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Review Article

Chronic Rinosinusitis with Nasal Polyposis and Smell Disorders: One Emergent Association

Melissa Castillo-Bustamante[1*], Diego Bustamante-Mesa[2], Wilson Bustamante-Hernandez[3], Stella Maris Cuevas[4]

[1]Otolaryngologist, Hospital de Clinicas Jose de San Martin, Buenos Aires, Argentina

[2]Otolaryngologist, Clinica Las Vegas, Medellin, Colombia

[3]Otolaryngologist, Clinica ORLANT, Medellin, Colombia

[4]Otolaryngologist, Hospital de Clinicas Jose de San Martin, Seccion Rinologia y Olfato, Buenos Aires, Argentina

***Corresponding Author:** Melissa Castillo-Bustamante, Avenida Cordoba 2351, Primer Piso, Otolaryngology Department, Buenos Aires, Argentina, Tel: +541132759594; E-mail: melissacastillobustamante@gmail.com

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Abstract

Nasal polyposis is one of the most frequent causes of nasal obstruction in Otorhinolaryngologic. This disorder is associated to symptoms as nasal congestion, facial pain and olfactory disturbances. Although olfactory disorders are indicated as one patient's complaint, the study of smell disorders in patients with nasal polyposis has been performed in other countries, in Latin America it is beginning. The aim of this work is to review the association between smell disorders and nasal polyposis as the approach of these concomitant pathologies.

Keywords: Smell; Nasal polyps; Smell disorders

1. Introduction

Chronic rhinosinusitis is a disorder marked by inflammation of the nose and sinuses, whose diagnostic criteria include facial pain, nasal obstruction and/or congestion, anterior or posterior discharge and olfactory alterations [1]. The olfactory alterations prevalence in patients with Chronic rhinosinusitis has been reported between 60 to 80%, causing physical, and social alterations that affects the life quality of patients [1, 2]. As main causes of olfactory dysfunction associated with chronic rhinosinusitis, there are two known mechanisms; one is the mechanical obstruction of the olfactory cleft by nasal polyps which can cause disturbance on the airflow. The other is the localized inflammation in the olfactory region that could cause functional disruption at the level of the olfactory

membrane [3]. However, these above are not the only ones etiologies associated, asthma, smoking and atopies are related to olfactory dysfunction on patients with chronic rhinosinusitis and polyps [4, 5]. Despite the incidence of olfactory dysfunctions in patients with chronic rhinosinusitis and nasal polyposis, there are few reviews of the association of olfactory disturbances and chronic rhinosinusitis with nasal polyps [6, 7]. The aim of this article is to review the definition and related concepts about the association between chronic rhinosinusitis with nasal polyposis and olfactory alterations as their clinical approach in patients with these concomitant entities.

2. Epidemiology

Olfactory disturbances are conditions that emerge from multiple etiologies, being the most common: conditions in the airway (39%), idiopathic causes (18%), trauma (17%), congenital abnormalities (3%) and other etiologies (3%) [8]. Rhinosinusitis (21%) is the second leading cause of olfactory alterations, at least 200,000 visits per year in North America are due to his cause and affects between 1-2% of the general population [9]. Around 10 million people in the United States per year are diagnosed with olfactory disorders [10]; in Spain around 230,000 patients consulted for anosmia and around 7.82 million people are diagnosed with different degrees of hyposmia [11]. In Latin America, there is an underreport of olfactory alterations according to the literature review.

