Original article:

A study of spectrum of sepsis in ICU

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ABSTRACT

Introduction: Although sepsis is one of the leading causes of mortality in hospitalized patients, information regarding early predictive factors for mortality and morbidity is limited.

Materials and Methods: Patients fulfilling the Surviving Sepsis Campaign-2018 guidelines criteria for sepsis within the Intensive care unit (ICU) were included over two years apart from baseline hematological, biochemical and metabolic parameters, Acute Physiology and Chronic Health Evaluation II (APACHE II), Simplified Acute Physiology Score II (SAPS II), and Sequential Organ Function Assessment (SOFA) scores were calculated on day 1 of admission. Patients were followed till death or discharge from the ICU.

Results: One hundred patients were enrolled during the study period (67%males).The overall mortality was 35%, (68.6% in males, 31.4% in females.) Mortality was 88.6% and 11.4% in patients with septic shock and severe sepsis, and none expired in the sepsis group, respectively. Patients who died were younger than the survivors (mean age, 43.74±17.50 years and 48.95±14.30 years respectively, P-value=0.112). Non-survivors had higher APACHE II, SAPS II, and SOFA scores. Requirement of mechanical ventilation had worse outcome with p-value of <0.001.

Conclusion: All three scores performed well in predicting the mortality. Overall, APACHE II had highest sensitivity hence was the best predictor of mortality in critically ill patients. SAPS II had the highest specificity hence it predicted improvement better than death .SOFA had intermediate sensitivity and specificity.

Key words: sepsis; sepsis scoring systems; outcome of sepsis; ICU

Introduction:

Sepsis is one of the leading cause of in-hospital mortality and morbidity among medical and surgical patients. Spectrum of sepsis includes Sepsis, severe sepsis, septic shock. Severe sepsis accounts for one in five admissions to intensive care units (ICUs) and is the leading cause of death in the non-coronary ICU[1] . Even though sepsis is the leading cause of mortality, information regarding early predictive factors are limited. Although well recognized as an important health issue globally, most of the epidemiological data regarding the incidence and mortality of sepsis have emerged from western countries and puts the overall incidence of sepsis ranging from 10% to 30% with mortality ranging from 10% to56%.[2,3] Available data from India suggest that the overall mortality of all septic patients is approximately 14% and that of severe sepsis alone is higher than 50%.[4] The presence of pre-existing disease and organ dysfunction and severity of illness scores have been associated with poorer outcome in majority of

reports.[2] This information, along with a knowledge of early and reliable prognostic markers, is essential for optimum clinical management and prediction of outcome .Various scoring systems are available for prediction of prognosis in sepsis.

Materials and Methods:

Patients fulfilling the Surviving Sepsis Campaign-2018 guidelines criteria for sepsis within the Intensive care unit (ICU) were included over two years period. Apart from baseline hematological, biochemical, and metabolic parameters, Acute Physiology and Chronic Health Evaluation II (APACHE II), Simplified Acute Physiology Score II (SAPS II), and Sequential Organ Function Assessment (SOFA) scores were calculated on day 1 of admission. Patients were followed till death or discharge from the ICU.

1. **Aims and objectives of the study :**

- To study the spectrum of sepsis in ICU .

- To study mortality rate in sepsis.

- To identify reliable and early prognostic variables of the disease.

   Source of data: The study was conducted in patients admitted to Intensive care Unit of Anil Neerukonda Hospital of NRI Institute of Medical Sciences, Visakhapatnam.

   Methods of collection of data

A. **Study design :** Prospective study

B. **Study period** : From January 2019 to January 2021

C. **Place of study:** Anil Neerukonda Hospital of NRI Institute of Medical Sciences , Visakhapatnam.

D. **Sample size:** 100 patients who gave consent for study and satisfying the inclusion criteria

E. **Inclusion Criteria:**

  1) 100 adult patients admitted in ICU fulfilling criteria for sepsis.

  2) All patients with existing sepsis and those who developed new onset sepsis

  3) Patients who agree and give consent for the study.

