Vol 45 (4) December , 2021

Print: ISSN 0304 4904
Online: ISSN 2305-820X

PAKISTAN PEDIATRIC JOURNAL

A JOURNAL OF PAKISTAN PEDIATRIC ASSOCIATION

Indexed in EMBASE/Excerpta Medica, Index Medicus WHO
IMEMR & Global Health/CAB Abstracts and UDL-EDGE Products and Services

www.pakpedsjournal.org.pk

http://www.pakmedinet.com/PPJ

ORIGINAL ARTICLE

Comparison of Hematological Parameters of Asthmatic Children: A Comparative Case Control Study

AFSHAN MEHBOOB KHAN, JAHAN ARA, DURR-E-SAMEEN, Ghulam Abbas, Muhammad Tahir Lakho, Fareena Zaheer

Pak Pediatr J 2021; **45(4):** 425-28

Correspondence to:

Afshan Mehboob Khan,
Department of Physiology,
Dow University of Health Sciences,
Karachi

E-mail: drafshanzafar@gmail.com

Received 30th June 2021;
Accepted for publication
21st November 2021

ABSTRACT

Objective: This study compared total and differential leucocyte count between asthmatic and non-asthmatic paediatric subjects and within asthmatic subgroups and their correlation with lung function test.

Study Design: Case control study

Place and Duration of Study: Physiology Department of Basic Medical Sciences Institute, Jinnah Postgraduate Medical Center, Karachi from October 2014 to April 2015

Material and Methods: Total 88 children of 6-14 years of age, were included in this study. A written proforma was filled and consent was obtained by every participant's guardian. Subjects were divided into two groups as controls and cases .Cases were further divided into mild and moderate persistent asthmatics. Asthmatics were diagnosed as per guideline of GINA. The children with other pulmonary illnesses were not included in the study. The severity of asthma was assessed by spirometry. Complete blood count was performed by sysmex KX 21.

Results: Total leukocyte count (TLC) and eosinophils were increased significantly in case group as compared to controls ($p<0.001$). Neutrophils and lymphocytes in moderate persistent asthmatics were higher than mild persistent asthmatic cases ($p<0.05$). Significant negative correlation of FEV1 with TLC ($r = -0.325$, p value 0.031) and eosinophils ($r = -0.353$, p value 0.018) were observed. FEV1/FVC% also shows strong negative correlation with eosinophils ($r = -0.531$, p value <0.001).

Conclusion: It was concluded that increased blood inflammatory parameters are the indicators of asthma severity. Their blood levels may be used to assess the diagnosis as well as prognosis of disease.

Key Words: *Asthma, Inflammation, Spirometery, Pulmonary illness*

INTRODUCTION

Asthma is an inflammatory illness in which bronchoconstriction causes difficulty in breathing, cough with or without sputum production and wheeze like signs.[1] Previously reported by WHO that 34% of Pakistani children <15 years of age having respiratory disorders.[2]

Asthma in children is an inflammatory disease with different types of presentations.[3] Respiratory tract infection in initial few years of life may be

linked with asthma in later part of life.[4] Asthma targeted about 300 million people worldwide. It is a leading cause of hospitalization among pediatric patients.[5] New studies show role of blood and sputum eosinophil count in the progression of this disease.[6] Recent researches also demonstrate strong correlation of blood eosinophilia with decline lung functions.[7] Studies also describe effects of blood and sputum neutrophilia on severity of asthma.[8] Neutrophils and eosinophil increase the severity of asthma. Neutrophils themselves increase the movement of eosinophil, towards the inflamed region of airways.[9]

This study was aimed to compare total leucocyte count (TLC) and different blood inflammatory cells between asthmatic and non-asthmatic pediatric subjects and within asthmatic subgroups and their correlation with lung function test (FVC, FEV1, FVC/FEV1).

MATERIALS AND METHODS

This comparative case control study was done from October 2014 to April 2015 in the physiology department of Basic Medical Sciences Institute (BMSI), Jinnah Postgraduate Medical Center (JPMC) Karachi. Ethical approval was taken from Institutional Review Board (IERB) of NICH, to conduct the research.

A total number of 88 children of 6-14 years of age, were included in this study by 10.2% prevalence.[10] Sample size was calculated by open EPI formula. Non-randomized sampling technique was used. Detailed history was asked, proforma was filled and consent was obtained from every guardian. Subjects were divided into two equal groups as control (44 healthy non-asthmatic) and case (44 asthmatic). Cases were further divided into mild and moderate persistent asthmatics. Asthmatic children were diagnosed as per guideline of GINA.[11] The children with other chronic pulmonary illness were not included in the study. The severity of asthma was assessed by spirometry.

Spirometry was executed by vitalograph spirometer (model 6600, Ennis company, Ireland). Best values for Forced vital capacity (FVC%), and forced expiratory volume in 1st second (FEV1%) and ratio of these two(FEV1/FVC%)were determined from each participant.

