Rhinology, 23, 195-199, 1985

Innervation of human nasal polyps

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SUMMARY

Nasal polyps from 12 patients were studied by means of transmission electron microscopy. Nerve fibers in the polyp could be recognized in 4 out of the 12 polyps. Both myelinated and nonmyelinated nerve fibers were observed. The endings of the nonmyelinated nerve were adrenergic and observed in the area close to the smooth muscle cells of the artery.

The secretory cells in the form of acini did not accompany nerve endings although these acini contained myoepithelial cells. Some nerves had normal features but others had a degenerated form in the pedicle of the nasal polyp. No cholinergic fibers were observed in these polyps.

INTRODUCTION

Although polyps originate from nasal mucosa they have features which differ from the original nasal mucosa. Nasal mucosa has a relatively rich innervation of the sensory branch of the trigeminal nerve and autonomic nerve (Mitchell, 1954; Malmcomson, 1959). The physiological and pathological reaction of the nose in response to coldness, warming and allergic stimulants indicates that these sensory and autonomic nerves correlate significantly (Konno and Togawa, 1976). Adrenergic fibers of the autonomic nervous system are to be found around the arteries, arterioles, veins and venous plexus (Dahlström and Fuxe, 1965; Cauna, 1970), while cholinergic nerves are located around the nasal mucous glands, arteries and veins (Ishii, 1970; Cauna et al., 1972a). On the other hand, nasal polyps have an extremely poor nerve supply: in one study it is reported that only a few nonmyelinated nerve fibers were observed in the pedicle part of some polyps (Cauna et al., 1972b). Since the innervation is still scarcely understood, we consider further study necessary.

This study deals with the distribution of the nerves in various sections of nasal polyps by means of transmission electron microscopy.

MATERIAL AND METHODS

Nasal polyps were obtained surgically from 12 patients under local anaesthesia

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Paper presented at the 10th Congress of the European Rhinologic Society and 4th ISIAN, Nancy (France), August 1984.

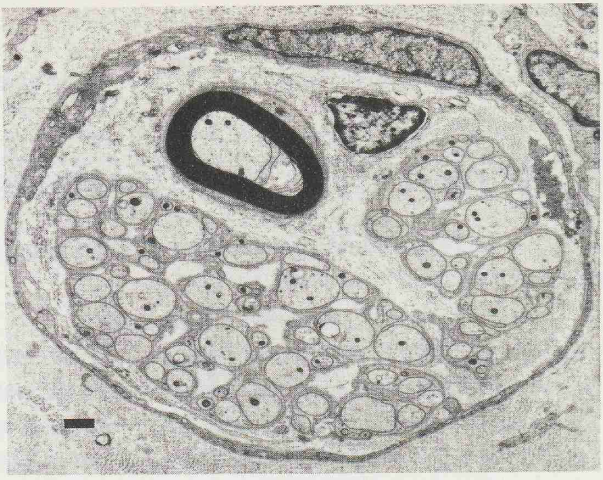

Figure 1.
Myelinated and non-myelinated nerve in the pedicle of the nasal polyp. 4700 ×

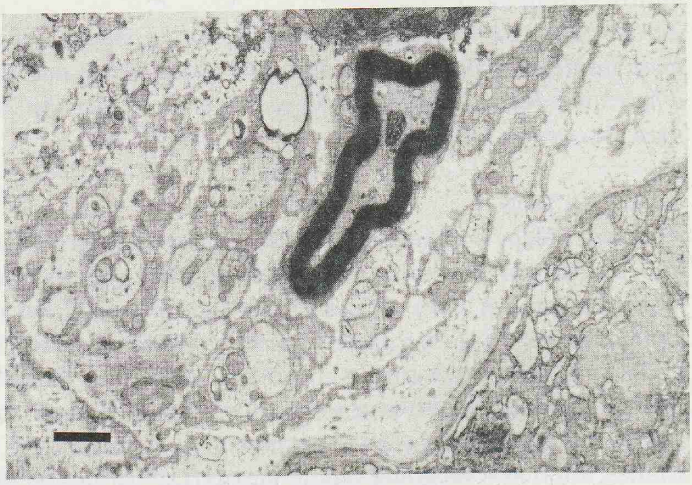

Figure 2.
Myelinated and nonmyelinated nerve in the pedicle of the nasal polyp. The connective tissue around the nerve is degenerated. 8900 ×

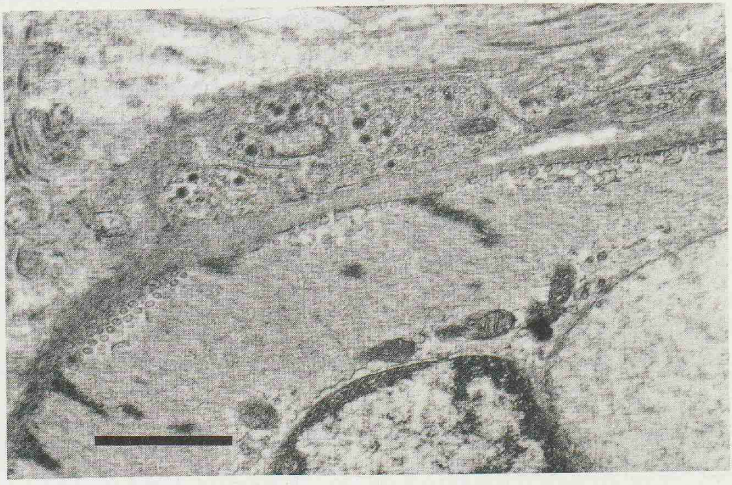

Figure 3.
The ending of the adrenergic fiber close to the smooth muscle cell. Vesicles with dense core. 22.000 ×

