

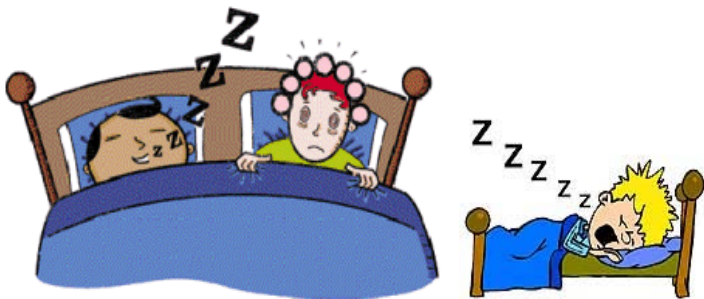


An update on childhood sleep-disordered breathing

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มหาวิทยาลัยสงขลานครินทร์

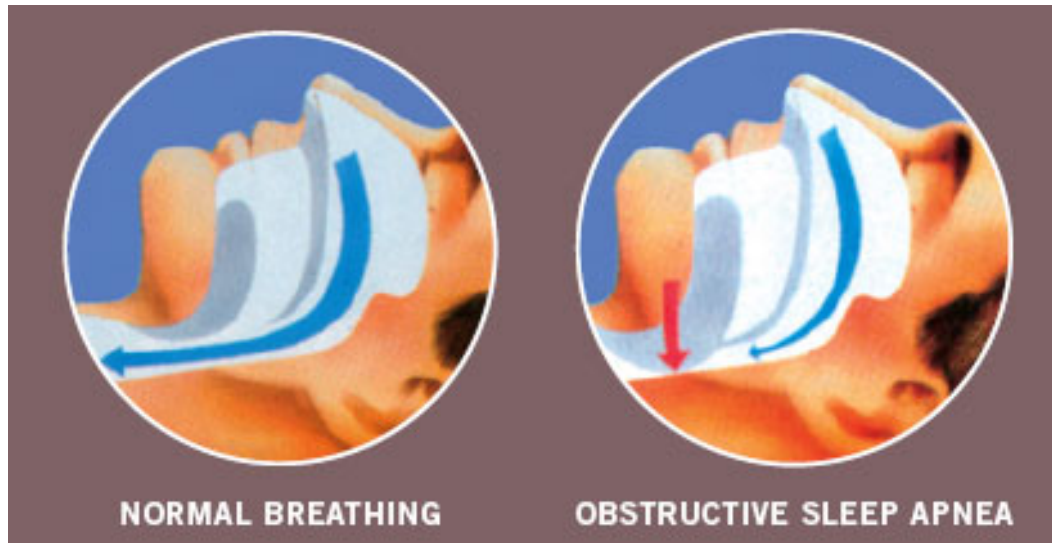


Sleep-disordered breathing

- **Primary snoring**
- **Upper airway resistance syndrome**
- **Obstructive hypopnea**
- **Obstructive apnea**



Pathophysiology



Patency of the upper airway during sleep

Neuromuscular factors

Pharyngeal dilating muscle

- Tonic activity
- Phasic contraction in response to negative upper airway pressure

Structural factors

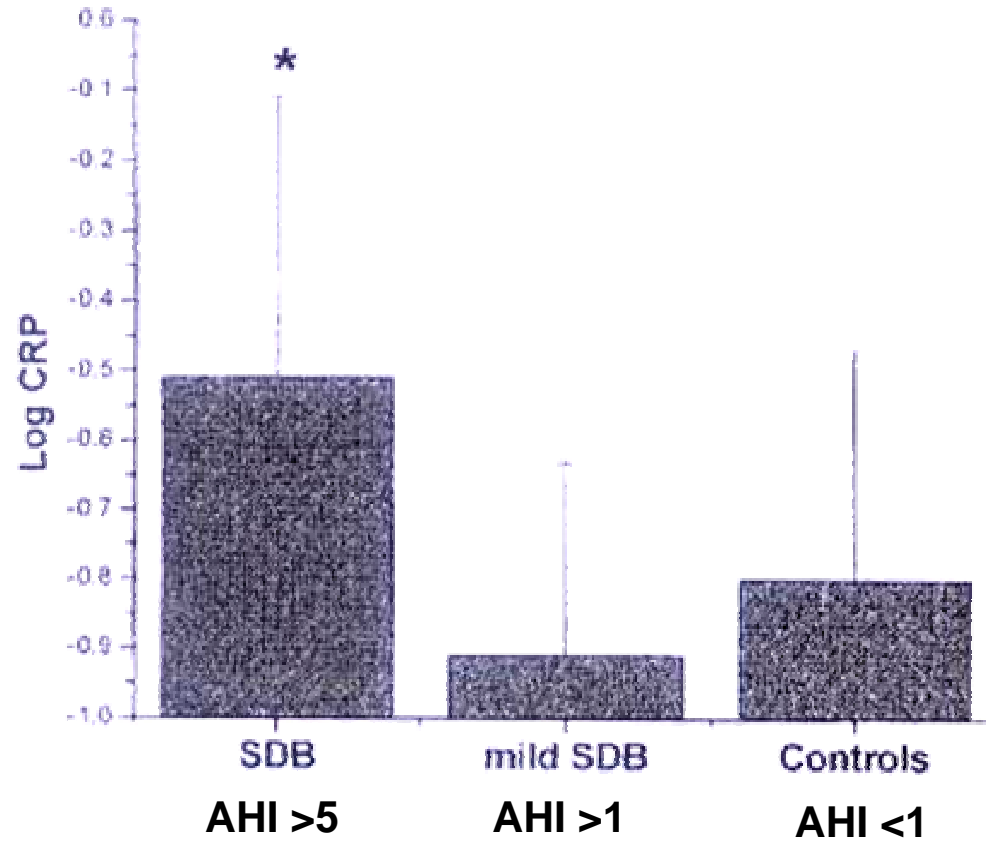
- Upper airway structure
- Enlarge tonsils and adenoid
- Nasal mucosa swelling
- Pharyngeal fat pad



