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Co-Relation of Left Ventricular Diastolic Dysfunction with Apache II Score in Sepsis Patients

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ABSTRACT

Background: Sepsis is a leading cause of mortality and is a major cause of morbidity by causing end-organ damage as well as cognitive and physical disability in survivors. Sepsis can be defined as the presence (probable or documented) of infection together with systemic manifestation of infection. Patients with sepsis generally have multiple predisposing factors and sources of infection. Cardiac dysfunction adds up in increasing the mortality rate in patients with sepsis. Diastolic dysfunction can predict long term mortality and morbidity in sepsis and is recognized to be a major cause of heart failure with normal ejection fraction (LVEF>55%).

Material and Methods: The study was done on subjects admitted in ICU under the department of Medicine. All patients above 18 years, those who gave their consent for the study or their relatives, also fulfilled the criteria for sepsis as mentioned in guidelines for sepsis. Though the calculated sample size with 50% proportion of sepsis in two years was 127, this study included 140 patients. Worst APACHE II scores were calculated during the period of admission within the first 24 hours. All the pathological and biochemical parameters were measured by standard laboratory techniques. Blood pressure was measured using a mercury sphygmomanometer, using a Riva-Roci cuff in the right hand in the supine position. Worst APACHE II score was calculated in the first 24 hours for the sepsis patients admitted in the Medicine intensive care unit and was interpreted.

Results: In the present study on 140 patients, the mean age of patients was 50.15±16.37 years. This study population was male dominant where 94 (67.14%) were males and 46 (32.86%) were females. Out of the total study population, 104 (74.3%) were survivors while 36 (25.7%) were non-survivors. Worse APACHE II score from 20 to 34 had a greater number of patients with left ventricular diastolic dysfunction. When the APACHE II score was correlated with the presence of LVDD in both survivors and non-survivors, it was observed that in the non-survivors as the APACHE II score worsens from 20 to 34, there was significant mortality as compared with the survivors.

Conclusion: LVDD was present in patients above the age of 40 years. As the APACHE II score worsens from 20 to 34, a greater number of patients showed LVDD. When APACHE II score was correlated with presence of LVDD in both survivors and non-survivors, it was observed that in the non-survivors as the APACHE II score worsens from 20 to 34 and there was a significant mortality as compared with the survivors.

Key Words: Sepsis, LVDD, APACHE II

INTRODUCTION

Sepsis is a leading cause of mortality and is a major cause of morbidity by causing end-organ damage as well as cognitive and physical disability in survivors^{1,2}.

Sepsis can be defined as the presence (probable or documented) of infection together with systemic manifestation of infection³. Despite significant advancements in the understanding

of the pathophysiology of sepsis, advancements in hemodynamic monitoring tools, and resuscitation measures, sepsis remains one of the major causes of morbidity and mortality in critically ill patients⁴. In United States of America, annual incidence of severe sepsis and septic shock is up to 300 cases per 100,000 people. The hospital stay of a patient with sepsis is nearly twice and the mortality rate is 8 times more than that of other patients^{1,5}.

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Patients with sepsis generally have multiple predisposing factors and sources of infection. Cardiac dysfunction adds up in increasing the mortality rate in patients with sepsis⁶. When compared to patients who don't have left ventricular diastolic dysfunction, patients who develop left ventricular diastolic dysfunction during sepsis have worse prognosis^{7, 8}.

Diastolic dysfunction can predict long term mortality and morbidity in sepsis and is recognized to be a major cause of heart failure with normal ejection fraction(LVEF>55%). Only a few studies and limited data are available on cardiac dysfunction in sepsis and septic shock and also on the prognostic importance of diastolic dysfunction in sepsis and septic shock^{9, 10, 11}.

There is sufficient data of LVDD (left ventricular diastolic dysfunction) in sepsis and its impact on outcome from developing countries. However, there is insufficient evidence from middle and low income countries.

Hence the objective of this study was to see LVDD in sepsis patients from a tertiary rural hospital and to co-relate left ventricular diastolic dysfunction with APACHE II score.

MATERIAL AND METHODS

Study setting

This present study was conducted in medicine ICU of Department of Medicine, Acharya Vinoba Bhave Rural Hospital (AVBRH) JNMC Sawangi, a tertiary care teaching hospital situated in the rural area of Wardha District.

