

Surgical Anatomy of the Nose: A Fundamental Pillar in Modern Rhinoplasty

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ABSTRACT

The surgical anatomy of the nose is a critical foundation for achieving optimal outcomes in plastic and reconstructive surgery, particularly in rhinoplasty, nasal reconstruction, and trauma management. This review article synthesizes recent advancements (2020–2025) in understanding the nasal anatomy, focusing on its osseocartilaginous framework, soft tissue envelope, vascular supply, and innervation. Key anatomical considerations, including the nasal septum, alar cartilages, and vascular networks, are explored with relevance to surgical techniques and complication avoidance. Data from peer-reviewed articles in plastic surgery literature over the past five years provide evidence-based insights, emphasizing the importance of precise anatomical knowledge for functional and aesthetic success.

KEYWORD: Nasal anatomy, rhinoplasty, plastic surgery, anatomical analysis, nose.

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INTRODUCTION

The nose, located in the center of the face, plays a crucial role in both facial aesthetics and vital functions such as breathing. Rhinoplasty, the surgery to reshape the nose, has become one of the most requested aesthetic procedures. However, its success lies not only in the technical skill of the surgeon, but, fundamentally, in a deep knowledge of nasal surgical anatomy. Remodeling the structures of the nose is an intricate process that requires an appreciation of the interaction between the skin, the cartilaginous and bony skeleton, and the soft tissue layers. This review article aims to consolidate the essential aspects of nasal surgical anatomy, highlighting its clinical relevance for the planning and execution of rhinoplasty.

NASAL SURGICAL ANATOMY.

The external appearance of the nose is the result of the interaction between the skin that covers it and the underlying osteocartilaginous framework. Anatomical components contribute to its normal topographical features. The skin varies in thickness along the nose, being greater in areas of skeletal narrowness. This variation influences the way the underlying skeleton manifests, and the surgeon must consider this factor when predicting outcomes.

The lobe can be defined as an area that includes the tip of the nose and is bounded by a line connecting the upper edge of the nostrils, the breaking point of the supratip, and the anterior half of the lateral wing wall. The lobe is subdivided into the tip, the supratip, and the infratip lobe. In the side view, one should be aware of the marked differences in the thickness of the soft tissue. (fig.1)

