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# Morphology of the dorsal nasal, frontal and facial veins in adult gilts

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*Morphological examinations conducted on adult gilts indicate that the dorsal nasal, frontal and facial veins belong to the myoelastic type with a well-developed internal elastic lamina and a thick tunica media with elastic fibers. Smooth muscle cells in the tunica media are mainly arranged circularly. A characteristic feature of individual veins, and even their parts, was the difference in the distribution and number of elastic fibers and amount of collagen, both in the internal elastic lamina and tunica media. Slight thickening of the vessel walls and a decrease in the number of elastic fibers were observed in the distal part of the dorsal nasal vein and in the proximal parts of the frontal and facial veins. No valves were found in the frontal vein. The bundles of smooth muscle cells in the tunica media and elastic fibers surrounding them were rounded, not laminar like in the other veins. Characteristic, sandwich-like arranged smooth muscle bundles, elastic fibers and large amounts of collagen were observed in the tunica media of the distal part of the facial vein. A distinctive feature of the middle auricular and radial veins was the presence of a well-visible external elastic lamina in the adventitia. An evaluation of the luminous vein surface in a SEM shows that endothelial cells are elongated and arranged consistently with the direction of blood flow in almost all of the veins analyzed. Endothelial cells were less elongated in the distal part of the facial vein, and microvilli were present on them.*

**key words: facial vein; dorsal nasal vein, frontal vein, histology, SEM, endothelial cells, pigs**

## INTRODUCTION

The number of papers dealing with the physiological and biochemical functions of veins and mechanisms controlling their functioning has increased recently. It is more and more often emphasized that veins are not only passive canals responsible for blood outflow from the tissues, but also they constitute a very specific, multifunctional system. In veins, as in arteries, the synthesis of numerous biologically active substances regulating their functions takes place. Depending on their location, veins perform different functions [23]. Within the head they participate in the regulation of intracranial pressure. The superficial facial veins and the cavernous sinus take part in the process of selective brain cooling (SBC) in humans and animals. The mechanism of SBC is mobilized when the organism is overheated: blood, cooled in the nasal mucous, is transported by the superficial nasal veins, angularis oculi vein and ocular veins to the cavernous sinus situated at the base of the brain, where heat is exchanged with the blood flowing through the arterial blood of the carotid rete to the brain [2,6,7,13,17,19,23]. Experiments and morphological examinations conducted on camels, rab-

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bits, pigs, reindeers and sheep [3,7,10,11, 12,18,19,22] show that in those animals due to certain morphological and functional adjustments of the angularis oculi vein and facial vein cooled blood from the nasal area may be directed either to the cavernous sinus or — through the facial and external maxillary veins — to the jugular vein. The direction of blood flow in animals subjected to thermal stress is determined by changes in the myogenic tension in the thick muscular coat of the angularis oculi vein and facial vein.

Concerning pigs, only general anatomy of their superficial facial veins is known [12,26]. Venous blood from the area of the nasal mucous is transported by the dorsal nasal vein, which at the level of the infraorbital foramen ramifies into the facial vein and frontal vein (corresponding to the angularis oculi vein in some animal species). The facial vein goes towards the mandible and — through the external maxillary vein — joins the jugular vein. The frontal vein passes through the supraorbital foramen and enters the orbital area, where — through the supraorbital vein — it joins the ophthalmic sinus. Through the ophthalmic sinus and external ophthalmic veins, the frontal vein joins the cavernous sinus situated at the base of the brain.

It was demonstrated that the male pheromone 5-$\alpha$-androstenol is resorbed into the venous blood flowing from the nasal area to the cavernous sinus. Then, it is transported through the vascular complex: cavernous sinus-carotid rete (supplying the hypophysis and brain), and then selectively accumulated in the hypophysis and certain brain structures [20]. According to Krzymowski, the specific structure and function of the nasal and facial veins is connected not only with the process of SBC, but — in case of females — may also serve to receive pheromonal chemical signals and send them to the cavernous sinus, hypophysis and brain. Following this hypothesis, the structural adjustment and functional reaction of the nasal and facial veins result in the activity of pheromones, or maybe also steroid hormones (estrogens) whose concentration increases in the maturation. Preliminary comparative microscopic analyses of the superficial facial veins, performed by Grzegorzewski and Zezula-Szpyra [16] in groups of sexually immature, mature and ovariectomized gilts, did not show any structural differences between their vascular walls. However, a morphometric analysis indicated changes between individual groups, concerning the degree of the venous lumen increase and tunica media thickness. This suggests a functional correlation between the facial veins examined and the sexual activity of gilts.

Moreover, the cavernous sinus and arterial blood of the carotid rete form a vascular complex. Part of blood from the nasal cavity and blood from the hypophysis flows into this complex [2]. The experiments conducted recently on gilts [14,15,21,27,28] indicate that a counter current transfer of such hormones as LHRH, oxytocin, progesterone and testosterone, depending on the phase of the estrous cycle, takes place in the vascular complex mentioned above.

The aim of the paper is to present and compare the detailed morphology of walls of the dorsal nasal, frontal and facial veins, paying special attention to those parts of the vessels which may be adjusted to increased vasomotor activity. An analysis of the structure of venous walls will provide the basis for studies on their reactivity under in vitro and in vivo conditions.

## MATERIAL AND METHODS

The studies were conducted on 12 adult gilts whose body weight varied between 100 and 120 kg. Venous vessels were cut out directly after exsanguination. Dissected veins (from one side of the head) were fixed in 10% phormalin and prepared for an evaluation in a light microscope. Paraffin embedded vessels were cut in the way that enabled to obtain their transverse and longitudinal sections. The sections were HE and orcein stained. Measurements of the muscular coat thickness and vascular lumen area (as the area of an ellipse) were carried out in orcein stained preparations, with a constant magnification (x 50), using the system PC-IMAGE (Foster Findlay Associates Ltd, UK). The average thickness of the muscular coat was calculated on the basis of three measurements, taken at the widest, narrowest and medium points. Due to certain problems with precise differentiating between the internal lamina and tunica media of the vein, both layers were measured. In order to determine the area of the vascular lumen, three measurements were taken at the points of the largest (A) and smallest (B) increase, and mean values were calculated.

Vein specimens taken from the other side of the head were rinsed with physiologic saline with heparin to remove blood. Then they were cut carefully and pinned to a cork plate, with the endothelium directed upwards. The specimens were fixed in 2.5% glutaraldehyde in phosphatic buffer and then prepared for examinations under a scanning electron microscope (SEM) [4]. The tissues, dried at the criti-

cal point, were coated with carbon and gold in a sputter-evaporator of the type JEE-4X JEOL (Japan), and then observed and photographed in a SEM of the type JSM 5200 JEOL.

