Asthma in Icehockey

Is it Under Diagnosed?

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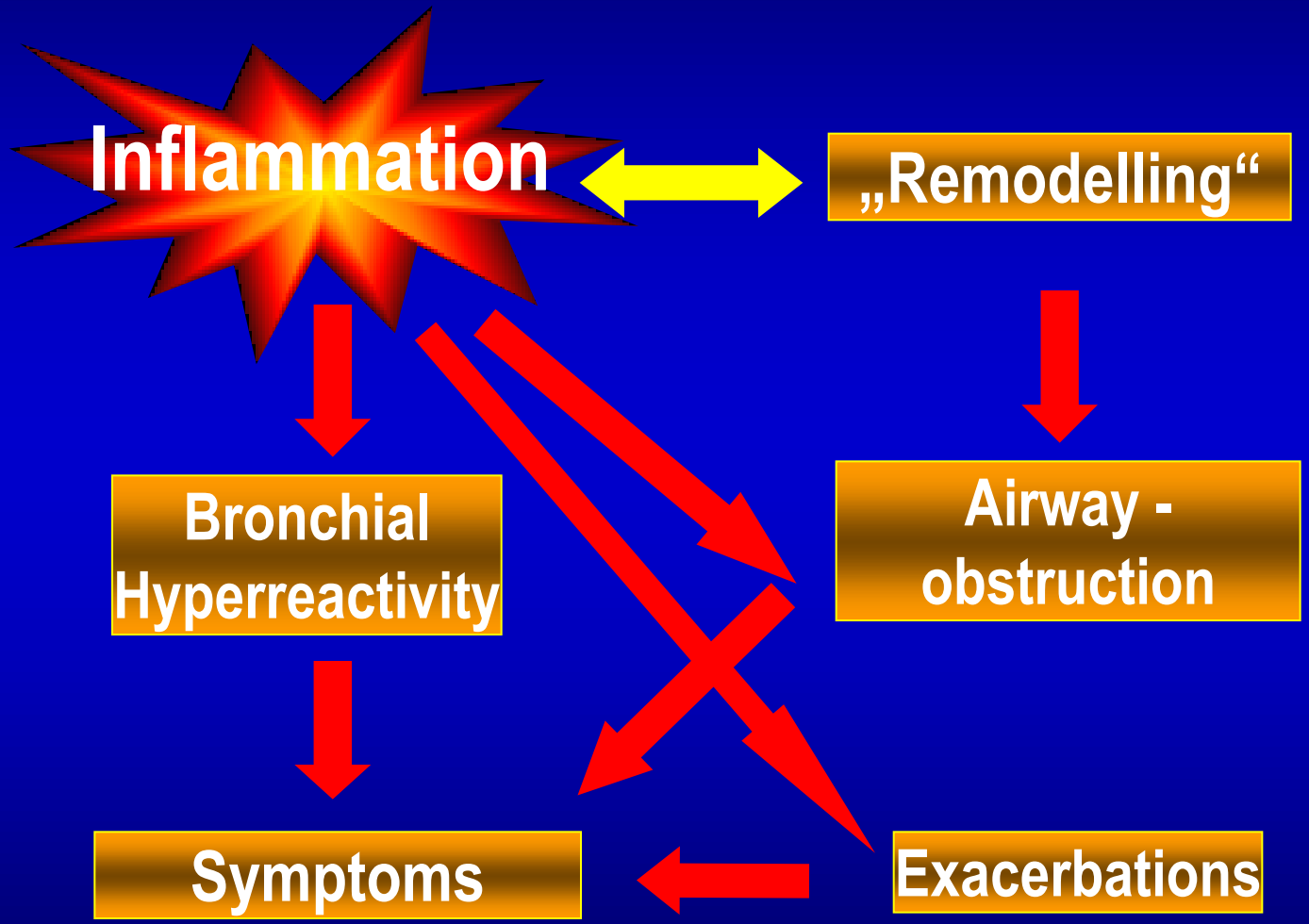
Asthma bronchiale Mechanism



3 Key Questions:

Respiratory Symptoms in Hockey Players:

Are they caused by Asthma Bronchiale?

Is the exercise-induced Bronchoconstriction (EIB) of the Ice-Hockey Player an special form of Asthma Bronchiale?

Ice-Hockey: does it make asthmatic?

Increased Prevalence of exercise-induced Bronchoconstriction in Elite Sports ?

Fact or Fiction?
Doping-induced?

Prävalence (age 18-40)	BHR	Asthma
Sapaldia (Switzerland 1992/2002)	18%	8%

Does the Prevalence of Asthma depend on the Type of Sports?

- Winter vs. Summer ?
- Individual vs. Team ?
- Endurance vs. Power ?
- Indoor vs. Outdoor ?

Risk Factors for Exercise-Induced Bronchoconstriction (AIB)

„regular“ Asthma bronchiale	
untreated:	
Children	**80 – 100 %**
Adult	**70 – 80 % (Lab)**
	45 – 73 % (Field)
inhaled Corticosteroids ICS	**< 50 %**
Atopics without Asthma	
during Pollen Season	**> 50 %**
No. pos. Skintest	**Strong Correlation with Severety of EIB**
„Sports“ Asthma (Meyers 2006)	
total	**- 55 % (peer reviewed)**
no Hx of Asthma/BHR/Allergy	**- 35 %**

How many Athletes of the Swiss Olympic Delegation at the OG in Torino 2006 suffered from „Asthma“?

a) Reversible Obstruction / positive Exercise -Test / positive Methacholine -Test (PD20: < 250 ug MC !!!)

b) Typical Symptoms

1. 10/130
2. 16/130
3. 22/130
4. 28/130

1. 10/130
2. 16/130
3. 22/130
4. 28/130

= 22 % !!

= Faktor 2,7 (Sapaldia)

Prevalence of Asthma in Icehockey

- Leuppi JD: Eur Resp J 1998 — 19 %
- Lumme A: Eur: Resp J 2003 — 15% / 22 %
- Wilber RL: Med Sci Sports Exerc 2000 — 23 %

- Haatela T: Eur Resp Mon 2006

Winter Sports

Cross country	14-55%
Icehockey	15-23%

Summersports

Swimmers	13-44%
Long distance runners	15-24%
Track & Field	16%

Lumme A.: Asthma in Icehockey Players
Eur Resp Journal, 2003, 22: 113-117

Table 2. – Occurrence of atopy, increased bronchial responsiveness, current asthma and total asthma

Characteristic	Ice hockey players	Control subjects	p-value#
Subjects n	88	47	
Atopy	51 (58)	17 (36)	0.025
Increased bronchial responsiveness	21 (24)	5 (11)	0.097
Current asthma	13 (15)	1 (2)	0.033
Total asthma	19 (22)	2 (4)	0.011

