

Exercise-induced Asthma

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Exercise-induced asthma (EIA) is a condition that causing transient narrowing of respiratory airway after triggered by vigorous exercises that performed even with a minimum of 5-8 mins during continuous high-intensity effort. The person will present with asthmatic symptoms such as wheezing, shortness of breath or coughing. There is another terminology that often used interchangeably with EIA is exercise-induced bronchoconstriction (EIB). Many clinicians or sport experts might use EIB instead of EIA as it does not imply the person themselves having underlying chronic asthma or being triggered by the exercise and causing reduction in the lung function. EIB can occurs with or without asthma symptoms. "Sport asthma" is defined by the presence of exercise-induced respiratory symptoms and bronchial hyperresponsiveness in the absence of allergic features. As compared to adults, children and adolescence are at higher risk of EIA and this may lead to poor participation in physical or sport activities. Other than that, elite athletes who participate in endurance sports such as running, cycling and in winter sports also at increased risk for EIA.

During normal breathing, nose functions to warm up and humidify the inspired air. The inhaled air has to achieve a certain moisture and heat level before the air reaches the alveoli for gases exchange. During exercise, breathing rate will increase as oxygen demand increase for the working muscles and also heat dissipation required to compensate the increase of the core temperature. Thus, vigorous exercise results in the inhalation of greater volumes of relatively cold and dry air, which will induce airway surface liquid becomes hyperosmolar and dehydration. The osmotic gradient difference forced the water molecules from any cells nearby to move to the dehydrated cells and resulting in cell shrinkage and release of the inflammatory mediators. This will further lead to distal airway epithelium injury and causing the contractions of airway smooth muscle. The cooling of the airways will cause reflexes in parasympathetic nerve stimulation and lead to bronchoconstriction through the vagal nerve as well. When bronchoconstriction occurs, the airways resistance increased, which will lead to dyspnoea and affect the sport performance. When

exercise ceases, a rewarming process begins and causing secondary hyperemia (rebound vasodilation of the peribronchial venules). The cooling-rewarming process might trigger inflammatory events by increasing the expression of the chemokines and cytokines. Compellingly, some studies found out that the inflammatory markers noticed in athletes' airways are not necessarily related to lung function, bronchial hyperresponsiveness or triggered by other diseases. When bronchial biopsies were performed by the researcher for winter sport athletes to investigate the presence of inflammatory signs, they have found out that airway inflammatory cells have increased but remain latent in the athletes. From this findings, the researchers suggest that the increased in airway inflammatory cells could be due to physical injury after high ventilation during strenuous exercises, and it recover with rest.

