

Exercise-Induced Asthma: The “Silent Asthma”

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Abstract:

Exercise-induced asthma produces discomfort and anxiety and frequently limits normal activity in children. New knowledge about exercise-induced asthma can be used by nurses to identify undiagnosed children and to control the undesirable effects produced by exercise. Normal growth and development are fostered by an individualized program that promotes the child's involvement without unduly stimulating attacks. A review of the literature concerning exercise-induced asthma is presented along with a description of assessment, management, and teaching.

Article:

Exercise is important for physical health and emotional well-being of children. Failure to be a participant in physical activity can lead to poor physical condition and to feelings of failure and low self-esteem. Children manifesting signs and symptoms of exercise-induced asthma (ETA) become short of breath after exercise from normal play and often limit activity without reporting respiratory discomforts to care givers. Although attacks of EIA are not generally life-threatening, the condition has an impact on children active in play and sports.

During the past few years, there has been an increasing interest in EIA. With newer diagnostic techniques and treatment, children can become more active participants in play and sports. Nurses and other health care professionals who work with children are in a particularly important position to identify, monitor, and reinforce treatment, educate for self-management, and evaluate exercise tolerance. With adequate care, these children can become adults who are physically fit and who have built adequate social skills.

CHARACTERISTICS

EIA has been defined as an acute, reversible, usually self-terminating airway obstruction that develops 6 to 8 minutes after strenuous exercise and lasts 15 to 60 minutes after the onset. It seems not too surprising that ETA is more common among children because of the activity level of this group. Furthermore, EIA occurs more frequently in those with extrinsic rather than intrinsic asthma because extrinsic asthma is more common among children (Leech & Kumar, 1985).

Clinical characteristics of EIA usually include shortness of breath and chest tightness after exercise, whereas some children exhibit only a cough (Leech & Kumar, 1985; Rubinfeld, 1985; Speight, 1986). Because these children limit exercise, they are relatively inactive and often play quietly by themselves (Orton, 1981; Rubinfeld, 1985). For this reason, a problem with psychosocial development may be suspected, when in fact the problem has an underlying physical nature.

Factors Influencing EIA Attacks

EIA must be fully understood before the effect of exercise on the child can be appreciated. The exact mechanism of airway obstruction continues to be debated. Recent research has shown that bronchospasm is triggered by cooling of the airway from increased ventilation (Ingram, Godfrey, Pierson, & Voy, 1986).

Although water loss is not necessarily a direct factor of airway obstruction, the vaporization of water may be important in the cooling process (Anderson, 1985; Ingram et al., 1986).

Cooling and water loss trigger a release of bronchoactive substances in mast and epithelial cells in the respiratory tract. These substances create an opposing effect to the bronchodilation that normally occurs in exercise. After exercise, the adrenalin concentration drops, the bronchoconstrictive substances become more concentrated and cause contraction of airway smooth muscle (Bar-Yishay & Godfrey, 1985; Lee et al., 1984).

■ TABLE 1 Assessment considerations

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- I. Lifestyle
 - A. Sedentary behavior
 - B. Types of play or sports
 - C. Social skills
 - D. School performance and attendance
 - II. History
 - A. Wheezing, coughing, or both related to exercise
 - B. Number of attacks of wheezing or coughing in the past 12 months
 - C. Upper respiratory tract infections
 - D. Allergies or family history of allergies
 - E. General pediatric medical history
 - III. Physical assessment
 - A. Overall health status
 - B. General measures of growth and development
 - C. Precipitation of obstructed airway after exercise
 - 1. Prolonged expiratory phase
 - 2. Use of accessory muscles with respirations
 - 3. Nostril flaring
 - 4. Tachycardia
 - 5. Diminished peak expiratory flow rate
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Data from J. Hen. (1986) "Office evaluation and management of pediatric asthma," *Pediatric Annals*, 15, 111-124 and N. Speight (1986). "The diagnosis and management of asthma in childhood," *The Practitioner*, 230, 549-552.

