

Asthma in Icehockey

Is it Under Diagnosed?

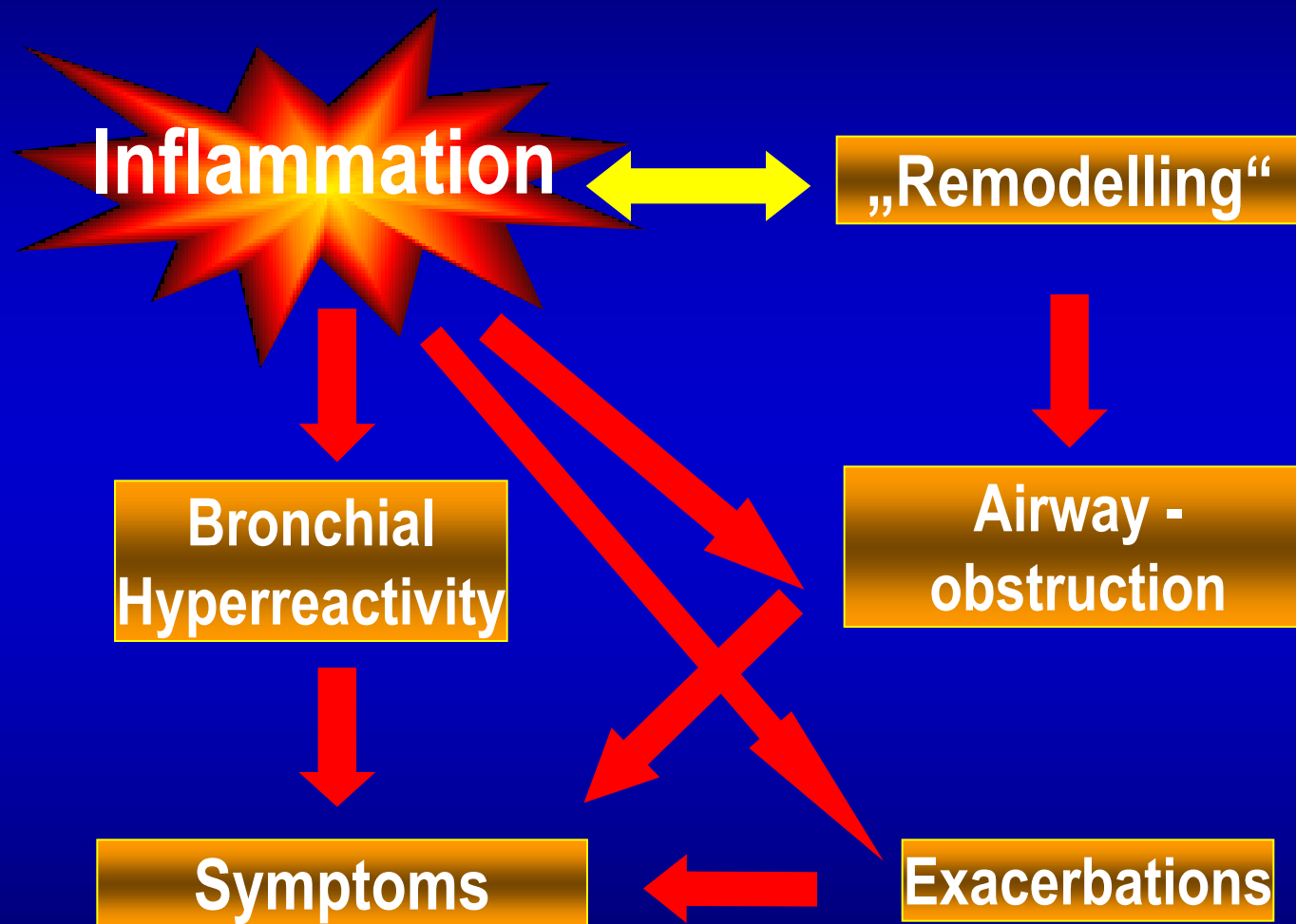


Dr. med. B. Villiger
CEO, Schweizer Paraplegiker Zentrum Nottwil



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 Severity 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	12 (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%

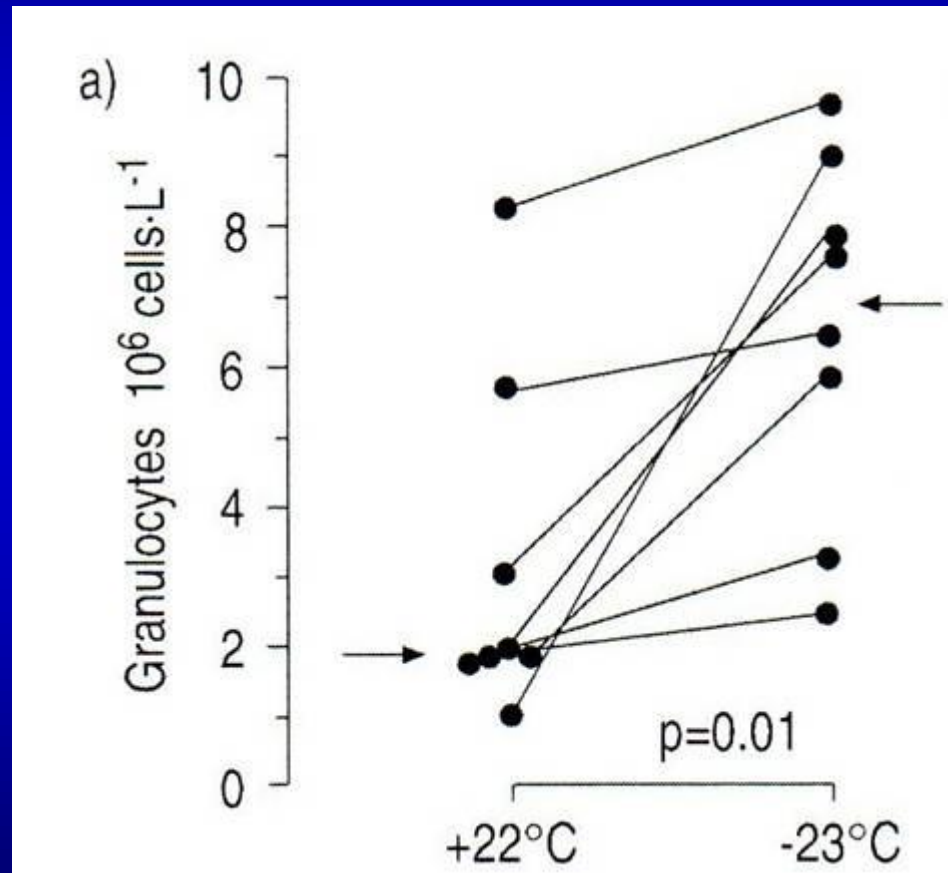
Leuppi 1998: Floor - Hockey vs. Ice – Hockey (CH)