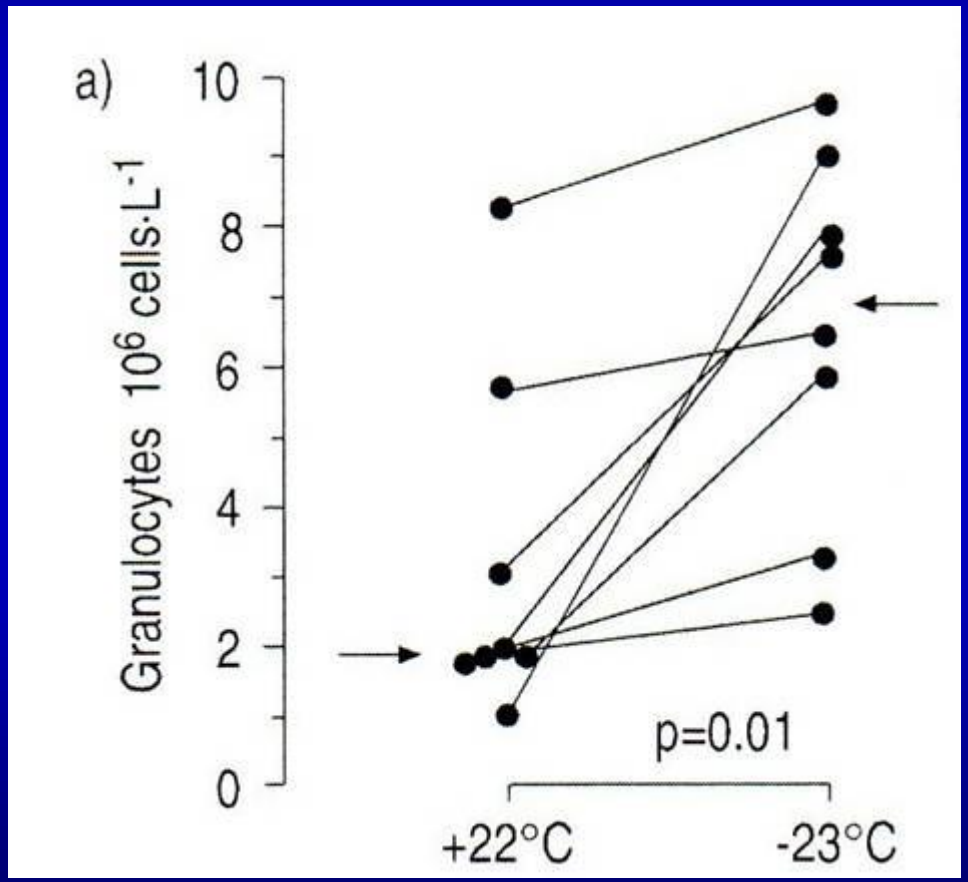
Data are presented as n (%) unless otherwise stated. #: Fisher's exact test.

EIB: Risk Factor „Cold Air“ ?

Larsson 1993:	**Cross Country (Winter)**	**vs.**	**Endurance (Summer)**
	BHR 54%		**8%**
	Asthma 32%		**5%**
Villiger 1996:	**Cross Country (Winter)**	**vs.**	**Sapaldia (CH)**
	BHR 31%		**18%**
	Asthma 15%		**8%**
Leuppi 1998:	**Floor - Hockey**	**vs.**	**Ice – Hockey (CH)**
	Asthma 4.2%		**19.2%**

Inhalation of cold air increases the number of inflammatory cells in the lungs in healthy subjects

K. Larsson et al, ERJ 1998, 12, 825-830



Prevalance of asthma in young cross country skiers in central Scandinavia: Differences between Norway and Sweden

Sue-Chu M., Resp. Med, 90: 99 (1996)

171 Skiers (N = 118, S = 53)

	N	S	
Asthma rel. Symptoms	36%	51%	
BHR	14%	43%	p < 0,001
Asthma	12%	42%	p < 0,001
Selfreported allergy	31%	32%	

Evidence of Airway Inflammation and Remodeling in Ski Athletes with/without BHR

Karjalainen E.M. et al, AJRCCM 161, 2086, 2000

	T-Ly	Macro	Eos	Mast	Neutro
Controls	12	4	10	50	3
Skier-Asthma	521	105	51	65	63
Asthmatics	853	253	81	164	31

	Controls	Asthmatics	Skiers
„BM-Remodeling“ µm	0,8	8,8	6,7

Comparison of Sputum Differential Cell Counts between Icehockey Players and Control Subjects Lumme A. et al, Eur Respi J 2003

	Icehockey	Controls	
Total Cell	5.1	4.6	ns
Eosinophils	2.6	0.2	0.03
Neutrophiles	80.9	29.9	0.001
Lymphocyten	0.5	0.6	ns
Macrophagen	15.8	66.2	0.001

Risk-Factor Cold Air ???

M. Davies et al, J Appl Physiol 2005

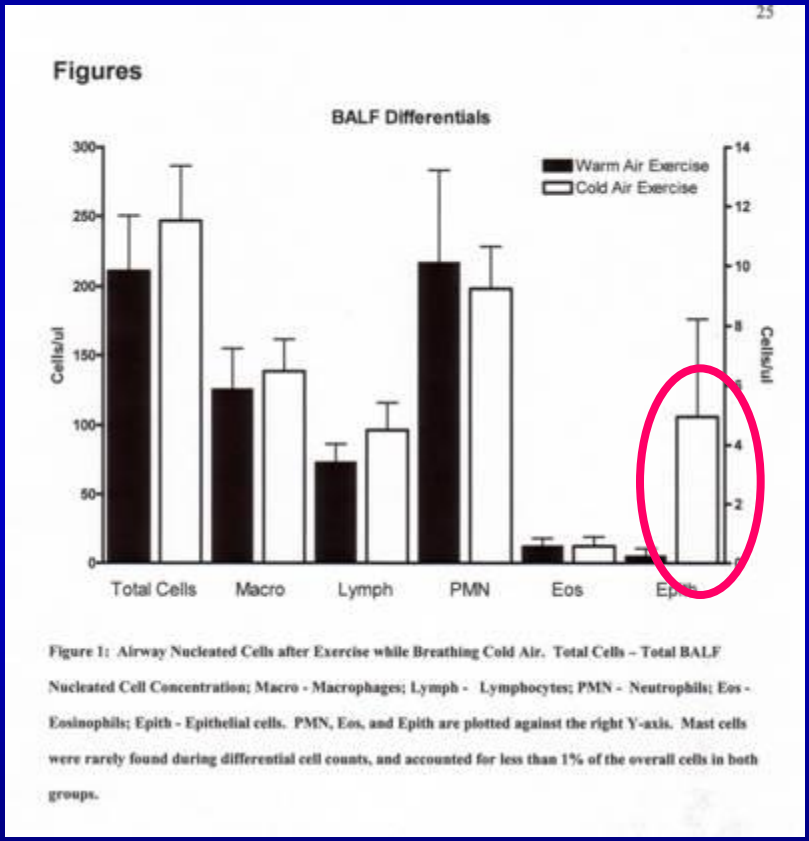


Figure 1: Airway Nucleated Cells after Exercise while Breathing Cold Air. Total Cells – Total BALF Nucleated Cell Concentration; Macro - Macrophages; Lymph - Lymphocytes; PMN - Neutrophils; Eos - Eosinophils; Epith - Epithelial cells. PMN, Eos, and Epith are plotted against the right Y-axis. Mast cells were rarely found during differential cell counts, and accounted for less than 1% of the overall cells in both groups.

