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Correlation of Sputum and Peripheral Eosinophil Count in Assessing the Clinical Severity in Bronchial Asthma

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Abstract: ***Asthma, a chronic airways disease, is often related to airway or blood eosinophilia. Importantly, asthmatics with significant eosinophilia are at higher risk for more severe disease. The evidence including clinical studies have demonstrated a causal role for eosinophils in asthma pathogenesis including airway hyper - reactivity, elevated mucus production and airway remodelling. The eosinophilic phenotype of asthma is related to type 2 cytokines such as interleukin (IL) - 4, IL5, and IL - 13. Corticosteroid (CS) is a key anti - inflammatory agent to control eosinophilic inflammation, and biologics targeting type 2 inflammation are effective in SA with high total eosinophil count (TEC). Recent studies have proposed a role for eosinophils in humoral immunity as an important source of pro - survival factors for long - lived plasma cells in the bone marrow. Thus, treatments that specifically target eosinophils are likely to be effective in controlling a number of important and prevalent diseases like asthma. The increasing incidence of eosinophil - associated disorders, as asthma, in high income and low income countries highlights the important and expanding need for eosinophil - targeted therapies. An emerging priority to standardize biological markers related to the eosinophils in clinical research. There was scarcity of the published literature to find the relationship between the peripheral eosinophils counts and severity of asthma. Hence, the present study was conducted to find the correlation between the serum and peripheral eosinophils count in the assessment of clinical severity of asthma.***

Keywords: asthma exacerbation, sputum eosinophil count, allergy, eosinophilic inflammation, eosinophil targeted therapy

1. Introduction

Asthma is a chronic inflammatory disease of multifactorial aetiologies that affects 300 million people worldwide. Initially, asthma was considered typical eosinophilic airway inflammation initiated by allergic sensitization, which results in airway hyper responsiveness (AHR) and acute bronchoconstriction. Among asthmatic patients, severe asthma (SA) is responsible for more than 50% of the medical expense of asthma, even though it accounts for 5% - 10% of entire asthma patients.

The first Expert Panel Report (EPR) Guidelines for asthma were established in 1991, focusing on patient education, environmental control to avoid asthma triggers, and assessment of asthma severity using lung function measures. Throughout the years, the EPR has been revised to reflect new research and novel treatment options; EPR - 4 (2020) is the latest update. Disease severity is central to EPR - 4 guidance, with step - therapy recommended to address an escalating need for more drugs, at higher doses, with persistently uncontrolled disease. Eosinophilia defined as a peripheral blood eosinophil count greater than 450 cells per microliter, is associated with numerous disorders. Eosinophils are bone marrow - derived leukocytes that are normally less than 5% of leukocytes in the blood, but can be found in higher numbers in tissues such as the bone marrow and gastrointestinal tract.

Recruitment of activated eosinophils from the bloodstream into tissues can occur under a variety of conditions and lead to the release of preformed and newly synthesized products, including cytokines, chemokines, lipid mediators and cytotoxic granule proteins, that can initiate, quickly escalate and sustain local inflammatory and remodelling responses. Eosinophil - rich inflammation has long been associated

with parasitic infestation and allergic inflammation. Eosinophils are terminally differentiated granulocytes that play a role in innate host defence against pathogens, particularly parasites and viruses. Eosinophils damage both pathogenic and host cells through the release of toxic granule proteins and reactive oxygen species. Eosinophils actively contribute to innate and adaptive inflammatory cascades through the production and release of diverse chemokines, cytokines, lipid mediators and other growth factors. Through these effector mechanisms, eosinophils can influence tissue specific function.

Aim: To study the correlation of sputum eosinophil count and peripheral eosinophil count in assessing the clinical severity of asthma

Objective

1) To find the eosinophil count in sputum and peripheral eosinophil count.
2) To find the correlation between the eosinophil count in sputum and determination with peripheral eosinophil count with the severity of asthma

Methods: A Prospective observational study was conducted to assess the correlation of sputum eosinophil count and peripheral eosinophil count in assessing the clinical severity of asthma from December 2020 to May 2022.

Ethical Clearance: A protocol of the intended study was submitted to the Institutional Ethical Committee and Review Board, J. L. N. Hospital & Research Centre, Bhilai and ethical clearance was obtained. (Ethical approval no JLNHRC/IEC/2020/44)

Permission and Consent: Necessary permissions were obtained from concerned authorities of hospital before conducting the study. Informed consent was obtained from the participants after explaining the procedure and purpose clearly.

Patient Selection Criteria:

Inclusion Criteria

- Diagnosed Asthma Patient Age 15 - 45 years as per GINA guideline 2022
- Normal Chest X ray
- No suggestive feature for COPD
- Patient have sputum and can perform PFT properly
- Non Smoker

Exclusion Criteria

- History of CCF, Bronchiectasis and repeated chest infection in childhood
- Mixed and restricted pattern of spirometry

Sample Size Calculation:

N = [(Zα+ Zβ) /C]2 + 3
The Zα = 1.645 (90%), Zβ= 0.84 (80%)
r= 0.325
C=0.5*In [(1+r) / (1 - r)] = 0.3372
N= [(1.645+0.84) /C]2 +3 = 58
Hence calculated sample size was **58**.