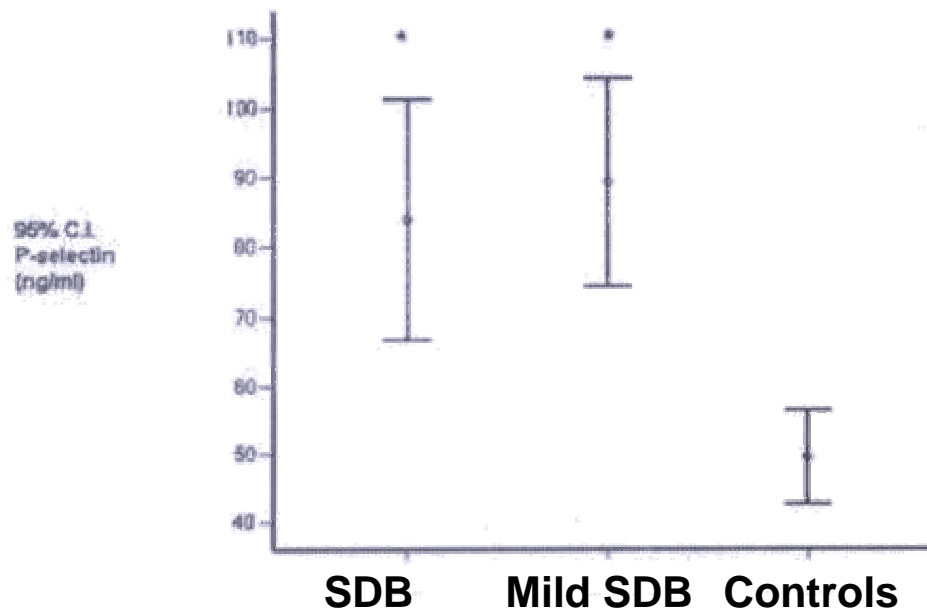
Update: SDB and inflammation



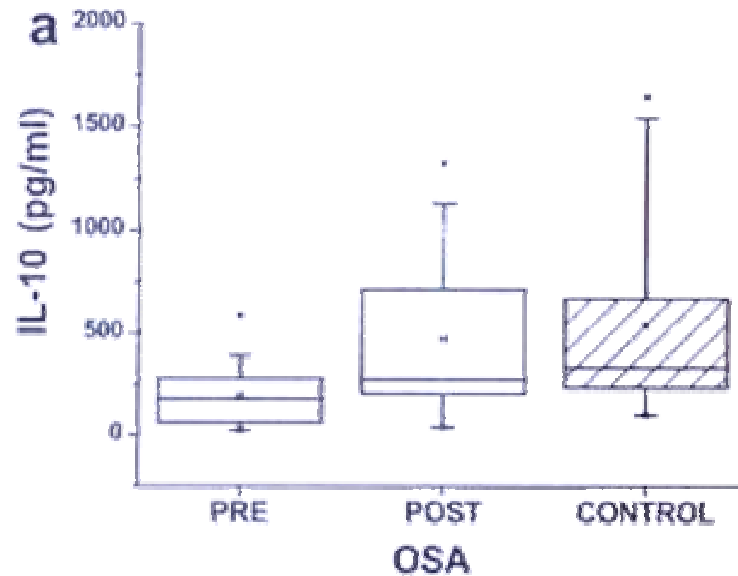
Plasma C-reactive protein levels among children with SDB



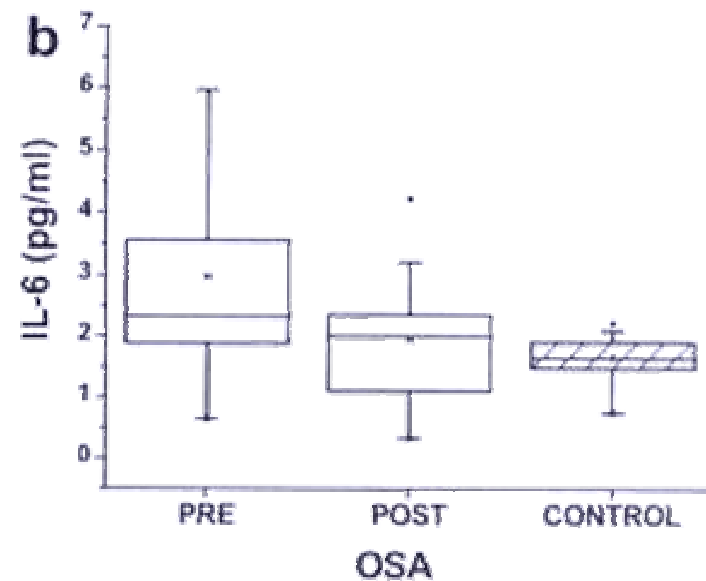
Comparison of P-selectin levels, a marker of platelet activation



IL-6 and IL-10 in children with SDB



IL-10, anti-inflammatory cytokines

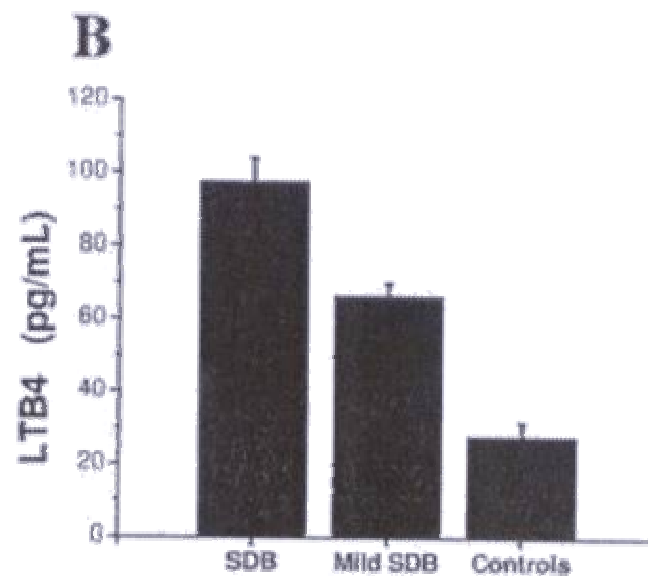
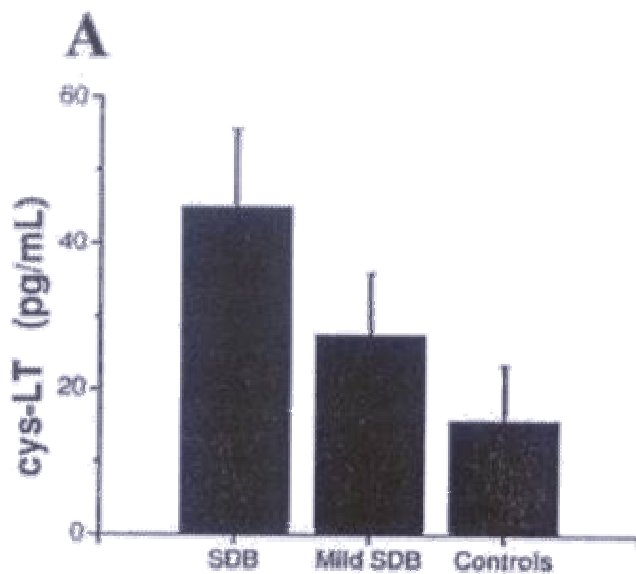


