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MAPPING THE CARDIAC BIOMARKERS IN SUBJECTS HAVING SEVERE SEPTIC SHOCK AND SEPSIS

Dr. Bharat Kumar Parmer,[1]Dr. Roshan Mandloi,[2]Dr. Sanjay Kumar Dubey[3*]

[1]MD [General Medicine], Assistant Professor, Department Of Medicine, Government Medical College, Ratlam, Madhya Pradesh. Email: drbharatkumarparmar@gmail.com
[2]MD [General Medicine], Assistant Professor, Department Of Medicine, Government Medical College, Ratlam, Madhya Pradesh. Email id: roshanmandloi105@gmail.com
Correspondence:
[3*]MD [General Medicine], Associate Professor, Department Of Medicine, Government Medical College, Ratlam, Madhya Pradesh. Email sanjaydub02@gmail.com

ABSTRACT

Background: Sepsis is a disease characterized by rapid disease process advancement needing immediate therapy adjustments. Assessment of disease severity is vital for appropriate disease management, preventing and decreasing the incidence of complications, decreasing mortality rates, and attaining a better prognosis.

Aims: The present study was conducted to assess laboratory and clinical parameters in subjects with severe septic shock and sepsis. Also, the study assessed Acute Physiology and Chronic Health Evaluation-II score (APACHE-II) with Echocardiographic evaluation of cardiac functions. Cardiac biomarkers including creatine phosphokinase myocardial band (CPK-MB)and Troponin-T were also assessed in the present study.

Materials and Methods: The present prospective clinical study was conducted to assess the cardiac biomarkers, clinical, and laboratory parameters in subjects with severe septic shock and sepsis.

Result: It was seen that significant mortality was seen in subjects with positive Troponin-T and high CPK-MB levels. In subjects with septic shock and sepsis, CPK-MB levels were raised. Increased levels of CPK-MB and Troponin-T were also indicative of myocardial injury which could lead to coronary insufficiency in subjects with septic shock and sepsis.

Conclusion: The present study concludes that in critically ill subjects, levels of Troponin are usually raised. However, more data is needed to prove prognostic and diagnostic significance with its implications in subjects with septic shock and sepsis.

Key Words: Acute Physiology and Chronic Health Evaluation-II, Creatine phosphokinase myocardial band, Septic shock, Troponin-T

INTRODUCTION

Sepsis is a disease characterized by rapid disease process advancement needing immediate therapy adjustments. Assessment of disease severity is vital for appropriate disease management, preventing and decreasing the incidence of complications, decreasing mortality rates, and attaining a better prognosis. In these subjects, it is vital to determine the organ dysfunction manifestation and underlying infection cause.[1]

Mortality and morbidity rates are increased with predisposing conditions like a history of organ transplantation, surgery, trauma, diabetes mellitus, extremes of age, and increased

disease severity. Assessing outcomes in subjects who are severely ill was difficult as first pointed in 1863 by Florence Nightingale. The outcomes and prognosis in subjects who are severely ill are based on the judgment and insight of treating professionals since the beginning of time.[2]

Based on substantiation and data outcome analysis had changed drastically with the intensive care unit expansion. Assessing and calculating outcomes are largely based on the identification of disease severity that came into existence in previous decades especially in subjects who are critically ill. Also, various disease severity scoring systems are introduced based on disease etiology and diverse conditions. Hence, an important part of treating critical cases is to evaluate disease prognosis.[3]

These scoring systems are used to stratify the risks, and hence, separating the critically ill subjects and their classification into various risk categories depending on laboratory and clinical parameters. To improve care standards, treatment, and outcomes in these subjects, it is vital to use scoring systems for subjects admitted to ICU. APACHE II scores were first proposed in 1985 by Knaus et al which assess disease severity with scoring systems for evaluating mortality and morbidity in subjects admitted to ICU depending on data on the admission day like APACHE or SAPS ((Simplified Acute Physiology Score).[4]

All these scoring systems usually have two parts including severity scores and estimation of mortality and morbidity probability where high severity score is directly proportional to disease severity. To determine the sepsis severity using standard methods is based on the use of Acute Physiology and Chronic Health Evaluation II score (APACHE II). The treating physicians should identify the importance of assessing the disease severity scores and use them in daily practice to get better outcomes.[5]

The present study was conducted to assess laboratory and clinical parameters in subjects with severe septic shock and sepsis. Also, the study assessed Acute Physiology and Chronic Health Evaluation-II score (APACHE-II) with Echocardiographic evaluation of cardiac functions. Cardiac biomarkers including creatine phosphokinase myocardial band (CPK-MB) and Troponin-T were also assessed in the present study.

