A Study of Clinical and Laboratory Profile in Septicemic Patients in Tertiary Care Hospital

Mohit Singla[1], Harbir Kaur Rao[2], Udit Narang[2], Ritu Garg[3], Siddharth Sharma[4], Navdeep Yadav[5]

[1]Assistant Professor, Department of General Medicine, Maharishi Markandeshwar Institute of Medical Sciences and Research (MMIMSR), Mullana, India

[2]Professor, Department of General Medicine, MMIMSR, Mullana, India

[3]Associate Professor, Department of Microbiology, MMIMSR, Mullana, India

[4]Senior Resident, Department of General Medicine, MMCH, Solan

[5]Junior Resident, Department of General Medicine, MMIMSR, Mullana, India

Corresponding Author: Dr. Siddharth Sharma, Senior Resident, Department of General Medicine, MMCH, Solan

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Abstract

Introduction: Sepsis is the most frequently encountered medical condition in the intensive care setting and the most common cause of death among hospitalized patients in non-cardiac intensive care units (ICUs), which is preventable through early evaluation of patient.

Objective: We evaluated the clinical profile, laboratory parameters and underlying risk factors associated with mortality in septicemic patients.

Material and Methods: The study was conducted at Medical Intensive Care Unit (ICU) in a tertiary care hospital in North India. A total of hundred consecutive septicemic patients admitted to the ICU were enrolled in this study. Patients were evaluated for clinical profile, laboratory parameters, APACHE II score, underlying risk factors and all cause mortality.

Results: In our study population, 56 were males and 44 were females. 64% patients were infected with gram-negative and 36% were infected with gram-positive bacteria. In the study subjects, there were 58% mortality cases and 42% responded to treatment. In our study, liver illness was the most common medical illness (32%) followed by renal illness (30%). The abdominal system was involved as a primary system in 38% of the subjects whereas the respiratory and cardiovascular system was involved in 18% and 8% of the subjects respectively. Maximum mortality (85.71%) was seen in the age group of 41-50 years. Patients with APACHE-II score >65 shows 100% mortality whereas no mortality was seen in patients with APACHE-II score <44 (p<0.001). In this study, 71.88% mortality was seen in patients with gram-negative bacterial infection and 33.33% in gram-positive bacterial infection (p<0.008). In the present study, similar mortalities were observed in the respiratory, cardiovascular and abdominal system i.e. 77.78% (14/18), 75% (6/8) and 78.95% (30/38), respectively. Higher mortality was recorded in patients with hepatic (81.25%) and renal (73.33%) illnesses.

Conclusion: The study showed that in our critical care setting, abdominal system was the most common system involved in septicemic patients. Maximum mortality was

seen in patients with hepatic and renal involvement. APACHE II score helped in identifying the patients with high risk of mortality. So the early evaluation of patient and selection of organ specific appropriate antibiotic therapy with best supportive care can reduce the mortality in the septicemic patients.

Keywords: Sepsis, Septicemia, ICU, Mortality, APACHE II score

Introduction

Sepsis is a clinical syndrome, due to some systemic infection.[1] Severe sepsis is induced by severe infection, in presence of hypoperfusion to tissue or else organ dysfunction, the shock is seen even after fluid resuscitation in sepsis.[2] The response of the host is required to curtail the infection but it is because of septic shock from Gram-negative bacteria, that encouraged physicians to study the pathophysiology of the sepsis.[3] Patient response to sepsis is dependent on the characteristics of both the host (co-morbidities and immune-suppression) and the pathogen (virulence and organism load). Vasodilation and hypotension lead to tissue hypoperfusion and decreased tissue oxygenation leading to organ failure.[2] The key clinical manifestations of sepsis are not caused directly by the invading pathogens; rather, the hypotension, coagulopathy, and multisystem organ dysfunction that characterize severe sepsis are predominant factors which result in deregulation of host-derived mediators of inflammation.[4] Sepsis is the most common cause of death among hospitalized patients in non-cardiac intensive care units (ICUs) and has instigated a lot of preclinical and clinical research in the field of sepsis. Despite continuous advances in intensive care medicine, severe sepsis and septic shock are currently one of the most common causes of morbidity and mortality in intensive care units.[5] Most

