Original Article

Role of Serum CRP, IgE, and Complement levels in Pediatric Population

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ABSTRACT

Objective: To evaluate the role of complement C3, C4 levels, Immunoglobulin E, eosinophil counts, platelets counts, hemoglobin levels and C-reactive protein (CRP) in children with asthma.

Study Design: This was a case control study.

Place and Duration of Study: This study was conducted at the Department of Pediatric Medicine, the Institute of Child Health, Multan and Pediatrics Department, Services Hospital, Lahore, Pakistan from September 2018 to February 2019.

Materials and Methods: A total of 160 children (80 cases and 80 controls) aged up to 16 years were included. Cases were diagnosed accompanying asthma while controls were healthy volunteers. Chi square test was adopted for comparing qualitative variables while t test was used for quantitative variables. P value less than or equal to 0.05 was taken as of statistical significance.

Results: Out of a total of 160 children, when cases and controls were compared, there was no statistical significance in terms of gender distribution ($p = 0.423$) or age ($p = 0.066$) in between cases and controls levels of CRP ($p < 0.0001$), C3 ($p < 0.0001$), Total IgE ($p < 0.0001$), hemoglobin ($p < 0.0001$) and eosinophi count ($p < 0.0001$) were significantly raised cases as compared to controls while C4 levels were noted to be significantly reduced in cases as compared to controls ($p < 0.0001$).

Conclusion: Children with asthma were found to have significantly raised C3, total IgE, eosinophil count and CRP levels but significantly reduced levels of C4 and hemoglobin and C4. These parameters could be used to mark severity as well as the prognosis of asthma in children.

Key Words: Asthma, CRP, eosinophil, hemoglobin,

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INTRODUCTION

Globally, asthma is considered as a significant cause of morbidity and mortality amongst children. More than 300 million individuals spanning all age groups are affected with asthma whereas, every year, more than 250000 deaths are attributed to asthma.[1,2] Asthma is the most frequent pulmonary disorder in children and described as chronic inflammation of airways in response to various stimuli.[3]

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Asthma's prevalence varies around the world but has been on the rise in the last couple of decades. Prevalence of asthma lies between 1 to 20 percent amongst children of different countries. It was noted that asthma's prevalence was relatively high in developed countries as compared to developing nations but in the recent years, studies from Asia, South America and Africa showed that there is a rise to asthma's prevalence in these regions.[1,4]

Asthma is noted as 3rd most frequent reason of hospitalization amongst children as more than 500000 hospitalizations are recorded every year in those children. Asthma is also a major contributor to emergency units and significant burden over healthcare facilities.[5]

Genetic as well as environmental factors play a major role contributing to asthma. Genetic connection involving families has been well documented while environmental risk factors like atopic diseases, bronchiolitis in infancy, passive smoking as well as sensitization to various allergic substances have also been noted to contribute.[6-8]

Helper-cells along with various cytokines (IL-4, IL-5) and eosinopil are thought to play a significant role in the pathogenisis of bronchial asthma.[9] Cough of non productive nature, respiratory difficulty, wheezing,

tightness of chest, headache, shortness of breath and loss of appetite are evident in asthma.[10]

Concentration of CRP are seen to enhance during inflammation, tissue damage and infection. Synthesis of CRP happens in the liver in response to pro inflammatory cytokines while it is noted to be the finest diagnostic parameter for early inflammatory processes and its treatment. In the recent years, CRP has been used to assess staging of inflammation in patients with asthma.[11]

Complement system has been presented as a major host defense entity versus pathogens and antibody mediated tissue injuries processes.[12] Levels of C3 are noted to be raised during active disease because of systemic inflammatory changes in TNF-α and IL-11.[13] IgE is involved is hypersensitivity response and provides defense to host.

Not many studies have been conducted in Pakistan evaluating role of the discussed factors in children suffering with asthma so this present study was aimed to evaluate the role of complement C3, C4 levels, Immunoglobulin E, eosinophil counts, platelets counts, hemoglobin levels and CRP in pediatric population with asthma.

MATERIALS AND METHODS

This case control, multi-centric study was done at The Department of Pediatric Medicine, The Institute of Child Health, Multan, Pakistan and Pediatric Medicine Department, Services Hospital, Lahore, Pakistan from September 2018 to February 2019. A total of 160 children i.e. 80 cases 80 controls (40 cases and 40 controls from each center), aged up to 16 years were included. Cases were diagnosed accompanying asthma on the basis of cough worsening during night and early morning for more than 6 months, and spirometry by forced expiratory volume in 1 sec (FEV1) less than or equal to 80% of predicted.[14] Controls were healthy volunteers. Children having any inflammatory disease, acute viral or any sort of bacterial infection of airway were excluded.

Informed consent was sought from parents or guardians of all the study participants. A blood sample of 5 cc was drawn from anticubital vein from all participants and sent to institutional laboratory for complete blood count, CRP, C3, C4 level and IgE.

