

**A comparative study of organ dysfunction in patients with sepsis and their short term outcome treated in medicine wards and ICU in a tertiary care hospital**

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**Conflicts of Interest:** Nil

**Abstract**

**Introduction:** Sepsis is a lifethreatening organ dysfunction caused by dysregulated host response to infection. Increasing number of sepsis is managed in general wards in resource limited countries.

**Aim:** To compare the incidence of organ dysfunction and shortterm outcome in patients admitted in medicine wards and ICU of Gauhati Medical College.

**Materials and Methods:** It is a prospective, observational study in sepsis patients in medicine ward and ICU in a tertiary care hospital. Two hundred sepsis patients (Medicine ward=150, ICU=50),  $\geq 18$  years, selected randomly, were studied to compare the incidence of organ dysfunction and shortterm outcome. Sepsis following surgery, trauma, those transferred to/from ICU and those with other lifethreatening diseases were excluded. Chi-square test/Fisher’s-exact

test was used for comparing ratios. A ‘p-value’  $< 0.05$  was considered statistically significant.

**Results:** Multiorgan dysfunction and mortality were significantly higher in ICU settings (78% vs. 65.2%,  $p=0.04$ ; 48.4% vs. 32.6%,  $p=0.041$  respectively). There was sharp rise in mortality with increasing number of organ dysfunction in both medicine wards and ICU. Patients with sepsis without organ failure had relatively low mortality (11.5% in General wards and 18.1% in ICU).

**Conclusion:** Our study aimed to identify incidence of organ failure and outcome of sepsis in medicine ward and compare with ICU settings. Sepsis in medicine ward had significantly lower incidence of multiorgan failure and lower mortality

**Introduction**

Sepsis is a lifethreatening organ dysfunction caused by a dysregulated host response to infection. The common

clinical features include signs of infection with organ dysfunction, plus altered mentation; tachypnea; hypotension; hepatic, renal, or hematologic dysfunction.

Sepsis-3 criteria for sepsis include-

1. A suspected infection
2. Acute organ dysfunction, defined as an increase by two or more points from baseline on the sequential organ failure assessment score (SOFA) [1]

Sepsis is a syndromic response to infection and is frequently a final common pathway to death from many infectious diseases worldwide.

The global burden of sepsis is difficult to ascertain, although a recent scientific publication estimated that in 2017 there were 48.9 million cases and 11 million sepsis related deaths worldwide, which accounted for almost 20% of all global deaths. [2]

Sepsis represents a substantial health care burden, and there is limited epidemiologic information about the demography or about the temporal changes in its incidence and outcome. Sepsis is among the most common reasons for admission to intensive care units (ICUs) throughout the world. Sepsis is a medical emergency.

Unfortunately, sepsis is still mostly overlooked and recognized too late. Sepsis remains the primary cause of death from infection despite advances in modern medicine, including vaccines, antibiotics, and intensive care. In 2017, an estimated 48.9 million (95% uncertainty interval [UI] 38.9–62.9) incident cases of sepsis were recorded worldwide and 11.0 million (10.1–12.0) sepsis-related deaths were reported, representing 19.7% (18.2–21.4) of all global deaths.[3]

India faces a major challenge with an estimated 11 million sepsis cases a year and almost 3 million deaths.[4] Conventionally, sepsis has been managed in

the Intensive Care Units (ICU). [5,6] Yet, numerous studies demonstrate that an increasing percentage of sepsis patients are also being treated in medical wards outside of the ICU. [7-11] The majority of sepsis patients admitted to ICUs had multiple organ failure and/or aberrant perfusion, making them more seriously unwell than those receiving care in medicine ward. [6]

As a result, there are numerous differences between the clinical spectrum of sepsis in ICU and non-ICU settings. Moreover, only ICU settings and not medicine ward have documented aspects such as reduction in mortality in response to early resuscitation in patients with sepsis. Even from industrialized

countries, there is little literature about the epidemiology of sepsis in non-ICU settings [12], let alone from underdeveloped countries.

Due to a lack of resources, a significant share of sepsis patients are treated in settings other than intensive care units in underdeveloped nations. The precise percentage of such patients managed outside the ICU, their severity, and their prognoses in comparison to those managed in ICUs are unknown.

### **Aim**

This study was carried out in Gauhati Medical College & Hospital, situated in north east India, to compare the incidence of organ dysfunction and short term outcome in patients admitted in medicine wards and ICU

### **Materials and methods**

The present study was a hospital-based prospective, observational study, carried out between December 2021 and November 2022, in patients with sepsis admitted to medicine ward and ICU of Gauhati Medical College & Hospital, Guwahati, a tertiary care hospital in northeast

India catering to several north eastern states of the country.