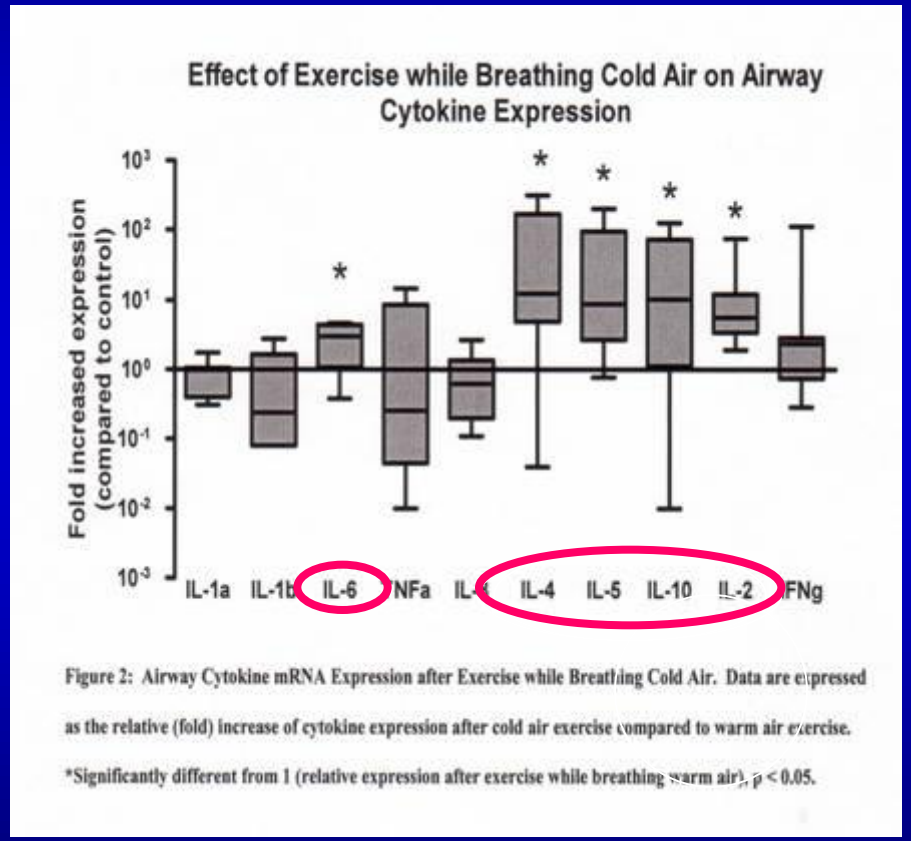


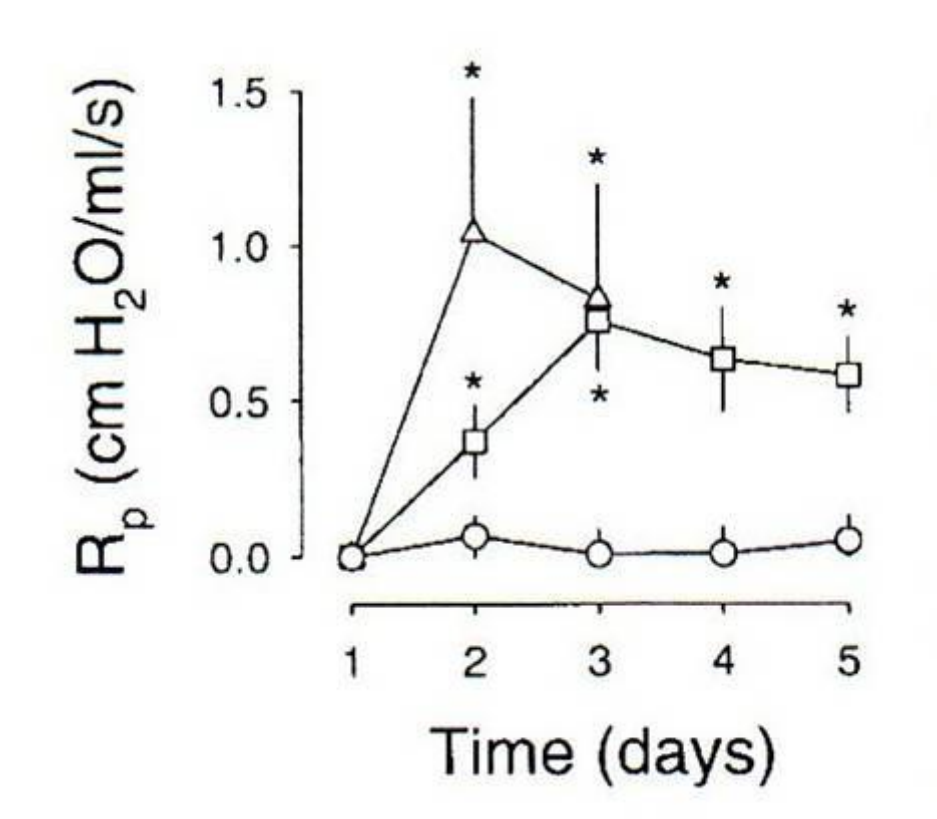
Figure 2: Airway Cytokine mRNA Expression after Exercise while Breathing Cold Air. Data are expressed as the relative (fold) increase of cytokine expression after cold air exercise compared to warm air exercise.

