

(RESEARCH ARTICLE)



## A study of inflammatory markers in women with polycystic ovary syndrome

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### Abstract

Polycystic ovary syndrome (PCOS), an endocrine disorder has been associated with low-grade inflammation based on increased levels of several inflammatory mediators. Aim of the study was to assess the inflammatory markers in women with PCOS and their correlation with each other. Various inflammatory markers, neutrophil/lymphocyte ratio, hsC-reactive protein and CRP albumin ratio were found to be increased in women with PCOS in the study. Early detection of raised levels of inflammatory markers may help early diagnosis of PCOS and prevent development of metabolic syndrome.

**Keywords:** Inflammatory markers; PCOS; hsCRP; Neutrophil lymphocyte ratio

### 1. Introduction

Polycystic ovary syndrome (PCOS), an endocrine disorder affects approximately 14-19% % of women in reproductive age [1]. PCOS has been associated with low-grade inflammation based on increased levels of several inflammatory mediators. The inflammatory markers commonly associated with this condition are C-reactive protein (CRP), tumour necrosis factor alpha (TNF $\alpha$ ), procalcitonin (PCT), interleukin-6 (IL-6) and neutrophil/lymphocyte ratio (NLR) [2]. a study of inflammatory markers in women with polycystic ovary syndrome.

The objective of the study was to assess the inflammatory markers in women with PCOS and their correlation with each other. The results of the study may help to assess inflammation among women with polycystic ovary syndrome in our population, so that easy, early and accurate detection of inflammation can be done and morbidity due to PCOS may be prevented.

### 2. Material and methods

This was a hospital based descriptive study conducted in a tertiary care hospital over a period of one year. 110 women, aged 18-40 year fulfilling the Rotterdam criteria for diagnosis of Polycystic Ovary Syndrome were included in the study. Institutional review board and ethical committee approval was taken prior to the study. Written informed consent was taken of all women.

Women who gave history of inflammatory diseases like rheumatoid arthritis, chronic obstructive lung disease, and chronic liver disease were excluded. Pregnant or lactating women or women with non-classical congenital adrenal hyperplasia (NC-CAH), Cushing's syndrome, androgen-secreting tumors, hyperprolactinemia, thyroid diseases, drug-induced androgen excess, as well as other causes of oligomenorrhea or anovulation were also not included.

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Detailed history was taken. General physical examination and complete systemic examination was done. Venous blood sample of women was collected for complete blood count, S. albumin, Procalcitonin and high sensitivity C- reactive protein (hsCRP). All the observations were recorded, statistical analysis done and conclusions drawn. P value < 0.05 was taken as significant.

### 3. Results and discussion

Women with PCOS have greater chronic subclinical inflammation. Various inflammatory markers were found to be increased in women with PCOS in the study.

High levels of neutrophils may indicate a severe infection or stress on the body. Low levels of lymphocytes may also reflect severe stress and the release of stress hormones. High N/L ratio is an indicator of an inflammatory disorder [3]. Normal NLR is roughly 1-3. The Neutrophil/lymphocyte ratio in our study too was elevated the mean being 3.8. Table 1.

**Table 1** Inflammatory Markers In PCOS Women

Inflammatory marker	Range	Number	Percentage (%)	Mean
Neutrophil/lymphocyte ratio	0-1.93	28	25.4	3.8
	1.93-2.81	27	24.5	
	2.82-4.06	27	24.5	
	4.07-17.22	28	25.4	
hsCRP (mg/L)	0-2.62	29	26.3	4.4
	2.63-4.1	30	27.2	
	4.2-5.7	23	20.9	
	5.8-15	28	25.4	
Procalcitonin (ng/L)	0.01-0.02	76	69	0.03
	>0.02	34	30.9	
CRP/albumin ratio	0-0.61	26	23.6	1.06
	0.62-0.87	27	24.5	
	0.88-1.45	31	28.1	
	1.46-3.58	26	23.6	

The body tries to heal inflammation by producing proteins called acute phase reactants. CRP is one of these proteins. Hence, their levels rise when there is inflammation [4]. The hs-CRP test accurately detects lower levels of the protein than the standard CRP test. Normal levels of are *hs-CRP*: < 3 mg/L. The levels of hsCRP in women with PCOS was elevated, mean being 4.4 mg/L.

