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THE DISPARITIES BETWEEN C-REACTIVE PROTEIN AND ERYTHROCYTE SEDIMENTATION RATE AS MARKERS OF INFLAMMATION

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ABSTRACT

Objective: We conducted this research to try to further understand the correlation between C-reactive protein (CRP) and erythrocyte sedimentation rate (ESR). **Materials and Methods:** This study was a retrospective study of 88 positive CRP results compared with ESR results of the patients who reviewed Alhomsi Clinical Laboratories between January 2018 to March 2019. **Results:** ESR was normal in 33 cases 37.5% of cases with an elevated CRP level, while ESR was elevated to different levels in 62.5% of all patients with an elevated CRP level. **Conclusion:** The discrepancies may be due to timing, with the rise in CRP manifesting itself before the ESR elevates, or simply because the sedimentation rate does not change with minor inflammation. Large-scale studies with a more diverse samples with different diseases and cases should be performed to understand the different comorbidities that could change the laboratory findings.

KEYWORDS: C-Reactive Protein, Erythrocyte Sedimentation Rate, Inflammation.

INTRODUCTION

Local damage to tissue invokes an inflammatory reaction. This potentiates the acute phase response in which there is an increase in various plasma proteins, including fibrinogen, haptoglobin, ceruloplasmin and C-reactive protein (CRP); at a later stage, there is also an increase in immunoglobulins. There are two methods in common use for detecting the acute phase response the erythrocyte sedimentation rate (ESR) and the more specific measurement of CRP concentration.[1,2] ESR became popular as a nonspecific screening test for disease in the routine examination of all patients, especially in small laboratories and primary health

clinics as it is cheap, easy to perform and does not require a power supply nor expensive equipment. In recent years, automated methods have been developed and such instruments have enabled the ESR to become a routine test in large laboratories.[3,4] The alternative method for assessing the acute phase response is by measurement of CRP concentration. An increase in the CRP occurs within 6–10 h after tissue damage, reducing towards normal values as the inflammatory response decreases. The ESR is also strongly influenced by anemia, which may confuse interpretation. CRP is of potential value as a marker for prediction of early cardiovascular disease[6], and may thus be expected to show an increase with age, even when there are no obvious clinical features. There is also evidence that in the elderly the apparently "normal" ESR is similarly influenced by incipient cardiovascular disease and, especially, by changes in fibrinogen concentration.[7] The International Council for Standardization in Hematology established a standardized method for ESR to avoid artefact errors in its measurement.[8] But they also published a guideline document in which it is stated that measuring ESR is of little value for monitoring the onset or resolution of the acute phase response, and is of use only for monitoring the protein changes that occur in chronic disease.[9] This serious limitation leaves the clinical utility of the ESR questionable. Furthermore, as suggested above, there has been some confusion with regard to the normal reference range for ESR. This is usually considered to be up to 12 mm/1 h in males and up to 20mm/1 h in females under the age of 60 years, after which age it may gradually increase, up to 30 and 35 mm/1 h in both men and women.[10] Whilst many others have also recognized that the ESR may be higher in the elderly[11,13], the extent and constancy of this age-related increase in healthy persons is debatable. Consequently, patients with ESR.10mm/1h in men and. 20mm/1h in women are often referred unnecessarily for further investigations when there is that no obvious clinical abnormality. Accordingly, this study was undertaken to review the established normal reference values for ESR, to assess the significance of high values in the elderly, and to re-examine the correlation, if any, between ESR and CRP in a healthy population.

MATERIALS AND METHODS

This study was a retrospective study of 88 positive CRP (C-Reactive Protein) results compared with ESR (Erythrocyte Sedimentation Rate) results of the patients who reviewed Alhomsi Clinical Laboratories between January 2018 to March 2019. This study included 88 cases. To ensure the privacy, only the authors collected all the data and all the names and personal information were blinded. Statistical analysis was done using SPSS 25.0.

Table 1: Distribution of CRP and ESR values in our study.