of the available data related to the incidence and outcome of sepsis are from Western countries. In contrast to Western countries where Gram-negative sepsis is the predominant cause of sepsis, tropical infections like dengue, malaria, leptospirosis, enteric fever and tuberculosis are also important causes of severe sepsis/septic shock in India. The reported mortality of severe sepsis is over 50%.[6,7] Sepsis is the most frequently encountered medical condition in the intensive care setting.[8] Patients with sepsis often present with variable clinical parameters and their laboratory parameters also differ. These variations are not only age-specific but previous studies have shown variation in presentation of septicemic patients based on gender, geography, medical condition and even systemic involvement.[9] So this study was planned to study the association of clinical and other laboratory findings in septicemic patients.

Material and Methods

The study was conducted at Medical Intensive Care Unit (ICU) at a tertiary care hospital in north India after due approval from the institutional ethical committee. Sepsis (or severe sepsis) is hypofunction of uninfected organs in response to proven or strongly suspected infectious etiology.[10] All patients with suspected diagnosis of septicemia as per the following clinical criteria were screened and 100 consecutive patients admitted in ICU with positive gram staining were enrolled in the study. Sepsis (or severe sepsis) was defined on the basis of following criteria:

- Cardiovascular: Arterial systolic blood pressure ≤90 mmHg or mean arterial pressure ≤70 mmHg that responds to administration of IV fluids

- Renal: Urine output <0.5 ml/kg per hour for 1 h despite adequate fluid resuscitation

- Respiratory: PaO_2/FiO_2 ≤250 or, if the lung is only dysfunctional organ, ≤200

- Hematologic: Platelet count <80,000/µl or 50% decrease in platelet count from the highest value recorded over previous 3 days

- Unexplained metabolic acidosis: A pH ≤7.30 or base deficit ≥5.0 mEq/L and a plasma lactate level >1.5 times upper limit of normal for reporting lab.[10]

Every subject was informed about the study and a written consent was taken from the subjects. Pregnant patients, unwilling patients, subjects with age less than 18 years and those admitted with history of trauma were excluded. Diabetes Mellitus, Hypertension, Chronic Kidney Disease (CKD), Chronic Liver Disease (CLD) and any immuno-compromised status were considered as risk factors for septicemia. For all the included patients, clinical history, examination data was recorded and the patients were subjected to following investigations at time of admission: Random Blood Sugar (mg/dl), Erythrocyte Sedimentation Rate (mm/hr), Serum Creatinine (mg/dl), Serum Sodium (mmol/L), Serum Pottasium (mmol/L), Serum Bilirubin (mg/dl), Hemoglobin (g/dl), TLC (cells/cumm), Platelet Count (lakhs/cumm), PT/INR (Prothrombin Time/ International Normalized Ratio), Blood for Gram Stain, pH and serum bicarbonate levels. Based on the presenting complaints (History), patients were categorized into no localizable organ involvement and specific organ involvement (Hepatic, Cardiovascular (CVS), Respiratory, Renal and Immuno-compromised). On the basis of physical examination patients were categorized into Respiratory, Abdomen, CVS, Central Nervous System (CNS) and others. APACHE II score was calculated at the time of admission and required investigations for the same were sent. All cause mortality of the enrolled patients was noted.