IL-6, pro-inflammatory cytokines

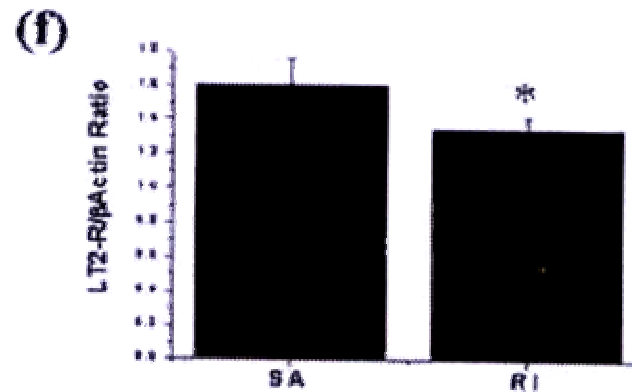
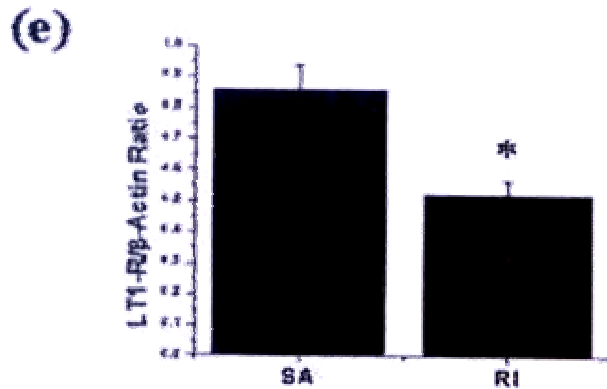
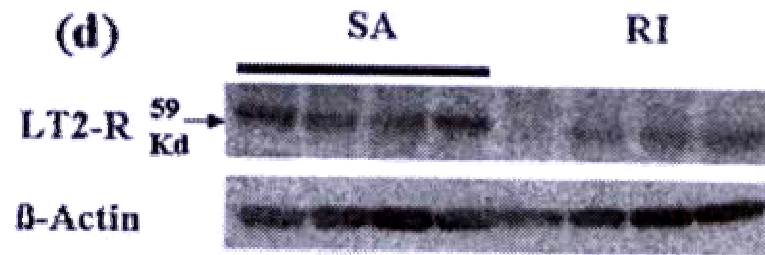
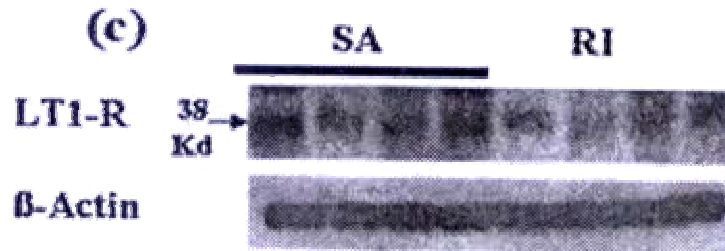
Urine cysteinyl - LT in children with SDB

Severity	Log- transformed urine cyst-LT	
	Mean	SD
Mod to severe	2.39	0.51
Mild	2.06	0.26
Primary snoring	2.11	0.25
Control	1.86	0.28
P value	<0.05	

Leukotriene in exhaled breath condensate of children with OSA



Leukotriene receptor 1 and 2 in tonsils of children with OSAS or recurrent infection



Inflammation in SDB

- C-reactive protein
- Adhesion molecules
- Cysteinyl leukotriene in urine
- Cysteinyl leukotriene in exhaled breath
- Interleukin-6 (pro-inflammatory cytokines) : increase
- Interleukin-10 (anti-inflammatory cytokines) : decrease



- Pathogenesis of SDB
- End-organ morbidity
- Marker for diagnosis



Predisposing factors

- **Adenotonsillar hypertrophy**
- **Allergic rhinitis**
- **Obesity**
- **Neuromuscular disease**
- **Craniofacial abnormalities**



Prevalence

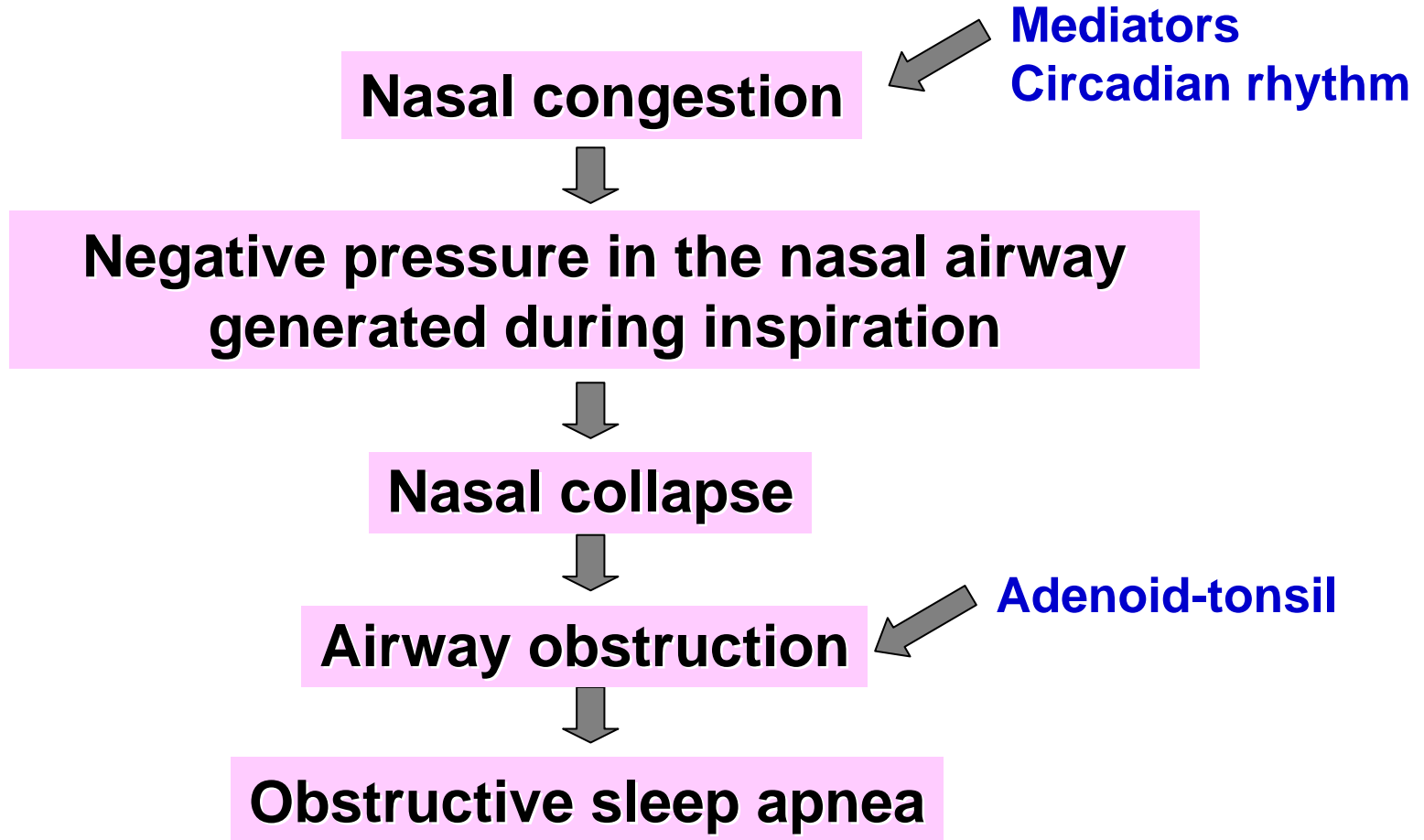
- **Primary snoring 7-9 %**
- **Obstructive sleep apnea 0.7-2 %**
- **Peak incidence 2-5 year, male = female**
- **OSA in obese children 13 - 46%**



Questionnaire-based study allergic rhinitis patients 12-17 years

- **Difficulty obtaining a good night's sleep** 78%
- **Unable to get to sleep** 75%
- **Awakened during the night** 64%