SPSS version 21.0 was used for data analysis. Quantitative variables were presented in terms of mean and standard deviation while qualitative variables were exhibited in terms of frequency and percentages. Chi square test was adopted for comparing qualitative variables in between cases and controls while t test was used for quantitative variables. P value less than or equal to 0.05 was taken as of statistical significance.

RESULTS

Out of a total of 160 children, there were 93 (58.1%) male and 67 (41.9%) female. When cases and controls were compared, there was no statistical significance in terms of gender distribution between the groups ($p = 0.423$). Mean age of the cases was 8.25 ± 2.89 years while mean age was 9.10 ± 2.92 in controls and the difference was statistically insignificant ($p = 0.066$).

In terms of CRP, there were 38 (47.5%) cases who had their CRP above 6 mg/dl in comparison to none in controls ($p < 0.0001$). Mean C3 was noted to be 167.271 ± 41.53 mg/dl while it was 116.24 ± 14.70 mg/dl in controls ($p < 0.0001$). Mean C4 was noted to be 21.17 ± 5.63 mg/dl in cases in comparison to mean 36.57 ± 11.88 mg/dl in controls ($p < 0.0001$).

Table No.1: Gender and Age between Cases and Controls

Characteristics		Cases (n=80)	Controls (n=80)	P Value
Gender	Male	44 (55.0%)	49 (61.3%)	0.423
	Female	36 (45.0%)	31 (38.8%)	
Age (mean ± SD)		8.25 ± 2.89	9.10 ± 2.92	0.066

Table No.2: Distribution of CRP, levels of complement C3, C4, Total IgE, Hemoglobin, Eosinophil Counts and Platelet counts in between Cases and Controls

Variables		Cases (n=80)	Controls (n=80)	P Value
CRP (mg/dl)	<6	42 (52.5%)	80 (100.0%)	<0.0001
	>6	38 (47.5%)	0 (0%)	
C3 Level (mean ± SD)		167.271 ± 41.53	116.24 ± 14.70	<0.0001
C4 Level (mean ± SD)		21.17 ± 5.63	36.57 ± 11.88	<0.0001
Total IgE (mean ± SD)		397.28 ± 127.61	128.48 ± 51.95	<0.0001
Hemoglobin Level (mean ± SD)		11.24 ± 1.88	12.11 ± 1.21	0.0006
Platelet Count (mean ± SD)		314.73 ± 108.57	276.95 ± 147.24	0.0666
Eosinophil Count (mean ± SD)		3.492 ± 1.548	1.812 ± 0.645	<0.0001

Mean total IgE was noted to be 397.28 ± 127.61 IU/ml in comparison to 128.48 ± 51.95 IU/ml ($p < 0.0001$).

Mean hemoglobin was noted to be 11.24 ± 1.88 g/dl amongst cases while 12.11 ± 1.21 amongst controls (p = 0.0006). Mean platelet count was 314.73 ± 108.57 10^3 / ul amongst cases while it was 276.95 ± 147.24 10^3/ul amongst controls (p = 0.0666). Mean Eosinophil count was 3.492 ± 1.548 % in cases while 1.812 ± 0.645 % in controls (p < 0.0001)

DISCUSSION

Asthma is a global problem affecting all age groups. Amongst children, it is the most frequent chronic disease. Our study noted a comparatively higher incidence of asthma amongst boys with boys to girls ratio of 1.2:1. A study from Lahore[14] showed boys to girls ratio of 1.3:1 which is very similar to what we found. A study conducted by Yao TC et al[15] on 5351 patients highlighted that asthma was more prevalent in boys as compared to girls but opposite results were found evaluating adult age groups. These findings prove that amongst children, male gender is affected more.

As compared to controls, we noted significantly higher levels of IgE amongst children with asthma. Our findings correlate with another local study done by Bano I et al[14] where they also noted that IgE level was significantly raised in children with asthma. Razi E et al[16] also noted higher levels of IgE in asthmatic cases as compared to controls which is again consistent with our findings. Other researchers[17] have also shown that total IgE was linked with asthma in non-allergic cases as compared to non allergic ones.

Evaluating C3 and C4 levels, we noted that C3 levels were significantly higher in cases as compared to controls but on the other hand, C4 levels were significantly low as compared to controls. Our results in terms of C3 and C4 levels are very aligned with what Bano I et al[14] found. Najam FE et al[12] evaluating cases with asthma noted that C3 levels were raised as compared to controls but C4 levels were normal. The difference could be because of different sensitivity technique. Mosca T et al[18] recorded 85% of cases with asthma to have raised C3 levels while either C3 or C4 were high in 73% of asthmatic cases.

In the present study, we noted that CRP levels were significantly raised in children with asthma as compared to controls. Kilic H et al[19] aimed to not any possible relation between CRP and asthma, they noted that CRP levels were significantly raised in cases of asthma. Another local study[14] also noted significantly higher number of asthmatic children in with raised CRP as compared to controls. Findings of Lama M et al[20] were also very similar to what we found in terms of CRP in this study.

