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Original Research Article

Epidemiology of sepsis and its various characteristics in a tertiary care adult-multidisciplinary ICU in South India: a retrospective study

Hussain Khan Tharappel Jalal[1], Teju P. Thomas[2]*, Alfy Ann George[3], Hamadan Mohammed[4]

[1]Department of Medicine, [2]Department of Critical Care Medicine, [3]Department of Pathology, Travancore Medical College, Kollam, Kerala, India
[4]Junior Resident, Travancore Medical College, Kollam, Kerala, India

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***Correspondence:**
Dr. Teju P. Thomas,
E-mail: tejupt@gmail.com

ABSTRACT

Background: The incidence of sepsis is increasing, especially in elderly populations with more comorbidities. It is now estimated that sepsis is a leading cause of mortality and critical illness worldwide. The Epidemiological data regarding sepsis, septic shock and organ involvement is mainly from western literature. Data from India, especially south India, are less when compared to western data. In this background authors conducted a retrospective study in tertiary care hospital in south India. Objectives of the study was epidemiology of sepsis and its various characteristics in a tertiary care adult-Multi disciplinary ICU in South India.
Methods: This study was a retrospective observational study, conducted during the time period of June 2016 and May 2017. The study population was patients above 18 yrs admitted in MDICU with sepsis. The study was conducted in a tertiary care adult -Multidisciplinary ICU in South India. Various characteristics like age group, comorbidities, organ involvement, septic shock, sofa score, need for ventilatory support, RRT support and outcome data was collected.
Results: In this study, 497 patients who satisfied the Surviving Sepsis Campaign guidelines were included. The majority of the patients (59.8%) were male; the majority was above 60 yr (range 18 to 92 yr). 76.3% Patients had comorbid disease. Hypertension was the most common co-morbid (62%) followed by diabetes mellitus (51.3%). Chronic Kidney Disease was found in 132 patients (26.6%) and Coronary artery disease in 121 patients (24.3%). 186 patients (46.5%) had single organ involvement 140(35%) patients had 2 organ involvement. 74(18.5%) patients had more than 2 organ involvement. Septic shock was found in 155 patients (31.2%). Renal involvement was the most common organ involvement found in 279 patients(59.9%). Most common source for sepsis was the respiratory system found in 230 patients (46.3%), followed by urinary tract infection in 117 patients (23.5%). The study shows a significant association between SOFA score and mortality (p-value 0.001) 52% of mortality happened in group of patients with SOFA score more than 15 and mortality was 28 % in group with a SOFA score of 10-15.
Conclusions: In this retrospective study of sepsis, authors found that the most common source of sepsis was pneumonia (46.3%) followed by urinary tract infection (23.5%). Majority of the patients had one organ involvement (46.5%). Among the organ involvement, Acute Kidney injury was the most common organ involvement (56.1%) followed by septic shock (31.2%) and respiratory support (29.6%). Mortality in this study was higher with higher SOFA score.

Keywords: MODS, Organ involvement, Sepsis epidemiology, SOFA

INTRODUCTION

Sepsis is now considered as a life-threatening organ dysfunction where the host has a dysregulated immune

response to infection.[1] There has been mainly three attempts to define sepsis by different societies. In the early 1990s, a consensus statement was developed by the American College of Chest Physicians and the Society of Critical Care Medicine (SCCM) was done. They said the concept of the Systemic Inflammatory Response Syndrome (SIRS) with or without positive blood culture.[2]

Table 1: Definitions of sepsis.

Category	Definition
Previous definitions	
SIRS (systemic inflammatory response syndrome)	Two of the following; Temperature >38 Celsius or <36 Celsius Herat rate >90 beats/min Respiratory rate >20/ minute or arterial carbon dioxide <32mmHg White blood cell count >12* 10 ^{9} or <4* 10^{9}/L
Sepsis	SIRS with infection (proven or probable)
Severe sepsis	Sepsis with evidence of acute organ dysfunction
Septic Shock	Sepsis with persistent hypotension after fluid resuscitation
Revised definitions	
Sepsis	Life threatening organ dysfunction caused by a dysregulated host response to infection
Septic shock	Sepsis and vasopressor therapy needed to increase mean arterial pressure to >65 mmHg and lactate >2 mmol/L despite adequate fluid resuscitation

The main changes were: (Table 1)

- The terminology of SIRS and severe sepsis were eliminated.
- Sepsis is considered as life-threatening organ dysfunction caused by a dysregulated host response to infection.
- Organ dysfunction is newly defined as change in SOFA (sequential organ failure assessment) score.
- Septic shock is CONSIDERED AS as the subset of sepsis in which underlying circulatory and cellular or metabolic abnormalities are profound enough to increase mortality substantially.[3]

In 2004 surviving sepsis campaign tried to redefine sepsis and management for the guidelines of sepsis.