	Value	N	%
CRP	≤40 mg/L	67	76.1
	>40 mg/L	21	23.9
ESR	Normal	33	37.5
	<30 mm/hr	12	13.6
	30-50 mm/hr	28	31.8
	>50 mm/hr	15	17.0

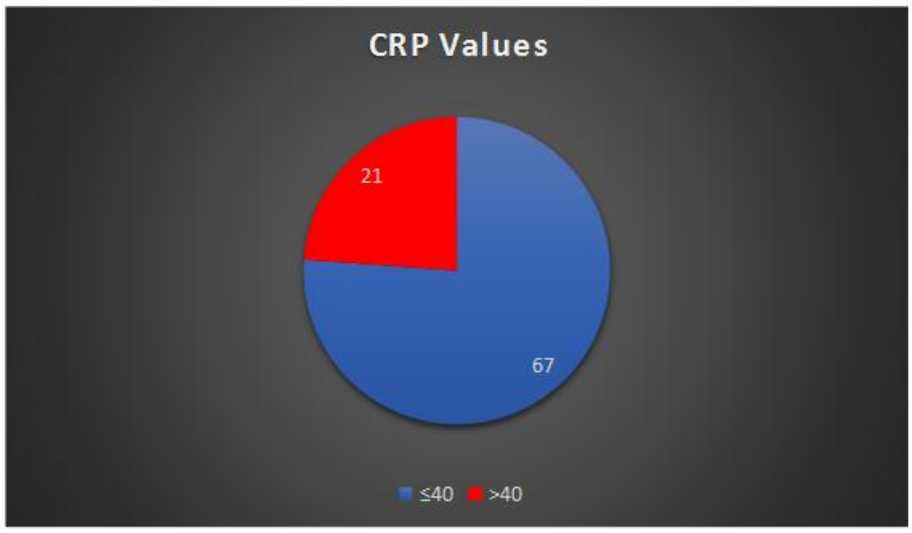

Figure 1: CRP values.

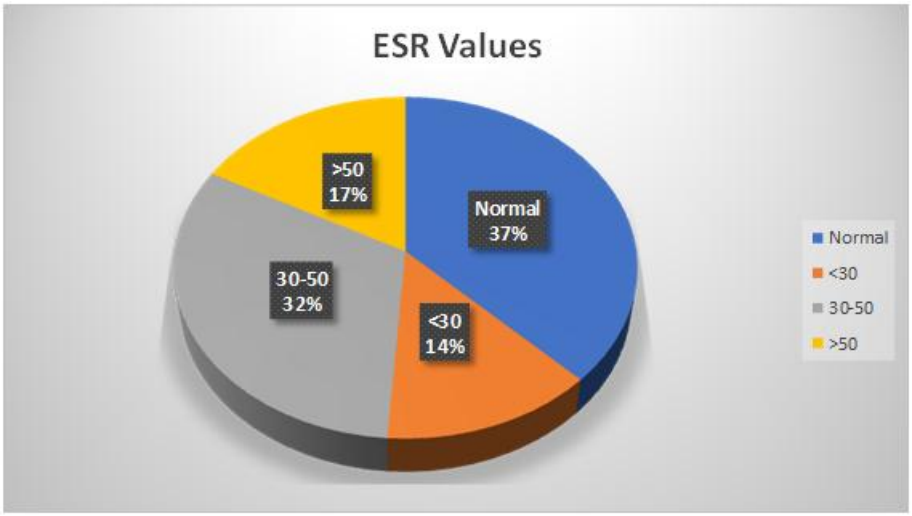

Figure 2: ESR values.

Table 2: Correlation between CRP and ESR.

			ESR
Kendall's tau b	CRP	Correlation Coefficient	.195*
		Sig. (2-tailed)	.049
		N	88
*. Correlation is significant at the 0.05 level (2-tailed).			