Allergic rhinitis and sleep-disordered breathing



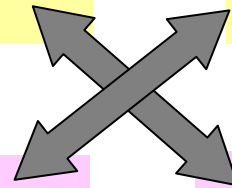
Classification of allergic rhinitis

Intermittent symptoms

- < 4 days per week
- or < 4 weeks

Persistent symptoms

- > 4 days per week
- and > 4 week



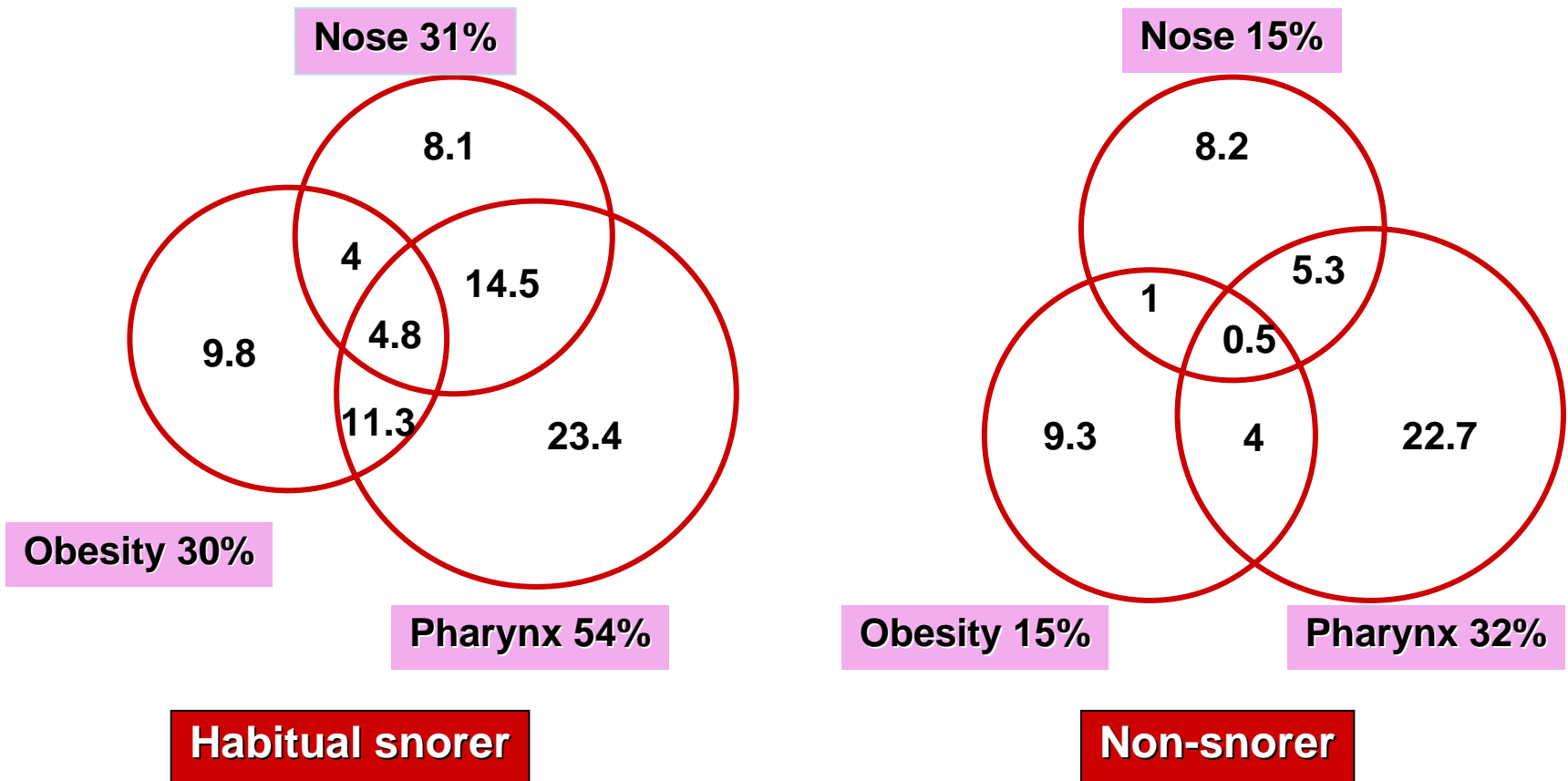
Mild

- normal sleep
- normal daily activities, sport, leisure
- normal work and school
- no troublesome symptoms

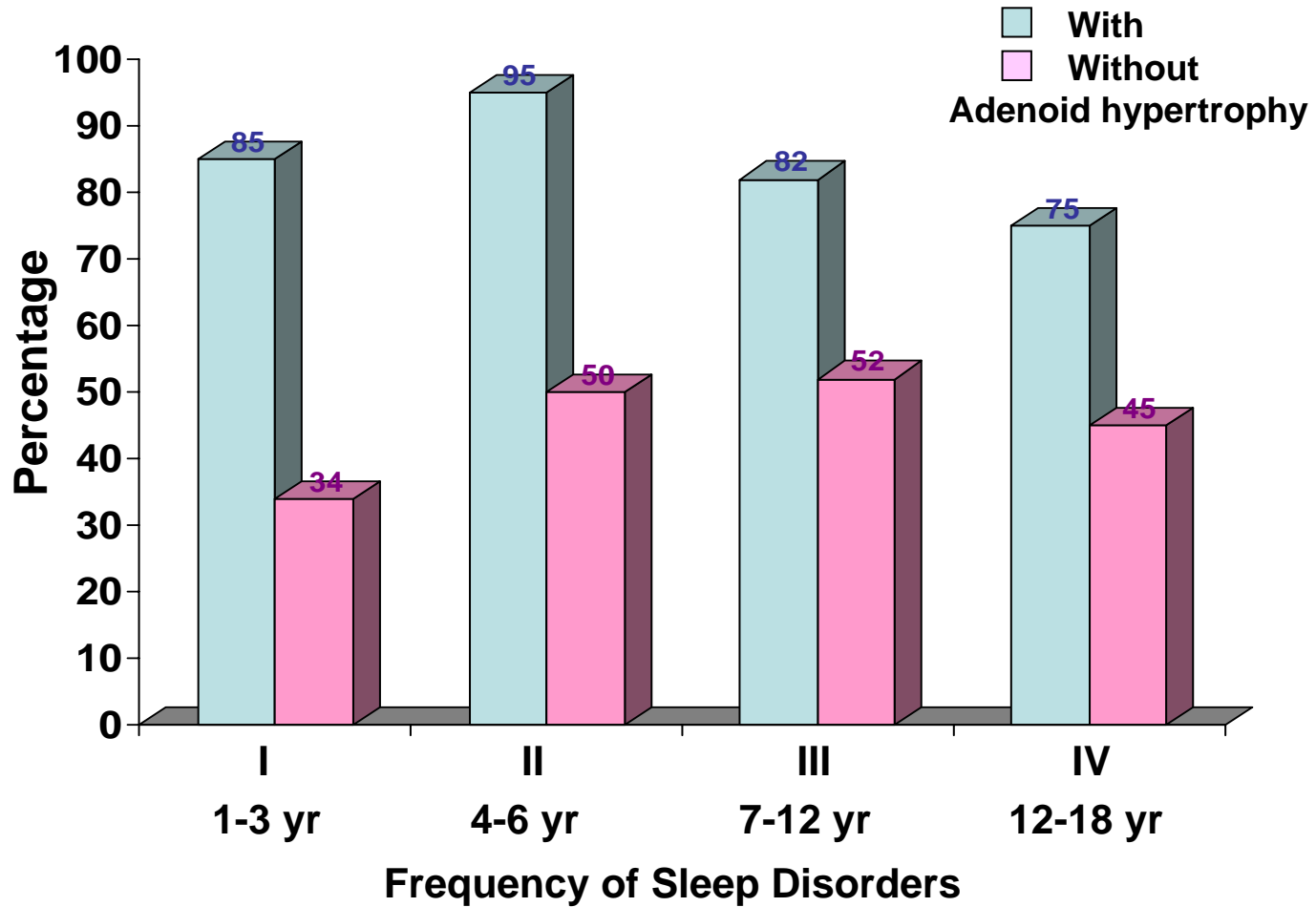
Moderate-severe

- one or more items
- abnormal sleep
- impairment of daily activities, sport, leisure
- problems caused at work or school
- troublesome symptoms

