wall)

- **Nasal obstruction:** due to hypertrophy of conchae or deviated septum.
- **Infection spread:** nasal infections may involve paranasal sinuses via meatal openings.
- **Epistaxis:** can also occur from posterior septal branches near sphenopalatine region.
- **Rhinitis and sinusitis:** commonly affect middle meatus region due to sinus openings.

Olfactory Nerve (1st Cranial Nerve)

Structure and Pathway

- Composed of **16–20 million bipolar olfactory cells** situated in the **olfactory mucosa** of the upper nasal cavity.
- Each cell has:
    - A peripheral process ending in **olfactory hairs** that detect odor molecules.
    - A central process forming fine **olfactory filaments** that pass through the **cribriform plate of the ethmoid**.
- These filaments synapse in the **olfactory bulb** within specialized **glomeruli**.
- **Mitral and tufted cells** in the bulb send axons through the **olfactory tract** to the **anterior perforated substance**, **uncus**, and **primary olfactory cortex** (periamygdaloid and prepiriform areas).
- Unlike other sensory pathways, this system **bypasses the thalamus** and directly projects to the cortex.

Clinical Anatomy

- **Anosmia:** complete loss of smell due to ageing, trauma, or infection.
- **Hyposmia:** partial loss of smell, often transient in rhinitis.
- **Cacosmia:** perception of foul odors in nasal infection.
- **CSF rhinorrhea:** fracture of the cribriform plate may tear olfactory filaments, causing cerebrospinal fluid leakage from the nose.

Paranasal Sinuses

Overview

- Air-filled cavities within the **frontal, maxillary, sphenoidal, and ethmoidal bones**.
- They open into the **lateral wall of the nasal cavity** and serve to:
    - Reduce skull weight,
    - Warm and humidify inspired air,
    - Act as resonating chambers for voice.
- Absent or rudimentary at birth; enlarge rapidly by 6–7 years and again at puberty.

Frontal Sinus

- Lies within the **frontal bone**, deep to the superciliary arches.
- Opens into the **middle meatus** via the **frontonasal duct** or **infundibulum**.
- Average size ? 2.5 cm in all dimensions; often asymmetrical.

- Pain in inflammation is felt above the eyes and root of the nose.

Maxillary Sinus

- Largest sinus, pyramidal in shape, within the **body of maxilla**.
- **Roof:** floor of orbit; **floor:** related to upper molar roots.
- Opens into **middle meatus** through the **hiatus semilunaris**.
- Infection leads to **maxillary sinusitis**; pain referred to upper teeth and cheek.

Ethmoidal Sinuses

- Multiple small air cells within the **ethmoidal labyrinth**.
    - **Anterior cells** ? open into **middle meatus**.
    - **Middle cells** ? form **ethmoidal bulla**.
    - **Posterior cells** ? open into **superior meatus**.
- Closely related to the **orbit**, so infection may spread to the eye.

Sphenoidal Sinus

- Occupies the **body of sphenoid bone** below the **pituitary fossa**.
- Opens into the **spheno-ethmoidal recess** above the superior concha.
- Inflammation may cause **deep headache** behind the eyes or at the vertex.

Clinical Anatomy of Paranasal Sinuses

- **Sinusitis:** inflammation causing nasal discharge, facial pain, and headache.
- **Frontal sinusitis:** pain above the orbit.
- **Maxillary sinusitis:** pain over upper jaw and teeth.
- **Ethmoidal sinusitis:** pain near inner canthus of the eye.
- **Sphenoidal sinusitis:** pain deep in the head or behind eyes.
- Chronic sinusitis may lead to postnasal drip and altered resonance of voice.

Pterygopalatine Fossa

Location and Shape

- Small **pyramidal space** located deep below the **apex of the orbit**, between the **pterygoid process** and **posterior surface of the maxilla**.

Boundaries

- **Anterior:** posterior surface of maxilla.
- **Posterior:** root of pterygoid process and greater wing of sphenoid.
- **Medial:** perpendicular plate of palatine bone.
- **Lateral:** opens to infratemporal fossa via pterygomaxillary fissure.
- **Roof:** body of sphenoid.

- **Floor:** pyramidal process of palatine bone.

Communications

- **Anteriorly:** with orbit through **inferior orbital fissure**.
- **Posteriorly:** with middle cranial fossa (foramen rotundum), foramen lacerum (pterygoid canal), and pharynx (palatinovaginal canal).
- **Medially:** with nasal cavity through **sphenopalatine foramen**.
- **Laterally:** with infratemporal fossa via **pterygomaxillary fissure**.
- **Inferiorly:** with oral cavity through greater and lesser palatine canals.

