

APPLIED ANATOMY, VASCULARISATION AND INNERVATION OF THE NOSE

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The nose is bounded by walls which are partially bone and partially cartilage, and which are covered by a mucous membrane; the nasal cavity is divided into two completely separated cavities by a partition, the septum nasi. The two nasal cavities communicate with the environment i.e. through the nostrils (nares) with the outer world, through the secondary choanae with the nasopharynx, and through several openings with the so-called paranasal sinuses (sinus frontalis, ethmoidales, sphenoidalis and maxillaris).

The two nasal cavities are a part of the facial region of the head. This regio facialis can be divided topographically, and especially so on account of the vascular supply, into three areas, the regio facialis superficialis, regio facialis profunda and the regio facialis neuralis. This distinction is applicable as well to the orbit and nasal cavities as to the regio temporalis. The regio facialis superficialis is the area of blood supply from the superficially lying branches of the a. carotis externa (a. facialis, a. occipitalis, a. temporalis superficialis and a. auricularis posterior); the regio facialis profunda from the deeper lying branches (a. pharyngea ascendens, a. lingualis, a. maxillaris) whereas the regio facialis neuralis also proves its neuro-ectodermal origin because of its vascularisation from the circulus arteriosus cerebri Willisii (aa. carotides internae and aa. vertebrales).

In the young human embryo with a length up to ± 12 mm the head actually only consists of the future neural part. The cranial base forms the front or the top wall of the primary mouth, the bottom of which is formed by the ectoderm of the cardiogenic region.

In and around this primary mouth the regio facialis develops gradually, with the cavities of the orbits, nasal and oral cavities and the temporal bones with the inner and middle ear. The specifically sensory elements which are found in these regions at a later stage, still indicate their development from the embryonic ectoderm.

In the nose it is the olfactory region which is formed from the neural ectoderm of the primary nasal cavities. In the embryonic stages from 8 to 12 mm these primary nasal cavities develop from the roof of the primary mouth and come into communication with this cavity through the primary choanae. The rests of these primary choanae are found later on in the incisive canals.

The area of the primary nasal cavity is originally vascularised by the olfactory artery, which is forced back later on by the ophthalmic artery from the circulus arteriosus cerebri. It is for this reason that the ophthalmic artery still gives off some arterial branches to the nasal cavity at a later stage.

Not less than eight bones contribute to the composition of the **lateral wall** of the nasal cavity: the os nasale, os frontale, os ethmoidale, os lacrimale,

os maxillare, os palatinum, os sphenoidale and the concha inferior (fig. 1). *) In this bony wall openings are found: in the inferior meatus that of the nasolacrimal duct, in the middle meatus those of the frontal sinus, the maxillary sinus and the anterior ethmoidal cells, in the superior meatus that of the posterior ethmoidal cells and also the sphenopalatine foramen, in the sphenothmoidal recess that of the sphenoid sinus. Also in the mucous membrane covered wall these foramina, excepting the sphenopalatine foramen, are still communications between the nose and the surrounding cavities, although the bony connection with the maxillary sinus is much larger than the opening in the mucous membrane; a large part of the hiatus maxillaris is closed off by means of a membrane, formed by the mucous membranes of the nasal cavity and the maxillary sinus. The bony sphenopalatine foramen, situated between os sphenoidale and os palatinum in the upper posterior part of the lateral nasal wall, and which forms a connection between the bony nasal cavity and the fossa sphenopalatina, is completely covered by mucous membrane.