Results

We studied a total number of 100 patients admitted in ICU. The mean age was 44.42 years and standard deviation (SD) was ±17.52 years. Out of 100 patients studied, 56 were males and 44 were females. The overall mortality in the study population was 58%. 64% cases presented with gram negative sepsis where as 36% had gram-positive infections as per gram staining done from isolates obtained from the growth in blood culture. In a total of 100 patients, 30 patients resided in a APACHE II score ranging from 55-64, 10 patients had a score of >75 whereas score of <54 was observed in 40 patients. On the basis of clinical history, hepatic involvement accounted for 32% of the cases followed by renal involvement in 30% of subjects. Cardiovascular and respiratory involvement was seen in 8% and 22% of the study subjects respectively. Whereas on physical examination, the abdomen system was involved in 38% patients as compared to respiratory and cardiovascular system, which showed involvement in 18% and 8% cases respectively (Table-1). In the present study, maximum mortality (85.71%) was seen in the age group of 41-50 years whereas majority of younger subjects (71.43%) i.e. less than 20 years of age survived. 71.88% mortality was seen in patients with gram-negative bacterial infection and 33.33% in gram-positive bacterial infection (p<0.008). Patients with APACHE-II score >65 shows 100% mortality, 93.33% mortality with a score ranging between 55-64 whereas no mortality was seen in patients with APACHE-II score ≤54 (p <0.001). Higher mortality was recorded in patients presented with history of hepatic (81.25%) and renal (73.33%) illnesses. Almost similar mortalities were observed in the respiratory, cardiovascular and abdominal system i.e. 77.78% (14/18), 75% (6/8) and 78.95% (30/38) respectively (Table-2). In

this study, multivariate regression analysis showed that with increasing serum creatinine, the risk for mortality increases with p-value equals to 0.03 and odds ratio equals to 1.820. Rest of the parameters failed to show any statistically significant relationship (p >0.05) (Table-3).

Category		Frequency (N=100)	Percentage (%)
Age (years)	< 20	14	14
	21-30	12	12
	31-40	16	16
	41-50	28	28
	51-60	12	12
	61-70	10	10
	71-80	8	8
Sex	Male	56	56
	Female	44	44
Mortality	Mortality	58	58
	Treated	42	42
Gram stain in bacteria	Gram Negative	64	64
	Gram Positive	36	36
Apache-II Score	<44	24	24.00
	45-54	16	16.00
	55-64	30	30.00
	65-74	20	20.00
	>75	10	10.00
Specific organ involvement (on history)	Liver	32	32.00
	CVS	8	8.00
	Respiratory	22	22.00
	Renal	30	30.00
	Immuno-compromised	20	20.00
System involvement (on physical examination)	General	36	36
	Respiratory	18	18
	Per abdomen	38	38
	CVS	8	8
	CNS	0	0
Table-1: Baseline characteristics of study population			

Category		Mortality		Total	P Value
		Mortality	Treated		
Age (years)	≤20	4 (28.57%)	10 (71.43%)	14 (100.00%)	0.127
	21-30	4 (33.33%)	8 (66.67%)	12 (100.00%)	
	31-40	8 (50.00%)	8 (50.00%)	16 (100.00%)	
	41-50	24 (85.71%)	4 (14.29%)	28 (100.00%)	
	51-60	8 (66.67%)	4 (33.33%)	12 (100.00%)	
	61-70	4 (40.00%)	6 (60.00%)	10 (100.00%)	
	71-80	6 (75.00%)	2 (25.00%)	8 (100.00%)	
Gram stain	Negative	46 (71.88%)	18 (28.13%)	64 (100.00%)	0.008
	Positive	12 (33.33%)	24 (66.67%)	36 (100.00%)	
Apache-II Score	<44	0 (0.00%)	24 (100.00%)	24 (100.00%)	<.0001
	45-54	0 (0.00%)	16 (100.00%)	16 (100.00%)	
	55-64	28 (93.33%)	2 (6.67%)	30 (100.00%)	
	65-74	20 (100.00%)	0 (0.00%)	20 (100.00%)	
	>75	10 (100.00%)	0 (0.00%)	10 (100.00%)	
Specific organ involvement (on history)	Liver	26 (81.25%)	6 (18.75%)	32 (100.00%)	0.032
	CVS	4 (50.00%)	4 (50.00%)	8 (100.00%)	1.000
	Respiratory	18 (81.82%)	4 (18.18%)	22 (100.00%)	0.092
	Renal	22 (73.33%)	8 (26.67%)	30 (100.00%)	0.215
	Immunocompromised	18 (90.00%)	2 (10.00%)	20 (100.00%)	0.031
System involvement (on physical examination)	General	10 (26.32%)	26 (73.68%)	36 (100.00%)	0.0004
	Respiratory	14 (77.78%)	4 (22.22%)	18 (100.00%)	0.271
	Per abdomen	30 (78.95%)	8 (21.05%)	38 (100.00%)	0.037
	CVS	6 (75.00%)	2 (25.00%)	8 (100.00%)	0.630
	CNS	0 (0.0%)	0 (0.0%)	0 (0.0%)	
Table-2: Comparison table between survivors and non-survivors					