Following aseptic methods, about 3 ml of venous blood was collected from antecubital vein and transferred into a tube containing anticoagulant for complete blood count and was performed by sysmex KX 21.

Reference ranges

- TLC : 4.5.- 11.5x 10^3/mm^3
- Neutrophils : 40 - 70 %
- Lymphocytes: 22 – 44%
- Eosinophils: 0 - 8 %

RESULTS

Statistical analysis was performed by SPSS software version 21. Comparison of means were analyzed by independent sample t-test. Associations were determined by Pearson correlation. P<0.05 showed statistical significance.

Table 1 compares the total and differential leucocyte count of two groups. TLC was increased significantly (9.99 ± 3.71 x10^9/L) in case group as compared to controls (6.80 ± 1.41 x10^9/L) (p<0.001). Eosinophils were also noticed to be highly significant in cases (2.36 ± 0.71%) as compared to control group (1.68 ± 0.56%) (p <0.001).No significant differences were observed in values of lymphocytes and neutrophils (p > 0.05).

TABLE 1: Comparison of total and differential leucocyte count between control and case groups

Variables	Control	Case	p value
	Mean±SD	Mean±SD	
TLC (x10^9/L)	6.80 ± 1.41	9.99 ± 3.71	<0.001
Neutrophil count (%)	56.84 ± 14.28	60.52 ± 4.22	0.104
Eosinophil count (%)	1.68 ± 0.56	2.36 ± 0.71	<0.001
Lymphocyte count (%)	35.20 ± 4.07	39.06 ± 14.32	0.081

Table 2 demonstrates the comparison of TLC and DLC among subgroups of cases. Neutrophils in moderate persistent asthmatics were higher (59.39 ± 1.81%) than mild persistent asthmatic cases (49.18 ± 1.31%) (p <0.05). Lymphocyte count was higher in moderate persistent asthmatic children (46.81 ± 1.16%) than mild persistent asthmatics (36.48 ± 1.90%) (p <0.05). TLC and eosinophil count did not show significant difference in both groups.

TABLE 2: Comparison of TLC and DLC among subgroups of cases

Variables	Mild Persistent Asthma Mean ± SD	Moderate Persistent Asthma Mean ± SD	p value
TLC ($x10^9$/L)	9.0 ± 4.17	10.33 ± 3.56	0.1113
Neutrophil %	49.18 ± 1.31	59.39 ± 1.81	<0.001
Eosinophil %	2.36 ± 0.674	2.36 ± 0.742	1.000
Lymphocyte %	36.48 ± 1.90	46.81 ± 1.16	<0.001

Table 3 describes association of hematological parameters with pulmonary function test in asthmatic group. We observed significant negative correlation of FEV1 with TLC (r = -0.325, p value 0.031) and Eosinophils (r = -0.353, p value 0.018). FEV1/FVC% also shows strong negative correlation with Eosinophils(r = -0.531, p value <0.001).

TABLE 3: Correlation of PFTS with total and differential leucocyte count in cases

Variables	FVC (L) (r)	p value	FEV1 (L) (r)	p value	FEV1/FVC % (r)	p value
TLC($x10^9$/L)	-0.210	0.171	-0.325	0.031*	-0.245	0.108
Neutrophil%	0.194	0.079	-0.225	0.141	-0.275	0.070
Eosinophil%	-0.255	0.094	-0.353	0.018*	-0.531	<0.001*
Lymphocyte%	-0.186	0.226	-0.275	0.070	-0.252	0.098

DISCUSSION

In this study, we did comparison of WBCs and inflammatory cells in blood between healthy and asthmatic children and related these parameters with pulmonary function test in cases. Further we did the comparison of hematological parameters among subgroups of cases. We noticed high TLC in cases. Similar results were shown by an Egyptian study.[12] In contrast, the study by Gungen and Ayedemir showed opposite results.[13] We did not find significant difference of TLC among subgroups of asthmatic group.

We also observed increased eosinophil count in our cases than healthy subjects. Katoh and collegues also showed similar results.[14] We also estimated eosinophil count in mild and moderate persistent asthmatic children but it did not give any significant difference. Rosario and fellows also found like our results.[15]

We did comparison of neutrophil count between cases and controls and among the cases. No significant result was seen between control and case groups but comparison between mild and moderate persistent asthma showed significant difference. Study by Tamazoust and fellows also noticed that neutrophil count was increased with severity of asthma.[16]

Comparison of lymphocyte count between controls and cases revealed non-significant result. But mild asthmatics had higher lymphocyte count than moderate asthmatics.