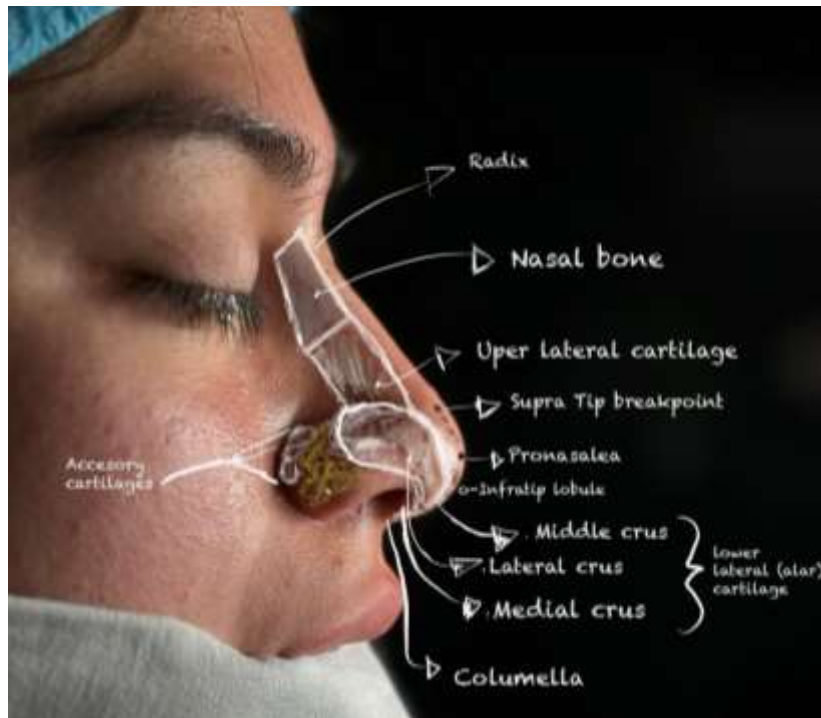


Fig. 1 Side view - nasal topographic anatomy

In the basal view (Fig. 2), the divergence of the caudal borders of the medial and middle cruras is observed. The degree of this divergence, added to the lateral curve of the plantar plates of the medial cruras, determines the width of the columella and the infratip lobe. Columellar deviations and asymmetries

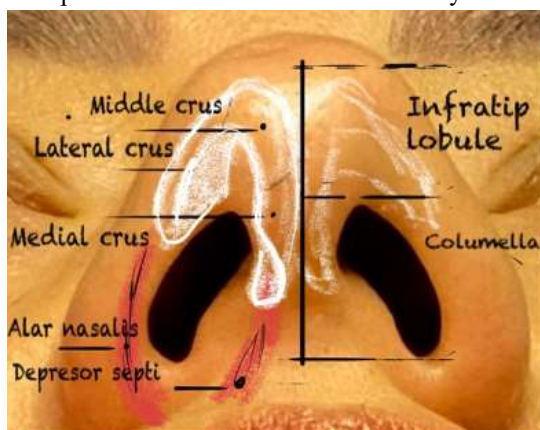


Fig.2 Vista basal - anatomía topográfica nasal

are frequently caused by deflections in the caudal septum. Medially, the relationship of the anterior nasal spine with the depressor septum muscle, which is even and inserts into the plantar plates of the medial cruras, should be noted. Laterally, the alar portion of the nasal muscle should be noticed.



Fig.3 Disección cartilagos laterales inferiores y septum.

Tissue Layers of the Nose The nose is composed of several overlapping layers, 4 in total, which the surgeon must dissect and manipulate precisely during rhinoplasty. From superficial to deep, these layers include:

1. The **superficial adipose panniculus**, which is the outermost layer of fat.
 2. The **fibromuscular layer**, which provides support and contour.
 3. The **deep adipose layer**, a critical layer through which the major superficial blood vessels and motor nerves run. The preservation of these structures is vital for vascularization and innervation of the nose.
 4. The **periosteum** or **perichondrium**, which is the membrane that covers the underlying bone and cartilage, respectively.
- Understanding the relationship between these layers is critical for planning safe dissection planes and for minimizing postoperative complications such as bruising or alterations in sensation. Nowadays one of the techniques in rhinoplasty is preservation rhinoplasty, which suggests performing a dissection at the subperichondrial and subperiosteal level to reduce edema and the risk of bleeding.

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From a frontal view, the external appearance of the nose is defined by a smooth, graceful curve that emerges from the medial eyebrows and extends to the definition points of the tip, forming the **dorsal aesthetic line**.

The **nasal lobe** (fig.2), which comprises the tip of the nose, is an area of particular aesthetic interest. It is defined by a line connecting the upper edge of the nostrils, the supratip break point, and the anterior half of the lateral wing wall. The lobe is anatomically subdivided into:

1. The **nasal tip**, the point of greatest projection.
2. The **supratip**, the region immediately above the tip.
3. The **infratip**, the portion below the tip that extends into the nasal columns.

Osseocartilaginous Framework

The nasal skeleton comprises an upper bony segment and a lower cartilaginous segment, providing structural support and shape.

