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Paediatrics

CLINICAL STUDY OF BRONCHIAL ASTHMA IN CHILDREN AGED 5 – 15 YEARS

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ABSTRACT Asthma is one of the most common chronic disease worldwide imposing a substantial social burden in children.[1]In our country children with mild asthma or persistent or recurrent asthma are not being evaluated to know their lung function in routine practice. It leads to missing the diagnosis when the disease is in mild stage and the child presents to the hospital when there is considerable severity.The PEFR measurement has gained worldwide acceptability as a method of recognition,assessment of severity and planning of therapy[2].This study aims to measure the PEFR in asthmatic children and observe its response to bronchodilator therapy.The study also concentrates on precipitating factors as this helps in suggesting preventive measures .

KEYWORDS : Asthma, PEFR, Bronchodilator, FEV1

INTRODUCTION

Worldwide childhood Asthma appears to be increasing in prevalence despite considerable improvements in management of Asthma[3].Although many patients have mild disease,any person with asthma can develop a severe excacerbration[4].Childhood Asthma is responsible for significant proportion of school days lost.The measurement of Forced expiratory volume in 1 second(FEV_1) and its accompanying Forced vital capacity(FVC) and peak expiratory flow are gaining widespread acceptance in patients over 5 years of age.The PEFR can be measured using "standard Wright Peak flow meter" as it is a simple and portable equipment.With proper instruction the results can be used to monitor improvement,early worsening and measure response to therapy.[2,5,6]

INDIAN DATA

The prevalence of asthma symptoms in children varies from 0-30% in different populations.In India prevalence of asthma in school going children has been reported between 4-20% in different geographic regions[7].The prevalence has increased by two folds in last 2 decades.Most surveys on asthma in children had found that the prevalence of asthma is higher in boys than in girls with a ratio of 2:1[8].WHO estimates the NUMBER OF DALY's (disability adjusted life years) lost to asthma 15 million per year,which corresponds to 1% of the global loss of DALY's due to illness.[9]Disease can start at any age,but in majority it starts before 10 years of age.Childhood asthma is responsible for significant proportion of school days lost.

STUDY DESIGN

This is a Case control study conducted at NRI Medical college and hospital during the period from October 2013 to October 2015.Total number of cases 100,were included in the study using the following inclusion and exclusion criteria.

INCLUSION CRITERIA

1. Age group 5-15 years boys and girls were taken
2. Children coming to NRI hospital for medical care

EXCLUSION CRITERIA

1. Children <5 years and children >15 years
2. Children with acute severe asthma needing emergency or critical care.
3. Children with other significant systemic diseases.

MANAGEMENT

Four components of optimal asthma management[3]:

1. Regular assessment and monitoring
a) Asthma checkups :every 2-4 per week until good control is achieved,and 2-4 per year to maintain good control
b) Lung function monitoring
2. Control of factors contributing to asthma severity
a) Eliminate or reduce problematic environmental exposures
b) Treat comorbid conditions :rhinitis,sinusitis,GER
3. Asthma pharmacotherapy
4. Patient education.

Table:3STEPWISE APPROACH FOR MANAGING ASTHMA IN CHILDREN[22]

PERSISTENT ASTHMA: DAILY MEDICATION														
				Step-1	Step-2	Step-3	Step-4	Step-5	Step-6					
			INTERMITENT ASTHMA	SABA prn	Low-dose ICS	Medium-dose ICS	Medium dose ICS + either LABA or LTRA	High-dose ICS + either LABA or LTRA	High-dose ICS + either LABA or LTRA					
					Cromolyn montelukast									
			THERAPY**	Preferred	Low-dose ICS	Either low-dose ICS ±LABA,LRTA, or Medium-dose ICS	Medium-dose ICS + LABA	High –dose ICS + LABA	High –dose ICS + LABA and Oral corticosteroid					
				Alternative	Cromolyn, LTRA, nedocromil, or theophyline		Medium-dose ICS + either LTRA or Theophyline	High –dose ICS + either LTRA or Theophyline	High-dose ICS +either LTRA or Theophylline and Oral Corticosteroid					
			AGE	0-4 years										
				Preferred	SABA prn	low-dose ICS + LABA or Medium-dose ICS		High –dose ICS + LABA & Consider omalizumab for patients with allergies	High-dose ICS + LABA + Oral Corticosteroid & Consider Omalizumab for patients with allergies					
				Alternative	Low-dose ICS	low-dose ICS + LTRA, theophyline, or zileuton	Medium-dose ICS+ LTRA, Theophyline or zileuton							
				Preferred	SABA prn									
				Alternative	Low-dose ICS	Cromolyn, LTRA, nedocromil, or theophyline								
				≥ 12 years										