The reference value for procalcitonin in adults is less than 0.1 ng/L. Levels greater than 0.25 ng/L can indicate the presence of an infection [5]. The Procalcitonin levels in the study were in normal range, mean being 0.03 ng/L.

CRP/albumin ratio, a marker for inflammation related to metabolic dysfunction, was found to have a stronger association with PCOS than either androgen excess or insulin resistance [6]. In our study too, the CRP/albumin ratio was 1.06.

Chronic low-grade inflammation plays a role in the pathogenesis of insulin resistance and the metabolic syndrome. The increased concentration of these inflammatory markers clusters with other cardiovascular risk factors, such as dyslipidaemia, glucose intolerance and type 2 diabetes, hypertension, hypo fibrinolysis and obesity.

The low-grade chronic inflammatory process might be related to relatively small increases in CRP, only measurable using high sensitivity methods. Increased hs-CRP concentrations and CRP/albumin ratio maybe suggestive of the existence of low-grade chronic inflammation seen in this condition [7].

Kalyan et al showed that the ratio of CRP to albumin is a more accurate and stronger correlate of PCOS compared with both free androgens and insulin resistance. They found the CRP/albumin ratio to have a higher specificity and sensitivity for inflammation associated with metabolic dysfunction than insulin resistance and androgens in matched PCOS patients [7].

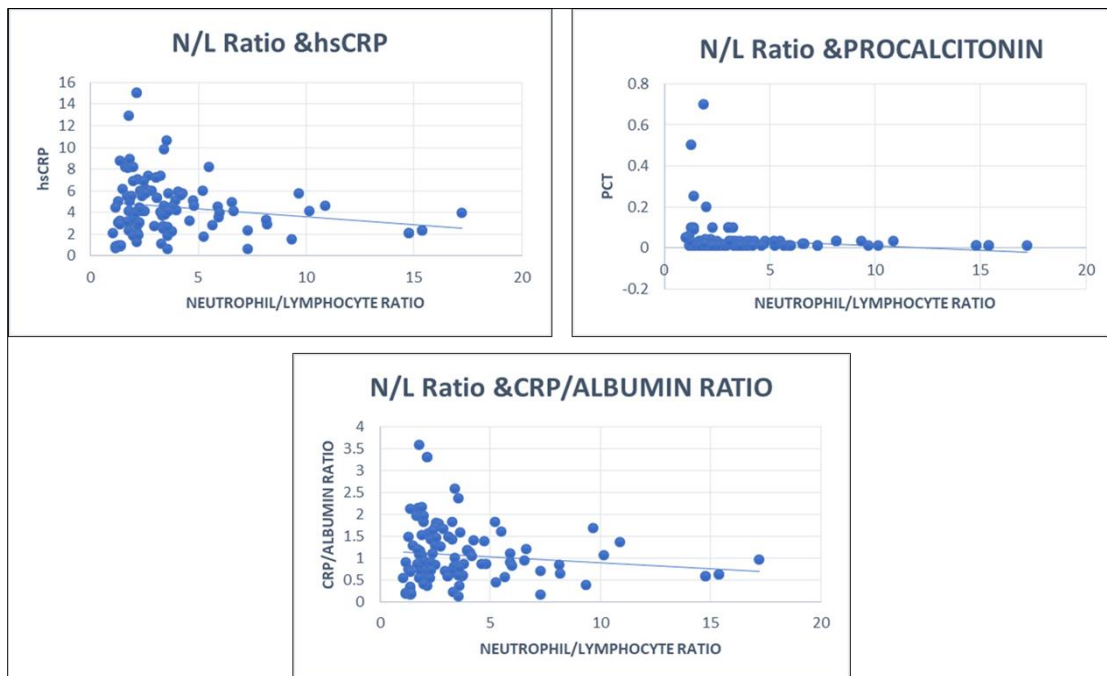
Correlation of inflammatory markers was done with each other. Significant positive correlation was found between hsCRP and CRP/albumin ratio ( $r=0.94$ ,  $p<0.001$ ).Table 2.

