

Which Parameters Are Most Useful in Determining Asthma Severity in Childhood?

J Malika-Rais, J Davidson, ME Krawiec and JD Spahn.
National Jewish Health. Denver, Co



Abstract

Rationale: Little is known regarding what parameters are most helpful in determining asthma severity in children.

Methods: We sought to prospectively evaluate lung function, biomarkers and morbidity in children diagnosed with mild, moderate and severe persistent asthma. All children underwent spirometry (pre- and post-albuterol), exhaled nitric oxide (FeNO), serum IgE and skin prick testing (SPT) to aeroallergens. Severity was determined by clinician impression applying NAEPP EPR 3 guidelines.

Results: We studied 62 children (mean age 11.8 +/- 3.4 years) 61% male. 66% of mild, 70% moderate and 88% severe had ≥ 3 positive SPT (p=0.25).

Severity	FEV ₁ % pred.	BAR* (% pred.)	FeNO** (ppb)	IgE** (IU/L)	Albuterol I/Wk	Exac/ Yr	Life. Hosp
Mild n=20	93 +/- 4	9 +/- 5	22 (10, 31)	91 (21, 378)	1.5 +/- 1.7	1.4 +/- 0.6	0.3 +/- 1.8
Moderate n=22	89.8 +/- 4	16 +/- 4	24 (14, 49)	322 (53, 1104)	4.4 +/- 1.4	3.8 +/- 0.8	1.4 +/- 1.6
Severe n=19	72 +/- 3	25 +/- 4	36 (29, 71)	448 (237, 919)	13.2 +/- 1.5	6 +/- 0.6	11.6 +/- 1.9
P value	0.0004	0.05	0.003	0.10	< 0.0001	< 0.0001	< 0.0001

*Beta agonist response; **Median (IQ 25, 75)

Conclusion: Asthma morbidity was best distinguished level of asthma severity. Severe asthma was distinguished from mild and moderate asthma by lung function, BAR, FeNO, albuterol use, and frequency of exacerbations and hospitalizations. Lung function and biomarkers did not differentiate children with mild and moderate asthma. Overall, optimal assessment of asthma severity requires evaluation of several distinct parameters including lung function, biomarkers and morbidity

Introduction

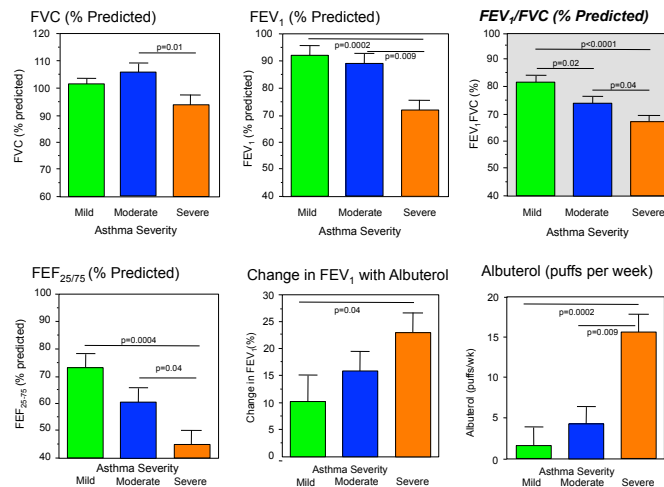
The 2007 NHLBI Asthma Guidelines recommend evaluating a child's asthma severity or control based on two distinct asthma domains: impairment and risk. The domains represent different manifestations of asthma, may not correlate with each other, and may respond differentially to treatment. In addition, the course of asthma may change over time; the relevance of the impairment & risk domains may be age related. Few studies have sought to determine the phenotypic characteristics using the impairment and risk domains in children with mild, moderate and severe asthma. In addition, few have sought to determine which parameters best differentiate children with mild, moderate, and severe asthma. In this prospective study, 67 children with clinician diagnosed mild (n=22), moderate (n=23), and severe persistent asthma (n=22) were evaluated. Data analyzed included: age, sex, BMI, asthma duration, inhaled glucocorticoid dose, spirometry (FVC, FEV₁, FEV₁/FVC, FEF_{25/75}, and % change in FEV₁ after albuterol administration), measures of impairment and risk including frequency of albuterol use, frequency of exacerbations and hospitalizations. In addition biomarkers of allergic inflammation (circulating eosinophils, IgE and exhaled nitric oxide (FeNO) were measured.

