Paparella III: Section 2: Disorders of the Head and Neck

Part 1: Nose and Paranasal Sinuses

Chapter 7: Nonallergic Rhinitis

John L. Gluckman. Robert Stegmoyer

Definition

Chronic rhinitis is an inflammation of the nasal tissue, which results in a symptom complex consisting of nasal obstruction caused by mucosal swelling secondary to blood vessel engorgement, rhinorrhea secondary to glandular hypersecretion and tissue transudate, sneezing caused by neural reflexes, and pruritus secondary to histamine release from mast cells and basophils. This represents a limited response of a target organ to allergy or a wide range of nonspecific external and internal stimuli. This chapter reviews and categorizes the various causes of nonallergic rhinitis, emphasizing the approach to diagnosis and treatment.

Incidence

Nonallergic rhinitis represents 40 to 70 per cent of all chronic rhinitis, afflicting 30 to 40 million Americans, with a prevalence of 20 per cent. Although not a life-threatening condition, rhinitis may cause significant discomfort and altered feelings of well-being because of congestion, pruritus, sneezing, anosmia, disturbed sleep, fatigue and irritability, dry mouth, and bothersome rhinorrhea or postnasal drainage, or both. This leads to untoward social ostracism and, when summated, significant economic impact. It is estimated that between 250 and 500 million dollars/year are spent on physicians' fees and drug costs, with between 10 and 28 million lost or restricted work or school days/year, and up to 6 million bedridden days/year. When thus measured, the significant individual and social impact of this simple condition becomes obvious.

Nasal Anatomy and Histologic Features

Essentially, the nasal fossae are paired, tubular structures separated by the septum, with variegated, redundant lateral wall affording a large surface area of erectile tissue under humoral and neurologic control subtending the primary nasal functions. The lateral nasal walls are closely related to the paranasal sinus ostia, eustachian tube orifices, and the nasolacrimal system; hence, any diseases affecting the mucosa may have secondary effects on the functions of these structures.

The vasculature of the mucosa includes arteries and arterioles, which are resistance vessels under alpha-adrenergic control regulating regional flow. The capillaries are fenestrated, porous vessels that contribute to fluid extravasation in certain pathological conditions. The venules and sinusoids within the nasal mucosa are capacitance vessels under parasympathic control, possessing erectile properties.

The autonomic nerve supply to the nasal mucosa derives from both sympathetic and parasympathetic fibers. The sympathetic fibers exert primary control over the nasal vasculature, whereas the parasympathetic fibers supply the mucosal glands, with only secondary effects on the vasculature. Preganglionic parasympathetic nerve fibers have their cell bodies in the superior salivatory nucleus; they leave the brain stem via the nervus intermedius, travel with the facial nerve through the geniculate ganglion, form the greater superficial petrosal nerve, synapse in the pterygopalatine ganglion, and give off postganglionic parasymathetic fibers that innervate the glands and capacitance vessels of the nasal mucosa. The preganglionic sympathetic nerve fibers originate in the upper thoracic intermediolateral gray column, travel in the cervical trunk, and pass through the pterygopalatine ganglion via the deep petrosal nerve to innervate the vasculature of the nasal mucosa.

The nasal mucosa consists of stratified squamous epithelium in the anterior one third of the nose and pseudostratified ciliated columnar epithelium in the posterior two thirds. Goblet cells within the mucosa secrete mucus, which with the cilia forms a mucociliary blanket. The nasal epithelium overlies a well-defined basement membrane, deep to which is the lamina propria overlying the bony and cartilaginous framework of the nose. The lamina propria contains seromucous glands, blood vessels, nerves, ground substance and connective tissue, and cellular elements.

The ground substance is an amorphous colloid containing cells and other components, including acid mucopolysaccharides of hyaluronic acid and chondroitin sulfate. This ground substance exists in a gel and sol state controlled by hyaluronidase. The connective tissue consists of fibers of collagen, reticulin, elastin, and oxytalan, and various cells, including fibroblasts, macrophages, mast cells, and plasma cells. The fibroblasts produce the fibers, as well as the acid mucopolysaccharides, whereas the mast cells and plasma cells are responsible for histamine release. The mast cells may play some role in the regulation of nasal physiology, with control of local blood flow via release of histamine and heparin.

The mucous blanket overlying the nasal mucosa has protective and humidifying functions. It consists of an exudate synthesized by goblet cells, serous and seromucous glands, and a tissue transudate via the fenestrated capillaries. The various nasal secretions are under parasympathetic cholinergic control, as well as histamine and vasoactive intestinal polypeptide control. Nasal secretions are composed of mucus-like proteins, immunoglobulins, secretory component, lactoferrin, lysozyme, kallikrein, antiprotease, tissue transudate, and various cells.