Duration and type of study

The study was a cross-sectional study. The study was done on subjects admitted in ICU under the department of Medicine from September 2016 to August 2018.

Ethics Committee Permission

This study was initiated after obtaining clearance from the institutional ethics committee on Date: 30/9/2016 with reference number: DMIMS(DU)/IEC/2016-17/4079.

Inclusion Criteria

CASE: All patients above 18 years, those who gave their consent for the study or their relatives, also fulfilled the criteria for sepsis as mentioned in guidelines for sepsis¹².

Exclusion Criteria: any severe debilitating illness with or without

- Chronic hypertension
- Myocardial disease
- Pericardial disease
- Valvular heart disease

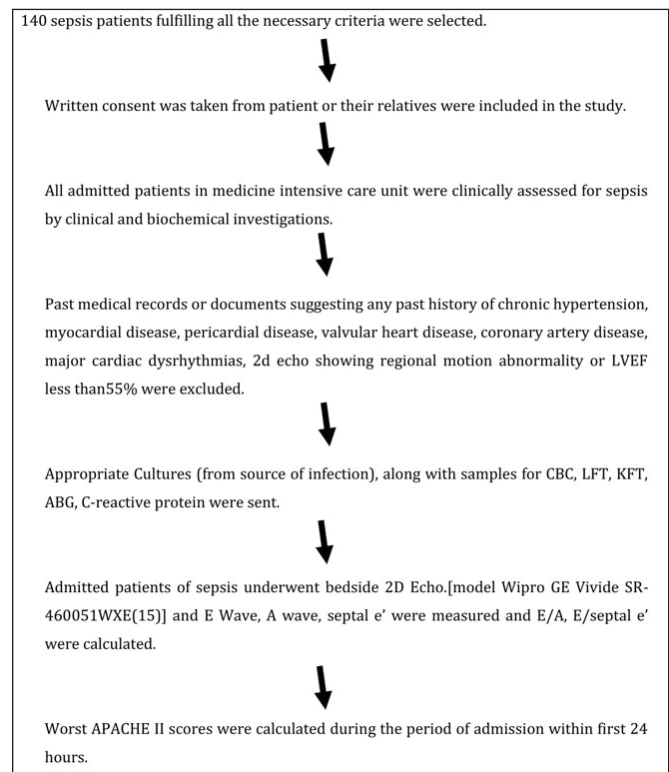
- Coronary artery Disease
- Major cardiac dysrhythmias
- 2D echo showing Regional Wall Motion Abnormality or LVEF (left ventricular ejection fraction) less than55%.(normal EF more than 55%)

Sample size

All consecutive patients admitted in ICU under Department of Medicine from September 2016 to August 2018 were enrolled in the study.

Though the calculated sample size with 50% proportion of sepsis in two years was 127, this study included 140 patients. Total patients admitted to AVBRH of sepsis from October 2016 to August 2018 in two years due to sepsis= N=127.

Methodology



All the pathological and biochemical parameters were measured by standard laboratory techniques.

Blood pressure was measured using a mercury sphygmomanometer, using a Riva-Rocci cuff in the right hand in the supine position.

APACHE II SCORE

APACHE II ("Acute Physiology And Chronic Health Evaluation II") is a severity-of-disease classification system. Worst APACHE II score was calculated in the first 24 hours for the sepsis patients admitted in Medicine intensive care unit and was interpreted according to table: 1

Table 1: APACHE II SCORE with Approximate mortality³

0 to 4 points	4% non – operated, 1% post - operated
5 to 9 points	8% non – operated, 3% post - operated
10 to 14 points	15% non – operated, 7% post - operated
15 to 19 points	24% non – operated, 12% post – operated
20 to 24 points	40% non – operated, 30% post – operated
25 to 29 points	55% non – operated, 35% post - operated
30 to 34 points	Approximate 73% both
35 to 100 points	85% non – operated, 88% post - operated

Statistical analysis

All Statistical analysis was done by using SPSS (statistical package of social science) 22.0 version and Graph Pad Prism 6.0 version.

The data were presented as mean for continuous variables or absolute number (%) for categorical variables unless otherwise specified. A ‘p’ value <0.05 was considered statistically significant.