Assessment of EIA

Classic signs of airflow obstruction include wheezing, cough, and shortness of breath at the end of exercise. Some persons may only have coughing or dyspnea that is disproportionate to exercise. It has been established that symptoms decrease if the child continues to exercise, probably because of the balancing-out factor created by adrenalin concentration (Leech & Kumar, 1985).

Although most diagnosed asthmatics have bronchospasm after exercise, symptoms often exist in undiagnosed asthmatics. Table 1 summarizes information to be obtained in the assessment of children. Many children appear sedentary because they withdraw from any strenuous activity in an attempt to avoid resulting breathing discomfort and are reluctant to join in playground activities, games, and physical education activities (Orton, 1981; Rubinfeld, 1985). For this reason, a careful psychosocial history is as important as a physical history because the characteristic wheezing caused by asthma sometimes does not occur. A physical history includes respiratory obstruction after activity and other respiratory problems. These children often have a history of frequent upper respiratory tract infections.

Although a good history is absolutely essential to detect children with EIA, a complete physical examination is also necessary. Wheezing, coughing, or both can usually be reproduced by having the child run in place for 10 minutes. In some cases, wheezing may only be detected on forced expiration (American Thoracic Society, 1987). Flushing of the skin, use of accessory muscles, flaring of the nostrils, tachycardia, wheezing associated with a prolonged expiratory phase, and productive coughing after exercise should be signs suggesting further

evaluation of the child's respiratory status. General measurements of development often indicate a lag created by decreased social contacts and physical fitness as a result of self-limited participation in activity (Orton, 1981).

Pulmonary function tests, peak expiratory flow rate with a Mini Wright Peak Flow Meter and spirometry are useful when results before and after exercise are obtained and compared (Hen, 1986b). To confirm airway obstruction, diagnostic procedures are used to measure the entire amount of air that can be forcibly expired from the lungs (FEV) and the amount that can be expelled in one second (FEV₁) (American Thoracic Society, 1987).

With EIA, exercise produces a diminished air flow on expiration. Measurements may be taken before exercise, immediately after, and at 5, 10, 20, and 40 minutes thereafter and compared (Leech & Kumar, 1985). Abnormal findings include a reduction of FEV and FEV₁. In general, decreases in FEV and FEV₁ of 15% to 35% are acceptable criteria for referral. Other findings such as a history of wheezing and tachycardia after exercise help to support a decision to refer a child with EIA (American Thoracic Society, 1987; Heri. 1986b; Leech & Kumar, 1985).

Peak flow tests are effort-dependent and require cooperation of the child to be reliable. However, with prior instruction, the tests can be accomplished quickly and easily. The best two out of three efforts will reduce error of measurement.

The cost of a Mini Wright Peak Flow Meter is approximately \$60, whereas a Standard Wright Peak Flow Meter is about \$450. Computerized spirometers that take into account height, weight, and age in determining a percentage of the norm for peak flow are now available. These units cost about \$3000. Light-weight, relatively inexpensive, and compact instruments for evaluating peak flow have been found to be accurate (Eichenhom, Beauchamp, Harper, & Ward, 1982).

Vital lung capacity may be normal unless the child has lung damage from other respiratory problems. Other tests may be completed as necessary to rule out other medical problems, such as cystic fibrosis and congenital heart disease (Leech & Kumar, 1985).

MANAGEMENT

Unlike extrinsic asthma where removal of the stimulus often prevents occurrences, in EIA the stimulus is exercise, a vital activity for normal development. Therefore the goal of prevention of EIA attacks is to encourage exercise and normal childhood activities while reducing the incidence of bronchospasm. This goal can be accomplished through prophylactic medications, maintaining moisture and heat in the airways, assisting the child with selection of activities, and breathing exercises.