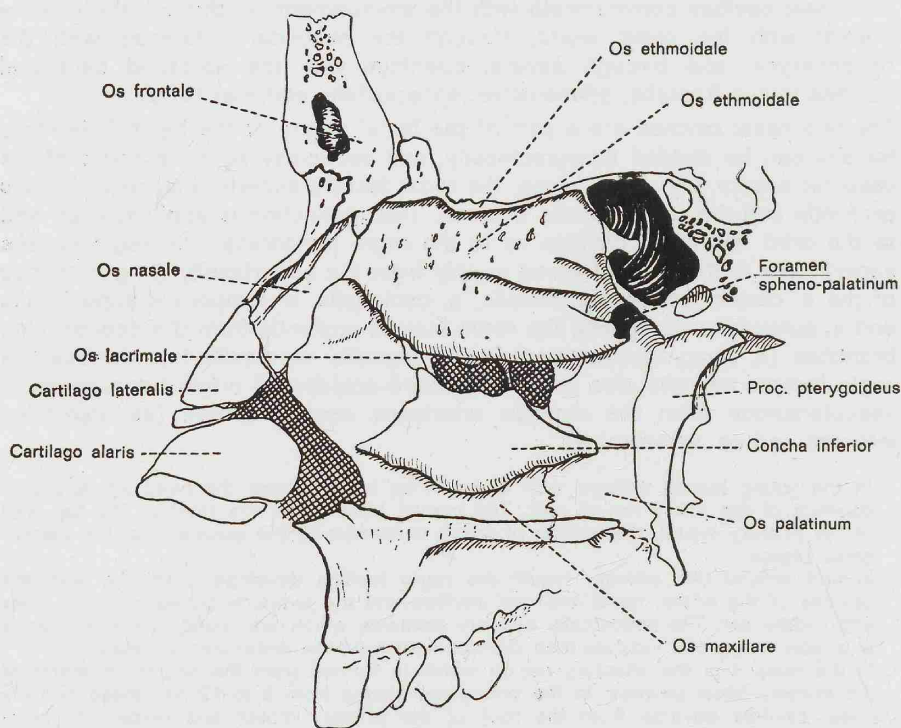


Fig. 1

The **fossa sphenopalatina** (or the pterygo-palatine fossa) is topographically a very important bony cavity in the deep facial area, which forms a central communication area between orbit, nasal cavity, oral cavity, cranial basis and

*) Some figures from J. C. B. GRANT's *Atlas of Anatomy* (1962) have served as a base for some of the illustrations in this article.

neural cranial cavity. It is the fossa from where the branches of the sphenopalatine ganglion, from the ramus maxillaris trigemini and from the maxillary artery are distributed over the surrounding regions. The fossa sphenopalatina stands in communication with the cranial cavity by means of the foramen rotundum, with the orbit through the fissura orbitalis inferior, with the nasal cavity through the foramen sphenopalatinum, with the oral cavity through the canalis pterygo-palatinus and with the basis cranii (spatium parapharyngeum) through the canalis pterygoideus (Vidii) (fig. 6).

The front part of the **lateral wall** is made of cartilage. It is mainly made up of two cartilages, the cartilago lateralis and the lateral part of the cartilago alaris, which form the wall here, although between these cartilages and the maxillary bone lies a part of the lateral wall in which there is no reinforcement by means of bone or cartilage. Because of this, especially the lower part of the external nose is rather flexible in relation to the bony wall.

Also the **septum nasi** consists of a bone and a cartilage part. The bony part consists mainly of the lamina perpendicularis of the ethmoid bone and of the vomer bone. These two bone plates join at the upper and lower wall of the nasal cavity to the cristae septales of the frontal, sphenoid, palatine and maxillary bones (fig. 2).

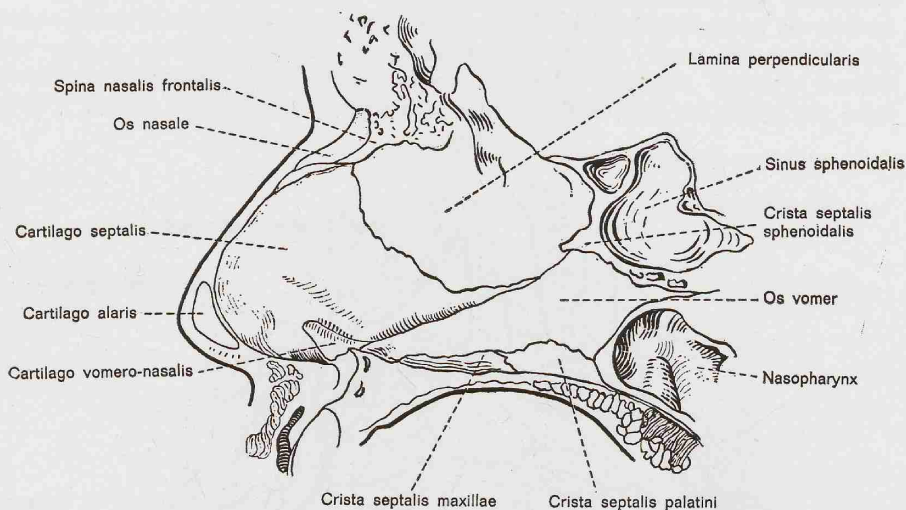


Fig. 2

Also in the septum the front part is made up of cartilage. This part is mainly formed by the cartilago septi, to which the middle part of the cartilago alaris, which is only loosely connected to the cartilago septi, joins in front and underneath.