Study Tools:

- Chest X - Ray (PA View)
- Lung function test – Spirometer
- A compound microscope in an Improved Neubauer's Chamber

2. Statistical Analysis

The data collected were entered into excel spread sheet and it was analyzed using the Statistical Package for Social Sciences (SPSS) version 24. Descriptive and inferential statistics was done. Continuous variables were presented as mean ± SD, and categorical variables were presented as absolute numbers and percentage. Data was checked for normality before statistical analysis and found the normal data set. Independent t test was used to find the difference in spirometry findings. Correlation among the Serum Eosinophils, Sputum eosinophils, FEV1 Predicted and Severity of Asthma was done through spearman's correlation test. Statistical significance was considered at p <0.05 (confidence interval of 95% was taken).

3. Results

Table 1: Age & Gender distribution of the study participants

Age	Male	Percent	Female	Percent	Total	Percent	p - value
15 - 20	4	6.9	5	8.6	9	15.5	
21 - 25	8	13.8	9	15.5	17	29.3	
26 - 30	6	10.3	9	15.5	15	25.9	0.021
31 - 35	3	5.2	6	10.3	9	15.5	
36 - 40	2	3.4	3	5.2	5	8.6	
41 - 45	1	1.7	2	3.4	3	5.2	
Total	24	41.4	34	58.6	58	100.0	

Chi square test, sig.2 tailed, p<0.05

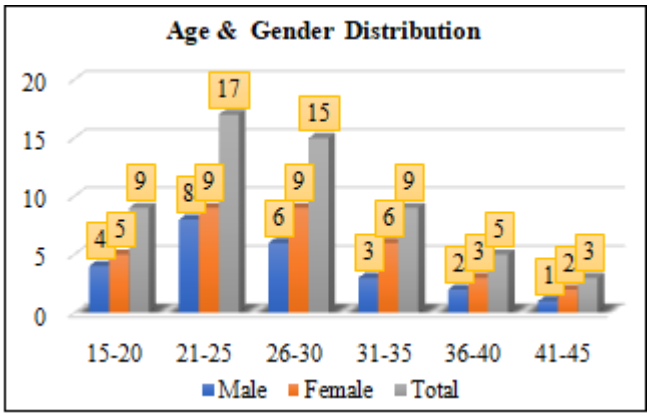


Figure 1: Age & Gender distribution of the study participants

The age of the study participants were range from 15 - 45 years, Most of the study participants were under age range of 21 -
30 years. Females were 58.6% and males were 41.4%.

Table 2: Gender distribution of the study participants

Gender	Number	Percent
Male	24	41.4
Female	34	58.6

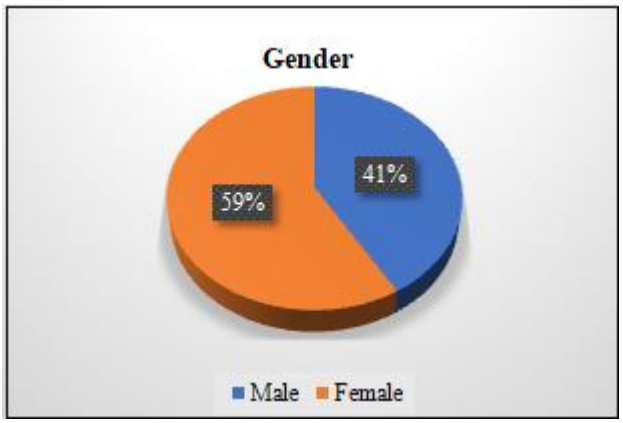


Figure 2: Gender distribution of the study participants

Females were 58.6% and males were 41.4%.

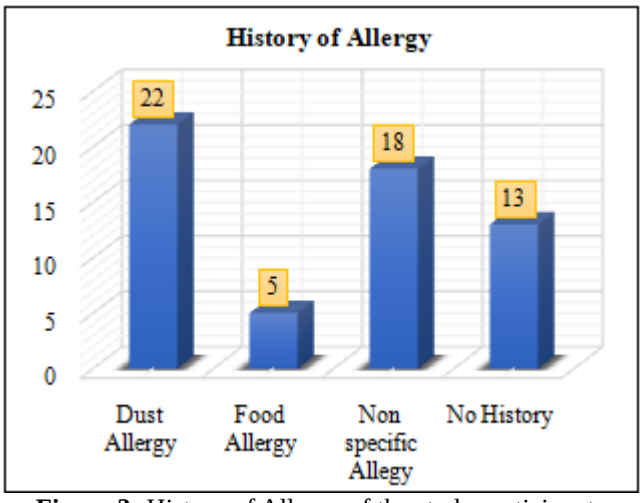


Figure 3: History of Allergy of the study participants

Table 3: History of Allergy of the study participants

History of Allergy	Number	Percent
Dust Allergy	22	37.9
Food Allergy	5	8.6
Non - specific Allergy	18	31.0
No History	13	22.4

Related to the history of the allergy among the study participants, the 37.9% of the study participants had dust allergy followed by 31% had non - specific allergy. No history of allergy was reported by 22.4% of the study participants.

Table 4: Prevalence of Asthma across gender of the study participants

Prevalence of Asthma	Male	Percent	Female	Percent	Total	Percent	p - value
Mild	5	8.6	8	13.8	13	22.4	
Moderate	13	22.4	15	25.9	28	48.3	0.002
Severe	6	10.3	11	19.0	17	29.3	
Total	24	41.4	34	58.6	58	100.0	

Chi square test, *sig.2 tailed, p<0.05*

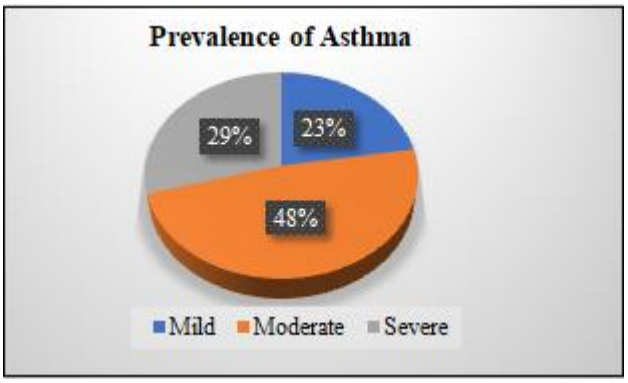


Figure 4: Prevalence of Asthma of the study participants

Related to the prevalence of asthma across gender of the study participants, the 23% had mild asthma, 48% had moderate and 29% had severe asthma. There was significant difference between the male and female participants related to the severity of asthma.