Results

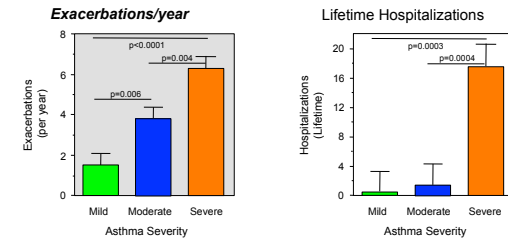
Patient Demographics

Parameters	Mild n= 22	Moderate n= 23	Severe N= 22	P value
Age	10.9 ± 0.8	11.6 ± 0.7	12.2 ± 0.8	0.45
Gender (%males)	55	70	45	0.25
Asthma Duration	6.2 ± 1	7.5 ± 0.8	9 ± 0.8	0.1
Exhaled Nitric Oxide	20.5 ± 0.7	43 ± 0.7	53.5 ± 0.7	0.0072
Circulating Eosinophils	350 ± 93	309 ± 84	367 ± 93	0.89
IgE	288 ± 143	564 ± 119	603 ± 133	0.22
FVC	100.5 ± 3.4	106.4 ± 3.4	94 ± 3.4	0.042
FEV ₁	92 ± 3.6	89.4 ± 3.5	72 ± 3.6	0.0003
FEV ₁ /FVC	81.7 ± 2.4	74 ± 2.3	70 ± 2.3	0.0002
FEF 25/75	73 ± 5.4	60.5 ± 5.2	44 ± 5.4	0.0002
% Change FEV ₁	10.2 ± 5	15.7 ± 3.9	22.9 ± 3.6	0.1
Number → SPT	8 ± 1.8	8.5 ± 1.6	10.4 ± 1.7	0.61
BMI	19.1 ± 1.5	23 ± 1.5	24.3 ± 1.5	0.06
Inhaled Glucocorticoid dose	160 ± 62	379 ± 58	805 ± 60	< 0.0001
Exacerbations/year	1.5 ± 0.6	3.8 ± 0.6	6.3 ± 0.6	< 0.0001
Lifetime Hospitalizations	0.3 ± 3.1	1.4 ± 3	17.5 ± 3	0.0003
Albuterol/week	1.5 ± 2.5	4.3 ± 2	15.6 ± 2.2	0.0001

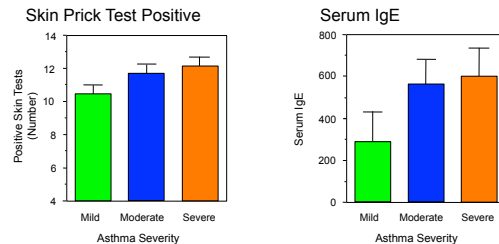
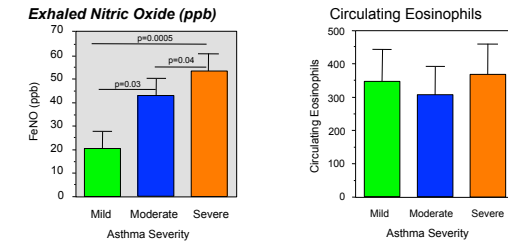
1. Impairment (lung function, β₂AR, and albuterol use)



2. Risk (exacerbations/yr and lifelong hospitalizations)



3. Biomarkers of Inflammation/Atopy



Conclusions

- Children with mild and moderate asthma had FEV₁ values within the normal range while those with severe asthma had moderately diminished FEV₁ values.
- Children with mild and moderate asthma required albuterol 1.5 to 4.3 times/wk respectively, while those with severe asthma required albuterol over 15 times/wk.
- Only 3 parameters studied were able to distinguish levels of severity between children with mild moderate and severe asthma.
 - FEV₁/FVC ratio
 - Number of exacerbations
 - Exhaled nitric oxide
- Several parameters differentiated severe asthma from mild and moderate asthma, while few parameters were able to differentiate mild from moderate asthma.