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

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

	<u>Controls</u>	<u>Asthmatics</u>	<u>Skiers</u>
„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

Figures

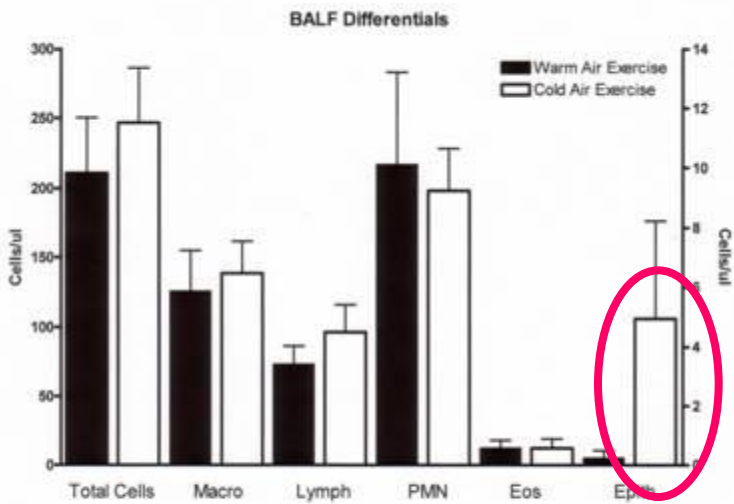


Figure 1: Airway Nucleated Cells after Exercise while Breathing Cold Air. Total Cells - Total BALF Nucleated Cell Concentration; Macro - Macrophages; Lymph - Lymphocytes; PMN - Neutrophils; Eos - Eosinophils; Epith - Epithelial cells. PMN, Eos, and Epith are plotted against the right Y-axis. Mast cells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

Effect of Exercise while Breathing Cold Air on Airway Cytokine Expression

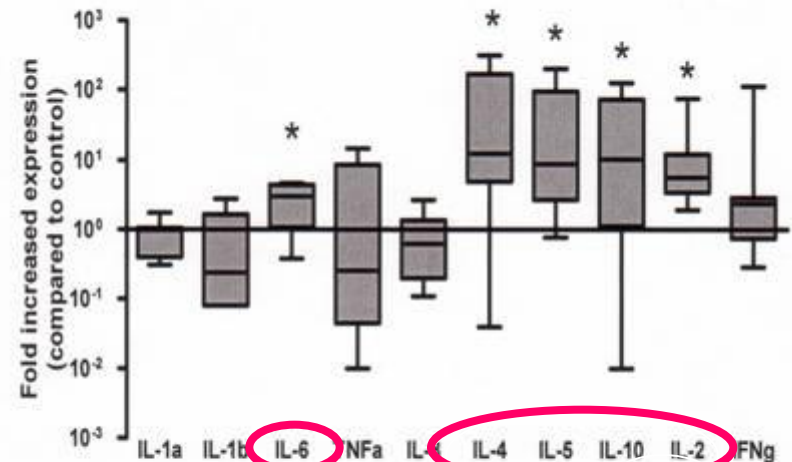


Figure 2: Airway Cytokine mRNA Expression after Exercise while Breathing Cold Air. Data are expressed as the relative (fold) increase of cytokine expression after cold air exercise compared to warm air exercise.

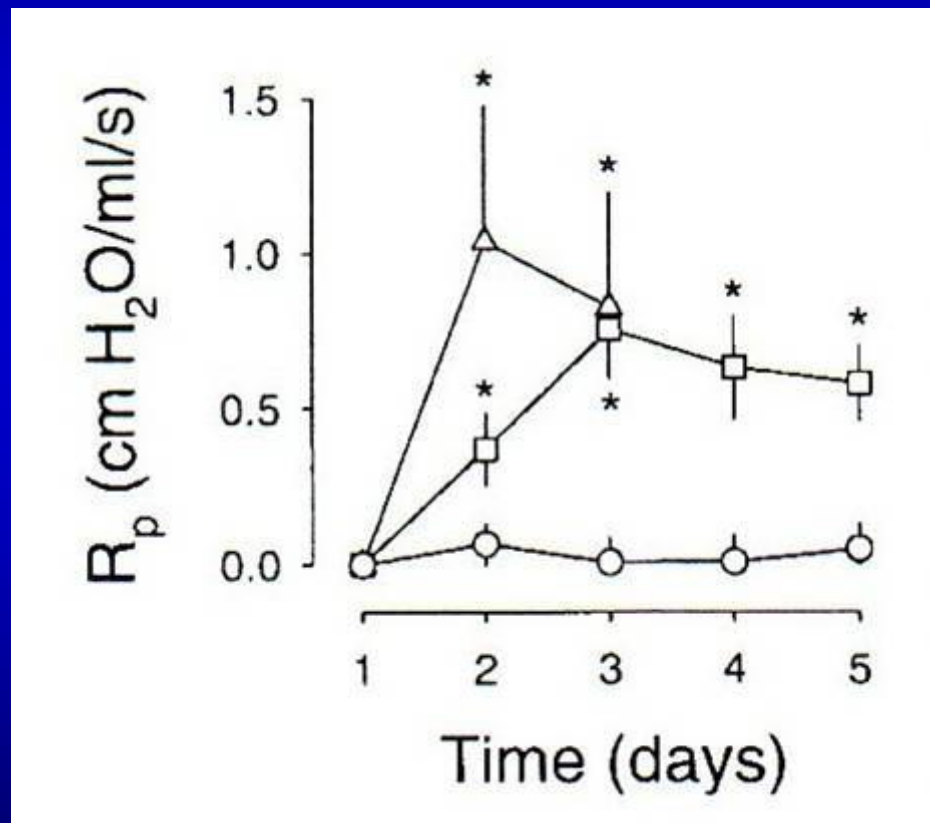
*Significantly different from 1 (relative expression after exercise while breathing warm air), $p < 0.05$.