Contents

- **Third part of maxillary artery** and branches.
- **Maxillary nerve (V?)** and branches: ganglionic, zygomatic, posterior superior alveolar.
- **Pterygopalatine ganglion** with its parasympathetic, sympathetic, and sensory fibers.

Applied Importance

- Serves as a **neurovascular hub** linking orbit, nose, mouth, and cranial fossa.
- **Pterygopalatine neuralgia** causes deep pain behind the maxilla or in the palate due to irritation of the ganglion.

Maxillary Nerve (V?)

- The **maxillary nerve** is the **second division of the trigeminal nerve (CN V)**.
- It is **purely sensory**.
- **Origin:** From the trigeminal ganglion in the middle cranial fossa.
- **Course:**
    - Leaves the cranial cavity via the **foramen rotundum** to enter the **pterygopalatine fossa**.
    - Gives off several branches before continuing as the **infraorbital nerve**, which passes through the **inferior orbital fissure**, infraorbital canal, and emerges on the face via the **infraorbital foramen**.

Branches

1. **Zygomatic nerve** ? divides into:
    - *Zygomaticotemporal nerve* (to temple and lacrimal nerve for secretomotor fibres).
    - *Zygomaticofacial nerve* (to cheek skin).
2. **Infraorbital nerve** ? continuation of maxillary nerve; supplies:
    - **Middle superior alveolar nerve:** upper premolars.
    - **Anterior superior alveolar nerve:** upper incisors, canines, maxillary sinus, and anterior nasal wall.
    - **Terminal branches:** palpebral, nasal, and labial (skin and mucosa of face).
3. **Pterygopalatine branches** ? connect the nerve to the **pterygopalatine ganglion**.

Pterygopalatine Ganglion (Sphenopalatine / Meckel's / Ganglion of Hay Fever)

Features

- **Largest parasympathetic peripheral ganglion.**
- Acts as a **relay center for secretomotor fibres** to:
    - Lacrimal gland
    - Nasal, palatine, and pharyngeal mucous glands
- **Location:** In the pterygopalatine fossa, below the maxillary nerve, in front of the pterygoid canal, lateral to the sphenopalatine foramen.
- **Relation:** Topographically with **maxillary nerve**, functionally connected with **facial nerve** (via greater petrosal branch).

Roots

1. **Parasympathetic (motor) root:**
    - From the **nerve of the pterygoid canal** (formed by the greater petrosal and deep petrosal nerves).
    - Fibres relay in the ganglion and pass to the **lacrimal, nasal, palatine, and pharyngeal glands**.
2. **Sympathetic root:**
    - From the **deep petrosal nerve**, fibres pass without relay to supply **vasomotor innervation** to nasal and palatal mucosa.

3. **Sensory root:**
    - From the **maxillary nerve**, fibres pass through the ganglion without relay.

Branches

- **Orbital branches:** to periosteum of orbit and orbitalis muscle.
- **Palatine branches:**
    - *Greater palatine nerve* ? hard palate, upper gums.
    - *Lesser palatine nerves* ? soft palate, tonsil.
- **Nasal branches:**
    - *Lateral posterior superior nasal branches* ? conchae.
    - *Medial posterior superior nasal branches* ? nasal roof and septum.
    - *Nasopalatine nerve* ? anterior hard palate via incisive foramen.
- **Pharyngeal branch:** via palatinovaginal canal ? nasopharynx.
- **Lacrimal branch:** secretomotor fibres through zygomaticotemporal and lacrimal nerves to lacrimal gland.

Clinical Anatomy

- **Trigeminal neuralgia (V?):** causes severe pain in the midface; the nerve can be anaesthetized at the **foramen rotundum**.

- **Pterygopalatine ganglion irritation/infection:** leads to congestion and overactivity of glands ? **runny nose and lacrimation** (hence called *Ganglion of Hay Fever*).
- **Sneeze reflex:** the **maxillary nerve** carries the **afferent limb** (general sensation from nasal mucosa).