   F.Exclusion Criteria:

1) Age below 18years.

2) Not fulfilling the criteria for sepsis.

3) Patients who died within 24h of admission

   G.Methodology:

The study is a prospective study conducted from January 2019 to January 2021 in the ICU of a tertiary care referral hospital. All the patients were admitted in ICU either with existing sepsis or those who developed new episode of sepsis / severe sepsis / septic shock within the ICU were enrolled. Those who died within 24 h of admission and those who did not satisfy the sepsis criteria according "Sepsis Surveillance Campaign" 2018 guidelines were excluded from this study.

Accordingly Sepsis was defined as clinical evidence or suspected source of infection and an acute increase in >2

SOFA points; Severe sepsis as the presence of sepsis plus evidence of organ dysfunction or tissue hypoperfusion and septic shock as the evidence of infection plus vasopressor therapy needed to maintain mean arterial pressure at >65mm hg and serum lactate >2.0 mmol/L, despite adequate fluid resuscitation.

After obtaining informed consent, detailed demographic, clinical, and laboratory data were recorded, including arterial blood gas analysis and relevant cultures of blood, urine, sputum, tracheal aspirates, or other samples as indicated. Acute Physiologic Assessment and Chronic Health Evaluation II (APACHE II), Simplified Acute Physiological Score II (SAPS II) and Sequential Organ Failure Assessment (SOFA) indices were calculated at baseline to assess the severity of illness. The total duration of ICU stay, mechanical ventilation, and hospital stay were recorded .All patients recruited in the study were monitored until death or discharge, whichever occurs earlier and were compared with scoring systems result and appropriate statistical analysis

Results

Table 1: Distribution of outcome in study population

Outcome	Frequency	Percent
Survivors	65	65.0
Non-Survivors	35	35.0
Total	100	100.0

A total of 100 patients were included in the study, out of 100 patients 65% (65patients) improved and were discharged from the ICU and 35% (35 patients) expired during the ICU stay.

Table 2: Comparison of age distribution according to study outcome.

N		Mean	SD	Min.	Max.	't' value	'p' value
Survivors	65	48.95	14.308	18	71	2.573	0.112
Non-Survivors	35	43.74	17.509	18	85		

*Student t test

In our study of 100 patients mean age among the Survivors was 48.95 ± 14.30 years with youngest

being 18 years and eldest being 71years, mean age among Non-survivors was 43.74 ± 17.50 years with youngest being 18 years and eldest being 85 years. Age in relation to the outcome had in significant p-value.

Table 3: Gender distribution of patients in relation to outcome

Outcome Total		Survivors	Non-Survivors		χ^2 value*	P value
Male		43	24	67		
		66.2%	68.6%	67.0%		
Female		22	11	33	0.060	0.806
		33.8%	31.4%	33.0%		
Total		65	35	100		
		100.0%	100.0%	100.0%		

*Chi Square test

Out of 100 patients in the study 67 were males and 33 were females. Among 65 patients who improved during the ICU stay 66.2% (43 patients) were males and 33.8% (22 patients) were females. Among 35 patients who expired during the ICU stay 68.6% (24 patients) were males and 31.4% (11 patients) were females. Mortality being higher in males, 68.6% (24 patients) when compared to 33.4 %(11 patients) in females. Sex distribution did not have any significant statistical correlation with the outcome.

Table 4: Comparison of Mean Duration of hospital stay in relation to outcome

N		Mean	SD	Min.	Max.	't' value	'p' value
Survivors	65	147.562	71.9701	26.5	432.0	9.425	*0.003*
Non-Survivors	35	90.500	113.5887	30.0	700.0		

*Student t test

In our study mean duration of hospital stay for 65 patients who survived was 147.562 ± 71.9 hours with least duration of stay being 26.5 hours and longest being 432 hours.

Mean duration of stay for the 35 patients who expired was 90.5 ± 113.5 hours with minimum duration of stay being 30 hrs and maximum being 700 hours. Statistical analysis showed significant P-value of <0.003, indicating that survivors had longer duration of hospital stay.