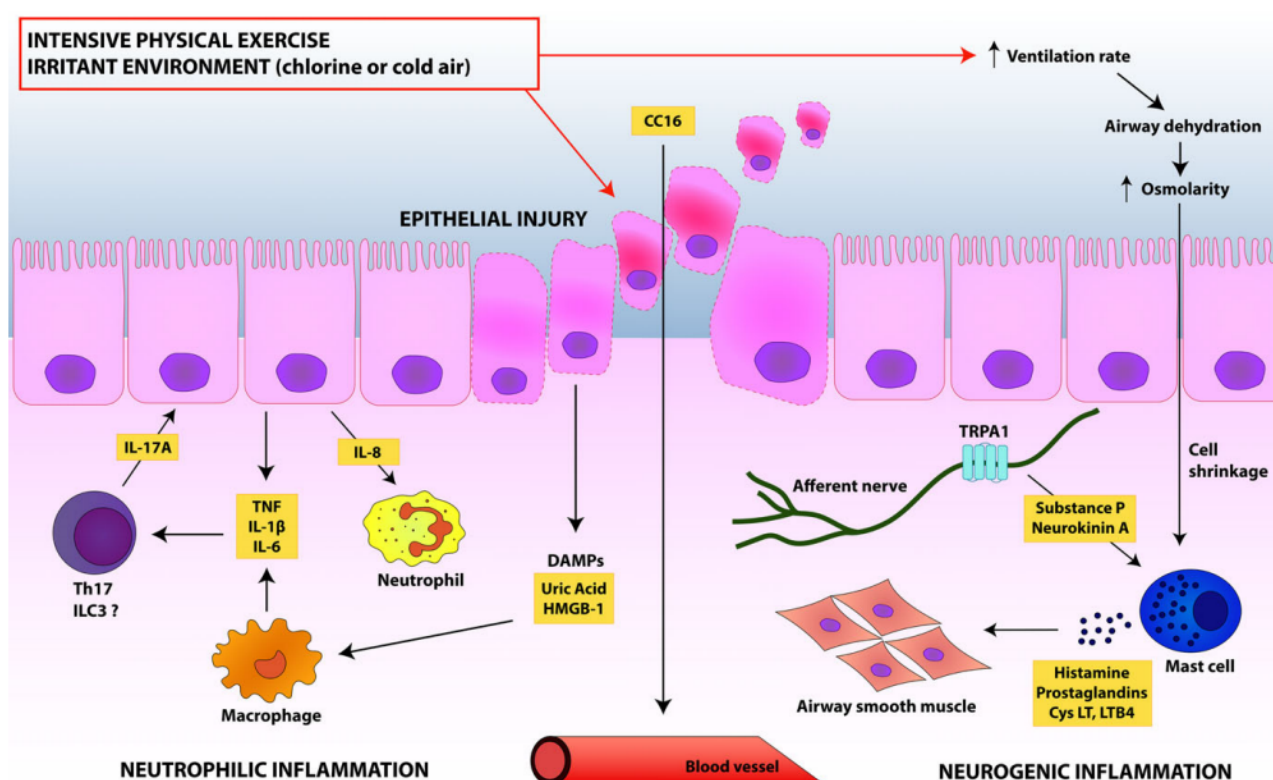


FIGURE 1 Emerging mechanisms of exercise-induced bronchoconstriction

FIGURE 1 Emerging mechanisms of exercise-induced bronchoconstriction. Couto et al. (2018). Mechanisms of exercise-induced bronchoconstriction in athletes: current perspectives and future challenges. *Allergy*, 73(1), 8-16.

Long duration, vigorous exercise and exercise at a cold environment had clearly seen to be the culprit for the "sport asthma" as it will increase the risk of osmolar and vascular modifications in the airways. For the past few decades, swimming always been considered as a very effective and healthy sport that improve asthmatic symptoms due to the humid air inhaled during swimming (only in chlorine-free swimming pool water). The present of chlorine-based irritants in the swimming pool

might induce childhood asthma and also airway inflammation with bronchial hyperresponsiveness in competitive swimming. Besides swimming, there are a few ways to improve EIA and control asthmatic symptoms as well, which is through exercise modifications. In order to prevent coughing during running exercise, here some tips to take note of: avoid breathing using the mouth, wearing face mask, indoor running and avoid over exhaustion would help to reduce symptoms. Moreover, get a proper warm up before the sport event allow athletes to take advantage of the "refractory period", which is important in reducing the occurrence of bronchospasm. The rest interval during exercise is associated with the release of protective prostaglandins (PGE₂), which aid in desensitize the cysteinyl leukotriene receptors and thus prevent bronchoconstriction. In normal individuals, instead of performing vigorous exercise training, practicing moderate intensity aerobic exercise will be a better option. Otherwise, try out the sports that performs with <5-8 mins effort (i.e tennis, <400m sprint etc.) or team sports that last <5-8 mins effort (i.e rugby, basketball, volleyball) which are more beneficial for allergic inflammation and EIA.

In summary, "sport asthma" or EIA/EIB is a very common condition during sport activities, especially with those vigorous endurance sports. Together with exercise regimen modifications, warm up prior to the exercise training, adopt interval or intermittent training program and prepare rescue medications can help to reduce the occurrence of EIA. Most importantly, seeking for medical consultation to get a proper diagnosis if needed as sometimes the underlying symptoms might be hindered by other medical problems.

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