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FEV1 Reversibility after Nebulisation with Short Acting Beta Agonist in Relation to Chronicity of Asthma

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Abstract

Asthma, a chronic disease of the air passages which is characterized by airway inflammation and narrowing. The response to bronchodilators reflects the reversibility of airway airflow obstruction in asthmatic patients. Bronchodilator Reversibility varies with chronicity of asthma. 1 To assess FEV1 before and after nebulization with SABA-salbutamol. 2 To assess chronicity in children using GINA checklist 3. To find out the association of reversibility with chronicity. Cross-sectional study, 90 Children aged 5-15 years old with diagnosis of asthma was recruited from Department of Paediatrics Chronicity was recorded using GINA checklist. FEV1 before and after 20 minutes of nebulisation with SABA noted. The reversibility of FEV1 after nebulization was categorised as <12% and >12%. Children with asthma, the chronicity is classified into <1 year, 1-3 years, 3-5 years, >5 years. The data was computed in Microsoft Excel 2023. Statistical analysis was done using SPSS version 20.0. Paired t test, Chi square test, Fischer's exact test and Post hoc test are used for the analysis. Reversibility of > 12 % post nebulization (57 %), while the rest 43 % had reversibility of <12 %. Majority of the participants with reversibility >12 % had h/o asthma in < 1 year and The difference in the FEV1 reduced as the chronicity of asthma increased. The mean FEV1 before nebulisation and after nebulisation showed significant difference with p<0.00. In children with chronicity >5 years, 66.7% showed reversibility and <1 year, 44.4% showed reversibility. By Fischer's exact test association between the reversibility of FEV1 in asthma and chronicity assessed were not statistically significant. As chronicity increases, airway reversibility also increases. Thus, Bronchodilator reversibility is a reliable marker of chronicity of asthma in children.

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Key Words

Reversibility, nebulisation, chronicity narrowing

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INTRODUCTION

Asthma which is explained by the action of airway leading to reversible airflow obstruction in association with airway hyper responsiveness and airway inflammation[2]. A diagnosis of asthma is also indicated when-Reversibility test is positive, PEFR variability is >20%, There is 15% or greater decrease in PEFR after running or other exercise. Irreversible obstructive lung diseases are differentiated from asthma by airway bronchodilator reversibility (BDR)[1]. BDR remains a simple and inexpensive method of measuring expiratory airflow variability. This test assesses the degree of reversibility of airway obstruction with the administration of a bronchodilator which provide independent information in the assessment of asthma. High airway bronchodilator reversibility denotes reduced lung function. Bronchodilator Reversibility varies with chronicity of asthma.

Aims and Objectives:

- To assess FEV1 before and after nebulization with SABA-salbutamol.
- To assess chronicity in children using GINA checklist To find out the association of reversibility with chronicity

MATERIALS AND METHODS

Study Design: Cross-sectional study, Children aged 5-15 years old, with a paediatrician diagnosis of asthma was recruited from Department of Paediatrics, Sree Mookambika Institute of medical sciences, with a sample size of 90. Children with comorbidities are excluded. Prior to the study, approval obtained from the IEC. Informed consent obtained from the parent. Assent taken from children above 7 years of age.

Chronicity was recorded using GINA checklist[1]. PFT was taken for children before and after nebulization with bronchodilator (SABA). Spirometry done and FEV1 noted. Nebulization given with Bronchodilator (short acting beta agonist-salbutamol). After 20 minutes spirometry repeated (FEV1-after nebulization noted). The reversibility was taken as FEV1 after nebulisation-FEV1 before nebulisation. The cut off value for reversibility is taken as 12%. The reversibility of FEV1 after nebulization was categorised as <12% and >12%. Children with asthma, the chronicity is classified into <1 year, 1-3 years, 3-5 years, >5 years. The data was computed in Microsoft Excel 2023. Statistical analysis was done using appropriate software SPSS version 20.0. Multiple statistical tests were used in the analysis of this study. Paired t test was applied for comparison of means. Chi square test was applied to test statistical difference in proportions. This test was used to find relationship between variables. Fischer's exact test was applied to test statistical difference in proportions. This test is used to determine extract non-random categorical variables and Post hoc test are used for the analysis.

RESULTS AND DISCUSSIONS

In our study population, 47.8% of the participants were in the age group of 5-10 years and 52.2% participants were in the age group of 10-15 years . Majority of the study participants were males (54%) and 46% females.

Among the participants 40% of the patients had chronicity for <1 year, 34.4% of the participants had chronicity for 1-3 years, 12.2 % had the chronicity for 3-5 years and 13.3% had chronicity of >5 years.