We also did correlation of these blood inflammatory cells with lung function test and we noticed significant negative correlation of FEV1 with TLC and Eosinophils. FEV1/FVC% also showed strong negative correlation with Eosinophils. Study by Hancox and fellows (2018) also observed strong negative correlation of blood eosinophils with FEV1 and FEV1/FVC% in adult asthmatics.[17]

CONCLUSION

It may be concluded that estimation of total and differential leucocyte count in blood of asthmatic children may reflect the type and severity of disease, which may direct the physician in the treatment. So, assessment of these inflammatory markers in blood should be a routine investigation while treating asthma.

Conflict of interest: Nil

Authors' affiliation

Afshan Mehboob Khan, Jahan Ara, Durr-E-Sameen, Ghulam Abbas, Muhammad Tahir Lakho, Fareena Zaheer
Department of Physiology, Basic Medical Sciences Institute, Jinnah Postgraduate Medical Center and National Institute of Child Health, Karachi

REFERENCES

1. Hall SC, Fischer KD, Agrawal DK. The impact of vitamin D on asthmatic human airway smooth muscle. Expert review of respiratory medicine. 2016 Feb 1;10(2):127-35.
2. Sadiq S, Ahmed ST, Rizvi NA, Ahmed F. Establishing age specific spirometry reference ranges for children/adolescents of Karachi, Pakistan: Randomized trials. JPMA. The Journal of the Pakistan Medical Association. 2019 Jan 1;69(1):24-8.
3. Trivedi M, Denton E. Asthma in children and adults—what are the differences and what can they tell us about asthma?. Frontiers in pediatrics. 2019 Jun 25;7:256.
4. de Benedictis FM, Attanasi M. Asthma in childhood. European Respiratory Review. 2016 Mar 1;25(139):41-7.
5. Banjari M, Kano Y, Almadani S, Basakran A, Al-Hindi M, Alahmadi T. The relation between asthma control and quality of life in children. International journal of pediatrics. 2018 Jul 3;2018.
6. Nakagome K, Nagata M. Involvement and possible role of eosinophils in asthma exacerbation. Frontiers in immunology. 2018 Sep 28;9:2220..
7. Shapira U, Krubiner M, Ehrenwald M, Shapira I, Zeltser D, Berliner S, Rogowski O, Shenhar-Tsarfaty S, Bar-Shai A. Eosinophil levels predict lung function deterioration in apparently healthy individuals. International journal of chronic obstructive pulmonary disease. 2019;14:597..
8. Zhang XY, Simpson JL, Powell H, Yang IA, Upham JW, Reynolds PN, Hodge S, James AL, Jenkins C, Peters MJ, Lin JT. Full blood count parameters for the detection of asthma inflammatory phenotypes. Clinical & experimental allergy. 2014 Sep;44(9):1137-45.
9. Nakagome K, Nagata M. Involvement and possible role of eosinophils in asthma exacerbation. Frontiers in immunology. 2018 Sep 28;9:2220.
10. Irfan O, Irfan B, Khan ZA, Tahir M, Sarwar Zubairi AB, Khan JA. Knowledge about asthma: A cross-sectional survey in 4 major hospitals of Karachi, Pakistan. Journal of Pakistan Medical Association. 2017;67(11):1787.)
11. Global Initiative for Asthma.(2019). GINA report, global strategy for asthma management and prevention. Available at: [http://www.ginasthma.org]
12. Elnadya HG, Foudac EM, Elsheikha OM, El-Alameeya IR, Elshafied AI, Sherifa LS, Younessb ER, Mohamed NA. Serum vitamin D level as a predictor of bronchial asthma in Egyptian children. J Arab Soc Med Res 2013, 8:67–73.
13. Gungen AC, Aydemir Y. The correlation between asthma disease and neutrophil to lymphocyte ratio. Res J Allergy Immunol. 2017 Aug;1(1):1-4.
14. Katoh S, Ikeda M, Shirai R, Abe M, Ohue Y, Kobashi Y, Oka M. Biomarkers for differentiation of patients with asthma and chronic obstructive pulmonary disease. Journal of Asthma. 2018 Oct 3;55(10):1052-8.
15. Rosario CS, Cat ML, Neto HJ, Riedi CA, Rosario NA. Eosinophil Counts and Asthma Severity in Children. Journal of Allergy and Clinical Immunology. 2017 Feb 1;139(2):AB200).
16. Guiddir T, Saint-Pierre P, Purenne-Denis E, Lambert N, Laoudi Y, Couderc R, Gouvis-Echraghi R, Amat F, Just J. Neutrophilic steroid-refractory recurrent wheeze and eosinophilic steroid-refractory asthma in children. The Journal of Allergy and Clinical Immunology: In Practice. 2017 Sep 1;5(5):1351-61.
17. Hancox RJ, Pavord ID, Sears MR. Associations between blood eosinophils and decline in lung function among adults with and without asthma. European Respiratory Journal. 2018 Apr 1;51(4).