

THE ERYTHROCYTE SEDIMENTATION RATE, C-REACTIVE PROTEIN, PLASMA FIBRINOGEN AND VISCOSITY IN CHRONIC RENAL DISEASE PATIENTS WITH INFECTION.

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Summary

The sensitivity of the C-reactive protein (CRP) measurement as an indicator for infection in patients with chronic renal disease was compared to that of ESR, fibrinogen and plasma viscosity measurements. The ESR, fibrinogen and plasma viscosity did not correlate with the presence of infection, whereas the CRP level was elevated in the majority of patients with infection/fever and decreased when fever subsided.

Key words: CRP, ESR, fibrinogen, plasma viscosity, chronic renal disease.

INTRODUCTION

C-reactive protein (CRP), an acute-phase protein, is one of the constituents of plasma produced by hepatocytes.^{1,2} The level is normally low, less than 10.0 mg/L in 99% of healthy adults³ but it may increase up to 3000 times in a number of clinical entities. When measured quantitatively, the CRP level appears to be a sensitive indicator of an underlying inflammatory disorder.⁴

The erythrocyte sedimentation rate (ESR), which is a conventional laboratory parameter often used in monitoring inflammatory disease process, however has a limited usefulness, especially in the case of chronic renal disease, where the ESR is persistently elevated.^{5,6}

In an attempt to evaluate the sensitivity of CRP as compared to the ESR as a marker of infection or inflammation in chronic renal disease patients, a study was conducted involving patients admitted in the Nephrology Unit, General Hospital, Kuala Lumpur.

SUBJECTS AND METHODS

The study involved measurements at two stages; the first measurements were made when the patients developed fever (temperature > 38°C), signifying an infection stage; and the second measurements made when the fever had subsided, signifying an infection-free stage.

Forty-five patients diagnosed as chronic renal failure were initially investigated, but only twenty-seven were available for the second measurement. Besides the measurements of ESR and CRP, as a comparison we have also included the estimations of fibrinogen (FIB) and plasma viscosity (PV) levels.

The ESR was estimated using the Westergren technique and the quantitative CRP was determined by the laser nephelometry method according to Kindmark.⁷ PV was measured by a viscometer from Coulter Electronics, measurements being made at 37°C following the method of Harkness.⁸ A modified method

TABLE 1

COMPARISON OF PARAMETERS BETWEEN INFECTION AND NON-INFECTION STAGES

Test	Mean ± 1 SD (n = 27)		P-value
	Infection stage	Infection-free stage	
ESR (mm/hr)	104.8 ± 32.3	108.7 ± 32.3	ns
CRP (mg/L)	144.0 ± 133.0	54.0 ± 53.0	< 0.001
PV (centipoise)	1.38 ± 0.25	1.39 ± 0.18	ns
FIB (mg/L)	728.5 ± 309.8	647.5 ± 214.6	ns

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from Ellis and Stransky was used to estimate the FIB levels.⁹ The normal level for CRP is taken as less than 10.0 mg/L. For ESR, it is less than 20 mm/hr.

RESULTS

The patients' ages ranged from 14 to 67 years with a mean of 35.7 years. Table 1 summaries the mean plus/minus 1SD for the parameters measured during the infection and infection-free stages. Paired t-test analyses showed no significant differences in the ESR, PV, and FIB measurements between the two stages. However, a positive significant difference ($p < 0.001$) was obtained in the CRP measurements. The means for all parameters except PV were above normal limits during the infection stage and continued to be above normal limits during the infection-free stage. Two out of 27 cases followed up showed no change, and two showed an increase in CRP. The others showed a fall in CRP with disappearance of fever. However, we did not study these cases in detail to try to correlate CRP changes with other evidence of infection besides fever. In the case of the ESR, 20 out of 27 showed persistent elevation even after the temperature had returned to normal limits and none fell within normal values. This is illustrated clearly in Figure 1.

PV was normal in 22 out of 27 cases studied at the infection stage and FIB levels were high in 22 out of 27 cases seen in both stages.