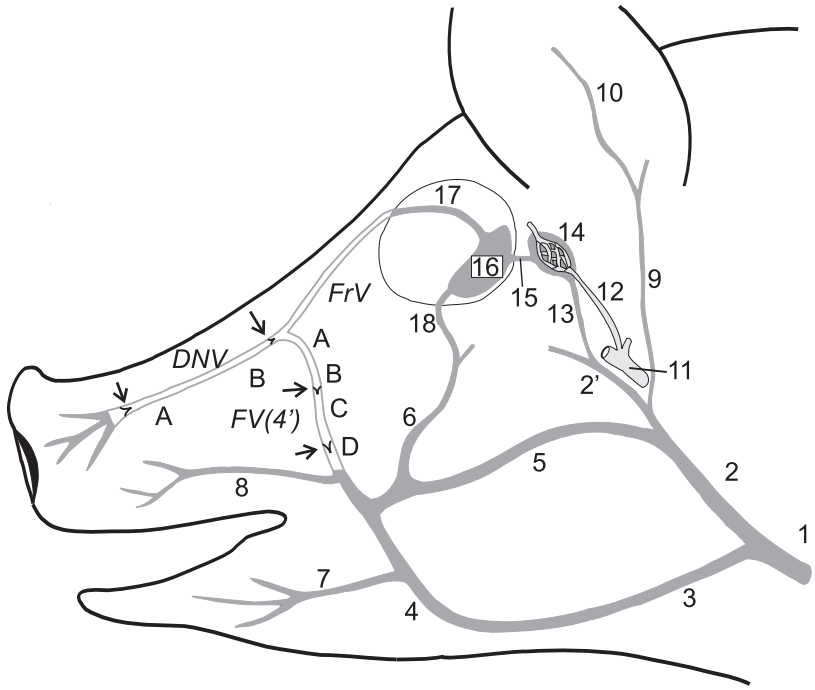
A detailed morphological evaluation and morphometric measurements were carried out in:

— the proximal (A) and distal (B) part of the dorsal nasal vein,
— the frontal vein (paying special attention to its proximal part),
— the facial vein divided into four parts (A,B,C,D) from its junctions with the dorsal, nasal and frontal veins (part A) to the ostium of the superior labial vein (end of part D). Each of the facial vein segments was ca. 1.5 cm in length.

For the purpose of comparison, similar morphometric measurements and a similar morphological analysis under a light microscope and a SEM were carried out for the middle auricular and radial veins, characterized by a similar size.

## RESULTS

General courses of the dorsal nasal, frontal and facial veins (vessels not stained blue) and distribution of venous valves are presented in Scheme 1. In adult gilts, the dorsal nasal vein is ca. 8.1 cm in length, the frontal vein — 6.2 cm and the facial vein — 6.1 cm (to the ostium of the superior labial vein). Valves were found at two points in the dorsal nasal vein. A big one, consisting of several cusps (Fig. 1), is situated very close to the point where two or three smaller lateral nasal veins form the dorsal nasal vein. The other one is located near the ramification of the dorsal nasal vein into the frontal and facial veins. No venous valves were observed in the frontal vein. In the segment of the facial vein examined, valves were observed at two points. The first one is situated ca. 1.5 cm below the branching-off of the facial vein from the dorsal nasal vein. The other, three-cusp one (Fig. 22), is located very near the opening of the superior labial vein to the facial vein.




**Scheme 1.** General scheme of the veins of the pig's head with respect to the veins' connections with the perihypophyseal cavernous sinus-carotid rete vascular complex. The veins not stained blue were evaluated morphologically and morphometrically, arrows — venous valve, DNV — dorsal nasal vein (A, B — parts of vein), FV (4') — proximal (superior) part of the facial vein (A, B, C, D — parts of vein), FrV — frontal vein, 1 — external jugular vein, 2, 2' — maxillary vein, 3 — linguofacial vein, 4 — facial vein, 5 — buccal vein, 6 — deep facial vein, 7 — inferior labial vein, 8 — superior labial vein, 9 — caudal auricular vein, 10 — middle auricular vein, 11 — external carotid artery, 12 — internal carotid artery, 13 — anastomotic branch between the cavernous sinus and maxillary vein, 14 — perihypophyseal cavernous sinus-carotid rete vascular complex, 15 — emissary vein of the foramen orbitorotundum, 16 — ophthalmic sinus, 17 — dorsal external ophthalmic vein, 18 — ventral external ophthalmic vein. (Adaptation from Ghosal NG, Zguigal H [12]).

Table 1 presents the results of morphometric measurements. The proximal part (A) of the dorsal nasal vein is characterized by a larger lumen area and a slightly thinner muscular coat than the distal part (B). In the frontal vein, the muscular layer and lumen area are smaller than in the dorsal nasal vein along the whole course. Considerable differences in the muscular coat thickness and lumen area were noted in the segment (consisting of a several centimeters) of the facial vein examined. In the proximal part (A) of this vein the muscular coat thickness amounts to 293.1 $\mu$m, and the lumen area — to 119902.3 $\mu m^2$ (which is the lowest value). In part B the muscular layer is thinner (261.4 $\mu$m), but then becomes thicker (287.4 $\mu$m in part C). Ca. 1.5 cm before the ostium of the superior labial vein (part D) it reaches the thickness of 441.8 $\mu$m. Also the lumen area is here the biggest — 265473.8 $\mu m^2$.

Microscopic examinations show that a well-developed internal elastic lamina and a thick tunica media characterize the superficial facial veins in adult gilts. However, there are certain differences in the number and distribution of elastic fibers, both in the internal elastic lamina and tunica media. In the proximal part (A) of the dorsal nasal vein the internal elastic lamina consists of several layers of thick and wrinkled, but disconnected, elastic fibers. It is well visible in longitudinal sections (Fig. 2) where elastic fibers are parallel to the longitudinal axis of the vein. Rather thick, disconnected elastic fibers are also present between bundles of smooth muscle cells in the tunica media. In the distal part (B) of the dorsal nasal vein, the internal elastic lamina has fewer layers, and elastic fibers dividing muscle bundles are shorter and thinner (Fig. 3 and 4). Smooth muscle cells are arranged mainly in a circular way along the whole course of the dorsal nasal vein. Yet in both longitudinal and transverse sections of the vessel (Fig. 2) there appear bands with cells arranged obliquely. Elastic fibers are scarce, short and form a very loose network in the adventitia of the dorsal nasal vein (Fig. 1, 3 and 4).

