

Incidence and surgery of concha bullosa in chronic rhinosinusitis*

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SUMMARY

Both diagnostic and therapeutical approaches of chronic non-allergic rhinosinusitis have been considerably modified by recently developed endoscopic and radiological means of investigation. Abnormalities of the ostiomeatal complex, such as hypertrophy and pneumatization of the middle turbinate (concha bullosa), seem to be associated with recurrent infections and inflammation of both turbinoseptal and adjacent sinuses mucosa. In 151 patients suffering from chronic non-allergic rhinosinusitis, the CT scan of the rhinosinusal area confirmed the presence of a middle concha bullosa and a mucoperiosteal thickening of the adjacent sinusal cavities in 35% of the cases. The surgical treatment included the resection of the anterior third of the pneumatized middle turbinate with concomittant opening of the ethmoidal bulla. This procedure was performed under local anaesthesia and endoscopic control. A marked and long-lasting improvement of the symptoms was obtained in 80% of the patients ($p < 0.001$). Biochemical analysis of nasal mucosa biopsies in chronic non-allergic rhinosinusitis patients revealed a higher amount of neuropeptides of sensory nerve origin than in controls ($p < 0.05$). The influence of sensory neuropeptide mechanisms involved in the vicious circle of chronic non-allergic rhinosinusitis is discussed.

Key words: chronic rhinosinusitis, surgery, sensory neuropeptides

INTRODUCTION

In the last decade, advances in nasal endoscopy and computed tomography (CT) have challenged the traditional concepts of sinonasal diseases. In patients suffering from chronic nasal obstruction and rhinorrhoea with recurrent headaches, a mucoperiosteal thickening of the maxillary sinus was frequently considered as the main conventional radiological finding in chronic rhinosinusitis (Lloyd, 1988). These symptoms could be present together with a mucoperiosteal thickening of the ethmoidal cells, which can only be observed by CT imaging (Kennedy et al., 1985). Increasing evidence supports the role of the anatomical area that comprises the anterior third of the middle turbinate, the uncinat process and the ethmoidal bulla, i.e. the ostiomeatal complex, in the pathogenesis of chronic non-allergic rhinosinusitis (Zinreich et al., 1987).

Anatomical variations and recurrent mucosal swelling of the ostiomeatal complex could disturb the permeability of the

ostia of the adjacent sinuses and may lead to recurrent infections (Messerklinger, 1978). The hypertrophy and pneumatization of the middle turbinate is frequently called concha bullosa. This anatomical entity was described many years ago (Wright and Smith, 1914) and could impair the ventilation and mucociliary clearance of adjacent sinonasal cavities (Messerklinger, 1978; Stammberger, 1986; Blaugrund, 1989). Among former studies, a concha bullosa was found in 5-20% of asymptomatic people (Loth op, 1903; Schaeffer, 1910; Davis, 1914; Turner, 1927). The CT of 17.4-80% of patients suffering from recurrent sinusitis showed the presence of a concha bullosa with mucoperiosteal thickening of the adjacent sinuses cavities (Goldman, 1987; Zinreich et al., 1988; Clark et al., 1989; Bolger et al., 1991). Several endoscopic surgical treatments of concha bullosa have been proposed, i.a. resection of the external part of the middle turbinate (Zinreich et al., 1988; Bouton et al., 1991). However, in order to prevent atrophic rhinitis, the size of the middle

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turbinate must be considered and only the patients with a large concha bullosa should be operated upon (Zinreich et al., 1988; Bolger et al., 1991).

In the last decade, increasing evidence has implicated neuropeptides of sensory nerve origin to play a role in the pathophysiological mechanism of chronic non-allergic rhinosinusitis (Stjarne et al., 1989; Lacroix et al., 1991). The neuropeptide calcitonin-gene-related peptide (CGRP) co-exists with substance P and neurokinin A (NKA) in a sub-population of unmyelinated sensory nerve fibres of the airways mucosa. Increased concentrations of CGRP were observed in nasal mucosa biopsies from chronic non-allergic rhinosinusitis patients as compared to controls (Lacroix et al., 1991).