Table 5: Distribution of Hypertension according to study outcome

Hypertension	Outcome		Total	$\square^2$ value*	P value
	Survivors	Non-Survivors			
Yes	13	8	21		
	20.0%	22.9%	21.0%		
No	52	27	79	0.112	0.738
	80.0%	77.1%	79.0%		
Total	65	35	100		
	100.0%	100.0%	100.0%		

*Chi Square test

Out of 100 patients 21% (21patients) were Hypertensive, they constituted 22.9% of non survivors and 20% of Survivors. Hence outcome of the patients was not influenced by the presence of Hypertension because p-value was not significant.

Table 6: Requirement of ventilation (ventilator / NIV) in relation to outcome

Outcome Ventilation			Total	x^2 value*	P value
	Survivors	Non-Survivors			
Yes	26	27	53		
	40.0%	77.1%	53.0%		
No	39	8	47	12.600	<0.001
	60.0%	22.9%	47.0%		
Total	65	35	100		
	100.0%	100.0%	100.0%		

*Chi Square test

In our study of 100 patients, 53% (53 patients) required ventilator support either in the form of Invasive mechanical ventilation or Non-invasive ventilation. They constituted 40% (26 patients) of survivors and 77.1% (27 patients) of non survivors. Statistical analysis showed very significant p-value of <0.001, hence requirement of ventilator support had worse outcome.

Table 7: Distribution of Spectrum of sepsis in relation to the outcome

Outcome Spectrum of Sepsis	Survivors	Non-Survivors	Total	x^2 value*	P value
Sepsis	34	0	34		
	52.3%	0%	34.0%		
Severe Sepsis	21	4	25		
	32.3%	11.4%	25.0%	51.996	<0.001
	10	31	41		

Septic Shock	15.4%	88.6%	41.0%		
Total	65	35	100		
	100.0%	100.0%	100.0%		

*Chi Square test

Among the 100 patients in the study, 34% (34 patients) had sepsis, among them all the patients survived. 25% (25patients) had severe sepsis out of which 21 patients survived and 4 patients expired. 41% (41patients) had septic shock out of which only 10 patients survived and 31 patients expired. Hence septic shock had worst outcome constituting 88.6% of non-survivors, when compared to severe sepsis and sepsis alone, with a significant P value of <0.001

Table 8: Comparison of three scoring systems in relation to outcome

	N		Mean	SD	Min.	Max.	't' Value	P value
APACHE II	Survivors	65	18.82	6.31	5	31	47.730	*<0.001*
	Non-Survivors	35	27.66	5.68	15	37		
SAPS II	Survivors	65	37.45	12.03	10	65	40.513	*<0.001*
	Non-Survivors	35	53.66	12.35	23	91		
SOFA Score	Survivors	65	7.94	3.61	1	16	45.302	*<0.001*
	Non-Survivors	35	12.91	3.34	5	19		

*Student t test

In our study the mean APACHE II score was 18.82 among the Survivors with least score being 5 and highest score being 31. Mean score among the Non-survivors group was 27.66 with least score being 15 and highest score being 37.Analysis showed significant correlation with p-value of <0.001. Mean SAPS II score in our study among the Survivors group in the study was 37.45 with least score of 10 and highest score of 65.Mean SAPS II score among the Non- survivors group was 53.66 with least score of 23 and highest score of 91.Analysis showed significant correlation with p-value of <0.001. Mean SOFA score in our study among the Survivors group was 7.94 with least score being 1 and highest being 16. Mean SOFA score among the Non-survivors group was 12.91 with least score being 5 and the highest score being 19. Analysis showed significant correlation with p-value of<0.001.