**Table 1.** Measurements of the superficial of the face and control veins of gilts (n=12)

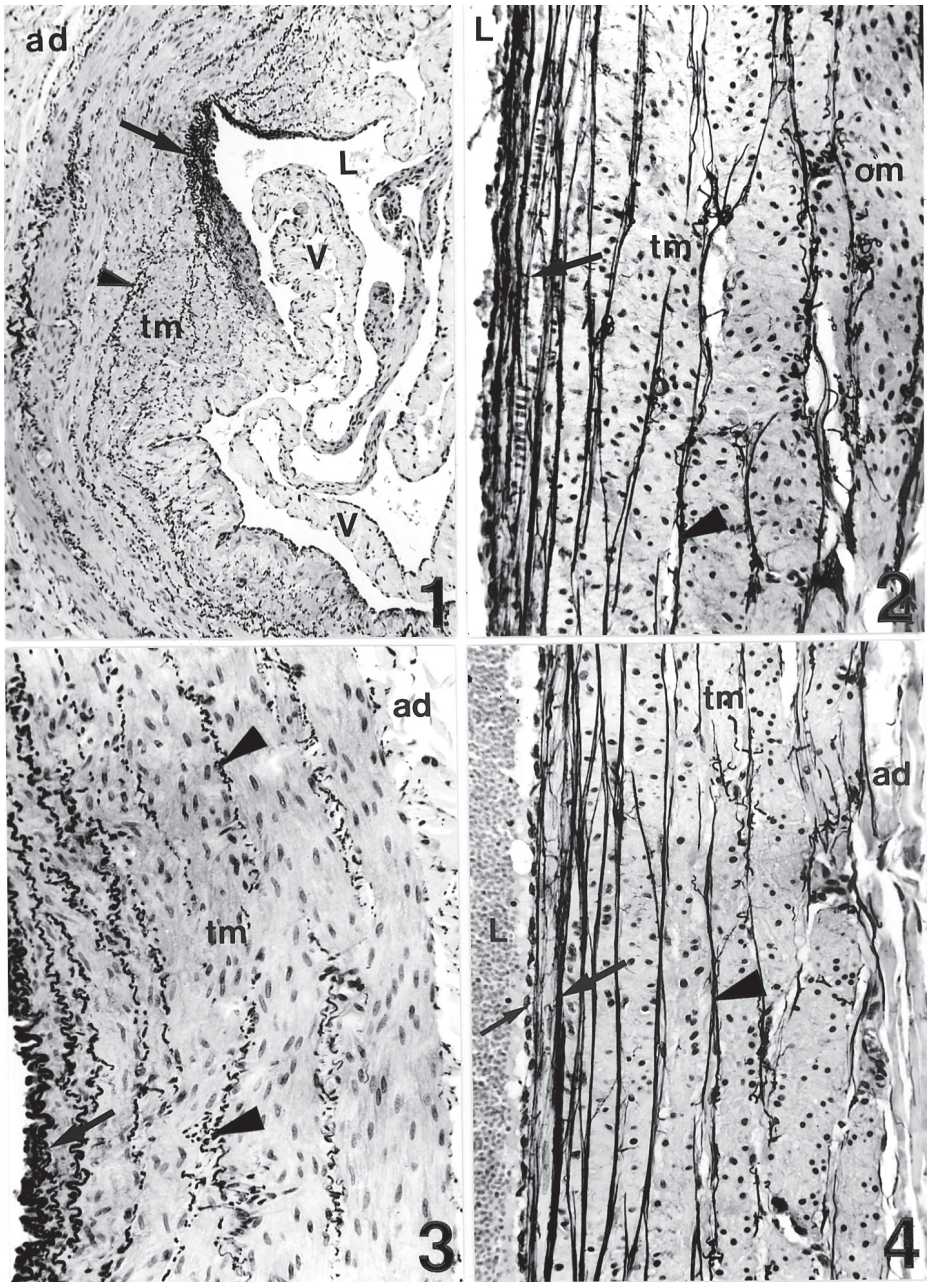
| Veins | Number of measurements | Tunica media thickness [$\mu$m] (x±SEM) | Vascular area lumen [$\mu m^2$] (x±SEM) |
|---|---|---|---|
| Dorsal nasal – A | n = 144 | 319,6 ± 8,3 | 292045,2 ± 32744,6 |
| Dorsal nasal – B | n = 144 | 327,2 ± 6,5 | 265742,8 ± 55595,1 |
| Frontal | n = 159 | 284,4 ± 6,0 | 162229,3 ± 21508,7 |
| Facial – A | n = 72 | 293,1 ± 10,4 | 119902,3 ± 17246,4 |
| Facial – B | n = 66 | 261,4 ± 8,1 | 140629,3 ± 14785,9 |
| Facial – C | n = 66 | 287,4 ± 14,9 | 137389,5 ± 20239,6 |
| Facial – D | n = 66 | 441,8 ± 20,4 | 265473,8 ± 57735,1 |
| Auricular intermedial | n = 96 | 197,5 ± 10,8 | 74042,7 ± 588,0 |
| Radial | n = 96 | 237,1 ± 16,4 | 110675,3 ± 1272,0 |

The wall structure in the proximal part of the frontal vein is similar to the wall structure in the distal part of the dorsal nasal vein. The frontal vein is characterized by a well visible internal elastic lamina with several layers of thick, wrinkled and disconnected elastic fibers (Fig. 5–7). Along the whole course of the frontal vein, bundles of smooth muscle cells are shorter and thicker than in the dorsal nasal and facial veins. They are surrounded by disconnected and wrinkled elastic fibers (Fig. 7, 9). Smooth muscle cells are arranged mainly in a circular way, but myocytes arranged obliquely were also observed (Fig. 6). In the distal part of the frontal vein the internal elastic lamina is less developed, and muscle bundles with smooth muscle cells arranged circularly are rounded (Fig. 8). Fewer and shorter are also elastic fibers surrounding individual bundles of smooth muscle cells in the tunica media (Fig. 9). No elongated bundles of muscle fibers were found in the frontal vein adventitia, and elastic fibers do not form a visible external elastic lamina there (Fig. 5, 7–9).