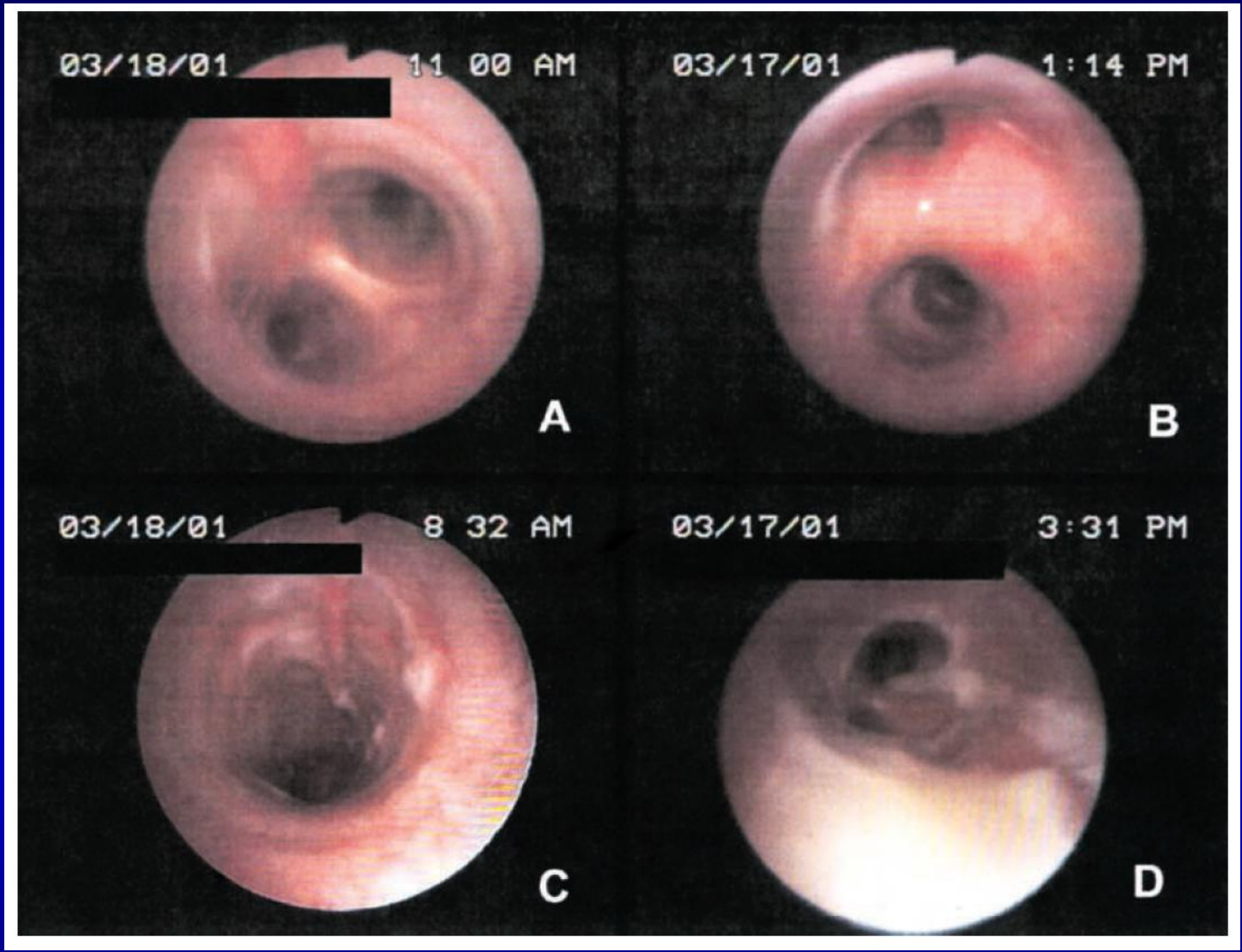
*Significantly different from 1 (relative expression after exercise while breathing warm air), $p < 0.05$.

Risk- Factor Hyperventilation ???

Repeated hyperventilation causes peripheral airways inflammation, hyperreactivity, and impaired bronchodilation in dogs

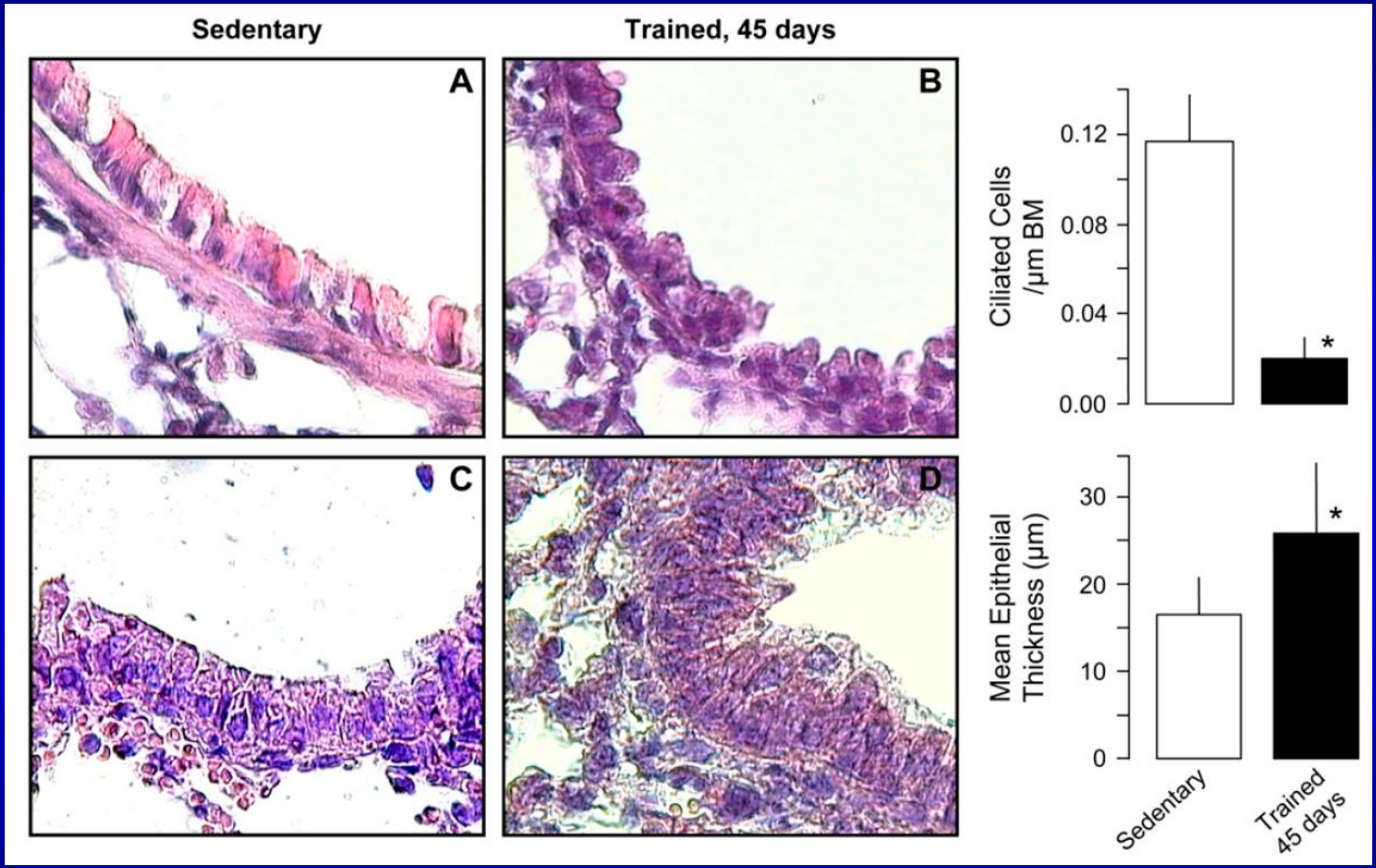
M.S. Davis et al, AJRCCM, 2001, 164:785-789



