J Cardiovasc Disease Res., 2017; 8(1): 6-15
A Multifaceted Peer Reviewed Journal in the field of Cardiology
www.jcdronline.org | www.journalonweb.com/jcdr

Original Article

Relation of Echocardiographic Parameters to Outcome of Patients with Severe Sepsis and Septic Shock

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ABSTRACT

Background: Myocardial dysfunction is one of the most important features of sepsis. The presence of cardiac dysfunction in sepsis has been associated with high mortality rate in septic patients. **Material & Methods**: This was prospective, observational cohort (patient with severe sepsis and septic shock) study conducted over period of one year in medical intensive care unit. Patients with an initial diagnosis of severe sepsis or septic shock were enrolled. **Aims & Objectives**: To study demographic profile, APACHE-II score and echocardiographic parameters in patients with severe sepsis and septic shock and to find out relation of echocardiographic parameters to variables of sepsis and outcome. **Study Population:** All patients underwent laboratory investigations, APACHE-II score and Transthoracic 2- Dimensional echocardiogram. **Statistical analysis:** Data was analysed by trial version SPSS-16 for mean, SD, chi-square test with *'p'* <0.05 was considered as statistically significant. **Results**: Of total 51 patients with sepsis and septic shock 32 were males and 19 were females with mean age of 51.48 (±13.11) years and 59.66 (±16.93) respectively. The mean LVEF was 35.70% (±7.47608). APACHE-II score had negative correlation with LVEF and positive with DD. Total 17.64% had normal LV diastolic function, 47.05% had grade-I diastolic dysfunction and 35.29% had grade-II diastolic dysfunction ['p'=0.082]. Overall mortality was 29.41% in patient with sepsis. Overall diastolic dysfunction was significantly more in patients with death compared to survived population ['p'= 0.0218 and 0.0329]. **Conclusion**: Diastolic dysfunction was common and a major predictor of mortality and outcome in severe sepsis and septic shock and was well correlated with APACHE-II score. Present study favors to use echocardiography as an ideal monitoring, tool in the septic patient for goal-oriented therapy for better outcome.

Key words: Myocardial dysfunction, Sepsis, APACHE-II score, Echocardiographic parameters, Septic shock.

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Submission Date: 08-05-2016;
Revision Date: 11-06-2016;
Accepted Date: 27-06-2016.
DOI : 10.5530/jcdr.2017.1.2

INTRODUCTION

Sepsis, defined as "The systemic inflammatory response syndrome (SIRS) which occurs during infection" is generally viewed as a disease aggravated by the inappropriate immune response. The mortality of sepsis is high.[1] One of the most important features of sepsis is myocardial dysfunction. One of the important features of sepsis is myocardial dysfunction, the underlying mechanisms involved in the development of myocardial dysfunction during sepsis are not entirely known but involve, TNF-α and interleukin 1 β and endothelial dysfunction.[2] The presence of cardiac dysfunction in sepsis has been associated with a very high mortality rate compared with septic patients without cardiovascular impairment. Echocardiography is not routinely done in patient with sepsis and septic shock. Echocardiography helps in the early goal-directed therapy protocol that may improve cardiac dysfunction, intravascular volume resuscitation and hypovolemia. Echo cardiographic parameters may be used as surrogate marker for predicting outcome in patient with sepsis and septic shock. As an important organ system frequently compromised by sepsis and always affected by septic shock, the cardiovascular system and its dysfunction during sepsis have been studied in clinical and basic research for more than 5 decades.[3,4] We designed this study to investigate the cardiac systolic and diastolic functions in patients presenting with severe sepsis and septic shock and their outcome.

MATERIAL AND METHODS

This was single centre, prospective, observational (non-interventional) Cohort (patient with Severe Sepsis and Septic Shock) study conducted over period of one year (1st Jan 2015- 31st Dec 2015) in medical intensive care unit in tertiary care teaching hospital. The study was approved by protocol and ethics committee of Krishna Institute of Medical Sciences Deemed University Karad.

Aims and Objectives

To study demographic profile, APACHE-II score and echocardiographic parameters [RV and LV function] in patients with severe sepsis and septic shock. To find out relation of echocardiographic findings of left and right ventricular systolic and diastolic function to APACE-II score, and variables of severe sepsis and septic shock in the early hours in and to correlate with hospital stay outcome in the form of improvement and mortality. Evaluate the reliability of bedside echocardiography in the ICU in the evaluation of patients with severe sepsis and septic shock.

Study Population

Patients admitted to Medical Intensive Care Unit (ICU) with an initial diagnosis of severe sepsis or septic shock. Age 18 Years and older of both the genders were eligible for the study.

Definition

Severe sepsis: Clinical signs of sepsis associated with organ dysfunction, alterations in perfusion, or hypotension. *Septic shock*: Sepsis with hypotension even after initial volume expansion.[1,5] *Inclusion criteria* included age ≥18 years of age with infection; hypotension (defined as a systolic arterial blood pressure <90 mmHg or reduction from baseline by >40 mmHg) with (SIRS group) or without (septic shock group) response to fluids resuscitation [sepsis-induced hypotension despite adequate fluid resuscitation along with the presence of perfusion abnormalities such as oliguria, lactic acidosis, and acute alteration in mental state]; Refractory hypotension (a systolic blood pressure less than 90 mmHg despite an intravenous fluid challenge of at least 20ml/kg)in addition to 2 or more of the following: Temperature >38 ^{0}C or <36 ^{0}C, Heart rate (HR) > 90 bpm, Respiratory rate (RR) > 30/min with $PaCO_2$ <32, Total leukocytic count (TLC)> 12· 109/L or <4· 109/L. or differential with greater than 10%

immature band forms. Enrolment of patients should occur within 8 hours of meeting criteria for severe sepsis or septic shock.