Distinctive differences in the structure of vessel walls were noted in the facial vein. In its proximal part (A) the vessel wall structure (Fig. 10) is the same as in the distal part of the dorsal nasal vein. The internal elastic lamina is made up of several layers of thick and disconnected elastic fibers, which is easy to observe especially in longitudinal sections of the vein (Fig. 11). Rather thick, but short elastic fibers can be found in the tunica media, between smooth muscle cells arranged circularly (Fig. 11, 12). In the middle parts of the vein (B and C) there are fewer elastic fibers in the tunica media (Fig. 13–15), and smooth muscle cells of the tunica media are in most cases arranged circularly (Fig. 14). At the end of part C and in part D of the facial vein there are fewer elastic fibers in the internal elastic lamina. They are thinner and shorter. On the other hand, there is much more collagen (Fig. 14–17). The tunica media in those vein parts is considerably thicker. Bundles of smooth muscle cells are clearly separated from one another by bands of fibrous tissue with short elastic fibers

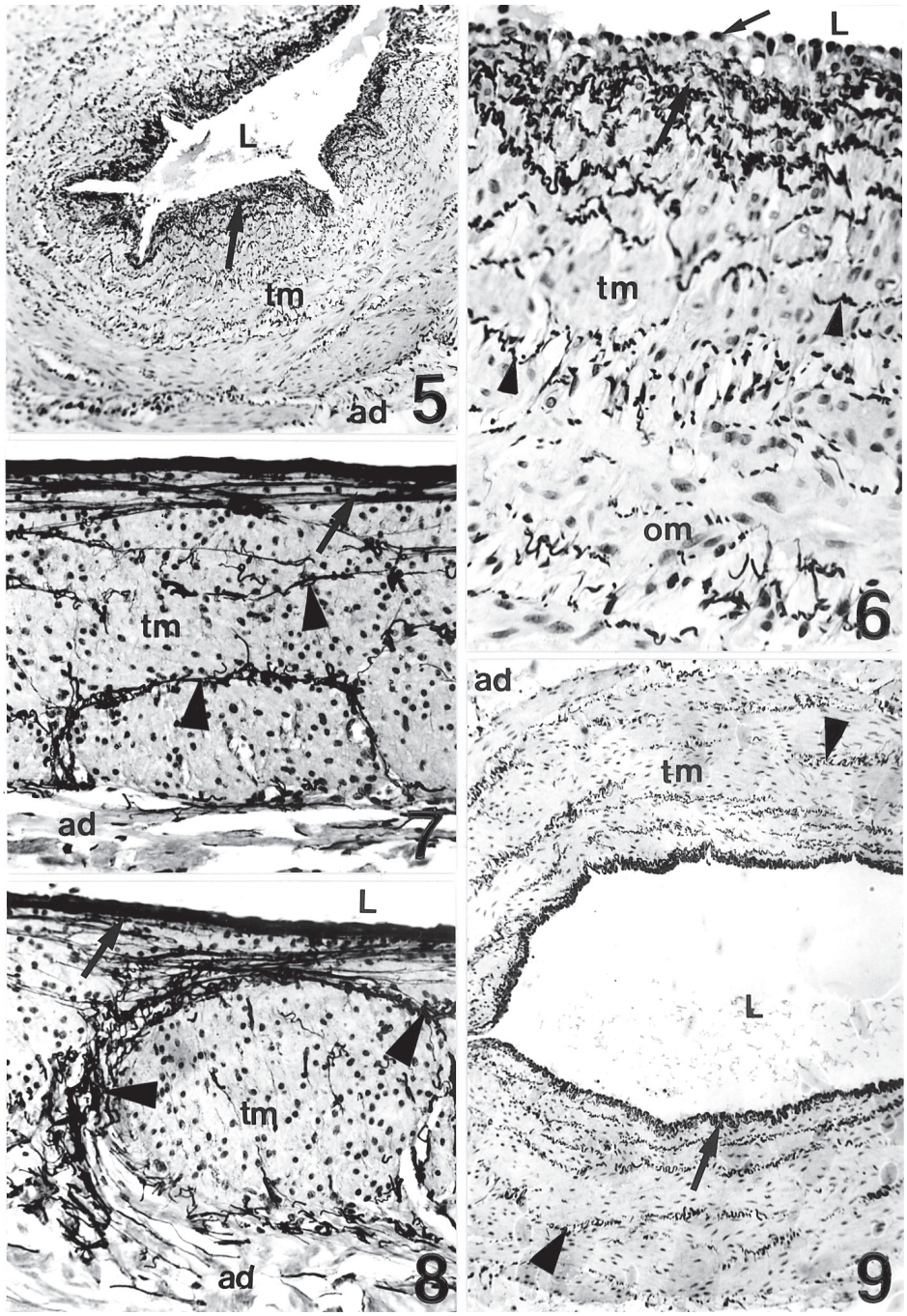
and collagen, which creates a characteristic, sandwich-like arrangement (Fig. 14–16). In the adventitia of the facial vein, similarly to the veins described above, neither bundles of smooth muscle cells arranged longitudinally nor a visible internal elastic lamina were observed (Fig. 10, 12–14, 16).

In the middle auricular (Fig. 18) and radial (Fig. 19) veins the internal elastic lamina consists of 2–3 layers of wrinkled and disconnected elastic fibers. No visible muscle bundles were found in the tunica media and elastic fibers surrounding them were not as numerous as in the superficial facial veins. A characteristic feature of the middle auricular and radial veins, compared with the facial veins, was the presence of the external elastic lamina in the adventitia.



