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FEV1 (FORCED EXPIRATORY VOLUME IN THE 1ST SECOND) REVERSIBILITY AFTER NEBULISATION WITH SABA (SHORT ACTING BETA AGONIST) AS A MARKER OF CONTROL OF ASTHMA

Dr. Anjana. M	Junior resident, Dept. Of Paediatrics, Sree Mookambika Institute of Medical Sciences
Dr. Rugmini. K	Paediatrician, Taluk Hospital, Fort, Thiruvananthapuram
Dr. Relve. P. Verghese*	Junior resident, Dept. Of Paediatrics, Sree Mookambika Institute of Medical Sciences*Corresponding Author
Dr.elizabeth.k.e	Professor and HOD, Dept. of Paediatrics, Sree Mookambika Institute of Medical Sciences

ABSTRACT **INTRODUCTION:** Variable expiratory airflow due to bronchoconstriction, airway wall thickening and increased mucus is an obvious feature in asthma. Variable airflow obstruction is evidenced by reversibility of FEV1 following a bronchodilator inhalation. PFT (Pulmonary Function Testing) using spirometry is often used for the estimation of FEV1. Reversibility is not uniform in all cases and vary with respect to severity and control of asthma.

AIMS & OBJECTIVES:

1) To determine the control of asthma in 5-15-year-old children using GINA checklist and estimate FEV1 before and after SABA nebulisation.
2) To find out the association between FEV1 reversibility and control of asthma.

MATERIALS & METHODS: This cross-sectional study included 90 consecutive 5-15-year-old-children with a clinical diagnosis of asthma attending the Paediatric OPD of a teaching hospital from October-May 2021. The symptoms, signs, comorbidities, treatment, compliance and assessment of control of asthma into 2 subgroups: Well-controlled and Partly-controlled/Uncontrolled asthma, as per GINA 2020 were recorded. All were subjected to spirometry for assessment of FEV1 before and 20 minutes after nebulisation with SABA. Depending upon FEV1, they were grouped as those with >12% reversibility and <12% reversibility. Data analysed using SPSS 20.0, Paired t test for comparison of means, Chi-square test for statistical difference in proportion, and post hoc tests.**RESULTS:** The M:F ratio was 1.2:1, 52.2% were 10-15 years and 47.8% 5-10 years. 68.9% had partly/uncontrolled, the rest well-controlled asthma (38.1%). The difference between mean FEV1 before (67.9±10.6) and after nebulisation (80.6±9.7) was statistically significant (p<0.00*). Among those with >12 reversibility, 64.5% were in partly/uncontrolled and 35.5% in well-controlled asthma and the difference was statistically significant (p -0.013*). **CONCLUSION:** The finding in the study that 68.9% had partly/uncontrolled asthma is an eye-opener to optimise protocol-based treatment among children. The statistically significant difference of >12% before and after nebulisation a marker of poor control was observed in 64.5% of partly/uncontrolled asthma compared to 35.5% of well controlled asthma. Hence, the persistence of a significant degree of bronchodilator response noted in those with partly/uncontrolled asthma is recommended as an objective surrogate of poor asthma control in children who can co-operate for a PFT in order to optimise protocol-based treatment.

KEYWORDS : FEV1 Reversibility, SABA, Control of asthma

INTRODUCTION:

Asthma is a chronic inflammatory disease of the airways. The prevalence of asthma in children is on the increase. It causes symptoms such as wheezing, shortness of breath, chest tightness and cough that vary over time in their occurrence, frequency and intensity associated with variable expiratory airflow due to bronchoconstriction, airway wall thickening and increased mucus. Variable airflow obstruction is evidenced by reversibility of FEV1 with a bronchodilator inhalation. PFT (Pulmonary Function Testing) using spirometry is often used for the estimation of FEV1. This is possible in children more than 5 years of age. Reversibility is not uniform in all cases and vary with respect to control of asthma.

OBJECTIVES:

1) To determine the control of asthma in 5-15-year-old children using GINA checklist and estimate FEV1 before and after SABA nebulisation.
2) To find out the association between FEV1 reversibility and control of asthma.

OPERATIONAL DEFINITION:

Bronchodilator Reversibility: FEV1 increases by >12% of the predicted value after inhaling a bronchodilator in children.

FEV1: Amount of air that you can force from your lungs in one second Control of asthma as per GINA 2020 guidelines (1)

MATERIALS AND METHODS

5-15-year-old with a clinical diagnosis of asthma attending Paediatric OPD of a teaching hospital from October-May 2021 were included. Sample size was calculated as 90 (2). Children with comorbidities like heart disease, genetic diseases, metabolic disorders. Parental informed consent and IEC approval were obtained prior to study. All were subjected to spirometry for assessment of FEV1 before and 20 minutes after nebulisation with SABA.

The participants were categorised into 2 subgroups as per control of asthma; Well-controlled and Partly-controlled/Uncontrolled asthma). Depending upon FEV1, they were grouped as those with >12% reversibility and <12% reversibility.

