EXERCISE INDUCED ASTHMA (EIA)

EXERCISE INDUCED BRONCHOCONSTRICTION (EIB)

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All violent exercise makes the asthmatic to breathe short.

– *Sir John Floyer, 1698*

EIA (Exercise-induced asthma)?
EIB (Exercise-induced bronchoconstriction)?

- EIB – acute airway narrowing that occurs due to exercise.

  EIB in patients without clinical asthma

  20% in general popul. 30-70% in elite atheletes

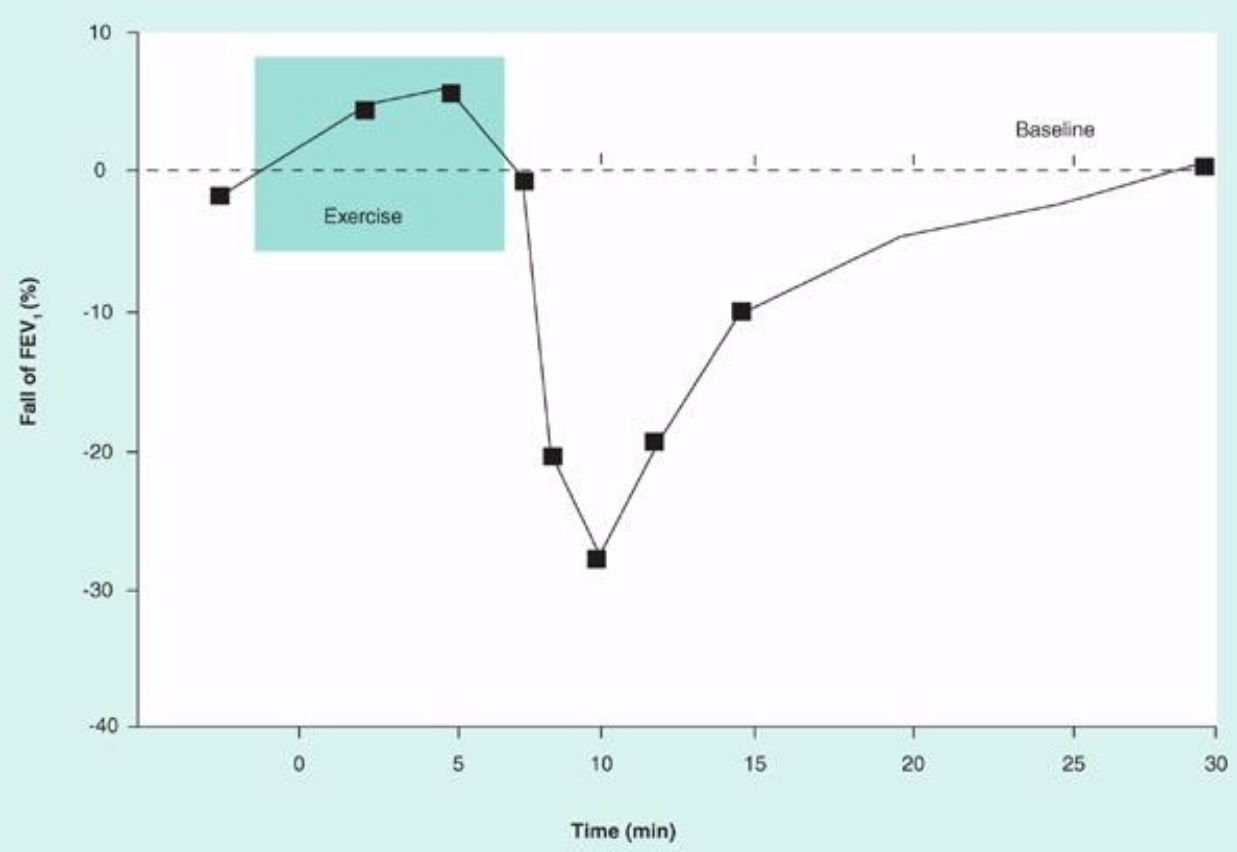
- EIA – EIB in patients with asthma

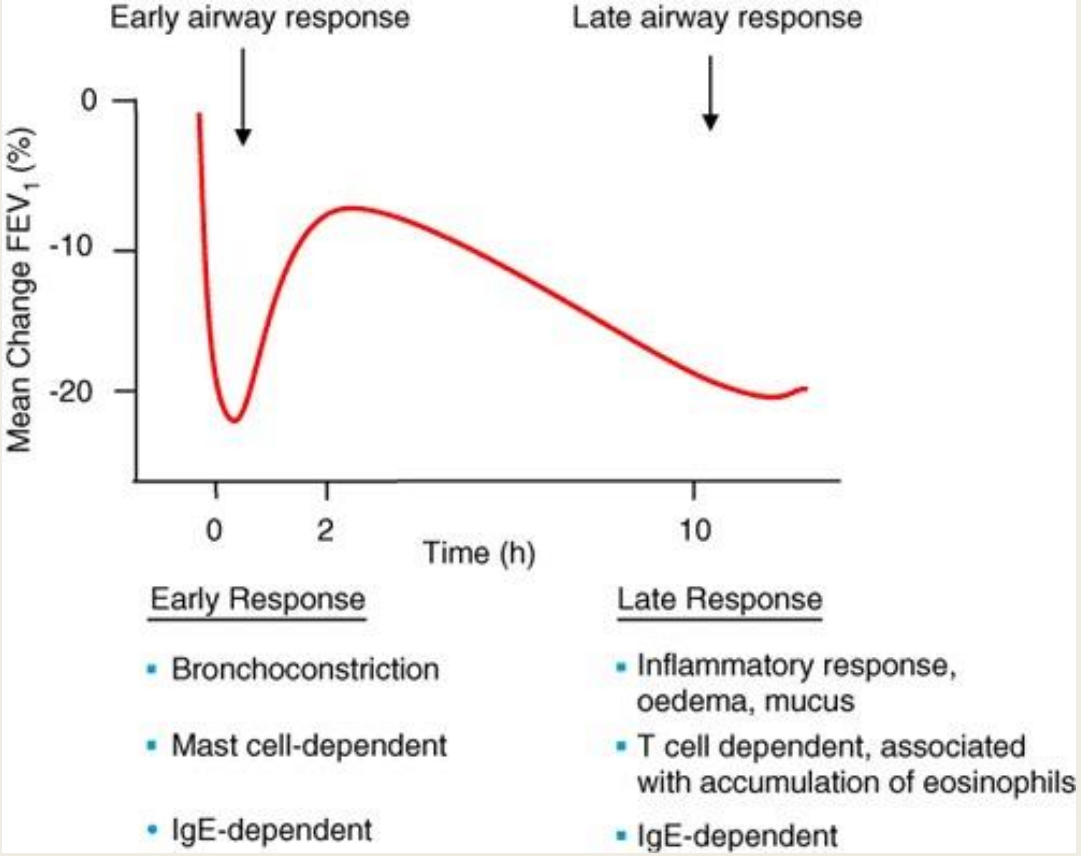
  40-90% in asthma patients

Subjects who are prone to EIB

- ↑ FeNO
- ↑ Leukotrienes
- ↑ expression of mast cell genes
- ↑ epithelial shedding into the airway lumen

EIB


10
0
-10
-20
-30
-40
Fall of FEV1 (%)
Exercise
Baseline
0
5
10
15
20
25
30
Time (min)


Early airway response
Late airway response
0
-10
-20
Mean Change FEV1 (%)
0
2
10
Time (h)
Early Response
Bronchoconstriction
Mast cell-dependent
IgE-dependent
Late Response
Inflammatory response, oedema, mucus
T cell dependent, associated with accumulation of eosinophils
IgE-dependent

Similarities to early response to allergen challenge

- rapid in onset
- pass off over 30-90 mins
- prevented by prior administration of sodium cromoglycate
- prevented or reversed by the inhalation of SABA

Important factors

- The type of exercise
- Severity and duration of exercise