- **Bony Vault:** The upper third of the nose includes the nasal bones, frontal process of the maxilla, and nasal process of the frontal bone. Recent studies emphasize the variability in nasal bone thickness, with implications for osteotomies in rhinoplasty. A 2021 study by Jang et al. utilized computed tomography (CT) to demonstrate that nasal bone thickness averages 1.5–2.5 mm, with thinner bones increasing fracture risk during surgery (Jang et al., 2021) (fig. 4)

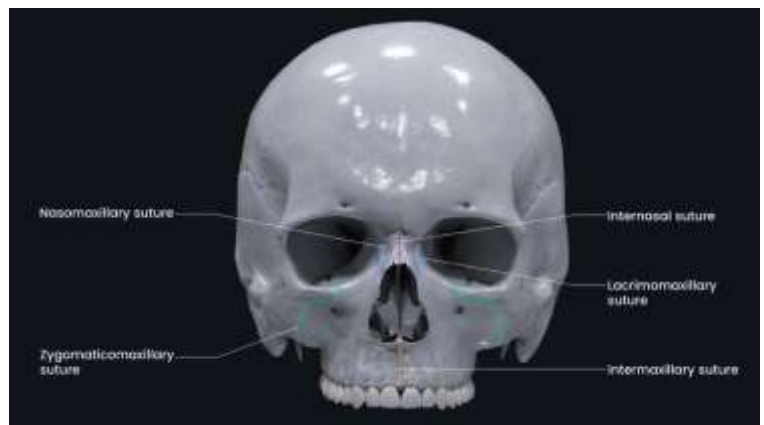


Fig.4 Anterior view of the sutures of viscerocranium

- **Cartilaginous Vault:** The middle and lower thirds consist of the upper lateral cartilages, lower lateral (alar) cartilages, and septal cartilage. The alar cartilages, comprising medial and lateral crura, are critical for tip support. A 2022 article by Toriumi highlighted the dynamic interplay between the alar cartilages and the scroll area, where the upper lateral cartilages overlap, affecting tip projection and airflow (Toriumi, 2022).
- **Nasal Septum:** The quadrangular cartilage, supported by the perpendicular plate of the ethmoid and vomer, is central to nasal stability. Recent research by Patel et al. (2023) underscores its role in providing structural integrity, with deviations often necessitating septoplasty to improve functional outcomes (fig.3)

Muscles

Nasal muscles are organized into four distinct categories, a classification validated by Letourneau and Daniel through the examination of 30 freshly dissected cadavers (Fig. 5). These categories are as follows:

1. **Elevator Muscles:** This group, which shortens the nose and widens the nostrils, includes the procerus, the levator labii superioris alaeque nasi, and the anomalous nasi.
2. **Depressor Muscles:** These muscles elongate the nose and also expand the nostrils. They consist of the alar portion of the nasalis muscle (known as the dilator naris posterior) and the depressor septi.
3. **Minor Dilator Muscle:** The dilator naris anterior functions as the minor dilator muscle.
4. **Compressor Muscles:** Responsible for lengthening the nose and narrowing the nostrils, this group comprises the transverse nasalis and the compressor narium minor.

All of these muscles receive their nerve supply from the zygomaticotemporal branch of the facial nerve. For a comprehensive exploration of these nasal muscles, consult the publications by Griesman and Letourneau and Daniel.

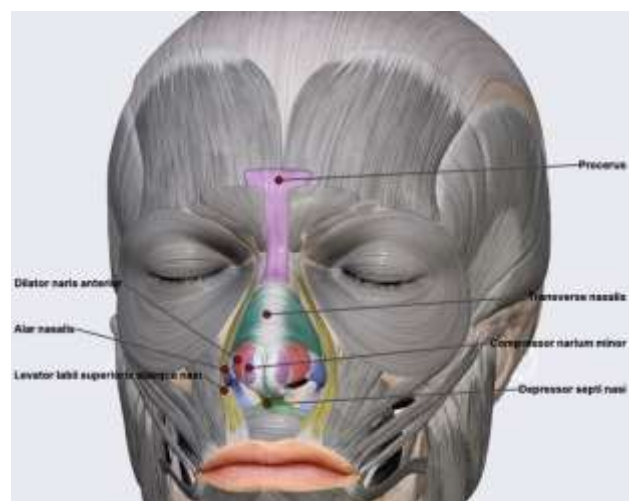


Fig.5 Nasal Muscles.

