Density of Mucous Glands in the Normal Adult Nasal Turbinates

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Summary. On 13 normal inferior and middle turbinates the mucous membrane was freed, stained by the PAS-alcian blue whole-mount method, and the mean density of glandular orifices was determined by counting in $4 \text{ mm}^2$ fields. The median density fell in both turbinates in the anteroposterior direction, being in the inferior turbinate 8.2 glands/$\text{mm}^2$ anteriorly, 7.9 in the middle, and 7.1 glands/$\text{mm}^2$ posteriorly. In the middle turbinate it was 8.4 glands/$\text{mm}^2$ anteriorly, 8.1 in the middle, and 7.3 glands/$\text{mm}^2$ posteriorly. There were no significant differences in median density between the medial and lateral wall or between the superior and inferior half of the inferior or middle turbinate as a whole. The median total number of glands in the inferior turbinate was 9,200 with a very wide interindividual range of 6,100–12,700. In the middle turbinate the median count was 6,700 glands and the range 4,400–11,500. The pathology of the mucous glands of the nose is discussed.

Key words: Nasal glands — Nasal gland density — Nasal mucosa.

In a previous study the density of mucous glands on the normal adult nasal septum was determined (Tos and Mogensen, 1976a). In the present study the investigations were extended to the turbinates which are easily accessible to biopsy and where comparative studies of a normal and abnormal mucosa is easiest to perform. It is a presupposition, however, that the density, size, and situation of the glands in the various parts of normal turbinates are known.

Previous Investigations

The reported data on the mucous glands of the nose are scanty and conflicting. Wagemann (1964) found 150 glands/cm$^2$ mucosa, corresponding to 1.5 glands/mm$^2$. In a quantitative study of sections, Krajina et al. (1975) found 28 glandular elements/mm$^2$ on the turbinates and 43 in the meatus.

The distribution of the glands is said to be irregular, the largest number being found on the conchae (Eggston and Wolff, 1947) or on the medial aspect of the
inferior turbinate (Schiefferdecker, 1900; Kubo, 1907; Wagemann, 1964). Schall (1932) found more glands on the middle than on the inferior turbinate. Schiefferdecker (1900) found no or only a few glands at the lower edge of the inferior turbinate; Oppikofer (1907) found that the density decreased towards the posterior pole of the inferior turbinate.

**Material and Methods**

In 13 patients, aged 57–95 years, who died of cardiopulmonary or malignant diseases, and who had no acute or chronic nasal diseases at the time of death, the entire inferior and middle turbinate was removed and fixed. The medial (septal) and lateral mucosal plate was freed. Under the stereomicroscope, the mucous membrane was separated into two layers — the deep layer comprising the deeper layer of glands with the vascular plexus, and the superficial layer comprising the epithelium, basement membrane, and a thin part of the lamina propria with subepithelial glands. This epithelial part of the mucous membrane was stained by the PAS-alcian blue whole-mount method (Tos, 1970), placed in a chamber filled with anise oil-colophonium, and sealed with paraffin (Fig. 1).

The turbinate was divided anteroposteriorly into three parts, the anterior, middle, and posterior third. Furthermore, it was divided into a superior and an inferior half, so that six localities appeared in the medial as well as lateral plate. Glandular orifices were counted on the mucosal surface in the stereomicroscope, × 50. In the eyepiece of the microscope, a net was mounted, restricting the counting field to 4 mm². In each locality 2–6 fields were counted, regularly distributed over the locality, and the mean density of glands (gland/mm²) was calculated for each locality (Tables 1 and 2). The results were analysed statistically.

**Results**

The glandular orifices were of different size and appearance. The largest ones presented in the whole mount as distinct, round, light defects in the blue-stained epithelium, surrounded by a blue ring (Fig. 2). They were most commonly seen in the

![Fig. 1. Medial wall of the inferior turbinate placed in a chamber, sealed with paraffin, and divided into three thirds and into a superior and an inferior half](image-url)