INTRODUCTION

Allergic rhinitis (AR) is a prevalent, chronic condition, and patients with this condition often self-medicate. For these reasons, and because a pharmacist may be the first healthcare professional that a patient consults, pharmacists must have a thorough understanding of the pathophysiology and treatment of this disease.

PREVALENCE

The prevalence of AR is increasing in developed countries. Based on a study of almost 500,000 children aged 13 to 14 in over 155 centres in 56 countries, Canada has one of the highest rates of AR in the world, approaching 30%. Prevalence is highest in adolescence and young adulthood. On average, onset is prior to adolescence, and incidence decreases with age. The costs associated with AR are high, accounting for at least $1.8 billion annually in the U.S. in direct costs (physician visits and medication expenses). The indirect costs associated with absence from work and school and impaired performance are high as AR is common in individuals in the workforce and in children.

PATHOPHYSIOLOGY

AR is an immunologic response initiated by exposure to inhalant allergens and mediated by immunoglobulin (IgE). Once the allergen is introduced to the body, it is engulfed by antigen-presenting cells (macrophages, dendritic cells, Langerhans cells, B-lymphocytes) and broken down within their phagolysosomes. The resulting allergen peptides associate with the molecules of the major histocompatibility complex and move to the surface of the cell where they are recognized by T-helper (TH) cells. The TH cells, particularly the TH2, release cytokines including interleukin-4 (IL-4), which results in isotype switching of B-lymphocytes to produce specific IgE. These IgE molecules attach to numerous cells, notably mast cells in the nasal mucosa and circulating basophils. The individual is now sensitized to the allergen. When there is further exposure to allergen, it is recognized by the IgE receptors on mast cells or basophils and cross-linkage of adjacent IgE occurs, leading to the immediate release of mediators such as histamine and leukotrienes, prostaglandins, tryptase and others. The actions of these mediators on nerves, mucous glands, and blood vessels produce the early-phase response characteristic of AR: sneezing, itching, rhinorrhea, and nasal congestion. In addition to this early-phase response that occurs within minutes of allergen exposure and fades within one hour, up to one-half of AR sufferers experience symptoms, particularly nasal congestion, three to 12 hours later without additional allergen exposure. This late response is caused by an infiltration of inflammatory cells (e.g. eosinophils, basophils, TH2 cells) which sets up chronic inflammation of the nasal tissues and exacerbates the reaction of the nasal
mucosa to further allergen exposure (priming) and to non-allergic/irritant stimuli, such as smoke, strong odours and air pollutants.3-5

AR can have a substantial negative impact on quality of life and is associated with other medical conditions.7 Chronic nasal obstruction in children can have serious consequences, such as excessive mouth breathing, which may cause facial abnormalities.3 A number of individuals with AR may also have asthma (21 to 58%). AR is common in those with asthma (28 to 92%).7,10 and there is evidence that individuals with AR are more likely to develop asthma.1 Theoretically, adequate treatment of AR should decrease the chance of progression to asthma, but this has not yet been proven.1 However, studies have shown that treating AR improves asthma symptom control and decreases health-care visits for asthma.6,11 AR is also associated with sinusitis and otitis media. Therefore, adequate treatment of AR may reduce the frequency of these conditions in atopic individuals.17

DIAGNOSIS

Family history of atopy (hereditary tendency to be sensitive to certain allergens) is the most important risk factor for AR.1 Diagnosis is based mainly on clinical history, confirmed by skin tests or radioallergosorbent tests to detect the presence of allergen-specific IgE in serum.2 Apart from sneezing, itching, rhinorhea, and nasal congestion, patients may describe symptoms such as weakness, malaise, irritability, and decreased appetite.2 Signs include the “allergic shiner”, a darkening of the lower eyelid caused by suborbital edema; the Dennie-Morgan line with linear folds or lines in the lower eyelid of children secondary to edema occurring in this area; the “allergic salute”, the upward rubbing of the nose with the palm of the hand; and the resulting “allergic crease”, a transverse skin line below the bridge of the nose caused by constant rubbing.1

Traditionally AR has been classified as either seasonal (hay fever) or perennial,1 with perennial AR defined as nasal symptoms for more than two hours a day for more than nine months of the year. The majority of patients exhibit seasonal AR,1 but medical costs, associated co-morbid diseases and use of concomitant medications are higher in those with perennial AR.18

Notably there is much variation between patients in the pattern of symptoms and there has been a move to change the terminology to intermittent versus persistent AR.11 Intermittent AR is defined as symptoms present for less than four days a week or for less than four weeks with “persistent AR” defined as symptoms present for more than four days per week and for more than four weeks.