As mentioned before the **vascularisation** is realised by different vascular systems (figs. 3 and 4). The most important supply of blood occurs through the sphenopalatine artery, which arises in the similarly named fossa from the maxillary artery (fig. 6 a). The artery penetrates through the sphenopalatine foramen into the nose and then lies under the mucous membrane in the lateral

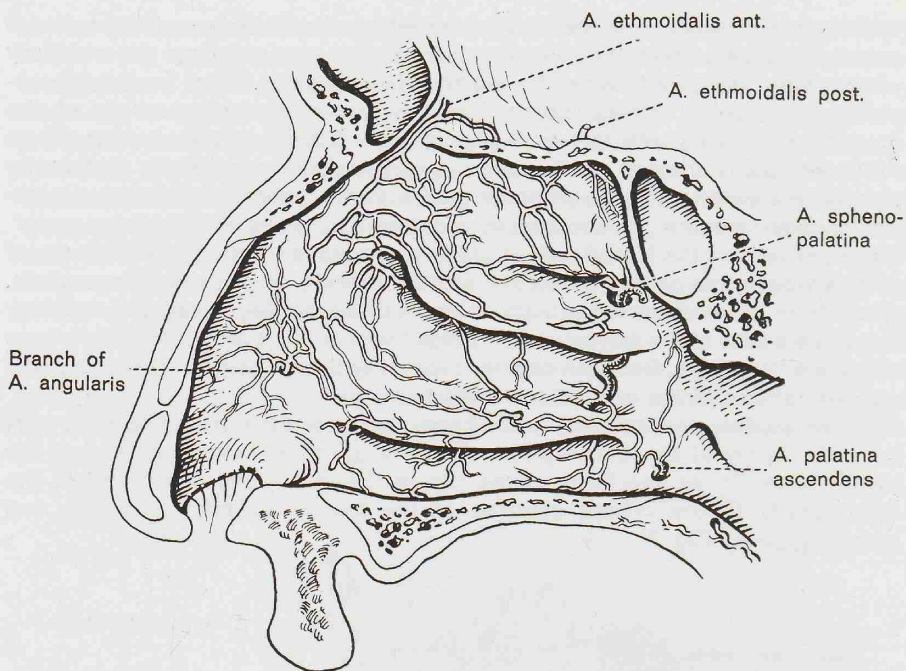


Fig. 3

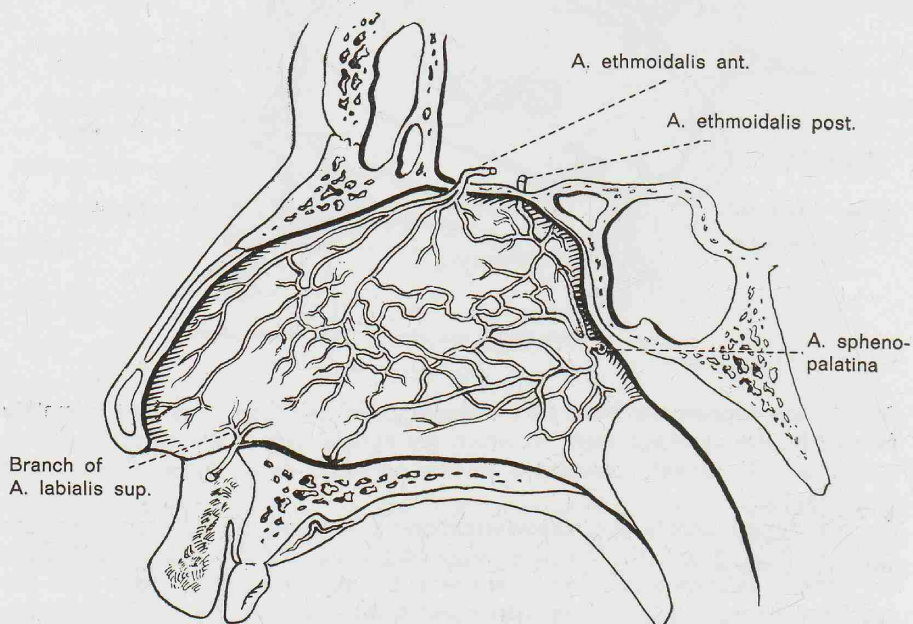


Fig. 4

wall, on the level of the bottom of the sphenoid sinus. Several branches, aa. nasales posteriores, some of which extend for a short distance in the bony wall, spread out over the lateral nasal wall and the nasal septum. The facial artery attributes in three places to the vascularisation: laterally and behind the inferior meatus by means of branches from the a. palatina ascendens, which extends from the pharyngeal wall to the front in the nasal wall, and two branches, one from the a. labialis superior, especially for the front part of the septum and one from the a. angularis, especially for the cartilage part of the side wall.

The anterior and posterior ethmoidal arteries which run through the lamina cribrosa, bring blood to the top part of the nose, both on the septum and on the lateral wall, the olfactory region included.