of the nasal mucosa by xylocain and adrenaline solutions. The nasal polyp was divided into three sections: the pedicle of the nasal polyp, the middle section and the distal section. Several specimens from each of the three sections of the polyp were cut into small parts, size of about 1.0 mm^3 and then immediately placed in a 2.0% glutaraldehyde in 0.2 M cacodylate buffer solution. This fixation lasted for 6 hours, after which these specimens were washed in a 0.1 M cacodylate buffer solution, and were then post-fixed in 1% osmic acid for one and a half hour. After dehydration in alcohol series, these specimens were embedded in an Epon-Araldyte mixture. Sections were stained with uranyl acetate-lead citrate double-stain.

RESULTS

Nerve fibers in the nasal polyp could be recognized in 4 out of the 12 polyps examined in this study. Some nerves had normal features but others had abnormal ones and a degenerated form. Both myelinated and nonmyelinated nerve fibers were observed in the pedicle of the nasal polyp, and they were also found in the stroma and the distal portion of the polyp. Nerve endings were observed in the area close to the smooth muscle cell of the artery in the pedicle. The distance of the nerve endings from the surface of the smooth muscle cell varied from about 2.000 Å to 13.000 Å. These nerve endings contained fine granular vesicles which showed a dense central core and were believed to contain norepinephrine in its final form. These nerves are adrenergic. No cholinergic fibers were observed in these polyps.

Groups of the secretory cells in the form of acini were frequently observed in nasal polyps and contained myoepithelial cells. However, no accompanying nerve endings were found near the myoepithelial cells.

Although the myelinated nerve fibers were observed in the polyps, sensory nerve endings could not be detected in this study.

DISCUSSION

This study shows that it is possible that only a very small number of nerve fibers is present in nasal polyps. According to Cauna et al. (1972b), nerve fibers were only found in 2 out of 8 polyps and were only nonmyelinated in the pedicle and stroma of the polyp. Our present results also demonstrate the presence of nerve fibers in 4 out of 12 polyps, not only in the pedicle part but also in the middle and distal section. The innervation in the nasal mucosa is very complicated and influences the physiological condition such as warming and humidifying the inspired air, controlling the blood flow and secretion of nasal mucous glands (Konno and Togawa, 1976). The blood vessels in the nasal mucosa are innervated with adrenergic and cholinergic fibers of the autonomic nerve system which controls the contraction or dilation of blood vessels. The glands of the human nasal mucosa

are a tubulo-alveolar variety and usually accompany myoepithelial elements. The peripheral nerves in the nasal gland are predominantly cholinergic and located in close proximity to the myoepithelial cell (Ishii, 1970; Cauna et al., 1972a). In the autonomic nerve, some axons contain an accumulation of fine thin walled vesicles which represent cholinergic nerves and other axons contain fine granular or dense-cored vesicles which are considered to be adrenergic nerves. Cauna (1972b) speculated about the existence of the nonmyelinated fibers in the polyps and also stated that it might not be related to the acini of the gland and adventitia of the artery but instead to the venules and mast cells. Present findings clearly show the existence of the myelinated nerves, the adrenergic fiber and their relation to the artery. In our observations only the endings of adrenergic axons were found and not the endings of cholinergic axons. Fine peripheral nerves were found adjacent to the blood vessel in the pedicle part. The endings of the adrenergic fibers were observed to be in close proximity to the smooth muscle cells of the artery with a distance of about 2.000 Å. This distance possibly enables the penetration of epinephrine from the adrenergic fiber to the artery. In the distal part of the polyp nonmyelinated fibers still exist close to the blood capillary. The endings of the myelinated nerves and cholinergic nerves could not be observed near the blood vessel and myoepithelial cell around the acini.
The local use of adrenalin on the nasal polyp made the polyp smaller than usual; this effect could explain the function of the adrenergic fibers in the polyp.

CONCLUSION

Some nasal polyps contain a small number of myelinated and nonmyelinated nerve fibers. The endings of the nonmyelinated nerves are adrenergic and located close to the smooth muscle cell of the artery. Some degenerated nerve fibers were observed in the pedicle of the nasal polyp.

RÉSUMÉ

Des polypes nasaux de 12 patients ont été étudiés à l'aide du microscope électronique de transmission. Dans 4 polypes parmi les 12 on a pu reconnaître des fibres nerveuses, tant myéliniques qu'amyéliniques. Les terminaisons des nerfs amyéliniques étaient adrénergiques; on en a observé dans la zone proche des cellules musculaires lisses de l'artère. Des cellules sécrétoires en forme d'acini ont été observées, mais quoique contenant des cellules myoépithéliales, elles n'étaient pas accompagnées de terminaisons de nerfs. Quelques nerfs avaient un aspect normal, tandis que d'autres, observés dans le pédicule du polype nasal, avaient une forme dégénérée. Dans ces polypes on n'a pas observé de fibres cholinergiques.

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