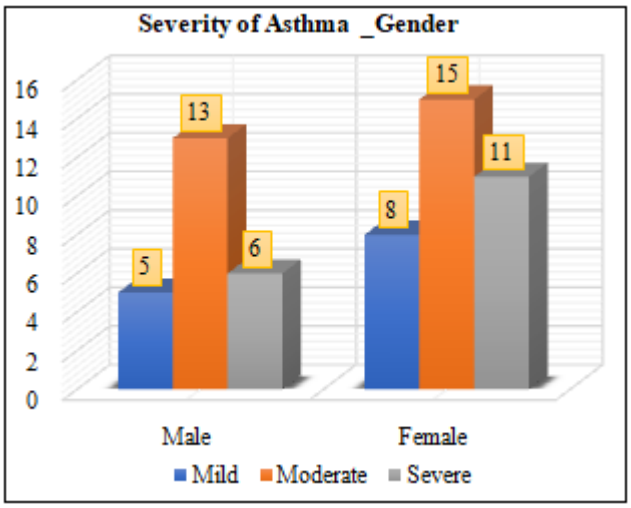


Figure 4 (A): Prevalence of Asthma across gender of the study participants

Table 5: Family history of study participants

Family History	Mild	Percent	Moderate	Percent	Severe	Percent	Total	Percent	P - value
Yes	2	3.4	17	29.3	14	24.1	33	56.9	
No	11	19.0	11	19.0	3	5.2	25	43.1	***0.032***
Total	13	22.4	28	48.3	17	29.3	58	100.0	

Chi square test, sig.2 tailed, p<0.05

About 56.9% of the study participants had the positive family history for the asthma. About 14 out of 17 severe asthma patients had positive family history.

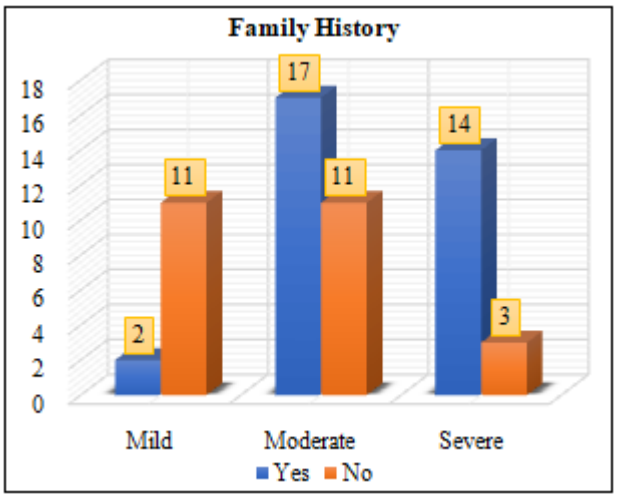


Figure 5: Family history of study participants

Table 6: Comorbidities of the study participants with bronchial asthma

Comorbidities	Number	Percent
ALLERGIC RHINITIS	18	31.0
SINUSITIS	9	15.5
ECZEMA	4	6.9
GERD	3	5.2
OBESITY	11	19.0
NONE	13	22.4

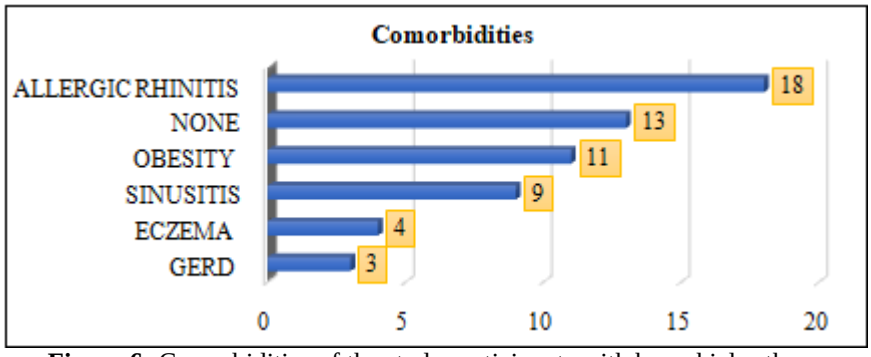


Figure 6: Comorbidities of the study participants with bronchial asthma

The allergic rhinitis was the most common co morbidities among 31% of the study participants followed by obesity. There were no comorbidities among 22.4% of the study participants

Table 7: Alcohol habit and BMI of the study participants

Alcohol Intake	Mild to Moderate	Percent	Severe	Percent	Total	Percent	p - value
Yes	24	41.4	10	17.2	34	58.6	
No	17	29.3	7	12.1	24	41.4	0.041
Total	41	70.7	17	29.3	58	100.0	
BMI							
<23	12	20.7	6	10.3	18	31.0	
>23	29	50.0	11	19.0	40	69.0	0.33
Total	41	70.7	17	29.3	58	100.0	
Mean BMI	24.53±4.05		21.11±3.7		22±6.7		0.741