3. Chronic Rinosinusitis with Nasal Polyposis and Olfactory Disturbances

Nasal polyposis is defined as a chronic inflammatory process with edematous with hyperplasic nasal involvement, it can be altered by comorbidities such as allergies, asthma or the combination of rhinitis and asthma, as well as bacterial or fungal infections, drugs toxicity and injuries due to patient's occupational environment [12].The altered perception of smell has been described as one of the most common symptoms in patients with nasal polyposis affecting 65 to 80% of patients [13]. Within olfactory dysfunctions, variations in the odor's perception are considered, such as hyposmia, where there is a decrease in smell, anosmia described as the complete loss of the odor. Other entities considered include distortion in olfactory perception such as dysgeusia and odor in the absence of an external stimulus known as pantosmia [14]. Although the chronic rhinosinusitis with polyposis associated with olfactory alterations's pathogenesis stills under study, this may be due to a combination of factors such as mechanical obstruction of the edematous mucosa and polyps as lesions in the olfactory neuroepithelium caused by chronic inflammation. This is associated to transport disturbances of odorants to the sensory receptor cells, which is defined as conductive loss. It has been found in patients with chronic rhinosinusitis with nasal polyposis, the nasal obstruction is mainly generated by polypoid tissue at least in 78% [15]. An increase of inflammatory mediators caused by the infiltration of cells of the immune system is also studied as an event associated with direct or indirect effects on the structure and/or function of the neuroepithelium, which is defined as a neurosensory loss [16]. Authors as Kern described in patients with chronic anosmia and rhinosinusitis significant levels of localized inflammation in the olfactory neuroepithelium, this is related to damage onto bipolar neurons and alter neurogenesis [17]. Other neurologic factors associated with olfactory compromise, are the inflammatory processes on the first and fifth cranial nerve generated by the rhinosinusal process [18]. However, the neuroepithelial damage is not the only one associated in the pathogenesis of the olfactory alteration; smoking, asthma, age, history of nasal endoscopic surgery

as well as allergic rhinitis are coadjuvants in the history of olfactory disruptions in patients with chronic rhinosinusitis with olfactory alterations [19].

4. Evaluation of Patients with Chronic Rhinosinusitis and Nasal Polyposis and Smell Disorders

4.1 Clinical history

In the initial approach of patient with chronic rhinosinusitis with nasal polyposis and olfactory alterations, other events related to age, occupation and medical status should be ruled out in order to direct the correct treatment and follow-up. In young patients should be inquired for congenital anosmia and Kallmann syndrome, in patients between sixty to seventy years old. Immunologic changes in smell should be taken in account, those are present without medication intake [20]. Other causes as viral and bacterial infections, traumatic brain injuries, psychological states should be asked. The smell loss is present at least in 10% of patients with traumatic injuries, on the frontal and/or temporal lobes, affecting The olfactory tract and cleft [21]. Active smoking status, migraine as neurodegenerative diseases as Alzheimer, Parkinson and multiple sclerosis are other disorders associated to smell disturbances. Other less common causes are cocaine use, chemical exposition of butyl-acetate, formaldhehíde, thrichloroetilene, benzene, selenide hydrogen and exposition to environmental agents as exposition to ashes, chalk, chromium, iron, nickel, silicon dioxide [22] .Other factors as nutritional status as A and B vitamin and Iron or Zinc deficiency, Chronic kidney failure, liver disease, cancer and human immunodeficiency syndrome should be inquired [22]. Psychiatric conditions as schizophrenia, depression, reference olfactory syndrome should be documented in the clinical and physical exam [22]. Other conditions as meningiomas, frontal and temporal lobe tumors,aneuryms, esthesioneuroblastoms and squamous cell cancer [22]. Drugs as antibiotics, antidepressives and anticonvulsants should be ruled out in patients with nasal polyps and chronic rhinosinusitis with smell disorders [22]. In the initial approach the type of olfaction loss needs to be documented if it was sudden, intermittent (due to inflammatory process as allergies and infections), gradual (seen in patients with nasal polyps and chronic infections of respiratory tract) and secondary as obstruction due to fracture and inflammation [22].

4.2 Physical exam

The rhinorrhea presence as intranasal lesions, polyps location (near the inferior turbinate or away classified for the Lund Mackay Score) should be recorded, as well the careful evaluation of the function of the cranial nerves, mainly with emphasis on the first and fifth cranial pairs [23]. The initial assessment of the patient with nasal polyposis and olfactory alterations, involves from the anamnesis of the patient, complementary examinations assessed by fiber-endoscopy and nasal endoscopy are especially useful in patients with nascent polyposis located in the middle meatus [23]. However, findings in the ethmoid sinuses are not easily found with this method, being computed tomography a complementary element in the study of patients with nasal polyposis and olfactory alterations. The analysis of the olfactory region and the extrameatal area is also extended in tomographic assessment [23].