Physiology

As already stated, the microvasculature supplying the nasal mucosa is controlled by the vasomotor system. Alpha-adrenergic sympathetic control of resistance vessels (arteries and arterioles) governs regional blood flow; however, parasympathetic control of capacitance vessels (venules and sinusoids) governs engorgement of tissues. The mediator of parasympathetic stimulation leading to vasodilatation and decreased nasal patency is at present unclear. This stimulus is not blocked by atropine; hence, it is not felt to be cholinergically mediated. Likewise,

there is no evidence that parasympathetic stimulation is mediated via prostaglandins. Possible mediators, however, do include kinins and vasoactive intestinal polypeptide.

There is a constant, baseline, low-output level of alpha-adrenergic sympathetic tone, which by controlling the capacitance vessels governs the blood content of the nasal mucosa. High-output alpha-adrenergic stimulation, in contrast, decreases blood flow to nasal mucosa and is abolished by alpha-adrenergic blockers. Beta-adrenergic stimulation causes no change in regional blood flow.

The normal physiologic nasal cycle, with a periodicity of approximately every 30 minutes, results from a constant, baseline balance between sympathetic and parasympathetic vasomotor control. This results in cyclic congestion and decongestion of the turbinates alternating from one side to the other.

Nasal glandular secretion is under parasympathetic cholinergic control. In addition to acetylcholine, it is felt that vasoactive intestinal polypeptide and histamine also control nasal secretions, with histamine probably enhancing the effects of acetylcholine. There is also a baseline parasympathetic output with a constant secretory output. Parasympathetic acetylcholine-mediated stimulation causes a profuse watery secretion, which is blocked by atropine. In addition, the parasympathetic nervous system innervates the contractile and secretory elements of the nasal glands. Nasal secretion is also under indirect alpha-adrenergic sympathetic control of the nasal vasculature. Loss of sympathetic stimulation with parasympathetic vasodilatation causes vessel engorgement and increased tissue transudate, which contributes to nasal secretion.

The mucociliary system consists of a sol layer (serous component of plasma transudate) and a gel layer (mucous component). This system is pH- and temperature dependent, trapping and clearing particles that are between 5 and 10 microm. The immunologic component of filtration includes secretory IgA.

There are four major functions of the nose: (1) airway protection, (2) air conditioning, (3) olfaction, and (4) resonance. Alteration in the mucosal physiology may affect these functions to some degree.

Pathologic Mechanism of Rhinitis

A number of intrinsic and extrinsic pathologic mechanisms alter normal nasal function and cause the symptoms of rhinitis.

The extrinsic factors include allergens, irritants, cold air, odors, infectious agents, pharmacological agents, and exercise. The intrinsic factors include food metabolites, hormonal and endocrine substrates, infiltrating cells, vasoactive mediators, and the autonomic nervous system.

The autonomic nervous system can mediate the various intrinsic and extrinsic factors causing rhinitis or can cause rhinitis directly via an imbalance with hyperactive parasympathetic activity. For example, antihypertensive agents may cause unchecked parasympathetic activity with decreased sympathetic activity. Irritants, temperature changes, and alcohol also increase parasympathetic activity and vasomotor instability. Estrogens and hypothyroidism potentiate parasympathetic cholinergic stimulation, whereas hypothyroidism acts sympathomimetically.

These extrinsic and intrinsic causes of rhinitis may also be mediated by non-IgE-activated vasoactive substances, including histamine, kinins, and vasoactive intestinal polypeptide.

In summary, a wide variety of both extrinsic and intrinsic factors have a significant effect on nasal function. The symptoms of rhinitis, caused by these factors, can be explained on the basis of autonomic nervous system imbalances, non-IgE-activated vasoactive mediators, and changes in the composition of ground substance with interstitial edema. These ground substance changes may be a direct result of the insulting agent or may be mediated via histamine or kinins.

Classification of Rhinitis

Rhinitis can result from multiple causes, but this chapter will deal only with nonallergic, noninfectious causes (Table 1). Obviously, in many patients the cause is multifactorial and will defy categorization.

Table 1. Classification of Nonallergic Noninfectious Rhinitis

Structural Abnormalities
Deviated nasal septum
Obstructing masses
Intranasal
Paranasal
Nasopharyngeal
Foreign body
Rhinitis Medicamentosa
Endocrine
Pregnancy
Hypothyroidism
Diabetes
Menstrual cycle
Irritative
Idiopathic
Vasomotor rhinitis
Eosinophilic nonallergic rhinitis
Mixed cellular rhinitis
Nasal mastocytosis

Miscellaneous

Postlaryngectomy rhinitis
Tracheostomy rhinitis
Recumbency rhinitis.

Specific Causes of Nonallergic Rhinitis

Structural Abnormalities

Structural abnormalities, such as nasal valve collapse or nasal septal deformity, adenoid hypertrophy, and even choanal atresia, may result in secondary mucosal abnormalities. Neoplastic conditions, both benign (papilloma, angiofibroma) and malignant, as well as granulomatous processes may also evoke classic symptoms of rhinitis by virtue of their mass effect and nasal obstruction. In the elderly patient, loss of cartilage support may cause the anterior nares to collapse with each inspiratory effort, which may cause or aggravate the nasal obstruction. A deviated septum is frequently associated with turbinate hypertrophy in the concavity of the septum, which will have to be addressed if adequate relief of the nasal obstruction is to be obtained by nasal surgery.

