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Correlation of C-reactive protein (CRP) levels with Pneumonia severity index (PSI) in adult population

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ABSTRACT

Objectives: The present study describes the determination of correlation between CRP and pneumonia severity index (PSI) in selected population of Community acquired pneumonia (CAP) and hospital acquired pneumonia (HAP). **Study Design**: Setting and duration: This study was conducted retrospectively from Dec 2013 to Dec 2009 at department of Pathology, Govt Lyari General Hospital and department of Biochemistry lab, Chemical Pathology, and Microbiology, Liaquat National Hospital and Medical College, Karachi. Materials and Methods: A total of 68 patients were included in the study and classified according to PSI index I to V, as described in studies carried out earlier. All data were collected from LIS and any other lab or diagnostic investigations that seem necessary were noted and documented. CRP was measured in serum samples by automated immuno-turbidimetric method on Hitachi 912 chemistry analyzer (Roche diagnostic-Basel). The cut off was < 5.0 mg/L. **Results**: Significant correlation of CRP with PSI was noted in PSI III vs CRP of R^2 = 0.9663 followed by similar significance in PSI V (R^2 = 0.9013), PSI IV (R^2 = 0.9086), PSI II (R^2 0.81), whereas PSI I exhibited minimal correlation of R^2 = 0.1108. Cumulative data of CRP from all patients was compared with all PSI groups depicting correlation of R^2 0.957**. Conclusion**: The results clearly indicate that CRP correlated significantly with PSI stages III and IV, followed by V and II. Thus it concluded that CRP showed marked levels of correlation, linearity and prognostic efficacy with PSI stages and pneumonia and would be a considerable bio-marker for the assessment of the same.

Keywords: C-creative protein CRP, pneumonia severity index PSI, community acquired pneumonia (CAP), Health Care associated pneumonia (HCAP), Hospital acquired pneumonia (HAP).

1. INTRODUCTION

Community acquired pneumonia (CAP), health care associated pneumonia (HCAP) and generalized pneumonia (GP) is becoming a medical anomaly, in recent years that needed special attention and extensive clinical care. In this regard, patients with CAP required to get hospitalized and thus categorization is necessary according to severity index [1-3]. Moreover, HCAP, which is a relatively new category of pneumonia, refers to the condition when a patient acquires pneumonia from environment during stay in hospitals [1,4].

For better management and evaluation of existing clinical conditions, pneumonia severity index "PSI" is now regard as a significant tool [1,5-7]. Pneumonia severity Index was originally described in 1997 by Fine *et al* [8] and now widely used to assess the prevailing patients' condition and probable management strategies. Similarly another scoring mechanism, known as CURB (confusion, urea, respiratory rate, blood pressure) scoring is generally used Europe, mostly for prediction of progress [7,9,10]. As far as predictive or diagnostic markers of bronchial origin are concerned, CRP noted to be the most significant one for providing distinctive information of

previous or existing clinical severity or progression [7,11-13]. The current study describes the possible significant correlation of CRP levels from pneumonia patients and established PSI system. Cumulative as well as individual CRP data were compared with staged/scored groups to predict conditions and possible significance.

2. MATERIALS AND METHODS

2.1. Selection of subjects and protocols

The study was carried out according to the protocols described earlier [14,15]. Subjects which were patients suffering from pneumonia, age-matched healthy subjects, clinical and related data and recording of co-morbids were performed according to reported methods [5,7,16]. This study was conducted retrospectively from Dec 2013 to Dec 2009 at department of Pathology, Govt Lyari General Hospital and department of Biochemistry lab and Chemical Pathology, and department of Microbiology, Liaquat National Hospital and Medical College, Karachi. All demographic, parametric and clinical data were obtained by review of medical records, in addition, internally integrated LIS, when and required, was also accessed for data collection. Since the study was hospital based, patients attending the out patients' dept (OPD) and those who were remain admitted in hospital were included in the study. Initial assessment was carried out in 192 patients, out of which 68 (males = 40; females = 28) were finally selected to be included in the study.

2.2. Inclusion and exclusion criteria

All criteria related to inclusion and exclusion parameters were followed according to previously published reports [5,14,15]. A total of 68 patients were included with prospective study and classified according to PSI as described in studies carried out earlier [5,7]. The patients were excluded from the current study were known HIV +ve, immuno deficient, immuno suppressed, neutropenic, multiple hospitalized, malignant and Tuberculosis confirmed cases.

2.2.1. CRP and laboratory assays

LIS data collection and registration includes immunological assays. CRP levels, other lab investigations such as pleural fluid analysis, computed topography, duration of antibiotics, ventilations, admission to ICU and any other lab or diagnostic investigations that seem necessary were noted and documented. CRP was measured in serum samples by automated immuno-turbidimetric method on Hitachi 912 chemistry analyzer (Roche diagnostic-Basel). The cut off was < 5.0 mg/L.