By Paired t test, applied for comparison of means, the mean of FEV1 in study group before nebulisation is 67.9±10.6 and the mean of FEV1 after nebulisation is 80.6±9.7. The difference between the mean of FEV1 before nebulisation and the mean of after nebulisation is 12.7 with 95% Confidence Interval, which is found to be statistically significant (p< 0.00)

In the asthma chronicity of <one year the difference of FEV1 (1-10) before and after nebulisation was 36.1% while the difference of FEV1 (21-30) was only 5.6%. In the chronicity of >5 years, 25% had FEV1 difference of 1-10 and 8.3% had difference of 21-30. Hence, the difference in FEV1 is increased as the chronicity of asthma increased. The difference in the FEV1 chronicity is not found to be statistically significant (p value-0.891).

Chi Square test was applied to test statistical difference in proportions. In 5-10 years age group, 53.5% participants had >12 % reversiblity and 46.5% had reversibility of <12%. In 10-15 years age group, 57.4 % participants had >12 % reversiblity and 42.6% had <12% reversiblity. The difference among the age groups is not found to be statistically significant (p value -0.832)

Fisher's exact test was applied to test statistical difference in proportions. In the study population, participants with more than 12% reversibility are 44% in chronicity of <1 year, 61.3% in 1-3 years chronicity, 63.6% in 3-5 years chronicity, 66.7% in >5 years chronicity.

Hence it was observed that as the reversibility increases , chronicity is also increased. The difference in reversibility in association with chronicity is not found to be statistically significant (p value-0.385)

Bronchodilator reversibility is one of the tests which is widely used in confirming the diagnosis of asthma. Bronchodilator reversibility in children is defined as FEV1 i.e. Forced air volume that is expired in the first second. In our study, 90 children with asthma were enrolled. The chronicity was categorised

Distribution of population based on chronicity

Chronicity in years	Frequency	Percentage
<1 year	36	40%
1-3 years	31	34.4%
3-5 years	11	12.2%
>5 years	12	13.3%
Total	90	100%

Association of FEV1 with chronicity of Asthma

	Difference in FEV1 before and after nebulisation				
Chronicity (in years)	Difference of 1-10	Difference of 11-20	Difference of 21-30	Total	p-value
<1 year	13 (36.1%)	21 (58.3%)	2(5.6%)	36(100%)	0.891
1-3 years	7(22.6%)	20(64.5%)	4(12.9%)	31(100%)	
3-5 years	3(27.3%)	7 (63.6%)	1 (9.1%)	11(100%)	
>5 years	3(25%)	8(66.7%)	1(8.3%)	12(100%)	
Total	26(28.9%)	56(62.2%)	8(8.9%)	90(100%)	

Distribution of population according to reversibility

Age in years	Reversibility		p-value
	>12%	<12%	
5-10 years (43)	23 (53.5%)	20 (46.5%)	0.832
10-15 years (47)	27 (57.4%)	20 (42.6%)	
Total (90)	50 (55.6%)	40 (44.6%)	

Association of Reversiblity with chronicity

	Peversiblity		
Chronicity in years	>12% Good reversibility	<12% Low reversibility	p-value
<1 yr (36)	16 (44%)	20 (55.6%)	0.385
1-3yrs (31)	19 (61.3%)	12 (38.7%)	
3-5yrs (11)	7 (63.6%)	4 (36.4%)	
>5yrs (12)	8 (66.7%)	4 (33.3%)	
Total	50 (55.6%)	40 (44.4%)	

Post Hoc Tests

Multiple Comparisons

Dependent Variable: Difference in FEV1

Tukey HSD (I)	Chronicity_r (J)	Chronicity_r Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					lower Bound	Upper Bound
< 1 yr						
	1- 3 yrs	-2.297	1.345	.326	-5.82	1.23
	3- 5 yrs	-1.452	1.891	.869	-6.41	3.50
	> 5 yrs	-.694	1.830	.981	-5.49	4.10

as <1 year, 1-3 years, 3-5 years and greater than 5 years. The FEV1 reversibility was compared with chronicity of asthma. In children with chronicity >5 years, 66.7% showed reversibility of >12 and with chronicity of <1 year, 44.4% showed reversibility >12. By Fischer's exact test association between the reversibility of FEV1 in asthma and chronicity assessed were not statistically significant (p value-0.385). Study by Busse. W[3], shows High reversibility which denotes reduced lung function is associated with Th 2 biomarkers elevation which correlates with my study that children with increased chronicity have reduced lung function which has increased reversibility.

CONCLUSION

As chronicity increases, airway reversibility also increases. This is because as chronicity increases the airway condition/patency also deteriorates and thus FEV1 reversibility increases after bronchodilator. Thus, bronchodilator reversibility can be used as a reliable marker of the chronicity of asthma in children.

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