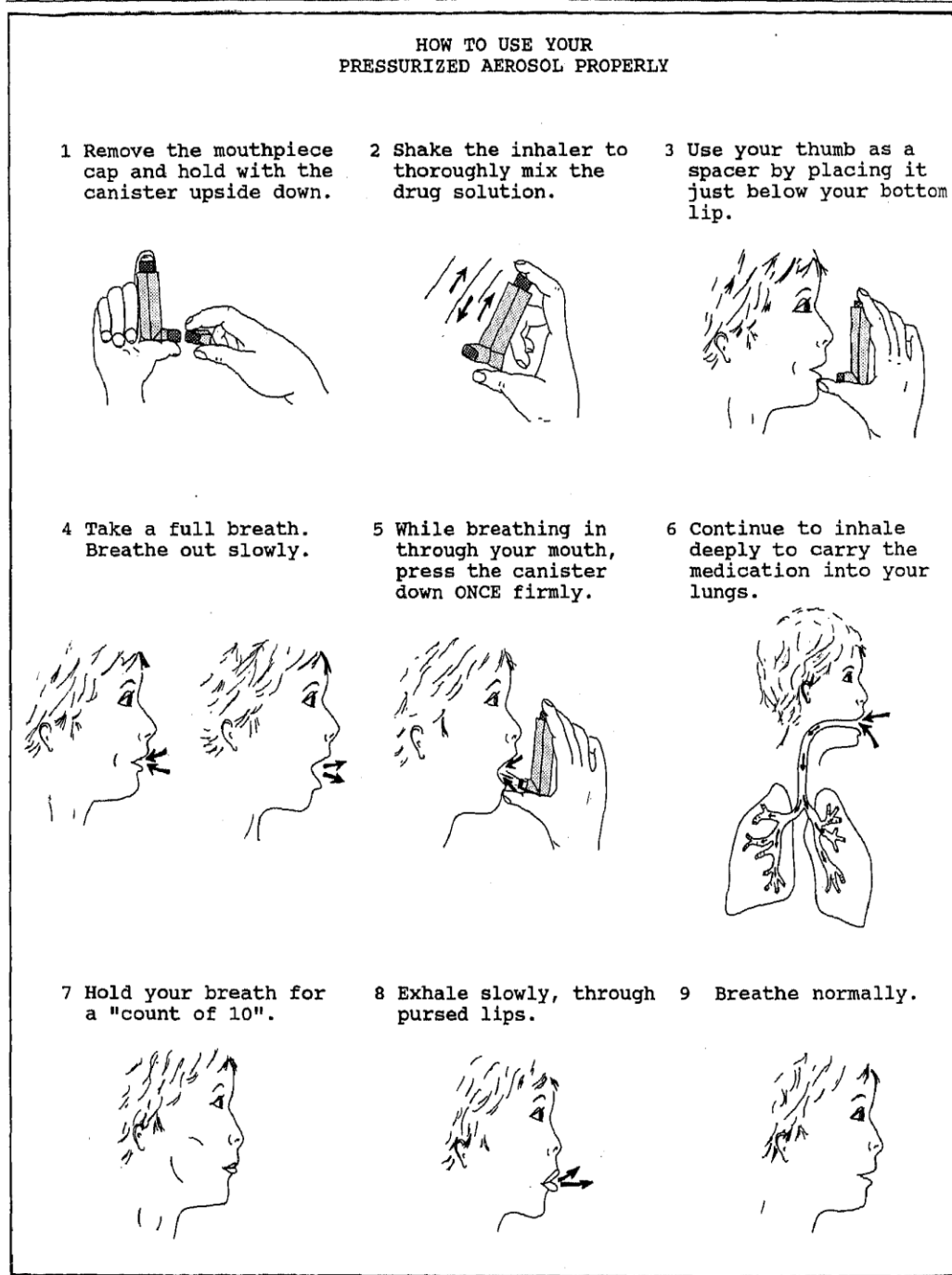
Drug Therapy

Because EIA only occurs after exercise, it is suitable to use drug therapy as needed rather than on a longterm, continual schedule. Pharmacologic agents useful in prevention of EIA are usually administered by inhalation 10 to 15 minutes before exercise. Oral therapy generally has not been recommended because of the length of time needed for absorption of the drug and uncertainties about the peak benefit in relation to the onset of exercise (Leech & Kumar, 1985).