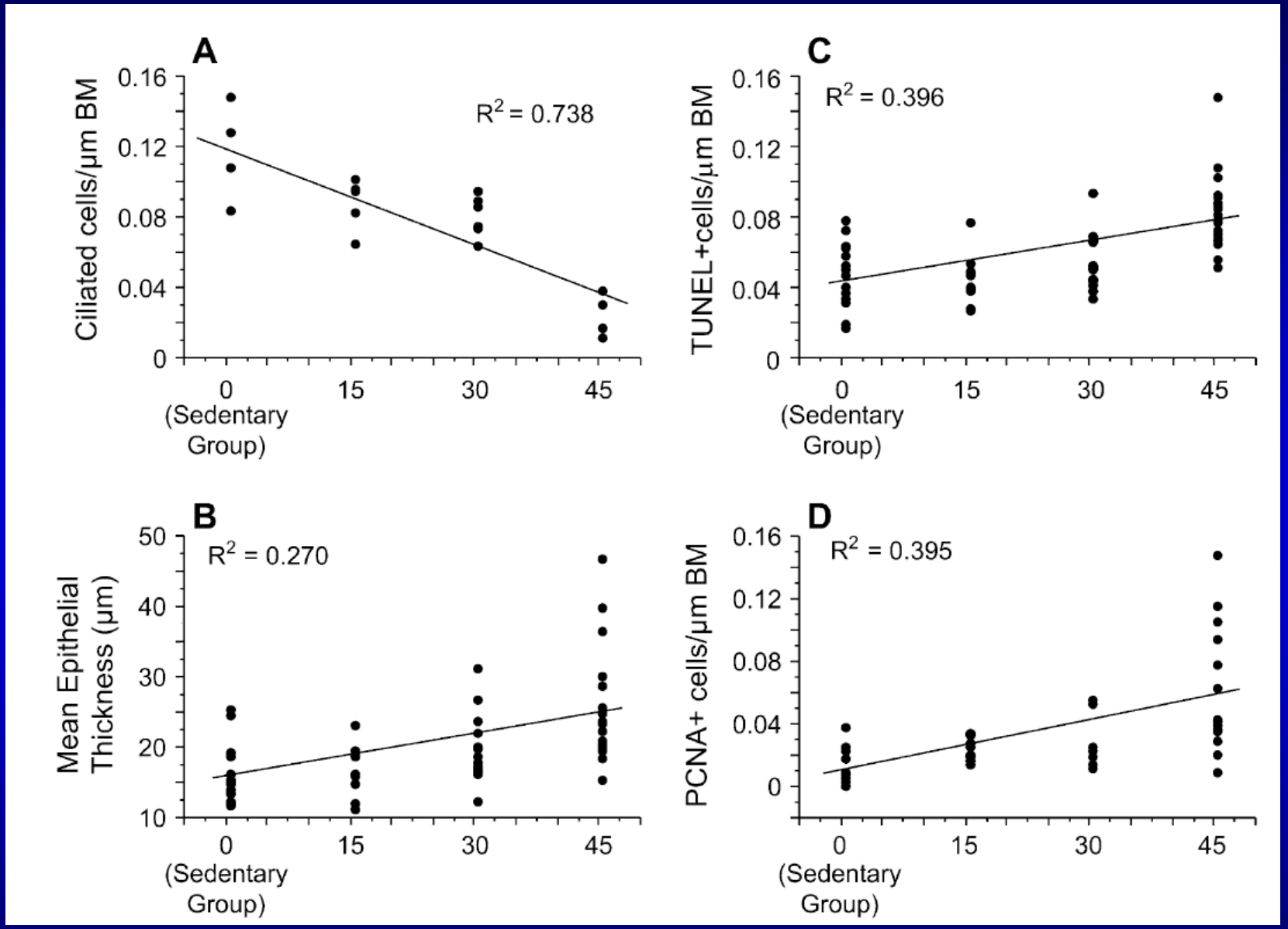


Davis MS et al: Am J Respir Crit Care Med 2002

Risk - Factor: Duration of Hyperventilation?



Chimeti L et al.: Am J Respir Crit Care Med 2005


A
Ciliated cells/µm BM
0.16
0.12
0.08
0.04
0
R^2 = 0.738
0
15
30
45
(Sedentary Group)
C
TUNEL+cells/µm BM
0.16
0.12
0.08
0.04
0
R^2 = 0.396
0
15
30
45
(Sedentary Group)
B
Mean Epithelial Thickness (µm)
50
40
30
20
10
R^2 = 0.270
0
15
30
45
(Sedentary Group)
D
PCNA+ cells/µm BM
0.16
0.12
0.08
0.04
0
R^2 = 0.395
0
15
30
45
(Sedentary Group)

Pathogenetic Mechanism

Thermo-osmolar Irritation/Injury by exercise-induced Hyperventilation with cold Air

- ⇒ **Heatloss** — **Direct, Evaporation**
- ⇒ **Dehydration** — **↓ Cellvolume, ↑ Osmolarity**
- ⇒ **Reactive Inflammation** — **eosphilic vs. neutrophilic**

Folgen: **1. in pre-existing BHR/ Asthma (↑ eos. inflammation)**

Mediator Release:
Histamin, Neuropeptide, LT, PG, TNF (lokal & Urin)
↑ Permeabilität
↑ Nerve Activity (Vagus)

⇒ ***Bronchoconstriction***

2. Direct Injury (↑ neutro. Inflammation)

Mediator Release ? ↑ Permeabilität ?
↑ Nerve Activity (Vagus)