STEP DOWN if possible (and asthma is well controlled for at least 3 months)

ASSESS CONTROL

STEP UP if needed (first check inhaler technique, adherence, environmental control, and comorbid condition)

Each step: Patient education, environmental control & management of comorbidities.
Age≥ 5 yr: Steps 2-4: Consider subcutaneous allergen immunotherapy for patients who have allergic asthma.

RESULTS :

Table 1 Sex distribution of Controls and Controls

	Cases				Controls			
Gender	**Frequency**	**Percent**	**95% Conf Limits**		**Frequency**	**Percent**	**95% Conf Limits**	
Female	37	37.0%	27.6%	47.2%	37	37.0%	27.6%	47.2%
Male	63	63.0%	52.8%	72.4%	63	63.0%	52.8%	72.4%
Total	100	100.0%			100	100.0%		

Both cases and controls are sex matched. Proportion of males is more in Cases as well as controls.

Table 2 Frequency of living area of Controls and Cases

	Controls				Cases			
Area	Frequency	Percent	95% Conf Limits		Frequency	Percent	95% Conf Limits	
Rural	100	100.0%	100.0%	100.0%	24	24.0%	16.0%	33.6%
Urban	0	0.0%	0.0%	3.6%	76	76.0%	66.4%	84.0%
Total	100	100.0%			100	100.0%		

TABLE 3 Residence area association with Cases and Controls

Cases Controls			
Residence Area	Control	Cases	TOTAL
Rural	100	24	124
Row %	80.6	19.4	100.0
Col %	100.0	24.0	62.0
Urban	0	76	76
Row %	0.0	100.0	100.0
Col %	0.0	76.0	38.0
TOTAL	100	100	200
Row %	50.0	50.0	100.0
Col %	100.0	100.0	100.0

Chi-square - corrected (Yates) 119.3761; P value 0.0001

Proportion of cases from urban area is significantly more. Cases are associated with urban living.

Table 4 Respiratory rate of Cases and Controls

	Cases	Controls
Sample size	100	100
Lowest value	32.0000	16.0000
Highest value	70.0000	20.0000
Median	44.0000	18.0000
95% CI for the median	42.0000 to 50.0000	18.0000 to 18.0000
Interquartile range	36.0000 to 58.0000	17.0000 to 18.0000

Mann-Whitney test (independent samples)

Average rank of first group	150.5000
Average rank of second group	50.5000
Mann-Whitney U	0.00
Test statistic Z (corrected for ties)	12.299
Two-tailed probability	P < 0.0001
Median respiratory rate in cases is significantly more than that of controls.	

Figure-1

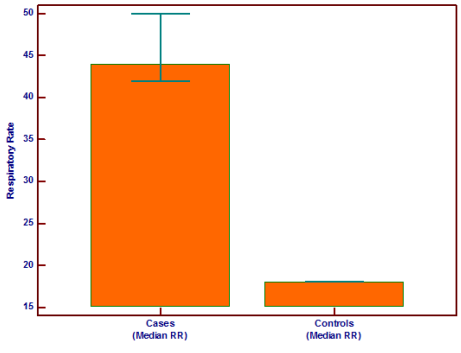

Table 5PrePEFR in Cases and Controls

	Cases	Controls
Sample size	100	100
Lowest value	60.0000	100.0000
Highest value	250.0000	290.0000
Median	120.0000	200.0000
95% CI for the median	110.0000 to 132.7658	180.0000 to 220.0000
Interquartile range	100.0000 to 150.0000	160.0000 to 220.0000