The **venous drainage** of the blood takes place by means of veins which follow the course of the arteries, in which it is most important to state that the anterior and posterior ethmoidal veins run towards the orbit and there open out into the superior ophthalmic vein, which brings the blood to the cavernous sinus. In this way there exists a communication between the vascular area of the nose and the dural sinus in the cranial cavity.

The **innervation** of the mucous membrane (fig. 5) concerning the **sensibility** takes place through the trigeminal nerve. The ramus ophthalmicus as well as the ramus maxillaris furnish this area with branches. From the former the anterior ethmoidal nerve arises which, together with the similarly named artery, passes through the lamina cribrosa, and branches out along the front

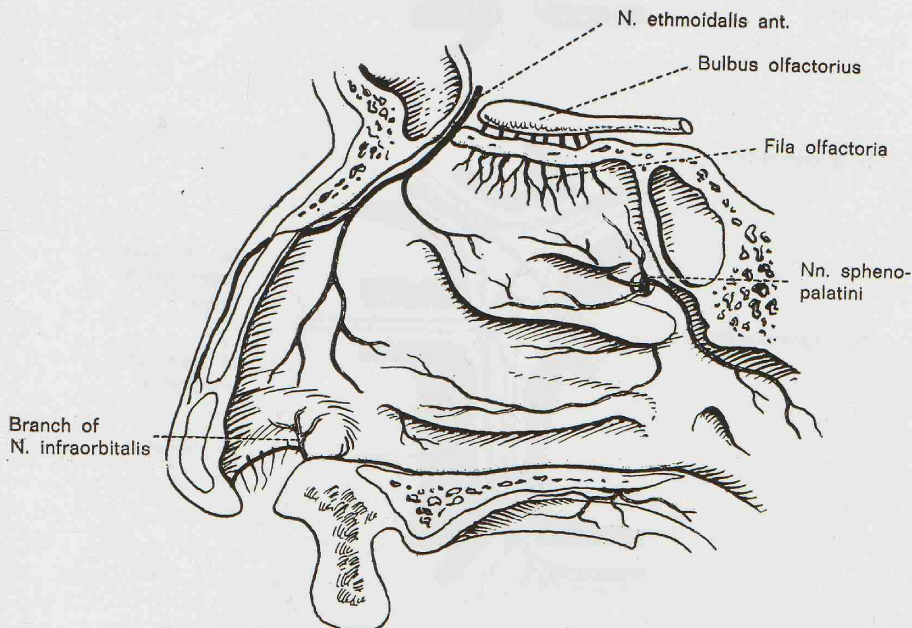


Fig. 5

part of the lateral wall, as well as along the septum. Between the nasal bone and lateral cartilage one branch, the external nasal nerve, branches off to the epidermis of the outer nose.

The second branch of the trigeminal nerve, the ramus maxillaris, penetrates the foramen rotundum on its way to the sphenopalatine fossa (fig. 6 b) and there it ramifies into a number of branches of which the sphenopalatine nerves penetrate the sphenopalatine foramen into the mucous membrane of the nose and extend along the lateral wall and the septum (fig. 5).