4.3 Imaging

In the study of patients with chronic rhinosinusitis with nasal polyposis and olfactory alterations, imaging studies may be useful. However, all imaging techniques have limitations and studies with negative results may not rule out structural injuries. Frontal radiographs have multiple limitations, because they do not offer enough detail about structures such as the osteomeatal complex [23]. Computed tomography is one of the most effective techniques for the study of olfactory alterations. Coronal sections are useful in the assessment of paranasal anatomy. 5 mm sections are useful to identify bone structures in the ethmoid, cribriform plate and olfactory cleft, as well as in the temporal bone and seventh cranial nerve [23]. Some classifications as Lund Mackay, is a validated staging system for chronic rhinosinusitis with nasal polyposis. Each paranasal sinus is evaluated with a score between 0 and 2 (0=no abnormality, 1=partial opacity, 2=total opacity) having a maximum score of 12 per side, being for both sides with a total of 24. The obstruction of the complex Osteomeatal is rated as 0 (no obstruction) or 2 (obstructed). Although all paranasal sinuses are qualified and staged, this scheme is an indicator of the inflammatory process in the nasal cavities, which is a significant factor for olfactory dysfunction in sinonasal pathology [24]. Computed tomography is less effective than nuclear magnetic resonance in the definition of soft tissue involvement. The use of intravenous contrast is optimal for the identification of vascular lesions, tumors, abscesses and meningeal and parameningeal processes that may occur concomitantly in patients with chronic rhinosinusitis with nasal polyposis [24].

4.4 Rhinodebitomanometry

Rhinodebitomanometry is a dynamic test which evaluates nasal function by calculating the airflow resistance through the measurement of transnasal pressure and the air passage during respiration. Laminar and turbulent flows are determined in accordance with nasal obstructive conditions such as the collapsibility of the nasal wall and irregularities on its configuration. The final result indicates an objective obstruction of the airway found for example, in patients with nasal polyposis where anatomical alterations at the nasal cavity are found. Other use reported is the objective measurement of pre and postoperative airflow [25]. Acoustic rhinomanometry is based on the analysis of the waves reflected from the nasal cavity, by sending pulses inside the nose, allowing recording and analyzing the sound reflex. The main benefit of acoustic rhinomanometry is the ability to identify the narrowest part of the nasal cavity, this usually corresponds to the area of the nasal valve or the head of the inferior turbinate. Its main use is to provide reflection on the geometry and volume of the nasal cavities as well as their anatomical assessment [25]. Although both studies have been used in the assessment of pre and postoperative nasal obstruction in patients with sinus pathology, no studies have been reported at the time of the evaluation of the literature to indicate its use in patients with olfactory disorders and chronic rhinosinusitis.

4.5 Tests for olfactory assessment

For the olfactory assessment, multiple tests have been described which are responsible for odorific discrimination in addition to the assessment of first and fifth cranial nerve function, which are involved in olfactory phenomena. One of the most widely used is the Odor Identification test, which evaluates the ability to identify 40 microencapsulated odorants. These emerge by rubbing microencapsulated strips with a pen or pencil. The scores of the patients are then

compared according to established values for age and sex. It can be useful in the assessment of each nostril separately. Unilateral olfactory deficits can suggest olfactory causes such as nasal obstruction due to septal deviation, nasal polyps and others [26].

Other tests available for olfactory evaluation include the Pocket Smell Test that evaluates three encapsulated items of forced choice, an olfactory briefcase for identification of odors and the kit of odors in squeezable bottles [27]. Currently, there are two references instruments known as the Pennsylvania Smell Identification Test (UPSIT) and the Connecticut Chemosensory Clinical Research Center (CCCRC) developed in the United States. Together, they have been used for olfactory evaluation studies in North America In Europe, smear tests as well as floppy tests are the most commonly used, however, the identification of the nature of the odor is associated with aromatic family items according to the region where they have been developed and validated [28].

As one of the olfactory assessment tools in Latin America, the BAST 24 (Barcelona Smell Test) has emerged as one of the evaluation alternatives with validation in Spanish population. In this is registered the ability to perceive the presence or absence of an odor, which is called detection and its ability to properly discern the presented odor,which is called accuracy. The applied method consists of the forced response evaluating the first and fifth cranial nerve components, verifying the olfaction and affection by the first cranial nerve and the affectation of the rhinosinusal mucosa via the fifth cranial nerve [28]. Twenty-four chemical components (odorants) are included within the BAST 24, 20 scents evaluate the first cranial nerve which include odorants such as: banana, gasoline, lemon, rose, onion, smoke, anise, coconut, vanilla, melon, tangerine, almond, pineapple, cheese, strawberry, mushrooms, eucalyptus, cloves, turpentine and peach; as well as 4 scents for the evaluation of the fifth pair: formalin, vinegar, amonio and mustard. Within the evaluation of some odors it can be determined that odorants such as lemon produce little excitement or little trigeminal excitation, others like the eucalyptus produce a mixed but balanced stimulation and that the mustard produces a strong trigeminal excitement [28].