Chi square test, sig.2 tailed, p<0.05, One way ANOVA, Sig 2 tailed, p<0.05

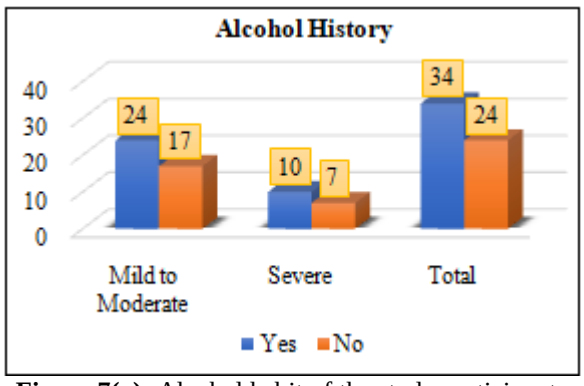


Figure 7(a): Alcohol habit of the study participants

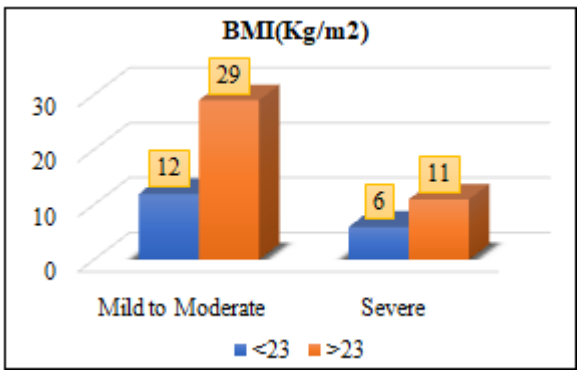


Figure 7 (b): BMI (Kg/m2) of the study participants

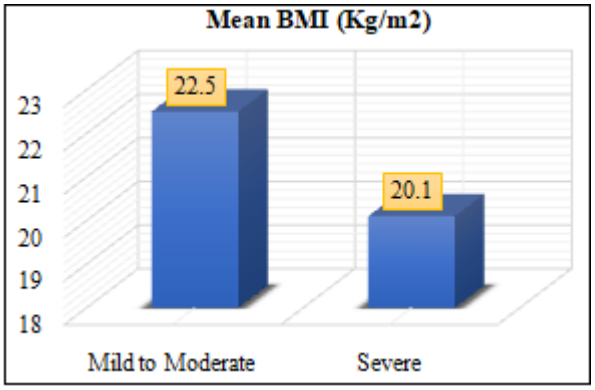


Figure 7(c): Mean BMI (Kg/m2) of the study participants

There were 58% of the participants had history of drinking alcohol and 10 out of 17 severe asthma patients had alcohol habit.

The Mean BMI of the study participants were 22 kg/m2. Which were higher for the mild to moderate asthmatic patients.

Table 8: Spirometry value of the study participants

Asthma	Mild	Moderate	Severe	p - value
FVC	3.61±0.9	3.1±0.9	2.47±0.8	**0.002**
FEV1	3.01±0.70	2.78±0.70	1.9±0.66	**<0.001**
FEV1 Predicted	78.11±1.22	71.47±2.77	58.68 ± 2.4	**0.031**
FEV1/FVC % predicted	72.22±1.4	69.4±0.77	61.54±0.99	**<0.001**

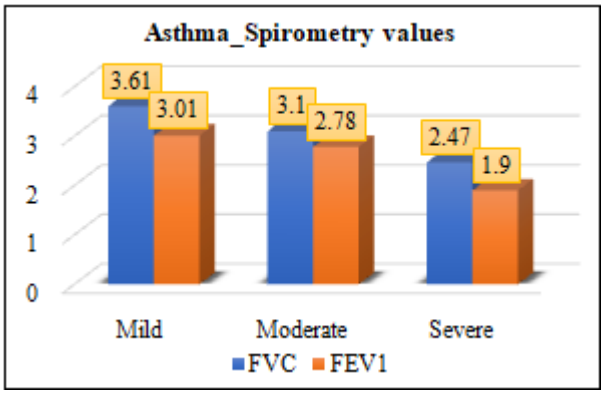


Table 8: Spirometry value (FVC/FEV1) of the study participants

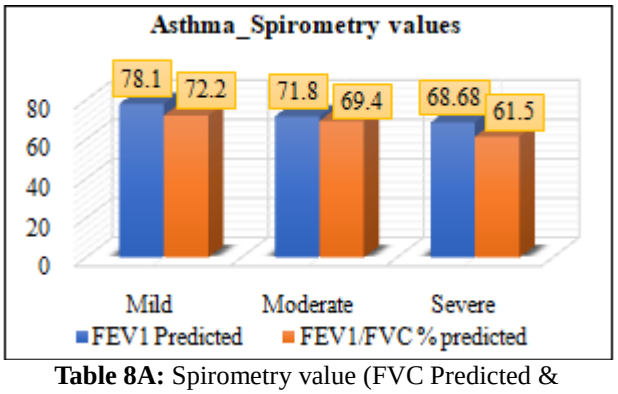


Table 8A: Spirometry value (FVC Predicted & FEV1/FVC% Predicted) of the study participants

The spirometry analysis suggests the significant difference between the Mild, moderate and severe asthmatic patients. The mean FVC value of mild (3.61±0.9), moderate (3.1±0.9) and severe (2.47±0.8), the difference is statistically significant. The mean FVEV1 value of mild (3.01±0.70), moderate (2.78±0.70) and severe (1.9±0.66), the difference is statistically significant. The mean FVEV1 Predicted value of mild (78.11±1.22), moderate (71.47±2.77) and severe (58.68 ± 2.4), the difference is statistically significant. The mean FEV1/FVC % predicted value of mild (72.22±1.4), moderate (69.4±0.77) and severe (61.54±0.99), the difference is statistically significant.

