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Original Research Article

Evaluation of peak expiratory flow rate with severity of lower respiratory tract infection in children of Hadoti region

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ABSTRACT

Background: Correlation of peak expiratory flow rate (PEFR) with severity of lower respiratory tract infection (LRTI) and comparison of PEFR with same age, sex, height and nutritional status of children of age group 7 to 18 years.
Methods: This is a case control study in children in the age group of 7 to 18 years of both sexes suffering from LRTI admitted in department of paediatrics of a tertiary care government hospital of Hadoti region. The duration of study was October 2019 to September 2020. Group 1 (case group) comprised of children having LRTI, whereas group 2 (control group) comprised of healthy and asymptomatic children There were 250 children in each group and they were further categorized into 3 age groups of 7-10 years, 11-13 years and 14-18 years. The PEFR of LRTI group children was compared with control group children with the similar age, sex as well as the anthropometric measurements.
Results: In LRTI group, the PEFR had significant difference from control group, in all three age groups ($p<0.0001$). The study showed positive co-linear relationship between age, height, weight and BMI with PEFR in both males and females in LTRI and control groups.
Conclusions: Effect of PEFR depends upon anthropometric measurements of children of different age group in both LRTI population and control population. In control group PEFR showed significant difference between boys and girls, but in LRTI group PEFR showed non-significant difference between boys and girl in their respective age groups.

Keywords: PEFR, LRTI, Children

INTRODUCTION

Acute respiratory tract infection is the one of the common causes of morbidity in developing countries.[1] Clinical diagnosis criteria for LRTI according to WHO guideline with respect to children of age group between 5-18 years includes fever; cough; tachypnoea, intercostal and subcostal retraction; chest pain (early stage of pleural fluid accumulation); abdominal pain (lower lobe pneumonia); and meningismus (upper lobe pneumonia).[2,3] Any individual presenting with manifestations of acute LRTI with sudden onset fever (>38° C) and cough or sore throat and shortness of breath or difficulty breathing with or without clinical or radiographic findings of pneumonia presenting within 7 days of onset of illness should be managed aggresively.[4] Viral pneumonia is usually a spread of infection along the airways accompanied by direct injury of respiratory epithelium. This results in airway obstruction from swelling, accumulation of abnormal secretions and cellular debris.[4,5] In bacterial pneumonia organisms colonize the trachea and necrosis of trachea-bronchial mucosa, formation of large number of exudates, oedema and local hemorrhage.[1,4,5] PEFR is defined as the

maximum flow which is achieved during an expiration delivered with maximum force starting from the level of maximal lung inflation. PEFR is impaired in obstruction in the extra thoracic airways; conditions which affect respiratory muscle function or limit chest expansion; and conditions which affect the integrity of the neural system.[6] PEFR is an inexpensive and easily available test which can be used to diagnose the severity of LRTI besides asthma. It is a small hand-held device, used in primary health centres and can assess severity of LRTI beside clinical criteria when radiodiagnostic facility like X-rays, computed tomography (CT) scan are not available. By using PEFR instead of radiological finding for diagnosis of LRTI, we can reduce the radiation exposure to the children.

In present study, we aim to correlate PEFR with severity of LRTI and to compare PEFR with same age, sex, height and nutritional status of children of age group 7 to 18 years.

METHODS

Our study was a case control study, which included 7-18-year-old children, of both sexes suffering from LRTI admitted from October 2019 to August 2020 in the department of pediatrics at government medical college, Kota, Hadoti region, Rajasthan, India. Ethical clearance for the study was obtained from institute ethics committee. The anthropometric measurements like height (cm), weight (kg) , chest circumference (cm) and body mass index (kg/m^2) were recorded in a pre-designed proforma and PEFR was measured by a "mini Wright's peak flow meter" (600-800 L/min). The study included 2 groups of children, one was LRTI group of children of 7-18 year age having signs and symptoms of LRTI and another was a control group of children of 7-18 year age having healthy and asymptomatic children. We excluded the following admitted patients from the study: suspected or known immunosuppressive, cardiac and neurological condition affecting pulmonary function, other chronic pulmonary disease and children with rib cage deformity or children who were not able to perform PEFR and who did not give consent. There were a total of 250 children in each group each belonging to 7-18 years. The LRTI group and control group population had 150 boys and 100 girls in each group. The value of PEFR was recorded serially at 5 minutes, 10 minutes and 15 minutes before the commencement of the treatment. The value of PEFR in LRTI group and control group was compared according to height, weight, BMI and chest circumference, from both sexes and were compared using paired t-tests and ANOVA test to establish construct validity.