RESULTS

In the present study on 140 patients, the mean age of sepsis patients in our study was 50.15±16.37 years. This study population was male dominant where 94 (67.14%) were males and 46 (32.86%) were females. Out of the total study population, 104 (74.3%) were survivors while 36 (25.7%) were non-survivors. CKD was present in 35 (25%) patients, 49 (35%) were DM, 9 (6.43%) were cirrhosis of the liver, and 23 (16.42%) were others like (COPD, HIV, HBsAg, MALIGNANCY).

Table 2: Baseline characteristics of study subjects (total number of sepsis patients n=140)

Baseline characteristics	No. of patients	Percentage	Mean ± SD
Age(years)			50.15±16.37
Gender			
Male	94	67.14%	
Female	46	32.86%	
Clinical Parameters			
Temperature (°Fahrenheit)			101.42±0.65
SBP (mmhg)			100.47±25.03
DBP(mmhg)			61.45±24.40
MAP(mmhg)			74.45±23.62
Pulse Rate(bpm)			113.74±10.25
RR(cpm)			25.85±4.34
APACHE Score			25.57±4.80

Table 2: (Continued)

Baseline characteristics	No. of patients	Percentage	Mean ± SD
Comorbidities			
CKD	35	25%	
DM	49	35%	
Cirrhosis	9	6.43%	
Others	23	16.42%	

Table 3: Left ventricular diastolic dysfunction in sepsis between gender (total number of sepsis patients n=140)

Left ventricular diastolic dysfunction	Male (n=94)	Female (n=46)	Total (total number of sepsis patients n = 140)
Present	58(69.88%)	25(30.12%)	83(59.29%)
Absent	36(63.13%)	21(36.87%)	57(40.71%)
Total	94(67.14%)	46(32.86%)	140(100%)
χ²-value	0.69, p-value = 0.40, NS, p>0.05		

It was observed that out of 83 patients having left ventricular diastolic dysfunction, 58(69.88%) were males and 25(30.12%) were females. It was seen that when left ventricular dysfunction was compared between the gender (males and females), it was seen more in males.

Table 4: Correlation of APACHE-II score with left ventricular diastolic dysfunction (total number of sepsis patients n=140)

APACHE-II Scoring points	No of patients	Left ventricular diastolic dysfunction	
		Present	Absent
0 to 4	0		
5 to 9	0		
10 to 14	1	1(100%)	0(0%)
15 to 19	13	4(30.77%)	9(69.23%)
20 to 24	44	18(40.91%)	26(59.09%)
25 to 29	52	36(69.23%)	16(30.77%)
30 to 34	26	21(80.77%)	5(19.23%)
35 to 100	4	3(75%)	1(25%)
Total	140	83(59.29%)	57(40.71%)
χ²-value	18.73, p=0.0022, S, p<0.05		

It was observed that, 13 patients had APACHE II score between 15 to 19, out of which 4(30.77%) patients had LVDD. 44 patients had APACHE2 score between 20 to 24, out of

which 18(40.91%) patients had LVDD. 52 patients had APACHE II score between 25 to 29, out of which 36(69.23%) patients had LVDD. 26 patients had APACHE II score between 30 to 34, out of which 21(80.77%) patients had LVDD. 4 patients had APACHE II score between 35 to 100, out of which 3(75%) patients had LVDD. In this table, it was observed that higher APACHE II score between 20 to 34 had a greater number of patients with left ventricular diastolic dysfunction.

It was observed that 13 patients had APACHE II scores between 15 to 19 out of which 4 (3.85%) patients who survived had LVDD. 44 patients had APACHE II score between 20 to 24, out of which 13 (12.50%) patients who survived had LVDD and out of non-survived patients, 5 (13.89%) patients had LVDD. 52 patients had APACHE II score between 25 to 29, out of which 23 (22.12%) patients who survived had

LVDD and out of non-survived patients, 13 (36.11%) patients had LVDD. 26 patients had APACHE II score between 30 to 34, out of which 11 (10.58%) patients who survived had LVDD and out of non-survived patients, 10 (27.78%) patients had LVDD. 4 patients had APACHE II score between 35 to 100, out of which 3 (8.33%) patients who died had LVDD.

When the APACHE II score was correlated with the presence of LVDD in both survivors and non-survivors, it was observed that in the non-survivors as the APACHE II score worsens from 20 to 34, there was significant mortality as compared with the survivors.

In our study, it was observed that the mean age among survivors was 48.41±15.97 years, while in non-survivors were 55.16±16.70 years.

