Asian Journal of Pharmaceutical and Health Sciences
www.ajphs.com

Study of organ dysfunction in sepsis patients from eastern India

Ramtanu Bandyopadhyay[1], Arnab Roy[1], Rudrajit Paul[1], Sudipan Mitra[2], Amit K Banerjee [1], Srabani Ghosh[3]

1. Department of Medicine Dept. of Cardiology, Medical College, Kolkata88, College Street, Kolkata 700 073, West Bengal.
2. Assistant Professor, Dept. of Medicine, Bankura Sammilani Medical College, Bankura, West Bengal
3. Assistant Professor, Dept. of Medicine, Midnapore Medical College, Midnapore 721 101, West Bengal.

ARTICLE HISTORY

Received: 05.12.2012

Accepted: 24.12.2012

Available online: 10.02.2013

Keywords:

Sepsis, Organ Dysfunction, blood culture, mortality, infection

***Corresponding author:**

Email : docr89@gmail.com
Tel : +91 9433824341

ABSTRACT

Sepsis is an important cause of morbidity and mortality. Severe sepsis, defined as sepsis with one or more organ dysfunction, causes a significant proportion of deaths in critical care setting. However, studies regarding sepsis and organ dysfunction are rare from India. We undertook this cross-sectional study to find the prevalence of organ dysfunction in sepsis patients and the relation of organ dysfunction with source of sepsis. Among 100 patients in our study, 53% were aged more than 55 years. The incidence of severe sepsis was significantly high in this age group, compared to the younger patients (64.15% vs. 49%). Respiratory source was the commonest aetiology of sepsis in our patients. However, source of infection was unidentified in 11%. 57% of patients had severe sepsis, with renal (26%) and pulmonary (18%) involvement the commonest. 21 patients had more than one organ dysfunction. Blood culture was positive in 33%. Mortality in sepsis patients was mainly related to age. Different studies from around the world have shown similar incidence of severe sepsis in elderly patients and a high rate of sepsis secondary to respiratory infections. However, if surgical ward patients are included in the study, the percentages are likely to change. Our study is also limited by the small number of patients and lack of use of newer markers like procalcitonin. Still, it gives an overview of the extent of organ involvement in sepsis.

INTRODUCTION

Sepsis is a leading cause of admission in non-cardiological intensive care units (ICU) and the second leading cause of death among ICU patients after cardiological causes [1]. The reported incidence of sepsis and septic shock in ICU patients admitted through emergency department have increased since 1997.In contrast, hospital mortality has decreased [2]. The rising incidence is attributable to the aging of the population, increased longevity of patients with chronic diseases, and the relatively high frequency with which sepsis develops in patients with AIDS. The widespread use of antimicrobial agents, immunosuppressive drugs, indwelling catheters, mechanical devices and mechanical ventilation also play some role in developing sepsis [3].

In a developing country like India, the incidence, patterns of organ dysfunction and the outcomes of patients with sepsis remains both under-diagnosed and under-reported. In 2001, Angus et al.[4] studied over six million records of hospital discharges in seven states in the US and found an estimate of 751 thousand cases of severe sepsis per year, with a mortality rate of 28.6%. In 2002 Alberti C et al. showed that, of all episodes of infection recorded in ICUs, 28% are associated with sepsis, 24% with severe sepsis, and 30% with septic shock [5].

Organ dysfunction, associated with high rates of ICU morbidity and mortality [6, 7], accounts for a high proportion of the ICU budget [7]. So a new concept developed regarding management of sepsis, the surviving sepsis campaign (SSC) in 2004 and updated in 2008 to decrease severe sepsis related mortality.

So in a country like India, it is very important to assess the pattern of organ dysfunction in sepsis not only to target therapy to reduce organ dysfunction and mortality but also to decrease the cost of treatment and to decrease ICU stay as almost all ICUs of our country are over loaded with patients. Patient turnover and cost of therapy without compromising mortality are important issues in our set-up.

METHODOLOGY

In this study, an attempt was made to find the prevalence of different organ dysfunctions in sepsis patients. Also, the relation of organ dysfunction with the source of sepsis was observed and analysed.

Patients had been selected from the medicine ward and from CCU (critical care unit) of a tertiary care medical college of Eastern India. Those patients who fulfilled the criteria of sepsis [as below] had been considered for entry into the study.

