

Vidian nerve resection in chronic hypertrophic non allergic rhinitis: effects on histamine content, number and rate of degranulation processes of mast cells in nasal mucosa

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SUMMARY

The effects of Vidian nerve resection on the histamine content, number and rate of degranulation processes of mast cells in the respiratory tract of the nasal mucosa in patients with intractable chronic hypertrophic non-allergic rhinitis (CHNAR) have been investigated at various times after surgery.

Preliminary data are also presented on the effects of Vidian nerve stimulation on the same parameters. The Vidian nerve was stimulated during surgery before resection. After neurotomy the histamine content was significantly lower than before but the values became less low with the passing of time. The number of mast cells per microscopic field and their degranulation index were significantly lower after surgery than before it. Stimulation determines a significant reduction in the number of mast cells per microscopic field and a parallel reduction in histamine content.

These data establish a relationship between cholinergic activity and secretory response of mast cells and demonstrate a role of the parasympathetic nerve supply in the pathogenesis of CHNAR.

The great reduction in the number of mast cells and histamine content also suggests that the parasympathetic nerve supply could play a role in the regulation of histamine synthesis and uptake.

INTRODUCTION

Vidian nerve resection is now believed to be the operation of choice whenever the vascular supply and secretion of nasal respiratory mucosa need to be modified by the complete inhibition of the parasympathetic nerve supply.

The pathogenetic influence of the parasympathetic nerve supply in CHNAR may

depend on a direct excitatory effect of VIP (Änggård, 1974; 1979; Lundberg et al., 1980; Malm, 1983) on vasodilation and acetylcholine on secretion (Änggård et al., 1979), as well as on a similar but indirect effect on blood vessels and secretory cells due to mast cell degranulation and histamine secretion elicited by parasympathetic nerve endings (Harries et al., 1979; Fantozzi et al., 1980; Blandina et al., 1980; 1983; 1984). However, little is known about the exact role played by the latter mechanism in these patients. We have therefore studied the effects of Vidian nerve resection on the respiratory nasal mucosa (medium turbinate) histamine content, as well as mast cell number and degree of degranulation in patients with severe intractable CHNAR.

This paper reports the results of this study together with further preliminary data on the effects of Vidian nerve stimulation on the same parameters.

MATERIAL AND METHODS

This study was performed on 22 patients of both sexes, with severe CHNAR unresponsive to medical treatment who had negative allergological skin testing, RAST and RIST. Their age varied from 18 to 35 years old. Specimens of respiratory nasal mucosa (middle turbinate) were obtained at surgery just before neurotomy in 14 of these 22 patients. The specimens were collected in 8 patients by means of a biopsy from the middle turbinate, without anaesthesia, at 1, 4, 7, 12 and 24 months after Vidian nerve resection. Specimens were taken before and after neurotomy in 3 patients. In 16 of these 22 patients, histamine was measured fluorimetrically, after extraction, using the method of Shore et al., (1959) as modified by Kremzner and Wilson (1961). The results were statistically evaluated using Wilcoxon's test for independent samples.

The mast cell number and their degranulation rate were evaluated in specimens obtained from the middle turbinate, immersion-fixed in Mota solution. The tissue blocks were then dehydrated in a graded series of ethanol and embedded in paraffin. The sections (7 μm) were stained with Toluidine Blue at pH 0.5: 12 sections, one every 70 μm , were obtained from each specimen and examined by light microscopy at 1000 \times magnification, corresponding to 240 Microscopic fields per specimen. The mast cells were divided into three groups according to their granular content: Type A rich in metachromatic granules, all contained in the cytoplasm and without degranulation process; Type B with scarce cytoplasmic granules and many free granulations in the intercellular matrix around the cells; Type C strongly degranulated.

Statistical evaluation of the differences was performed using Wilcoxon's test and $P < 0.05$ was chosen as the degree of the significance. The degranulation index was calculated, adding together the total of numbers of mastocytes B and C and mast cells $(B + C)/Mzt$.

Just before neurotomy in two patients the histamine content, the number and the

degranulation rate of mast cells evoked by stimulation of the Vidian nerve were measured in order to further establish a link between cholinergic nervous system and tissue histamine stores. Two platinum electrodes were used for field stimulation: the parameters employed were 0.8 mS – 6 Hz – 5 mA which have been shown to produce a selective stimulation of parasympathetic nerves. In the first patient the stimulation period was 60 msec. and in the second 90 msec.

RESULTS

Morphology

The number of mast cells per microscopic field and the degranulation index were significantly lower after surgery than before it. This was true for all patients, as well as for the three patients studied both before and after surgery (Tables 1 and 2).

Biochemistry

The mean histamine content before surgery was 58.83 ng/mg wet tissue. The histamine content for the two patients with polypoid degeneration was significantly higher than in the other patients.