Rhinitis Medicamentosa

Rhinitis medicamentosa is a drug-induced rhinitis representing 5 per cent of all chronic rhinitis syndromes and characterized by rebound nasal congestion, with edematous, red, engorged, and friable nasal mucosa. It is the end result of prolonged, sustained use of topical vasoconstrictors (alpha-adrenergic stimulators) or systemic drugs, particularly antihypertensive drugs (Table 2).

Table 2. Drugs Causing Rhinitis Medicamentosa

Systemic

Antihypertensive agents
--> Methyldopa
--> Guanethidine
--> Reserpine
--> Hydralazine
--> Prazosin
Beta-blockers
--> Propanolol
--> Nadolol
Antidepressants and tranquilizers
--> Thioridazine
--> Chlordiazepoxide-amitryptiline
--> Perphenazine

--> Alprazolam
Oral contraceptives and estrogen therapy
Aspirin and nonsteroidal anti-inflammatory agents
Ergot alkaloids
Antithyroid drugs
Iodides
Alcohol
Tobacco
Hashish
Marijuana

Topical

Vasoconstrictors
Cocaine.

Frequent and prolonged use of topical vasoconstrictors results in a rebound vasodilatation (rebound rhinitis), which may become permanent because of vascular atony. For this reason, topical vasoconstrictors should not be used for longer than 5 consecutive days, otherwise, the patient will become a "nose drop addict".

Oral medications may include reserpine, hydralazine, guanethidine, methyldopa, propranolol, thioridazine, and perphenazine. These medications all cause depletion of norepinephrine stores in one way or another; for example, reserpine inhibits norepinephrine transport to storage pools, and guanethidine causes active release of norepinephrine from these pools. Reserpine is the drug most likely to cause problems. In addition, aspirin, alcohol, tobacco, iodides, hashish, and marijuana may also cause rhinitis medicamentosa. Aspirin alters prostaglandin metabolism, causes degranulation of mast cells, and lowers the threshold of the nasal mucosa to histamine. Oral contraceptives may also cause the symptoms and signs of rhinitis.

In treating rhinitis medicamentosa caused by topical decongestants, the physician must attempt to identify the underlying cause for the nasal obstruction that initiated the use of the topical medication in the first place. The patient must stop using the topical decongestant and topical or systemic steroids, with saline nose sprays or systemic decongestants substituted to alleviate the symptoms during the withdrawal period. If permanent changes have occurred, with resultant chronic hypertrophic turbinates, some form of turbinectomy may become necessary. If the rhinitis is due to systemic drug administration, the drug will need to be replaced with an alternate drug if feasible.

Although cocaine has been described as a potential cause of rhinitis medicamentosa, this is an unlikely scenario, as most abusers do not use the drugs frequently enough, and also most cocaine sold illicitly is usually "cut" and, therefore, is unlikely to cause problems. Conversely, the irritation from its use, together with the vasoconstrictive effect, may cause crusting,

ulceration, septal necrosis, and even collapse.

Nasal Polyposis, the Aspirin Triad, and Nonallergic Rhinitis

A small percentage of patients with asthma and rhinitis (4 per cent) or just rhinitis (2 per cent) have associated nasal polyposis. Of those patients with nasal polyposis, approximately 14 to 31 per cent have associated aspirin sensitivity characterized by bronchospasm (70 per cent), urticaria (13 percent), rhinitis (10 per cent), or a combination of symptoms (7 per cent). Of all the patients with aspirin intolerance, about 45 percent have associated polyps. There is an increased incidence in individuals older than 30 years. Of those patients with nasal polyposis, a greater percentage have negative rather than positive skin test results to common allergens. When patients with known aspirin intolerance are challenged with aspirin, they experience bronchospastic or naso-ocular symptoms, or both, which are unaltered by pretreatment with steroids or aminophylline. About 30 per cent of these patients have been found to have a different end-organ response on rechallenge, and 10 per cent are found to have no response on rechallenge with aspirin.

The various nonallergic types of rhinitis, as well as other conditions, have been associated with the subsequent development of nasal polyposis or the aspirin triad, or both. One such predictor is rhinitis associated with eosinophilia; however, in the specific nonallergic, eosinophilic type of rhinitis, there is no associated or subsequent development of polyposis, the aspirin challenge test produces negative results, and there is no evidence of hyperactive airway disease. Other predictors of polyposis and aspirin intolerance include perennial nonallergic rhinitis; cystic fibrosis (25 per cent of children with cystic fibrosis have associated nasal polyps, and 40 per cent of children with nasal polyps are found to have cystic fibrosis); atopic nonallergic perennial rhinitis demonstrating a strong hereditary pattern; and a neutrophilic nasal transudate.