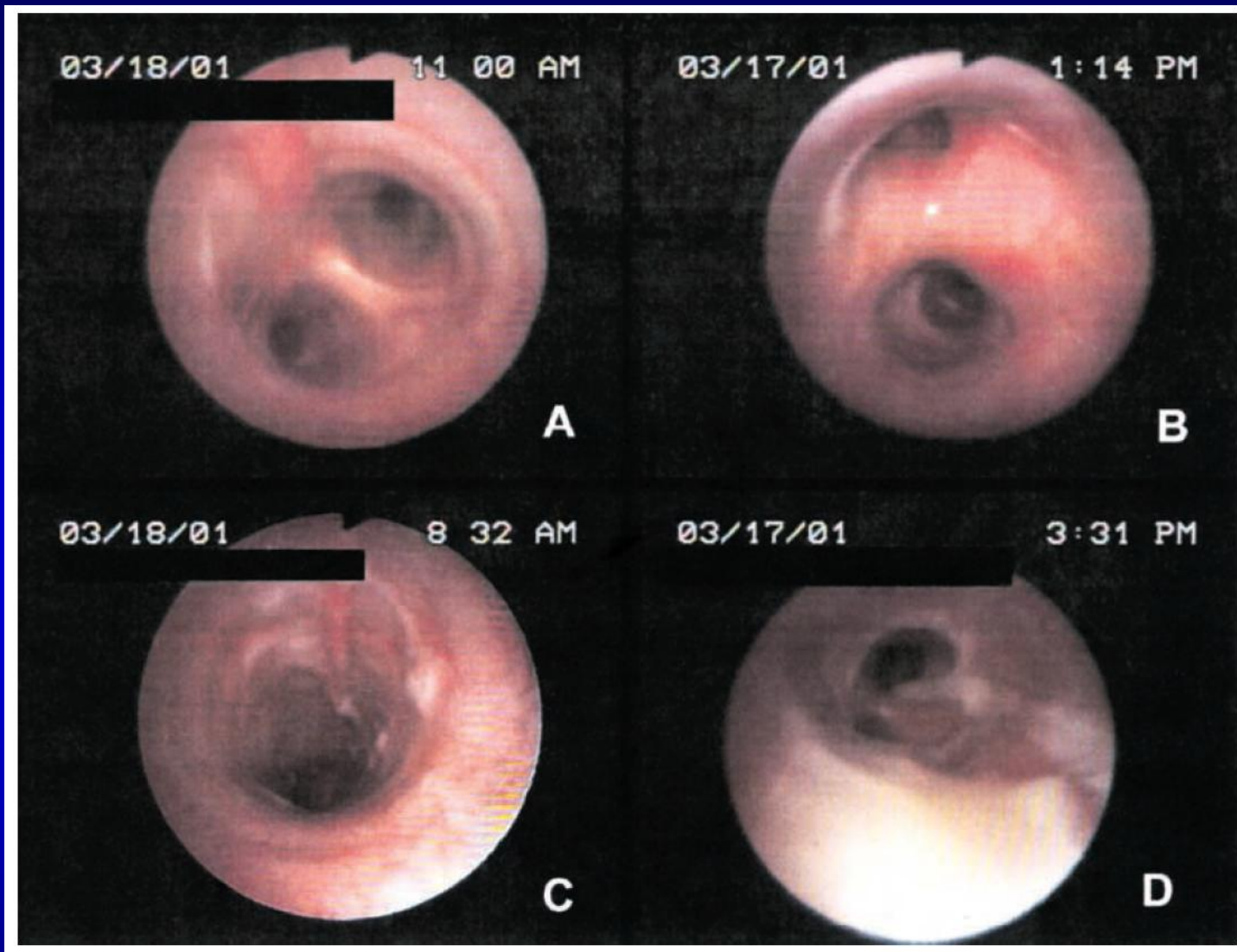


Risk- Factor Hyperventilation ???