⇒ ***Bronchoconstriction***

Respiratory Water Loss
Humidification and Warming of Cold Air

↓

Mucosal dehydration and direct cooling

↓

Increase in $[Na^+]$, $[Cl^-]$, $[Ca^{2+}]$, $[K^+]$

↓

Increase in osmolarity and direct injury

↙ ↓ ↘

Airway surface liquid | Epithelial Cells | Submucosa

Presence of airway inflammation

↓

Mediator release from Inflammatory Cells

↓

Bronchial smooth muscle contraction

Prevalence of EIB in Ice – Hockey: 15-22%

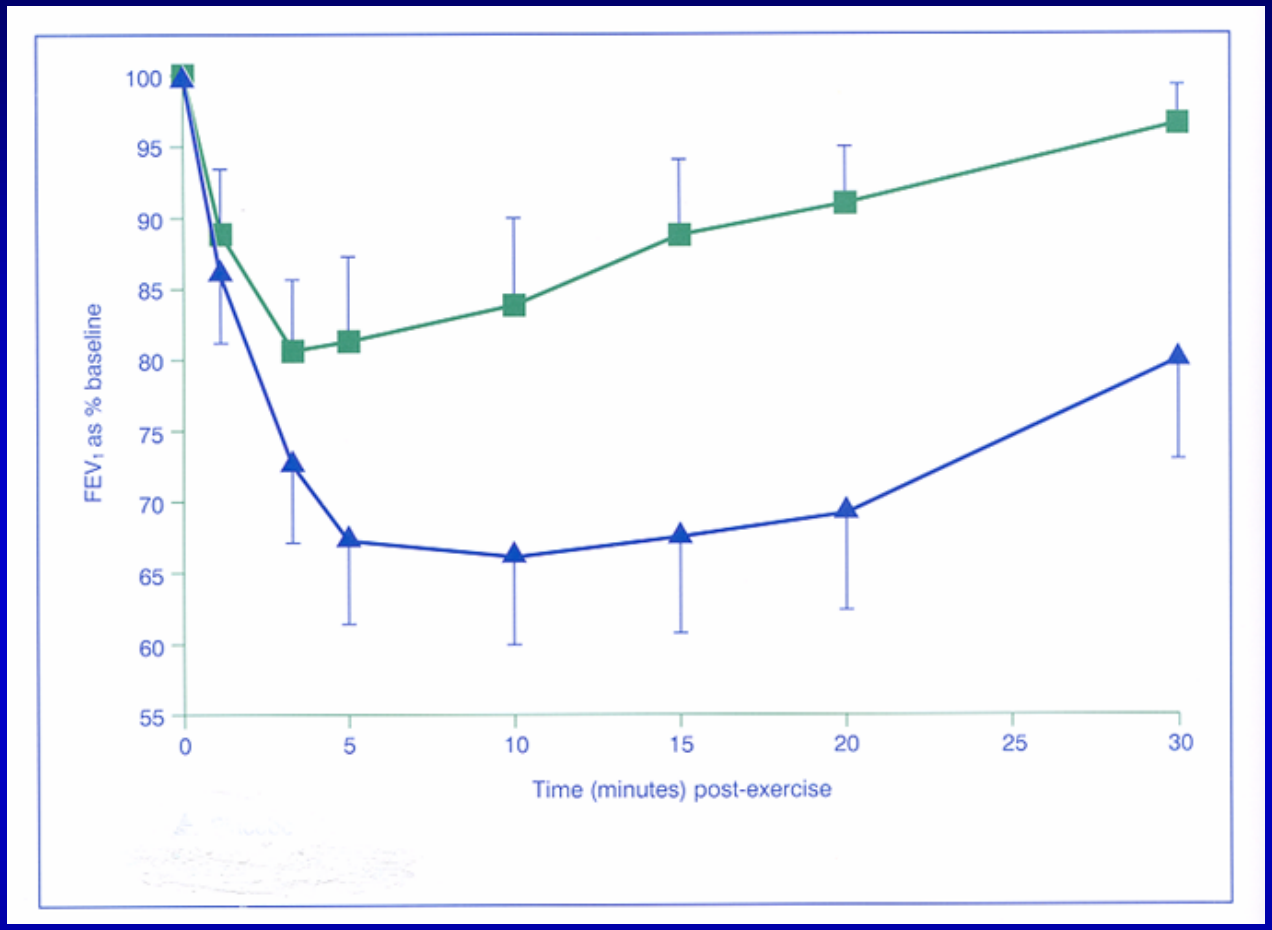
Why do we miss so many athletes with EIB in Wintersports???
Report of Swiss-Olympic Medical Team in Torino 2006:

Physician:
- Don‘t know the Symptoms of EIB
- Don‘t know the Difference of Asthma and EIB
- Look for the wrong Things (rev. Obstruction)
- Think, Athletes would like to dope with Anti-Asthmatic Medication

Athletes:
- Ignorance and wrong Information_
- Symptoms don‘t correlate with EIB
- Fear from beeing pushed to use Medication
- what do Orthopedic Surgeons know about Asthma?
- …..I‘m a tough Guy!

6-8 min

Start >---------



EIB: Why does‘nt it start immediatelly and improves with Time?

Bronchoprotection in EIB

- **Immediate Protection**
  ⇒ Adrenaline ↑ (6-8‘)
- **Late Protection**
  ⇒ after 10-20‘ start of the Refractory Period
  ⇒ PGE_2 ↑, PGI_2 ↑
  ⇒ Protection post Exercise
  after 1h still 75% Protection from EIB
  after 2h 50% Protection
  after 4h 0% Protection
- **Prevention → prolonged „Warming Up“ > 10-15‘**

Intervall	45%/90% VO_2max
Steigerung	30% → 70% VO_2max
Aerobic	50% → 70% VO_2max
Walking	45% VO_2max

Exercise-Induced Bronchoconstriction (EIB)

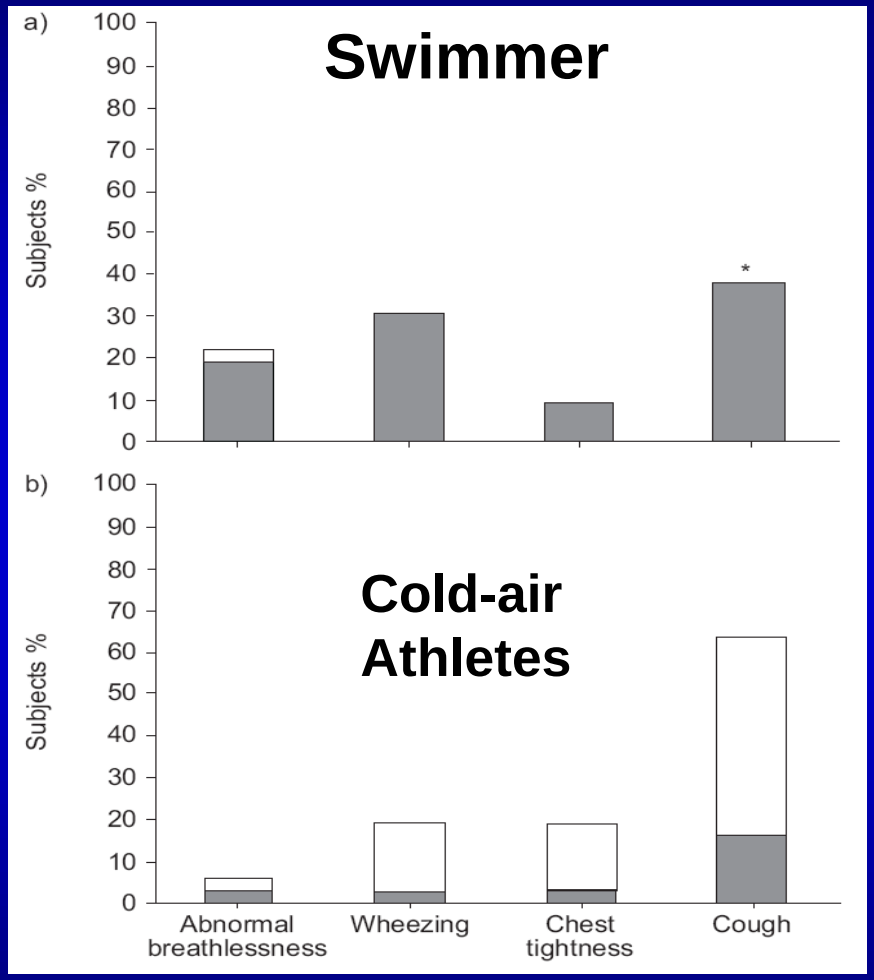
Definition: Temporary Bronchoconstriction during/after Intense Physical Activity

Complaints: Symptoms: 6-8‘ after start of exercise

Dry cough (during/after Exercise), for hours!
Dyspnoe without Wheezing
Chest Tightness
Decrease in Performance
Wheezing (exspiratory)

Running through !!!!!!!!!!!!!!!!!
Improvement of Performance after 15-20‘

Are Respiratory Symptoms allways caused by BHR



BHR negativ

BHR positiv

Bougault V et al.: Eur Respir J 2009

Diagnostic Procedures for EIB

„Specific“ Tests

- **Spirometry:**
  ⇒ Reversibility FEV1 = >12% (Salbutamol)
  ⇒ FEV1 Instability (?)