In a study done by Keskin et al among Turkish women with PCOS, correlation analysis revealed a moderate correlation between neutrophil/lymphocyte ratio and hsCRP ( $r$  0.459,  $p < 0.001$ ) but was not seen in our study [8].

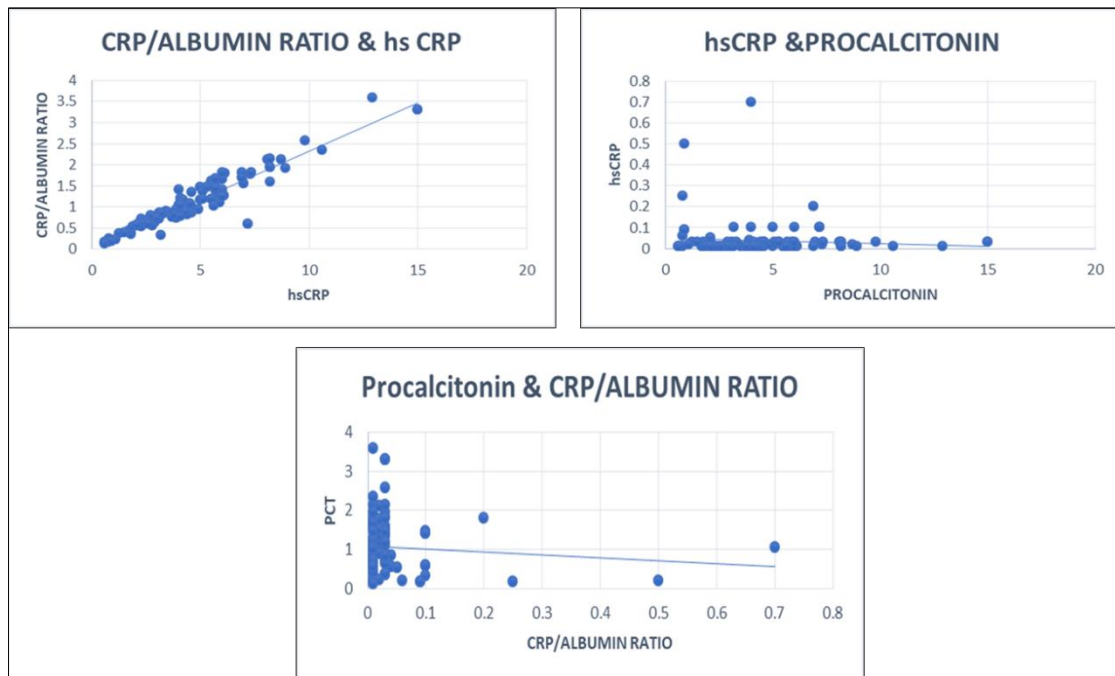
**Table 2** Correlation of Inflammatory Markers with Each Other

Inflammatory markers	hsCRP		Procalcitonin		CRP/albumin ratio	
	r	p	r	p	r	p
N/L ratio	-0.17	0.46	-0.16	0.59	-0.13	0.84
hsCRP	-	-	-0.08	0.99	0.94	<0.001*
Procalcitonin	-	-	-	-	-0.09	0.3

r: correlation index; \* p < 0.05 (Significant)



**Figure 1** Correlation of Neutrophil/Lymphocyte ratio with other inflammatory markers



**Figure 2** Correlation Of Inflammatory Markers With Each Other

#### 4. Conclusion

Chronic low-grade inflammation has been proposed to play a role in the pathogenesis of insulin resistance and the metabolic syndrome. The increased concentration of these inflammatory markers in women with PCOS reflects a state of chronic low grade inflammation. Early detection of inflammation can be done in these women and morbidity due to PCOS may be prevented.

Future studies in this field are needed to assess if they would be useful as early predictors of PCOS in women who have as yet only one of the findings of Rotterdam criteria.

#### Compliance with ethical standards

##### *Disclosure of conflict of interest*

There was no conflict of interest what so ever because all the authors that appeared on the manuscript contributed significantly in making this publication processes a success

##### *Statement of informed consent*

Written Informed consent was obtained from all individual participants included in the study.

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