Exclusion Criteria

Primary diagnosis of acute coronary syndrome or Major cardiac dysrhythmia, Valvular and or congenital heart disease, Primary LV systolic dysfunction including cardiomyopathy, COPD, ILD and other primary lung disease, Primary Hepatic and or renal dysfunction, Severe anemia and any other disease which will affect cardiac hemodynamics or cardiac function.

Echocardiography

All the subjects with sepsis underwent resting transthoracic 2-dimensional echocardiography and Doppler imaging, to assess left ventricular systolic and diastolic function. Echo cardiographer was not aware of this study to avoid bias in the interpretation. A transthoracic 2-dimentionsional echocardiogram (TTE) with pulsed Doppler evaluation of transmit ralinflow and Tissue Doppler Imaging (TDI) and 2D echocardiography was performed to minimize the errors in assessing the diastolic dysfunction. Echocardiography was performed by harmonic imaging mode by Acuson-Siemens-X 300 echocardiography machine (5-1 MHz multifrequency probe) according to the standard protocol.

Diastolic dysfunction

LV diastolic dysfunction was considered to be present if any of the following findings were seen, as previously described: E/A ratio < 1 or > 2 [transmitral early diastolic rapid filling (E-wave) and atrial contraction late filling (A-wave) velocities; DT < 150 or > 220 ms [deceleration time]; IVRT < 60 or > 100 ms, [isovolumteric relaxation time] or ; E/e' ratio > 15; é <8.0 cm/s.[6] *Independent and dependent variables*: Demographic profile, temperature, Hb, CBC, BSL, Sr. creatinine, potassium, sodium, LFTs, GCS, co-morbidities, LVEF, LV diastolic function [E, A, E/Em, LA size], ABGA, APACHE score-II etc.

Left ventricular ejection fraction (LVEF) was calculated by modified Simpson's method; and, LVEF ≥ 50% was considered as normal[6] APACHE II score system is the sum of the acute physiology score (12 physiologic variables like vital signs, oxygenation, laboratory values), type of ICU admission, Glasgow coma score, age, and chronic health points. The worst values during first 24 hr in the ICU were used.[7] *Statistical analysis*: All data collected will be analysed by trial version SPSS -16 for mean, SD, chi-squre test and Pearson Correlation Test. A value of *'p'* <0.05 will be considered as statistically significant.

RESULTS

Total 51 patients fulfilling inclusion criteria were enrolled in this prospective observational study. Of total 51 patients with sepsis and septicemic shock 32 were males and 19 were females with mean age of 51.48 (±13.11) years and 59.66 (±16.93) respectively (Table 1).

Diastolic function had positive correlation with age (0.432), outcome (0.387), duration stay (0.085), respiratory rate [RR] (0.207), mean arterial pressure [MAP] (0.389), CVP (0.348), TLC (0.011) pulmonary artery pressure [PAP] (0.106) pH (0.466), creatinine (0.620) and APACHE-II score (0.198830139). Diastolic function had negative correlation with Hematocrit (-0.367), PaO_2, (-0.199) and heart rate [HR] (-0.197). Various parameters of diastolic dysfunction (E/Ea -0.59, Ea/Aa [m] -0.37, E/Ea [m] -0.17, Ea/Aa [l] -0.41 and E/Ea[l] -0.33)were negatively correlated with APACHE-II score.

Left ventricular systolic function (LVEF) had positive correlation with age (r = 0.073) duration stay (0.103) age (0.073) MAP (0.627) CVP (0.011) PAP, (0.627), PaO_2 (0.503), pH (0.135). Left ventricular systolic function (LVEF) r had negative correlation with RR (-0.344011507), HR (-0.318433508), TLC (-0.181), Hematocrit (-0.182), Creatinine (-0.086), RR (-0.344), HR (-0.318), APACHE-II score (-0.312) and outcome (-0.13).

The correlation of diastolic dysfunction and LV ejection fraction to the parameters of sepsis and APACE-II score is shown in Table 2. (Figure 1, 2, 3).

Total 9 [17.64%] had normal LV diastolic function, 24 [47.05%] had grade-I diastolic dysfunction and 18 [35.29%] had grade-II diastolic dysfunction with predominance of grade-I diastolic dysfunction ['p'=0.082] (Table 3).

Total 9 (28.12%) male and 6 (31.57%) female patients succumbed with no significant statistical difference. Total 23 males and 13 females were survived ('p'= 0.793). Overall mortality was 29.41% in patient with sepsis (Table 4).

The comparison of mean in male, female population with death and survived by ANOVA was 0.99. Comparison of male and female population, with survived and those with succumbed was insignificant [ANOVA 'p'= 0.794] (Table 5).

Of total 51 patients 9 had normal LV diastolic function, 24 had grade-I diastolic dysfunction, 18 had grade-II diastolic dysfunction. The subcategory grades of diastolic dysfunction were not statistically differ among survived and death population('p'=0.0864) but overall diastolic dysfunction was significantly more in patients with death compared to survived population with 'p'= 0.0218 and 0.0329 (Table 6 and Table 7).