Distribution of risk factors in habitual snorers



Adenoid hypertrophy in children with allergic rhinitis



Clinical presentation

- **Snoring**
- **Allergic rhinitis**
- **Obesity**
- **Complication**



History

- ◆ **Habitual snoring**
- ◆ **Difficulty breathing**
- ◆ **Restless sleep**
- ◆ **Apnea**
- ◆ **Mouth breathing**
- ◆ **Neck hyperextension**
- ◆ **Secondary enuresis**
- ◆ **Excessive daytime sleepiness**



Physical Examination

- ◆ **Normal during awake**
- ◆ **Signs of underlying diseases**
- ◆ **Growth :**
 - Obesity**
 - Failure to thrive**



Test to determine the etiology of OSA

Film adenoid



Test to confirm diagnosis of OSA

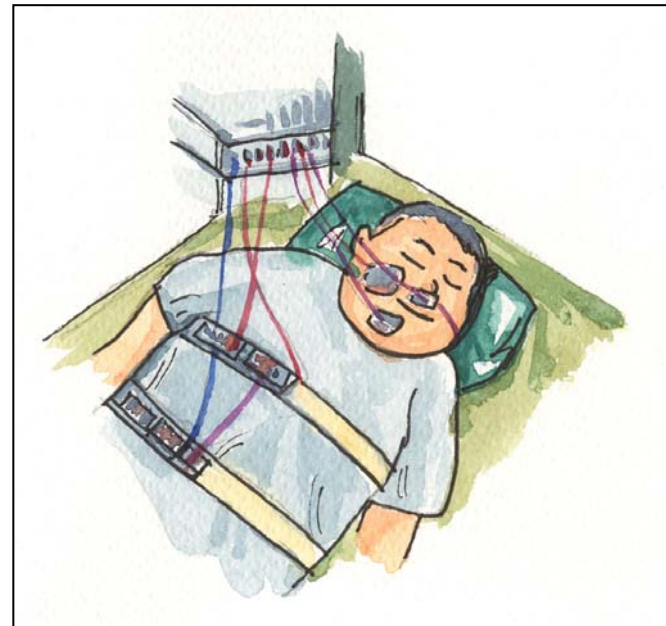
- ◆ Polysomnography
- ◆ Observe during sleep
- ◆ Overnight oximetry
- ◆ Audiotape and videotape
- ◆ Nap polysomnography



Polysomnography

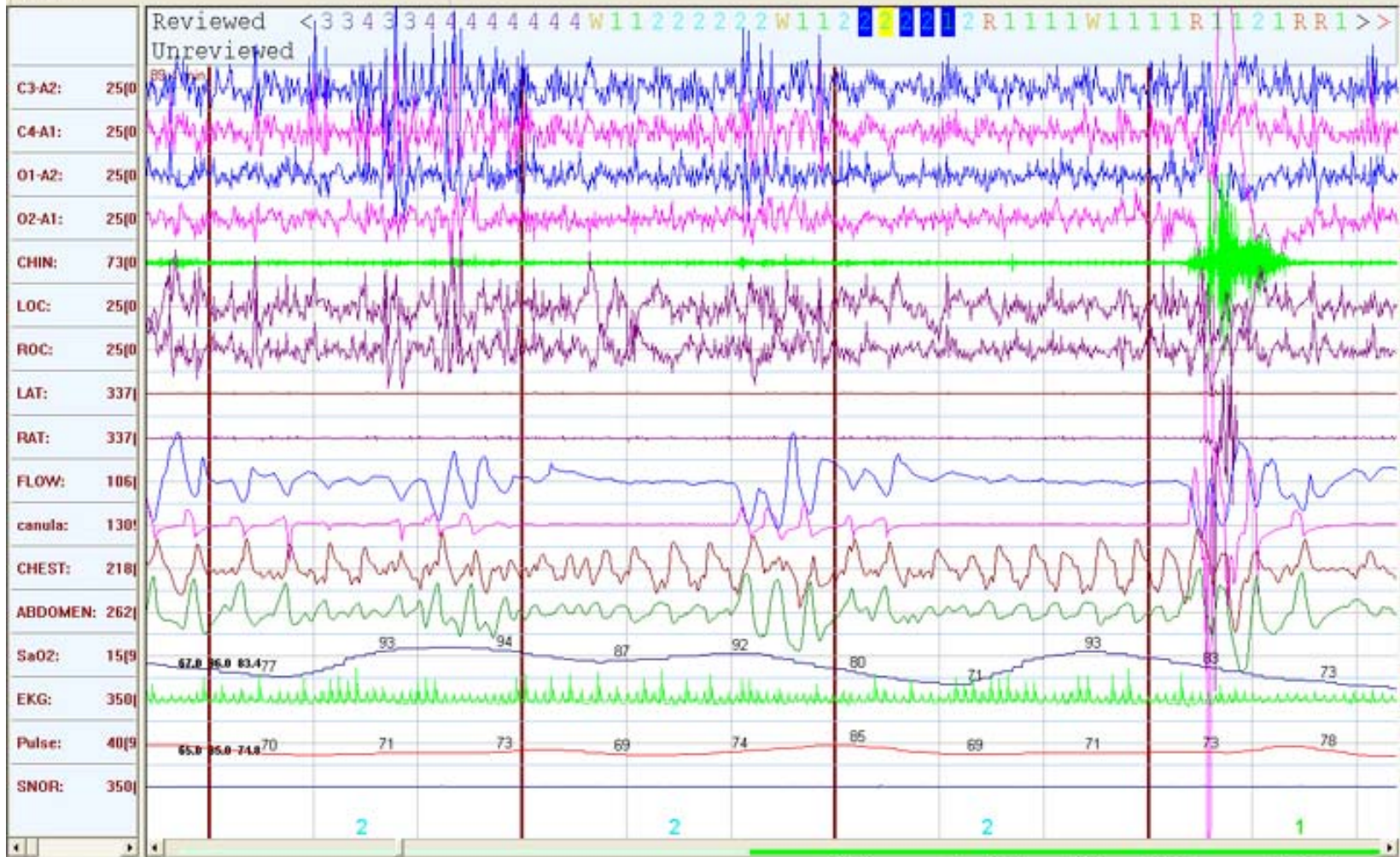
- ➔ EEG
- ➔ EMG
- ➔ EOG
- ➔ EKG
- ➔ Pulse oximetry
- ➔ End tidal CO₂
- ➔ Oronasal airflow
- ➔ Chest and abdominal movement

Gold standard





Auto 2 Likelihoods Wake 1.0 Sig1 3.0 Sig3 3.0
Manual 2 REM 0.0 Sig2 93.0 Sig4 0.0
Previous 2



Comparison of Home Oximetry Monitoring With Laboratory Polysomnography in Children*

Valerie G. Kirk, MD, FCCP; Shelly G. Bohn, BSc; W. Ward Flemons, MD; and John E. Remmers, MD

Study objectives: To measure the accuracy and reliability of a portable home oximetry monitor with an automated analysis for the diagnosis of obstructive sleep apnea (OSA) in children.

