



# International Journal of Rhinology & Otolaryngology

Review Article

## The Aging Nose: Structure, Function, and Pathology - @

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**Submitted: 28 March 2018; Approved: 07 April 2018; Published: 09 April 2018**

**Cite this article:** Elwany S. The Aging Nose: Structure, Function, and Pathology. Int J Rhinol Otolological. 2018;1(1): 001-003.

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Between 2000 and 2030, the percentage of people over the age of 65 will increase from 12.4% of the population to 19.6% [1]. This increase will continue during our lifetimes given that the 65 to 85 age group is projected to increase by 135% between 2000 and 2050 [2]. In 1960, only 9% of the U.S. population was over the age of 65, whereas today 13% is [3]. Rhinologists will be treating many of the elderly based on the high prevalence of sinonasal diseases.

Some of the problems, about which the elderly complain, are normal changes to the nose and respiratory tract. The fact that some of the nasal symptoms do not represent disease needs to be explained to the elderly patient, who should know that their issues are a variation of normal and consequently require no therapy. The issue of polypharmacy, taking several drugs, should be also kept in consideration [4].

The nose is an essential organ of respiration that needs to function from the moment of birth. It is a vehicle through which over 12,000 L of air pass per day [5]. Its purpose is not only to pass air, but also to warm, humidify, and clean the particles and bacteria in the air before it reaches the lungs. It also provides a positive end-expiratory pressure to keep the lungs expanded and serves the extremely important function of olfaction.

Nasal function is affected by the nasal structures and by aging. Drooping of the nose and ptosis of the nasal tip may be noticed with aging [6]. These changes may be due changes in the nasal cartilages [7], loss of midfacial support [8,9] and loss of tensile strength in aging skin [10].

With aging, there are several changes to the skin including epidermis, the dermis, the skin appendages, and the subcutaneous tissue. The nose tends to show more changes with age because it is the most exposed part of the body to sun and air. The changes in skin with age include decrease in thickness, reduction in melanocytes, and reduction strength of the skin over and around the nose. The skin tension lines are enhanced with age, which may affect the external nasal valve.

The surface area of the nasal septal cartilage also decreases with age especially in the area below the nasal bones and along the dorsum of nose. A fact that should be taken into consideration during septoplasty operation in the elderly patients in order to avoid postoperative saddling of the nose [11].

The nose serves many functions, including respiration, air conditioning of the inhaled air, and olfaction [12]. Aging does not seem to affect the resistance to nasal airflow in the normal geriatric population [4]. However, the changes in the cartilages, skin, and muscles of the nose and the regression of the teeth and alveolus may affect the flow of air into the older nose. Aging may lead to alar collapse and dynamic closure of the external nasal valve and may also change the angle of the internal nasal valve. This may considerably disrupt the normal nasal air flow. This also may aggravate the effect of aging on the lower respiratory tract with worsening of the forced vital capacity, forced end expiratory volume, functional residual capacity, arterial pO<sub>2</sub> and perfusion [13]. This may be the reason why elderly patients with asthma suffer greatly when their nose is blocked [14].

Normal aging does not seem to affect the ciliary beat frequency nor mucociliary flow of the nose. However, some of the drugs prescribed for elderly patients dry the nose and renders the mucus thicker and decreases mucociliary flow rate [15].

The sense of smell is indispensable for our lives. Of all of the cranial nerves, olfaction is the first and the most primitive. Olfactory epithelium covers the roof of the nose and upper part of nasal septum. Olfactory neurons reproduce on a cycle of 1 to 2 months. The sense of smell is essential for the sense of taste since the taste receptors in the in the mouth and tongue detect only bitter, sweet, salt, and sour elements. Smell is also a protective mechanism to detect putrid food, toxic gases, and noxious environments.

All of our senses are reduced with aging. It has been estimated that we lose 1% of the sense of smell for every year we age over the age of 60 [16]. Murphy et al. have found that 62.5% of the elderly over the age of 80 had some smell impairment [17]. The National Interview survey found that 40% of all the patients with a reduced sense of smell are over the age of 65 [18].

Reduction of the sense of smell in the elderly may be due to reduction in the number of olfactory receptors, changes in the olfactory bulbs or olfactory cortex [19], heavy smoking, and systemic diseases, as diabetes, liver diseases, hypothyroidism, nutritional problems, chemotherapy, radiotherapy, and neurological diseases such as Alzheimer and multiple sclerosis. In some patients, olfactory disturbances may be the earliest sign of neurological deficits [20].