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Vascular Supply

The nasal vasculature is critical for flap survival and complication avoidance in reconstructive surgery.

- **Arterial Supply:** The external carotid artery provides the dominant supply via the facial and angular arteries, while the internal carotid contributes through the ophthalmic artery and its dorsal nasal branch. A 2023 study by Rohrich et al. mapped the vascular network using Doppler ultrasound, identifying the lateral nasal artery as a key pedicle for paramedian forehead flaps (Rohrich et al., 2023) (fig.6, fig.7)
- **Venous Drainage:** The angular and facial veins drain the nose, with potential implications for hematoma formation. Recent findings by Ghavami et al. (2022) emphasize meticulous hemostasis to prevent venous congestion in rhinoplasty. (fig.8)
- **Surgical Relevance:** Understanding vascular anatomy is vital for designing local flaps, such as the nasolabial or forehead flap, and avoiding vascular compromise during osteotomies.

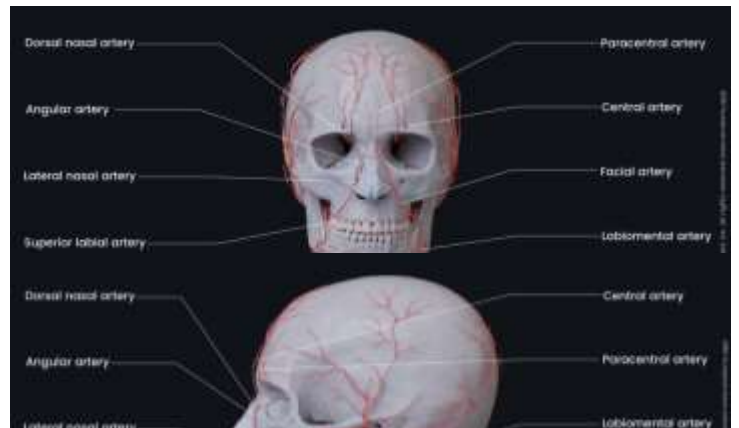


Fig.6 Anterior view of vascular supply.

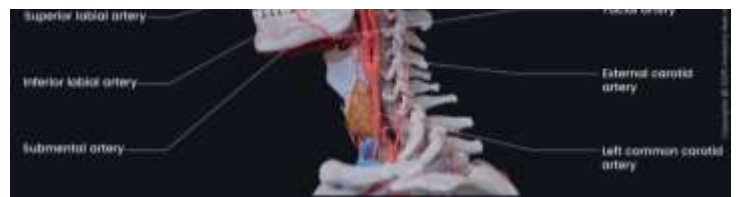


Fig.7 Lateral view of vascular supply.

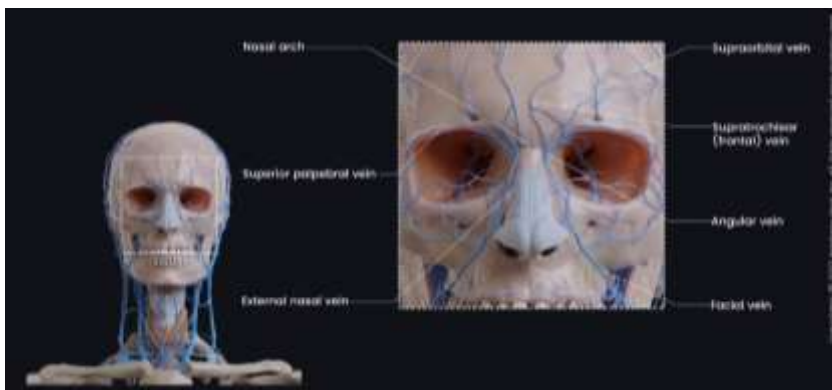


Fig.8 Venous drainage.