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

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



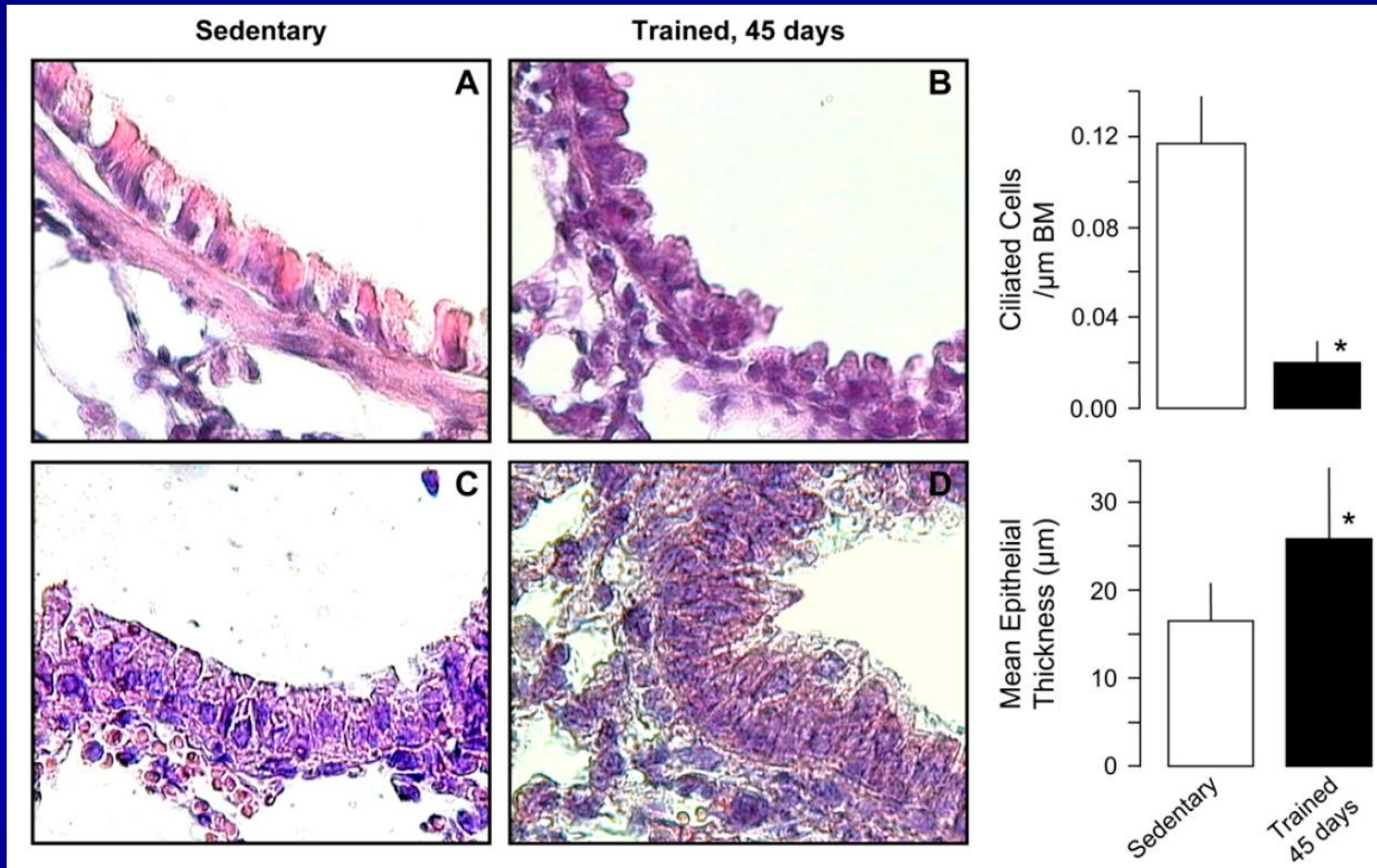


Davis MS et al: Am J Respir Crit Care Med 2002

Beat Villiger: 1. Sports Medicine Seminar KHL - Asthma in Icehockey

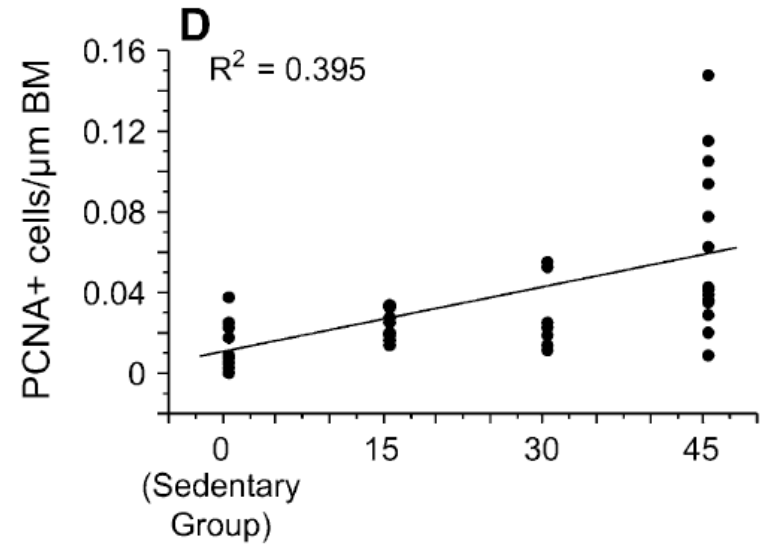
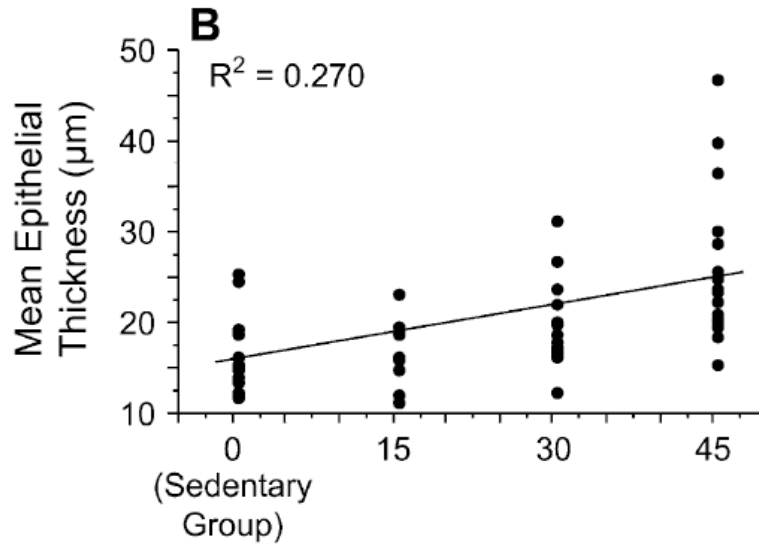
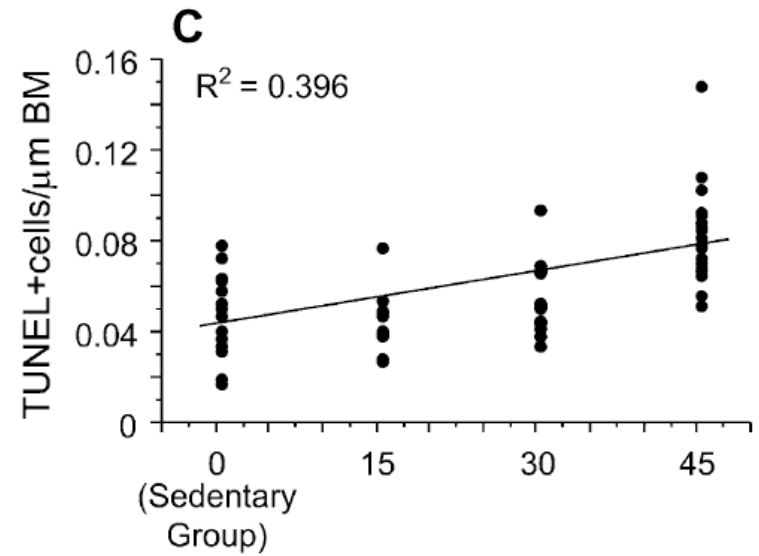
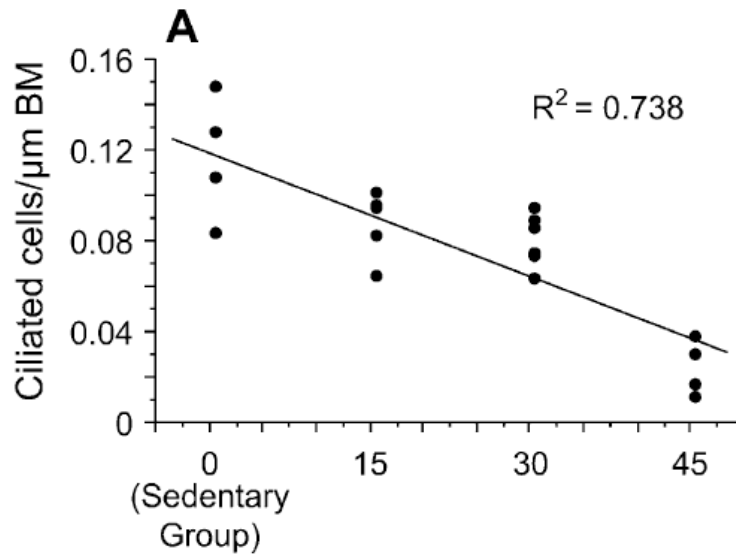