MATERIAL AND METHODS

The present prospective clinical study was conducted to assess laboratory and clinical parameters in subjects with severe septic shock and sepsis. Also, the study assessed Acute Physiology and Chronic Health Evaluation-II score (APACHE-II) with Echocardiographic evaluation of cardiac functions. Cardiac biomarkers including creatine phosphokinase myocardial band (CPK-MB) and Troponin-T were also assessed in the present study. The study was conducted at Department Of Medicine, Government Medical College, Ratlam, Madhya Pradesh. The study population was comprised of the subjects admitted to the ICU of the hospital with severe sepsis or septic shock. After explaining the detailed study design, informed consent was taken from all the study subjects.

The inclusion criteria for the study were subjects with a confirmed diagnosis of septic shock and sepsis, age more than 18 years, and subjects willing to participate in the study. The

exclusion criteria were subjects with the cerebrovascular accident, severe anemia less than 7gm% hemoglobin, subjects with systemic diseases like collagen vascular disease, COPD, HIV, hypertension, or diabetes mellitus, chronic renal disease, and subjects not willing to participate in the study.

After confirmed diagnosis, 70 subjects were divided into two groups using SIRS criteria for severe septic shock or sepsis based on the Consensus conference of 1991. Based on the inclusion and exclusion criteria, subjects were finally enrolled in the study.After final inclusion, detailed history and examination were done for all the subjects. The laboratory investigations were done to assess the levels of CPK-MB, Roche cardiac Troponin-T sensitive test, and Troponin-T in the serum with a cut-off value of 5 IU/L and a normal range of 5-25 IU/L. Other laboratory parameters assessed were complete blood count, liver function tests, serum potassium and serum sodium using ion-selective electrode process, serum creatinine using, blood culture, and blood urea with the urease-GLDH process.

The collected data were subjected to the statistical evaluation using SPSS software version 21 (Chicago, IL, USA) and one-way ANOVA and t-test for results formulation. The data were expressed in percentage and number, and mean and standard deviation. The level of significance was kept at $p<0.05$.

RESULTS

The present study was conducted to assess laboratory and clinical parameters in subjects with severe septic shock and sepsis. Also, the study assessed Acute Physiology and Chronic Health Evaluation-II score (APACHE-II) with Echocardiographic evaluation of cardiac functions. Cardiac biomarkers including creatine phosphokinase myocardial band (CPK-MB) and Troponin-T were also assessed in the present study. It was seen that in sepsis, majority of subjects had severe sepsis in 34.28% (n=24) study subjects followed by septic shock in 30% (n=21) subjects, UTI in 21.42% (n=15) study subjects, pneumonia in 12.85% (n=9) study subjects, and ARDS in 1.42% (n=1) subject. Cultures were negative and positive in 6.85±8.6 and 13.37±9.22 respectively. Based on Troponin-T versus APACHE-II scores, it was seen that positive Troponin-T was significantly associated with APACHE-II scores with 15.43±6.75. On assessing the association of culture reports to positive Troponin-T levels, a significant association was seen between culture-positive and positive Troponin-T wherein culture positive subjects, 25 subjects had positive Troponin-T levels. Also, APACHE-II was significantly associated with CPK-MB levels with $p<0.0001$ (Table 1).

On assessing the various sepsis variables, it was seen that sepsis was present in 23 troponin-T positive subjects and 21 Troponin-T negative subjects. The mean values of Troponin-T were 11.93±10.32 and 7.96±6.47 in subjects with and without sepsis respectively. This difference was statistically significant with $p<0.0001$. In subjects with severe sepsis or septic shock 40% (n=28) of subjects died, whereas,60% (n=42) subjects survived following treatment as shown in Table 2.

The survival rates of study subjects were also assessed based on Troponin-T presence, it was seen that in Troponin-T positive subjects, 18 subjects did not survive severe sepsis or septic shock, whereas, 16 subjects were survivors. In subjects with negative Troponin-T, it was seen

that 28 subjects dies, whereas, 16 subjects survived severe septic shock or sepsis as depicted in Table 3.