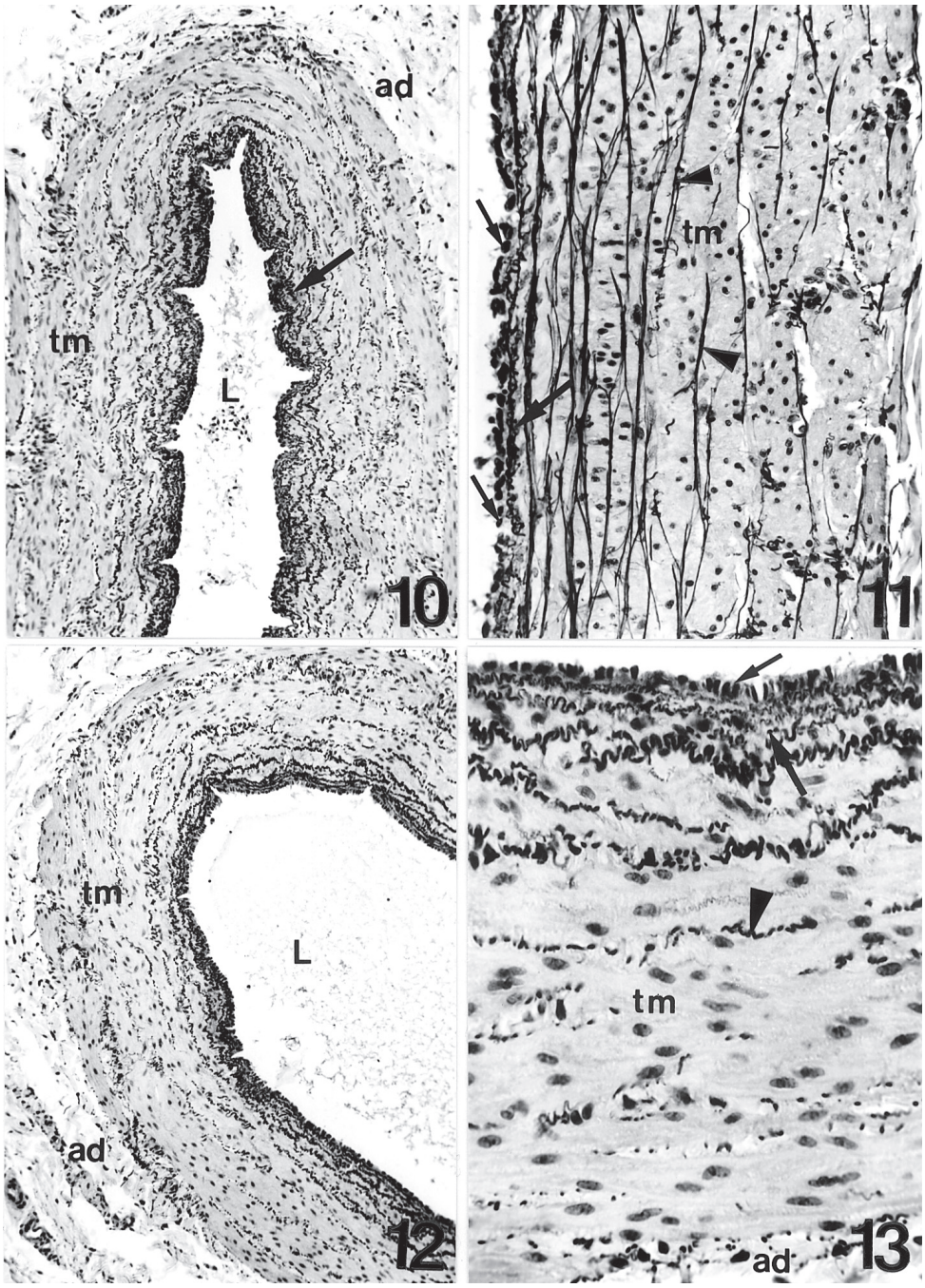

**Figures 1–4.** Transverse and longitudinal sections of the dorsal nasal vein. Fig. 1 and 2 — proximal (A) part of vein. The transverse section of the vein shows a big valve (V). The longitudinal section shows thick, several-layer, mostly continuous elastic fibers of internal elastic lamina (arrow), om — bundle with an oblique arrangement of smooth muscle cells. Orcein stain, x 125 and 250, respectively. Fig. 3 and 4 — distal (B) part of the vein. Elastic fibers of the internal elastic lamina (big arrow) are fewer and slightly thinner. Orcein stain, x 250. Along the course of the dorsal nasal vein elastic fibers and muscle bundles form characteristic lamellar units. L — lumen, small arrow — endothelium, tm — tunica media, arrowheads — elastic fibers surround bundles of smooth muscle cells, ad — tunica adventitia.

The arrangement and shape of endothelial cells of the veins examined by means of SEM are presented in Figures 20, 21, 23–25. In all the vessels endothelial cells were spindle-shaped, with well visible elongated protrusions of cell nuclei. The luminal surface of the proximal part of the dorsal nasal vein (Fig. 20) was wrinkled, with distinctly differentiated endothelial cells. On some folds those cells were flattened, on others they were characterized by nuclei protruding towards the vascular lumen. Such great morphological differences between endothelial cells were not noted in the distal part of the dorsal nasal




**Figures 5–9.** Transverse and longitudinal sections of the frontal vein. In the proximal (Fig. 5–7) part of the vein bundles of smooth muscle cells are smaller and more numerous than in the distal (Fig. 8 and 9) part of the vein. Along the course of the frontal vein smooth muscle cells in the tunica media form oval bundles, especially well visible in longitudinal sections (Fig. 7 and 8). L — lumen, small arrow — endothelium, big arrow — internal elastic lamina, tm — tunica media, om — muscle bundles with an oblique arrangement of smooth muscle cells, arrowheads — elastic fibers surround muscle bundles, ad — tunica adventitia. Orcein stain, Fig. 5 and 9 x 125, Fig. 6 — x 500, Fig. 7 and 8 — x 250.

vein, frontal vein (Fig. 21) and in the proximal part of the facial vein. Endothelial cells situated right behind the big valve in the facial vein were flattened, oval or round, with flattened, rounded nuclear protrusions (Fig. 23). Numerous, uniformly distributed microvilli were observed on the luminal surface of the elongated and tightly arranged endothelial cells in the middle (C) and distal (D) part of the facial vein (Fig. 24). There were very many of them on some endothelial cells. In the middle auricular and radial veins, endothelial cells were elongated and spindle-shaped similarly to those in the dorsal nasal and fron-