- **Exercise Test for EIB**
  ⇒ Defined Exercise-Test on Tretmill/Bike

- **BHR**
  ⇒ Methacholine-Test, Mannitol-Test, Hypertonic NaCl-Test, eucapnic Hyperventilation-Test

Therapy of EIB (1)

no Sports

- Unstable „untreated“ Asthma
- Cold Temperature (< -18°):
  in Combination with intense Hyperpnoe
  Induction of Inflammation with BHR

Refractory Period

- extended Warming Up (>15‘) with
- slow increase in Intensity
- Intervalls

Sporadic EIB:

β_2-Agonist (DoU,TUE)

- Short Acting β2 (SABA):
  15‘ before Exercise

Parasympatolytics

- Tiotropium (Spiriva)/Ipratropium (Atrovent):
  60‘ before Exercise
  (less effective!)

Therapy of EIB (2)

1. *Asthma bronchiale*

Basic:	**ICS: Budesonid et al (DoU)**
	ev plus LTRA (Montelukast et al)
on demand:	**prophylactic: 15‘ before Exercise / Rescuemed.**
	SABA: Type Salbutamol et al(DoU,TUE)
	LABA: Formoterol (TUE), Salmeterol (DoU)

falls Dauertherapie notwendig:

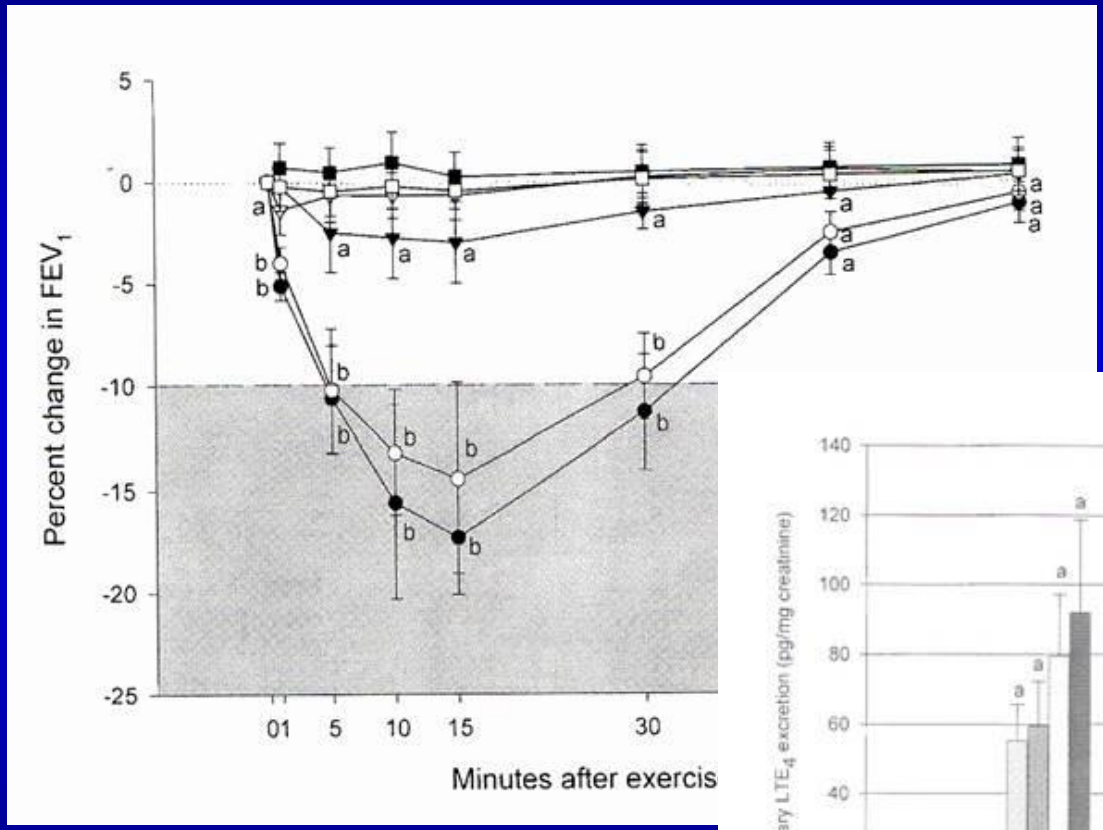
Kombinationen (Symbicort/Seretide (TUE) oder LTRA/LABA (TUE)

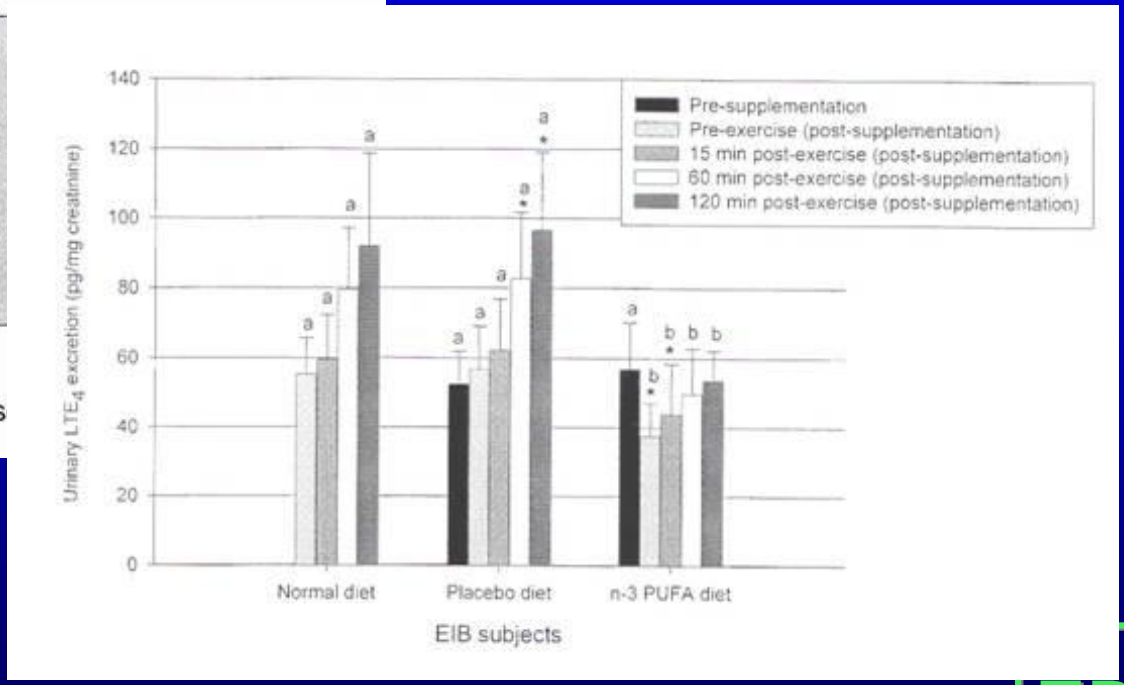
2. *„Sportl-induced“*

intermittend:	**prophylactic: 15‘ before Exercise mit SABA**
rezidivierend:	**LTRA (Montelukast) ev. in Combination with ICS and Beta2**
Prevention:	**Omega 3 FS (500mg, q 12h)**