STUDY PARAMETERS:

The symptoms, signs, comorbidities, treatment, compliance, assessment of control of asthma as per GINA 2020 (1) and spirometry parameters – FEV1 before and 20 minutes after nebulisation with SABA were assessed and recorded in a proforma.

STATISTICAL ANALYSIS:

The data was computed in Microsoft Excel 2019 and analysed using SPSS.20.0. Descriptive statistics of the quantitative variables were expressed as mean and standard deviation. Using SPSS software version 20.0, statistical analysis was done. Paired t test, Chi square test, and post hoc tests were utilised for the analysis.

RESULTS:

In our study, the M:F ratio was 1.2:1, 52.2% were between 10-15 years and 47.8% between 5-10 years. 48.9% were partly-controlled, followed by well-controlled (31.1%) and uncontrolled (20%). 68.9% had partly/uncontrolled, the rest well controlled asthma (38.1%). 40% of them had asthma for less than one year and 35 % for about 3-5 years. The mean years of asthma among the study participants was 2.39 ± 2years. 55.6% had >12% reversibility after SABA nebulisation and 44.4% had <12% reversibility. Among those with >12 reversibility, 64.5% were in partly/uncontrolled and 35.5% in well controlled asthma and the difference was statistically significant (p -0.013*). The difference between mean FEV1 before (67.9±10.6) and after nebulisation (80.6±9.7) was statistically significant (p<0.00*).

Distribution of study participants based on FEV1 (using paired t test)				
FEV1	SABA nebulisation (n=90)		Difference in mean (95% CI)	
	Before Mean (SD)	After Mean (SD)		
	67.9 (10.6)	80.6 (9.7)	12.7 (-13.8 to -11.5)	<0.00

Association between FEV1 Reversibilty and control of asthma (using Chi-square test)			
Control	FEV1 Reversibilty	FEV1 Reversibilty	p value
	>12% [n (%)]	<12% [<12%]	
Well controlled	10 (35.7)	18 (64.3)	0.013*
Partly/uncontrolled	40 (64.5)	22 (35.5)	
Total	50 (55.6)	40 (44.4)	

Post hoc test - Multiple Comparisons						
Dependent variable: Difference in FEV1 (Tukey HSD)						
(I) Well controlled	(J) Partly/Un-controlled	Mean difference (I-J)	Std. error	Sig.	95% CI	
					Lower bound	Upper bound
Well controlled	Partly controlled	-2.571	1.295	.122	-5.66	.52
	Uncontrolled	-3.821	1.618	.053	-7.68	.04

DISCUSSION:

In our study the control of asthma was categorized according to GINA guidelines and there is a negative association between control of asthma and reversibility that is in partly/uncontrolled asthma, the reversibility in response to short acting beta agonist is more while in well controlled the reversibility was less. In a study of Heffler E. et al (3), they evaluated the relationship between lung function which includes bronchodilator response that is improvement in FEV1 and after administration of short acting beta agonist like Salbutamol and the control of asthma assessed by ACT Score and found that in asthmatic patients under regular treatment according to international guidelines, after intake of the SABA (salbutamol), degree of response in terms of improvement of FEV1 correlates with poor asthma control defined using the ACT questionnaire. The persistence of a significant degree of the bronchodilator response (BDR) despite regular treatment according to guidelines was a marker of worse asthma control.

Wei J, Ma L et al (4) analysed that high reversibility was more frequently associated with a higher level of Th2-biomarkers, lower lung function in baseline. In our study, the reversibility was significantly higher in partly/uncontrolled group with mean FEV1 65±9.4%. Better asthma control after the first-month initial treatment had lower reversibility. High reversibility is a physiologic indicator of lower lung function and severe small airway obstruction which is more related with an increased level of Th2-biomarkers than lower reversibility. Moreover, high reversibility may indicate controlled asthma after the first month initial treatment. This finding may contribute to identification of asthma endotype. In agreement with their study, the present study showed high reversibility with uncontrolled asthma.

In a study of Busse.W et al (5) observed that high reversibility is a physiologic indicator of reduced lung function and it is commonly associated with elevations in Th 2 biomarkers which is similar to the present study that children with poorly controlled asthma has reduced lung function which has increased reversibility, i.e., the extent of reversibility correlates well with severity of asthma. There was a statistically significant difference between groups and there is an association between increase in severity and reversibility of FEV1. In other words, in well control asthma percentage of reversibility reduces.

CONCLUSION:

The finding in the study that 68.9% had partly/uncontrolled asthma is an eye-opener to optimise protocol-based treatment among children. The statistically significant difference of >12% before and after nebulisation a marker of poor control was observed in 64.5% of partly/uncontrolled asthma compared to 35.5% of well controlled asthma. Hence, the persistence of a significant degree of bronchodilator response noted in those with partly/uncontrolled asthma is recommended as an objective surrogate of poor asthma control in children who can co-operate for a PFT in order to optimise protocol-based treatment.

LIMITATIONS:

The cut off of reversibility was taken as 12% for all age groups in the study. Age-specific cut-offs for reversibility must be ensured.

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