Sepsis was diagnosed using the Third International Consensus Definition put forwarded by sepsis definition task force 2016.[1] 200 cases of sepsis were studied (150 cases from medicinewards and 50cases from ICU) during the period.

#### **Inclusion criteria**

Any patient > 18 years admitted to the general medicine ward and ICU with clinical and laboratory evidence of sepsis as per the Third International Consensus Definition put forwarded by sepsis definition task force 2016.[1]

#### **Exclusion criteria**

1. Post-operative cases
2. Post traumatic cases
3. Patients initially admitted to General Wards and then subsequently transferred to ICU or vice versa
4. Patients with other potentially life-threatening disease or condition, like
  - a) Cerebrovascular accident
  - b) Myocardial infarction
  - c) Fulminant hepatic failure etc.

Complete blood counts, urine analysis, blood urea, serum creatinine, blood glucose, liver function tests, coagulation profile, chest x-ray, abdominal ultrasound, abdominal CT scan, CT scan of the appropriate region (as indicated), along with cultures from the appropriate samples (urine, sputum, serous fluids, and/or blood were done in all cases to establish the diagnosis of sepsis) were all performed to make the diagnosis. Antibiotic sensitivity was done on Muller-Hilton agar plates using standard Clinical and Laboratory Standards Institute (CLSI) guidelines.

Demographic data, clinical features, relevant laboratory parameters and the clinical course of the patient were recorded in a pre-tested structured proforma.

#### **Ethics**

All participants in the study provided written informed permission, and institutional ethical committee approval was obtained.

#### **Statistics**

##### **Sample size**

Of the total admitted patients with sepsis (medicine ward - 17441; ICU - 526), 200 consecutive patients with sepsis (medicine ward – 150; ICU – 50) who satisfied the laid down inclusion and exclusion criteria were selected for this present study.

##### **Statistical analysis**

Statistical Analyses were done using Statistical Package for Social Survey (SPSS) for Windows version 17.0. Chi-square test/Fisher's-exact test was used for comparing ratios. A 'p-value' <0.05 was considered as statistically significant. The results were tabulated and graphically represented using Microsoft Office for Windows 2010.

#### **Results**

Based on the selection criteria, 200 patients with sepsis, 150 from medicine ward and 50 from the ICU were enrolled in the study.

As seen in Table 1, during the period of study the total no of patients admitted to the General wards was 17441 out of which 2490 were diagnosed to have sepsis, showing a hospital incidence of 14.2%.

Of the 526 patients admitted to the ICU during the same period 94 patients had a diagnosis of sepsis, showing an incidence of 17.8% in ICU.

Table 1: Showing the Incidence of sepsis in General ward and ICU

Location	Total patients	Patients with sepsis	Incidence
Medicine ward	17441	2490	14.2%
ICU	526	94	17.8%

The baseline characteristics of the two patient groups were statistically comparable with regard to the frequency of various presenting symptoms and co-morbidities. Most of the patients with sepsis presented with fever as the predominant symptom (95.3% in medicine ward and 96.0% in ICU),

followed by altered sensorium, cough, urinary symptoms (dysuria, frequency of micturition, decreased urine output), dyspnea and gastrointestinal symptoms (loose stool, vomiting, pain abdomen). Altered sensorium as the presentation of sepsis was significantly higher in ICU patients (38.0%) compared to medicine ward (26.9%) (p=0.02).

No statistically significant difference was seen in presentation of other symptoms between medicine ward and ICU [Table 2]. Co-morbidities were present in 53.3% of patients with sepsis in medicine wards and in 58% in ICU but the difference was not statistically significant (P=0.55).

The most commonly associated co-morbidities in ICU and medicine wards were Diabetes mellitus and Chronic obstructive pulmonary disease (COPD), followed by hypertension, chronic kidney disease and benign prostatic hypertrophy.

There was no significant difference in comorbidities among patients with sepsis in medicine wards and ICU.