2.2.2. Pneumonia severity Index (PSI)

PSI assessment were done as per instruction of the Ohio state University College of medicine CAP (2014) online web calculation, that includes pneumonitic steps with algorithmic flow of yes and no. The assessment criteria includes query regarding co-morbids such as neoplastic diseases, hepatic disorders, congestive heart failure, cerebral and renal insufficiencies. Regarding physical condition, PSI assessed altered mental status, respiratory rate > or = 30/min, systolic BP temperature < 35^{o}C or > 40^{O}C and pulse > or = 125 beats/min. After careful assessment of all PSI required parameters, the patients were classified into PSI class/category of I to V.

2.2.3. Statistical analysis

Data were stated as variables and presented in either percent or mean values. The correlations of CRP levels with PSI class/category were assessed with regression correlation analysis R^2. Significance of variability and correlation was determined by two-tailed tests with level of significance $P < 0.05$. All statistical analysis was performed with SPSS ver 13.0 (SPSS Inc, Chicago IL, USA).

3. RESULTS

A total of sixty eight patients were assessed during present study with males = 40 and females 28. The period of the retrospect study was Dec 2009 to Dec 2013. These patients were included in the study after detailed assessment of their data, reports and clinical information. According to PSI scaling, out of 68, n = 9 were found to be suffering from pneumonia scale I (13.23%); followed by n = 13 (19.11%) pneumonia scale II; n = 12 (17.6%) pneumonia scale III; n = 16 (23.52%) pneumonia IV and n = 18 (26.47%) pneumonia scale V. Most of the patients suffering from PSI III to V showed significant altered respiratory rate, more than 30 to 45/min, pulse rate 125 to 135 beats/min, chest infection, loss of appetite, congestion and related co-morbids. Regarding CRP level in all groups and sub-groups, the most significant correlation of CRP with PSI was noted in PSI III vs CRP of R^2 = 0.9663 (Figure 1) with Y intercept 0.8269 x + 18.633 followed by similar significance in PSI V [R^2 = 0.9013 y = 1.8589 x + 46.757] (Figure 2) and PSI IV [R^2 = 0.9086 y = 1.584 x + 31.733] (Figure 3). Patients in group PSI II (Figure 4) showed R2 0.81 correlation index vs CRP, whereas PSI I group exhibited minimal correlation of 11% [R^2 = 0.1108 y 0.09 x + 8.511] (Figure 5). Interestingly when cumulative data of CRP from all patients was compared with all PSI groups, a significant correlation of R^2 0.957 was manifested (Figure 6), depicting the potential important role of CRP,

regardless of individually grouped low correlated value in PSI I, in diagnostic assessment and severity determination of pneumonia stages.

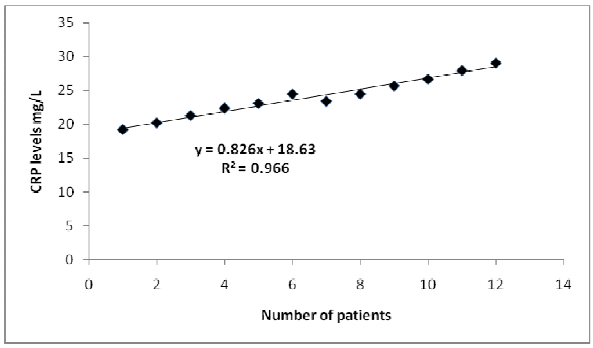

Figure - 1: Correlation of CRP with PSI scale III (n = 12).

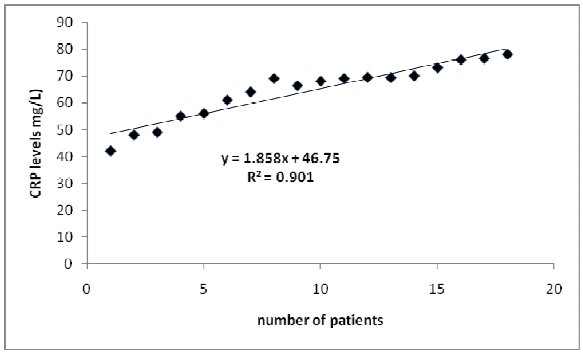

Figure - 2: Correlation of CRP with PSI scale V (n = 18).

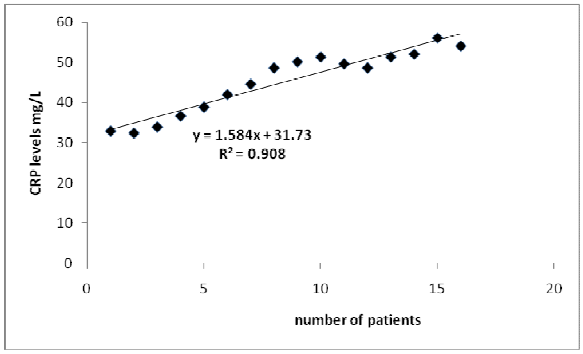

Figure - 3: Correlation of CRP with PSI scale IV (n = 16).