PREVENTIVE MEASURES

A meta-analysis of six prospective studies concluded that exclusive breastfeeding during the infant’s first three months of life helps prevent AR regardless of whether there is a family history of atopy or not.20 Reducing exposure to perennial allergens such as animal dander, mould, and house-dust mites in the home environment may reduce a child’s likelihood of developing AR. Once an individual is diagnosed with AR, reducing contact with known allergens is certainly important. Mould is less likely in homes where the humidity is kept low and condensation is avoided.12,13 Some measures to reduce dust mites include weekly vacuuming and washing bedding in hot water (>130°F), removing stuffed animals from the bed, and covering mattresses and pillows with impermeable covers.11 For those with seasonal AR, minimizing time spent outdoors on windy days or on days when the pollen count is high, and showering after spending time outdoors may be helpful.11 These individuals should not wear clothing or use bedding that has been dried outside.

TREATMENT

The Allergic Rhinitis and Its Impact on Asthma (ARIA)—World Health Organization (WHO) initiative classifies AR symptoms as mild and moderate-severe.11 The guidelines are summarized in Table 1. Patients who do not experience improvement after two to four weeks should be assessed for medication compliance, heavy persistent allergen exposure, and accuracy of diagnosis.11 The Patient Self-Care textbook provides a useful flow chart for assessment and initial treatment of patients with AR.11

Prevention of bronchial hyper-reactivity in patients with asthma and AR has been demonstrated subsequent to treatment with intranasal corticosteroids, intranasal Cromolyn sodium, oral antihistamines (cetirizine, loratra-
Oral Antihistamines

Oral antihistamines remain a first-line treatment for AR. They block the H1 receptor, inhibiting numerous pathways that contribute to inflammatory cell recruitment and accumulation. They effectively ameliorate the classic symptoms of sneezing, itching, rhinorrhea, and conjunctivitis. Generally, nasal congestion does not respond well to antihistamine treatment.

The newer second-generation antihistamines (e.g. cetirizine, fexofenadine, loratadine) and third-generation (desloratadine) antihistamines have not been shown to be more effective than first-generation antihistamines (e.g. chlorpheniramine, clemastine), with the possible exception of desloratadine for nasal congestion. However, because of their greater specificity for the H1 receptor, they have fewer anticholinergic effects, and therefore less potential for drug-disease interactions (e.g. aggravation of glaucoma). This group does not cross the blood-brain barrier so drowsiness is less of an issue and there is less potential for additive interactions with other medications that cause sedation. The pharmacist must be sensitive to the fact that AR can have an immense impact on a patient’s health-related quality of life (HRQL). Several trials have demonstrated quality-of-life benefits of some second-generation oral antihistamines when used to treat AR in adults. Two randomised, double-blind placebo-controlled studies in adults with seasonal AR have demonstrated significant improvements in HRQL with cetirizine 10 mg once daily versus placebo. Fexofenadine (120 mg or 180 mg) was also shown to be significantly better than both placebo and loratadine (10 mg) in randomised, double-blind, placebo-controlled trials over two weeks. It should be noted that the absorption of fexofenadine is decreased by co-administration with aluminum or magnesium and dosage must be modified in renal impairment. Although two second-generation antihistamines (terfenadine, astemizole) were removed from the Canadian market because of the propensity to cause prolongation of the QTc interval, currently marketed second-generation antihistamines do not appear to have this risk. Antihistamine therapy should be initiated prior to the allergen season for seasonal/intermittent AR so histamine blockade is in place before exposure to allergen and symptoms have developed and taken regularly during that time. Dosage information and adverse effect profiles of the antihistamines available in Canada (except for desloratadine) are summarized in the textbook, Patient Self-Care.