The aim of the present study was to determine the incidence of concha bullosa in patients suffering from chronic non-allergic rhinosinusitis in the area of Geneva. The therapeutic effect of the resection of the pneumatized part of the middle turbinate, under endoscopic control and local anaesthesia, was evaluated during a 12-month follow up. In addition, the concentration of CGRP-like immunoreactivity was determined by radio-immunoassay in nasal mucosa biopsies of patients treated by partial middle turbinectomy.

METHOD

Thirty patients (11 women, mean age 36 ± 7 years; and 19 men, mean age 41 ± 5 years) have been included in the study. All these patients suffered from nasal blockage, posterior rhinorrhoea and recurrent headaches in spite of medical treatment for more than one year. The intensity of their symptoms was not modified by weather change, travelling, or vacations. The intensity of the different symptoms was evaluated before and after surgical treatment by means of an analogue visual scale graded from 0 to 5 (where "0" means absence of symptoms, and "5" symptoms of severe intensity). All patients had an endoscopic examination of their nasal cavity (0°- and 90°-lens; Hopkins, Karl Storz, Germany) and olfaction test (Smell Identification TestTM; Sensonics, USA). An axial CT scan of the sinonasal area was performed in all patients. Surgical treatment was decided when the presence of uni- or bilateral concha bullosa with mucoperiosteal thickening of adjacent ethmoidal cells and maxillary sinus was associated with a symptom score of more than "4". Surgery was performed as an outpatient procedure. Pre-medication was done with Dormicum[®] (7.5 mg per os; Midazolam, Hoffman-La Roche, Basel, Switzerland), and contact anaesthesia was obtained with application of cotton tissues soaked with cocaine (5% aqueous solution) in the nasal cavity for 15 min. Local anaesthesia was completed by infiltration (1 ml of 2% xylocaine/adrenaline; Astra, Dietikon, Switzerland) at the infra-orbital outcome of the trigeminal nerve. Under endoscopic control, xylocaine/adrenaline (1 ml of a 2% solution) was injected submucosally at the origin of the middle turbinate and its inferior part. A resection of the anterior third of the middle turbinate was performed with scissors (MCO 4C; Micro-France,

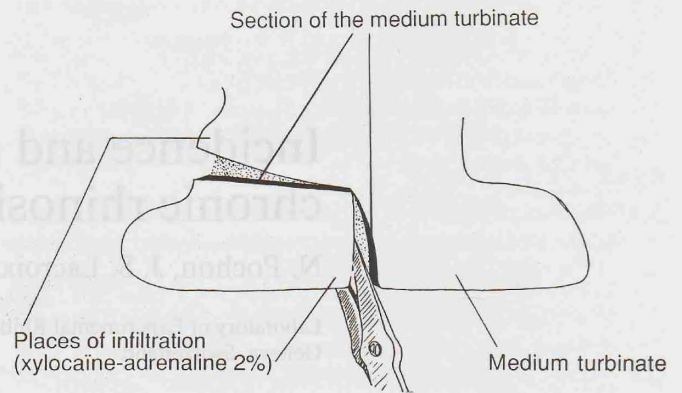


Figure 1. Schematic drawing of the resection of the pneumatized middle turbinate under endoscopic control.

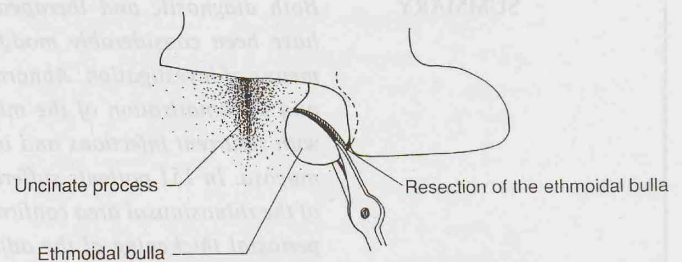


Figure 2. Schematic drawing of the opening of the ethmoidal bulla under endoscopic control.