Fish Oil (Omega 3 FS) Supplementation reduces Severity of Exercise Induced Bronchoobstuction in Elite Athletes

T.D. Mickleborough, R.L. Murray, A.A. Ionescu, M.R. Lindley, ADRCCM, 168, 1181-1189 (2003)





Take Home Message (1)

EIB in	Asthma	„Sport-induced“ Asthma
Hx Asthma	+	-
Hx Allergy	+/-	-
Inflammation	Eosinophils	Neutrophils
„Key“-Symptoms	Wheezing	Dry Cough
	Dyspnoe	Chest Tightness
	Scating through	Scating through
BHR	Methacholine	Exercise-/EHV Test
Therapy	ICS > LRA	ICS = LRA (?)
Prevention	SA Beta 2 +++	SA Beta 2 +++
	Omega 3 +/-	Omega 3 +++
Hx	lifelong	3 yrs after career < 3%

Take Home Message (2)

Yes!
EIB is in Ice Hockey
still Under Diagnosed

If not at least 15% of your Ice Hockey Players are treated for an Exercise-Induced Bronchoconstriction (EIB)…….

Your Team will not perform optimally !!!!!

Do you want that?

Thanks for your attention!

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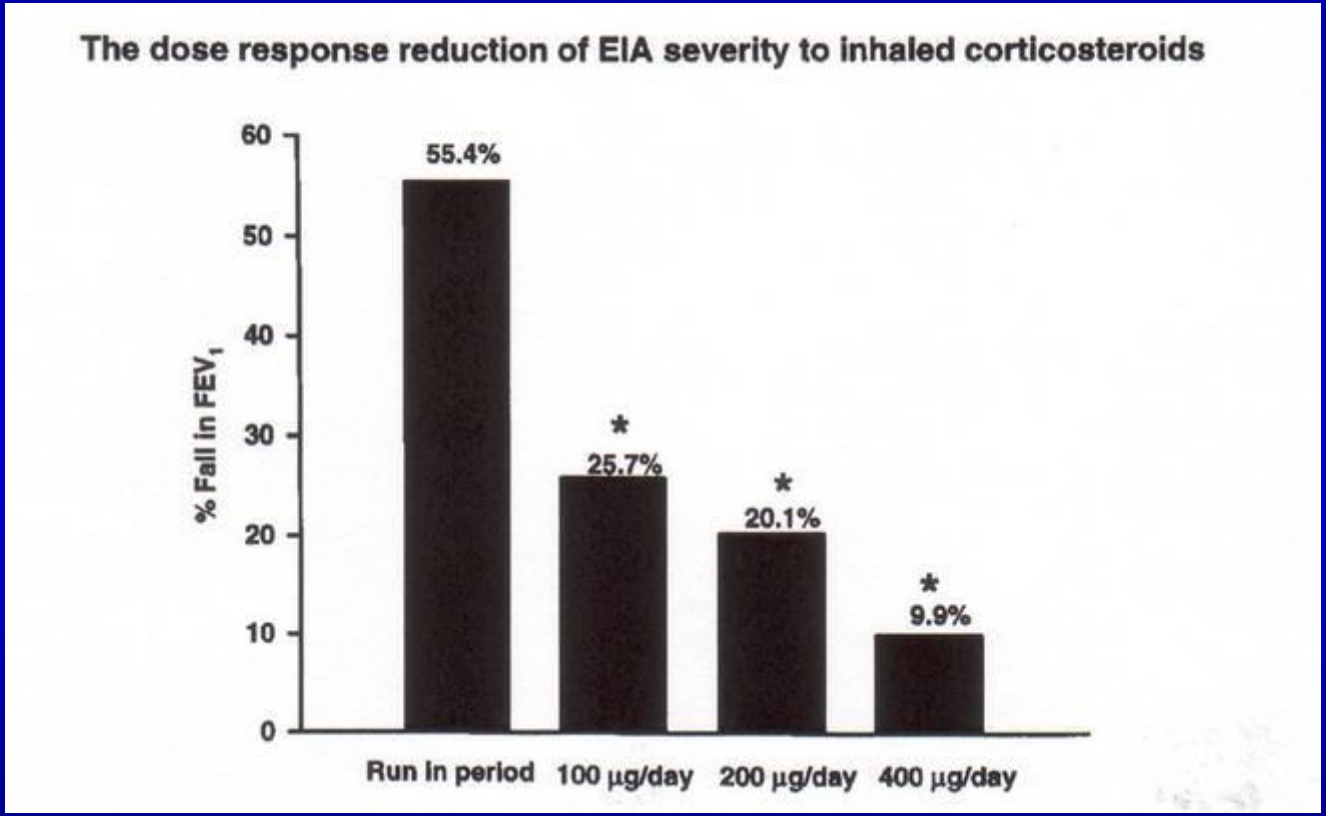
Therapy of EIB in Asthma bronchiale

S.A. Anderson: Effect of Budesonid on EIA in Asthmatics
JACI 1995: 95,29-33



Effect of Montelukast (Singulair) on EIB

Leff JA et al. NEJM 1998

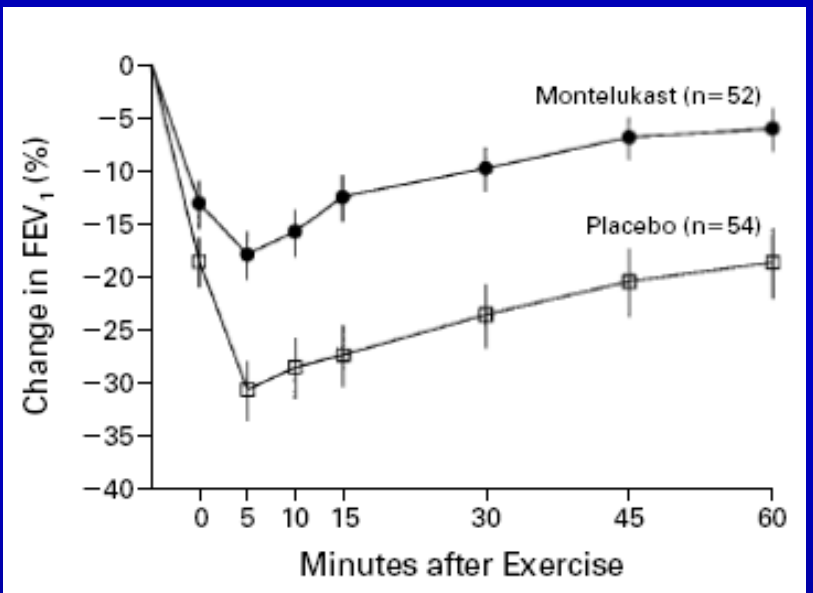


Figure 2. Mean (±SE) Changes in FEV_1 after Exercise Challenge after 12 Weeks of Treatment with Montelukast or Placebo.

Treatment with montelukast was associated with a significant (P=0.002) reduction in exercise-induced bronchoconstriction.