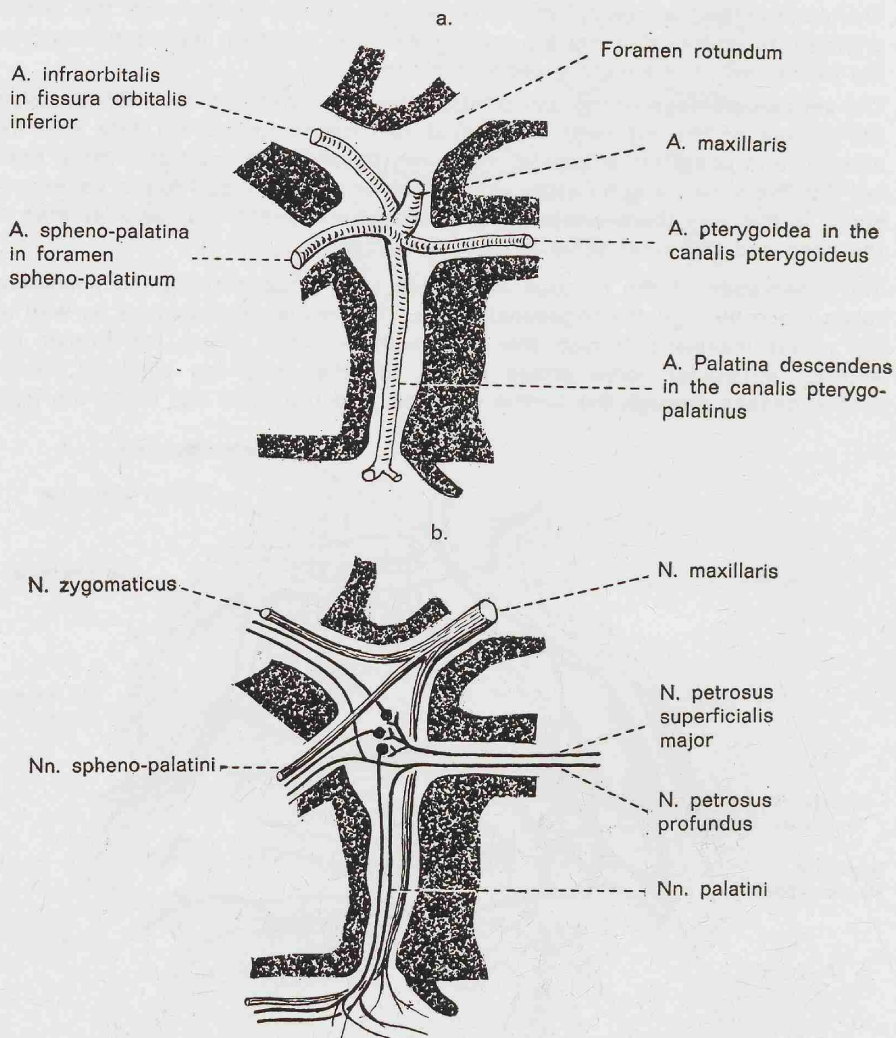


Fig. 6. Schematic drawings of the fossa sphenopalatina with a: showing the maxillary artery and b: showing the position of the nerves and the sphenopalatine ganglion.

Autonomic nerves run together with these sensible fibres, of which the parasympathetic nerves have their synaptic cells in the sphenopalatine ganglion. The preganglionic fibres originate from the facial nerve; they run in the N. petrosus superficialis major which comes through the canalis pterygoideus into the sphenopalatine fossa. The sympathetic fibres also run through the canalis pterygoideus (N. petrosus profundus); they are already postganglionic, their synaptic cells lying in the superior cervical ganglion of the sympathetic chain. The autonomic supply of the mucous membrane of the nose is especially important for the innervation of the numerous glands and bloodvessels. The mucous membrane of the most frontal and inferior part of the nasal cavity, the vestibulum nasi, is innervated by a terminal branch of the infra-orbital nerve.

Strictly speaking, the **fila olfactoria**, which come out of the olfactory mucous membrane and pass along to the bulbus olfactorius through the lamina cribrosa, cannot be regarded as nerves. The sense organ of smell contains sensory nerve cells which means that the sensory cells conduct the impulses with their **own prolongations** to the bulbus olfactorius. In man the number of sensory elements in the olfactory region decreases steadily, probably because of the numerous inflammatory processes.

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