Table 9: Mean Serum Eosinophil and Sputum eosinophils count of the study participants

Eosinophil count	Serum Eosinophils	p - value	Sputum eosinophils	p - value
Mild	305.71±69.19		1.2±0.7	
Moderate	438.83±75.25	***0.041***	2.4±0.8	***0.008***
Severe	605.24±83.16		3.1±0.6	

One Way ANOVA, Sig 2 tailed, p<0.05

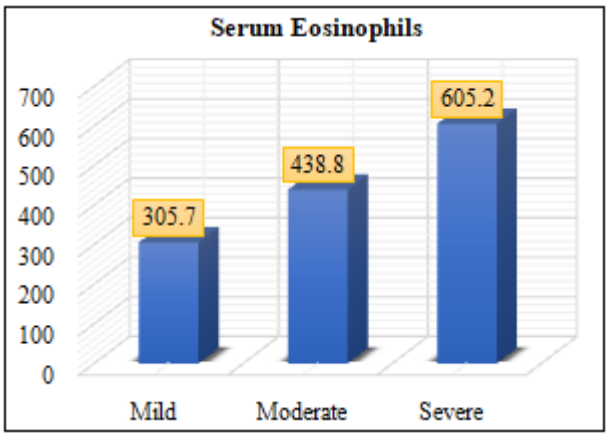


Figure 9: Mean Serum Eosinophil count of the study participants

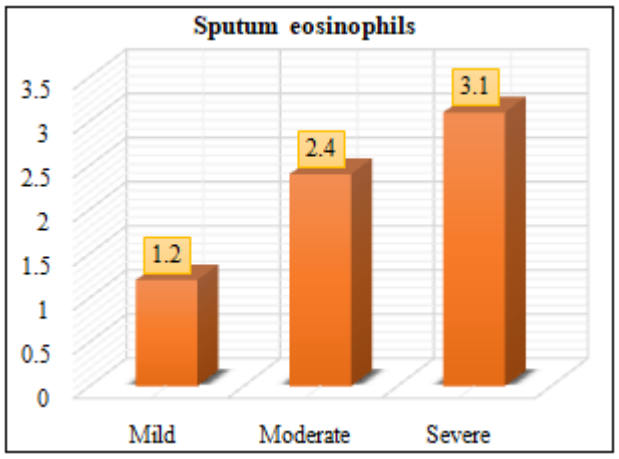


Figure 9A: Mean sputum Eosinophil count of the study participants

Table 10: Distribution of the study participants based upon the severity and eosinophilic count

Eosinophil count	<400	>400
Mild	12	1
Moderate	24	4
Severe	1	16

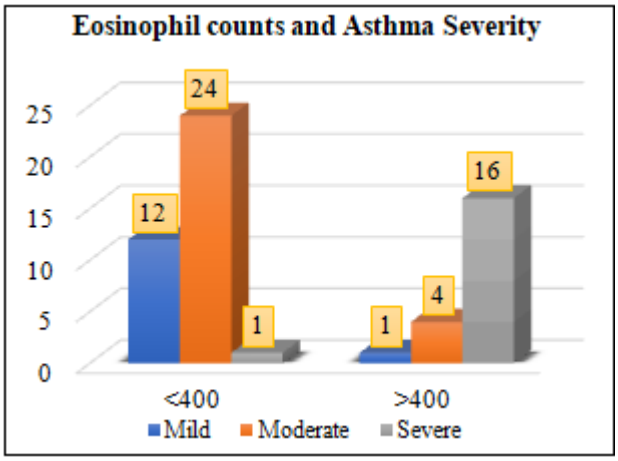


Figure 10: Distribution of the study participants based upon the severity and eosinophilic count

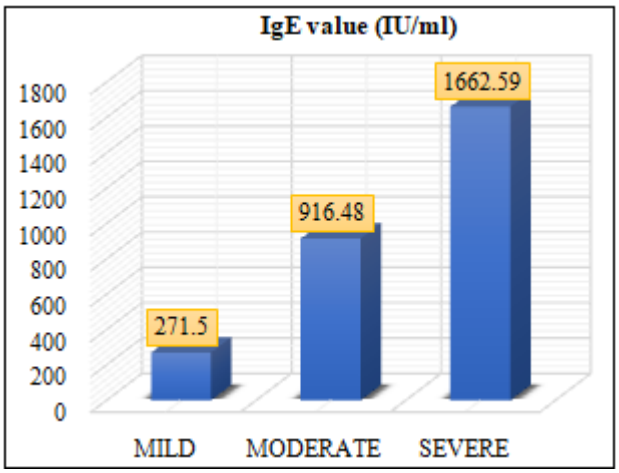


Figure 11: Severity of Asthma and IgE value

Table 11: Severity of Asthma and IgE value

Severity	IgE value (IU/ml)
Mild	271.5
Moderate	916.48
Severe	1662.59

Table 12: GINA with severity of asthma

GINA step - care level	Mild	Percent	Moderate	Percent	Severe	Percent	Total	Percent
Step 1	1	1.7	4	6.9	0	0.0	5	8.6
Step 2	5	8.6	3	5.2	0	0.0	8	13.8
Step 3	4	6.9	11	19.0	4	6.9	19	32.8
Step 4	2	3.4	10	17.2	13	22.4	25	43.1
Step 5	0	0.0	0	0.0	1	1.7	1	1.7
Total	13	22.4	28	48.3	17	29.3	58	100.0