Mann-whitneytest(independent samples)

Average rank of first group	66.3100
Average rank of second group	134.6900
Mann-Whitney U	1581.00
Test statistic Z (corrected for ties)	8.372
Two-tailed probability	P < 0.0001

Median PrePEFR in controls is significantly more than that of cases

Table 6 Summary of PostPEFR in cases

Variable	PostPEFR	
Sample size	100	
Lowest value	80.0000	
Highest value	270.0000	
Arithmetic mean	155.0000	
95% CI for the mean	146.6077 to 163.3923	
Median	150.0000	
95% CI for the median	140.0000 to 162.7658	
Variance	1788.8889	
Standard deviation	42.2953	
Kolmogorov-Smirnov test for Normal distribution	accept Normality (P=0.0672)	
Percentiles		95% Confidence Interval
2.5	100.0000	
5	100.0000	80.0000 to 101.3963
10	105.0000	100.0000 to 110.0000
25	120.0000	110.0000 to 130.0000
75	180.0000	180.0000 to 200.0000
90	215.0000	202.8353 to 229.4614
95	225.0000	218.6037 to 262.6159
97.5	240.0000	

The mean post PEFR in cases is 155 L/min with Standard deviation ±42.3

Table 7 PEFR difference before and after Salbutamol in Cases

Paired samples t-test Back-transformed after logarithmic transformation.		
	PrePEFR Cases	PostPEFR Cases
Sample size	100	100
Geometric mean	122.0564	149.4077
95% CI for the mean	114.5705 to 130.0314	141.5188 to 157.7364
Variance of Logs	0.01919	0.01410
Difference on Log-transformed scale		
Mean difference	0.08781	
Standard deviation	0.03353	
95% CI	0.08116 to 0.09447	
Test statistic t	26.188	
Degrees of Freedom (DF)	99	
Two-tailed probability	P < 0.0001	
Back-transformed results		
Geometric mean of ratios of values	1.2241	
95% CI of geometric mean	1.2055 to 1.2430	

There is significant improvement in PEFR in cases after single dose of salbutamol.

Table 8 PEFR difference before and after Salbutamol in Cases by Age group

Age Group	PrePEFR Cases l/min(mean±SD)	Post PEFR Cases /min(mean±SD) ±SD	Paired t test				PEFR Control l/min(mean±SD) ±SD
			Mean difference l/min(mean±SD)	95% CI	Tstatistic (df)	Pvalue	
I. 5-6 years (n=15)	85±15.5	108±16.6	22.7±4.6	20.1 to 25.2	19.2 (14)	0.0001	115.3±11.9
II. 7-8 years (n=18)	93.3±13.7	120±6	27.2±4.6	24.9 to 29.5	25.1 (17)	0.0001	158.3±14.2

III. 9-10 years (n=20)	Median (95% CI)		Wilcoxon test (paired samples)				
	110 (110 to 145)	140 (140 to 175)	Number of positive differences: 20	Number of negative differences: 0	Smaller total of ranks: 0.00	0.0001	199±36.6
	Mean ±SD	Mean difference±SD	95% CI		Tstatistic (df)	P value	
IV. 11-12 years (n=36)	144.2±26.8	171.4±28.4	27.2±10.6	23.6 to 30.8	15.4 (35)	0.0001	223.1±19.1
V. 13-15 years (n=11)	200±22.8	229.1±20.2	29.1±8.3	23.5 to 34.7	11.6 (10)	0.0001	241.8±24.4

DISCUSSION

This is a case controlled study with age and sex matching between cases and controls.

The controls are age and sex matched with cases.

There is significant predominance of male children in our study in cases and hence in controls. Similar observation of made by others[10,11,12].

The cases and controls are divided into five groups (5-6; 7-8; 9-10; 11-12; 13-15) to facilitate appropriate comparison of PEFR and anthropometric data.

In our study the cases are predominantly from urban area (76%; 95%CI=66.4% to 84%) compared to controls(24%,95%CI=0 to 3.6%).such predilection of childhood asthma to urban area was observed by others[13,14].