Cromolyn sodium (Intal) is useful in prevention of EIA but has no value once symptoms occur (Fisons Corp., 1985; National Jewish Center for Immunology and Respiratory Medicine, 1985). This drug is not a bronchodilator but rather appears to prevent the lungs from reacting to exercise stimulus by inhibiting calcium flux across mast cell membranes, thereby preventing mediator release. Cromolyn is administered to children (ages 5 years and older) 10 to 15 minutes before exercise. Two metered sprays (800 µg/whiff) provides protection for 2 to 4 hours.

Occasionally, cromolyn causes cough or bronchospasm. This adverse effect can usually be prevented by bronchodilator administration before the cromolyn inhalation (National Jewish Center for Immunology and Respiratory Medicine, 1985). Another frequently reported adverse effect is a bad taste, which can be prevented by assuring proper use of aerosol administration and encouraging rinsing of the mouth after administration.

Four to 6 weeks of use is necessary to determine the effectiveness of cromolyn in preventing EIA (American Thoracic Society, 1987; Fisons Corp., 1985). It is important that parents and children be instructed to take the medication for this period of time even though preventive effects are not yet experienced.



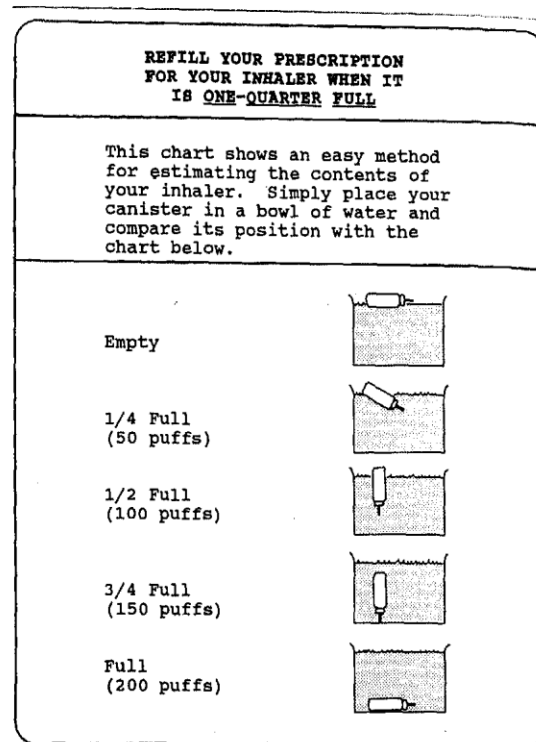
■ **FIGURE 1** Patient education guide for use of a pressurized aerosol inhaler. Data from *Self-Help: Your Strategy for Living with COPD* by the Christmas Seal League of Southwestern Pennsylvania, p. 7, copyright 1983 by the Robert D. Anderson Publishing Co., Sacramento, and from Lisa Corbett, RN, Pulmonary Nurse Specialist, Pulmonary Rehabilitation, Home Hospital, Lafayette, IN.

Albuterol (Ventolin, Proventil) is a newer drug and has been successful in preventing episodes of EIA. A β_2 -adrenergic agent, albuterol inhibits the release of mast cell mediators and causes bronchodilation (Hen, 1986a; Ingram et al., 1986). The preferred method of administering albuterol is by a metered-dose inhaler (90 $\mu\text{g}/\text{whiff}$), two whiffs 15 minutes before exercise. The onset of action is rapid; because the dose is smaller, there are fewer side effects of restlessness, nausea, cough, and heart palpitations.