DISCUSSION

Sepsis and septic shock are common causes of cardiovascular failure in critical care and are the most frequent causes of mortality in intensive care units. The phenomena of myocardial depression in sepsis was first described by *Parker, et al*.[7] Echocardiography is feasible and reliable imaging bedside tool in the septic patient due of its non-invasiveness and instantaneous, reproducible capability. Sepsis and septic shock represent complex situations where early hemodynamic assessment and support are among the keys to therapeutic success. Echocardiography in the management of the septic patient, and propose an echocardiography-based goal-oriented hemodynamic approach to septic shock. Recent findings Echocardiography can play a key role in the critical septic patient management, by excluding cardiac causes for sepsis, guiding hemodynamic management of those patients with sepsis In recent years, there have been both increasing evidence of the use of echocardiography as monitoring and guiding tool in the patients with Sepsis and septic shock. Echocardiography has now a day acknowledged and is increasingly used in critical care as an irreplaceable tool in the management of the critical patient.[8] Key recommendations according to international guidelines for management of severe sepsis and septic shock considering well known fact that, myocardial dysfunction is frequent in patient with septic shock with more than 90% systolic and more than 75% diastolic dysfunction in present cohort of septic shock, which favor inclusion of bedside echocardiography for early quantitative and goal-directed resuscitation of the septic patient.[9] Intensivists can safely and accurately perform goal-oriented echocardiography. Although not yet proven to influence clinical outcome, we suggest that the major utility of echocardiography is for those with distributive or mixed shock in whom target central venous pressure has been achieved without evidence of adequate tissue perfusion. In this subset of patients, echocardiography can aid in selecting those most likely to benefit from further fluid or inotropic support.[10] Several works have already demonstrated that systolic dysfunction is common in septic shock and that the ejection fraction reduction found in this setting is reversible in patients who survive (Table 8). Conversely, only few and small studies (< 54 patients) have investigated diastolic dysfunction in sepsis and septic shock: one found an

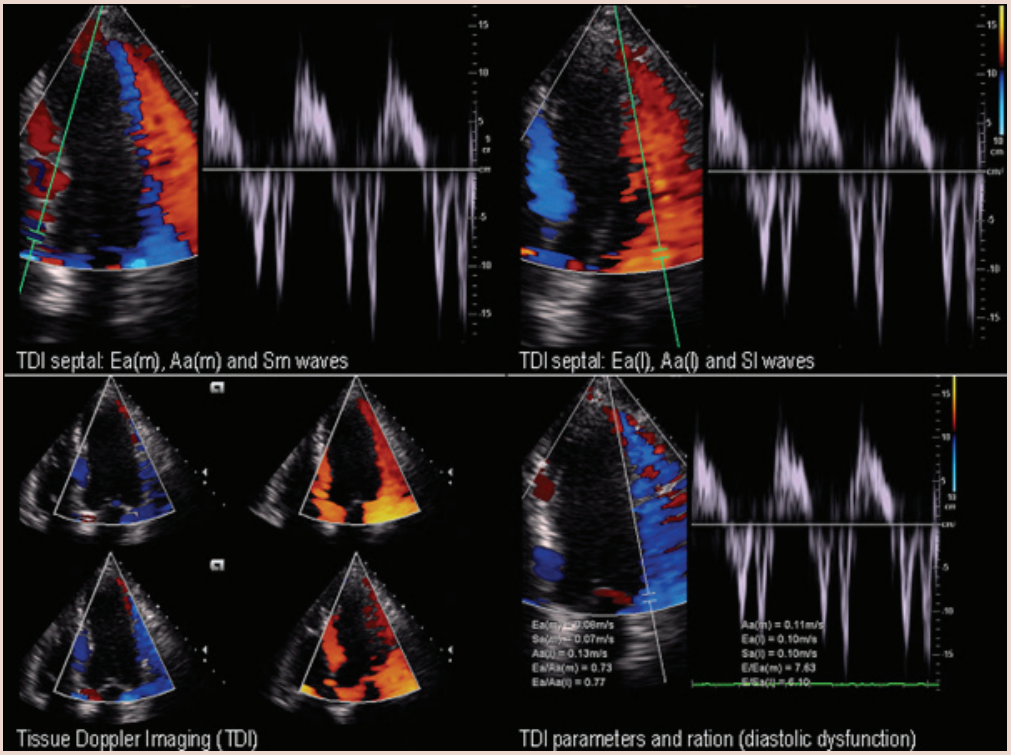


Figure 1: Echocardiography and Doppler study showing parameters of TDI in diastolic dysfunction.