The pathologic mechanisms of aspirin intolerance and the formation of nasal polyps include prostaglandin synthesis abnormalities and connective tissue alterations. Aspirin and other nonsteroidal anti-inflammatory agents inhibit prostaglandin pathways with the buildup of the metabolites 5-hydroxy-6,8,11,14-eicosatetranoic acid (5-HETE) and the slow-reacting substance of anaphylaxis (SRS-A), which are chemotactic for eosinophils and neutrophils and may cause degranulation of mast cells and a lower threshold for the histamine response. Aspirin also alters the ratio of prostaglandin E2, a bronchodilator, to prostaglandin F2, a bronchoconstrictor. Aspirin may also cause IgE-mediated angioedema and urticaria. It may also affect the composition of connective tissue and ground substance, with subsequent polyp formation.

Polyps contain active fibroblasts, collagen, and abundant ground substance composed of acid mucopolysaccharides, eosinophils, plasma cells, and neutrophils. Nasal polyps have also been shown to release histamine, STS-A, eosinophil chemotactic factor of anaphylaxis (ECF-A), and serotonin.

The management of nasal polyposis includes surgery and systemic or topical steroids. Systemic steroids or surgery, or both, may be necessary to reduce the bulk of the nasal polyps

before topical steroids can be effective. Since nasal polyposis is generally not associated with antigen-specific allergy, desensitization is usually ineffective.

Endocrine and Hormonal Causes of Rhinitis

Although rhinitis medicamentosa affects the autonomic nervous system and microvasculature of the nasal mucosa, the endocrine and hormonal causes of rhinitis affect the matrix and ground substance of the submucosa. These causes of rhinitis include pregnancy, menstruation, oral contraceptive use, hypothyroidism, and diabetes mellitus.

The rhinitis of pregnancy is an estrogen-induced rhinitis. Estrogens increase the hyaluronic acid component of ground substance, causing increased tissue hydration and tissue edema. During the second trimester, there is an increase in estrogens, an increase in mucous glands, a decrease in ground substance, and the development of large cavernous areas with an atrophic basement membrane in the nasal mucosa. In addition, the estrogen effects on the nasal mucosa include squamous metaplasia, intraepithelial edema resulting from tissue hydration, an increase in collagen fibers and fibroblasts, congested capillaries, loss of cilia, and hyperplastic mucous glands with increased secretory activity.

The rhinitis of pregnancy is characterized by nasal congestion without sneezing, pruritus, or rhinorrhea. It occurs during the second and third trimesters. Although the treating physician should always consult with the patient's obstetrician, judicious corticosteroid administration, particularly topical steroids with minimal absorption, would appear a relatively safe method of treatment. Systemic decongestants and antihistamines can also probably be used safely, but in the final analysis, the obstetrician and patient should participate in the decision whether to treat the patient at all.

Hypothyroidism induces thyrotropic hormone release, which stimulates acid mucopolysaccharide production, with increased turgidity and edema of the turbinates, congestion of subcutaneous tissues, and mucous gland hypertrophy. The premenstrual "cold" may also be due to hormonal changes.

In some patients, it has been shown that wide swings in blood levels of glucose, as occurs in uncontrolled diabetes mellitus, result in altered molecular configurations of ground substance acid mucopolysaccharides, with more short-chain hydrophilic polysaccharides, increased osmotic pressure, edema, collagen and elastic tissue deposition, and the eventual formation of fibromyxomatous nasal polyps. Meticulous control of blood glucose levels is necessary to control this rare cause of rhinitis.

Irritative Cause of Rhinitis

Persistent irritation of the nasal mucosa may cause chronic rhinosinusitis. The most common irritants are occupational (dust, fumes, chemicals), but environmental factors such as pollution may play a role. Control of pollution is becoming a serious problem for the future.

Idiopathic Causes of Nonallergic Rhinitis

Vasomotor Rhinitis. This diagnosis is made only after all of the other causes of rhinitis previously described are excluded. Hence, vasomotor rhinitis represents only a small percentage of the perennial non-allergic, noninfectious types of rhinitis. It is characterized by idiopathic, nonspecific airway obstruction with postnasal drainage and profuse rhinorrhea. There is no associated pruritus or sneezing. The family history is negative for allergy. The skin test results are also negative. The serum IgE level is normal, and the nasal smears show few, if any, eosinophils. There may, however, be other associated autonomic abnormalities, such as irritable bowel syndrome.

Vasomotor rhinitis is felt to be the result of an unstable autonomic nervous system with a hyperresponsive parasympathetic outflow and a hyperresponsive mucosa. Nonspecific irritants such as fumes, tobacco smoke, odors, and weather changes may trigger this already hyperresponsive, unstable autonomic nervous system with the nasal mucosa as the end-organ. Likewise, anxiety, hostility, guilt, depression, and constant frustration can all affect the autonomic nervous system, with resultant vasomotor rhinitis.

Eosinophilic Nonallergic Rhinitis. This is a specific entity affecting a defined patient population. This perennial condition, with no geographic variation, presents with paroxysms of sneezing, watery rhinorrhea, and pruritus. There is an absence of hyperactive airways and negative results on methacholine and aspirin challenge tests, a normal serum IgE level, negative skin test results, and prominent nasal eosinophilia. Nonspecific irritants, such as strong odors, dust, smoke, and weather changes, are noted to evoke change in 15 to 30 per cent of afflicted patients. This condition is noted in patients older than 20 to 30 years of age; it presents in paroxysms, is worse in the morning, and is better later in the day.