	B	S.E.	P-value	Odds ratio
Temperature	.137	.218	.529	1.147
SBP	-.009	.011	.419	0.991
DBP	-.014	.020	.485	0.986
HR	.018	.020	.355	1.018
RR	.028	.049	.568	1.029
RBS	.010	.007	.132	1.010
Hb	-.217	.124	.081	0.805
ESR	.011	.011	.327	1.011
Na	.130	.068	.055	1.139
K	.812	.546	.137	2.253
HCo$_3$	.004	.081	.961	1.004
Serum Bilirubin	.784	.362	.030	2.190
WBC	.000	.000	.319	1.000
Ph	-.258	2.409	.915	0.773
Serum Creatinine	.599	.286	.036	1.820
Table-3: Multivariate regression analysis of the study population				

Discussion

Septicemia is one of the leading causes of death in India.[7] The present study was aimed to study the clinical profile and laboratory parameters in septicemic patients and the underlying risk factors associated with mortality. In our study, the patients' age ranged from 18 to 80 years. Majority of them (28%) were in between age group 41-50 years. Only 8% of the subjects were above 70 years of age. Mean age among the study population was 44.42 ± 17.52 years. In Dash et al[11] study in 2018, they found the mean age for sepsis was 38 years and the maximum mortality was seen in 56-65 years of age. Martin et al[12] also noted that the elderly were 26% more likely to die during the first week of hospitalization for sepsis than their younger counterparts. In our study population,

maximum mortality 85.71% (24/28) was seen in the age group of 41-50 years. This finding of our study was contradictory to what was reported in majority of other studies. We contemplate this to increase prevalence of alcoholic liver disease in younger age group in north Indian populations as evident in our study too, from hepatic involvement in majority of patients in our study population. For patients above 60 years of age, mortality was seen in 64.28% (18/28) of patients in our study. Nasa et al[13] have shown that the elderly are predisposed to sepsis due to co-existing co-morbidities, repeated and prolonged hospitalizations, reduced immunity, functional limitations and above all due to the effects of ageing itself. Age itself is an independent risk factor for death in patients with severe sepsis, however, many patients

respond well to timely and appropriate interventions. In the present study Gram negative infection was seen in 64% of subjects where as 36% had gram positive infections. Chatterjee et al[7] in 2017 also showed similar finding of 73% gram negative infections in their cohort of 172 patients. Comparing the mortality on the basis of type of sepsis, higher mortality was seen with gram-negative bacterial infections (71.88%) as compared to gram positive infections (33.33%). 100% mortality was seen in patients with APACHE II Score of ≥65. Similar findings were reported by Bo et al[14] mentioning, a higher APACHE II was associated with higher mortality. The abdominal system was involved as a primary system in 38% of the subjects which was more as compared to other systems in the present study. However, Vincent et al[15] reported respiratory system to be the commonest system involved followed by abdomen but according to Dash et al[11] cardiovascular system was more involved in severe sepsis. In our study, higher mortality was recorded in patients with hepatic (81.25%) and renal (73.33%) involvement. However, Ullah et al[16] in his study observed that, the patients having respiratory and urinary tract infection were least likely to survive. The limitation of the our study were small sample size, no blinding of the investigator, data regarding the source of infection was not accounted for and data regarding the exact type of micro-organisms was not collected. However, this study can be considered as a pilot study to design a better study on larger group of sample size, as many findings were not similar to what has been reported in other similar studies conducted in India.

Conclusion

The study showed that in our critical care setting, abdominal system was the most common system involved in septicemic patients. Maximum mortality was seen in patients with hepatic and renal involvement. APACHE II score helped in identifying the patients with high risk of mortality. So the early evaluation of patient and selection of organ specific appropriate antibiotic therapy with best supportive care can reduce the mortality in the septicemic patients.

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