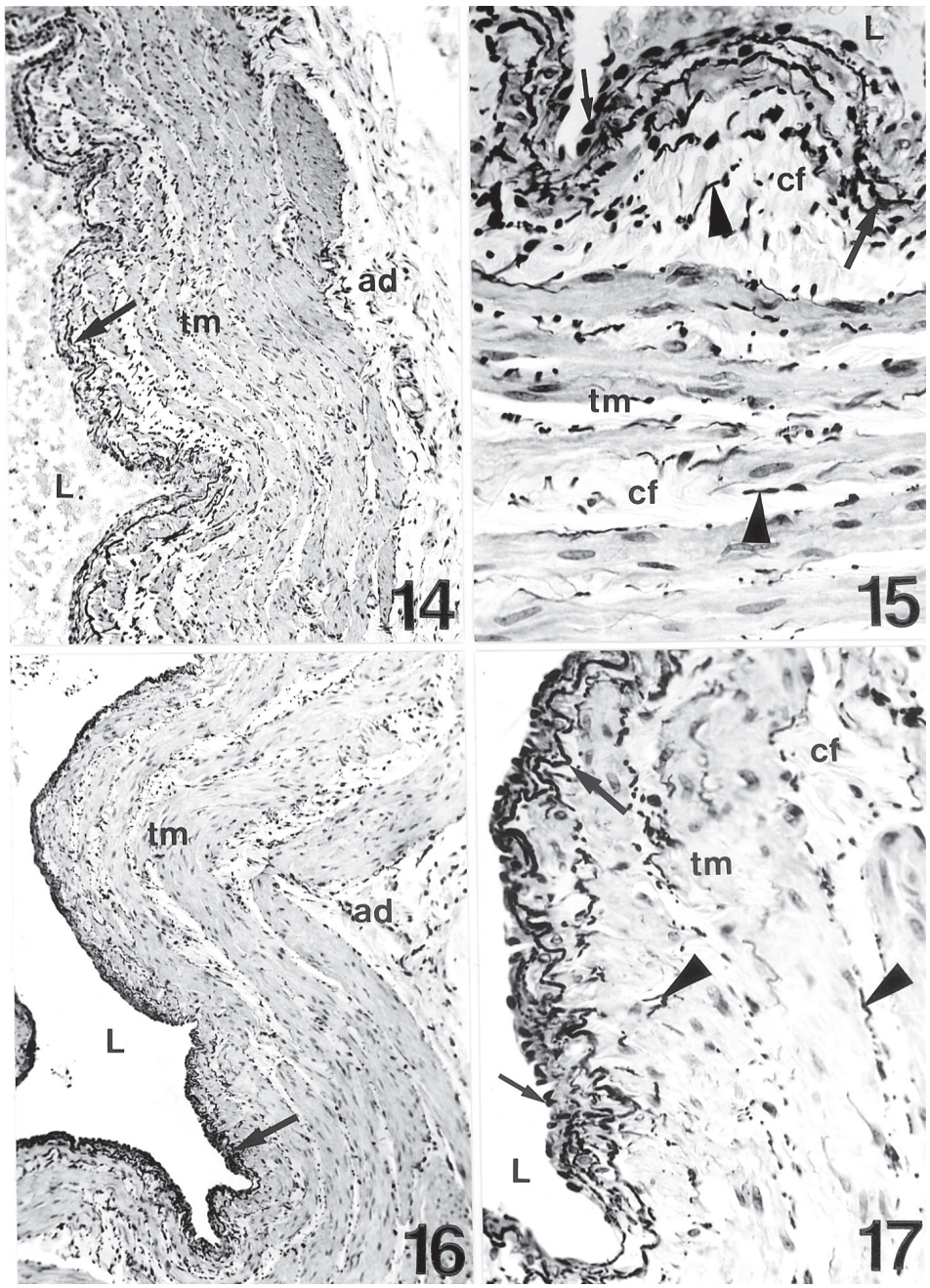



**Figures 10–13.** Transverse and longitudinal sections of the proximal (Fig. 10 and 11) and middle (Fig. 12 and 13) parts of the facial vein. The structure of those parts of the facial vein is similar to the structure of the distal part of the dorsal nasal vein. Tunica media (tm) of the proximal part of the facial veins is slightly thicker and the vascular lumen is more constricted than in the middle part (Fig. 12). L — lumen, small arrow — endothelium, big arrow — internal elastic lamina, and arrowheads — elastic fibers surround muscle bundles, ad — tunica adventitia. Orcein stain, Fig. 10 and 12 x 125, Fig. 11 x 250 and Fig. 13 x 500.

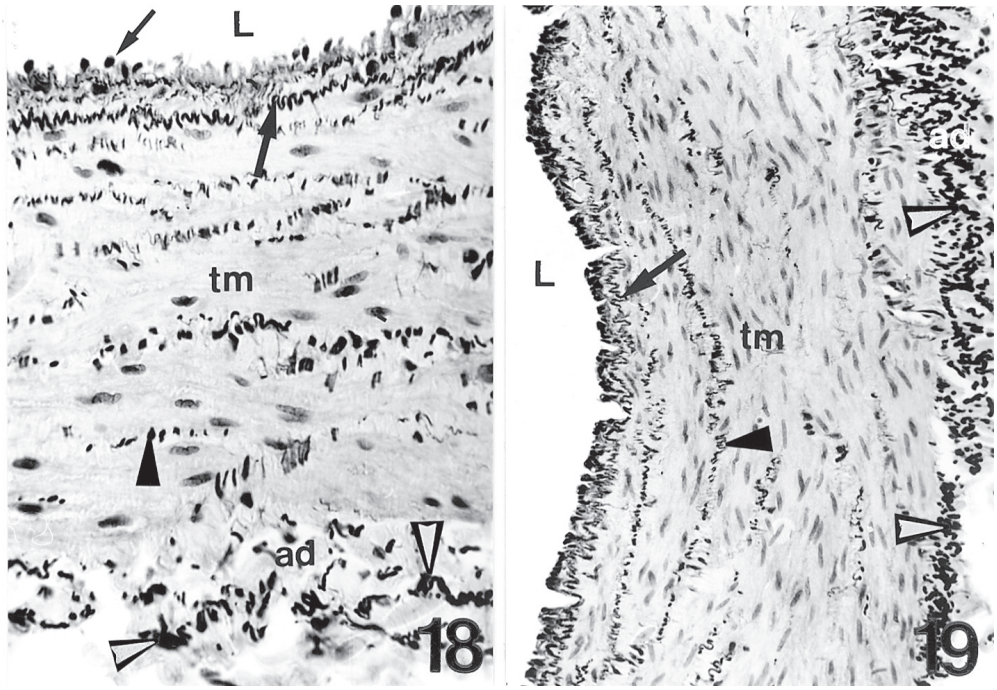
tal veins. However, the protrusions of their nuclei were not always closely adherent (Fig. 25). Such an arrangement of endothelial cells was observed even in specimens analyzed in a light microscope (cf. Fig. 18).

## DISCUSSION

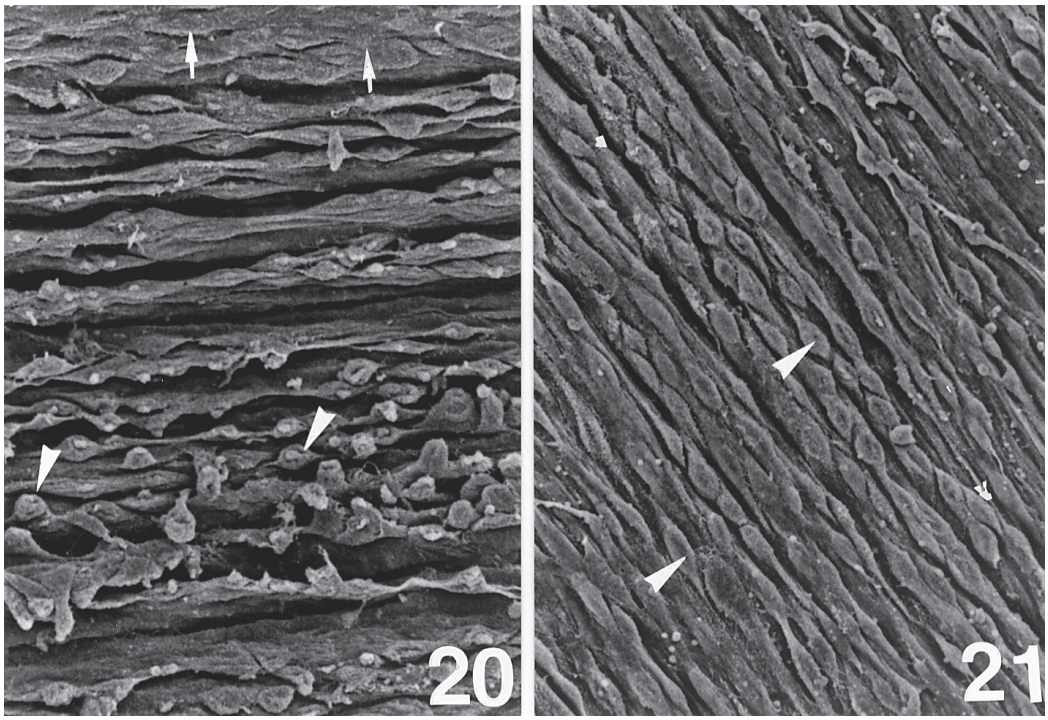
Detailed morphological examinations show that the superficial facial veins in pigs belong to the myoelastic type with a well-developed internal elastic lamina and a thick tunica media with numerous layers of smooth muscle cells (arranged mainly circularly) and with elastic fibers situated between them. No longitudinally arranged bundles of smooth muscles were observed in the tunica media or adventitia. The circular arrangement of smooth muscle cells in the tunica media of the superficial facial veins in-




