Innervation of Pars cutanea of Vestibulum nasi and Nasus externus in Latter Half of Human Embryonic Life

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Since 1942, a series of histological studies on the innervation of the skin have been undertaken in this laboratory, which contributed to clarifying the interesting facts that in the haired skin, unlike the hairless skin, such as the palm and the sole, sensory nerve fibres are mostly developed in close relation with hairs, generally ending in complex terminations, while only a small minority of the fibres goes on close to the epidermis and ends there in very simple terminations, and that the development of the sensory hair nerve fibres depends only on the locations, not standing in relation to the growth of the hairs.

The objectives of such studies on haired skin in this laboratory have been the scalp (Seto),1) the eyelid (Seto),2) the cutaneous part of lip in adult (Seto, Fujii and Ikui)3) as well as in the latter half of embryonic age (Suga)4) and the ventral abdominal wall in the 10th month human embryos (Azuma).5) In succession to these, I had the opportunity of conducting the following study on the haired cutaneous part of the human nasal vestibule and the skin of the apex et ala nasi adjacent thereto.

The same preparations used in my study on the innervation of the mucous part of the nasal vestibule reported previously were reused in this study. These consisted of many sagittal and frontal sections of the nasal vestibules and tips of noses in 6th and 10th month embryos, stained with Seto’s silver impregnation.

The sensory nerve fibres supplying the haired skin mostly terminate in connection with hairs as mentioned above. Their terminal areas are represented by specific locations, that is, Seto’s so-called hair-nerve shields and tubes, consisting of special connective tissue cells. The former are formed one-sidedly in the follicle neck, while the latter many-sidedly, surrounding the outer hair root sheath tubulously. Consequently, the development of the sensory terminations is stronger in the latter than in
the former. And as in the hair-nerve tubes the many-sided development of the sebaceous glands is prerequisite for the development of the sensory fibres, the latter is dependent very closely on the former. Needless to say, the development of the sensory fibres is also dependent on the density of the hair growth.

Since the short and stiff vibrissae in the cutaneous part of the nasal vestibule are rather sparse in growth, it would suffice with a comparatively small number of sensory nerve fibres. However, the sebaceous glands belonging to each vibrissa are always plural in number, which open into the hair root sheath through each duct, showing a many-sided strong development around the hair root sheath. It follows that the sensory terminal areas connected with the vibrissae are almost all represented by hair-nerve tubes. Consequently, the development of sensory nerve fibres must be strong too.

The above picture of tissue formation is clearly developed in the 6th month embryos already, becoming clearer in the 10th month, where the hair-nerve tubes consisting of spindle-shaped special connective tissue cells and the numerous sensory fibres running therein are very remarkably developed, as shown in Fig. 1. The terminal formations are illustrated in the vertical sections and are in general very complex, the majority being represented by plexus-like terminations, as shown in Fig. 2, and the minority

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Fig. 1. A number of sensory nerve fibres running through the hair-nerve tube formed around a vibrissa in the cutaneous part of nasal vestibule of a 10th month human embryo. Horizontal section. g sebaceous glands. Seto's silver impregnation. ×400, reduced to 1/2.

Fig. 2. Plexus-like termination of sensory hair nerve fibres formed in the special terminal area around a vibrissa in the same. Vertical section. Same staining. ×450, reduced to 1/2.
by serrate terminations (Fig. 3) or by a hybrid type of the two above, and sometimes by arborized terminations (Fig. 4). Not rarely, a part of the nerve fibres run upward from these terminations beyond the top of the follicle neck along the outer hair root sheath into the papillar layer, to end in very simple unbranched endings.

Seeing that the majority of the sensory terminations connected with the vibrissae in the cutaneous part of the nasal vestibule is formed complexly in the hair-nerve tubes, already in the latter half of the embryonic life, it may be presumed that they come to even further development in adult, to very complex terminal formations as may be found in connection with the eye-lashes (Seto)²)

The epidermis of the cutaneous part of the nasal vestibule is of deciduous nature as in common skin and the papillar layer shows little tendency to form papillae into the epidermis. In consequence, there are very few sensory nerve fibres running into this part, only a few unbranched, sharply ending fibres being found beneath the epidermis in the papillar layer in rare cases.