Innervation

Nasal sensation and motor function are mediated by cranial nerves V and VII.

Sensory Innervation: The external nose derives its sensory innervation from branches of the ophthalmic and maxillary divisions of the trigeminal nerve, also known as the fifth cranial nerve. (fig.9)

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- **Upper Nose Innervation:** The skin over the radix, rhinion, and upper nasal side walls is supplied by the supratrochlear and infratrochlear branches of the ophthalmic nerve.
- **Distal Nose and Tip:** Sensation to the distal dorsum and nasal tip is provided by the external nasal branch of the anterior ethmoidal nerve. This nerve exits between the nasal bone and the upper lateral cartilage, running alongside its corresponding artery.
- **Lower Nose:** The infraorbital branches of the maxillary nerve supply the soft tissues of the lower half of the nose, including parts of the columella and lateral vestibule.

During rhinoplasty, the external nasal branch is at risk of injury, particularly with intercartilage or cartilage-splitting incisions. Such damage often leads to postoperative numbness at the nasal tip. To mitigate this risk, surgeons should avoid deep endonasal incisions and instead perform dissections directly along the cartilage surface, staying beneath the fibromuscular layer and the superficial musculoaponeurotic system (SMAS).

For procedures under local anesthesia, an infraorbital nerve block is vital to ensure effective pain management, given the maxillary nerve's role in innervating the lower nasal region.

- **Motor Innervation:** The facial nerve (VII) innervates the nasal muscles. Preservation during surgery is crucial, as highlighted by Saban et al. (2021), to maintain nasal symmetry. (fig.10)

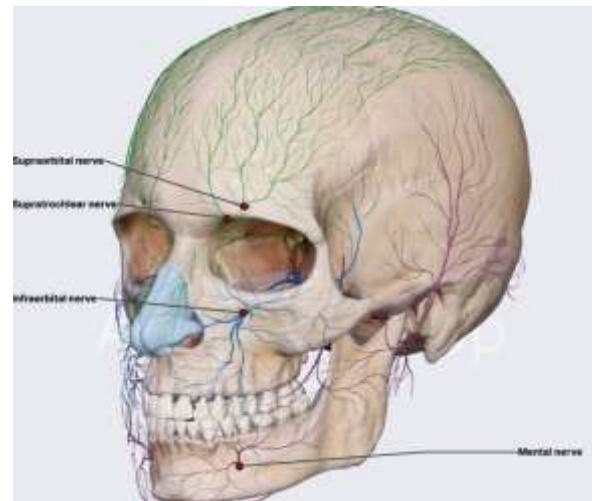
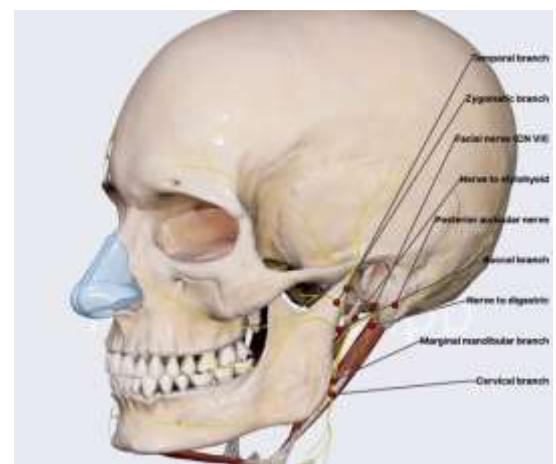


Fig.9 Trigeminal nerve.



Alar cartilage anatomy

Historically, the structure of the alar cartilage was understood to consist of two primary components—the medial and lateral crura—joined by a segment known as the domal segment. To improve the understanding of nasal tip anatomy, particularly for surgical applications like rhinoplasty, Sheen and Sheen introduced the idea of a middle crus. They defined this structure as extending from its lower edge at the columellar lobule junction to its upper edge at the point where the lateral crus begins medially. Later, Daniel's observations refined this model by situating the domal segment at the uppermost part of the middle crus.