Table 2: Showing clinical presentations of patients with sepsis in General ward and ICU

Parameters	No of patients (%)		P-value
	General ward (n =150)	ICU (n=50)	
Presenting symptoms			
Fever	143 (95.3)	48 (96.0)	1.0
Urinary symptoms	42 (28.0)	13 (26.0)	0.85
Cough	49 (32.6)	18 (36.0)	0.73
Dyspnea	31 (20.6)	15 (30.0)	0.17
Abdominal symptoms	19 (12.6)	8 (16.0)	0.63
Altered sensorium	35 (26.9)	20 (38.0)	0.02
COMORBIDITIES	80 (53.3)	29 (58.0)	0.62
Diabetes	44 (29.3)	17 (34.0)	0.59
COPD	31 (20.6)	14 (28.0)	0.32
CKD	18 (13.8)	9 (18.0)	0.33
CLD	13 (8.6)	5 (10.0)	0.77
Hypertension	24 (16.0)	10 (20.0)	0.51
Malignancy	10 (6.6)	4 (8.0)	0.75
BPH	21 (14)	8 (16.0)	0.81

Respiratory tract infection was the major source of sepsis in both medicine ward (48.6%) and ICU (54%), followed by the urinary tract, primary blood stream infections and gastrointestinal tract. Microbiological culture from appropriate specimen (as determined by clinical presentation), e.g., sputum, urine, stool, pus, ascitic or pleural fluid could identify a definite microorganism in 53.3% and 58% of cases of sepsis in medicine ward and in ICU respectively. Blood culture was positive in only 27.3% and 22% of cases in these two groups respectively. The microorganism isolation rates did not differ significantly between medicine wards and ICU. [Table 3]

Table 3: Showing the sources of sepsis in Medicine ward and ICU patients

Source of sepsis	No of patients (%)		P value
	General ward (n=150)	ICU (n=50)	
Respiratory tract	73 (48.6)	27 (54.0)	0.62
Urinary tract	30 (20.0)	9 (18.0)	0.83
Gastrointestinal tract	11 (7.3)	3 (6.0)	1.0
Primary blood stream infection	21 (14.0)	6 (12.0)	0.81
Soft tissue infection	5 (3.3)	2 (4.0)	1.0
Others / unspecified	10 (6.6)	2 (4.0)	0.73

Table 4:

Culture	No of patients (%)		P value
	General ward (n = 150)	ICU (n=50)	
Appropriate specimen positive	80 (53.3)	29 (58.0)	0.62
Blood culture positive	41(27.3)	11 (22.0)	0.57

While organ dysfunction was a common feature of sepsis in both medicine ward and ICU (65.2% and 78% respectively), multi-organ ( $\geq 2$ ) dysfunction was present in a significantly higher proportion of patients in ICU as compared to medicine ward ( $p=0.04$ ).

The occurrence of single organ involvement was similar in General wards (26.6%) and ICU (22%) [Table 4].

Table 4: Showing patients with sepsis with organ dysfunction in General ward and ICU

Number of organ failure	No of patients (%)		P value
	General ward (n=150)	ICU (n=50)	
None	52 (34.6)	11 (22.0)	0.11
One	40 (26.6)	11 (22.0)	0.57
Multiple (two or more)	58 (38.6)	28 (56.0)	0.04

There was sharp rise in mortality with increasing number of organ dysfunction in both medicine ward and ICU. Patients with sepsis with multi organ dysfunction had the highest number of mortalities in both medicine wards (55.1%) and ICU (64.2%). [Fig 1]

The overall mortality rate of sepsis in hospital was found to be 36.5% which is significantly higher compared to overall hospital mortality rate of 11.3% from all causes combined. [Table 5] Overall hospital mortality in sepsis in this study was found to be 36.5%.

It was seen that mortality in ICU (48.0%) was significantly higher in comparison to that of General ward (32.6%) ( $p=0.041$ ). [Table 6]

Fig 1: Showing mortality in relation to organ failure in General ward and ICU

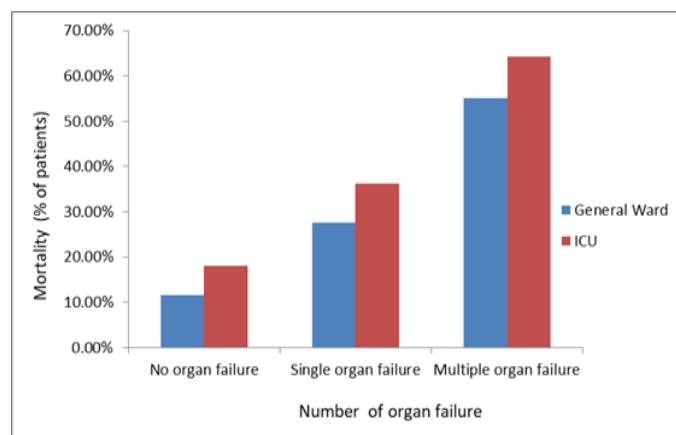


Table 5: Showing overall hospital mortality and mortality due to sepsis

Parameter	No of deaths (%)		P value
	All hospital admission with sepsis (n = 17967)	Sepsis (study population) (n = 200)	
Mortality	2048 (11.3)	73 (36.5)	<0.01