Topical Antihistamines

Levocabastine is a potent and selective anti-histamine and currently the only ophthalmic or nasal spray antihistamine formulation available in Canada. Levocabastine nasal spray or ophthalmic drops would not generally be used first-line except for mild persistent AR with symptoms limited to either the eye or nose. The tolerability of intranasal levocabastine is similar to that of sodium cromoglycate. The most common adverse effects associated with intranasal levocabastine include headache (4%), nasal irritation (3%), somnolence (3%), and fatigue (2%). The only adverse effects that were noted more commonly with levocabastine ophthalmic drops compared to placebo were eye irritation (16.4% vs 15.8%) and tiredness (2% vs 1.4%).

Oral Decongestants

Pseudoephedrine is available as a single entity product, in combination with an antihistamine, and/or a pain reliever. It is suitable add-on therapy to antihistamines as it helps alleviate nasal congestion for which antihistamines are generally not effective. Phenylephrine is available in combination products. These drugs are sympathomimetic amines, and should be used with caution in people with high blood pressure, cardiac or thyroid disease, diabetes, glaucoma, or prostatic hypertrophy. Dosage information and common adverse effects are listed in Patient Self-Care. Patients taking non-selective monoamine oxidase inhibitors should avoid taking oral decongestants because of the potential for increased pressor effect that can result in severe hypertension, hyperpyrexia, seizures, arrhythmias and death.

Topical Decongestants

Topical decongestants (xylometazoline, oxymetazoline, naphazoline and phenylephrine are available in Canada), can provide short-term relief of nasal congestion but should not be used for more than five to 10 consecutive days to avoid developing rhinitis medicamentosa, characterized by rebound congestion, nasal hyper-reactivity, tolerance and histologic changes of the nasal mucosa. If a patient has developed rhinitis medicamentosa, characterized by rebound congestion, nasal hyper-reactivity, tolerance and histologic changes of the nasal mucosa, treatment with nasal corticosteroids has been shown to be effective. Individuals who have experienced rhinitis medicamentosa in the past should be particularly careful when using topical decongestants again as rebound
Intranasal Corticosteroids

Intranasal corticosteroids are the most effective medications for treating AR and are recommended first-line treatment for moderate-severe AR and/or persistent symptoms. They inhibit the release of mediators from basophils and the influx of eosinophils and other inflammatory cells and are effective for all the symptoms of allergic inflammation.

There are currently six intranasal corticosteroids marketed in Canada: budesonide, fluticasone, flunisolide, beclomethasone, mometasone and triamcinolone. No therapeutic advantage has been shown for one product over another when administered at equivalent dosages in adults, although patients may prefer one formulation over another or a once-daily versus twice-daily dosing schedule. Cost may also be a factor in patient choice. Interestingly, combination of intranasal corticosteroid with oral antihistamine has not been shown to be more effective than intranasal corticosteroid therapy alone.

In counselling, it should be emphasized to patients that this is not a relieving medication. While some patients may experience symptom relief within 12 hours, the maximal effect may not be achieved until after several days to weeks of regular use because these agents prevent the release and recruitment rather than block the effect of inflammatory mediators. The American Academy of Otolaryngology - Head and Neck Surgery Foundation published a review of the techniques of intranasal steroid use. Because no convincing evidence emerged regarding whether any particular technique provided maximal efficacy or safety, the panel recommended a seven-step standard technique. Hold head in an upright neutral position. Clear nose of any thick or excessive mucus. Insert spray nozzle into the nostril. Direct the spray away from the septum and toward the outer portion of the eye or the top of the ear on that side. (If possible, use the right hand to spray the left nostril and left hand to spray the right nostril, to direct the spray away from the septum.) Activate the device as recommend-
ed by the manufacturer and with the number of sprays recommended by the doctor. Gently breathe in or sniff during the spraying. Breathe out through the nose.