In subsequent studies, this middle crus has also been referred to as the intermediate crus. However, not all researchers agree on its distinct existence. Some have questioned whether it should be considered a separate entity, suggesting instead that it might be better described as the body or intercrural segment. Nevertheless, the authors argue that this region's intricate and diverse nature has a profound impact on the shape of the nasal lobule, justifying its recognition as a unique component rather than merely a bridge between the medial and lateral crura. Based on this perspective, the alar cartilage is divided into three distinct sections: the medial crus, the middle crus, and the lateral crus. (fig.11).

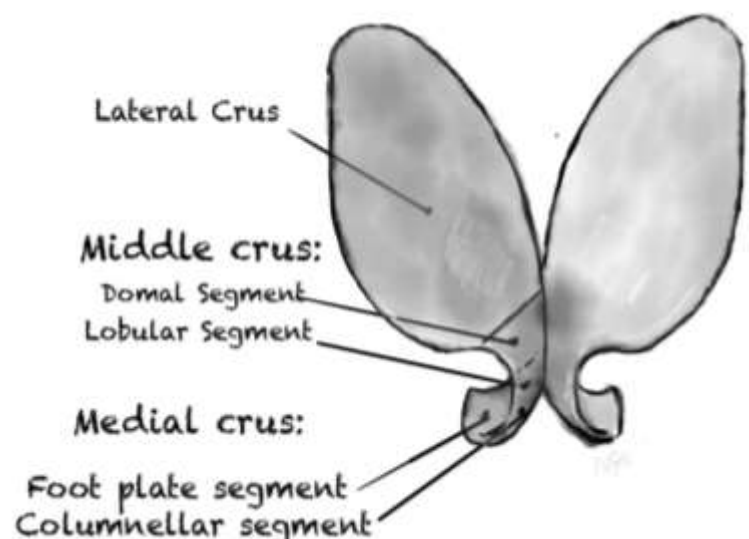


Fig.11. alar cartilage anatomy

Nose Internal Anatomy

Nasal Vestibule and Mucosa

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The nasal vestibule, the entryway to the nasal cavity, is covered with squamous epithelium featuring numerous coarse hairs known as vibrissae. The limen nasi serves as the distinct boundary where this skin meets the nasal mucosa. This mucosa, critical for respiratory function, should be safeguarded during surgical interventions whenever feasible. Higher up, the yellowish olfactory mucous membrane lines the superior region, playing a key role in the sense of smell.

Bony Septum

The upper portion of the nasal septum is bony, primarily formed by the perpendicular plate of the ethmoid. This structure extends upward to connect with the frontal bone and cribriform plate, while anteriorly it aligns with the midline projection of the nasal bones. Below, it links to the septal cartilage and vomer. The extent of contact between the ethmoid and vomer depends on the amount of septal cartilage separating them. The junction of the perpendicular plate with the septal cartilage, located at the dorsal keystone area, varies in height based on how much the nasal bones overlap the upper lateral cartilage—sometimes positioned 1 cm or more above the nasal bone's lower edge. Where the ethmoid meets the septal cartilage anteriorly, a groove may exist, complicating their separation during septoplasty. In such instances, surgeons might find it simpler to cut through the cartilage 2 to 3 mm ahead of this junction.

Vomer and Premaxilla

The vomer, resembling the keel of a boat, stretches from the sphenoid bone downward and forward to the nasal crest of the palatine bones and maxilla, where it merges with the premaxillary wings. Originally paired structures during fetal development, the vomer and premaxillary wings fuse to create a channel that secures the lower edge of the quadrilateral septal cartilage. The anterior nasal spine, the most prominent caudal feature of the premaxilla, anchors the inferior border of the septal cartilage. The bony groove supporting the septal cartilage is deepest at the premaxilla and gradually flattens as it extends backward along the vomer.