DISCUSSION

The present study was conducted to assess laboratory and clinical parameters in subjects with severe septic shock and sepsis. Also, the study assessed Acute Physiology and Chronic Health Evaluation-II score (APACHE-II) with Echocardiographic evaluation of cardiac functions. Cardiac biomarkers including creatine phosphokinase myocardial band (CPK-MB) and Troponin-T were also assessed in the present study. It was seen that in sepsis, majority of subjects had severe sepsis in 34.28% (n=24) study subjects followed by septic shock in 30% (n=21) subjects, UTI in 21.42% (n=15) study subjects, pneumonia in 12.85% (n=9) study subjects, and ARDS in 1.42% (n=1) subject. Cultures were negative and positive in 6.85±8.6 and 13.37±9.22 respectively. Based on Troponin-T versus APACHE-II scores, it was seen that positive Troponin-T was significantly associated with APACHE-II scores with 15.43±6.75. On assessing the association of culture reports to positive Troponin-T levels, a significant association was seen between culture-positive and positive Troponin-T wherein culture positive subjects, 25 subjects had positive Troponin-T levels. Also, APACHE-II was significantly associated with CPK-MB levels with $p<0.0001$. These results were consistent with the studies of Sharma D et al[6] in 2017 and Raja Dc et al[7] in 2017 where similar parameters were depicted by the authors as in the present study.

The present study also assessed the various sepsis variables, it was seen that sepsis was present in 23 troponin-T positive subjects and 21 Troponin-T negative subjects. The mean values of Troponin-T were 11.93±10.32 and 7.96±6.47 in subjects with and without sepsis respectively. This difference was statistically significant with $p<0.0001$. In subjects with severe sepsis or septic shock 40% (n=28) of subjects died, whereas,60% (n=42) of subjects survived following treatment. These findings were in agreement with the results of Landesberg G et al[8] in 2014 and Vallabhajosyula S et al[9] in 2017

The survival rates of study subjects were also assessed based on Troponin-T presence, it was seen that in Troponin-T positive subjects, 18 subjects did not survive severe sepsis or septic shock, whereas, 16 subjects were survivors. In subjects with negative Troponin-T, it was seen that 28 subjects dies, whereas, 16 subjects survived severe septic shock or sepsis. These results were comparable to the results of Jos FF et al[10] in 2018 and Fleischmann C et al[11] in 2016 where a similar correlation was seen in Troponin-T and survival rates in subjects with severe sepsis or septic shock.

CONCLUSION

Within its limitations, the present study concludes that in critically ill subjects, levels of Troponin are usually raised. However, more data is needed to prove prognostic and diagnostic significance with its implications in subjects with septic shock and sepsis.CPK-MB levels are also raised in subjects with severe sepsis and septic shock. Increased levels of CPK-MB and Troponin-T were also indicative of myocardial injury which could lead to coronary insufficiency in subjects with septic shock and sepsis. However, the present study had a few limitations including a small sample size, shorter monitoring period, and geographical area biases. Hence, more longitudinal studies with larger sample size and longer monitoring period will help reach a definitive conclusion.

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TABLES

Parameters	**Percentage (%)**	**Number (n)**
Diagnosis		
Urinary Tract infection (UTI)	21.42	15
Septic shock	30	21
Severe Sepsis	34.28	24
Pneumonia	12.85	9

ARDS	1.42	1
Culture results	**Mean± S. D**	
Negative	6.85±8.6	
Positive	13.37±9.22	
Troponin-T vs APACHE II scores	**Mean± S. D**	
Negative	19.1±7.12	
Positive	15.43±6.75	
Troponin-T vs Culture	**Troponin-T positive (n)**	**Troponin-T negative (n)**
Negative	5	30
Positive	25	10
APACHE-II with CPK-MB	**CPK-MB Pearson coefficient**	**p-value**
APACHE-II	0.632	<0.0001

Table 1: Clinical parameters in the study subjects

Variables	**Mean± S. D**	**p-value**
Sepsis (n)	**Troponin-T positive (n)**	**Troponin-T negative (n)**
Present	23	21
Absent	7	19
Sepsis		
Present	11.93±10.32	<0.0001
Absent	7.96±6.47	
Outcomes following sepsis	**Percentage (%)**	**Number (n)**
Deceased	40	28
Survived	60	42

Table 2: Clinical variables in the study subjects

Troponin-T	**Deceased**	**Survived**
Negative	10	26
Positive	18	16
Total	28	42

Table 3: Outcomes in the study subjects based on Troponin-T levels