The external circumferential part of the cutaneous part of the nasal vestibule, that is the margin of the nares, is visibly covered with dense, short downs, unlike the cutaneous part of vestibulum nasi. It follows that this area should be very rich in sensory nerve fibres, but as the sebaceous glands belonging to these downs are very weak and one-sided in development, not alike those to the vibrissae, some even almost unprogressed in
development at all, the hair nerve fibres distributed to this part end in very ill-developed hair-nerve shields, so that the sensory hair-nerve fibres are also small in number and terminate very simply, in most cases in simple plexus-like terminations.

In the apex and ala nasis, tow types of downs are found, the thicker and the thinner. The thicker downs grown in approximately regular distance, and the sebaceous glands belonging to them are strongly developed, with the exit of their ducts opening to the epidermis so large that they form pores quite visible to the naked eye, in adult. So, these downs show the appearance as if they belong to the glands. However, as these strongly developed glands are formed only on one side of the outer hair root sheath, the terminal areas of the sensory nerve fibres are represented by hair-nerve shields, so that the sensory fibres themselves are far weaker in development than those belonging the vibrissae. The terminations of the sensory fibres are generally represented by simple plexus-like or arborized formations, as shown in Figs. 5 and 6, but sometimes serrate terminations may be found.

Fig. 5

Plexus-like termination in a hair-nerve shield around a minute down on ala nasi of a 6th month embryo. Same staining. ×600, reduced to 1/2.

Fig. 6

Arborized termination composed of thick nerve fibres formed in a hair-nerve shield of a minute down on ala nasi of a 10th month embryo. Same staining. ×450, reduced to 1/2.

The sebaceous glands belonging to the shorter downs are very poorly developed, as in the margin of the nares, some barely formed on the one side, or in rarer cases on many sides, but many of them showing no develop-
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ment at all. In parallel, the sensory fibres and their terminations are very infantile, the majority having no end formation to speak of. Presumably, they are destined to show little further development even in adult stage, as the terminations of hair-nerve fibres to the minute downs in the cutaneous part of the eye-lid (Seto).  

As few papillae are formed under the epidermis on the apex and ala nasi, the sensory nerve fibres ending in these parts are also very small in number and only unbranched terminations are found. But in some cases, a part of the hair-nerve fibres rises along the outer hair root sheath beyond their terminal area into the papillar layer to end there in simple sharp endings.

In summary, it may be noted that the cutaneous part of the vestibulum nasi, where the hair growth is only sparse, is not richly provided with sensory nerve fibres, but as in the majority of the hair follicle necks, there are found Seto's hair-nerve tubes originating in the development of the sebaceous glands formed on many sides, the development of sensory hair nerve fibres is good on this score, their terminations being all represented by complex plexus-like or serrate formations.

In the margin of the nares, which is densely overgrown with minute downs, the sensory nerve fibres should be abundantly found, but as the development of sebaceous glands is poor, the development of the hair-nerve terminations is much poorer than that in the vibrissae.

On the apex and ala nasi, two kinds of downs are found the thicker and the thinner. For the former, the sebaceous glands are strongly, but only one-sidedly developed, so that the sensory nerve fibres thereto end in rather simple plexus-like endings. As the sebaceous glands to the thinner downs are similar to those in the marginal part of the nares in their weak development, the development of sensory nerve fibres to these downs is also very poor.

Since few papillae are formed under the epidermis in the cutaneous part of the vestibulum nasi and the skin of the nose, as in the common haired skin, the papillar layer in these parts is also very poorly provided with sensory fibres, simple unbranched sharp terminations only being found on rare occasions.

References

2) Seto, Tohoku Igaku Zassi (Jap.), 1949, 39, 1.
3) Seto, Fujii & Ikui, No to Shinkei (Jap.), 1951, 3, 85.
4) Suga, Tohoku Igaku Zassi (Jap.), 1951, 45, 437.