Innervation of the Palatine Mucous Membrane in the *Cebus apella* Monkey

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WATANABE, I. and KONIG, B., Jr. *Innervation of the Palatine Mucous Membrane in the Cebus apella Monkey*. Tohoku J. exp. Med., 1977, **123** (3), 215-220
— A histological study was conducted on the innervation of the *Cebus apella* palatine mucosa. Ten monkeys were used for the present study. After perfusion with 10% formalin, the whole hard palate mucosa was removed in one piece and made into histological sections according to De Castro's method for silver impregnation. We concluded that the nerve fibers form free endings and organized corpuscles, like Meissner corpuscles. Free nerve endings are numerous in the hard palate mucosa and they show a great variety in form and size. ——— platine mucous membrane; *Cebus apella* monkey; innervation

Many researches were done about the innervation of different parts of the mouth mucosa in animals as well as in man by many authors (Nakayama 1943a, b; Ohgaki 1953; Abe et al. 1954; Yamamoto et al. 1957; Bernick 1959; Nakai 1960; Kerebel 1965; Grossmann and Hattis 1967) who, among other aspects, described the structure and the distribution of free nerve endings and sensory corpuscles.

Among them, Bernick (1952) studied the innervation of periodontal tissue in the rhesus monkey and mentioned that this tissue is supplied with dental and interalveolar branches of the alveolar nerve. Bernick also called attention to the fact that the nerve fibers that reach the gum come either from the periodontal membrane or from the alveolar bone. More recently, Kadanoff (1971a, b and c) and Watanabe and Konig (1977) described the innervation of tongue papillae in primates.

Specific studies concerning the innervation of the human hard palate have been fulfilled by Gairns (1951, 1954, 1955, 1956) who observed various free nerve endings and some Meissner's corpuscles.

No paper was found, however, referring to the innervation of the hard palate in the monkey *Cebus apella*, so it is the aim of this work to study the distribution of nerve fibers in this structure.

MATERIALS AND METHODS

In the present study, mucosae of the hard palates from ten *Cebus apella* monkeys were used. The mucosa was removed after perfusion of each animal with 10% formalin

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Received for publication, November 7, 1976.

Fig. 1. Frontal section of the hard palate mucosa emphasizing the nerve in connective tissue. $\times 400$.

Fig. 2. Aspect of a free nerve ending extending towards the basal portion of the epithelium. $\times 400$.

Fig. 3. Free nerve ending close to the basal area of the epithelium. $\times 400$.

through the external carotid artery of the right side. The removal of the palatine mucosa was performed by incising it circumferentially along the palatine aspect of the maxillary teeth over its whole extension and stripping off from the bone. This removal was done

Fig. 4. Organized nerve ending close to the basal portion of the epithelium. $\times 400$.

Fig. 5. Aspect of free nerve ending. $\times 400$.

Fig. 6. Subepithelial layer of the mucosa with many nerve endings. $\times 400$.

in one piece.

The material was prepared for histological sections according to De Castro's method for silver impregnation. The embedding was performed in two positions, in order to allow frontal and horizontal sectioning, in a thickness of $8\text{ }\mu\text{m}$.

RESULTS

In frontal sections of the *Cebus apella* hard palate mucosa, many vessels and nerves were observed belonging to the neurovascular bundles of the major palatine and incisive channels. The postero-anterior pathways of the palatine nerves from both sides and the anastomosis among their branches were observed in horizontal sections.

In the mucosa of the anterior one third, it was observed that the nerve filaments coming from the nasopalatine nerve send small branches to terminate in the subepithelial layer or to form anastomoses with filaments coming from the posterior portion.

The posterior branches, as they reach the anterior one third, diminish their diameters by multiple divisions into numerous smaller branches. These branches reach the superficial layer and often end in connective tissue papillae protruding into the epithelium (Fig. 1).

The majority of free nerve endings are localized in the subepithelial connective tissue and are relatively organized (Figs. 2 and 3). They are, of course,

Figs. 7 and 8. Sections of corpuscles of Meissner type in connective tissue papillae beneath the mucosal epithelium. $\times 400$.

numerous in the whole areas of connective tissue and the subepithelial layer (Figs. 4 and 5).

When the nerve fibers reach the subepithelial layer they may branch in many ways and further continue in the direction towards the epithelial layer (Fig. 6).

The presence of sensory corpuscles of Meissner's type was also revealed (Figs. 7 and 8) in many connective tissue papillae in the epithelium of the hard palate.

DISCUSSION

The nerve fibers distributed in the hard palate's mucosa of the *Cebus apella* monkey are originated from the greater palatine and naso-palatine nerves.

As our results demonstrated the palatine mucosa is innervated chiefly by fibers of the posterior two thirds. It is important to point out that in this region there are a great number of nerve fibers mostly originated from the posterior portion and that a plexus is formed from which, after successive branching, many kinds of nerve endings reach the subepithelial and epithelial layers.

On the other hand, the anterior one third receives nerve fibers derived from the nasopalatine nerve, which again present numerous subdivisions to form a plexiform structure. They interchange fibers with those from the posterior portion.

The structure and distribution of free nerve endings in the mucosa of the *Cebus apella* hard palate are basically similar to those in man as presented by Gairns (1955), and in animals as presented by Ohgaki (1953), Okano (1953), Abe et al. (1954), Yamamoto et al. (1957) and Grossmann and Hattis (1967).

Based on the present observations, it can be noticed that highly organized nerve endings are always present in the subepithelial layer of the mucosa and that they differ from endings of simpler form distributed in deeper layers.

Acknowledgments

We wish to thank Professor Eros A. Erhart for his orientation in the laboratory technic and Professor Roberto Holland for his help in the photography documentation.

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