The main recommendation was the early administration of broad-spectrum antibiotic therapy. Whenever possible to deescalate to a narrow-spectrum antibiotic. The duration of antibiotic was recommended to be 7-10 days depending on the clinical response. For sepsis-induced hypotension and septic shock, the recommendation was source control with the equivalence of crystalloid and colloid resuscitation for aggressive fluid challenge. The main aim was to restore mean circulating filling pressure. For fluid non-responders, they advised vasopressors. The preference for norepinephrine and adrenaline and cautious use of vasopressin. The study was not recommending the low-dose dopamine administration for renal protection. In case the need for inotropes dobutamine was suggested in a few scenarios. The recommendation was against of supranormal oxygen delivery as a goal of therapy the importance of stress-dose steroid therapy for septic shock was mentioned. They recommended against the use of recombinant activated protein C in patients with severe sepsis. The target hemoglobulin was haemoglobin of 7-9 g/dL. Among blood products, appropriate use of fresh frozen plasma and platelets was recommended. In ventilated patients, a low tidal volume and limitation of inspiratory plateau pressure strategy for acute lung injury and acute respiratory distress syndrome as well as the application of a minimal amount of positive end-expiratory pressure in acute lung injury/acute respiratory distress syndrome were recommended. It Advised avoidance of neuromuscular blockers, if at all possible; maintenance of blood glucose <150 mg/dL after initial stabilization.[4]

The incidence of sepsis is increasing, especially in elderly populations with more comorbidities. It is now estimated that sepsis is a leading cause of mortality and critical illness worldwide.[5] The Epidemiological data regarding sepsis, septic shock and organ involvement is mainly from western literature. Data from India, especially south India, are less when compared to western data.[6] In this background authors conducted a retrospective study in tertiary care hospital in south India from June 2016 and May 2017. Different variables like septic shock, organ involvement, sofa score and outcome were assessed.

METHODS

This is the retrospective observational study conducted at MDICU Travancore medical college Kollam. Patients >18 yr with sepsis admitted to MDICU. A total of 497 sepsis patients admitted in MDICU between June 2016 to May 2017.

Inclusion criteria

- Patients above 18 yr with sepsis admitted to MDICU.

Exclusion criteria

- Patient below 18 yr
- Lost follow up

Patient fitting the inclusion criteria were taken into the study using purposive sampling method until the required sample size was achieved. A diagnosis of sepsis was made based on the diagnosis documented at the point of admission by the treating clinician. Authors studied sepsis based on SOFA score (Table 2).[7]

Table 2: Sequential organ failure assessment score.

Organ System score	0	1	2	3	4
Respiration					
PaO2/FiO2, kPa	>53.3	40-53.3	0-39.9	0-25.2 R)	0-13.3 R)
torr	>400	≤400	≤300	≤200 R)	≤100 R)
Coagulation, Haematology					
Platelets, x10E9/L*	>150	101-150	51-100	21-50	0-20
Hepatic					
Bilirubin, µmol/l mg/dL	0-19 <1.2	20-32 1.2-1.9	33-101 2.0-5.9	102-204 6.0-11.9	>204 >12.0
CNS					
Glasgow Coma Score	15	13-14	10-12	6-9	<6
Circulation, Cardiovasc. MAP, mmHg	>70	0-70	Dopamine ≤5.0 or dobutamine (any dose)[a]	Dopamine 5-14,9 or epi ≤0.1 or norepi ≤0.1[a]	Dopamine ≥15 or epi >0.1 or norepi >0.1[a]
Renal					
s-creatinine, µmol/l mg/dL	<110 <1.2	110-170 1.2-1.9	171-299 2.0-3.4	300-440 3.5-4.9	>440 or dialysis >5.0
Or urine output				Or <500 mL/24h	Or <200 mL/24h

R) With respiratory support
*corresponds to $x10^3/mm^3$
[a]Adrenergic agents administered for at least 1 hr(doses given are in µg/kg/min).

The PaO_2/FiO_2 ratio is calculated without reference to the use or mode of mechanical ventilation, and without reference to the use or level of PEEP.