DISCUSSION

CRP estimation has been shown to be useful in detecting infection in leukaemic patients and in monitoring response to antibiotic therapy.¹⁰ In chronic renal diseases there are often several factors such as anaemia, hyperglobulinaemia and hypercholesterolemia that could increase the ESR even in the absence of inflammation.⁴ In our study we found that the average ESR was equally elevated in the infected and non-infected states of the patients investigated. The ESR in only 6 out of 27 patients decreased with disappearance of fever, therefore the persistently elevated ESR could be misleading in the interpretation of infection in chronic renal disease.

CRP levels are probably raised in many inflammatory processes, whether infective or not. Any coexisting subclinical inflammatory disease is likely to cause a diagnostically confusing elevation of CRP levels. The CRP levels in our study were increased in a majority of the patients during the infection stage and subsequently decreased following the clearance of infection. However, as expected, some patients did not show any

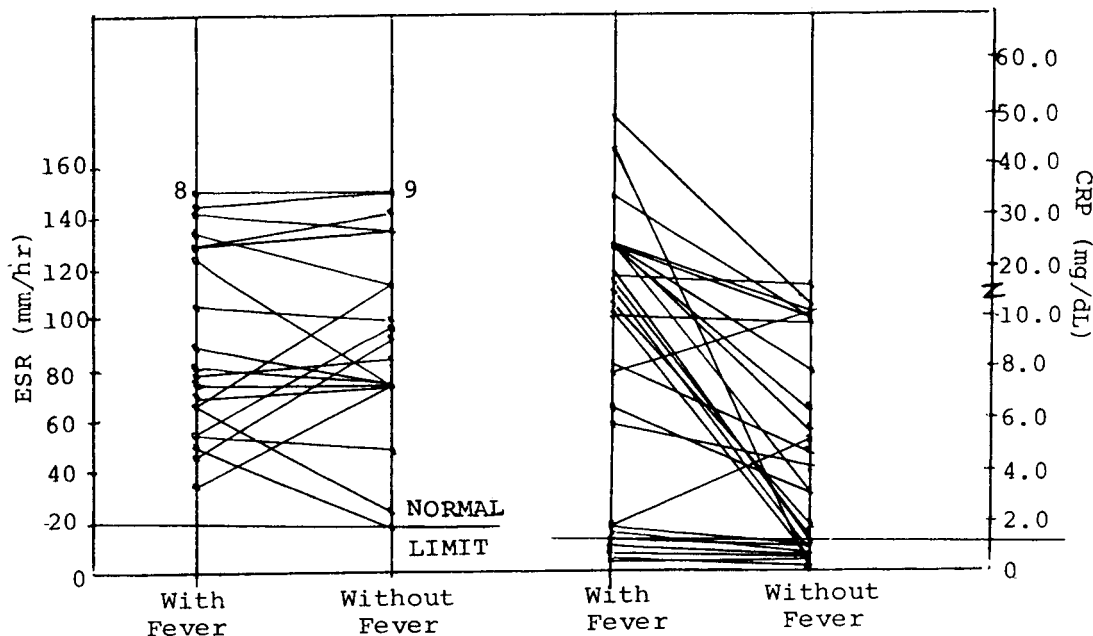


FIG. 1. Comparison of ESR and C-reactive Protein (CRP) levels in 27 patients with chronic renal disease. Note: Figures in plot indicate number of coincident points.

change in CRP and a few in fact showed an increase of CRP with disappearance of fever. We interpret this to mean that CRP elevation is not specific for infection and may reflect the presence of other inflammatory changes. However, when infection is the main or sole cause of the CRP increase, this study indicates that good response to infection is reflected by decreasing CRP values. It is evident however, that single CRP values are not as useful in this context as a series of CRP values.

Our findings support the sensitivity of CRP as compared to the ESR as an index for monitoring infection in patients with chronic renal diseases, but CRP is not specific to infection. The ESR on the other hand, is very misleading in indicating the presence or absence of infection in this disorder. Fibrinogen levels however are expected to be elevated in infection/inflammation and its clearance is not as fast as C-reactive protein which is cleared within 24 hours. The plasma viscosity levels were normal in both infection and infection-free stages in this study, and is therefore not a suitable parameter for monitoring infection.

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