Original Article

STUDY OF C-REACTIVE PROTEIN, ERYTHROCYTE SEDIMENTATION RATE LEVELS AND APACHE II SCORE IN SEPSIS

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Received: 25/05/2020 Revised: 16/07/2020 Accepted: 22/07/2020

ABSTRACT:

Background: Sepsis is a diagnosis based on clinical criteria as 'life-threatening organ dysfunction caused by a dysregulated host response to infection' Serum acute phase reactant level measurements are useful because they frequently reflect the presence and intensity of an infection and/or inflammatory process.

Objectives The aim of this study is to determine the value of CRP, APACHE II score, ESR in sepsis for the prediction of patient outcome in the form of mortality.

Materials and methods: The present study was undertaken in Dept. of General Medicine, SSIMS & RC over a period of 12 months. This study was a cross sectional observational study. The necessary investigations for these patients were sent and APACHE II score was calculated based on the values.

Results: Among 100 patients with sepsis of various causes showed that majority were elderly, with comparable gender distribution, with predominantly diabetic with APACHE II SCORE of 14 and 33, CRP 24 and 39, ESR 21 and 44 in survived and non-survived group respectively similarly each variable was considered and compared which showed significantly higher values in non- survivors group hence each variable considered as predictor of mortality.

Conclusion: it is better to combine CRP and APACHE II for predicting the mortality in sepsis patients, than using either of them.

Keywords: CRP, ESR, APACHE II SCORE

INTRODUCTION

Sepsis is one of the leading causes of in-hospital mortality and morbidity among medical and surgical patients.

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Sepsis accounts for one in five admissions to intensive care units. Available data from India suggest that the overall mortality of all the septic Patients is approximately 14% and that of severe sepsis alone is higher than 50%.Sepsis is life-threatening organ dysfunction caused by a dysregulated host response to infection[1]. Sepsis is defined as the presence (probable or documented) of infection together with systemic manifestations of infection[2].

Severe sepsis is defined as sepsis plus sepsis – induced organ dysfunction or tissue hypoperfusion[2]. However, this term has been removed now. Sepsis-induced hypotension is defined as a systolic blood pressure (SBP) < 90mm Hg or mean arterial pressure (MAP) < 70mm Hg or a SBP decrease 40mm Hg or less than two standard deviations below normal for age in the absence of other causes of hypotension. Sepsis-induced tissue hypoperfusion is defined as infection-induced hypotension, elevated lactate, or oliguria.[2] Mortality Prediction Systems have been introduced as tools for assessing the performance of ICUs. Prognostic scoring systems have a number of applications. They help in individual patient outcome prediction.

Acute-phase reactants such as erythrocyte sedimentation rate and C-reactive protein have traditionally been used as markers for inflammation and as a measure of "sickness index" in infectious and noninfectious conditions.[3] Surviving sepsis campaign has repeatedly emphasized the significance of early diagnosis in the prognosis of the disease as routine screening of potentially infected patients allows earlier implementation of goal-directed therapy.[4]

The 3 commonly used scoring systems are Acute Physiology and Chronic Health Evaluation (APACHE), Simplified Acute Physiology Score (SAPS) and Sequential Organ Function Assessment (SOFA).[5] There are very few studies in literature which have used both scoring systems and acute phase reactants together to predict outcome in sepsis patients. The aim of the study is the correlate the levels of C-Reactive Protein, Erythrocyte Sedimentation Rate, Acute Physiology and Chronic Health Evaluation II score in Sepsis.

MATERIAL AND METHODS

Participants:

The research protocol used in this study was approved by the Clinical Research Ethics Board of the college. This study was conducted in the Department of General Medicine, SSIMS&RC. Inclusion criteria

1. Patients above 18 years.
2. Sepsis- Sepsis with one or more signs of organ dysfunction.
    a. Cardio-vascular System-Systolic Blood Pressure (SBP) of less than or equal to 90 mm Hg that responds to administration of intravenous fluids.
    b. Urine output less than 0.5 ml/kg/hour for one hour despite adequate fluid replacement
    c. Respiratory system-PaO2/FiO2 ratio below 250.
    d. Metabolic-pH less than 7.3 or a plasma lactate level more than 1.5 times of the upper limit of normal value.
    e. Hematologic System-Platelet count below 80,000/mm3.
3. Septic-Shock-Sepsis with hypotension (SBP less than 90 mm Hg) for at least one hour despite adequate fluid resuscitation or the need for vasopressors to maintain SBP greater than 90 mm Hg. Patients meeting the above criteria with informed consent were included in our study.