Discussion

Sepsis is a leading cause of in-hospital mortality and morbidity among patients. Various scoring systems are available for prediction of sepsis. This study is intended to determine the spectrum of sepsis, to identify reliable prognostic variables for sepsis and to compare the usefulness of prevalent scoring systems namely APACHE II, SAPS II and SOFA[10] in our tertiary care hospital. This was a prospective study with sample size of 100 patients. Among 100 patients, 65% improved during the hospital stay and were discharged from ICU whereas 35% expired during the ICU stay.Where as in a study by Anna Thusara Matthias et al[5] 63% patients survived, Khan MS et al[7] 60% of patients survived and mortality was 40%. Study by Alejandria M et al[2] had 66.3% survivors and 23.5% non survivors. In a similar study done by Mohan et al[4] 47% of patients survived and 53% of patients expired.

Distribution of outcome of patients

	Survivors	Non-survivors
Khan MS et al[7]	60%	40%
Alejandria M et al[2]	66.3%	23.5%
Mohan et al[4]	47%	53%
Anne Thusara Matthias et al[5]	63%	37%
Our study	65%	35%

We observed that the mortality rate in our study was 35% which is lesser than Khan et al[7] and Mohan et al[4] which are done in India, and Anne Thusara Matthias et al[5] done in Sri Lanka whereas it's higher than Alejandria et al[2] which was done in Philippines. Average mortality reported in previous studies in India is 40.3%.

Mean age of study population among survivors was 48.95±14.30 years and in Non survivors was 43.74±17.50 with P-value of 0.112. Thus the age did not have any statistically significant association

	Age in survivors	Age in non-survivors	p-value
Khan MS et al[7]	35.6±14.7	44.4±19.6	0.049
Alejandria M et al[2]	47.2±17.8	51.7±19.8	0.000
Mohan et al[4]	44.3±15.5	57.4±20.4	0.01
Our study	48.95±14.30	43.74±17.50	0.112

We can see that in our study in contrast to the above mentioned studies mean age of survivors was more than mean age of Non-survivors

Out of 100 patients in our study 67 were males and 33 were females. In the study done by Mohan et al[4] out of 100 patients 54 were males and 46 were females

		Survivors	Non-survivors	p-value
Mohan et al[4]	Female	30.5%	69.5%	0.003
	Male	61.1%	38.9%	
Our study	Female	66.6%	33.4%	0.806
	Male	64.1%	35.9%	

Out of 100 patients 21 patients were hypertensive. They constituted 22.9% (8 patients) of Non-survivors and 20% of survivors (13patients) .

P-value was not significant .Hence we conclude that outcome was not influenced by presence of hypertension

	Total Hypertensives	Survivors	Non-survivors	P value
Mohan et al[4]	34%	39.6%	27.6%	0.208
Our study	21%	20%	22.9%	0.738

In the study by Mohan et al[4], 34% of patients were hypertensives. They constituted 27.6% of non-survivors and 39.6% of survivors. P value was not significant.

In our study 53 out of 100 patients required ventilator support ,either in Invasive or Non- invasive form. They constituted 40% of the survivors and 77.1% of Non-survivors. P- Value was <0.001.Hence we conclude that requirement of ventilator support indicates poor prognosis

Among the 100 patients, 34 patients had Sepsis, 21 patients had severe sepsis and 41 patients had Septic shock. Out of the Survivors 52.3% had Sepsis, 32.3% had severe sepsis and 15.4% had septic shock. Out of the Non-survivors 11.4% had severe sepsis and 88.6% had septic shock. Hence we conclude that septic shock had worse outcome which was statistically significant with P-value of<0.001.

In the study done by Mohan et al[4], 27% had sepsis alone, 38% had severe sepsis and 35% had septic shock. Mortality was highest with septic shock (65.7%) followed by severe sepsis (55.3%) and sepsis (33.3%).

In study done by Alejandria M et al[2], 27 out of 315 patients had septic shock and all of them died (100%).

Conclusion:

- Out of 100 patients 65 patients survived and 35 patients expired in our study

- Males outnumbered females. 67-males and 33-females..

- Requirement of mechanical ventilation was associated with higher mortality with significant p-value.

- Presence of hypertension did not have any significant association with outcome.

- Mean age and Mean duration of Hospital stay of Survivors was higher than Non- survivors

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