**Figures 14 –17.** Transverse section of the facial vein. In the distal part of the vein the tunica media (tm) becomes thicker and has characteristic sandwich-like arranged bundles of smooth muscle cells, the vascular lumen (L) also increases. The internal elastic lamina (big arrow) is less developed than in the proximal and middle parts of the vein. Short elastic fibers (arrowheads) and numerous collagen fibrils (cf) are visible between muscle bundles. Small arrows — endothelium, ad — tunica adventitia. Orcein stain, Fig. 14 and 16 x 125, Fig. 15 and 17 x 500.



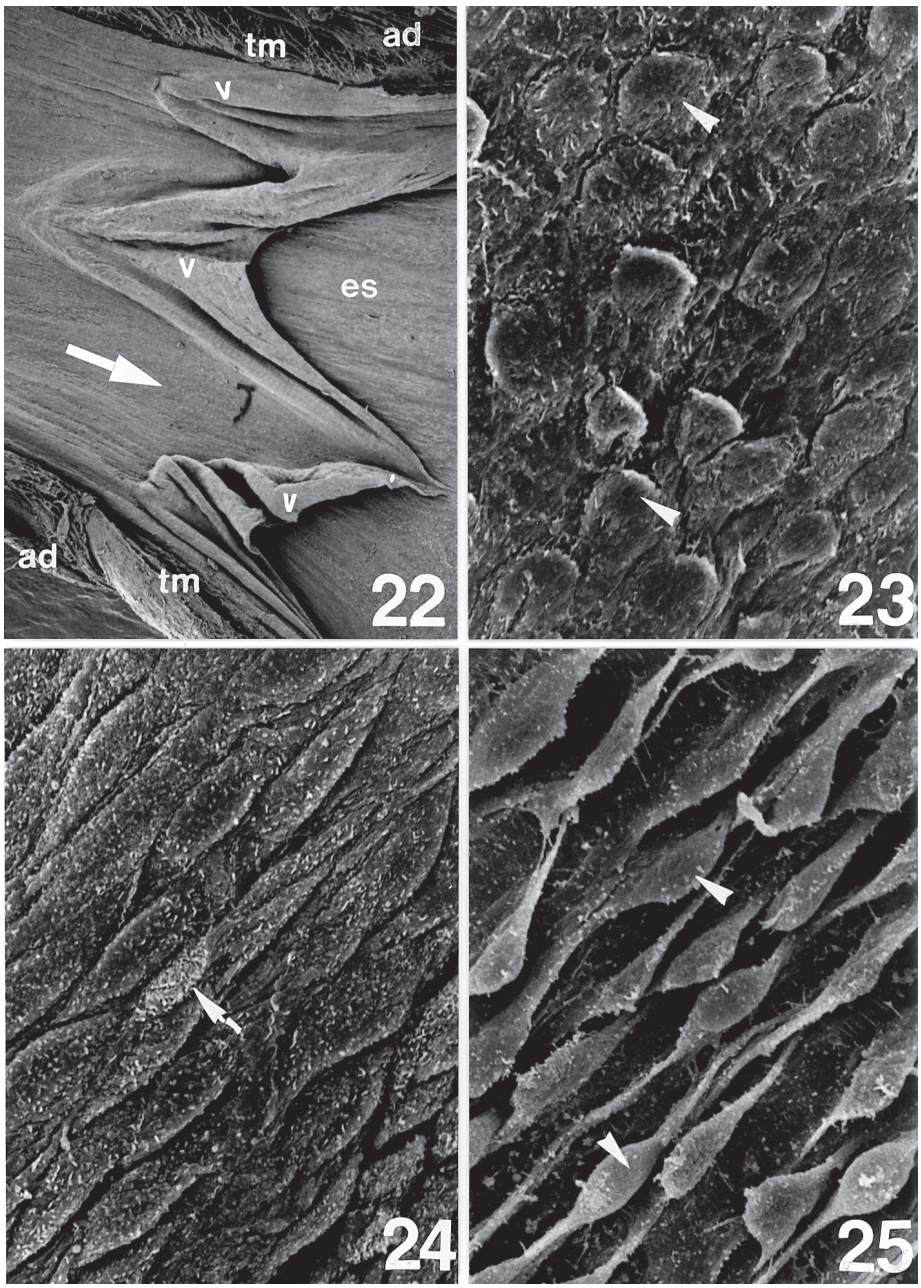

**Figures 18 and 19.** Transverse sections of the middle auricular and radial veins. The walls of those veins have structures similar to the structure of the facial veins, but as opposed to them they have a well visible external elastic lamina (white-black arrowheads) in the tunica adventitia (ad). The internal elastic lamina (big arrow) consists of two or three layers of disconnected elastic fibers. Few disconnected elastic fibers (arrowhead) are visible between smooth muscle bundles in the tunica media (tm). L — lumen. Orcein stain, x 500 and x 250 respectively.




**Figures 20 and 21.** Scanning images of endothelial cells of the dorsal nasal and frontal veins. **Figure 20.** Luminal surface of the dorsal nasal vein with easy to notice elongated folds. Endothelial cells, most of them spindle-shaped, with visible protrusions of cell nuclei (arrowheadss). On some folds endothelial cells are elongated and flattened (arrows). **Figure 21.** The luminal surface of the frontal vein is less folded. Endothelial cells, as well as the protrusions of their nuclei (arrowheads), are elongated and arranged regularly. SEM, x 750.

dicates their ability to contract. A characteristic, made up of several layers, structure of the internal elastic lamina and different distribution of elastic fibers in the tunica media were especially well visible in longitudinal sections of the superficial facial veins in pigs. A similar internal elastic lamina consisting of thick elastic fibers running longitudinally along the vascular wall was presented in the canine saphenous vein by Crissman et al. [5]. They emphasize that the architecture of the elastic fiber network contributes to vascular flexibility and allows circumferential distension of veins.