Risk - Factor: Duration of Hyperventilation?



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





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:

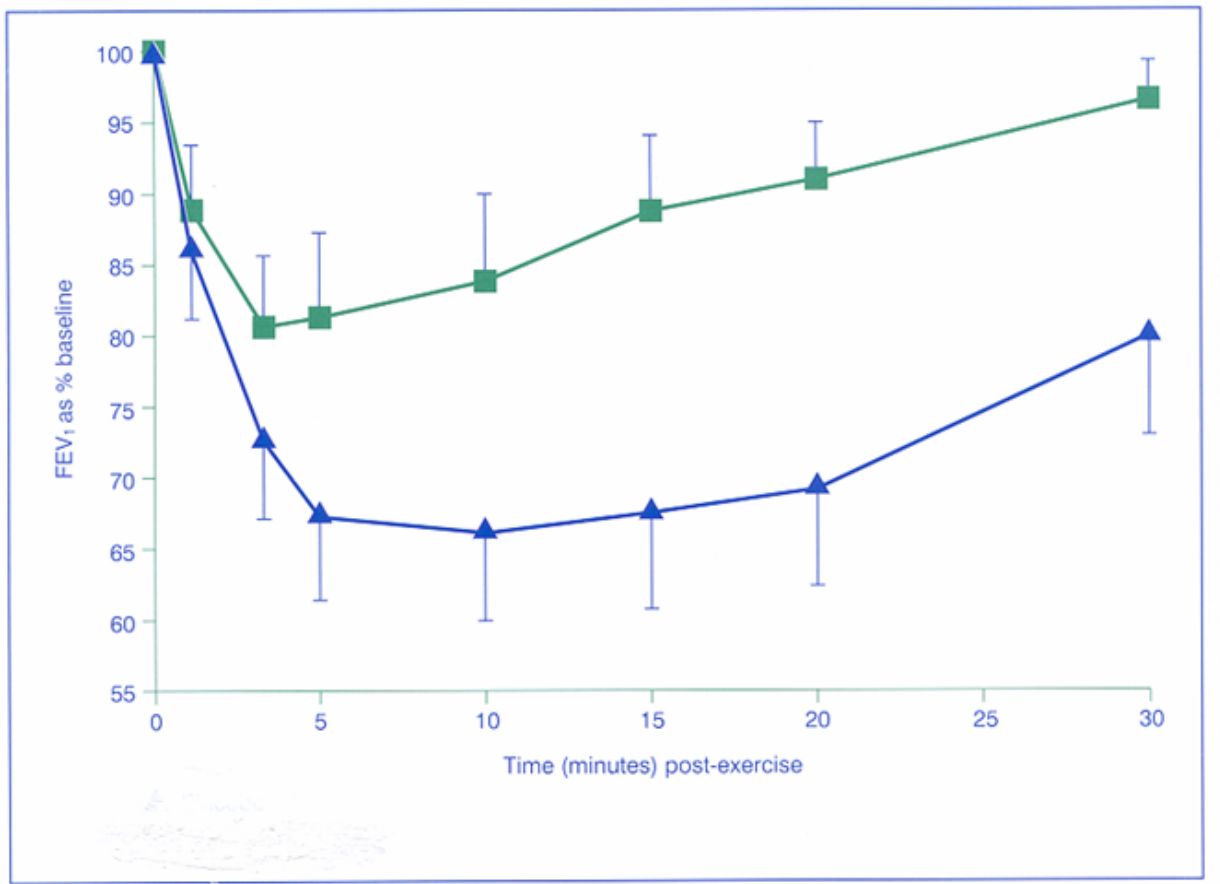
- Physician:**
- Don't know the Symptoms of EIB
 - Don't know the Difference of Asthma and EIB
 - Look for the wrong Things (rev. Obstruction)
 - Think, Athletes would like to dope with Anti-Asthmatic Medication