Within these parameters, eosinophilic nonallergic rhinitis is a specific subgroup of all types of rhinitis associated with eosinophilia. They include allergic rhinitis, nasal polyposis, nonallergic asthma with rhinitis, and aspirin sensitivity. As noted, eosinophilic nonallergic rhinitis, whatever the cause, is intermittent and is characterized by rhinorrhea and induced by nonspecific irritants with negative skin test results. In contrast, eosinophilic rhinitis associated with allergy is continuous or seasonal and is induced by specific antigens, with positive skin test results. Approximately 25 per cent of patients with eosinophilic rhinitis have associated nasal polyps.

Despite the cause, eosinophilic rhinitis is characterized histologically by a thickened submucosa; a mixed infiltrate of plasma cells, lymphocytes, eosinophils, and neutrophils; intense local IgE staining; and a damaged basement membrane.

Presumptive mechanisms for eosinophilic rhinitis include altered prostaglandin synthesis or metabolism, aberrant eosinophil chemotactic factors, a persistent reaction to bacterial or viral infection, vasomotor instability, nonspecific irritants, and undiagnosed specific allergies.

Eosinophilic rhinitis is treated by removal of the offending irritants, surgical removal of the polyps, avoidance of aspirin, and the use of antihistamines and topical steroids. Asthma, if present, should be treated with the appropriate bronchodilating agents.

Mixed Cellular Rhinitis. This represents up to 50 per cent of the chronic types of rhinitis. This condition is characterized by rhinorrhea, congestion, and a red, inflamed mucosa. The nasal smears contain mixed lymphocytes, plasma cells, and eosinophils. There is a normal serum IgE level, and skin test results are negative.

Nasal Mastocytosis. This is a rare condition found mostly in adults and characterized by rhinorrhea and congestion without pruritus. There is an idiopathic increase in mucosal mast cell content from a normal value of 200 to 400 cells/cu mm to 2000 cells/cu mm. There are few eosinophils, skin test results are negative, and serum IgE levels are normal. This condition may have its onset with associated upper respiratory tract infection. Approximately 15 per cent of patients afflicted with nasal mastocytosis have a medical history of cluster headaches, and another 15 per cent have associated rhinitis with alcohol ingestion. The mast cell infiltrate results from unknown, nonspecific stimuli that attract mast cells and cause release of mediators that account for the symptoms of rhinorrhea and congestion.

Miscellaneous Causes of Nonallergic Rhinitis

Recumbency rhinitis is a nonspecific vasomotor congestion characterized by the dependent side of the nose becoming congested while sleeping on one's side. In patients with a laryngectomy or tracheostomy in which the nose is excluded from the air flow, a vasomotor reaction occurs, with the mucosa becoming congested and boggy.

Patient Evaluation

History

As in the evaluation of any other medical complaint, the workup for rhinitis begins with a detailed history. The chief complaint will be one of nasal obstruction, anterior or posterior nasal drainage, nasal irritation, sneezing, or a combination of all these symptoms. Symptoms of nasal itching and sneezing may be indicative of an allergy or eosinophilic nonallergic rhinitis. Intermittent nasal congestion and blockage may be due to the normal nasal cycle or to any of the conditions previously described. If the nasal congestion is constant, an anatomic obstruction such as nasal polyps or chronic end-stage hyperplastic rhinitis should be considered. If the obstruction is recent in onset and the patient has not undergone an operation to the nose or sustained an injury, the problem is probably due to mucosal disease.

The history should include the onset, frequency, duration, character, and severity of symptoms. Any precipitating factors, as well as response to any previous treatment, should also be documented.

The onset of symptoms may be in childhood, as an adult, after trauma or an upper respiratory tract infection, or following a move from one geographic location to another. The onset of symptoms early in life may indicate an allergic cause, whereas symptoms beginning in adulthood are more likely to be due to nonallergic rhinitis.

The symptoms may be seasonal or perennial, constant or episodic, and paroxysmal, acute (less than 10 days' duration), or chronic. The character of the nasal drainage, whether watery, mucoid, or purulent, may help distinguish between allergic, nonallergic, and infectious rhinitis.

The severity of the symptoms, the disability, and the social and economic impact should be noted and quantified if possible.

Any precipitating factors such as allergens, irritants, weather changes, and medications should be identified. These factors may be deduced by questioning the patient as to whether the symptoms occur indoors or outdoors, at home or at work, during a particular season, or in a specific geographic location. Obviously, a detailed drug history that includes prescription medications, over-the-counter preparations, alcohol, tobacco, and illicit drugs is necessary. Patients sensitive to aspirin may also experience similar symptoms with other nonsteroidal anti-inflammatory agents, as well as with dyes and preservatives such as tartarazine, sodium benzoate, and sulfur dioxide.