The Glasgow Coma Score is preferably calculated by the patients nurse, and is scored conservatively (for the patient receiving sedation or muscle relaxants, normal function is assumed unless there is evidence of intrinsically altered mentation).

Mean arterial pressure (MAP)= diastolic + (1/3*(systolic-diastolic));

The primary clinicians decided whether the patient had a documented or presumed infection, based on the definitions of the International Sepsis Forum.[8] The survival status of patients was monitored as morality within the ICU.SIRS was defined as the occurrence of ≥2 of the following criteria: white cell count of >12,000 cells.mm^{-3} or <4000 cells.mm^{-3} or >10% immature forms; heart rate of >90 beats.min^{-1}; temperature >38°C or <36°C; and respiratory rate >20 per.min-1 or a partial pressure of carbon dioxide <32mmHg during spontaneous breathing or the need for mechanical ventilation. Sepsis was defined as the presence (documented or presumed) of infection with SIRS.[8] Severe sepsis was defined as sepsis plus at least one sepsis-induced organ dysfunction, which was defined as follows:

a) Acute encephalopathy: acute deterioration of neurologic condition (inattention, stupor, delirium, seizures, and coma),
b) Haematological dysfunction: platelet count <100,000μL^{-1},
c) Respiratory dysfunction: PaO_2/fraction of inspired oxygen <200 if lungs are the site of infection or <300 if lungs were not the infection site,
d) Renal dysfunction: urinary output <0.5mL.$kg.h^{-1}$ for at least 2 h despite adequate volume resuscitation or serum creatinine >2mg.dL^{-1} not attributable to chronic renal failure or >50% increase from known baseline,
e) Lactic acidosis: plasma lactate level >2mmol.L^{-1}, and
f) Liver dysfunction: bilirubin >2 mg.dL-1 or international normalized ratio >1.5 in the absence of anticoagulant agents. Septic shock was defined as severe sepsis associated with refractory hypotension; despite at least 2 h of adequate volume resuscitation, a systolic blood pressure (SBP) <90mmHg or a reduction of ≥40mmHg from baseline level or a mean arterial pressure <70mmHg in the absence of other causes of hypotension or the need for vasopressors to maintain SBP ≥90mmHg.[9]

RESULTS

In this present study, 497 patients who satisfied the Surviving Sepsis Campaign guidelines were included. The demography distribution as shown in table 3, The majority of the patients (59.8%) were male; females were 40.2%. Out of 497 patients, 242 patients were above the age of 60(48.7%). There were 170 patients (34.2%) between the age group 40-60. 85 patients (17.1%) were between the age group 18-40 yrs. The majority was above 60 yr.

Among the comorbidity 379(76.3%) Patients had comorbid disease. Hypertension was the most common

co-morbid. 308 patients (62%) had hypertension. Diabetes mellitus was found in 255(51.3%) patients. Chronic Kidney Disease was found in 132 patients (26.6%) and Coronary artery disease in 121 patients (24.3%) (Table 4).

Table 3: Demography Distribution.

		Frequency	Percentage
Age group	18-40	85	17.1
	40-60	170	34.2
	>60	242	48.7
	Total	497	100.0
Gender	Male	297	59.8
	Female	200	40.2
	Total	497	100.0

Table 4: Comorbidity.

Comorbidity	Frequency	Percentage
Yes	379	76.3
No	118	23.7
Total	497	100.0
Diabetes mellitus	255	51.3%
Hypertension	308	62.0%
CKD	132	26.6%
CAD	121	24.3
CVA	73	14.7%

Table 5: Organ involvement.

		Frequency (n=400)	%
Single organ involvement		186	46.5
2 organ involvement		140	35.0
>2 organ involvement		74	18.5
Total		400	100.0
Thrombocytopenia	Yes	88	17.7
	No	409	82.3
Bilirubin >2	Yes	155	31.2
	No	342	68.8
Septic shock	Yes	155	31.2
	No	342	68.8
Altered sensorium	Yes	46	9.3
	No	451	90.7
A K I	Yes	279	56.1
	No	218	43.9

As shown in table 5 total of 186 patients (46.5%) had single organ involvement. 140(35%) patients had 2 organ involvement. 74(18.5%) patients had more than 2 organ involvement. Septic shock was found in 155 patients (31.2%). Among the organ involvement, renal involvement was the most common organ involvement found in 279 patients (59.9%). Thrombocytopenia was found in 88 patients (17.7%). Increased Bilirubin was found in 155 patients (31.2%). Altered sensorium was found in 46 patients (9.3%).