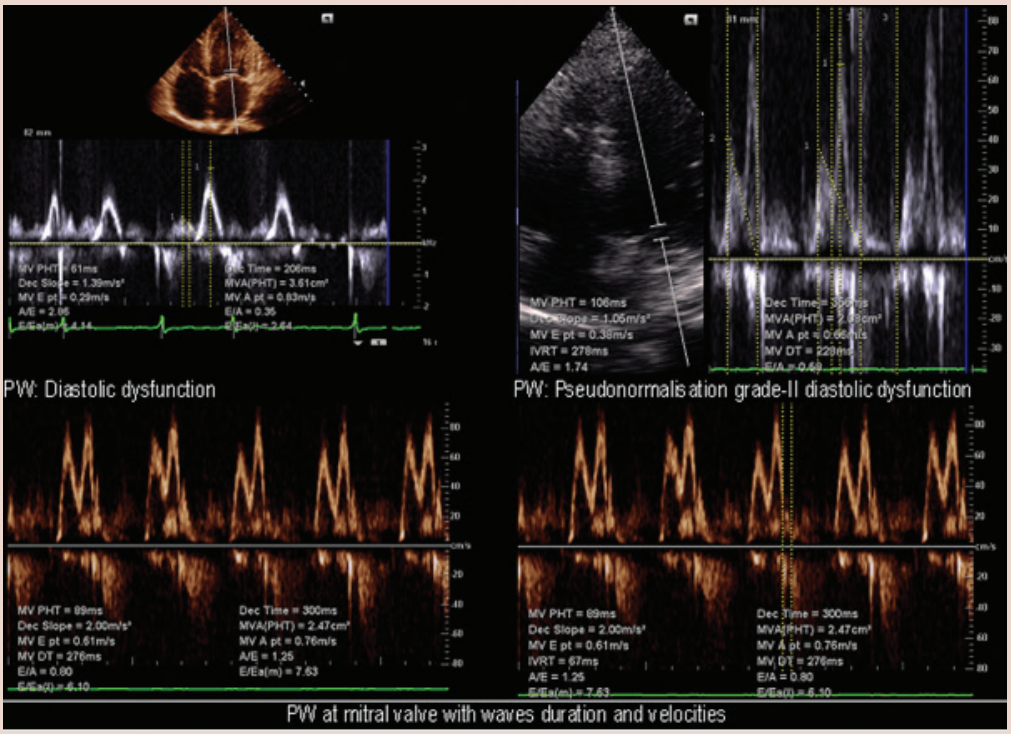


Figure 2: Echocardiography and Doppler study showing parameters of PW in diastolic dysfunction.