RESULTS

The control and LRTI groups were comparable in terms of age and sex parameters (Table 1). A comparison of the values of correlation coefficient with age, sex, height, BMI and chest circumference with respect to PEFR, in control and LRTI groups showed that as these variables increase, the value of PEFR increases; establishing a positive correlation between these variables and the value of PEFR in both sexes and both groups (Table 2). The mean PEFR values showed significant difference between the two groups across all the three age groups in both sexes (Table 3). P mean PEFR showed significant difference between boys and girls in control group; whereas the p mean PEFR did not show any significant difference between boys and girls in LRTI group (Table 4).

Table 1: Demographic parameters among the two groups.

Age (Years)	LRTI group, (n=250) (%)		Control group, (n=250) (%)		Total	
	Boys, (n=150)	Girls, (n=100)	Boys, (n=150)	Girls, (n=100)	Boys	Girls
7-10	70 (46.67)	48 (48)	35 (23.33)	23 (23)	105 (35)	71 (35.50)
11-13	50 (33.33)	29 (29)	47 (31.33)	32 (32)	97 (32.33)	61 (30.50)
14-18	30 (20)	23 (23)	68 (45.34)	45 (45)	98 (32.67)	68 (34)
Total	150	100	150	100	300	200

Table 2: Correlation coefficient values of PEFR with age, weight, height, BMI and chest circumference among the two groups.

Variables	Boys		Girls	
	Correlation coefficient		Correlation coefficient	
	Control	LRTI	Control	LRTI
Age (Years)	0.971	0.887	0.978	0.735
Weight (kg)	0.848	0.926	0.764	0.713
Height (cm)	0.784	0.944	0.855	0.731
BMI (kg/m2)	0.696	0.879	0.708	0.679
Chest circumference (cm)	0.823	0.916	0.770	0.702

Table 3: Age groups and their mean PEFR values in both groups.

Age (Years)	LRTI group, (n=250)		Control group, (n=250)		P value	
	Boys, (n=150)	Girls, (n=100)	Boys, (n=150)	Girls, (n=100)	Boys	Girls
7-10	137.45±45.28	141.58±64.06	304.51±35.88	298.60±34.55	<0.0001	<0.0001
11-13	191.48±44.09	198.00±66.14	406.85±27.18	382.18±23.49	<0.0001	<0.0001
14-18	341.40±61.71	295.13±89.94	457.86±33.78	479.67±35.00	<0.0001	<0.0001
Total	196.25±90.57	193.26±93.25	415.98±76.61	397.02±70.40	<0.0001	<0.0001

Table 4: Descriptive statistics for PEFR among both the groups.

PEFR	Number		Minimum		Maximum		Mean		SD	
	Control	LRTI	Control	LRTI	Control	LRTI	Control	LRTI	Control	LRTI
Boys	150	150	224	84	560	540	415.98	196.2	76.61	90.57
Girls	100	100	244	84	530	460	397.02	193.2	70.40	93.25

DISCUSSION

It was a comparative prospective case control study conducted in our paediatrics department and we found that there is a significant positive correlation between PEFR values and various anthropometric measurements in both groups, such as age, height, weight and BMI. The PEFR values of both sexes from control and LRTI population (Table 1) had similar results as that of previous other studies, such as study by Kodgule et al Swaminathan et al, Pulickal et al, Pande et al, Mishra et al and Abraham et al.[7-12] Compared to the control group, the PEFR values in LRTI group had significant difference in all age groups. In our study, the value of PEFR was found to be decreased for the LRTI group (Table 2). This conclusion is different from the study by Krishna et al where they found no significant difference in the values of PEFR in their LRTI population.[1] In our study, the p mean PEFR showed significant difference between boys and girls in the control group; whereas the p mean PEFR did not show any significant difference between boys and girls in the LRTI group. This result is similar to the study by Krishna et al where they concluded that the values of PEFR in LRTI group male and female patients had non-significant difference.[1]

There are a few limitations to our study such as the fact that any measure of severity requiring expiratory manoeuvres would be difficult to obtain in a patient with severe obstruction and respiratory distress. The patient would have trouble getting enough air entry during inspiration to have a meaningful expiratory measurement. Another drawback is that it is very difficult to give command for PEFR in children less than 7 years of age. The value of PEFR is effort dependent so if the child not willing to perform or unable to understand the instruction, the value of PEFR will be falsely low.

CONCLUSION

This study shows that the values of PEFR depend upon anthropometric measurements of children of different age groups in both LRTI population and normal population. In control group, PEFR had significant difference between boys and girls but in cases of LRTI, the PEFR values had non-significant difference between boys and girl. The values of PEFR between LRTI patients and normal children had significant differences. To conclude, PEFR can be used in the diagnosis of LRTI.

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