Design: Prospective cohort study.

Setting: Alberta Lung Association Sleep Center, Alberta Children's Hospital Sleep Clinic.

Study subjects: Consecutive, otherwise healthy children, aged 4 to 18 years, presenting to the Pediatric Sleep Service at the Alberta Children's Hospital for assessment of possible OSA.

Interventions: All subjects underwent 2 nights of monitoring in the home with an oximetry-based portable monitor with an automatic internal scoring algorithm. A third night of monitoring was done simultaneously with computerized laboratory polysomnography according to American Thoracic Society guidelines.

Measurements and results: Both test-retest reliability of the portable monitor-based desaturation index (DI) between 2 nights at home and between laboratory and home were high using the

Sensitivity 67%, specificity 60 %

apnea (polysomnography AHI > 5/h) were 67% and 60%, respectively.

Conclusion: Portable monitoring based only on oximetry alone is not adequate for the identification of OSA in otherwise healthy children. (CHEST 2003; 124:1702-1708)

Key words: abbreviated monitoring; ambulatory monitoring; children; diagnosis; obstructive sleep apnea; oximetry; sleep apnea syndromes

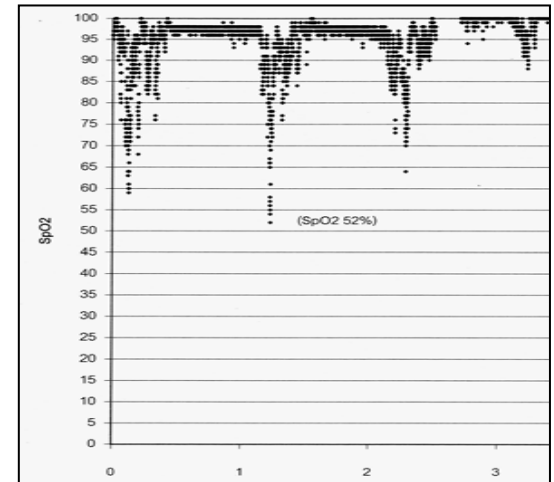
Abbreviations: AHI = apnea-hypopnea index; DI = desaturation index; OSA = obstructive sleep apnea; RDI = respiratory disturbance index

Overnight oximetry monitoring

Oxygen sat < 90%
At least 3 times/night



Positive predictive value 97%
Negative predictive value 47%



Screening OSA by home videotapes recording

Thirty minutes of home video-recordings

- **Highly correlation between PSG results and video test results**
- **Overall sensitivity 94%, specificity 68%**

Nap and overnight PSG

Sensitivity, specificity, PPV, NPV of nap parameters

Parameters	Sensitivity	Specificity	PPV	NPV
Abnormal nap	69	60	77	49
OSA	23	85	76	36
Hypopnea	40	69	72	37
Hypoxemia	26	85	78	37
Hypoventilation	25	88	80	37

Medical or surgical treatment

- ◆ Adenotonsillar hypertrophy
- ◆ Allergic rhinitis
- ◆ Obesity

*****Concurrent infection*****



Update: management of adenotonsillar hypertrophy

- ◆ **Adenotonsillectomy**
- ◆ **Role of intranasal corticosteroid**
- ◆ **Role of leukotriene antagonist**

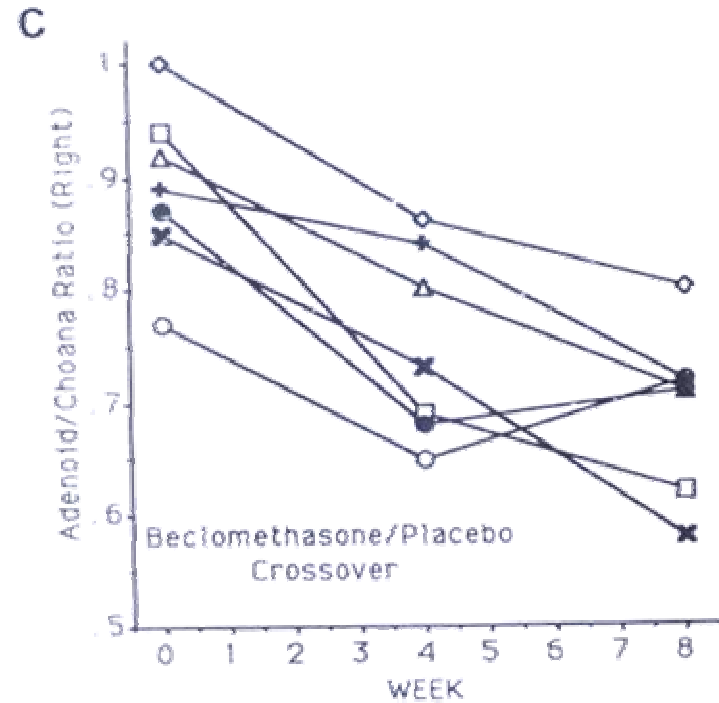
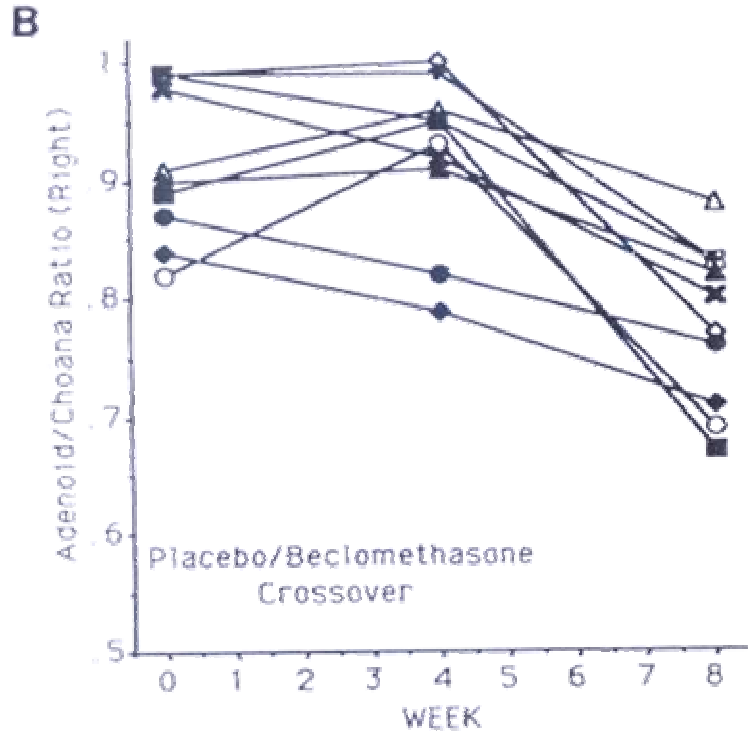


Intranasal corticosteroid for adenoid hypertrophy and obstructive sleep apnea

- **Beclomethasone**
- **Fluticasone propionate**
- **Budesonide**
- **Mometasone fuorate**
- **Budesonide**