Exclusion criteria

1. Patients less than 18 years of age.
2. Pregnant women.
3. Patients who died within 24 hours of admission into ICU.
4. Collagen vascular diseases and malignancy possibly causing high CRP values.

Data collection:

Detailed clinical, and laboratory data were recorded from 100 patients, including arterial blood gas analysis and relevant cultures of blood, urine, sputum, tracheal aspirates, or other samples as indicated CRP, ESR. Acute Physiologic Assessment and Chronic Health Evaluation II (APACHE II), indices were calculated at baseline to assess the severity of illness further we observed

the various variables among the survivors and non survivors and the data was interpreted to know the outcome.

Statistical analysis:

Categorical variables were expressed as frequency & amplitude; percentages. Continuous variables were expressed as mean ± standard deviation. To assess mean difference between groups unpaired t test was performed. To know the relation between variables Person's Correlation was done. The value of P <0.05 was considered statistically significant. Statistical Package for the Social Sciences (SPSS) version 22 (IBM) for windows was used for analyses.

RESULTS

A total of 100 patients were studied. The age distribution of the patients involved in the study predominantly belonged to the age group of 41 to 60 years, when further investigated the percentage of patients in the recovered group was about 60% belonged to the age group of less than 40 years . The percentage of non survivors was about 50% belonged to the age group of 71 to 80 years. The analysis of ESR in recovered group shows a mean of 23.3 ±11.9 with a p value of <0.001. The analysis of ESR in non survivors group shows a mean of 44.16± 7.98 with a p value of <0.001.

This study shows a mean value of CRP in recovered group which was 25.78 in males and 25.72 in females with SD of 7.8 and 5.5 with a p value of <0.001 . This study shows the mean values of CRP in non-recovered group which was 39.30 in males and 40.2 in females with a SD of 5.5. and 8.3 with a p value of<0.0001 which was statistically significant. The APACHE 2 scores in recovered group of males shows a mean of 15.92±9.3 with a p value of <0.0001. The APACHE 2 scores in recovered group of females shows a mean of 16.68±11 with a p value of <0.0001 as shown in table 1.

The APACHE 2 scores in non-recovered group of males shows a mean of 35.31±5.26 with a p value of <0.0001. The APACHE 2 scores in non recovered group of females shows a mean of 32.3±6.48 with a p value of <0.0001 as shown in table 2.

A total of 100 subjects were included in the study. Out of the 100 subjects 57 of the subjects were survivors and 43 were non survivors. The age distribution of the patients involved in the study predominantly belonged to the age group of 41 to 60 years, when further investigated the percentage of patients in the recovered group was about 60% belonged to the age group of less than 40 years . The percentage of non survivors was about 50% belonged to the age group of 71 to 80 years. The analysis of ESR in the study revealed a total mean of 32.8 as shown in table 1. The ESR in survivors group shows a mean of 24.3 as shown in table 1. The ESR in non survivors group shows a mean of 44.1 as shown in table 1. On statistical analysis the ESR had a standard deviation of 11.3 in the survivors group and 7.9 in the non survivors group, with a p value of <0.0001.

The chart 1 shows the pearsons correlation between APACHE 2 scoring and crp. Which shows a positive correlation between CRP and APACHE 2 scoring.

Table 1: Mean of variables in survivors and non survivors groups

Variables	Mean	Mean in survivors	Mean in non-survivors
ESR	32.8	24.3	44.1
CRP	31.7	25.7	39.7
APACHE II	23	16	33

Table 1 shows the mean ESR in the study conducted is 32.8, the mean ESR in survivors is 24.3 and among non survivors is 44.1. The mean CRP in the study is 31.7, the mean CRP in the survivors group is 25.7 and among the non survivors group is 39.7. The mean APACHE II

scoring in the study being 23 and the mean in the survivors group was found to be 16 and among the non survivors group is 33.