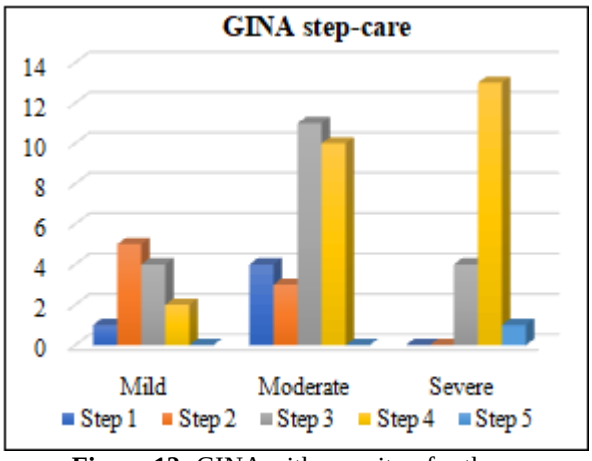


Figure 12: GINA with severity of asthma

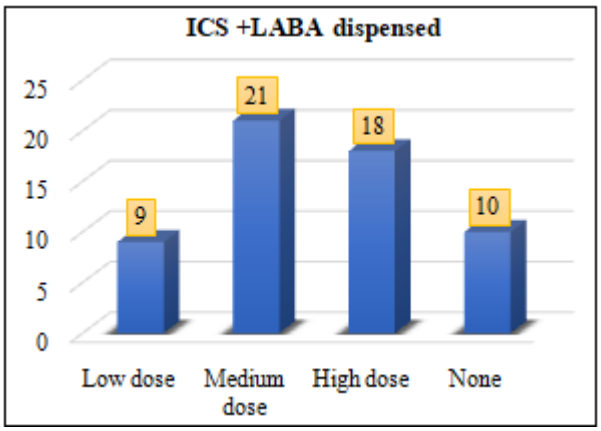


Figure 13: Medication for bronchial asthma

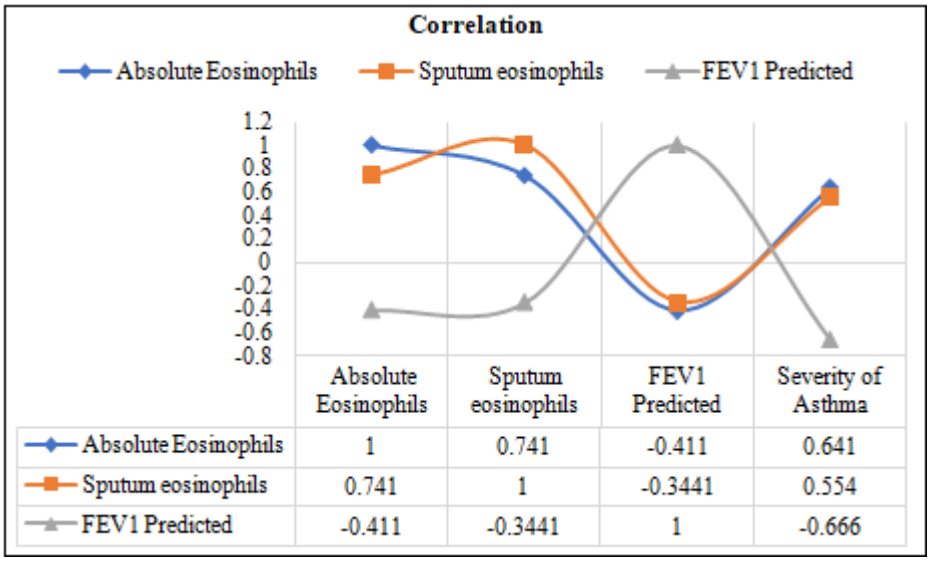
Table 13: Medication for bronchial asthma

ICS +LABA dispensed	Number	Percent
Low dose	9	15.5
Medium dose	21	36.2
High dose	18	31.0
None	10	17.2

Table 14: Correlation among the Serum Eosinophils, Sputum eosinophils, FEV1 Predicted and Severity of Asthma

Correlation		Serum Eosinophils	Sputum eosinophils	FEV1 Predicted	Severity of Asthma
Serum Eosinophils	r - value	1	0.741	- 0.411	0.641
	p - value		***0.001***	***0.003***	***<0.001***
Sputum eosinophils	r - value	0.741	1	- 0.3441	0.554
	p - value	0.001		0.41	***0.01***
FEV1 Predicted	r - value	- 0.411	- 0.3441	1	- 0.666
	p - value	***0.003***	0.41		***0.012***

Spearman's Correlation, sig 2 tailed, p<0.05



	Absolute Eosinophils	Sputum eosinophils	FEV1 Predicted	Severity of Asthma
Absolute Eosinophils	1	0.741	-0.411	0.641
Sputum eosinophils	0.741	1	-0.3441	0.554
FEV1 Predicted	-0.411	-0.3441	1	-0.666

Figure 14: Correlation among the Serum Eosinophils, Sputum eosinophils, FEV1 Predicted and Severity of Asthma

The mean serum eosinophils count mild (305.71±69.19), moderate (438.83±75.25) and severe (605.24±83.16), the difference is statistically significant.

The mean sputum eosinophils count mild (1.2±0.7), moderate (2.4±0.8) and severe (3.1±0.6), the difference is statistically significant. Severity of asthma and IgE value were correlated and had higher for the severe asthmatic patients.

About 43.2% were at step 4 followed by step 3 as per GINA guideline. The ICS +LABA dispensed, 36.3% are under medium dose.