Experiments and morphological analyses conducted on camels, reindeers, and sheep [10,17,22]




**Figures 22–25.** Scanning images of the luminal surface of the distal part of the facial (Fig. 22–24) and radial (Fig. 25) veins. **Figure 22.** Large tricuspidal valve (v) located between the middle and distal parts of the facial vein. Big arrows indicate the direction of blood flow, es — endothelial surface, tm — tunica media, ad — tunica adventitia. SEM, x 35. **Figure 23.** Luminal surface of the facial vein right behind the valve. Endothelial cells and the protrusions of their nuclei are flattened and round or oval (arrowheads). **Figure 24.** Endothelial cells of the distal part of the facial vein are elongated and arranged regularly. Microvilli are uniformly distributed on all endothelial cells, arrow — endothelial cell with numerous microvilli. **Figure 25.** Endothelial cells of the radial vein are spindle-shaped and have elongated nuclear protrusions (arrowheads). SEM, x 2000.

show an artery-like structure of the walls of the dorsal nasal vein, the angularis oculi vein and the proximal part of the facial vein. It is also emphasized that each of those veins can function as a sphincter, which may result in a considerable reduction in the blood flow. Our studies on the superficial facial veins in pigs also indicate that they are morphologically adjusted to such functioning. All the veins analyzed were characterized by a thick tunica media with numerous, circularly arranged layers of smooth muscle cells. However, certain differences in the distribution and number of elastic fibers and amount of collagen suggest low contractile activity of the proximal part of the dorsal nasal vein and the middle part (C) of the facial vein. The distal part (D) of the facial vein, although characterized by the thickest tunica media, probably shows low vascular activity, which is connected with an increased number of stiff, non-elastic collagen fibrils [29]. A different wall structure was observed in the frontal vein. This vein has no valves. As opposed to the dorsal nasal and facial veins, circularly arranged smooth muscle cells surrounded by elastic fibers in thick, oval bundles were observed in the tunica media of the frontal vein. Such an arrangement of muscle bundles was especially visible in longitudinal sections of the vein wall. The morphology of the frontal vein may be related to the frontal venous plexus, connecting the left and right frontal veins [26]. The frontal vein, because of its structure, may be characterized by higher vascular activity than the distal part of the dorsal nasal vein or the proximal part of the facial vein. We should not reject the hypothesis that in the case of thermal stress in pigs relaxation of the frontal vein takes place and more blood flows towards the vascular complex: cavernous sinus-carotid rete. Under optimum temperature conditions, the blood from the dorsal nasal vein may be uniformly "distributed" among the frontal and facial veins. Preliminary investigations carried out by Grzegorzewski and Zezula-Szpyra [14] in groups of sexually immature and mature gilts indicate that the vascular activity of the superficial facial veins is correlated, among other, with the sexual activity of gilts. Those suggestions and observations should be confirmed in the course of studies on the reactivity of the superficial facial veins.

Observations made under a SEM show that in all of the veins examined endothelial cells were considerably elongated and spindle-shaped. Bands of endothelial cells whose nuclei were protruding towards the vascular lumen were found in the veins characterized by a wrinkled luminal surface. The shape and arrangement of endothelial cells are caused by their exposure to the forces appearing during the flow of blood. Those cells are usually subjected to shear stress tangent to the endothelium surface and parallel to the direction of blood flow [8,9]. Elongated, spindle-shaped endothelial cells were observed in arteries characterized by high intensity of shear stress. Oval or round ones were found at the points of ramification of arteries and veins, i.e. where blood flow whorls are observed and shear stress intensity is low [25]. Our studies indicate that the luminal surface of the facial veins, with elongated endothelial cells, looks more like that of arteries than veins. The presence of elongated endothelial cells in the veins examined suggests high intensity of shear stress, i.e. an increased flow of blood in those vessels. This correlation is confirmed by the presence of flattened, almost round endothelial cells situated under the cusps of venous valves where shear stress intensity is very low. Scanning observations of the luminal surface of the facial vein show microvilli uniformly distributed on endothelial cells. It seems interesting that there were very many of them on some cells. The presence of microvilli on the luminal surface of endothelial cells was noted in the aorta, heart, big and smaller arteries in humans and animals [1,24,30]. The function performed by microvilli on endothelial cells remains unknown. Some authors [30] claim that endothelial surface projections serve to induce whorls and inhibit the flow of blood cells along the endothelium surface, which facilitates and is conducive to the exchange of nutrients and metabolites between the blood and vessels characterized by an intensive flow of blood. Maybe a similar function is fulfilled by microvilli present on the luminal surface of endothelial cells in the facial vein. It is also difficult to determine why they are more numerous on some endothelial cells than on other. Maybe there exists functional specialization among endothelial cells of the facial vein.

To sum up, the morphological evaluation made allows to classify the dorsal nasal, frontal and facial veins of adult gilts as the myoelastic type. A well-developed internal elastic lamina and a multi-layer tunica media, characterized by smooth muscle cells (arranged mainly circularly) and numerous elastic fibers, were present in all of the vein parts examined. Thickening of the vein walls and a decrease in the number of elastic elements in the distal part of the dorsal nasal vein and the proximal parts of the frontal and facial veins suggest that those parts are morphologically adjusted to higher vasomotor activity.

Low reactivity may be characteristic of the proximal part of the dorsal nasal vein, due to a well-developed internal elastic lamina and numerous, thick elastic fibers situated among bundles of smooth muscle cells in the tunica media. The lowest reactivity was noted in the distal part of the facial vein: it had the thickest wall, but contained well visible collagen fibrils located both under the internal elastic lamina and between bundles of myocytes in the tunica media. No elongated muscle bundles were observed in the adventitia of the superficial facial veins analyzed. The middle auricular and radial veins, as opposed to the facial veins, had a well-visible external elastic lamina. Observations made under a SEM show that the luminal surface of the veins examined looks more like that of big arteries with high shear stress than veins. Elongated endothelial cells, parallel to the longitudinal axis of the veins, suggest an increased flow of blood in those vessels. The presence of microvilli, found in arteries, on the luminal surface of endothelial cells in the distal part of the facial vein is worth emphasizing. It should also be explained why there are so many of them of some endothelial cells.

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