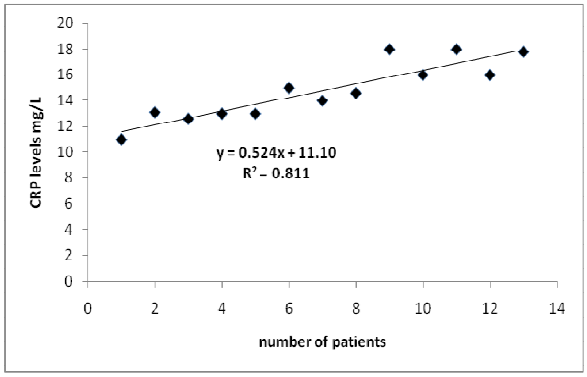

Figure - 4: Correlation of CRP with PSI scale II (n = 13).

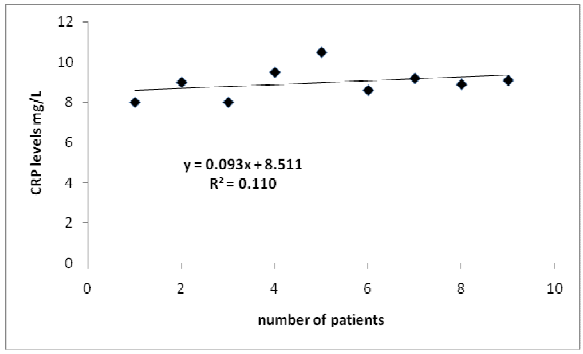

Figure - 5: Correlation of CRP with PSI scale I (n = 9).

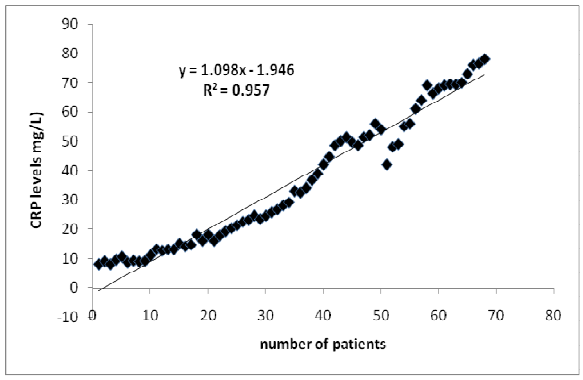

Figure - 6: Cumilative correlation of CRP with PSI scales I to V (n = 68).

4. DISCUSSION

In recent years, greater emphasis has been given to the significance at which prompt, accurate and affordable diagnosis and management can be determined in a patient. In this regard, management of pneumonia, whether CAP or HAP, became more important with passing years, due to untoward changes and resistant to medications. To better assess pneumonia stages for appropriate management, several clinicians and scientists developed criteria for scaling of severity such as CURB, CURB-65 and PSI[8-10,17]. Further advancement and progression showed other parameters, mostly biochemical, been included with diagnosis and management assessment criteria of pneumonia, CAP or HAP[7,8,11,14-16].

In our presented study, it was noted tat CRP levels were linearly correlated with PSI index, with III and IV showing the highest level of R2 values. Our study was also corroborated, besides many in previous years, by a recent study where significant number of nursing home residents has acquired pneumonia and their stages were correlated with pro-Calcitonin and CRP [16]. Previous studies have also reported CRP as a significant biochemical parameter that performed more effectively whilst assessing the complicated pneumonia cases [7,12]. Similarly yet another study exhibited profound linearity among progression

stages through PSI/CURB in CAP versus WBC and CRP levels [13]. A recent past study completed by our group demonstrated that pneumonia patients with bacteria as pathogens exhibited higher levels of CRP than those with viral etiology [15]. This also validated current study where R2 levels of greater than 90 were exhibited by those groups suffering from bacterial based pneumonia. Furthermore, in last 20 years, several studies were performed that elaborated the role of CRP, WBCs, and interleukins or pro-Calcitonin with diagnostic criteria of pneumonia, CAP/HAP and staging versus mortality [14,18-20]. Evaluating and concluding all such studies, it was noted that mostly CRP showed significant correlation, linearity and prognostic efficacy with PSI stages and pneumonia in most of the cases.

5. CONCLUSION

The present study described the assessment of diagnostic efficacy and correlation of CRP with pneumonia severity index I to V in selected patients of CAP or HAP. It was noted that CRP correlated significantly with PSI stages III and IV, followed by V and II. Thus it concluded that CRP showed marked levels of correlation, linearity and prognostic efficacy with PSI stages and pneumonia and would be a considerable bio-marker for the assessment of the same.

6. REFERENCES

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