There was positive correlation between the sputum and serum eosinophilic count (r=0.741) and negative correlation between the eosinophilic count and FEV1% (- 0.66).

4. Discussion

In this section, we are comparing the results of our study with previous studies conducted and their results. This was a study conducted among 58 bronchial asthma patients. The purpose of the study was to find out if there was any correlation between serum eosinophil count, sputum eosinophilic count and severity of bronchial asthma.

Age & Gender: The age range was 15 - 45 years, with higher prevalence of disease were under 21 - 30 years of age, which was similar to the previous studies done. In the present study, females were **59%** as compared to males **41%**. Which is similar to study done by B. Leynaert et al that have shown that asthma was 20% more frequent in females than in males over the age of 35 years. Studies done by Kynyk Et al show that women are more likely to develop asthma and suffer from more mortality than men. Hormonal and genetic susceptibility both contribute to this change. Studies by de Marco. R et al also show severe asthma is more predominant in women. During childhood, girls had a significantly lower risk of developing asthma than boys (relative risk (RR): 0.74 and 0.56 in the 0 to 5yr and 5 to 10 yr age, respectively). Around puberty, the risk was almost equal in the two sexes (RR = 0.84). After puberty, the risk in women was always significantly higher than that in men (RR: 1.38 to 5.91). Women's greater susceptibility to asthma in early adulthood was at least partly, explained by their smaller airway calibre.

Allergy & Family history: Prevalence of asthma is more in patients with allergy in our study population. Most of the allergy was due to the dust followed by non - specific cause. According to studies by Lebowitz et al and Peat et al, the role played by atopy contributes to the highest risk. Asthma triggered by exposure to the same substances that trigger allergy symptoms. In our study population, **56%** had a positive family history. Among the **56.9%** who had a positive family history, **24%** had severe, **29.3%** had moderate and **3.4%** had mild asthma. Results of a study done by Parisa Davoodi, P. A Mahesh and Nallur B. Ramachandra indicated a positive association between having a family history of asthma and higher socio - economic status. Family history of asthma and atopy have been introduced as the strongest risk factors in adult asthma.

Comorbidities: In our study, **77.6%** had associated comorbidities, among which allergic rhinitis constituted 31% cases, others were sinusitis, eczema, obesity and GERD. Comorbidities had positive correlation with severity of bronchial asthma as assessed by spirometry which were similar to studies by de Groot et al and Andrea G Gershon. Studies by Louis Philippe Boulet, Marie Eve Boulay, report that asthma in adults is most commonly associated with comorbidities such as rhinitis, sinusitis, obesity, obstructive sleep apnea and gastro - oesophageal reflux disease which is similar to comorbidities in our study population.

Spirometry: Related to the spirometry finding that there is marked difference in the FEV1% predicted between the severe and mild groups with the moderate group in between the two. The mild group has FEV1% predicted test value of 78.11±1.22 compared with the severe group having **58.68 ± 24.49** while the moderate has **71.47±2.77**. This is consistent

with the findings of Bai TR et al. Jatakanon A et al, classified asthmatics into mild, moderate and severe, in his study the FEV1% predicted in mild asthmatics was 81, for moderate it was 74 while for severe it was 61.9 These values are in line with the findings of the present study.

Serum IgE level with asthma severity: Our present study shows that suggest that serum IgE levels increase with severity which is similar to studies by Janeway et al and Kovac et al. Burrow et al in 1982 and Castorline et al in 1983 first described role of S. Ig E and air flow obstruction in asthma.

Serum & Sputum Eosinophilic count: Sputum eosinophil levels correlate with the severity of asthma clinical outcomes and response to inhaled corticosteroid treatment, according to a study published in the Journal of Asthma. While forced expiratory volume during the first second (FEV1) is used to measure lung function in asthma, inflammation and remodelling can persist even when FEV1 has returned to normal. Bronchoscopy with biopsy and Broncho alveolar lavage may be used to monitor airway inflammation, but the invasiveness of these methods limits their use in clinical practice.

Sputum analysis offers a non - invasive alternative for assessing airway inflammation. Eosinophil infiltration plays an important role in the pathogenesis of asthma. Sputum eosinophil percentages are more accurate markers for asthma than blood eosinophil levels, but whether sputum eosinophil counts correlate with asthma severity was unknown until recently.

Present study found a higher value of mean serum eosinophil count which is consistent with the findings of Hussain MM et al, where the absolute eosinophil count in asthmatic patients was found to be 442±48.52.10 In this study, the mean absolute eosinophil count is **330±88.64**. Lalrinpuia B et al. which is more than the normal value of 150 - 300 cells/µl. Rytila P et al, also showed that eosinophil count of asthmatic patients was significantly higher as compared to healthy controls suggesting that eosinophilia is an important diagnostic feature of bronchial asthma.

Thus, our study confirms peripheral blood eosinophil count may be a useful instrument to identify the eosinophilic phenotype of asthma in clinical practice. In our study, we did not evaluate the relationship between the eosinophilic phenotype and asthma exacerbations because the cross sectional design did not allow us to have precise information about previous exacerbations.

Eosinophils and FEV1% as markers of asthma severity revealed in this study is consistent with the findings of Roquet A et al, where a significantly higher eosinophil count (p was found among the bronchial hyperactive patients estimated by a bronchial challenge test. Also there was an relation (r= - 0.4, p=0.001) between the eosinophil count and the FEV1 predicted as measured by histamine challenge. These findings are similar to the findings of the present study where there is a significantly higher correlation between the sputum and FEV1 predicted value.