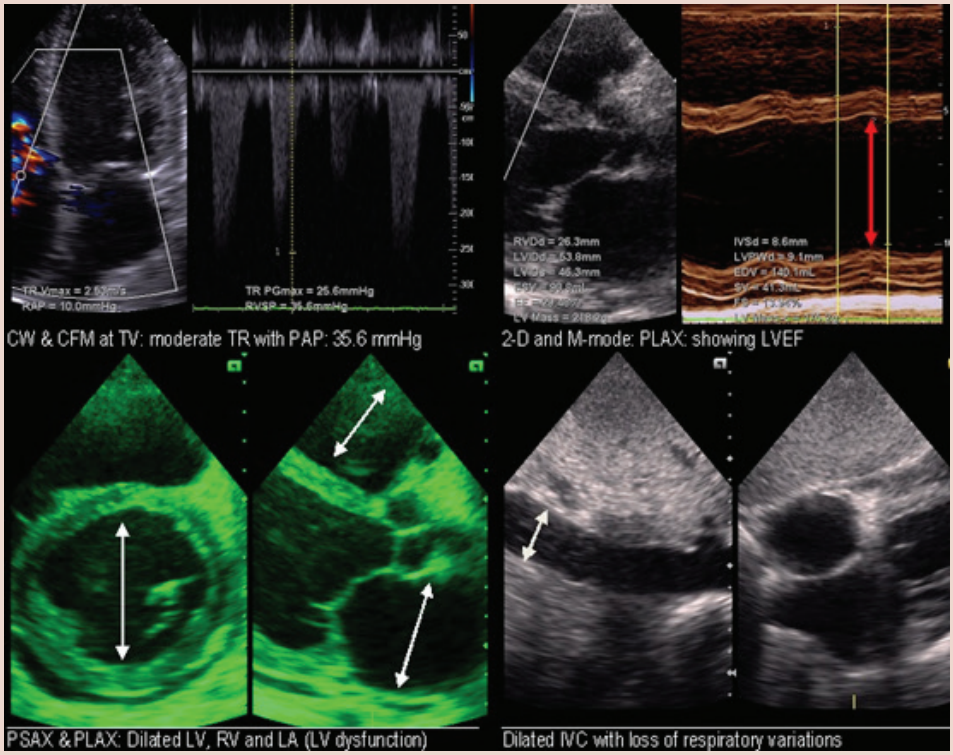
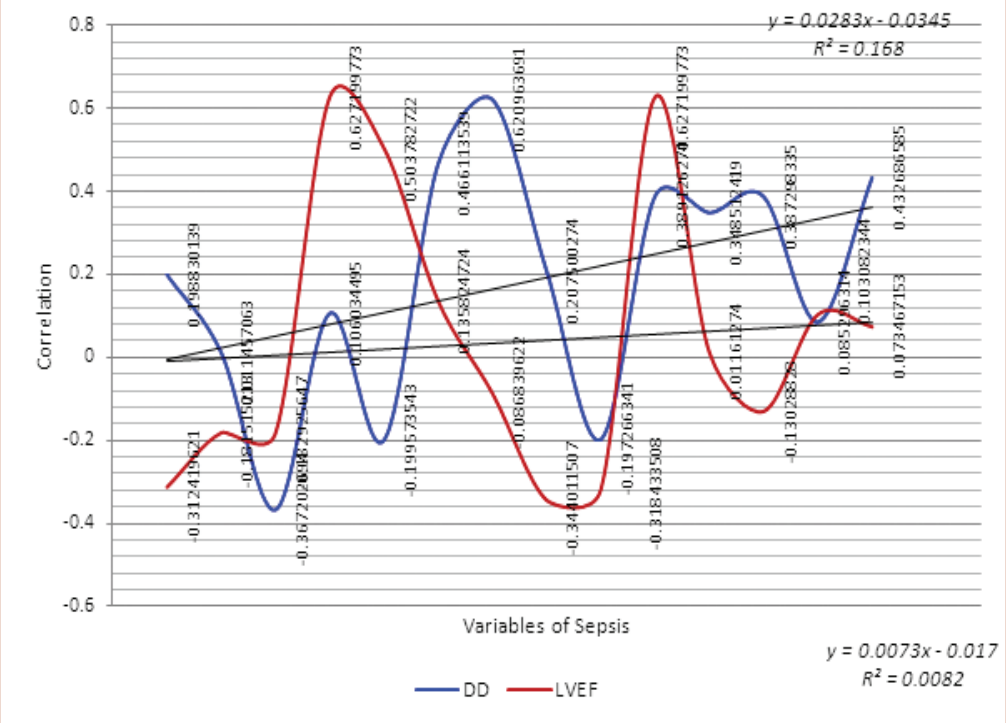
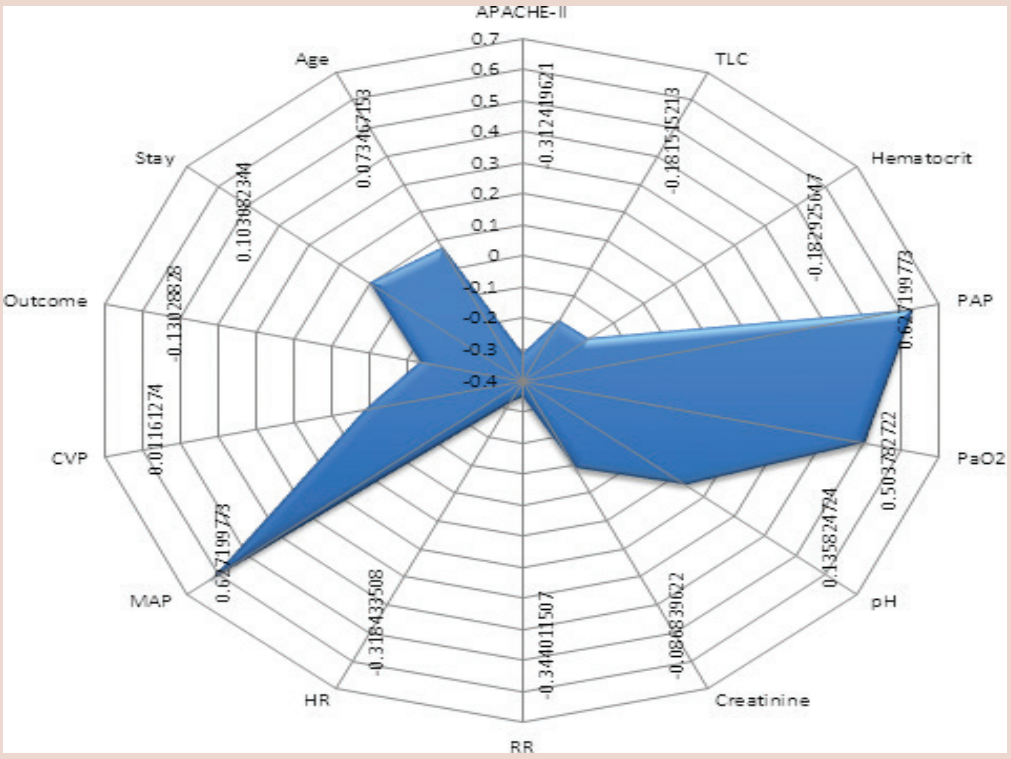


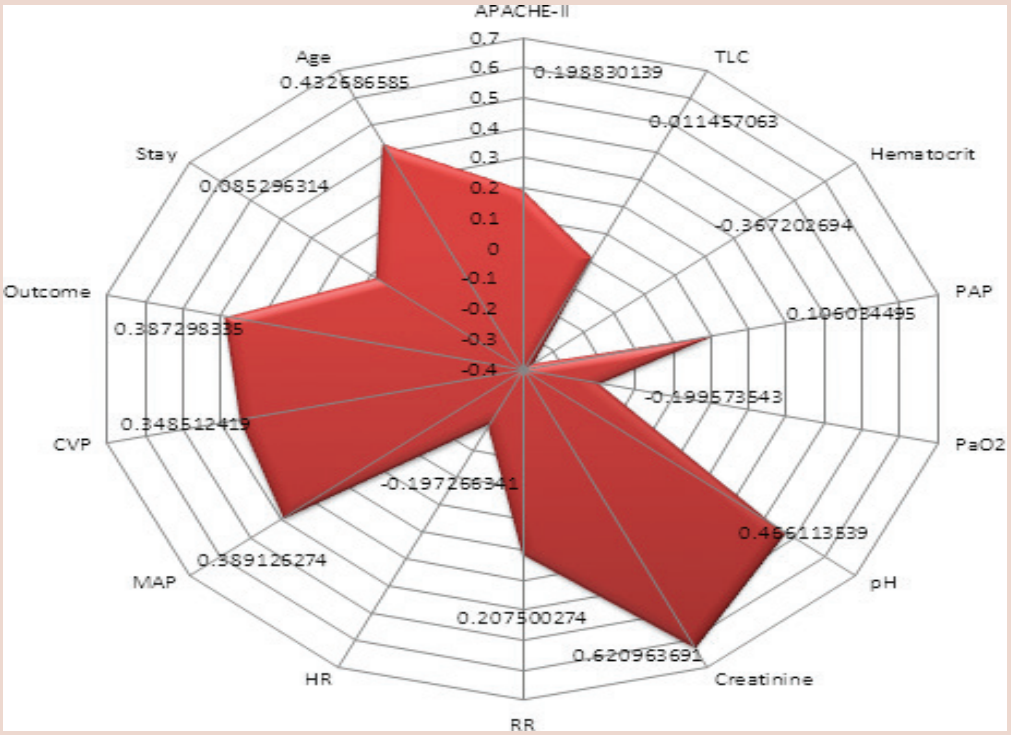
Figure 3: Echocardiography study showing dilated cardiac chambers, LV systolic dysfunction and dilated IVC.