Associated symptoms should also be noted and would include hyposmia or anosmia, disturbed sleep, mouth breathing with associated dry mouth, snoring, fatigue, and irritability.

The efficacy or failure of previous treatment modalities, whether medical or surgical, should be documented and considered in establishing the diagnosis and planning any further treatment.

The medical history should include specific inquiry as to hypertension, diabetes, thyroid dysfunction, pregnancy, estrogen therapy and other endocrine abnormalities, and other conditions associated with autonomic nervous system abnormalities.

A detailed family history of asthma, rhinitis, hay fever, and atopic dermatitis should be noted.

The Physical Examination

A patient presenting with rhinitis requires a complete otolaryngologic head and neck examination as well as at least a cursory evaluation of the lower respiratory tract. The conjunctive should be inspected for infection or edema, the chest auscultated for wheezing, and the skin inspected for urticaria. The patient should be evaluated for the stigmata of hypothyroidism.

Before routine rhinoscopy, the external nose and caudal septum should be inspected for gross obstructing deformity. Gentle upward traction on the lower lateral cartilages may relieve

symptoms of obstruction caused by nasal valve collapse.

Rhinoscopy should be undertaken with a nasal speculum and brilliant illumination, both before and after vasoconstriction. Any secretions, particularly if directly visualized in the middle meatus, are evaluated as to the their character, and any obvious masses, either benign or malignant, are documented. The contour of the nasal septum and the patency of the nasal valve are assessed for possible contributions to symptoms of obstruction. The characteristics of the mucosa are noted. Pale, boggy, gray mucosa is seen in nonallergic rhinitis and hypothyroidism, whereas engorged, reddened mucosa may be seen in rhinitis medicamentosa. Thin, crusted mucosa is characteristic of atrophic rhinitis and may be associated with a foul odor (ozena). These changes may or may not be useful in diagnosing the cause. The size of the turbinates is evaluated both before and after vasoconstriction with 4 per cent cocaine solution or any other topical vasoconstrictor. Turbinate hypertrophy, significant enough to cause nasal obstruction and unresponsive to vasoconstrictive agents, may require surgical therapy. One must not forget that sarcoidosis may mimic chronic hyperplastic rhinitis.

Probably all patients with chronic rhinitis should undergo *paranasal sinus radiography.* Twenty per cent of patients with perennial rhinitis have mild mucosal changes, whereas another 20 per cent have dense clouding of the paranasal sinuses on x-ray evaluation. Ethmoidal clouding is a frequent finding. The mechanisms of paranasal mucosal changes include ostial blockage due to middle meatus mucosal edema, secondary sinus infection, or a similar reaction of the sinus mucosa to the cause of the nonallergic rhinitis. Obvious conditions primarily affecting the sinuses may cause secondary nasal mucosal changes.

The nasopharynx should be carefully evaluated to exclude the presence of obstructing masses, which may result in secondary rhinitis. In an adult this can be accomplished by indirect mirror examination or fiberoptic nasopharyngoscopy. In a child, a lateral x-ray of the nasopharynx may suffice.

The Laboratory Evaluation

The laboratory evaluation of a patient presenting with rhinitis is dependant on the history and physical findings. Nasal smears may be evaluated for eosinophils, mast cells, or neutrophils. A nasal mucosa biopsy and electron microscopy will be necessary for the diagnosis of immotile cilia syndrome or sarcoidosis.

When indicated, blood work for serum IgE levels, a total eosinophil count, thyroid hormone levels, glucose determinations, and drug levels should be performed. A sedimentation rate may be useful if occult infection is suspected as the underlying cause of the patient's symptoms.

Skin testing may be helpful if the history and physical findings are suggestive of an allergic cause.

The Treatment of Nonallergic Rhinitis

The treatment of nonallergic, noninfectious rhinitis may be either medical or surgical. As the causes of rhinitis can fall on a continuum between antigen-specific rhinitis and nonspecific, idiopathic, perennial vasomotor rhinitis, the treatment of rhinitis may be specific and directed to the etiologic agent or directed solely toward symptomatic control. Specific treatment modalities are best used in allergic rhinitis and include avoidance of the offending antigen, measures to clean the air, and immunotherapy. Likewise, nonallergic rhinitis may also be treated by avoidance of the offending irritants, hormones, and medications inducing the symptoms. Symptomatic treatment includes use of antihistamines, oral vasoconstrictors, anticholinergic agents, corticosteroid nasal sprays, and cromolyn sodium. It has been suggested by some that sleeping with the head of the bed elevated and regular exercise help minimize the symptoms.

Antihistamines

Antihistamines selectively block H1 receptors and suppress those symptoms mediated by histamine. The response of nonallergic rhinitis to antihistamines is variable and depends on the contribution of histamine to the symptoms, as well as on the chemical structure of the particular histamine. Antihistamines also exert an anticholinergic-like effect on rhinorrhea; however, non-histamine-mediated symptoms, such as nasal stuffiness, are not affected.