Intranasal corticosteroids are well tolerated. Local adverse effects include sneezing and irritation of the nose and throat. Crusting, transient dryness and minor epistaxis are also possible. The greatest concern with intranasal corticosteroid use is the possible effect on the hypothalamic-pituitary-adrenal axis and growth in children. Overall, the published clinical and pharmacokinetic literature indicates that “intranasal corticosteroids are unlikely to cause any significant suppression of the HPA axis when administered short-term (<1 year) at the recommended therapeutic dosage.” Reassuringly, adding intranasal corticosteroids to inhaled corticosteroid treatment does not appear to increase suppression of the HPA axis. In prospective studies with standard doses of mometasone and fluticasone propionate, no inhibitory effect on growth in children was shown.

Sodium Cromoglycate

Sodium cromoglycate stabilizes mast cells and prevents degranulation and release of histamine and other mediators. It has no effect on basophils nor any effect against histamine that has already been released so is most effective if administered prior to the development of symptoms. It can be administered intranasally or intraocularly for AR. It has poor systemic absorption, therefore the adverse-effect profile is mainly comprised of local reactions such as nasal stinging or burning, sneezing and local irritation for the intranasal preparation and transient stinging and burning for the ophthalmic preparation. The ophthalmic preparation primarily targets ocular symptoms, whereas the intranasal preparation has some impact on sneezing, rhinorrhea, nasal obstruction and nasal itch. One of the drawbacks of sodium cromoglycate is that it needs to be administered four times a day. Contact lenses should not be worn when using the ophthalmic preparation.

Ipratropium Bromide

Administered intranasally, this anticholinergic agent can be effective for reducing watery rhinorrhea in AR because histamine- and antigen-induced submucosal secretion is cholinergically mediated. Ipratropium has minimal systemic absorption. Associated adverse effects include mild and transient epistaxis, local irritation and nasal dryness.

Leukotriene Antagonists

Leukotriene antagonists (i.e. montelukast, zafirlukast) would appear to be logical choices for the treatment of AR because leukotrienes are implicated in causing congestion and rhinorrhea. However, a review of current literature by Nathan concluded that these agents are “sometimes more effective than placebo; no more effective than nonsedating antihistamines; and less effective than intranasal corticosteroids in the treatment of allergic rhinitis.” Moreover, the combination of a leukotriene antagonist and an antihistamine has not been shown to be better than monotherapy with either agent.

Leukotriene antagonists have a low incidence of adverse effects, with headache being the most common, but with a similar incidence as that reported with placebo.

Anti-IgE Antibody

Because IgE initiates the inflammatory processes underlying AR, it is a prime target for drug therapy. Omalizumab is a recombinant, humanized murine anti-IgE antibody that binds to circulating IgE. It is administered subcutaneously once every three to four weeks for four months and has demonstrated efficacy and good tolerability in seasonal and perennial AR, with rates of adverse events similar to placebo injection. It is currently undergoing phase II clinical trials for AR in Canada.

Immunotherapy

The three clinical indications for immunotherapy are: IgE-mediated rhinoconjunctivitis, allergic asthma and severe anaphylactic reactions to bee stings. Immunotherapy can also be considered when allergen avoidance...
and pharmacologic treatment is unsuccessful. Immunotherapy involves the administration of gradually increasing quantities of an extract of a specific allergen in order to desensitize the allergic individual over a period of years. Immunotherapy down-regulates the allergic phenotype and may reduce the progression of rhinitis to asthma.1 Injection therapy has several drawbacks, notably the potential for local and systemic reactions including anaphylaxis. Results with sublingual immunotherapy have been encouraging. A Cochrane review of sublingual immunotherapy for AR concluded that it is a safe treatment that significantly reduces symptoms and need for pharmacotherapy compared to placebo.6

Alternative Therapy
It is helpful to have reliable sources of information to consult in order to answer questions from patients or other healthcare professionals about the putative efficacy of an alternative therapy. The Natural Medicines Database6 is extensive, well-organized, referenced, and user-friendly.

