

## VASCULARIZATION OF THE LABYRINTH MUCOSA IN THE ETHMOID BONE OF PIGS

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*The mucosa which covers the ethmoid bone of pigs and which represents most of the olfactory region is vascularized by arteries of intracranial and extracranial origin. Blood is conducted to most of the mucosa of the olfactory region, i. e. the mesethmoid and ethmoturbinates by branches of a. ethmoidea interna, while branches of the a. sphaenopalatinae bring blood only to a smaller part of the mucosa of the oroventral and orodorsal parts. Branches of both arterial regions anastomose very intimately.*

*Key words: vascularization, labyrinth mucosa, pig*

### INTRODUCTION

The elementary functions of the nasal cavity and its mucosa, and in particular the functions of heating, moistening, filtration and olfaction (Dukes, 1970; Negus, 1958; Hinchcliffe and Harrison, 1976; Popović, 1965; Popović, 1988) have become a subject of great interest in recent years, especially with respect to aerial pollution resulting from dust, gases and various radioactive material. All of this disrupts the ecological balance and increases the importance of the protection of different ecological systems. This results in unprecedented interest in the functioning of systems of natural defence and detection, which includes the elementary functions of respiration and olfaction. These functions of the nasal cavity are in direct connection with the morphological characteristics of both the skeleton (Ellenberger et al., 1943; Hillman, 1971; Loeffler, 1959; Popović, 1964; Romer, 1966) and the mucosa itself, and especially vascularisation (Dawes, 1952; Horst, 1960; Popović, 1965, 1990).

### MATERIAL AND METHODS

The experiment included 20 heads from pigs of different breeds and aged from 1.5 months to 2 years.

Anatomical investigations were performed using the method of preparation, making corosive and cleared preparations, and roentgenography. Rever-tex—T latex and caoutchouc dissolved in acetone was used for making corrosive

preparations and gelatin-minimum was used as the contrast device in roentgenology. Mucosa preparations were cleared in glycerin.

#### RESULTS AND DISCUSSION

The mucosa in the region of the labyrinth of the ethmoid bone is vascularized by arteries of intracranial and extracranial origin.

The most important artery of intracranial origin which vascularizes the mucosa in the region of the ethmoid bone labyrinth is a. ethmoidalis interna.

A. ethmoidalis interna (Figure 1<sub>10</sub>; 2<sub>10</sub>) is a double blood vessel which is an extension of a. cerebri rostralis (Figures 1<sub>9</sub>; 2<sub>9</sub>, 2<sub>9</sub>), according to Horst (1960) and our findings, while Ellenberger-Baum (1943) maintains that it breaks off from the beginning of a. corporis callosi (Figure 2<sub>13</sub>). In the region of fossa ethmoidea, 2-3 vessels branch off a. ethmoidalis interna to form the ethmoid network (rete ethmoideum, Figure 2<sub>11</sub>). According to Ellenberger-Baum, (1943) and Horst, (1960) and others a. ethmoidalis interna reaches only fossa ethmoidea, where it forms rete ethmoideum. However, a. ethmoidalis interna then distends further apically and passes through openings in the ethmoid bone, dorso-medially along the crista galli in the nasal cavity. Up to now this fact has been pointed out only by Marschlewski (1933) while studying the embryo of the pig. In the apical part of the labyrinth, it breaks up into three terminal branches (ramus lateralis, medialis et intermedius, Figures 1<sub>10'</sub>; 1<sub>10''</sub>; 3<sub>10''</sub>) for the mucosa of the nasal cavity. The medial and lateral terminal branches and

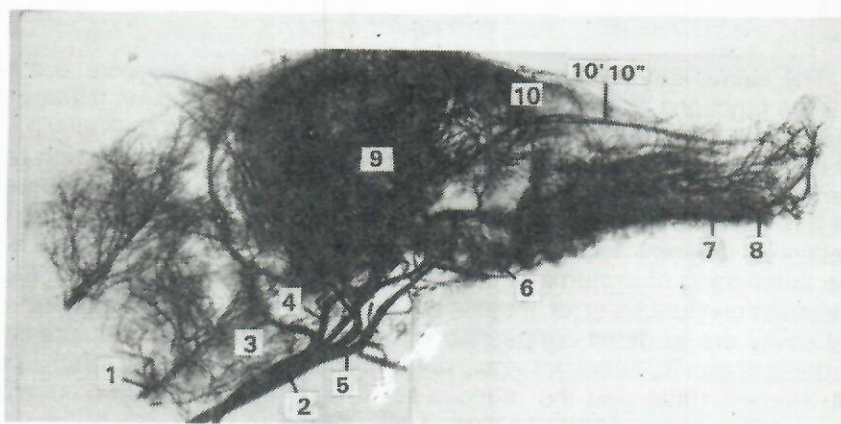


Figure 1. Roentgenogram of the arteries of a pig's head in its latero-lateral projection. The legend for figures 1-4.