There was positive correlation between the serum and sputum eosinophilic count (r=0.74, p=0.001), which suggest the use of the sputum eosinophilic count as marker for the severity of asthma. Eosinophils are important indicator of disease severity where a significant rise is often detected in the most severe cases of bronchial asthma. serum eosinophil count and sputum eosinophilic count are important indicators of asthma severity and can even be used to predict disease progression.

Previous clinical studies have relied on induced sputum to identify eosinophilic phenotypes, a laboratory method that is not easily transferred from the research setting to routine use in the clinic because sputum collection and processing are time consuming and require specialized personnel and training.

Other less invasive and simpler tests, such as FeNO and peripheral blood eosinophil counts, have been studied to find alternative predictive markers for sputum eosinophil counts. Indeed, the present findings support the need to further explore the role of FeNO in combination with peripheral blood eosinophil levels on asthma exacerbation.

Recently, the US National Institutes of Health and federal agencies convened an expert group to propose biomarkers that should be assessed in future clinical asthma research studies and concluded that analysis of blood eosinophils by an automated complete blood cell counter provides useful information to characterize study populations for prospective clinical studies in asthma and eosinophil counts can be used as a biomarker to monitor the systemic biological effects of pharmacologic and immunologic interventions in patients with asthma.

The positive association between blood eosinophilia and asthma severity as found in this study provides further support of the use of eosinophil levels in assessing asthma status. Authors advocate the use of this simple and sensitive laboratory test as significant adjunct objective technique in the assessment of asthma severity and management. In the future, markers of airway eosinophilic inflammation could be used to monitor asthma disease and have a particularly useful role, when continuing medical assessments and management are required.

5. Summary

- The age of the study participants ranged from 15 - 45 years. Most of the study participants were under age range of 21 - 30 years. Females were 58.6% and males were 41.4%.
- Related to the history of the allergy among the study participants, the 37.9% of the study participants had dust allergy followed by 31% had non - specific allergy. No history of allergy was reported by 22.4% of the study participants.
- Related to the prevalence of asthma across gender of the study participants, the 23% had mild asthma, 48% had moderate and 29% had severe asthma. There was significant difference between the male and female participants related to the severity of asthma.

- About 56.9% of the study participants had the positive family history for the asthma. About 14 out of 17 severe asthma patients had positive family history.
- The allergic rhinitis was the most common co morbidities among 31% of the study participants followed by obesity. There were no comorbidities among 22.4% of the study participants.
- 58% of the participants had history of drinking alcohol and 10 out of 17 severe asthma patients had alcohol habit.
- The Mean BMI of the study participants were 22 kg/m2. Which were higher for the mild to moderate asthmatic patients
- The spirometry analysis suggests the significant difference between the Mild, moderate and severe asthmatic patients. The mean FVC value of mild asthmatics was (3.61±0.9), moderate was (3.1±0.9) and severe was (2.47±0.8), the difference is statistically significant. The mean FEV1 value of mild (3.01±0.70), moderate (2.78±0.70) and severe (1.9±0.66), the difference is statistically significant.
- The mean FEV1 Predicted value of mild (78.11±1.22), moderate (71.47±2.77) and severe (58.68 ± 2.4), the difference is statistically significant. The mean FEV1/FVC % predicted value of mild (72.22±1.4), moderate (69.4±0.77) and severe (61.54±0.99), the difference is statistically significant.
- The mean serum eosinophils count mild (305.71±69.19), moderate (438.83±75.25) and severe (605.24±83.16), the difference is statistically significant.
- The mean sputum eosinophils count of mild was (1.2±0.7), moderate was (2.4±0.8) and severe was (3.1±0.6), the difference is statistically significant. Severity of asthma and IgE value were correlated and was found to be higher for the severe asthmatic patients.
- About 43.2% were at step 4 followed by step 3 as per GINA guideline. Among those ICS +LABA dispensed, 36.3% are under medium dose.
- There was positive correlation between the sputum and serum eosinophilic count (r=0.741) and negative correlation between the eosinophilic count and FEV1% (- 0.66).

6. Conclusion

The present study was conducted to find the correlation between the serum and sputum eosinophils count in the assessment of clinical severity of asthma. The age of the study participants ranged from 15 - 45 years, with female gender predisposition. The mean serum eosinophils count of mild asthmatics was (305.71±69.19), moderate asthmatics was (438.83±75.25) and severe asthmatics was (605.24±83.16), the difference of the severity of asthma and serum eosinophilic count was statistically significant. Higher serum eosinophil count were associated with the severe asthma. The mean sputum eosinophils count of mild asthmatics was (1.2±0.7), moderate asthmatics was (2.4±0.8) and severe asthmatics was (3.1±0.6), the difference is found to be statistically significant. Similar to the serum eosinophil counts, the higher sputum eosinophils were associated with the severe asthma. There was positive correlation between the sputum and serum eosinophilic count (r=0.741) and negative correlation between the eosinophilic count and FEV1% (- 0.66).

7. Recommendations

- Spirometry is the investigation of choice to establish diagnosis and look for the severity of the disease.
- As a part of assessment serum eosinophil counts allows one to determine the severity of the disease and its changes with time and treatment, so we recommend that Serum eosinophil counts should be done in follow - up of asthmatics.
- Likely, the sputum eosinophil counts have also been found to be significant in assessing the severity of asthma.
- In rural areas where the facility for spirometric evaluation is not possible, we can use this simple blood test serum eosinophil counts as marker for evaluating prognosis, treatment response and severity of illness.
- As our study showed significant correlation between serum and sputum eosinophil counts with the disease severity, all the patients should undergo these tests for follow up.

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