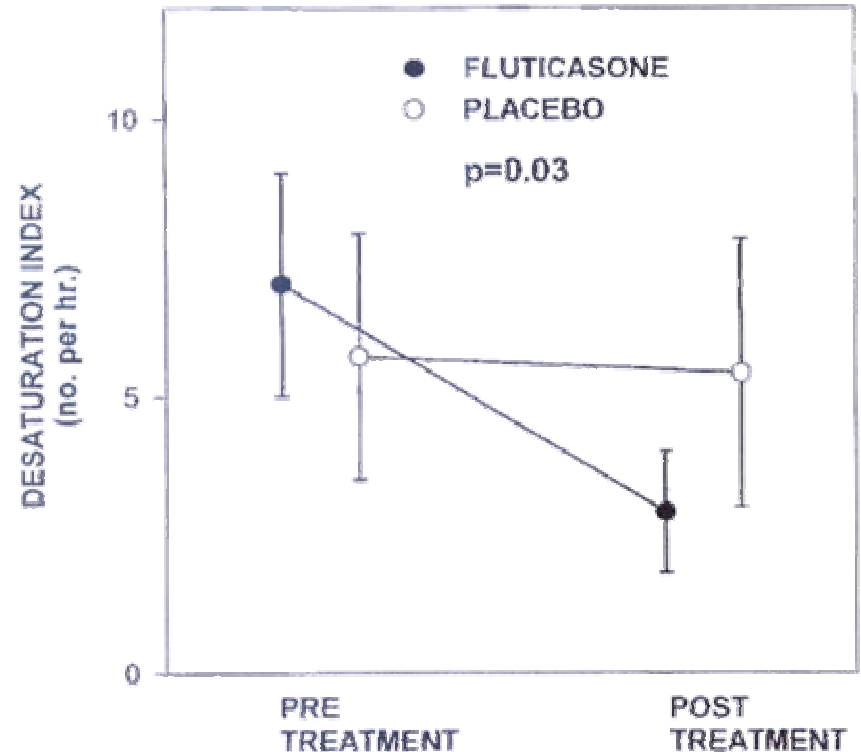
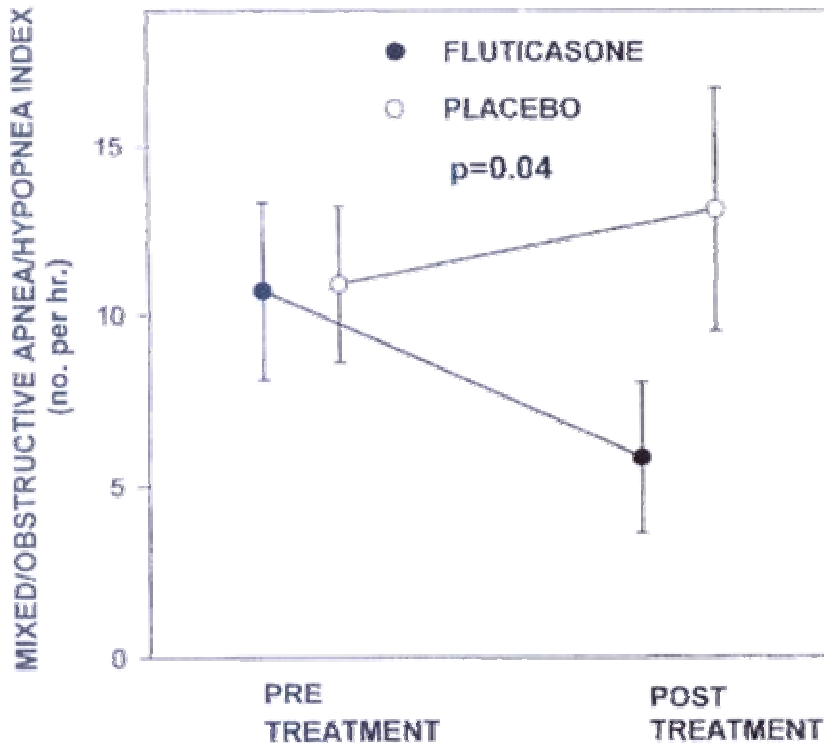


Beclomethasone 336 mcg/day for 8 weeks

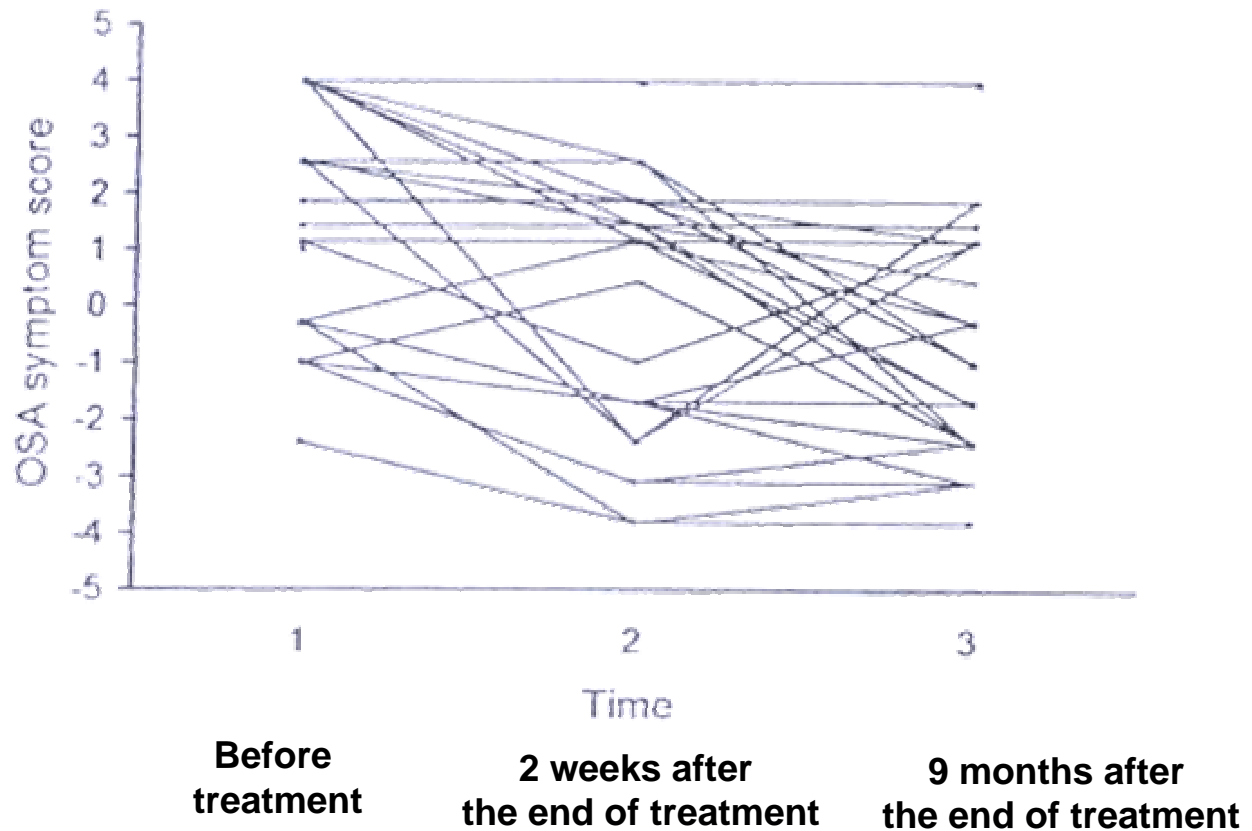


Demain JG. 1995;95:355-364

Fluticasone 200 mcg/day in the 1st week then 100 mcg/day for 5 weeks



Budesonide 200 mcg/day for 4 weeks



Intranasal corticosteroids for moderate to severe adenoidal hypertrophy

Limited evidence suggests that intranasal corticosteroids

- 1. Significantly improve nasal obstruction symptoms in children with moderate to severe adenoid hypertrophy**
- 2. Improvement may be associated with a reduction of adenoid size**
- 3. The long-term effect remains to be defined**