Graph 1: Correlation of diastolic dysfunction and LV ejection fraction to the parameters of sepsis.



Graph 2: Correlation of LV systolic function to variables of septic shock.



Graph 3: Correlation of LV diastolic Dysfunction to variables of septic shock.

Table 1: Mean standard deviation of variable of demographic, sepsis APACHE-II score and echocardiographic parameters

Variable	Mean	SD	Minimum	Maximum
Age	54.37	15.27	53	84
Duration of stay	10.35	9.48	25	40
Temperature	38.35	0.77	39	40
MAP	85.16	14.54	112.2	112.2
HR	115.64	21.16	112	160
CVP	10	3.73	4	6
RR	28.94	6.96	28	44
pH	7.39	0.12	7.44	7.68
PaO2	76.05	13.14	84	95
Na	134.94	6.51	146	146
K	4.017	0.54	4.1	4.9
Creatinine	1.94	1.64	4.2	6.5
Hematocrt	32.55	7.18	29.2	50
TLC	15086.08	7775.68	13000	34000
GCS	11.47	4.73	6	15
Bilirubin	2.16	2.95	1.1	11.9
LVEF	35.70	7.47	20	55
PAP	39	12	36	75
APACHE-II	27.56	6.89	15	42

Table 2: Correlation of diastolic dysfunction and LVEFto the parameters of sepsis

Variables of Sepsis	Diastolic dysfunction [*r*]	LVEF[*r*]
APACHE-II	0.198	-0.312
TLC	0.011	-0.181
Hematocrit	-0.367	-0.182
PAP	0.106	0.627
PaO2	-0.199	0.503
pH	0.466	0.135
Creatinine	0.620	-0.086
RR	0.207	-0.344
HR	-0.197	-0.318
MAP	0.389	0.627
CVP	0.348	0.011
Outcome	0.387	-0.130
Duration Stay	0.085	0.103
Age	0.432	0.073

Table 3: Prevalence of diastolic dysfunction

	Normal D. fun	%	Gr.I	%	Gr.II	%	Total	%
F [death n=6]	0	0	3	50	3	50	6	100
M [death n=9]	0	0	3	33.33	6	66.66	9	100
Survived n=36	9	25	18	50	9	25	36	100
Total [n=51]	9	17.64	24	47.05	18	35.29	51	100

Table 4: Prevalence of survival and death in male and female population

	Survived	%	Death	%
Males	23	71.87	9	28.12
Females	13	68.42	6	31.57
Total	36	71	15	29.41
'p' value	= 0.793529	Insignificant		

Table 5: ANOVA comparison in survived and death population

Variables	F-Death Mean	M-Death Mean	Survived Mean
AGE	41	60.33	55.11
Duration of hospital stay	4.5	12.67	10.75
Temperature	39	38.67	38.16
MAP	66.05	94.7	85.96
HR	126	134	109.33
CVP	7.33	11.56	10.63
RR	37	27.33	28
pH	7.3	7.433	7.39
PaO_2	76.16	77.89	75.58
Na^+	125	138.7	135.66
K^+	4.5	3.867	3.97
Creatinine	3.6	3.8	1.20
Hematocrit	27.5	31	33.79
TLC	4991.66	14740	16855
GCS	4	5.333	14.25
Bilirubin	3.85	4.433	1.31
LVEF	34.33	39.11	35.083
PAP	42.16	38.56	39.02
APACHE II	33.66	32.78	25.25

Table 6: Comparison of diastolic dysfunction between survived and death population

	Normal D. fun	Gr. 1	Gr. 2	Total	
F (death n=6)	0	3	3	6	Chi-Square: 8.1458; DF:4
M (death n=9)	0	3	6	9	P-value: 0.0864
N (survived=36)	9	18	9	36	
Total	9	24	18	51	
	Normal D. fun	**Gr. 1**	**Gr. 2**	**Total**	
Death (n=15)	0	6	9	15	Chi-Square: 7.6500; DF:2
Survived (n=36)	9	18	9	36	P-value: 0.0218
Total (n=51)	9	24	18	51	
	Normal D. fun	**DD**	**Total**		
Death (n=15)	0	15	15		Chi-Square: 5.349; DF: 1;
Survived (n=36)	9	27	36		P-value: 0.0329
Total (n=51)	9	42	51		

