ORIGINAL RESEARCH PAPER

Critical Care Medicine

A STUDY ON SEPSIS-INDUCED CARDIAC DYSFUNCTION IN PATIENTS ADMITTED TO INTENSIVE CARE UNIT OF A TERTIARY CARE HOSPITAL

KEY WORDS: Sepsis, Sepsis-Induced Cardiac Dysfunction, Echocardiography, SOFA Score

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ABSTRACT

Background: Sepsis-induced cardiac dysfunction is a common but under-recognized complication of sepsis. **Objectives:** To study nature and severity of cardiac dysfunction in patient of sepsis and septic shock according to their disease severity **Methods:** This cross-sectional observational study included 100 adult patients with sepsis admitted to a tertiary care ICU. **Results:** Left ventricular systolic dysfunction was observed in 38% of patients, diastolic dysfunction in 36%, combined systolic-diastolic dysfunction in 13%, and right ventricular dysfunction in 14%. Systolic dysfunction was significantly associated with higher SOFA score (p=0.028) and vasopressor requirement (p=0.004). Diastolic dysfunction was also associated with higher SOFA score (p=0.024) and vasopressor use (p=0.006). Right ventricular dysfunction correlated significantly with both disease severity and vasopressor requirement (p=0.010). Elevated NT-proBNP, positive troponin, bilateral B-lines, and pleural effusion were frequently observed in patients with cardiac dysfunction. **Conclusion:** Sepsis induced cardiac dysfunction is highly prevalent among critically ill septic patients and is strongly associated with greater disease severity and circulatory failure.

INTRODUCTION

Sepsis is a life-threatening syndrome characterized by dysregulated host responses to infection, resulting in acute organ dysfunction and substantial mortality worldwide(1). Sepsis-induced myocardial dysfunction, also known as septic cardiomyopathy, is a common complication in septic patients and is associated with increased mortality(2).It is characterized by (i) left ventricular (LV) dilatation with normal or low filling pressure, (ii) right and/or LV (systolic and/or diastolic) dysfunction and (iii) reversibility(3) . The underlying mechanisms include inflammatory cytokine release, mitochondrial dysfunction, endothelial injury, autonomic dysregulation, and impaired calcium homeostasis, ultimately leading to myocardial depression(4).

Echocardiography has become the cornerstone for diagnosing Sepsis induced cardiac dysfunction because it provides rapid bedside assessment of ventricular structure and function. Cardiac biomarkers such as NT-proBNP and cardiac troponins reflect myocardial stress and injury(5,6), whereas lung ultrasound findings, including B-lines and pleural effusion, provide additional information regarding pulmonary congestion and fluid status(7) and associated with increased mortality, mechanical ventilation, and prolonged hospital stay in septic patients (8) .

However, the true burden and pattern of cardiac dysfunction in septic patients remain under-recognized in routine clinical practice, particularly in resource-limited settings ,and Individualized work-up and management of these patients is crucial to improving outcome(9).

Inclusion Criteria

Patients admitted with sepsis, age more than 12 years.

Exclusion Criteria

a) Patients with pre existing heart disease e.g.Ischemic heart disease (IHD),Dilated cardiomyopathy (DCM), Valvular heart disease (VHD) etc. where preexisting LV±RV dysfunction present
b) Patients with long standing T2 Diabetes Mellitus where cardiac dysfunction may be present.
c) Chronic kidney disease (CKD)
d) Chronic alcoholic
e) Chronic liver disease(CLD)
f) Chronic obstructive pulmonary disease / Asthma
g) Pregnant women

RESULT

Table 1 show distribution of patients according to different categories of systolic dysfunction , diastolic dysfunction and combined cases.

Table 1

LV Function	Number of Cases (%)
LV Systolic Dysfunction	38
LV Diastolic Dysfunction	36
Combined Dysfunction	13
Normal LV Function	26

Table 2 show distribution of study patients according to RV size and RV function.

Table 2

RV size	RV dysfunction Present n=14	RV dysfunction absent n=86	Remark
Dilated n=24	12	12	p value
Normal n=76	2	74	<0.0001

Table 3 show distribution of different grade of systolic and diastolic function in study patients.