Medication with β_2 agonists is the current preferred preventive therapy for EIA. However, when this therapy alone fails to control the bronchoconstriction, cromolyn can be added to the medication program. When cromolyn is given with a bronchodilator, the bronchodilator is given first to open the airways so the cromolyn reaches more lung tissue (Christmas Seal League of Southwestern Pennsylvania, 1983; Fisons Corp., 1985).

Nursing management of the medication therapy includes evaluating the positive effects as well as the side effects of medication. Because response to a drug can sometimes change, therapy must be periodically evaluated (National Jewish Center for Immunology and Respiratory Medicine, 1985). Teaching the child, parents, and other care givers, including teachers and athletic coaches, about the medication is an important role of the nurse because it is these persons who are directly involved when the medication is used.

Instructions on taking the medication include proper technique of administering an aerosol medication to ensure adequate therapeutic benefits. Cochrane (1986) emphasizes that poor understanding by the patient about use, dosage, effects, and administration are reasons for failure of medication therapy. Guidelines for use of a pressurized aerosol that should be included in patient education are summarized in the patient education guide (Figure 1).



■ FIGURE 2 Guide for estimating the amount of medication in a pressurized canister. Reprinted with permission of the American Lung Association of Western Pennsylvania/Formerly Christmas Seal League from *Self-Help: Your Strategy For Living With COPD*, p. 7.*

Children under the age of 6 years generally do not have the dexterity to operate an aerosol and will need assistance from adults. There are "spacer-inhalers" on the market that require less coordination to use and might be considered for younger children.

In addition to understanding how to use a pressurized aerosol correctly, the child should know the importance of rinsing the mouth after each treatment to prevent irritation. If the child is experiencing a strong taste of medication, the drug is probably being dispensed onto the tongue rather than being inhaled into the lungs. If this is a problem, further guidance in aerosol use is indicated.

Even when empty, aerosol canisters are under a great amount of pressure. For this reason, the nurse should remind the child and parents not to puncture or discard the canister into an open fire.

Parents should be informed to refill the aerosol prescription when the canister is one fourth full. The aerosol canister can be dropped into a pan of water to determine how much inhalant is left. The position of the canister in the water will show how much medication is left (Figure 2).

Maintaining Moisture and Heat in the Airway

Inspiration of warm, humidified air during exercise will reduce key factors in triggering EIA. This can be accomplished by having the child wear a simple face mask, covering the nose and mouth during exercise. The child can also be encouraged to breathe through the nose, rather than the mouth, to maintain as much heat in the airway as possible. Equally important is maintaining hydration of the child. In an otherwise normal child, 2 to 3 quarts of liquid should be consumed each day to maintain moisture in the respiratory mucosa.

Choosing an Activity

Some types of exercise are more tolerated by some children than other types. Swimming is a weak stimulus for EIA followed by gymnastics, bicycling, and other moderate activities. Generally, exercise requiring short bursts of activity or moderate stress is less likely to cause bronchospasm (Bar-Yishay & Godfrey, 1985; Orton, 1981; Wolf, 1980). Since response to exercise in the form of bronchospasm varies with the type of exercise, the choice of activity is individualized (Orton, 1985). Children and adolescents can be encouraged to choose an activity that is enjoyable and yet does not precipitate EIA. It is important to document particular activities that contribute to an asthma attack. This can be accomplished with a diary card (Figure 3).

EIA has a characteristic "run through" phenomenon. A short burst of exercise causes mild bronchospasm. When more strenuous exercise is repeated, the severity of EIA is decreased (Leech & Kumar, 1985; Rubinfeld, 1985). This building of exercise tolerance suggests that a short warm-up period before more moderate exercise will decrease or eliminate the more severe attacks of EIA.

Once exercise patterns have been established, an exercise program can be developed for the child. Various exercise training programs have been evaluated and are effective in controlling EIA (Lewiston, 1986; McCaully & DeSilets, 1983; Orton, 1981; Rubinfeld, 1985). By eliminating only the activities causing EIA, the child is allowed a more normal lifestyle with as few restrictions as possible.