Leukotriene modifier therapy in SDB

16 weeks treatment with montelukast in 24 children with SDB

	Montelukast			No treatment		
	Pre	Post	P	Pre	Post	P
A/N ratio	0.76±0.03	0.56±0.03	<0.001	0.78±0.04	0.79±0.04	NS
Respiratory arousal index	7.2±0.8	3.0±0.3	<0.001	9.4±0.7	12.8±1.3	<0.03
Obstructive AHI	3.0±0.22	2.0±0.3	0.017	3.2±0.2	4.1±0.4	<0.03

Intranasal steroids + Leukotriene modifier therapy

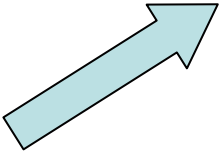
Montelukast + budesonide 12 weeks in 22 children with residual SDB after adenotonsillectomy, AHI 1-5/hr

	Montelukast/budesonide			No treatment		
	Pre	Post	P	Pre	Post	P
Respiratory arousal index	4.6±0.6	0.8±0.03	<0.001	4.7±0.7	5.89±1.3	NS
Obstructive AHI	3.9±1.2	0.3±0.3	<0.001	3.6±1.4	4.7±1.5	<0.04

OSAS



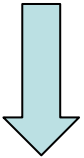
**Hypoxia
&
Hypercarbia**



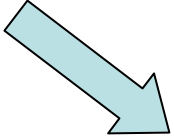
Respiratory
Infection
Respiratory failure



Growth
Growth failure

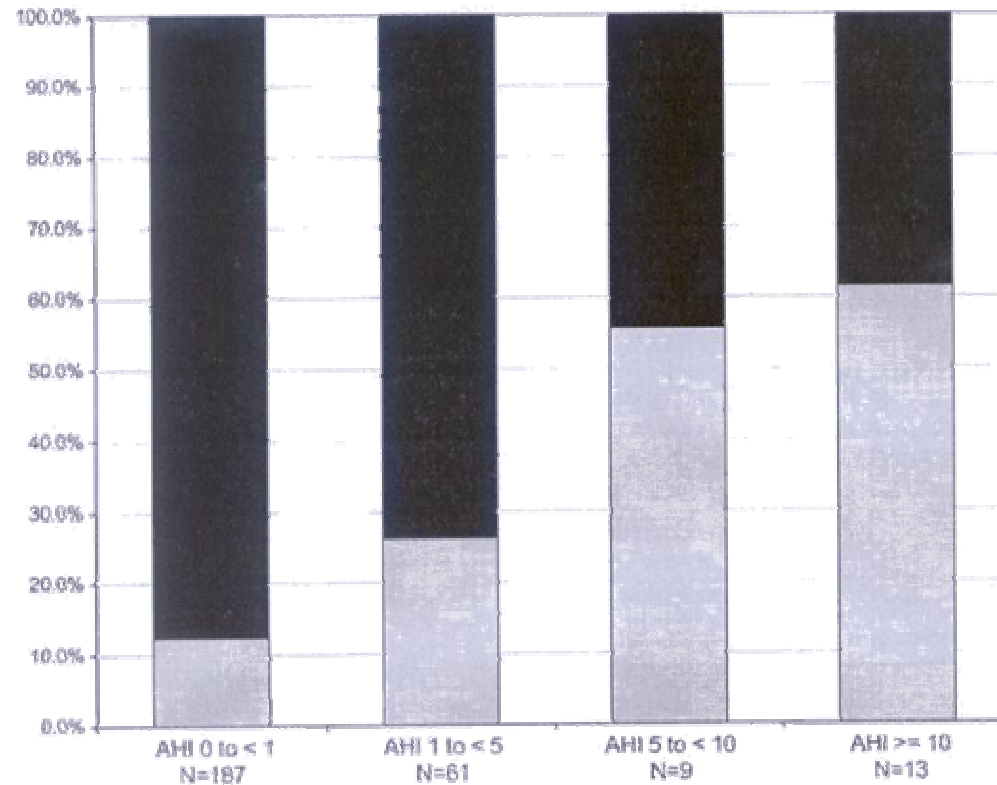


CVS
Right heart failure
Pulmonary hypertension
Systemic hypertension



Cognitive & behavior
Poor learning
Attention deficit
Hyperactivity

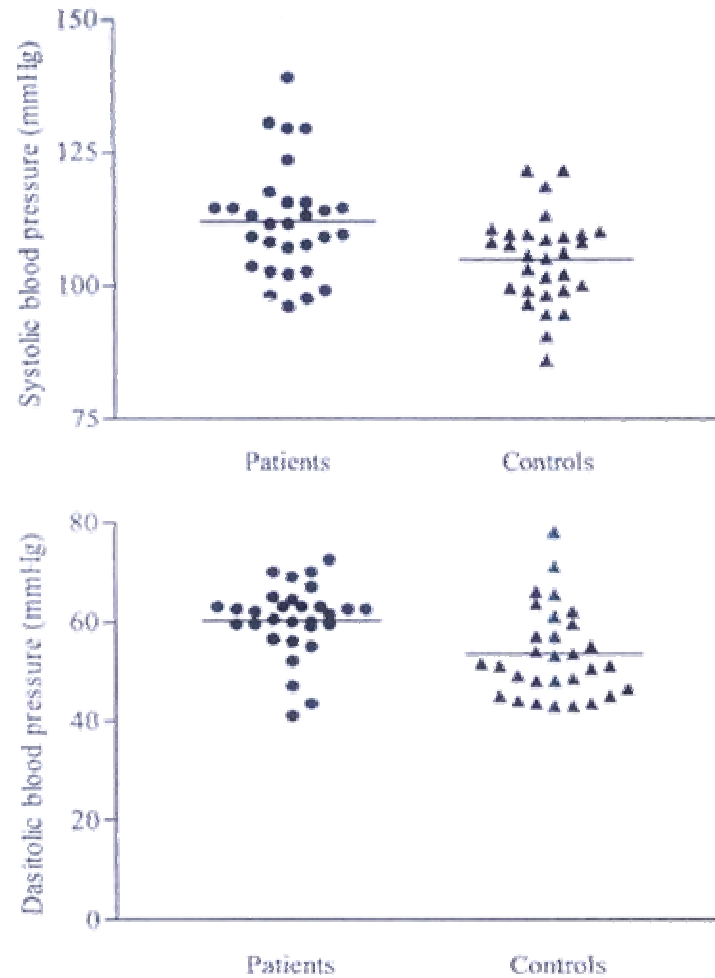
Prevalence of the metabolic syndrome in increasingly severe categories of SDB



Complication of primary snoring



BP in children with primary snoring



Neurobehavioral complication in primary snoring

**Children with primary snoring:
worse on measures related to**

- Attention
- Social problem
- Anxious
- Depressive
- IQ

Author suggestions

- Larger studies are required
- Current guidelines for treatment for primary snoring may require reevaluation



Thank you