The histamine content after surgery was significantly lower than before it (Table 3); the longer the time elapsed since surgery less low the values. A sharp reduction of histamine content also took place in the two patients with polypoid degeneration. These results hold true both for all the patients as a whole and for the three patients studied both before and after surgery.

Vidian nerve stimulation

The stimulation of the Vidian nerve before resection was followed by a significant reduction in the number of mast cells per microscopic field and a parallel reduction in the histamine content.

DISCUSSION

Vidian nerve resection induces a reduction in the histamine content, mast cell density and degranulation index. Stimulation of the Vidian nerve induces a time-dependent histamine release and reduction in mast cell density.

These data demonstrate a role of parasympathetic innervation in the pathogenesis of CHNAR and confirm *in vivo* a stimulatory effect of parasympathetic nerve endings on mast cell secretion. This effect has been previously observed only *in vitro* (Blandina, 1984). These data also suggest that parasympathetic innervation plays some role in the regulation of histamine synthesis and reuptake.

Table 1.
Mast cell density in mucosal samples of the middle nasal concha in patients with chronic hypertropic non allergic rhinitis (CHNAR).

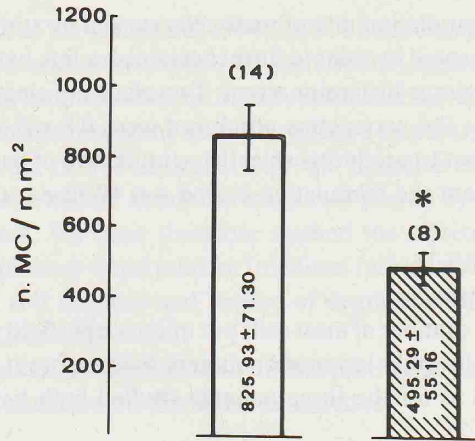


Table 2.
Mast cell degranulation index in mucosal samples of the middle nasal concha in patients with CHNAR.

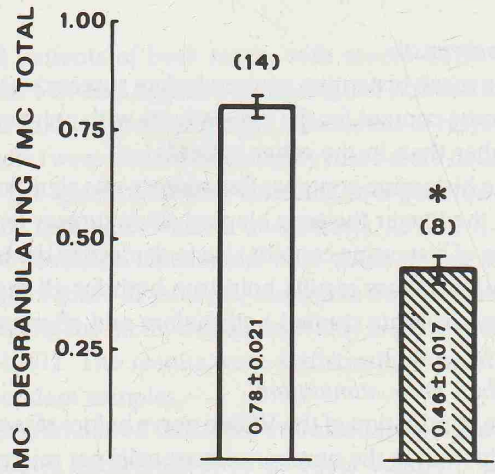
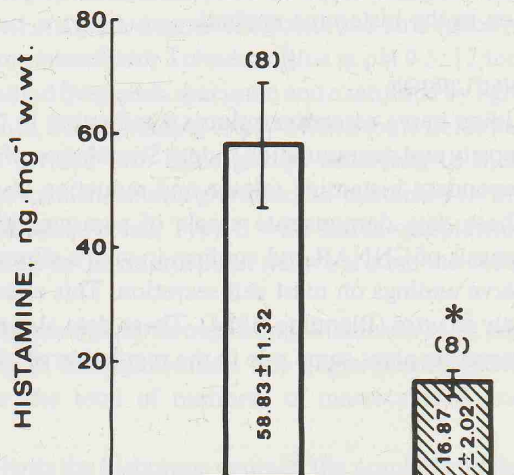


Table 3.
Histamine content in mucosal samples of the middle nasal concha of patients with CHNAR.



□ BEFORE OPERATION
 ▨ AFTER 1-24 months "

* P ≤ 0.0001

RÉSUMÉ

Chez des patients atteints de rhinite chronique hypertrophique non allergique (CHNAR) et opérés de résection du nerf Vidien par voie nasale les auteurs ont étudié les variations du contenu tissulaire en histamine et du nombre et du degré de dégranulation des mastocytes dans la portion respiratoire de la muqueuse nasale.

Les prélèvements de muqueuse ont été effectués lors de l'intervention, après stimulation électrique du nerf Vidien, et répétés plusieurs fois jusqu'à 24 mois de l'opération.

Après la neurotomie le contenu tissulaire en histamine présente une réduction significative; les valeurs obtenues montrent une tendance à une ultérieure diminution avec le temps.

Le nombre de mastocytes par champ microscopique et leur degré de dégranulation est significativement réduit après la résection.

Ces données démontrent le rôle du système parasympathique dans la pathogénèse de la CHNAR et l'existence d'un rapport entre activité cholinergique et réponse sécrétoire des mastocytes. La remarquable réduction du nombre des mastocytes et du contenu en histamine suggère aussi que l'innervation parasympathique peut jouer un certain rôle dans la synthèse et la recaptation tissulaire de l'histamine.

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