Breathing Exercises

Although it is not well documented as a factor in controlling EIA, breathing and relaxation exercises frequently help expiratory function during exercise (American Thoracic Society, 1987). The child should be encouraged to take deep breaths, inhaling for as long as possible and then exhaling normally. The child can be taught to count to 3 while inhaling, then exhaling through pursed lips while counting from 4 to 6. This can be adjusted to steps taken during exercise. An example is to inhale on steps 3 or 4 and then exhale during steps 6 or 7. This can be adjusted for the particular activity involved.

Working with Parents and Teachers

The challenge of working with adults may be twofold. The child who does not participate in physical activity may appear lazy or unfit and may be forced into physical activities with a result of frightening bronchospasm. Another problem occurs after a child has been diagnosed as having EIA. Once identification of

the problem has been made, parents and teachers may either be overprotective of the child or may not want to take responsibility for treatment or the possibility of promoting bronchospasm resulting from exercise.

ASTHMA DIARY		From ___/___/___		To ___/___/___																		
Last Name		First Name		Date of Birth																		
Address		City/State		Telephone Number																		
<p>Purpose: The purpose of this card is to keep a complete record of your asthma symptoms for 3 weeks. This will enable us to determine the best course of treatment for you.</p> <p>Instructions: Write a score for each of the items listed each day. If you have comments to make, write them in the space provided and on the back. Bring this card to your next visit on ___/___/___.</p>																						
		Week 1			Week 2			Week 3														
		M	T	W	Th	F	S	S	M	T	W	Th	F	S	S	M	T	W	Th	F	S	S
1. Wheeze after exercise	None 0 Little 1 Moderately bad . . . 2 Severe 3																					
2. Cough after exercise	None 0 Little 1 Moderately bad . . . 2 Severe 3																					
3. Pulse after exercise	(write in)																					
4. Sputum amount	None 0 Small amount 1 Large amount 2 Color: Yellow (Y) Green (G) White (W)																					
5. Activity today	Increased 0 Normal 1 Sl. Decreased 2 Very Decreased . . . 3																					
6. Type of activity	Swimming(S) Gymnastics(G) Bicycling(B) Running(R) Other (write in)																					
7. Treatment (doses/day)	Drug bronchodilator Cromolyn																					
8. Environment	Rain/storm(A) High pollen count. .(B) Heat on in house . .(C) Humidifier used. . .(D) Air conditioner used(E) Smoking exposure . .(F)																					
9. Other	Had to see doctor. .(D) Missed school. . . .(S) Infection.(I) Upset.(U) Unable to take gym .(G)																					
Comments: _____																						

■ **FIGURE 3** Diary card for assessing patterns of EIA over time. From J. Hen, "Office Evaluation and Management of Pediatric Asthma," 1986, *Pediatric Annals*, 15, p. 116. Adapted by permission.

The nurse is responsible for educating parents and teachers about the characteristics of Ea, management and prevention of attacks and individualized exercise on a regular basis. This includes an ongoing evaluation of exercise tolerance, working through the administration of medications at school and building an awareness in those care givers working with the child that exercise is needed to achieve normal development.

Self-management programs are available and are often helpful aids to both children and adults who care for the child. The Family Asthma Program and "Superstuff," a kit for children and parents, are available from the American Lung Association. A similar program, "WOW" (Winning Over Wheezing), is available from the Asthma and Allergy Foundation of America. Studies have shown these materials to be effective in patient education (Green, Goldstein, & Parker, 1983; Lewiston, 1986; McCaully & DeSilets, 1983).

SUMMARY

Physical activity increases lung capacity and promotes physical and psychosocial development. The nurse has an important role to ensure optimal physical activity. Assessment and teaching are significant components of nursing care. The nurse can assist in controlling episodes of EA through an individualized and comprehensive prevention program. Once EIA is controlled, the child can experience life in a more normal way.

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