Butterbur (Petasites hybridus) is one herbal preparation that is being touted for AR.47 Importantly, butterbur should not be used by women who are pregnant or breastfeeding, and it is not recommended in children.47

SPECIAL POPULATIONS
AR in Pregnancy
Approximately one-third of women with AR will experience increased symptoms during pregnancy.44 The possibility of vasomotor rhinitis, related to increased estrogen and progesterone levels can make the diagnosis more complicated.44 Allergen avoidance should be attempted. If possible, drug treatment should be reserved until after the first trimester when major organ formation in the fetus is complete. Nasal saline spray and elevating the head of the bed may be helpful. There are differing opinions regarding the safety of intranasal decongestants. Demoly et al. recommend avoiding intranasal decongestants even after the first trimester because data is lacking.44 In contrast, Blass states that non-prescription nasal sprays such as oxymetazoline can be recommended for occasional use.44 Oral decongestants, except for pseudoephedrine, have demonstrated teratogenicity in animals and should be avoided in pregnancy.45,46 Because oral pseudoephedrine taken during the first trimester has been associated with a rare condition, infant gastrochisis, it should not be used during the first trimester.49 Intranasal sodium cromoglycate can be used as first-line treatment for AR in pregnancy. It has minimal systemic absorption and has not been associated with a risk of congenital malformations. Because they have been in use longer, first-generation antihistamines rated Federal Drug Administration category B are recommended over second-generation antihistamines. However, cetirizine or loratadine, both of which are currently rated category B, can be used for those who do not tolerate or do not respond to the recommended first-generation agents.49,50 Intranasal corticosteroids are an option. Corticosteroids are teratogenic in animals and systemic corticosteroids are known to increase risk of abnormalities in humans.46 However, inhaled corticosteroids (rated category C except budesonide which is category B) are used by pregnant women with asthma and have not been implicated in causing abnormalities. Intranasal fluticasone propionate has been shown to be effective for treating vasomotor rhinitis over an eight-week period; no adverse effects were noted in the offspring.51 Intranasal ipratropium has poor systemic absorption and may be used for symptoms of rhinorrhea.48 Although there is consensus that specific immunotherapy should not be initiated during pregnancy, women may continue with a regimen that was begun prior to pregnancy.48,52 Herbal medicines should not be taken due to insufficient efficacy and safety data.

Although the data are limited for some drugs, none of the medications used to treat AR would appear to be incompatible with breastfeeding. In light of the likely protective effect of breastfeeding for preventing AR, it may be particularly important for women with AR to breastfeed. Because of the low systemic bioavailability of corticosteroids administered intranasally, little if any drug is excreted into breast milk.45 Although pseudoephedrine is excreted in breast milk, the American Academy of Pediatrics considers oral pseudoephedrine to be compatible with breastfeeding.53 Similarly oral antihistamines are excreted in breast milk but are considered to be compatible with breastfeeding;50 non-sedating agents would be preferable to sedating agents to minimize any possible adverse effects in the infant.

AR in Children
Children do not generally exhibit seasonal allergies until after the age of two or three because it takes at least two seasons of exposure to induce sensitivity. Allergen control measures should be strongly encouraged (see Preventive Measures). Newer generation antihistamines, loratadine and cetirizine, are available in liquid form and are appropriate first-line treatment. Intranasal corticosteroids have a very benign adverse effect profile in children, but compliance may be an issue because of the frequent dosage schedule. Some intranasal corticosteroids are approved for use in children as young as three years and have good efficacy. As discussed above, the risk of systemic effects is low.

AR in the Elderly (>65 Years)
Because elderly patients are at increased risk of drug-drug and drug-disease interactions, second-generation antihistamines are preferred over first-generation antihistamines. Kidney function decreases with age, therefore the dosage of agents that are eliminated renally, such as fexofenadine,54 may need to be adjusted. Intranasal ipratropium can be useful for rhinorrhea in elderly individuals and has a low risk of interactions with other drugs.55 However, individuals with or predisposed to glaucoma (the prevalence of which increases with age), must take care that the spray does not come into contact with the eyes as there are isolated reports of aerosolized ipratropium causing ocular complications.43

ROLE OF THE PHARMACIST
Patients often feel frustrated until the optimal regimen for symptom control is found.
Ensuring that the patient understands the purpose of each medication, correct administration, and possible adverse effects will contribute to achieving this goal. Preventive measures should be encouraged. There are, several useful websites to which patients can be directed (http://www.aaaai.org/patients/resources/fastfacts/rhinitis.htm and http://www.lung.ca/asthma/allergies/)

Pharmacists are also an information resource for patients and health-care professionals regarding alternative therapy and treatment options mentioned in the media.