Table 6 shows respiratory support by Invasive or non-invasive ventilator was required for 147 patients (29.6%). Renal replacement therapy was required in 33 patients (6.6%).

Table 6: Respiratory support and RRT.

Ventilatory support		Frequency	Percentage
NIV	Yes	147	29.6
	No	350	70.4
RRT	Yes	33	6.6
	No	464	93.4

Among the source of sepsis Most common source for sepsis was the respiratory system found in 230 patients (46.3%), followed by urinary tract infection in 117 patients (23.5%). Cellulitis was found in 89 patients (17.9%). Abdominal source of sepsis was found in 61 patients (12.3%) (Table 7).

Table 7: Source of Sepsis.

	Frequency	Percentage
Abdominal sepsis	61	12.3
Cellutitis	89	17.9
Pneumonia	230	46.3
Urosepsis	117	23.5

Among 153 patients (30.8%) had a SOFA score between 6-10 and 81 patients (16.3%) patients had a SOFA score More than 15 (Table 8).

Table 8: SOFA score

SOFA	Frequency	Percentage
<5	141	28.4
6-10	153	30.8
11-15	122	24.5
>15	81	16.3

Table 9: Mortality.

SOFA Score	Mortality		Chi square value	p value
	Yes	No		
<5	2(8.0%)	139(29.4%)	27.583	0.001*
6-10	3(12.0%)	150(31.8%)		
11-15	7(28.0%)	115(24.4%)		
>15	13(52.0%)	68(14.4%)		

*statistically significant

Table 9 shows a significant association between SOFA score and mortality (p-value 0.001). 52% of mortality happened in a group of patients with SOFA score more

than 15 and mortality was 28% in group with a SOFA score of 10-15.

DISCUSSION

In this study, the incidence of sepsis, Various organ involvement, septic shock and outcome was assessed. the population characteristics variables were also assessed. The outcome like RRT and Mortality was also assessed. Male gender showed predominance over females for developing sepsis-related complications. This was at par with another study conducted by Merin et al, at south Indian hospital.[10] In the present study, hypertension and diabetes mellitus was the common co-morbid condition predisposing to infection due to abnormalities of host responses particularly neutrophil chemotaxis, neutrophil adhesion and intracellular death and altered humoral immunity.[11] Among our patients majority had a respiratory system as the main source of sepsis. This was similar to other studies which also reported respiratory system as the main source of infection.[12,13] But a similar study conducted in south India had urinary tract infection as the main source of sepsis.[10] Incidence of AKI in this study is 56.1%, which is higher than the study done in critically ill patients, where incidence varied between 15% and 50%.[14] In another study, the incidence of community-acquired AKI reported in India was 4.14/1000 admissions in 1996-2008.[15] Majority of the patients was above 65 yr old in this study. In a similar study by Brun-Buisson C, Doyon F, Carlet J et al, the average age of patients was 65 years.[16] The incidence rate for sepsis in diabetes patients was found to be high in the cohort of Danail et al.[17] and Stegenga et al.[18]

Septic shock was found in 31.0 % of patients which was very low when compared to another study where the incidence of septic shock was 77.7%. In a study by Peake SL, Bailey M, Bellomo R et al, the urinary tract was the source of infection of up to 30% of severe sepsis or septic shock patientt.[19]

In this Study 52% of this mortality happened in Group of patients with SOFA score more than 15 and in group with SOFA score between 10-15 was 28%. So, the mortality in this study was higher with higher SOFA score.

Fereria FL, Bota DP found that initial SOFA score up to 9 predicted mortality of less than33% while an initial SOFA score of greater than 11, predicted a mortality rate of 95%.[20] Vosylius S, Jurate Sipylaite, in Vilnius, Lithuania observed that SOFA score on day 1 and day 3 was significantly higher in non-survivors than those in survivors.[21]

This studies had few limitations. The mortality mentioned in this study was on the lower side, which was probably due to the low sample size. This was a retrospective study with the follow-up period limited to the ICU stay of these patients. The new definition of sepsis-3, based on qSOFA, was not used in this study. This was because the new definition was published after the data collection. A large sample prospective study with a new definition of sepsis is needed in future studies.

CONCLUSION

In this retrospective study of sepsis, Authors found that the most common source of sepsis was pneumonia (46.3%) followed by urinary tract infection (23.5%). Majority of the patients had one organ involvement (46.5%). Among the organ involvement, Acute Kidney injury was the most common organ involvement (56.1%) followed by septic shock (31.2%) and respiratory support (29.6%). Mortality in this study was higher with higher SOFA score.

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