- Athletes:**
- Ignorance and wrong Information_
 - Symptoms don't correlate with EIB
 - Fear from being pushed to use Medication
 - what do Orthopedic Surgeons know about Asthma?
 -I'm a tough Guy!



6-8 min

Start >-----



EIB: Why doesn't it start immediately and improves with Time?



Bronchoprotection in EIB

- **Immediate Protection**

⇒ Adrenaline ↑ (6-8')

- **Late Protection**

⇒ after 10-20' start of the Refractory Period

⇒ PGE₂ ↑, PGI₂ ↑

⇒ 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% VO₂max

Steigerung 30% → 70% VO₂max

Aerobic 50% → 70% VO₂max

Walking 45% VO₂max



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

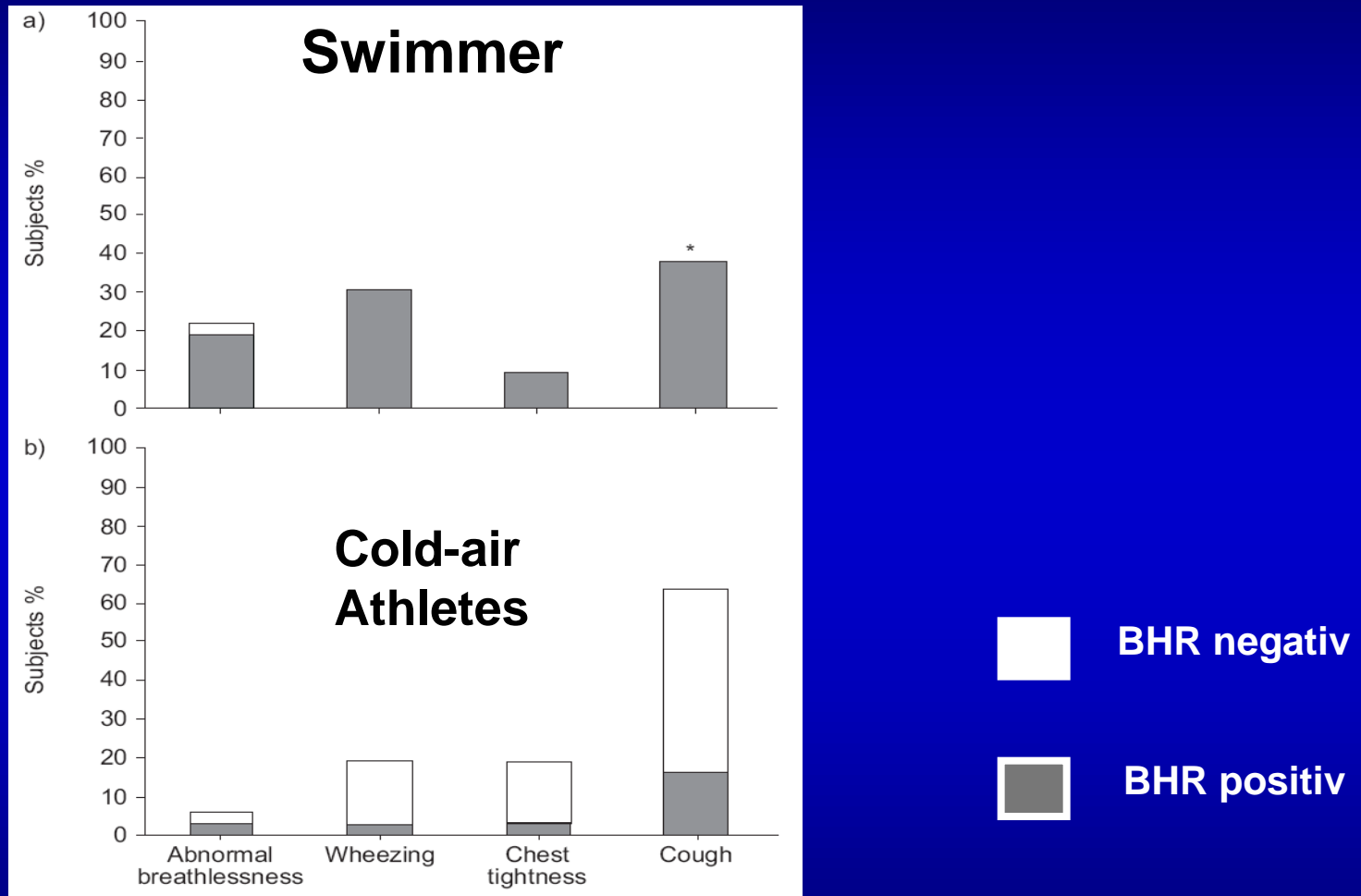
Wheezing (expiratory)

Running through !!!!!!!!!!!!!!!!!!!!!