Summary of Pterygopalatine Fossa

The fossa contains structures often remembered in groups of **three**:

Three Contents:

- Maxillary nerve
- Third part of maxillary artery
- Pterygopalatine ganglion

Three Names of Ganglion:

- Sphenopalatine
- Pterygopalatine
- Ganglion of Hay Fever / Meckel's

Three Structures in Posterior Wall:

- Maxillary nerve ? foramen rotundum
- Nerve of pterygoid canal ? pterygoid canal
- Pharyngeal branch ? palatinovaginal canal

Three Through Inferior Orbital Fissure:

- Infraorbital nerve
- Zygomatic nerve
- Orbital branches of the ganglion

Three Inferior Openings:

- Greater palatine nerve + vessels
- Two lesser palatine nerves + vessels

Three Medial Openings:

- Nasopalatine nerve + sphenopalatine vessels
- Medial and lateral posterior superior nasal branches

Three Roots of Ganglion:

- Sensory, sympathetic, and secretomotor

3 × 2 Branches of Ganglion:

- Orbital, pharyngeal, lacrimal, anterior palatine, posterior palatine, nasopalatine

3 × 2 Branches of Third Part of Maxillary Artery:

- Posterior superior alveolar, infraorbital, sphenopalatine, pharyngeal, artery of pterygoid canal, greater palatine

Facts to Remember

- **Artery of epistaxis:** The **sphenopalatine artery** is the main vessel responsible for nasal bleeding.
- The **upper few millimeters** of the nasal septum and lateral wall are lined by **olfactory epithelium**, which contains **bipolar receptor neurons** for smell.
- Most **nerves and vessels** supplying the **lateral wall and septum** are **common**, differing mainly in size and distribution.
- **Maxillary sinusitis** is the **most frequent form** of chronic sinus infection.
- The **middle meatus** receives the openings of **four paranasal sinuses** — frontal, maxillary, and anterior and middle ethmoidal.
- **Sinusitis** can result from **air pollution, allergy, or infection** spreading from the nasal cavity.
- The **pterygopalatine ganglion** is known as the **ganglion of hay fever**, as its irritation causes **rhinorrhea (nasal discharge)** and **lacrimation** due to overactivity of nasal and lacrimal glands.
- **Referred pain:**
    - **Maxillary sinusitis** ? upper teeth and cheek region.
    - **Ethmoidal sinusitis** ? medial side of orbit.
    - **Frontal sinusitis** ? forehead.

Clinicoanatomical Problem

Case:
A child playing outdoors during hot summer picks his nose and experiences sudden bleeding.

Question 1: *What is the source of the bleeding?*

- The source is **injury to the rich capillary plexus** at the **anteroinferior part of the nasal septum**, known as **Kiesselbach's plexus** or **Little's area**.
- This site is the most common location for **epistaxis (nosebleed)**.

Question 2: *Which arteries supply the nasal septum?*

1. **Anterior ethmoidal artery** – branch of the ophthalmic artery (from internal carotid).
2. **Superior labial artery** – branch of the facial artery (from external carotid).
3. **Sphenopalatine artery** – terminal branch of the maxillary artery (from external carotid).
4. **Greater palatine artery** – branch of the maxillary artery.

Explanation:

- These arteries **anastomose** in Little's area to form a vascular network highly prone to rupture in trauma, infection, or dry climates.
- In recurrent epistaxis, **cauterization or arterial ligation** may be required.

Frequently Asked Questions

1. What are the boundaries of the nasal cavity?

- **Roof:** Nasal bone, cribriform plate of ethmoid, sphenoid body.

- **Floor:** Palatine process of maxilla and horizontal plate of palatine bone.
- **Medial wall:** Nasal septum.
- **Lateral wall:** Formed by conchae and meatuses.

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2. What is Little’s area and why is it important?

- A vascular area in the **anteroinferior part of the nasal septum**.
- Site of anastomosis of **sphenopalatine, greater palatine, anterior ethmoidal, and superior labial arteries**.
- Commonest site of **epistaxis** (nosebleed).

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3. What are the openings in the middle meatus?

- **Frontal sinus** (via frontonasal duct).
- **Maxillary sinus** (via hiatus semilunaris).
- **Anterior and middle ethmoidal air cells.**

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4. Which sinus is most commonly infected?

- **Maxillary sinus**, due to poor drainage and close relation with upper molar teeth.

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5. What is the nerve of the pterygoid canal?

- Formed by the **greater petrosal (parasympathetic)** and **deep petrosal (sympathetic)** nerves.

- Connects the **facial nerve** with the **pterygopalatine ganglion.**

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6. Why is the pterygopalatine ganglion called the “ganglion of hay fever”?

- Because its **overstimulation** causes **nasal secretion and lacrimation** during allergic rhinitis (hay fever).