The side effects of antihistamines include drowsiness, dry mouth, irritability, and dizziness. In larger doses, delirium, hallucinations, ataxia, muscle twitching, fever, convulsions, and death have been reported. Little is known about the teratogenicity of antihistamines; however, brompheniramine and diphenhydramine have been associated with congenital malformations. Antihistamines interact with medications producing drowsiness, as well as with anticholinergic agents such as the tricyclic antidepressants.

There is little correlation between the wheal suppression and the half-life of antihistamines; hence, dosing of antihistamines remains empiric.

Sympathomimetic Agents

Sympathomimetic agents stimulate alpha-adrenergic receptors, constrict vessels, decongest mucous membranes, and provide an overall decrease in nasal airway resistance. They are also felt to increase cyclic adenosine monophosphate (cAMP) and inhibit release of mediators.

Sympathomimetic agents such as pseudoephedrine and phenylpropranolamine are given orally and are the first-line drugs used for symptoms of nasal congestion. Side effects caused by oral sympathomimetic drugs include nervousness, insomnia, irritability, and difficulty urinating in elderly men. No effect on blood pressure is noted in normotensive individuals; however, an increase in diastolic blood pressure in patients with labile or overt hypertension or in individuals taking monoamine oxidase (MAO) inhibitors may be noted.

For control of the multiple symptoms of rhinitis, including obstruction, rhinorrhea, sneezing, and pruritus, combination antihistamine-sympathomimetic preparations are available. The strength of these preparations are fixed; therefore, the physician may need to alter the dosage schedule to obtain optimal benefit.

Topical sympathomimetic agents include phenylephrine and oxymetazoline. These agents have a marked short-term effect followed by rebound congestion and rhinitis medicamentosa after prolonged use. Therefore, these agents should be used only sparingly and for short periods in acute situations requiring rapid mucosal decongestion (ie acute sinusitis).

Anticholinergic Agents

Anticholinergic drugs such as propantheline and belladonna may be effective in reducing the rhinorrhea of vasomotor rhinitis. These drugs have not found widespread clinical use in the treatment of rhinitis, and at any rate should be avoided in patients with tachyarrhythmias, obstructive uropathy, and narrow-angle glaucoma. However, studies comparing glucocorticoids with anticholinergic agents in the treatment of nonallergic perennial rhinitis have found no significant decrease in severity of symptoms when anticholinergic agents were used. As noted, secretions are controlled by other mediators in addition to acetylcholine; hence anticholinergic agents should not be expected to be as effective in controlling the symptoms of rhinitis.

Topical Steroids

Topical steroids suppress the local inflammatory response caused by the release of vasoactive mediators. Steroids also reduce the sensitivity of irritant receptors (thus diminishing the sneeze response), reduce the reactivity of acetylcholine receptors with some decrease in rhinorrhea, and decrease the total basophil and eosinophil counts. There is also experimental evidence to show in vitro inhibition of mediator release, a phenomenon previously not attributed to topical steroids.

The topical steroid preparations in common use are beclomethasone dipropionate and flunisolide. Both medications are delivered in a propylene glycol carrier via a mechanical pump, thus avoiding use of fluorocarbon aerosol (Freon)-propelled sprays. Neither flunisolide nor beclomethasone inhibits the hypothalamic-pituitary-adrenal axis at recommended doses. However, reports of adrenal suppression at increased doses of flunisolide have been noted.

Both beclomethasone and flunisolide have been shown to cause a significant improvement in the symptoms of rhinitis when compared with placebo. The symptoms of congestion are particularly affected, both subjectively and objectively, with a documented decrease in nasal airway resistance. Nasal steroids are effective in allergic as well as in nonallergic rhinitis, including vasomotor rhinitis and nasal polyposis. When used for vasomotor rhinitis, the primary benefit is relief of nasal obstruction rather than rhinorrhea and postnasal drainage. In particularly severe cases of nasal obstruction or polyposis, a short course of oral steroids may be necessary to provide initial decongestion or shrinkage of the polyps, which can then be maintained with

subsequent use of the topical steroids.

Side effects of topical steroids include mucosal edema, mild erythema, burning, drying, epistaxis, and occasionally a stinging sensation upon application. Development of subsequent candidiasis with prolonged use of nasal steroids has not been a problem. A relatively new topical steroid, fluocortin butyl, has recently been evaluated in a multicenter double-blind placebo-controlled study for both allergic and nonallergic rhinitis. This medication is breath-activated and is delivered as an odorless, tasteless powder in a lactose carrier. There is a significant reduction in symptoms and use of concomitant medication versus placebo, with relatively few side effects.

Cromolyn Sodium

Cromolyn sodium prevents mast cell degranulation and inhibits the release of histamine. This medication may be of some benefit in IgE-mediated allergic rhinitis; however, no benefit over oral antihistamines alone has been shown for the nonallergic types of rhinitis. A recent evaluation of 4 per cent cromolyn sodium in eosinophilic nonallergic rhinitis revealed no significant difference between cromolyn sodium and placebo in the control of symptoms.