Marcel Blanc & Cie, Lausanne, Switzerland) under endoscopic control (Figure 1). This resection allowed the visualization of the uncinate process and the ethmoidal bulla. Then, the anterior and inferior parts of the ethmoidal bulla were resected (Figure 2). The horizontal origin of the middle turbinate was always preserved. Haemostasis was obtained with electric cauterisation. The exposed area was covered with Diprogenta[®] (0.05% betamethasone and 0.1% gentamicin; Essex Chimie AG, Luzern, Switzerland). Portions of the excised mucosa from both chronic non-allergic rhinosinusitis patients ($n=15$) and controls ($n=11$) were rapidly frozen on dry ice and weighed. The extraction was performed in 1 M acetic acid at 95°C for 10 min, and the biopsies were then homogenized. After centrifugation, the supernatants were lyophilized and re-dissolved in buffer followed by a RIA to determine CGRP-like immunoreactivity; human CGRP (Peninsula, U.S.A) was used as standard (Stjarne et al., 1989).

The patients left the hospital 2 h after surgery and were controlled after 2, 4, 7, 14 days, 1, 3, 6, and 12 months. Data are given as mean \pm SEM and statistical differences were evaluated with the Student's t-test.

RESULTS

In 12 months (between January and December 1990), 292 patients were seen at our consultation of Rhinology. One hundred and fifty-one patients (=52%) presented symptoms of chronic rhinosinusitis. Anterior endoscopic examination suggested a hypertrophy of the middle turbinate with a con-

cha bullosa in 28 patients (19% of the patients suffering from chronic rhinosinusitis). The CT revealed a pneumatization of the head of the middle turbinate (concha bullosa) with ostiomeatal obstruction and mucoperiosteal thickening of the anterior ethmoidal cells in 53 patients (35% of the patients suffering from chronic rhinosinusitis).

In this group of 53 patients, a resection of the pneumatized part of the middle turbinate and opening of the ethmoidal bulla were performed in 30 patients. In 23 patients we did not perform surgery, as the concha bullosa was considered too small or was suspected to have polyps within the ethmoidal cells. During a 12-month follow-up, the nasal obstruction, the posterior rhinorrhoea and the intensity of the headaches were improved by 62%, 61% and 66% ($p < 0.001$), respectively (Figure 3). Biochemical analysis revealed that CGRP-like immunoreactivity was 15 ± 3.2 pmol/mg in the nasal mucosa of patients with chronic non-allergic rhinosinusitis, and 6.8 ± 1.9 pmol/mg in controls ($p < 0.05$).

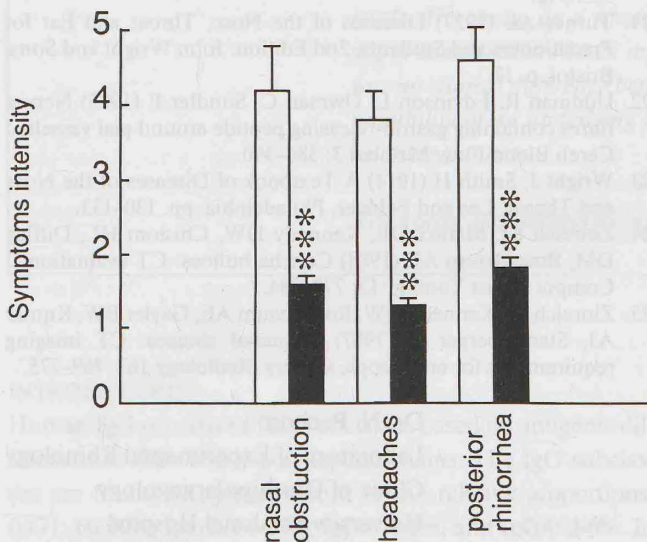


Figure 3. Score of symptoms measured on a visual analogue scale (graded from 0 to 5, where "0" represented absence of symptoms and "5" severe intensity of symptoms) for nasal obstruction, headaches and posterior rhinorrhoea. Open columns: before surgery; closed columns: 12 months after resection of the concha bullosa and opening of the ethmoidal bulla ($n=30$; ***: $p < 0.001$ (Student's *t*-test) when compared to symptom score prior to surgery).