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7. What are the communications of the pterygopalatine fossa?

- **Anteriorly:** Orbit via inferior orbital fissure.
- **Posteriorly:** Middle cranial fossa (foramen rotundum), foramen lacerum (pterygoid canal), pharynx (palatinovaginal canal).
- **Medially:** Nasal cavity (sphenopalatine foramen).
- **Laterally:** Infratemporal fossa (pterygomaxillary fissure).
- **Inferiorly:** Oral cavity (greater and lesser palatine canals).

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8. What are the branches of the maxillary nerve in the pterygopalatine fossa?

- **Ganglionic branches** (to pterygopalatine ganglion).
- **Zygomatic nerve.**
- **Posterior superior alveolar nerve.**
- **Infraorbital nerve** (continuation).

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9. What is the sensory supply of the nasal cavity?

- **Anterosuperior part:** Anterior ethmoidal nerve (ophthalmic division).
- **Posteroinferior part:** Nasopalatine and greater palatine nerves (maxillary division).

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10. Which sinuses open into the superior meatus?

- **Posterior ethmoidal air cells.**

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11. What is the function of the paranasal sinuses?

- Lighten skull bones, improve resonance of voice, humidify air, and act as air reservoirs.

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12. What are the effects of pterygopalatine ganglion inflammation?

- Causes **pain in the root of the nose, eye, and palate**, and **increased nasal secretion and lacrimation**.

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13. Why can sinusitis cause dental pain?

- Due to proximity of **maxillary sinus** to roots of upper teeth and their shared innervation by the **infraorbital and superior alveolar nerves**.

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14. What is the sensory nerve of the nasal septum?

- **Anterosuperior part:** Anterior ethmoidal nerve.
- **Posteroinferior part:** Nasopalatine nerve.

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15. How does infection from nasal cavity spread to the eye?

- Through the **ethmoidal sinuses**, which lie between the nasal cavity and the orbit.

Multiple Choice Questions

1. Which of the following is known as the *artery of epistaxis*?
A. Anterior ethmoidal artery
B. Greater palatine artery
C. Sphenopalatine artery
D. Superior labial artery
? **Answer:** C. Sphenopalatine artery

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2. Which one of the following air sinuses does **not** drain into the middle meatus?
A. Anterior ethmoidal
B. Middle ethmoidal
C. Posterior ethmoidal
D. Maxillary
? **Answer:** C. Posterior ethmoidal

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3. Which air sinus is the **first to develop**?
A. Maxillary
B. Ethmoidal
C. Frontal
D. Sphenoidal
? **Answer:** B. Ethmoidal

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4. The *nerve of the pterygoid canal* is formed by which of the following?
A. Greater petrosal and deep petrosal nerves
B. Lesser petrosal and deep petrosal nerves

C. Greater petrosal and external petrosal nerves
D. Lesser petrosal and external petrosal nerves
? **Answer:** A. Greater petrosal and deep petrosal nerves

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5. Which air sinus is most commonly infected?
A. Ethmoidal
B. Frontal
C. Maxillary
D. Sphenoidal
? **Answer:** C. Maxillary

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6. What is the length of the auditory tube in an adult?
A. 36 mm
B. 3.6 mm
C. 46 mm
D. 48 mm
? **Answer:** A. 36 mm

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Key Takeaways

- **Sphenopalatine artery** is the main vessel responsible for **epistaxis**.
- The **posterior ethmoidal sinus** drains into the **superior meatus**, not the middle one.
- **Ethmoidal sinuses** develop first embryologically.
- **Maxillary sinus** is the most prone to infection due to its poor drainage.

- The **nerve of pterygoid canal** carries both **parasympathetic (greater petrosal)** and **sympathetic (deep petrosal)** fibers.

Additional MCQs

1. Which structure passes through the **sphenopalatine foramen**?
A. Sphenopalatine artery
B. Greater palatine nerve
C. Nasolacrimal duct
D. Infraorbital nerve
? **Answer:** A. Sphenopalatine artery

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2. Which of the following nerves carries **secretomotor fibres to the lacrimal gland**?
A. Auriculotemporal nerve
B. Zygomaticotemporal nerve
C. Nasociliary nerve
D. Infraorbital nerve
? **Answer:** B. Zygomaticotemporal nerve

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3. The **posterior ethmoidal sinus** opens into which of the following?
A. Middle meatus
B. Superior meatus
C. Inferior meatus
D. Common meatus
? **Answer:** B. Superior meatus

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4. The **pterygopalatine ganglion** is functionally related to which cranial nerve?
A. Trigeminal nerve

B. Facial nerve

C. Glossopharyngeal nerve

D. Vagus nerve

? **Answer:** B. Facial nerve

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5. The **nasopalatine nerve** is a branch of which structure?