Table 6: Showing mortality of sepsis in General ward and ICU

Parameter	No of death (%)		P value
	General ward (n=150)	ICU (n=50)	
Mortality	49 (32.6)	24 (48.0)	0.041
Overall hospital mortality in sepsis- 73/200= 36.5%			

**Discussion**

The present study was conducted with the objective of analyzing the incidence of organ dysfunction and short-term outcome in patients in medicine ward and ICU. The incidence of sepsis in the patients admitted to medicine wards was 14.2% and that in the ICU was 17.8% in our study. Todi S *et al.* (2010) in a multicentric, prospective trial from 2006 to 2009 in Indian ITUs found the incidence of severe sepsis to be 16.4% of all ITU admissions. [13] Blanco J *et al.* (2008) in a prospective, observational multicenter study in Spain in 2002 found the incidence of sepsis to be 11.9% of all admissions. [14]

In both patient groups, the frequency of various presenting symptoms, co-morbidities, and sepsis sources were statistically comparable. The majority of symptoms in both contexts were reported to be fever (95.3% in medicine ward and 96% in ICU), cough, altered sensorium, urinary symptoms, dyspnea, and gastrointestinal problems. Both in the medicine ward and

the ICU, many of the patients had co-morbid conditions at the time of the diagnosis of sepsis, with diabetes being the most prevalent (29.3% in the medicine ward and 34% in the ICU), followed by COPD, hypertension, and chronic renal disease. Despite similar discovery has been made previously by Martin GS *et al.*, who showed that the most frequent co-morbidities were diabetes, hypertension, cancer, and congestive heart failure. In our investigation, there was no discernible statistical difference between the co-morbidities that were present in the two settings. [15] In both medicine ward (48.6%) and ICU (54%), respiratory tract infection was the main cause of sepsis, followed by infections of the urinary system, principal blood streams, and gastrointestinal tract. In contrast, patients in non-ICU settings were more likely to have genitourinary or soft-tissue infections, and those in the ICU were more likely to have a respiratory cause of infection, according to a previous study. [16] Blood culture was positive in only 27.3% and 22.0% of cases of sepsis in General wards and ICU respectively. The pattern of blood culture positive results was similar both in medicine ward and ICU.

In the present study it was found that organ dysfunction was common in patients with sepsis in both medicine ward (65.2%) and ICU (78.0%). The proportion of patients with multiple organ dysfunction ( $\geq 2$ ) was significantly higher in ICU (56.0%) compared to medicine wards (38.6%) (P=0.04). The most common organ/system involved was the respiratory system (54.3 % in medicine wards and 58.0 % in ICU), cardiovascular system, followed by kidneys, haematological and central nervous system. There was a sharp rise in mortality in patients with associated multi-organ dysfunction. Further, mortality was significantly higher in ICU as compared to medicine ward. Our findings are consistent

with research from other regions of the world, where sepsis-related mortality has been estimated to be between 50 and 60 percent in ICU settings.[17][18] Earlier studies have shown that mortality in sepsis increased with associated organ failure to the range of 70% in patients with multi-organ failure as compared to only 15% without organ failure. Overall hospital mortality from sepsis was found to be 36.5% (73 out of 200). In the medicine wards, 49 patients with sepsis out of 150 patients died (32.6%) whereas 24 out of 50 patients died in ICU (48%). Mortality in ICU from sepsis was significantly higher compared to medicine wards ( $p=0.041$ ). Artero A *et al.* (2010) in a study in Spain involving 624 patients in ICU with sepsis showed that the overall in hospital mortality in sepsis was 56%. [17]

#### Limitation

Our study, which was hospital-based, does not accurately represent the burden of sepsis in the wider community. Due to time and resource limitations, the sample size was also reduced. These are the study's limitations.

#### Conclusion

Our study was aimed to identify the incidence of organ dysfunction and outcome of sepsis in medicine ward and compare with ICU settings. On the basis of our data, we demonstrated that the number of organ dysfunction was a useful indication for sepsis mortality. Among organ dysfunctions, respiratory system has the highest incidence.

Mortality in patients with organ dysfunction was higher in ICU than in medicine ward. In comparison to sepsis treated in ICU, sepsis treated in medicine ward had a considerably reduced incidence of multiorgan failure and lower mortality.

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