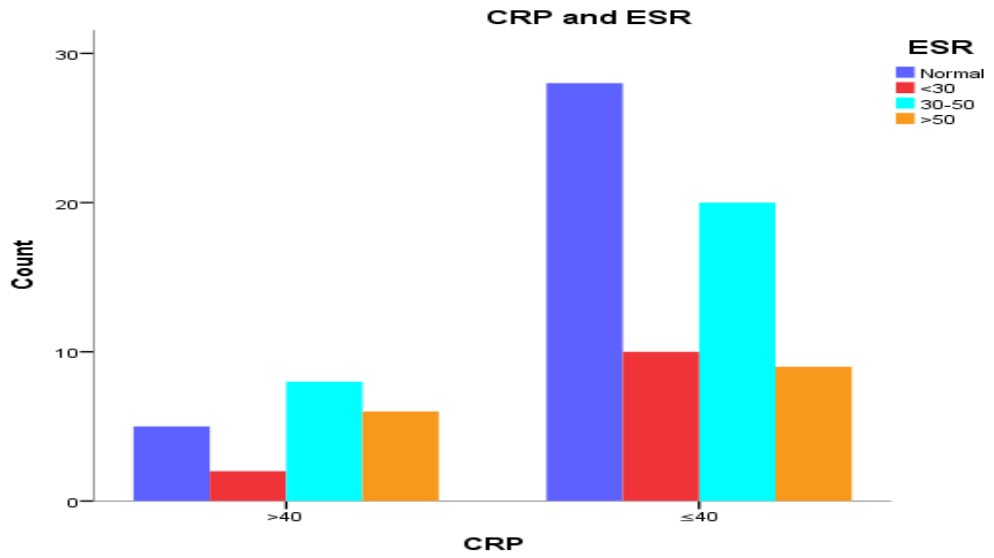

Figure 3: CRP and ESR values in our study.

Table 3: ESR levels related to CRP.

			ESR				Total
			Normal	<30 mm/hr	30-50 mm/hr	>50 mm/hr	
CRP	≤40 mg/L	Count	28	10	20	9	67
		% within CRP	41.8%	14.9%	29.9%	13.4%	100.0%
	>40 mg/L	Count	5	2	8	6	21
		% within CRP	23.8%	9.5%	38.1%	28.6%	100.0%

In our study, 67 patients (76.1%) had a CRP level ≤40 mg/L and 21 (23.9%) had a CRP level of >40 mg/L. (Figure 1, Table 1).

Regarding ESR, 33 patients (37.5%) had a normal value, 12 patients (13.6%) had a value of <30mm/hr, 28 patients (31.8%) had a value of 30-50mm/hr and 15 patients (17%) had a value of >50 mm/hr. (Figure 2, Table 1).

To compare between CRP and ESR, we found that 58.2% of all cases with a positive CRP (≤40mg/L) had a positive ESR (most of them between 30-50mm/hr). For those with a CRP >40, 76.2% had a positive ESR (most of them also between 30-50mm/hr), however, more cases had an ESR value of >50mm/hr (Table 3). We also found that 41.8% of those with a CRP ≤40mg/L had a normal ESR value, compared to only 23.8% for those with a CRP>40 mg/L who had a normal ESR. (Table 3).

DISCUSSION

The erythrocyte sedimentation rate is a surrogate marker of the acute phase reaction. During an inflammatory reaction, the sedimentation rate is affected by increasing concentrations of fibrinogen, the main clotting protein, and alpha globulins.[14]

The non-specificity of the erythrocyte sedimentation rate means the test is more likely to be falsely positive (elevated in the absence of inflammation) than a C-reactive protein test. Also, the erythrocyte sedimentation rate's slow response to the acute phase reaction leads to false negatives early in an inflammatory process.[14,15]

Raised erythrocyte sedimentation rates are observed in patients without an acute phase reaction, for example when hematological disorders including anemia are present. Renal failure, obesity, ageing and female sex are associated with higher erythrocyte sedimentation rates. C-reactive protein results are also higher with obesity but are not affected by renal failure.

In laboratory-based studies examining consecutive patients with elevated C-reactive protein or erythrocyte sedimentation rate, C-reactive protein has been found to be a better marker of the acute phase reaction than the erythrocyte sedimentation rate. It is a more sensitive test and rapidly detects changes in the acute phase reaction.

In a retrospective cohort study, discrepancies between C-reactive protein and erythrocyte sedimentation rate have been reported in 12.5% of patients.[16] Patients with raised C-reactive protein and a normal erythrocyte sedimentation rate usually have infection but some have other tissue damage (e.g. myocardial infarction or venous thromboembolism). These discrepancies may be due to timing, with the rise in C-reactive protein manifesting itself before the sedimentation rate elevates, or simply because the sedimentation rate does not change with minor inflammation.[15] Patients with a high erythrocyte sedimentation rate and normal C-reactive protein mostly have conditions without demonstrable systemic inflammation such as malignancy.

Compliance with Ethical Standards

Funding: This study was not funded by any institution.

Ethical approval: The names and personal details of the participants were blinded to ensure privacy.

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