A study done by Galez D and colleagues[11] noted that C3, C4, Total IgE, platelet count as well as CRP levels were raised in children with asthma which is in accordance to our findings. The same study also noted that hemoglobin level in children were asthma were lower as compared to controls which is again very similar to our findings.

CONCLUSION

Children with asthma had significantly raised C3, total IgE, eosinophil count and CRP levels but significantly reduced levels of C4 and hemoglobin and C4. These parameters could be used to mark severity as well as the prognosis of asthma in children.

Author's Contribution:

Concept & Design of Study:	Farhan Zahoor
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Conflict of Interest: The study has no conflict of interest to declare by any author.

REFERENCES

1. Khan AA, Tanzil S, Jamali T, Shahid A, Naeem S, Sahito A, et al. Burden of asthma among children in a developing megacity: childhood asthma study, Pakistan. J Asthma 2014;51(9):891–9.
2. Kozak LJ, Owings MF, Hall MJ. National Hospital Discharge Survey: 2002 annual summary with detailed diagnosis and procedure data. Vital and health statistics. Series 13, Data from the National Health Survey 2005;(158):1-99.
3. Soferman R, Glatstein M, Sivan Y, Weisman Y. Hs CRP levels: measurement of airway inflammation in asthmatic children. Pediatr Int 2008;50(1):12-6.
4. Waqar MA, Khan M, Hasnain SM, Saleem A, Shaukat S, Sarwar F, Mahmood Y. Prevalence of allergy and asthma in school children of Islamabad, Pakistan. World Appl Sci J 2009;6:426-32.
5. Roorda RJ. Prognostic factors for the outcome of childhood asthma in adolescence. Thorax 1996;51(Suppl 1):S7-12.
6. Anderson WC, Apter AJ, Dutmer CM, Searing DA, Szefler SJ. Advances in asthma in 2016: designing individualized approaches to management. J Allergy Clin Immunol 2017;140:671–80.
7. Ito S, Noguchi E, Shibasaki M, Yamakawa-Kobayashi K, Watanabe H, Arinami T. Evidence for an association between plasma platelet activating factor acetylhydrolase deficiency and increased risk of childhood atopic asthma. J Human Genetics 2002;47(2):99-101.

8. Kato G, Takahashi K, Izuhara K, Komiya K, Kimura S, Hayashi S. Markers that can reflect asthmatic activity before and after reduction of inhaled corticosteroids: a pilot study. Biomarker insights 2013;8:97.
9. Husain AN. Lung. In: Kumar V, Abbas AK, Aster JC, editors, Robbins Basic Pathology. 8th ed. Philadelphia: Elsevier Saunders;2007,p.459-512.
10. Tillett WS, Francis T. Serological reactions in pneumonia with a non-protein somatic fraction of pneumococcus. J Experimental Med 1930; 52(4):561-71.
11. Galez D, Dodig S, Raos M, Nogalo B. C-reactive protein in children with asthma and allergic rhinitis. Biochemiamedica 2006;16(2):163-9.
12. Najam FE, Shembesh AH, Giasuddin AS. Complement components (C3, C4) in childhood asthma. The Ind J Pediatr 2005;72(9):745-9.
13. Fattah MA, Baz ME, Sherif A, & AdelA. complement component as inflamatory markers in asthma. Ind J Pediatr 2010;77(7):771-73.
14. Bano I, Shahzad F, Ramzan M, Rathore AW, Rabia T. Serum C-Reactive Protein, Complement and Total IgE Levels in Asthmatic Children. Pak Pediatr J 2016;40(4):215-20.
15. Yao TC, Ou LS, Yeh KW, Lee WI, Chen LC, Huang JL. Associations of age, gender, and BMI with prevalence of allergic diseases in children: PATCH study. J Asthma 2011;48(5):503-10.
16. Razi E, Moosavi GA. Serum total IgE levels and total eosinophil counts: relationship with treatment response in patients with acute asthma. Jornal Brasileiro De Pneumologia 2010;36(1):23-8.
17. Beeh KM, Ksoll M, Buhl R. Elevation of total serum immunoglobulin E is associated with asthma in nonallergic individuals. Eur Respirat J 2000;16(4):609-14.
18. Mosca T, Menezes M, Dionigi PC, Stirbulov R, Forte WC. C3 and C4 complement system components as biomarkers in the intermittent atopic asthma diagnosis. J de Pediatria 2011;87(6):512-6.
19. Kilic H, Karalezli A, Hasanoglu HC, Erel O, Ates C. The relationship between hs-CRP and asthma control test in asthmatic patients. Allergologiaet Immune Pathologia 2012;40(6):362-7.
20. Lama M, JEE MC, Nayak C, & Chaudari TK. elevated c-reactive protein concentration in inhaled corticosteroid naive children with asthma. Int J Chem Sci 2010;4(8):2729-35