Arterial Supply

Internal Carotid Artery:

Via the **ophthalmic artery**, it gives rise to the **anterior and posterior ethmoidal arteries**, which supply the superior nasal cavity and nasal septum. These contribute to **Kiesselbach's plexus**.

External Carotid Artery:

The **facial artery** branches into the **superior labial artery**, supplying the anterior septum and nasal floor.

The **maxillary artery** provides the **sphenopalatine artery**, which vascularizes the lateral nasal walls and septum, also contributing to Kiesselbach's plexus and often implicated in posterior epistaxis.

Venous Drainage

Veins drain into the facial vein, pterygoid plexus, and ophthalmic veins. Their connection to the cavernous sinus poses a risk of intracranial infection spread lymphatic drainage.

Lymphatics flow to the **submandibular** and **retropharyngeal lymph nodes**, relevant for managing nasal infections or malignancies.

Innervation of the Nose

The nasal cavity's innervation includes sensory, olfactory, and autonomic components, each with implications for surgical outcomes.

Sensory Innervation

The trigeminal nerve (CN V) provides sensation (fig 12):

Ophthalmic division (V1): Supplies the superior nasal cavity via the anterior and posterior ethmoidal nerves. Injury to the anterior ethmoidal nerve during rhinoplasty can cause nasal tip numbness.

Maxillary division (V2): Innervates the inferior nasal cavity through the nasopalatine and greater palatine nerves.

Special Sensory Innervation

The **olfactory nerve (CN I)** innervates the olfactory epithelium in the superior nasal cavity, enabling smell. Surgical disruption may lead to anosmia (Nasal Anatomy: Embryology, Skin and Soft Tissues, Blood Supply and Lymphatics, 2024).

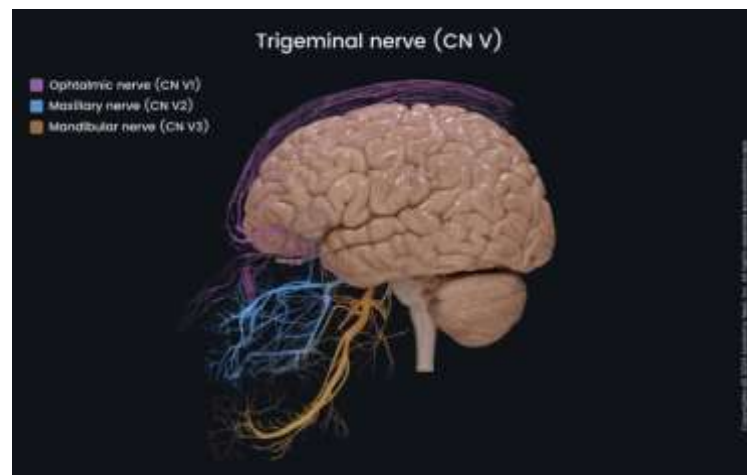


Fig 12.- Lateral view trigeminal nerve.

DISCUSSION

Recent literature (2020–2025) reflects a shift toward personalized surgical planning, with imaging modalities like CT and ultrasound enhancing anatomical precision. The integration of vascular and nerve-sparing techniques has improved functional outcomes, particularly in reconstructive cases. However, challenges remain, including variability in patient anatomy and the need for long-term outcome studies. Future research should focus on standardizing anatomical classifications and refining minimally invasive approaches.

CONCLUSION

The surgical anatomy of the nose, as elucidated in recent plastic surgery literature, provides a robust framework for optimizing rhinoplasty and reconstruction. Advances in understanding the osseocartilaginous framework, soft tissue envelope, vascular supply, and innervation enable surgeons to achieve superior aesthetic and functional results. Continued research and technological integration are essential to address anatomical variability and enhance surgical outcomes.

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