Surgical Management of Nonallergic Rhinitis

The surgical management of nonallergic rhinitis involves the correction of any anatomic abnormalities including the removal of tumors and polyps and the surgical debulking of chronic turbinate hypertrophy. Often, a combination of abnormalities necessitates a combination of procedures to afford relief.

Anatomic abnormalities usually include bony and cartilaginous deformities of the septum, external nose, and nasal valve area. Various septorhinoplastic techniques have been popularized to restore a normal nasal airway. One must remember that not every deviated septum requires surgical correction; only if it is felt to be contributing to the nasal obstruction should this procedure be performed. As noted, a wide variety of benign, malignant, and granulomatous processes may also affect the nasal cavity and mimic the symptoms of rhinitis. Therapy for there lesions ranges from simple biopsy for diagnosis to radical ablative surgery for removal of malignant neoplasms.

Nasal polyps, if small, may be managed successfully with topical steroids. Those polyps refractory to this management, or large multiple polyps, should be removed surgically via an intranasal route or via the sinuses if necessary. The sinus route should also be used if polyps recur after intranasal extraction. The use of topical steroid therapy after surgical removal should prevent their recurrence.

Vasomotor rhinitis refractory to conservative therapy, even if the mucosa has not undergone chronic hyperplastic change, may be managed by cryosurgery or submucous diathermy to the turbinates or even vidian neurectomy. Cryosurgery to the turbinates has been described as effective in treating vasomotor rhinitis with nasal obstruction but is less effective for excessive

rhinorrhea. Vidian neurectomy provides only short-term relief for rhinorrhea and sneezing of vasomotor rhinitis and is not very useful for the nasal obstruction. It is not commonly performed any longer.

Chronic turbinate hypertrophy that is unresponsive to medical management is a late sequela of rhinitis of whatever cause. Diagnosis of this condition is characterized by a failure of the turbinates to shrink after application of topical vasoconstrictors. This end stage, chronic hypertrophic rhinitis may be managed by a number of surgical techniques, including intraturbinate steroid injection, turbinate out-fracture, cauterization, cryosurgery, laser vaporization, submucous resection of the conchal bone, partial inferior turbinate resection, and total inferior turbinectomy. Surgery is considered only after failure of an adequate trial of medical management, as already discussed. The middle turbinates are not usually the cause of airway obstruction, but if felt to be the problem, they can be easily outfractured, or if particularly prominent, they can be crushed. Middle turbinectomy in our experience is frequently complicated by prolonged postoperative crusting until the area heals. In general, it is the inferior turbinates that warrant the surgical attention.

Intraturbinate steroid injection using triamcinolone acetonide is accomplished by injecting 0.5 mL submucosally into the anterior tip of the inferior turbinate, gently to minimize the described rare complication of blindness resulting from retinal vasospasm or embolization. Although many patients are delighted with the results, others do not obtain long-term relief of symptoms.

Turbinate outfracture is usually not very successful, as at best a "greenstick fracture" is created and the turbinate gradually drifts back into its original position. Surface cautery using silver nitrate or an electric current usually affects only the mucosa, sparing the submucosa and, therefore, is likewise not very effective for true hyperplastic rhinitis. Surface cryosurgery, in contrast, will cause not only mucosal but also submucosal necrosis. This is quite successful, but there is significant prolonged postoperative nasal congestion, and the eschar takes a long time to separate. Damage to the adjacent nasal septum may be difficult to avoid.

Submucosal resection of the inferior turbinate has been proposed by many authors as the most ideal method of debulking the inferior turbinate. Technically, however, this is quite difficult, and it frequently results in significant bleeding and a floppy residual inferior turbinate that does not give the desired result in relieving airway obstruction.

Submucosal diathermy along the length of the turbinate may be very successful provided that the obstruction is not predominantly caused by bony enlargement. It also avoids the crusting seen with surface cautery. Necrosis of the underlying bone has been described as a complication.

Rhinomanometric data have implicated the anterior end of the inferior turbinate as the major site of obstruction owing to its proximity to the nasal valve, and excellent improvement has been reported following removal of just the anterior half of the turbinate. It has, however, been our experience that the obstruction is frequently due to a hyperplastic posterior segment

obstructing posterior choanae, which would fail to be resolved by this technique. A subtotal turbinectomy, which essentially consists of removing the inferior turbinate along its entire length, has, in our hands, proved an excellent method of achieving relief of nasal congestion caused by turbinate hypertrophy. It is technically simple, with excellent results being reported by many authors. Complications include significant hemorrhage and crusting, particularly when performed in dry climates. In general, rhinitis sicca and atrophic rhinitis have not proven to be a problem, even after many years.

The technique consists of initially infracturing the turbinates and applying a straight hemostat (Kelly clamp) along the length of the turbinate just medial to its attachment to the lateral wall. After waiting approximately 1 minute, the clamp is removed, and the turbinectomy is performed by cutting along the tissue crushed by the clamp. A suction cautery is then used to cauterize the stump of tissue remaining for hemostasis as indicated. The packing is removed the following day, and the eschar usually spontaneously becomes dislodged after approximately 10 days.