Table 3

LVEF	Normal diastolic function n=64	Gr-I DD n=18	Gr-II DD n=6	Gr-III DD n=12	Remark
≥50% n= 62	52	10	0	0	p-value
41-49% n=8	4	0	4	0	
≤40% n=30	8	8	2	12	<0.0001

Table 4 show distribution of study patients according to different grade of cardiac function with SOFA score .

Table 4

Cardiac parameter	Category	SOFA ≥ 10	SOFA < 10	Remark
LV systolic function	≥50%	22	40	p value

	41-49%	4	4	
	≤40%	18	12	0.028
LV diastolic function	Normal	20	44	p value
	Gr-I DD	10	8	
	Gr-II DD	6	0	0.024
	Gr-IIIDD	8	4	
RV function	RV dysfunction present	10	4	p value
	RV dysfunction absent	30	56	0.010

Table 5 show distribution of study patients according to different grade of cardiac function with or without vasopressor support.

Table 5

Cardiac parameter	Category	Vasopressor support Yes	Vasopressor support No	Remark
LV systolic function	≥50%	18	44	p value
	41-49%	4	4	
	≤40%	18	12	0.004
LV diastolic function	Normal	18	46	p value
	Gr-I DD	8	10	
	Gr-II DD	4	2	0.006
	Gr-IIIDD	10	2	
RV function	RV dysfunction present	10	4	p value
	RV dysfunction absent	30	56	0.010

Table 6 show distribution of study patients according to B-lines with Systolic and Diastolic Dysfunction

Table 6

B-lines	Systolic dysfunction present	Systolic dysfunction absent	Remark
Present	28	22	p value
Abent	10	40	0.0046
	Diastolic dysfunction present	Diastolic dysfunction absent	
Present	24	26	p value
Absent	12	38	0.0219

DISCUSSION

A total of 100 patients with sepsis were evaluated using echocardiographic parameters, biochemical markers, and clinical severity scores.Left ventricular systolic dysfunction was observed in 38% of patients, while diastolic dysfunction was present in 36%; 13% exhibited combined systolic and diastolic dysfunction. Right ventricular dysfunction was identified in 14% of patients. These findings are consistent with previous reports demonstrating that myocardial dysfunction affects approximately 40 60% of patients with severe sepsis and septic shock(10,11).

A significant association was found between LV systolic dysfunction and higher SOFA score (p=0.028), diastolic dysfunction and higher SOFA score (p=0.024), and RV dysfunction and higher SOFA score (p=0.010). Similarly, systolic dysfunction (p=0.004), diastolic dysfunction (p=0.006), and RV dysfunction (p=0.010) were significantly associated with vasopressor requirement, indicating that cardiac dysfunction parallels increasing severity of illness.

Reduced LVEF showed a highly significant association with worsening grades of diastolic dysfunction (p<0.0001), suggesting that Sepsis induced cardiac dysfunction represents a global myocardial process involving both systolic and diastolic impairment(10). RV dilatation was also strongly associated with RV dysfunction (p<0.0001).

Biochemical markers supported the presence of myocardial injury, with elevated NT-proBNP levels in the majority of patients and positive troponin I/T in 56%. Lung ultrasound demonstrated bilateral B-lines in 44% of patients and pleural effusion in 38%, with B-lines showing significant associations with both systolic and diastolic dysfunction.

Our study demonstrated several structural and functional abnormalities like LV dilatation (LVIDs >37 mm) in18% ,Reduced stroke volume (<60 ml) in 30% ,Wall motion abnormalities in 44% (global hypokinesia 26%, RWMA 18%), RV dilatation in 24% cases.These findings support the classical description of septic cardiomyopathy by Parker et al.(1984) involving ventricular dilatation and reduced contractility (12).

CONCLUSION

Sepsis-induced cardiac dysfunction is a frequent and clinically significant complication of sepsis, encompassing left ventricular systolic dysfunction, diastolic dysfunction, and right ventricular dysfunction. The present study demonstrates that these abnormalities are strongly associated with increased disease severity, higher SOFA scores, and greater vasopressor requirements, highlighting their importance as markers of adverse clinical status.

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