Table 7: Comparison of LV systolic function between survived and death population

	Normal LVEF	LVEF<50%	Total	
F (death n=6)	1	5	6	Chi-Square: 8.1458; DF:4 P-value: 0.0864
M (death n=9)	1	8	9	
N (survived=36)	11	25	36	
Total	13	38	51	
	Normal LVEF	**LVEF<50%**	**Total**	
Death (n=15)	2	13	15	Chi-Square: 7.6500; DF: P-value:0.0218
Survived (n=36)	11	25	36	
Total (n=51)	13	38	51	

Table 8: Comparison of various studies with present study

Author	Findings	Conclusions
Jardin F et al (n= 90)	Defective LV preload with worsen despite fluid loading (62%).	Depressed LV systolic function at the initial phase of septic shock
Samuel M B et al (n=78)	Total 61.8% patients had diastolic dysfunction and mortality was 16.5%	Grade I diastolic dysfunction was associated with increased mortality
Landesberg G et al (n=262)	Mortality 36%. Patients with systolic and or diastolic dysfunction (e′-wave,8 cm/s), had higher mortality	Diastolic dysfunction and Reduced e′-wave was the strongest predictor of mortality in septic shock
Ashraf A et al (n=36)	Systolic function (LVEF) was impaired in septic shock patients, compared with SIRS group	High prevalence of type 2 diastolic dysfunction in patients with septic shock and type 1 DD in SIRS
Sevilla Berrios RA et al meta-analysis. (n=585)	The overall mortality diagnostic odd ratio for septic patients with LV systolic dysfunction was 1.92	Presence of LV systolic dysfunction with sepsis was neither a sensitive nor a specific predictor of mortality
Sam R Orde *et al.*	Speckle tracking echocardiography (STE) may unmask systolic dysfunction not seen with conventional echocardiography	RV dysfunction by STE, was associated with high mortality in patients with severe sepsis or septic shock
Pulido JN et al prospective study. (n=106)	DD was present in 37% patients, LV systolic dysfunction in 27%, and RV dysfunction in 31%. Mortality rates of 36% and 57%	LV diastolic, LV systolic, and RV dysfunction is important for tailoring specific therapy in patients with severe sepsis or septic shock
Landesberg G et al (n=225)	e'-wave predicted in-hospital mortality, independent of APACHE-II score with mortality of 39%	LV diastolic and RV systolic dysfunction associated with mortality in severe sepsis and septic shock
Landesberg G et al (n=105)	Diastolic dysfunction (e′-wave < 8 cm/s) or E/e'-ratio were found in 50%, and 25% patients, respectively. APACHE II scores predicted mortality 42%	NT-proBNP strongly correlated with both reduced LVEF and reduced e′-wave velocity, hs-troponin-T correlated with reduced e′-wave
Lina De Geer et al[19] (n=47)	Decreased é, increased E/é, decreased LVEF and decreased LV global longitudinal peak strain (GLPS)	GLPS is the most reproducible echocardiographic measurement of LV function in septic shock
Lina De Geer et al (n=50)[21]	Strong correlation GLPS to LVEF and mitral annular motion velocity (é)	GLPS is frequently reduced in septic shock patients, reduced LVEF and/or é
Present study	About 80% subjects and 70% of subjects with sepsis and septic shock had diastolic dysfunction and systolic dysfunction respectively. Various parameters of echocardiography were well correlated with APACHE-II score and other parameters	Diastolic dysfunction was the common echocardiographic finding and predictor of mortality in severe sepsis and septic shock

isolated and reversible impairment of left ventricle relaxation, associated with transient increase in troponin-I and inflammatory markers, while another identified diastolic dysfunction as an independent predictor of mortality.[6] Predictors of outcome in critical care are well described and they include clinical, diagnostic, and physiologic variables The acute physiology and chronic health evaluation II (APACHE II) scoring system is commonly used in the intensive care population to prognosticate outcome, in intensive care units. Transthoracic echocardiography (TTE) is a widely recognized non invasive clinical tool in the assessment of patients with cardiovascular disease. TTE diagnostic variables have been shown to be predictive of mortality in non-critical care cardiovascular patients with diastolic dysfunction.[11] *Landesberg* G *et al* (2015) Studied 105 patients with sepsis and found that, N-terminal pro-B-type natriuretic peptide (NT-pro BNP) strongly correlated with both reduced LVEF and reduced e′-wave velocity, and hs-troponin-T correlated mainly with reduced e'-wave with severe sepsis and septic shock. In present study because of resource limitations we have not included cytokines and biomarkers, but there was strong correlation between diastolic dysfunction and mortality in patients with septic shock.[12] Systolic dysfunction in septic shock is well recognized and, paradoxically, predicts better outcome. *Landesberg*