Chart 1 Pearson's correlation between APACHE 2 and CRP

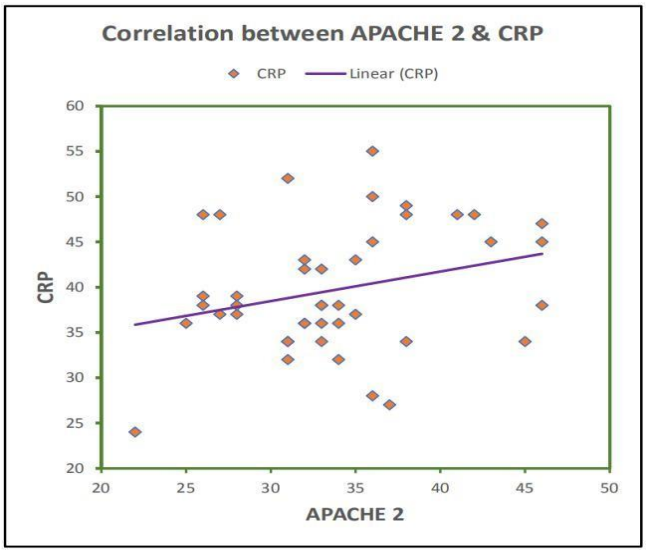

Chart 1 shows a positive correlation between APACHE 2 and CRP indicating the 2 variables can be used together in accessing the outcome of critically ill patients.

DISCUSSION

In this study 100 patients were included based on the inclusion and exclusion criteria. All necessary investigations were done and APACHE II score was calculated. The Acute- phase reactants such as erythrocyte sedimentation rate and C-reactive protein were correlated with APACHE II. The mean APACHE II score was 33 in non survivors and 16 in survivors. The mean CRP was 39 and 25 in non survivors and survivors. The mean ESR was 44 in non survivors and 24 in survivors. The number of patients with APACHE II score above 23 had poor prognosis and increased mortality than those with the score of less than 23 . In a study done by Agarwal A et al observed that the predicted mortality in their patients as per the APACHE II score was lower than the mortality observed. So they concluded that it is better to include APACHE II SCORE in combination with CRP in predicting mortality.[6]

In a study done by Kruse JA *et al.,* done in patients admitted with sepsis in ICU APACHE II SCORE was calculated to predict the mortality which demonstrated a Correlation between mortality and the scoring system and when associated with higher score the prognosis was poor, however it was also compared with clinical judgement.[7]

In a study done by Sierra R *et al.,* showed that determination of serum C-reactive protein can be used as an early indicator of infection in patients with sepsis and the best threshold value for C-reactive protein for predicting sepsis was 8 mg/dl .[8] In a study conducted by P. Póvoa *et al.,* showed that daily measurement of CRP is useful in the detection of sepsis and it is more sensitive. The plasma CRP levels were significantly related to the infectious status ($p < 0.05$).[9]

In a study done by Lobo SM *et al.,* showed that in a heterogeneous ICU population, increased concentrations of serum CRP on ICU admission are associated with an increased risk of organ failure and death. Also, persistently high CRP levels are associated with a poor outcome.[10]

The CRP AND APACHE II scoring when correlated according to Pearsons correlation had a positive correlation concluding that when combined can predict the mortality and prognosis.

CONCLUSION

In our study, we observed CRP level of >31 mg/dl and APACHE II score of > 23, ESR >32 can be used to predict the mortality in patients with sepsis. Also the patients with higher APACHE II score had more complications, longer hospital stay, increased ventilator requirement, and poor outcome compared to those with significantly lower values. In conclusion, it is better to combine both the acute

phase reactants such as CRP, ESR and predictive scoring systems such as APACHE II for predicting the outcome and mortality in patients with sepsis.

Disclosure

The authors have no conflicts to declare with regards to financial interests or associations.

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How to Cite this article :

Nagaraja V. T, Janhavi G, VinodKumar C. S, Aravind B. Study of c-reactive protein, erythrocyte sedimentation rate levels and APACHE II score in sepsis. J Pub Health Med Res 2020;8(2):1-5

Funding: Declared none

Conflict of interest: Declared none