Table 5: Table showing correlation of outcome and APACHE-II score with-in hospital mortality and left ventricular diastolic dysfunction (total number of sepsis patients n=140)

APACHE-II Scoring points	No of patients	Actual Outcome			
		Survivor (n=104)		Non Survivor (n=36)	
		Left ventricular diastolic dysfunction present	Left ventricular diastolic dysfunction absent	Left ventricular diastolic dysfunction present	Left ventricular diastolic dysfunction absent
10 to 14	1	1(0.96%)	0(0%)	0(0%)	0(0%)
15 to 19	13	4(3.85%)	9(8.65%)	0(0%)	0(0%)
20 to 24	44	13(12.50%)	25(24.04%)	5(13.89%)	1(2.78%)
25 to 29	52	23(22.12%)	14(13.46%)	13(36.11%)	2(5.56%)
30 to 34	26	11(10.58%)	3(2.88%)	10(27.78%)	2(5.56%)
35 to 100	4	0(0%)	1(0.96%)	3(8.33%)	0(0%)
Total	140	52(50%)	52(50%)	31(86.11%)	5(13.89%)
χ ² -value		14.47, p=0.012, S, p<0.05		29.09, p=0.0001, S, p<0.05	

(p value to be significant is < 0.05)

DISCUSSION

Sepsis is characterized by circulatory abnormalities resulting in intravascular volume depletion and vasodilatation and causes oxygen supply-demand imbalance in the tissues, the cardiac performance is likely to be reduced due to major changes in the cardio microcirculation due to endothelial disruption and maldistribution of blood flow as a result of sepsis leading to cardiac dysfunction. When compared to patients without left ventricular diastolic dysfunction, patients who develop left ventricular diastolic dysfunction during sepsis have a worse prognosis^{8,9}. Diastolic and systolic dysfunctions have been focused separately in most of the researches on cardiovascular dysfunctions in septic patients^{14,15}.

Sepsis was seen across all age groups in this present study population of 140 patients. The mean age of the patient

population in this present study having sepsis was 50±16 years.

While investigating gender distribution among 140 sepsis patients, 94 (67%) were males and 46 (33%) were females in this present study. Gustavo Rolando et al.¹⁶ conducted a study, in which the mean age was 74±13 years. It had 55% males and 45% females. In other study conducted by T. Furian et al.¹⁷, mean age was 51±18 years having 35% males and 65% females in the study. Clancy DJ et al.¹⁸ conducted a study in which mean age was 63.1±12.4 years and there were 56% males and 44% females.

In this present study, LVDD was seen to be statistically significant in patients above the age of 40 years in both males and females. However, its presence in both males and females was not comparable. Juan N. Pulido et al.¹⁹ conducted

a study showing the statistical difference between survivors and non-survivors including APACHE II score, SOFA score, and PaO₂/FiO₂ ratio. In another study by Y. Mahjoub et al.²⁰, HR, SBP, DBP, MAP was found to be insignificant in survivors and non-survivors. Likewise, T. Furian et al.²¹ in their study observed that the APACHE II score, SBP, HR were not significant. Landersberg et al.¹⁵ study observed that the APACHE II and SOFA scores were significant between survivors and non-survivors.

Percentage of LVDD in sepsis patients in this present study was 59.29 % and in other studies like Gustavo Rolando et al.¹⁷ it was 84% and in Juan N. Pulido et al.²⁰ it was 84%. Juan N. Pulido et al.²⁰ conducted a study in which it was observed that patients having Left ventricular diastolic dysfunction were much older (72 years).

In a study by Munt B et al.²², it was observed that the APACHE II score and deceleration time were important predictors of mortality. When this was compared with the present study, it was seen that APACHE II score correlated with the presence of left ventricular diastolic dysfunction in both survivors and non-survivors and also had a significant effect on the mortality.

CONCLUSION

In the present study when LVDD was compared across age distribution in males and females, it was observed that LVDD was present in patients above the age of 40 years which was statistically significant. As the APACHE II score worsened from 20 to 34, a greater number of patients LVDD was detected. When the APACHE II score was correlated with the presence of LVDD in both survivors and non-survivors, it was observed that in the non-survivors as the APACHE II score worsened from 20 to 34, there was significant mortality as compared with the survivors in this present study.

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