A. Mandibular nerve

B. Maxillary nerve

C. Glossopharyngeal nerve

D. Pterygopalatine ganglion

? **Answer:** D. Pterygopalatine ganglion

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6. Which sinus lies **closest to the pituitary gland**?

A. Maxillary

B. Sphenoidal

C. Ethmoidal

D. Frontal

? **Answer:** B. Sphenoidal

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7. Which of the following nerves supplies the **posterior part of the nasal septum**?

A. Nasociliary nerve

B. Anterior ethmoidal nerve

C. Nasopalatine nerve

D. Frontal nerve

? **Answer:** C. Nasopalatine nerve

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8. The **maxillary nerve** leaves the middle cranial fossa through which opening?

A. Foramen rotundum

B. Foramen ovale
C. Foramen spinosum
D. Superior orbital fissure
? **Answer:** A. Foramen rotundum

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9. The **roof of the nasal cavity** is mainly formed by:
A. Cribriform plate of ethmoid bone
B. Nasal cartilage
C. Palatine process of maxilla
D. Horizontal plate of palatine bone
? **Answer:** A. Cribriform plate of ethmoid bone

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10. The **posterior wall of pterygopalatine fossa** is formed by:
A. Root of the pterygoid process
B. Perpendicular plate of palatine bone
C. Body of sphenoid bone
D. Posterior surface of maxilla
? **Answer:** A. Root of the pterygoid process

Viva Voce

1. What are the paranasal sinuses?
Air-filled cavities within the **frontal, maxillary, sphenoidal, and ethmoidal bones** that communicate with the nasal cavity.

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2. What are the functions of the paranasal sinuses?
They **lighten the skull**, **resonate the voice**, **humidify and warm inspired air**, and **act as air reservoirs**.

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3. Which is the largest paranasal sinus?

The **maxillary sinus** — pyramidal in shape and located within the body of the maxilla.

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4. Which sinus is related to the pituitary gland?

The **sphenoidal sinus**, lying directly below the **sella turcica**.

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5. Which sinus is most commonly infected? Why?

The **maxillary sinus**, due to its **poorly placed opening** high on the medial wall, leading to inefficient drainage.

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6. What is Little's area (Kiesselbach's plexus)?

A vascular area in the **anteroinferior part of the nasal septum** where five arteries anastomose — a common site for **epistaxis**.

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7. What is the function of the olfactory nerve?

It conveys the **sense of smell** from the **olfactory mucosa** of the upper nasal cavity to the **olfactory bulb**.

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8. What is the functional component of the olfactory nerve?

It carries **special visceral afferent (SVA)** fibres for olfaction.

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9. What is the nerve of the pterygoid canal?

It is formed by the **greater petrosal (parasympathetic)** and **deep petrosal (sympathetic)** nerves.

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10. Why is the pterygopalatine ganglion called the "ganglion of hay fever"?

Because its stimulation causes **nasal secretion and lacrimation** during allergic rhinitis (hay fever).

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11. Which nerve carries secretomotor fibres to the lacrimal gland?

Zygomaticotemporal nerve (via pterygopalatine ganglion and lacrimal nerve).

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12. Through which foramen does the maxillary nerve leave the middle cranial fossa?
Through the **foramen rotundum** to enter the **pterygopalatine fossa**.

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13. What are the branches of the pterygopalatine ganglion?

- **Orbital branches**
- **Palatine branches (greater and lesser)**
- **Nasal branches (including nasopalatine)**
- **Pharyngeal branch**
- **Lacrimal branch (via zygomaticotemporal nerve)**

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14. What are the boundaries of the pterygopalatine fossa?

- **Anterior:** Posterior surface of maxilla
- **Posterior:** Root of pterygoid process
- **Medial:** Perpendicular plate of palatine bone
- **Lateral:** Pterygomaxillary fissure
- **Roof:** Body of sphenoid
- **Floor:** Pyramidal process of palatine bone

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15. What is the sensory supply of the nasal cavity?

- **Anterosuperior part:** Anterior ethmoidal nerve

- **Posteroinferior part:** Nasopalatine and greater palatine nerves