1 — a. vertebralis; 2 — a. carotis communis sinistra; 3 — a. occipitalis; 4 — a. carotis interna; 5 — a. carotis externa; 6 — a. maxillaris interna; 7 — a. infraorbitalis; 8 — a. palatina; 9 — a. cerebri rostralis 9' — a. cerebri rostralis sinistra; 9'' — a. cerebri rostralis dextra; 10 — a. ethmoidalis interna; 10' — ramus lateralis a. ethmoidalis internae; 10'' — ramus medialis a. ethmoidalis internae; 11 — rete ethmoideum; 11' — rami ethmoidales; 12 — a. sphaenopalatina; 13 — a. corporis callosi; Cg — crista galli; Cnd — concha nasi dorsalis; Cnm — concha nasi media; Dnph — ductus nasopharyngicus; F — os frontale; Fe — fossa ethmoidea;



rete ethmoideum (Figure 2<sub>11</sub>) are the most important elements in the blood supply of the mucosa in the area of the labyrinth.



Figure 2. Arteries of the cavum cranii in the region of fossa ethmoidea. Corrosive preparation (celluloid).

The medial terminal branch (ramus medialis, Figures 1<sub>10''</sub>; 3<sub>10'</sub>) of a. ethmoidalis interna is distended along the dorsal-lateral edge of the mesethmoid and the nasal septum until tip of the snout. In the mesethmoid region, branches of ramus medialis anastomose with it from a. sphaenopalatinae so that both take part in the vascularization of the mucosa of that part of the mesethmoid (Figure 3).

The lateral terminal branch (ramus lateralis, Figure 1<sub>10'</sub>) of a. ethmoidalis interna extends along the dorso-lateral side of the dorsal nasal concha, deep inside the mucosa under the venal plexus. It vascularizes the mucosa of the aboral part of the dorsal nasal concha and the apical region of the labyrinth mucosa. Here, its branches anastomose with the lateral branches of a. sphaenopalatinae (Figure 4<sub>12</sub>).

Rete ethmoideum (Figure 2<sub>11</sub>) is especially important for the vascularization of the labyrinth mucosa. It is situated extradurally in fossa ethmoidea. It is mainly formed from 2-3 branches of a. ethmoidea interna (Figure 2<sub>11</sub>). In some cases it was established that this network also includes a few smaller branches of a. corporis callosi (Figure 2<sub>13</sub>). Rami ethmoidales (Figure 3<sub>11'</sub>) break off from this network, passing through openings in the ethmoid bone and breaking up into the finest branches, characteristically in the form of a brush. Rami ethmoidales are distended in the mucosa of the caudal and caudodorsal parts of laminae medianae (Figure 3), ethmoturbinate and the medial nasal concha (Figure 4) and vascularize them to a large degree, mostly in the aboro-dorsal

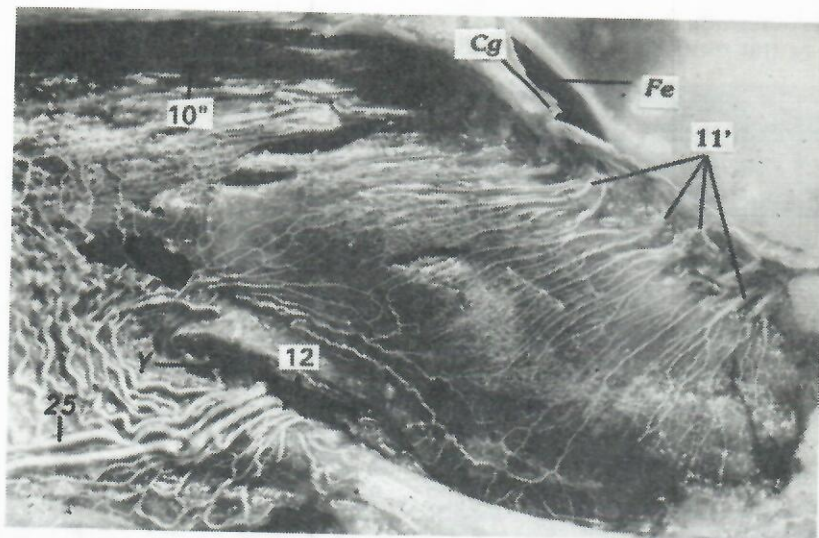


Figure 3. A closer aspect of the arterial network of branches and ramifications of a.sphaenopalatina and a.ethmoidalis interna belonging to the right medial side of the mucous membrane of the mesethmoid of the pig. Septum nasi and lamina mediana are removed. Gelatin minium. Cleared preparation.

part. Rami ethmoidales anastomose with branches of a.sphaenopalatinae, which only slightly vascularizes the mucosa of the oro-ventral and oro-dorsal parts of mesethmoid and ethmoturbinates (Figures 3, 4).