Improvement of Performance after 15-20'



Are Respiratory Symptoms always caused by BHR



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 ($< -18^{\circ}$):
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 β_2 (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)

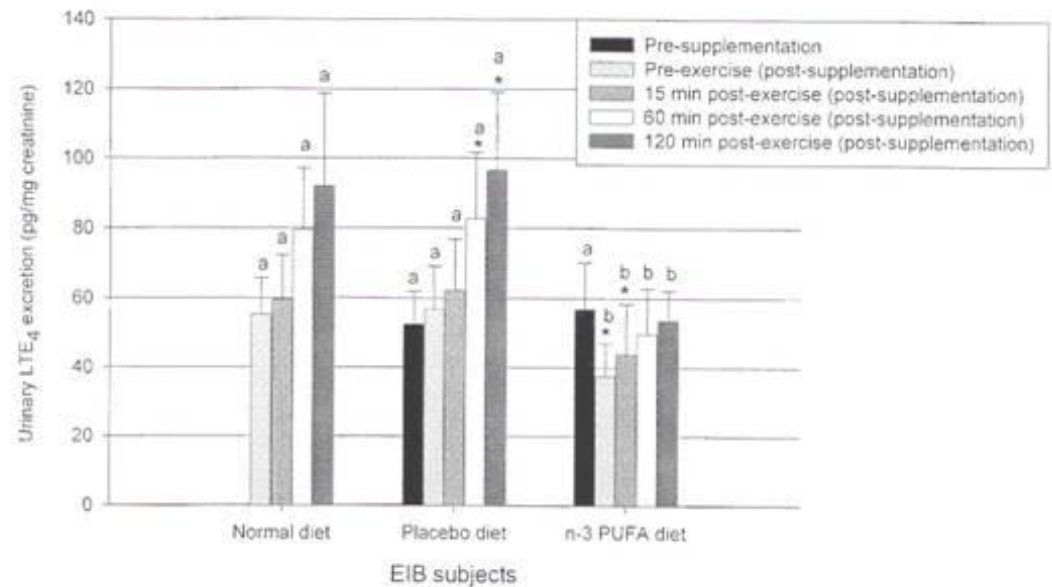
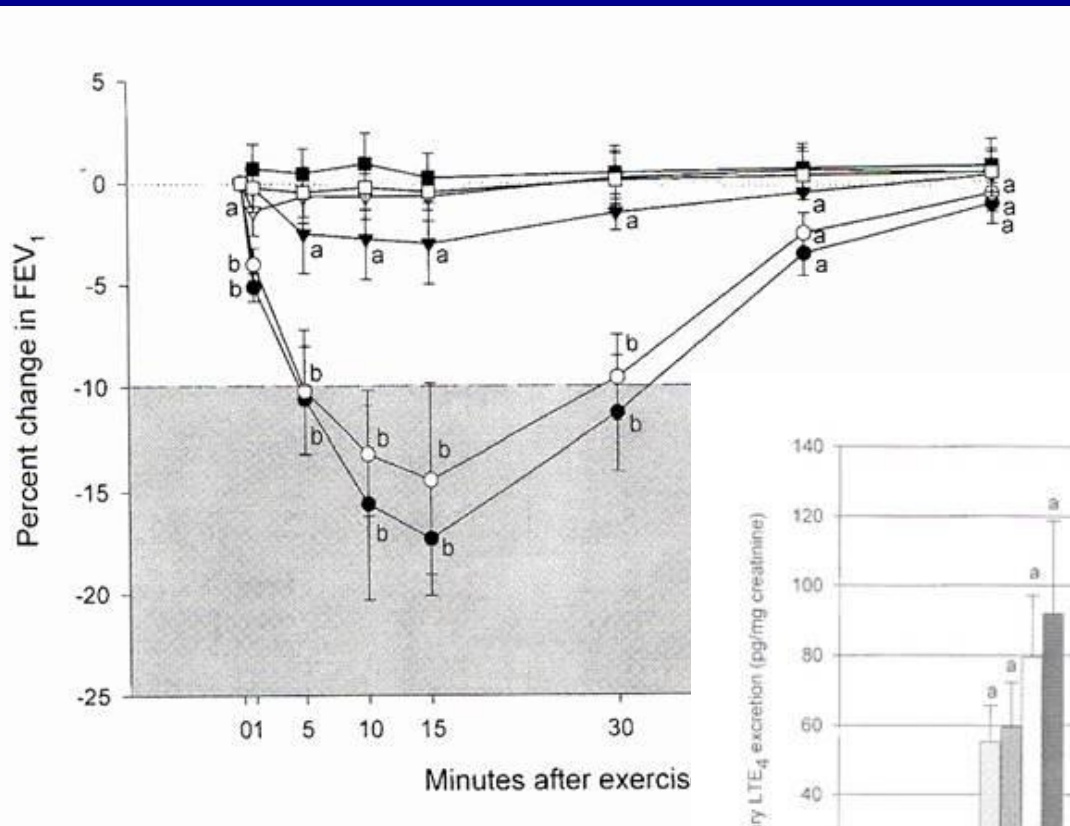
2. „Sportl-induced“

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 Bronchoobstruction 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!