G et al (2012) in their cohort of 262 patients with severe sepsis or septic shock found that, reduced e'-wave was the strongest predictor of mortality. Patients with systolic dysfunction only (LVEF: ≤50%), diastolic dysfunction only (e'-wave <8 cm/s), or combined had higher mortality. Diastolic dysfunction is common and is a major predictor of mortality in severe sepsis and septic shock with 36% mortality; these findings are comparable with our study.[6] In our study significant number of patient had diastolic dysfunction (100%) those who succumbed compared to survived (75%) ['p'-value: 0.0329]. In present cohort of patient with septic shock APACHE-II score had positive correlation with Diastolic dysfunction (*r* =0.198) negative PaO_2 had negative correlation with DD [-0.199]. *Sevilla Berrios RA et al* (2014) conducted a systematic review and meta-analysis to evaluate the prognostic functionality of newly diagnosed LV systolic dysfunction in patients with severe sepsis or septic shock, similar to our findings.[13] In present study significant proportion of patients with sepsis had LV systolic dysfunction [mean LVEF: 35.70588% (±7.47608)] and LVEF was negatively correlated with APACHE-II score (-0.312), these findings are in agreement with previous studies. *Pulido JN et al* studied 106 patients with severe sepsis or septic shock. Left ventricular diastolic dysfunction was present in 37% patients, LV systolic dysfunction in 27%, and RV dysfunction in 31%). The 30-day and 1-year mortality rates were 36% and 57%, respectively. Myocardial dysfunction is frequent in patients with severe sepsis or septic shock.[14] In present study 46 (98.19%) patients had LVEF < 50% and only 5(9.80%) patients had LVEF ≥50% with more than three fourth had LV diastolic dysfunction. In present study the mean LVEF was 35.70% (±7.47) with about more than three fourth of population had diastolic dysfunction. *Jardin Fet al* quoted similar findings in their cohort of 90 septic patients with confirmed defective LV preload and results are in agreement with depressed LV systolic function.[15] Myocardial dysfunction, which is characterized by transient biventricular impairment of intrinsic myocardial contractility, is a common complication in patients with sepsis. In present study LV systolic and diastolic dysfunction were correlated with high mortality and poor outcome. Similarly *Maeder M et al* stated that, early recognition of myocardial dysfunction is crucial for the administration of the most appropriate therapy. The elevation of cardiac troponin levels in patients with sepsis, severe sepsis, or septic shock has been shown to indicate left ventricular dysfunction and a poor prognosis.[16] In present cohort of patient with septic shock, APACHE-II score had positive correlation with Diastolic dysfunction (*r* =0.198) and negative correlation with LVEF (-0.312). Similar findings were quoted by *Landesberg Get al* (2014)in their 225 patients with sepsis. Left ventricular diastolic dysfunction and right ventricular dilatation correlated with concomitant high-sensitivity troponin-T concentrations. Left ventricular diastolic and right ventricular systolic dysfunction seem associated with troponin with mortality in severe sepsis and septic shock.[17] The present study highlighted significant proportion of patient with diastolic and systolic dysfunction with correlation with outcome of patients with sepsis and septic shock. Similarly *Ashraf A. Omar et al* (2012) observed that, LVESD and LVEDD are significantly increased in septic shock patients compared to patients with SIRS; while EF shows the reverse. Patients with SIRS showed mild diastolic dysfunction compared to severe form of diastolic dysfunction with septic shock.[18] In present cohort of patient with septic shock APACHE-II score had positive correlation with Diastolic dysfunction (*r* =0.198830139) and negative correlation with LVEF (-0.312). PaO_2 had negative correlation with DD [-0.199] and positive correlation with LVEF (0.503). Serum creatinine level had positive correlation with DD (0.620) and negative correlation with LVEF (-0.086). Mortality had positive correlation with DD (0.387) and negative correlation with LVEF (-0.130). Similarly *Lina De Geer et al* (2015)quoted that, the LVEF and/or é were frequently reduced, alone or in combination, decreased diastolic tissue velocity of the base of the LV septum (é), increased early mitral inflow (E) to é ratio (E/é), decreased LV ejection fraction (EF) in septic shock patients.[19] *Sam R Orde et al* (2014) stated that, Cardiac dysfunction was associated with high mortality in patients with severe sepsis or septic shock.[20] LV dysfunction was not associated with survival outcomes, similarly in present study mean LVEF in both genders in death and survived group in cohort of septic shock were statistically insignificant.

CONCLUSION

Diastolic dysfunction was the common echo cardiographic finding in present study and predictor of mortality in severe sepsis and septic shock in present study. Total more than 80% subjects and more than 70% of subjects with sepsis and septic shock had diastolic dysfunction and systolic dysfunction respectively. Echocardiography is being a non invasive, feasible, reliable and reproducible tool, the goal-oriented echocardiography may help in the form of fluid or inotropic support in patients with severe sepsis and septic shock. Echo cardiographic parameters were well correlated with APACHE-II score and other parameters of septic shock in present cohort. Echocardiography can be used as an ideal monitoring tool in the septic patient, as it allows, differential diagnosis of shock and early recognition of sepsis-related myocardial dysfunction, detect pre existing cardiac pathology; comprehensive hemodynamic monitoring helps in septic shock management, integration with other monitoring devices; and last but not least it allow screening for cardiac source of sepsis. Present study favours routine use of echocardiography as an indispensible, non invasive bedside tool for the management of patients with severe sepsis and septic shock.

ACKNOWLEDGEMENT

We would thank to residents, hospital staff for their sincere care and support in managing patients. We would like to thank our principal advisor, research director, medical director for helping out and encouraging us to conduct this study.

CONFLICT OF INTEREST

The author declare no conflict of interest.

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Cite this article : Patil VC, Patil HV, Rajput A, Rao SS, Shetye JN. Relation of Echocardiographic Parameters to Outcome of Patients with Severe Sepsis and Septic Shock. J Cardiovasc Disease Res., 2017;8(1):6-15.