The most important artery of extracranial origin which vascularizes the labyrinth mucosa in the ethmoid bone is a.sphaenopalatina (Figures 3, 4) with its branches: ramus medialis et lateralis.

Ramus medialis seu septalis (Figure 3) branches off from the main vessel of a.sphaenopalatinae and further proceeds along the ventral surface of the bone roof — vomer, in the oro-medial direction towards the nasal septum. Most of its strongest branches vascularize the respiratory part of the mucosa of the nasal septum (Figure 3). Only a few smaller branches stretch dorsally and caudoventrally, where they anastomose with rami ethmoidales of rete ethmoideum (Figure 3). These branches mostly vascularize the smaller, oro-ventral part of the mesethmoid mucosa. These branches anastomose dorsally and dorso-caudally also with ramus medialis of a.ethmoidea interna (Figure 3).

Ramus lateralis a.sphaenopalatinae (Figure 4) branches off from the main vessel immediately after it passes through for.sphaenopalatinum and is directed in the oro-ventral direction. At the very beginning of this vessel, branches break off to supply the mucosa of the medial nasal concha and the oro-ventral part of ethmoturbinates (Figure 4). Through these branches, a.sphaenopalatina anastomoses with rami ethmoidales (Figure 4) which is vascularized by the remaining, greater part of ethmoturbinates mucosa (Figure 4).



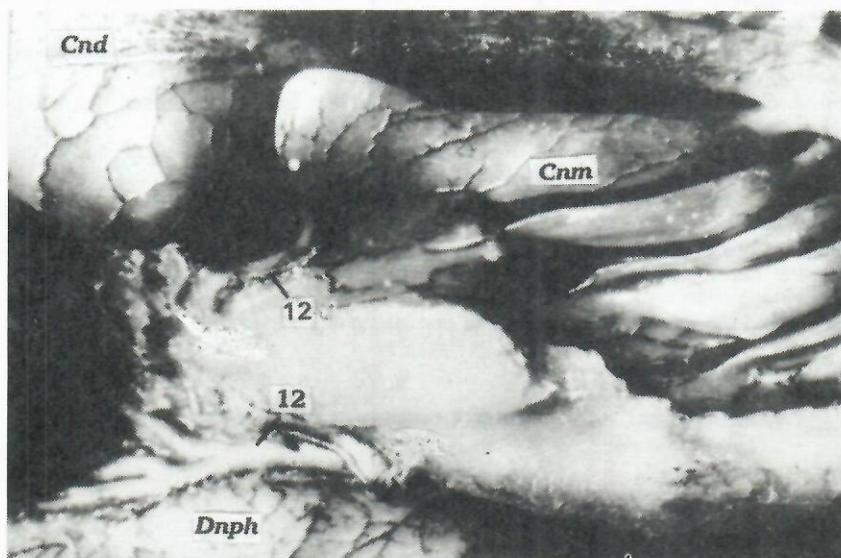


Figure 4. Arteriography of branches and ramifications of the a. sphaenopalatina belonging to the mucous membrane of labyrinth mucosa in the ethmoid bone of the pig. Gelatin minium. Cleared preparation.

Therefore, it can be said that the mucosa in the region of the labyrinth of the ethmoid bone in pigs is vascularized by arteries of intracranial and extracranial origin. Blood is brought to the greater part of the mucosa of the olfactory region and the entire region of the ethmoid bone by branches of a. ethmoidalis interna, and to the smaller oro-ventral and oro-dorsal part of the mucosa by branches of a. sphaenopalatinae. It is also characteristic that larger and smaller branches of both vascular regions anastomose to a large degree.

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#### VASKULARIZACIJA SLUZOKOŽE LABIRINTA SITASTE KOSTI SVINJE

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SADRŽAJ

Sluzokožu koja prekriva sitastu kost svinje a koja u najvećoj meri predstavlja i sluzokožu mirisne regije, vaskularišu arterije intrakranijalnog i ekstrakranijalnog porekla. Za najveći deo sluzokože mirisne regije tj. mezetmoida i etmoturbinalija krv dovede ogranci a. ethmoidalis interna a samo za manji deo sluzokože oroventralnog i orodorzalnog dela krv dovode grane a. sphaenopalatinae. Grane i ogranci oba arterijska područja međusobno intimno anastomoziraju.