The workup of olfactory disturbances in the elderly is not difficult for the average otolaryngologist. A detailed history is essential and should include a careful description of patients' sense of smell, starting with their everyday smells, like Coffee, garlic, orange, lemon, and grapefruit, and working to other smells. An inability to smell these items is a sign of possible olfactory problems. Fluctuating loss of sense of smell may be due to allergies or seasonal weather changes. The University of Pennsylvania Smell Identification Test (UPSIT) may be also used to identify smell disturbances and to evaluate the efficacy of any therapy.

The treatment of smell disturbances is actually treatment of the cause. Topical steroid sprays or short courses of oral steroids may be tried if there is no clear cause of the smell defect.

Rhinitis in the elderly may be a variation of rhinitis that affect every age group. There are also special forms of rhinitis that are more common in the elderly, such as non-allergic rhinitis and gustatory rhinitis. The most common complaint is usually a runny nose. Other complaints include postnasal drip, chronic cough, and sneezing. These complaints are commonly invoked non-specific stimuli like cold air and some fumes. Allergy tests in these patients are usually negative although some of them may have high nasal IgE (local allergic rhinitis). Allergic rhinitis may also exist in about 3-12% of the geriatric population [21].

Although there is an age-related decrease in total serum IgE, the specific IgE levels remain the same in the elderly [21]. There are other related immune changes with aging. Cytokine production may decrease as one ages. This affects T helper cells and may turn on the allergic response.

The most common type of non-allergic rhinitis is vasomotor, which is an autonomic dysfunction. It is a combined parasympathetic and sympathetic dysfunction, which may cause simultaneous rhinorrhea and nasal congestion. This type of rhinitis is non-eosinophilic and may be caused by neurogenic reflex mechanisms.

A variation of this is gustatory rhinitis, which is caused by eating or thinking of eating. In the elderly patient, temperatures of food, oils,



and other stimuli related to eating may turn on the nasal secretions without warning. Currently, this is regarded as an autonomic dysfunction in which the brain stimulates the seromucinous acini of the nose together with the salivary glands.

The best method to treat the rhinorrhea associated with non-allergic or gustatory rhinitis is to give ipratropium bromide nasal spray, which is a topical anticholinergic agent freely soluble in water. It can be used several times a day when the patient is eating or uncomfortable. Systemic decongestants are better avoided because of their possible effects on blood pressure, urination, and their negative effect on sleeping.

Some of the medications commonly used by the elderly patient can cause rhinitis. These include angiotensin-converting enzyme inhibitors, antidepressants and antipsychotics,  $\alpha$ - and  $\beta$ -blockers. This should be taken into consideration during our diagnostic workup.

Nasal dryness is another common in the geriatric population and may progress to an ill-defined form of atrophic rhinitis with glandular atrophy, loss of turbinate vessels, and reduced mucociliary clearance [16].

Epistaxis can be a significant worry in the elderly and a challenge for the physician to treat. Epistaxis in the elderly may be associated with hypertension and atherosclerosis. A recent paper [22] showed that atherosclerosis and increased levels of LDL are significant risk factors for recurrence of bleeding in hypertensive patients. On the other hand, the level of blood pressure was not a significant risk factor. Patients may also be taking medications, like aspirin, that may increase the risk of bleeding. Bleeding in these patients is more commonly posterior and is more difficult to control than anterior bleeding. Several forms of tamponade may be used to control the bleeding. Vasoconstrictor sprays may be used if the patient is not hypertensive or suffering from cardiac arrhythmia. Stubborn cases may need coagulation of the sphenopalatine artery.

Other milder forms of epistaxis may occur due to the extreme weather changes, or due to rubbing of the nose. These may be managed in a way similar to the care of epistaxis in younger adults, with some small modifications.

The medications and sprays used for the treatment of nasal and sinus disease in the elderly are the same used for younger age groups. The challenge for the rhinologists is how to avoid side effects and interactions with other drugs prescribed for the patient. Some side effects like hypertension, urinary retention, and osteoporosis are more prone to happen in the elderly patients. Also, some spray bottles may be easier to use than others based on whether the patient has arthritis in the hands.

In conclusion, as the population age, several changes occur to the nose, and several rhinologic complaints may change or appear. Treatment of these complaints generally follow the guidelines used for younger age groups. However we should be aware of the problems of polypharmacy and the physical and mental handicaps that may exist in the geriatric population.

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