SUMMARY
AR is a common, chronic condition affecting both children and adults. Antihistamines continue to be the foundation of pharmacotherapy; intranasal corticosteroids are also first-line treatment. Decongestants are often useful add-on therapy. Leukotriene antagonists are another treatment option and anti-IgE antibody treatment is undergoing clinical investigation. Immunotherapy is useful in individuals who have a single allergy for which pharmacologic treatment has not been effective. Pharmacists have a role to play in educating patients about the disease, ensuring correct use of non-prescription and prescription pharmacotherapy, and providing information on alternative therapy and new treatment options.

REFERENCES
42. Merck Frosst. Singulair® (montelukast sodium) product monograph.

1. A local mothers’ group has invited you to do a presentation. You select allergic rhinitis (AR) as your topic because this condition is common in children and young adults.
What has been identified as a risk factor for a child developing AR?
a) Parental history of smoking
b) Parental history of AR/atopy
c) <32 weeks gestation at birth
d) >3 siblings
2. These are all valid reasons for early diagnosis and appropriate treatment of AR in children EXCEPT
a) improving quality of life.
b) decreasing the incidence of the common cold.
c) decreasing the chance of developing facial abnormalities.
d) decreasing the likelihood of developing asthma.
3. The late-phase response in AR:
a) occurs in up to 50% of those with the condition
b) is manifested primarily by a recurrence of sneezing
c) is noted one hour after the early-phase response
d) does not occur in immunoglobulin(Ig) A-deficient individuals.
4. A.N., a 28-year-old landscaper, consults you for help regarding his allergies, which typically flare up in Spring. In the past he has used topical decongestants and experienced what sounds like rhinitis medicamentosa. He takes no other medication, smokes one package of cigarettes daily, and has no other medical conditions. Which statement is TRUE?
a) If untreated, his seasonal (intermittent) AR may progress to perennial (persistent) AR.
b) His allergic symptoms will likely become more severe as he gets older.
c) He will likely have a higher tolerance to developing rhinitis medicamentosa from topical decongestants having experienced it before.
d) He should wear goggles or sunglasses while working and shower at the end of each day to lessen allergen exposure.
e) All of the above.
5. A.N. begins taking loratadine 10 mg daily and returns for a smoking cessation appointment. Issues to consider include:
a) any form of nicotine replacement therapy reduces the blood levels of loratadine.
b) his allergic symptoms may worsen as his sense of smell improves after quitting smoking
c) some individuals who do very physical work find that the nicotine patch does not adhere well.
d) nicotine replacement therapy is contraindicated for use in anyone with a concomitant medical condition.
6. A. N. read a newspaper article about a new treatment – omalizumab – for AR that only needs to be given every three to four weeks. What is the mechanism of action of this agent?
a) Blunting the effects of cytokines.
b) Increasing the ratio of TH1 to TH2.
c) Inhibition of phosphodiesterase.
d) Acting as an antibody against IgE and binding to it in the circulation.
7. B. G. is a 35-year-old who has been experiencing very itchy eyes and some sneezing for the past two months. Upon questioning her you learn that three months ago she brought her mother’s cat to live with them because her mother is currently too ill to care for it. B.G. takes no medication, has no other medical conditions, and does not smoke. Other information that would be most relevant to learn before making any recommendations would be:
a) whether the cat is short- or long-haired.
b) B.G.’s diet
c) whether or not B.G. wears contacts
d) all of the above

8. B.G. begins taking fexofenadine 120 mg daily and restricts the cat to a non-carpeted room far from her bedroom and has some improvement in symptoms. However, she subsequently experiences 2 episodes of coughing and chest tightness. Her peak flow measured in the pharmacy is 70% of expected so you refer her to her doctor. The most likely scenario is:
   a) She is not actually allergic to cats.
   b) The symptoms suggestive of asthma are unrelated to the allergy.
   c) The allergy has led to the development of asthma.
   d) B.G. is experiencing anxiety because of her mother’s illness.

d) The patient should breathe out through the mouth after administering a dose.