- The refractoriness
- Climatic conditions during the exercise
- Allergenic environment and air pollution
- The clinical severity of the asthma

The type of exercise

- They are often aware that some type of exercise are likely to provoke an attack
- Running >> Swimming
- Ice rink sports, Nordic skiers, competitive swimmers, distance runners
- Humidity of air breathed

Severity and Duration of exercise

- Severity of EIA depends upon the severity of exercise and its duration
- 2/3 of maximum working capacity : maximal severity of EIA
- severity of EIA increases with exercise duration up to 6-8 minutes
- Plateau effect

The refractoriness

- Prior exercise reduces the response
- The half-life of the refractory effect is 45 minutes
- After 2-3 hours the subject is again fully responsive
- The pattern of exercise matters

Climatic conditions

- Breathing warm, humid air virtually abolishes EIA
- Osmolarity of the fluid lining the airways as a triggering factor
- Asthma closely resembling EIA can be provoked by inhaling fogs of hypotonic or hypertonic salt solutions

Allergenic environment and air pollution

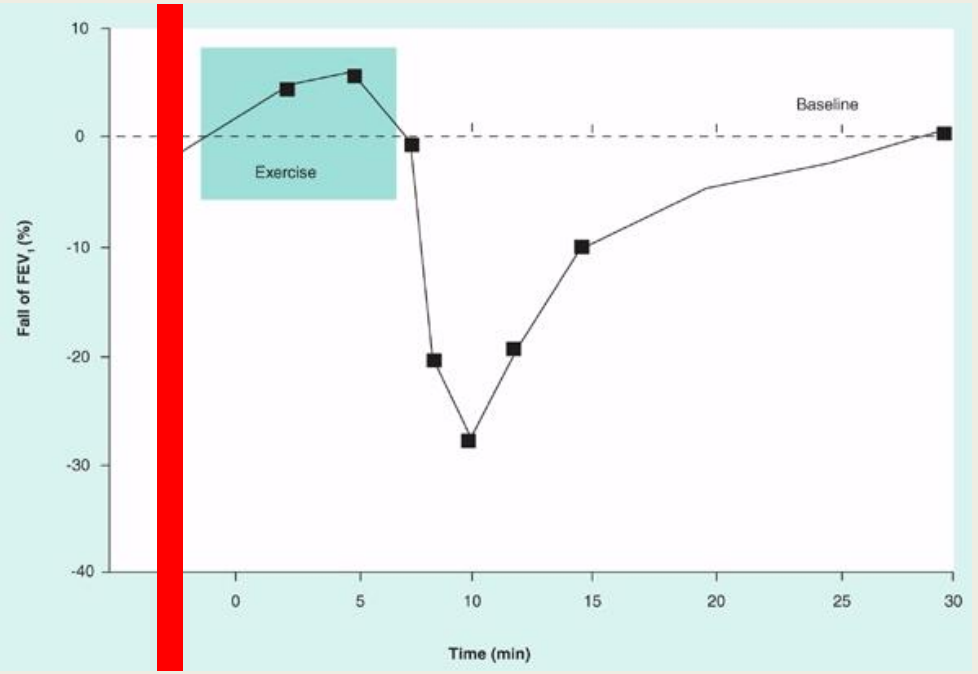
- The prevalence of allergens in the environment can influence bronchial reactivity
- EIA can increase after specific allergen bronchial provocation tests.
- Air pollution simulated in the laboratory enhanced EIA
- Ozone, PMs

