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New Perspective: Are Nasal Function İmpairment and Nasal Airflow Affected by Omalizumab Therapy in Patients with Allergic Rhinitis and Nasal Polyps?

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INTRODUCTION

The human nose is an important and complex organ with many functions, including ventilation, filtration and olfaction. People who suffer from nasal function impairment have a reduced overall quality of life. Nasal Obstruction (NO) is defined as the subjective perception of discomfort or difficulty in the passage of air through the nostrils, and it is thought that this sensation is physiologically or pathologically generated in the trigeminal sensory receptors of the nasal mucosa. The terms obstruction and nasal congestion may be used as synonyms, although obstruction usually refers to the subjective sensation of irreversible blockage. Nasal Obstruction (NO) is a symptom that is frequently reported by patients in primary care and otorhinolaryngology and allergy consultations [1-4]. Although there are no precise data, it is estimated that the condition may affect at least 30%-40% of the general population [1,2].

NO is an annoying symptom that greatly affects Quality of Life (QOL), predisposes to and exacerbates lower airway diseases, alters night-time rest, decreases work efficiency, and aggravates sleep apnea [1,4,5]. Diagnosis of its specific cause is essential to be able to select the appropriate therapy. The enormous social and health care expenditure that it entails results from factors such as incorrect diagnoses and/or unsuitable treatment [1,5,6].

NO is frequently reported by patients in primary care and in specialized care. It has a huge impact on patients' QOL and especially on sleep quality. As it can be caused by various factors, a complete medical history and clinical examination are the main basis of etiological diagnosis. Furthermore, although both the pattern and location can suggest the underlying disease, objective and subjective assessment tools are useful for evaluation of NO [1-3].

The pathophysiology of Allergic rhinitis is a complex inflammation with numerous cytokines and inflammatory mediators, although Allergic rhinitis symptoms are recurrent and the airway inflammation in Allergic rhinitis is persistent. The airway inflammation pattern appears to be similar in all clinical forms of asthma and in all age groups, including allergic, non-allergic or aspirin-induced. Mast cells, eosinophils, T lymphocytes, dendritic cells (DCs), macrophages and neutrophils are the primary cells involved in the inflammatory processes. Immunoglobulin E (IgE) plays a central role in the pathophysiology of asthma, as in other allergic diseases, such as urticaria, food allergy and allergic rhinitis [7-10]. In the early allergic phase, the allergen is first taken up by the DCs in the body and processed to present to antigen-specific T-cells. During this process, T lymphocytes transforming into Th 2 phenotype provide the development of IgE-producing B cells. The crystallized Fc portion of the free IgE binds to the high-affinity IgE receptor (FcεRI) on the basophils and mast cells. Mast cells with IgE bound to the FcεRI receptors on the surface are activated through allergen exposure [8-10].

The efficacy of humanized anti-IgE monoclonal antibody (omalizumab) was first evaluated in a randomized, double-blind, placebo-controlled study of 221 patients with seasonal allergic rhinoconjunctivitis [11]. That study showed that

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significant symptomatic relief in up to 48% of the combination treatment group (specific immunotherapy [SIT]+omalizumab), compared to the SIT group alone. A randomized study in Japan revealed a significant improvement in daily nasal (nasal congestion, serous discharge, sneezing, itching) and eye symptoms (itching, flushing, serous discharge) in patients with seasonal allergic rhinoconjunctivitis receiving omalizumab [12].

In 2007, a randomized placebo-controlled study of eight patients was the first to report reduced rates of postoperative polyp recurrence in patients with atopic asthma and nasal polyps (NP) [13]. In a study of 19 patients with severe asthma and NP in 2011, Vennera et al. [14] reported symptom reduction and disease stabilization with the use of omalizumab treatment. In addition, Tajiri et al. [15] evaluated omalizumab in patients with severe asthma and NP and reported significant improvements in nasal symptoms, asthma control, and sinus tomography results. However, not all studies have been able to show the beneficial effects of the treatment. In a randomized, double-blind, placebo-controlled study of patients with chronic rhinosinusitis receiving omalizumab, Pinto et al. [16] showed improvement in the Sino-Nasal Outcome Test (SNOT-20) scores at 3, 5 and 6 months, although there was no significant difference in the scores compared to the control group.

The human nose is a complex organ that shows large morphological variations and has many important functions. However, the relationship between shape and function is not yet fully understood. In a previous study, a high quality statistical shape model of the human nose was presented based on clinical CT data of 46 patients. A technique based on cylindrical parametrization was used to create a correspondence between the nasal shapes of the population. Applying principal component analysis to these corresponding nasal cavities resulted in highly accurate average nasal geometry and geometrical variations, known as principal components, present in the population. The analysis resulted in 46 principal components, accounting for 95% of the total geometric variation captured. These variations are first discussed qualitatively, and the effect on the average nasal shape of the first five principal components is visualized. Hereafter, by using this statistical shape model, two application examples that lead to quantitative data are shown: nasal shape in function of age and gender, and a morphometric analysis of different anatomical regions. Shape models, such as the one presented here, can help in the better understanding of nasal shape and variation and their relationship with demographic data [17]. These findings suggest that humanised monoclonal antibody treatments (OMALIZUMAB) could show an effect on nasal mucosa because of the anti-inflammatory effects at the mast cell level.

Previous studies have suggested that omalizumab is a novel and promising agent for the long-term control of allergic asthma [7-10,18-22] and have also documented the clinical effect of Th1/2 cytokines, pro-inflammatory proteins (CD200), IL-22, IL-10RB, IL-25 and IL-33 signaling in the pathogenesis of SPA [18-22]. Omalizumab treatment has been observed to not only improve asthma symptoms but also allergic rhinoconjunctivitis symptoms, thereby improving quality of life for patients and nasal and pulmonary airflow.

CONCLUSION

In conclusion, Omalizumab treatment may play a role in the regulation of nasal airflow, reducing the need for topical steroids. However, large-scale, prospective, randomized clinical studies are needed to establish a definite conclusion.

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