12. J.W. is wondering whether she can take any medication for AR when she is breastfeeding. You respond that:
   a) All the medications used to treat AR appear to be compatible with breastfeeding.
   b) A sedating antihistamine may be preferred because of its shorter duration of action compared to a non-sedating antihistamine.
   c) Atopic women should not breastfeed because IgE is transferred to breastmilk, inducing allergy in the infant.
   d) Antihistamines decrease milk production.

13. C.M., an 80-year-old with rheumatoid arthritis and hypertension controlled with ASA. He is currently receiving inhaled fluticasone 500 mcg twice daily and intranasal budesonide one spray into each nostril twice daily. He mentions that he still experiences nasal congestion and presents a prescription for montelukast 10 mg daily from an ear, nose and throat specialist. Which of the following is TRUE of montelukast?
   a) It is rational therapy in someone with concomitant asthma, AR and ASA allergy.
   b) It is prescribed at a lower dosage for AR than for asthma.
   c) It has a well-defined role as second-line therapy in persistent AR.
   d) All of the above

14. A mother presents a prescription for intranasal sodium cromoglycate for her five-year-old daughter, N.M. How would you counsel the mother on this medication?
   a) It can cause drowsiness, so observe her performance at kindergarten.
   b) It commonly causes nose bleeds.
   c) It commonly causes nasal stinging.
   d) It commonly causes dry mouth; sugarless gum or ice chips may offset this adverse effect.

15. After two weeks, N.M. still has troubling symptoms. Possible reasons for this include all of the following EXCEPT
   a) poor compliance with the frequent dosing schedule.
   b) sodium cromoglycate is ineffective in this age group.
   c) initiation of the drug after the pollen season has begun.
   d) excessive pollen exposure.

16. N.M.’s physician prescribes intranasal mometasone. Her mother is reluctant to fill the prescription because she has heard that steroids stunt growth. What is your response?
   a) Intranasal mometasone is less effective than some other intranasal corticosteroids.
   b) Intranasal mometasone should be avoided in case her child requires inhaled corticosteroid treatment for asthma in the future.
   c) Immunotherapy would be a simpler option.
   d) At dosages recommended by the manufacturer, intranasal mometasone has not been shown to affect children’s growth.

17. D.V. is a 32-year-old lawyer with asthma and persistent AR. He is allergic to ASA. He is currently receiving inhaled fluticasone 500 mcg twice daily and intranasal budesonide one spray into each nostril twice daily. He mentions that he still experiences nasal congestion and presents a prescription for montelukast 10 mg daily from an ear, nose and throat specialist. Which of the following is TRUE of montelukast?
   a) It is rational therapy in someone with concomitant asthma, AR and ASA allergy.
   b) It is prescribed at a lower dosage for AR than for asthma.
   c) It has a well-defined role as second-line therapy in persistent AR.
   d) All of the above

18. You counsel D.V. that montelukast:
   a) should be taken on an empty stomach.
   b) commonly causes sedation.
   c) is unlikely to interact with his current medications.
   d) none of the above

19. Levocabastine ophthalmic drops are most appropriate to treat AR when used
   a) in children.
   b) with predominantly ocular symptoms.
   c) in elderly patients.
   d) where severe nasal congestion precludes intranasal administration.

20. Which combination has proven benefits over monotherapy with either agent alone?
   a) Non-sedating antihistamine + intranasal corticosteroid
   b) Non-sedating antihistamine + oral decongestant
   c) Oral decongestant + topical decongestant
   d) Antihistamine + leukotriene antagonist
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