5. Therapeutic Proposal and Post-Treatment

5.1 Nasal polyposis and postoperative olfactory alterations

The presence of nasal polyposis in patients with chronic rhinosinusitis with olfactory alterations can lead to initial medical management and follow-up by otolaryngologists, requiring the use of local and systemic medical treatments. In refractory processes, as well as permanent and persistent respiratory obstruction, the surgical option emerges as an option [29]. The aim of endoscopic sinus surgery is to optimize rhinosinusal function and improve access for topical medical therapy. However, olfactory outcomes after endoscopic nasal surgery can be variable and their results are variable. Some previous studies indicate that these procedures improves olfactory dysfunction, however, other recent prospective studies have added detail about the impact of endoscopic procedures on olfactory dysfunction. In patients with anosmia who have nasal polyposis versus patients with hyposmia with same condition, olfaction improvement has been reported for anosmic patients after endoscopic sinus surgery. The improvement for this group of patients remained stable even one year after surgery [29].

The possible hypothesis associated with olfactory improvement in patients with anosmia was indicated as a mechanical obstruction in the olfactory cleft which was sensitive to surgical removal. Compared with hyposmic patients who have a multifactorial etiology of the olfactory tract associated with inflammation and neuroepithelial damage, surgical removal was less amenable to surgical optimization [29]. Olfactory changes after surgery have been reported in studies indicating at least 23% of patients who perceived change, 68% did not indicate improvement and 9% of patients worsened after performing endoscopic nasal surgery. Regarding the clinical evolution of patients with anosmia, an improvement of 75% has been reported in those who received endoscopic surgery, although residual hyposmia was documented, probably due to a permanent lesion at the level of neuroepithelium [30]. According to the reviewed evidence, it has been suggested that the improvement of olfactory dysfunction related to chronic rhinosinusitis after endoscopic nasal surgery is variable and is a challenge to predict, some factors studied such as the severity of olfactory loss, age less than 55 years, duration of olfactory loss less than 10 years, eosinophilia and the non-existence of endoscopic nasal surgery have been determinants in the evaluation of olfactory improvement after endoscopic nasal procedures. Although there is contradictory evidence, it seems that in anosmic patients with nasal polyposis they have a considerable olfactory improvement after rhinosinusal endoscopic surgery [30, 31].

5.2 Medical treatment after endoscopic sinus surgery

The use of intranasal and systemic corticosteroids has been described within the schemes of use for pre and postoperative treatment in patients with chronic rhinosinusitis with polyposis,some of them with olfactory dysfunction associated. These are determinants in inflammatory decline and edema [32]. Oral corticosteroids have shown subjective and objective improvement in the olfactory response in patients with chronic rhinosinusitis with polyposis in periods of 8 to 12 weeks of medical treatment. It is plausible that the effect of oral corticosteroids may decrease after the initial improvement in the first weeks. Evidence for objective improvement with steroids has been indicated as a weak recommendation [32]. There is no evidence to support the use of antibacterials, antifungals, anti-inflammatory injections or herbal medications in the improvement of olfactory results [32]. Since the medical treatment after surgery is a short-term rehabilitation support, there are no studies with higher levels of evidence that support olfactory improvement for longer periods, nor has the clinical characteristics of patients with chronic rhinosinusitis been discriminated in other studies. operated by nasal polyposis with olfactory alterations and the topical or oral treatment used [32]. Being an emergent association of care and follow-up by Otolaryngologists, further studies are needed in Latin America for the characterization of patients with chronic rhinosinusitis with nasal polyposis and olfactory disorders associated.

6. Conclusion

Nasal polyposis associated with chronic rhinosinusitis with olfactory alterations is a frequent pathology in the otorhinolaryngology consult, whose study and follow-up must involve an adequate clinical and physical examination to rule out other alterations associated with the chronic rhinosinusal process. Although in Latin America there is no validated tool in the objective study of olfactory alterations, some tests such as olfactometry like

BAST 24 could be extrapolated and validated in the Hispanic population. There are still controversies in the postoperative medical treatment of patients with chronic rhinosinusitis and nasal polyposis. Larger epidemiological and olfactometric studies in the Latin population are required in the field of olfactory disorders.

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