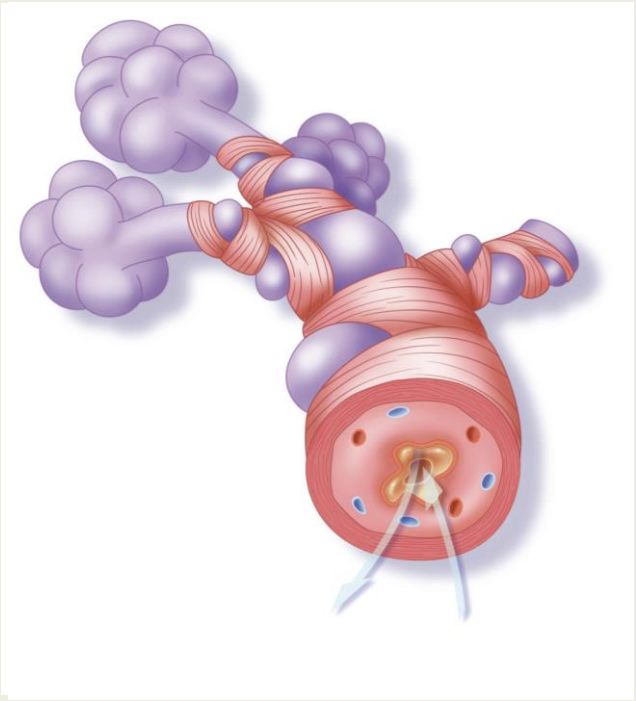
The clinical severity of asthma

- Not enough data to support the expectation that the clinical severity of asthma would influence the severity of EIA
- FEV1 drop after exercise tests in 272 asthma patients
  - *15.8% in mild*
  - *22.8% in moderate*
  - *21.1% in severe*

Pathophysiology of EIA

- Hyperventilation and subsequent cooling and drying of the mucosa
- Mucosal secretion of bronchoconstricting mediators
  - *(LTD4, histamine, tryptase, etc)*
- Iincreased sympathetic activity and reduced bronchial tone prevent much change during exercise
- Bronchoconstricting mediators cause the attack of EIA at the end of exercise
- Release of inhibitory PG (possibly mediated by the rise of LTD4) results in refractoriness





Hyperventilation (cold, dry air)

Release of bronchoconstricting mediator(s) – LTD_4

Compensated by sympathetic bronchodilation

Release of inhibitory PGs

“Refractoriness”

Diagnosis – exercise test

- Based on changes of lung function, not on symptoms
- Symptoms are neither sensitive nor specific
- FEV1 at baseline, 5, 10, 15, and 30 minutes after exercise
- % drop of FEV1 (15% or 10% and 200ml)
- severity
  - *mild* *10%-25% FEV1 fall*
  - *moderate* *25%-50% FEV1 fall*
  - *severe* *>50% FEV1 fall*

Treatment

- SABAs (15min before exercise)
- As a controller, daily ICS or LTRAs < LABAs
- Mast cell stabilizing agents before exercise
- anticholinergics, antihistamine – minor role
- Adequate control of underlying asthma in EIA

Nonpharmacological therapy

- Warming up before exercise to induce a refractory period
- maneuvers to prewarm and humidify the air during exercise (mask/scarf/nasal breathing)
- Improving general physical conditioning
- losing weight if obese
- Dietary modification (weak evidence)

EIA can be prevented of managed

- US summer Olympic team 1996
  - *10.4% current asthma (taking medication)*
  - *16.7% having had a diagnosis of asthma and having used medications*
  - *32.9% of active asthma won medals (28.7% without asthma)*

Summary

- EIA vs. EIB
- EIB occurs due to exercise-driven section of bronchocontricting mediators
- increased sympathetic tone prevents EIB during exercise
- Secretion of inhibitory PGs can explain refractory period
- Diagnosis based on exercise test (%FEV1 fall: >10%, 200ml)
- Can be safely managed pharmacologically and non-pharmacologically