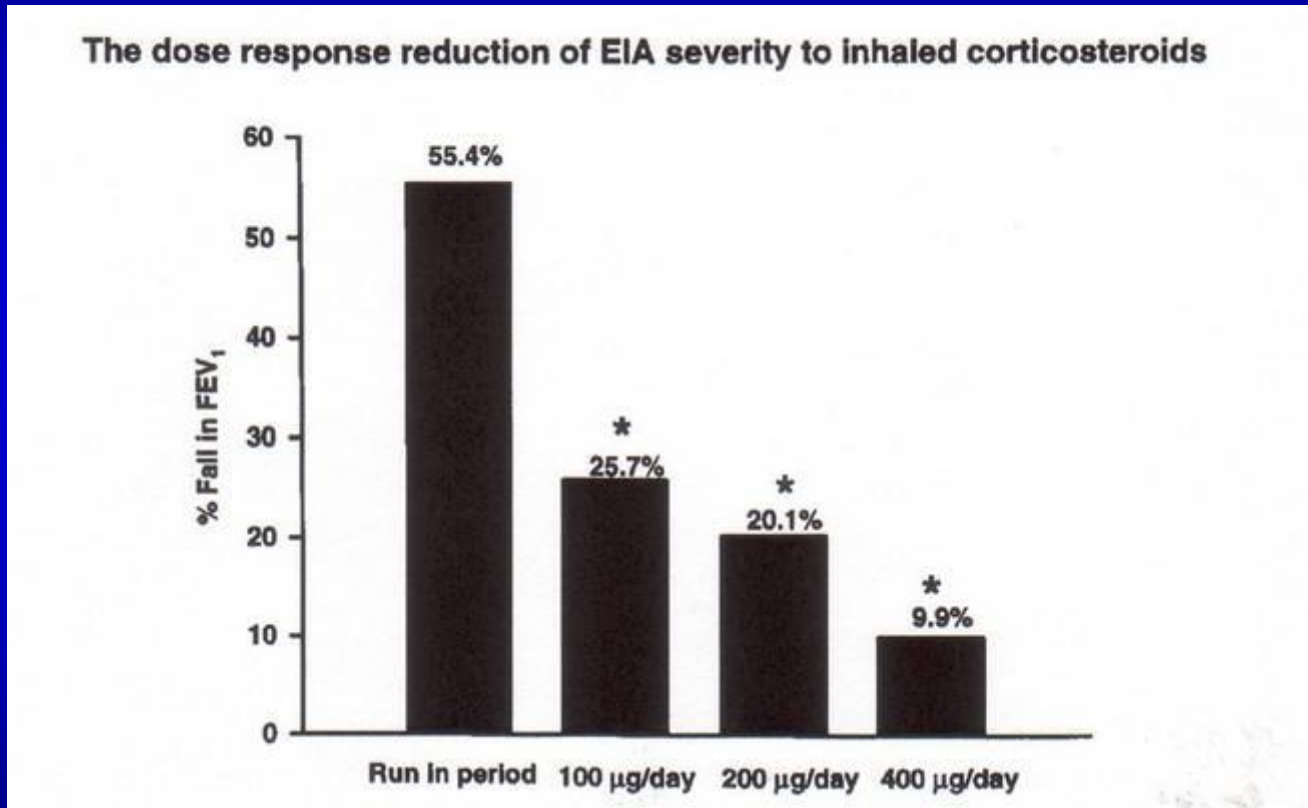
Beat Villiger, MD, CEO SPC
Swiss Paraplegic Center
6207 Nottwil/Switzerland

Phone	+41 41 939 55 51
Fax	+41 41 939 55 57
E-Mail	beat.villiger@paranet.ch
Internet	www.paranet.ch



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

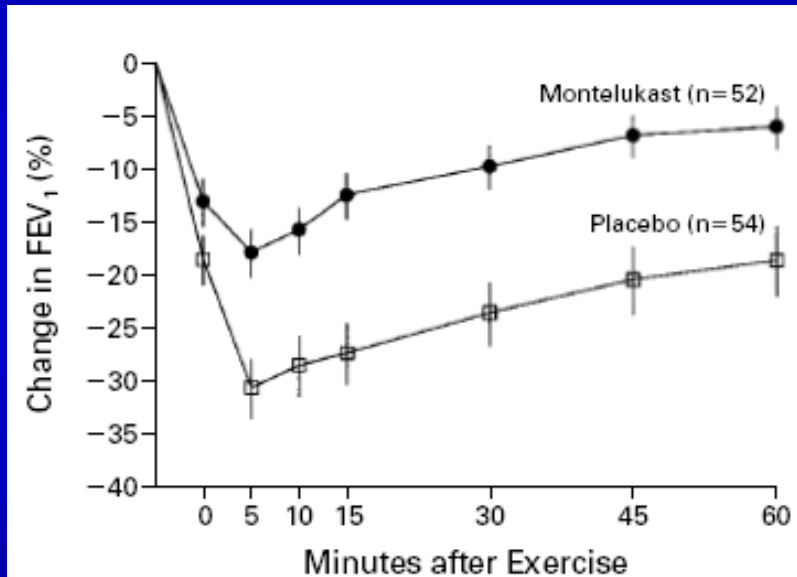


Figure 2. Mean (\pm SE) Changes in FEV₁ after Exercise Challenge after 12 Weeks of Treatment with Montelukast or Placebo.

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

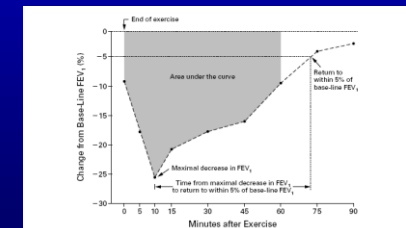


Figure 1. End Points Used to Assess the Degree of Exercise-Induced Bronchoconstriction. The following end points were assessed: the area under the curve for the percent decrease in FEV₁ in 0 to 60 minutes after exercise, the maximal decrease in FEV₁ after exercise, and the time from the maximal decrease in FEV₁ to the return to within 5 percent of the FEV₁ value before exercise.