In spite of a significant improvement of the symptoms in 80% of the patients treated, six patients had no symptom improvement 3 months after surgery. At this time, the endoscopic and histological examination revealed a nasal polyposis in three of these six patients, associated with non-allergic rhinitis with eosinophils (NARES, see Jacobs et al., 1981). In the other three patients, allergic investigation (including Prick test[®]; Allergomed, Allergopharma, Germany; and measurement of plasma IgE-specific Cap[®], Pharmacia, Switzerland) revealed a specific hyperreactivity. After surgery no negative side effects, such as epistaxis or local superinfection, were observed and the olfaction test remained correct.

DISCUSSION

The CT examination performed in patients suffering from chronic rhinosinusitis revealed a higher number of uni- or bilateral concha bullosa ($n=53$) than was clinically expected ($n=28$). The incidence of concha bullosa in the Geneva area is similar to previous observations from other geographical areas. Hypertrophic pneumatized middle turbinates are frequently associated with chronic or recurrent acute rhinosinusitis (Goldman, 1987; Zinreich et al., 1988; Clark et al., 1989). The present study revealed the presence of a 2-fold increase of the concentration of CGRP-like immunoreactivity (as a marker of sensory nerves) in the middle turbinate mucosa of patients with chronic non-allergic rhinosinusitis. Mechanical stimulation of the nasal mucosa, i.e. contact between the nasal septum and the concha bullosa, could provoke local secretion of sensory neuropeptides by a local axon reflex mechanism (Stammerger and Wolf, 1988). Sensory neuropeptides, such as substance P and CGRP, provoke vasodilatation of both resistance and capacitance vessels, with increased nasal airway resistance (Stjarne et al., 1991), plasma extravasation ("neurogenic oedema"), and hypersecretion (Saria and Lundberg, 1984). Moreover, sensory neuropeptides from the trigeminal nerve have been proposed to be involved in the onset of headache (Uddman et al., 1983). These observations further support the possible role of sensory neuropeptides in the development of chronic non-allergic rhinosinusitis. Both intranasal application of capsaicin (Lacroix et al., 1991) and cryosurgery (Lundblad et al., 1985; Fischer et al., 1991) reduce the symptoms of chronic rhinitis in parallel to a reduction of sensory neuropeptide concentration in the nasal mucosa. Resection of the concha bullosa could abolish chronic mechanical stimulation due to turbinoseptal contact and, therefore, interrupt the vicious circle (Figure 4) of chronic inflammation of the ostiomeatal complex.

We conclude that a CT performed in patients suffering from chronic rhinosinusitis reveals the presence of a concha bullosa more often than is clinically expected. The resection of the pneumatized part of the middle turbinate, under local anaesthesia and endoscopic control, is a safe procedure with significant and long-lasting improvement of the nasal blockage, posterior rhinorrhoea and headaches.

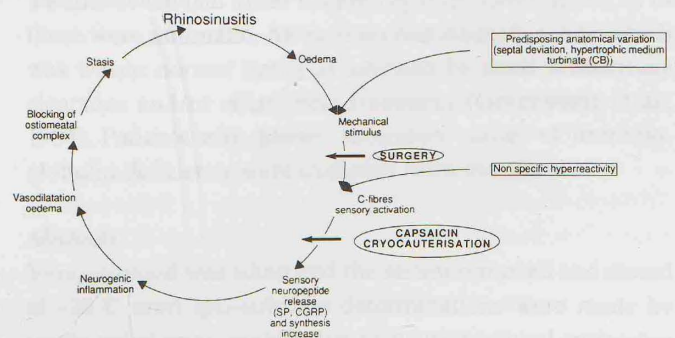


Figure 4. Vicious circle of the chronic non-allergic rhinosinusitis.

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