

Evaluation of C-Reactive Protein, Albumin and the C-Reactive Protein/Albumin Ratio in General Surgical Trauma Patients

AYESHA SIDDIQUA HASHMI¹, SYED ALI HAIDER RIZVI², ASMA AMIN³, KIRAN NAZ⁴, ERUM KAZIM⁵, MISBAH MAHMOOD⁶

¹Senior Registrar, General Surgery, Dow University of Health Sciences, Civil Hospital Karachi

²Consultant General Surgeon, District Malir Karachi, Health Department Government of Sindh

³Consultant General Surgeon, Health Department Government of Sindh

⁴Consultant, Liver Transplant & HPB Surgeon, Dow University of Health Sciences, Civil Hospital Karachi

⁵Assistant Professor, ⁶Consultant General Surgeon, Department of Surgery Unit IV, Civil Hospital, Karachi

Correspondence to Dr. Ayesha Siddiqua Hashmi, E-mail: drayeshasiddiqua@hotmail.com Cell: 0333-3403569

ABSTRACT

Aim: To determine the frequency of in hospital mortality and to compare this frequency of mortality with CRP/Albumin ratio in patients with surgical abdomen and/or chest trauma.

Study Design: Cross-sectional study

Place and Duration of Study: Surgical Unit IV, Civil Hospital Karachi from 26th June 2019 to 25th December 2019.

Methodology: One hundred and thirty one patients with abdominal and/or chest surgical trauma were enrolled within 24 hours of trauma. Serum CRP level and serum albumin level were done through hospital hematology laboratory and CRP/albumin ratio was calculated and relation with in hospital mortality was found.

Results: The mean age of patients was 34.24±15.5 years with 74 male and 57 females. Mean height was 167.5±13.9 cm, mean weight was 62.6±8.6 kg and mean BMI was 22.4±5.3kg/m². Mean CRP was 14.3±9.6 mg/dl, mean albumin was 3.76±0.98 g/dl and mean CRP/Albumin ratio was 3.74±2.3. In CRP/Albumin cluster there were 32.1% patients in 0.01-2 cluster, 43.5% in 2.01-4 cluster and 32.1% in 4.01-9 cluster. 12.2% patients were expired among them there were 7.1% expiry rate in 0.01-2 cluster, 10.6% in 2.01-4 cluster and 19% patients expired in 4.01-9. Increased CRP/Albumin cluster was associated with increased mortality rate.

Conclusion: An elevated CRP/Albumin ratio in traumatized patient was associated with an increased risk of mortality.

Keywords: Surgical trauma, Prognostic marker, CRP/albumin ratio

INTRODUCTION

Traffic accidents are one of the main cause of casualties and hospital admissions worldwide. They are a major, yet preventable cause of injury, morbidity and mortality all over the world, claiming more than 1.2 million lives each year and another 20 to 50 million sustain nonfatal injuries¹ and costing governments around 3% of GDP².

Pakistan is 5th leading contributor to deaths due to road traffic injuries (RTI)³. Identification of high risk patients within the victims of RTAs can be used to reduce the mortality rate observed in these cases. Several scoring systems^{4,5} have been proposed to help in predicting the outcome. Multiple biochemical markers have also been found to be associated with the outcome, showing potential to predict it, including C-reactive protein, several cytokines (IL-4, IL-6, IL-8, TGFB) procalcitonin etc⁶⁻⁹.

C-reactive protein (CRP) is a blood test marker for inflammation in the body. CRP is produced in the liver and its level is measured by testing the blood. CRP is an acute phase reactant, which indicates that it will rise in response to inflammation, and typically not detected in significant amounts in the blood unless some degree of inflammation is present. Erythrocyte sedimentation rate (ESR) and blood platelet count are some other common acute phase reactants. CRP has been implicated to correlate well with degree of tissue damage in surgical patients^{10,11} as well as complications following severe trauma including sepsis and multiple organ failure, and to actual survival¹²⁻¹⁶.

Serum albumin accounts for 50-60% of plasma protein and is produced by the liver. Albumin functions primarily as a carrier protein for steroids, fatty acids, and thyroid hormones (when their specific binding globulins are saturated), unconjugated bilirubin and other organic anions, and many drugs (for example, penicillin, warfarin) in the blood, and is central to stabilizing extracellular fluid volume by contributing to oncotic pressure of plasma; without albumin, the high pressure in the blood vessels would force more fluids out into the tissues, manifesting as edema¹⁷.

Hypoalbuminemia has been implicated as an independent predictive factor of morbidity and mortality in critically ill trauma

patients¹⁸ independently associated with increased mortality after cardiopulmonary bypass¹⁹, independently associated with outcome in acute surgical patients without any pre-existing deficits²⁰.