In our study there is no significant difference in height and weight between cases and controls. Often childhood asthma is known to cause growth impairment in children[1]. In our study due to mild degree of asthma in cases studied the growth is not affected.

Usually severe degree asthma, moderately severe, persistent asthma are known to be adversely affecting growth.

We observed in our study the median respiratory rate in cases (44/min; 95%CI=42%to 50%) is more than median respiratory rate (18/min;95%CI=18 to 18).This is because the controls in our study do not have any respiratory illness and/or normal as regards to respiratory health at the time of study. All the cases in our study are having tachypnea.

Pre salbutamol PEFR values in cases(median PEFR = 120 L/min,95%CI=110 to 133 L/min) is significantly less than that of controls(median PEFR = 200L/min,95%CI=180 to 220).In all age groups the mean pre PEFR in cases is significantly less than pre PEFR in controls in our study(Table 8).

The PEFR values in controls in our study are similar to those observed in healthy children by other workers[15,16]. This indicates that the cases in our study are not under control and regular management though the disease is not of severe form. We administered single dose(0.5%) salbutamol by nebulizer to the cases as per the standard norms after 10 min PEFR was measured again in the cases we observed improvement in PEFR after salbutamol nebulisation in almost all the cases except in two cases.

The post PEFR (post salbutamol nebulisation) in our observation showed considerable improvement. The mean percentage increase in PEFR is 23% (95%CI=21% to 25%). SK.Das et al in their study found an improvement of 14%. We observed the post PEFR in our cases is still less than the PEFR of controls of similar age group. This indicates that a child will not return to healthy status with single dose of therapy even though they are of mild disease. Probably the cases are not taking inhalation corticosteroids as needed, this probable inadequate inhalation corticosteroid therapy may lead to persistent inflammation in respiratory tract and those children are unlikely to return to normal PEFR value with single dose salbutamol.

In our study the PEFR values are having high positive correlation with age, weight and height of the child and negative correlation with respiratory rate.

We observed for possible risk factors which are associated with presence or absence of reactive airway disease in a child.

The factors studied in both cases and controls are age, sex, height, weight, respiratory rate, living area, PEFR.

On Multivariate logistic regression analysis presence or albescence of HRAD in our study is positively associated with height and weight and negatively with pre PEFR.

Respiratory rate and living area are not useful to predict with HRAD. The variables with HRAD predictive ability are Height, weight and pre PEFR.

The more the height of the child the chance of HRAD is 1.5 times more. The child with more weight is 1.6 times more likely to be having HRAD. The child with higher pre PEFR is 0.8times less likely to have HRAD.

Among the clinical features studied Cough and wheeze are present in all the cases.

Cold air exposure and URTI are found to be precipitating factors in 30% to 50% of the cases.

TABLE 9

Precipitating factor	Present study	Ratageri et al[10] (mild Asthma)	Ratageri et al[10] (severe Asthma)
Cold air	48%	61.7%	83.3%
Cold food	6%	63.3%	80%
URTI	30%	100%	70%
Dust	16%	46.6%	56.6%

Asthma is an atopic disease, some studies have showed strong genetic component in atopic disease including Asthma. In our study, family history of Asthma was present in 40% children.Similar observation was made by others.

Family Historyof Asthma, Compared To Other Studies:
TABLE 10

Present study	Wayne J et al[8]	Jaun C. Celdon[11]	Ratageri et al[10]
40%	40%	38.3%	40%

In our study X-Ray chest and stool microscopy are not useful in HRAD cases.

Anaemia, leukocytosis, and oesinophilia are not usually found in our cases.

RESULTS

- 63% cases were male and 37% cases were female.
- 76% cases were from urban area compared to 24% cases from rural area
- Family history of Asthma was found in 40%cases.
- The median respiratory rate of cases was significantly more than that of controls.
- Cold and upper respiratory tract infection were important precipitating factors.
- Cough and wheeze was present in all cases (100%).
- The median pre PEFR of cases was 120 L/min, the mean post PEFR of cases was 149 L/min.
- The mean improvement in PEFR after salbutamol nebulisation is 23%.
- The median PEFR of controls was 200 L/min.
- Asthma is positely associated with height and weight and negatively associated with pre PEFR.