Both CRP and albumin have been proven to be linked with mortality. Mitsunaga Iwata et al²¹ concluded that both high CRP levels (>5 mg/dl) and hypoalbuminemia (3.5 g/dl) were associated with risk of in-hospital death. Ranzani et al²² analyzed the predictive power of CRP vs. CRP/albumin ratio in ICU patients and found that CRP/albumin ratio is a better predictor than CRP alone, for 90 day mortality in septic patients²³. Soltani et al²⁴ evaluated 76 trauma patients admitted to the ICU for >48 hours and found a considerable association with albumin and CRP on 1st and 3rd day of admission to mortality and survival. The cluster of patients with ratio between 0.01-2 had a mortality rate of 4.34%; patients with ratio between 2.01-4 had a mortality rate of 11.1%, while patients with ratio of 4-9 had mortality rate of 19.73%.

MATERIALS AND METHODS

After getting permission from IRB, this descriptive study was carried out in Surgical Unit 4, Civil Hospital Karachi from 26th June 2019 to 25th December 2019 and 131 trauma patients were enrolled. Male and female patients admitted to the ward within 24 hours of blunt or penetrating traumatic injury to chest or/and abdomen and age between 13-65 years were included. All patients presenting more than 24 hours after trauma and patients suffering from immunosuppressive diseases or with active pulmonary disease were excluded. Serum CRP and albumin levels were measured at presentation, and CRP albumin ratio was calculated. All the parameters were recorded. All data was entered and analyzed through SPSS-21. Comparison of mortality with CRP/albumin ratio was done for chest and abdominal trauma by using chi-square test.

RESULTS

The mean age of patients was 34.24±15.5 years. Mean height of sampled population was 167.5±13.9cm, mean weight was 62.6±8.6kg and mean BMI was 22.4±5.3kg/m². Mean CRP was 14.3±9.6mg/dl, mean albumin was 3.76±0.98g/dl and mean CRP/Albumin ratio was 3.74±2.3in sampled population (Table 1).

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There were 74 male and 57 females (Table 2). In CRP/Albumin cluster there were 32.1% patients in 0.01-2 cluster, 43.5% in 2.01-4 cluster and 32.1% in 4.01-9 cluster (Table 3). Total 12.2% patients expired in sample size (Table 4). There were 57.3% patients with abdominal trauma (Table 5).

Table 1: Descriptive statistics of the patients

| Variable | Mean±SD |
|------------------------------|--------------|
| Age (years) | 34.24±15.57 |
| Physical parameters | |
| Weight (kg) | 62.67±8.68 |
| Height (cm) | 167.55±13.95 |
| BMI (kg/m ²) | 22.48±5.34 |
| Laboratory parameters | |
| CRP (mg/dl) | 14.3±9.6 |
| Albumin (g/dl) | 3.76±0.98 |
| CRP/Albumin ratio | 3.74±2.3 |

Table 2: Frequency of gender (n=131)

| Gender | No. | % |
|--------|-----|------|
| Male | 74 | 56.5 |
| Female | 57 | 43.5 |

Table 3: Frequency of CRP/albumin cluster (n=131)

| CRP/albumin cluster | No. | % |
|---------------------|-----|------|
| 0.01-2 | 42 | 32.1 |
| 2.01-4 | 47 | 35.9 |
| 4.01-9 | 42 | 32.1 |

Table 4: Frequency of in-hospital mortality (n=131)

| In-Hospital Mortality | No. | % |
|-----------------------|-----|------|
| Discharged | 115 | 87.8 |
| Expired | 16 | 12.2 |

Table 5: Type of trauma (n=131)

| Type of trauma | No. | % |
|------------------|-----|------|
| Abdominal trauma | 75 | 57.3 |
| Chest Trauma | 56 | 42.7 |

DISCUSSION

Trauma injury is one of the leading causes of morbidity, mortality and also of ICU admissions. Several prognostic markers and scoring systems have developed for the evaluation of critically ill patients' assessment. It has been proved that, SOF score could prove a better evaluation score for patient evaluation. Higher CRP value also proves a good predictor for clinical prognosis²⁵. Present study also highlights that; higher CRP value is directly proportional the poor outcome. Other studies also reported the similar findings²⁶⁻²⁸.

Serum albumin results after trauma injury are also proved to be a prognostic. Few studies reported that, advance age and low albumin level showed higher chances of mortality in trauma injury^{29,30}. Result of present study also highlights that, highest incidence of mortality was observed who had higher CRP/albumin ratio. This might indicate that, CRP/albumin ratio is a better prognostic approach then to serum albumin alone^{31,32}.

Few other studies also compared the hemoglobin level, CRP value and CRP/albumin ratio in critically ill patients with other patients. Analysis showed that, highly different values were obtained in both types of patients^{33,34}. Serum albumin and CRP both biochemical varieties are not routinely assessed especially in traumatic patients. Present study highlights the importance of these two predictors as a valuable prognostic approach in traumatic patients.

CONCLUSION

Road accidents are main cause of traumatic death globally which accounts for >45% of hospital admissions. Along with therapeutic approach, biochemical varieties could also be a beneficial source for patient evaluation. Result of present study highlights that,

CRP/albumin ratio is a powerful tool for the evaluation of associated mortality risk.

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