CONCLUSION

- In our study asthmatic children predominantly are boys and from urban area.
- Precipitating factors or triggers are cold air and URTI (30% - 50%). This helps in suggesting preventive measures in those where precipitating factors are identified.
- In our study the cases are of mild to moderate degree asthma as indicated by no growth impairment compared to controls. In our

cases the pre PEFR is 81% of post PEFR, with single dose of salbutamol nebulisation (0.5%) there is improvement of PEFR by 23%. This shows good response.

- Though there is good response to drug the post PEFR is 75% of that of the controls. This shows that lung functions of cases compared to controls is very much impaired and is still considerably lower than control values even after single dose of salbutamol nebulisation. This indicates that children are under inadequate follow up and management.
- Risk factors associated with presence of asthma in a child are more with greater height and weight. Protective associated with asthma presence in a child is better pre salbutamol PEFR.

REFERENCES:

1) Global initiative for Asthma, Global strategy for Asthma Management and prevention, National Institute of Health, Updated 2011.
2) National Institute of Health, National Heart, Lung and Blood Institute. National Asthma Education and prevention Programme. Expert panel Report 3: Guidelines for the Diagnosis and Management of Asthma 2007.
3) Andrew.H.Liu, Ronina.A.Covar, Joseph.D.Sphan, Donald.Y.M.Leung– Childhood Asthma. In Nelson Textbook of paediatrics – 19th EdEditor Behrman R.E. Kliegman R.M.,Stanton.B.F, Joseph.W.St.Geme, Nina.F.Schor,Elsevier Saunders company 2012:780-801.
4) Singh V, Singh.A – Bronchial Asthma in API text Book of Medicine, 9th Edition. Editor Mungal.Y.P ,Sharma.Sk, Jaypee Brothers Medical Publications 2012: 1704-1711.
5) Perks W.H., Tams I.P, Thompson D.A. and Prowse K. An evolution of mini Wright Peak Flow Meter. Thorax 1979, 34:79-81.
6) Old H.G, Bevan M.M. Mc Dermott M. Papers comparison of new miniature Wright peak flow meter with the standard Wright Peak Flow Meter. Thorax, Vol.34:807-809, Copy right 1989 by Thorax.
7) Ghai.O.P, Paul V.K, Aravind.B.Ghai Essential Paediatrics,7Ed,Revised 2009
8) Wayne J Morgan and Fernando D, Martinez, Risk factors for developing wheezing and Asthma in childhood. PCNA 1992:39(6):1185-1203.
9) DtschArztebl Int. 2008 May; 105(21): 385–394.
10) Ratageri Vinod H, Kabra S.K, Dwivedi S.N, Seth V. Factors associated with severe Asthma, Indian paediatrics 2000; 37: 1072-1082.
11) Lee YL, Lin YC, Hsiue TR, Hwang BF, Guo YL. Indoor and outdoor environmental exposures, parental atopy, and physician-diagnosed Asthma in Taiwanese schoolchildren. Paediatrics. 2003 ; 112(5):389.
12) Jaun. C. Celedon, Manuel E. Soto-quiros, Edwin K. Silver man, Lars A. Hanson and Scott T. Weiss, Risk factors for childhood Asthma in Costa Rica. Chest, 2001; 120:785-790. © 2001 American College of Chest Physian.
13) Andrew Aligne C Auinger, Bydres, Weitzman M, Risk factor for paediatric Asthma. Contribution of poverty, race and urban residence. American journal of respiratory critical care Medicine-2000,162-878.
14) Chakravarthy S, Singh RB., Swaminathan S, Venkatesan P, Prevalence of Asthma in urban and rural children in Tamilnadu. Natl Med J India. 200 ;15(5): 260-263.
15) Tahera.H, Sangeeta.S.T, Rajesh.K.C.Pulmonary function testing in healthy school children. Lung India:27:3:2010:145-148.
16) Sandeep.B, Dalitsingh, Puneet.A.P, Gurudeep.S.D. Pulmonary functions in normal school children in age group of 6 – 15 years in North India. Iran J Pediatr:2010:20:1:82-90.