Criteria:- Those fulfilled two or more of the following with a proven or suspected microbial aetiology:

Oral temperature>38^{0}C or hypothermia<36^{0}C, Respiratory rate>20 breaths/min, Heart rate>90 beats/min, Leucocytosis (>12000/mm^3) or Leucopenia (<4000/mm^3) or Band form>10%. Patients with known prior chronic liver disease, renal impairment, coagulation or haematological disorder, prior history of stroke or heart failure, patients on immunosuppressive drugs and those with known lung diseases were excluded.

This was a hospital based cross sectional observational study carried out from January 2010 to June 2011. Organ dysfunction assessment was done particularly on the basis of initial SOFA (sepsis related organ failure assessment) scoring system using the relevant blood/other tests [8]. Six organ systems are included in the SOFA scoring system. For every organ system point 0 means no organ dysfunction and point 4 means most severe organ dysfunction. Although SOFA scoring system includes only bilirubin testing for liver dysfunction, we here also checked the liver enzymes viz. SGOT, SGPT to assess liver dysfunction. Similarly, in SOFA scoring system, only platelet count is used to assess coagulatory dysfunction. We here also checked the Prothrombin time. For other organ systems no additional variable were added to SOFA scoring system.

The data were tabulated in excel worksheet. Categorical data are presented as number/percentage. The statistical analysis was done by using MedCalc12.0.3.0 statistical software [Freeware].

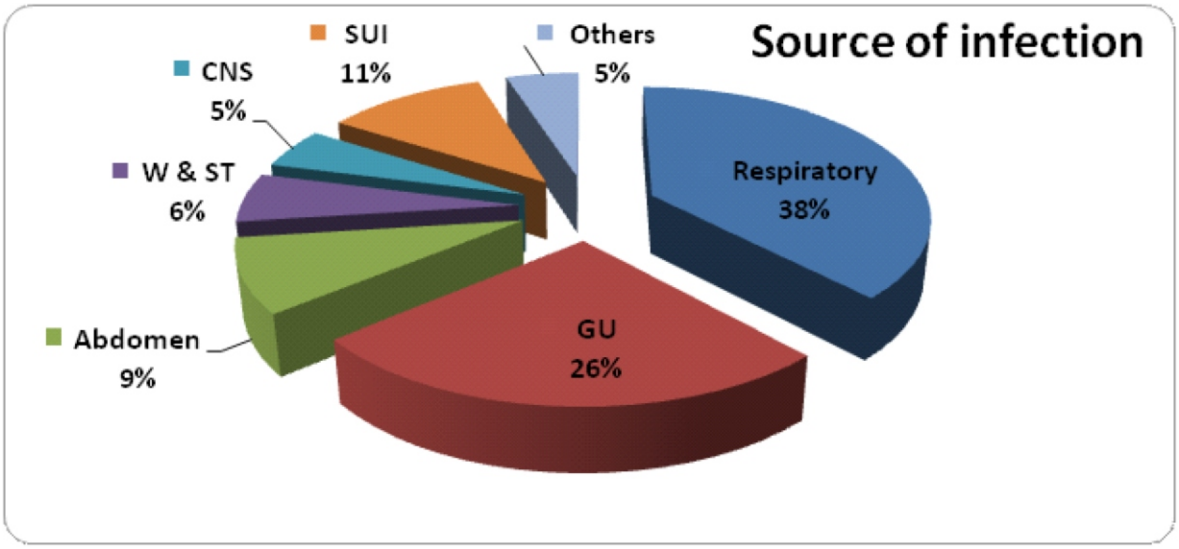
RESULTS

There were a total of 100 patients in our study. Initially, 127 patients were recruited, but some of them died before any tests could be done and some others had incomplete test results. Patients were divided into 2 age groups- Group A (14 to 55 yr. n=47), Group B (age> 55yr, n=53). Incidence of sepsis with organ dysfunction in Group B was 64.15%. Incidence of sepsis with organ dysfunction in Group A was 48.94%.

In this study it is seen that the respiratory source (38%) was the most common source of infection causing sepsis, followed by genito-urinary source (26%). Source was unidentified (SUI) in a high percentage of cases (11%) (Fig. 1). Among all the patients with sepsis, 57% had one or more organ dysfunction. 4% patients had hepatic dysfunction, 15% had cardiovascular dysfunction, 18% had pulmonary dysfunction, 13% had coagulation dysfunction, 5% had central nervous system dysfunction and lastly a major percentage had renal dysfunction (26%) (Table 2). 4 patients had hepatic dysfunction. Among these 4 patients, 3 had both elevated serum bilirubin and liver enzymes. 1 patient had only elevated liver enzymes with normal bilirubin level. Total 13 patients had coagulation abnormality. Among these, six cases are common to both decreased platelet and prolonged PT. One patient developed DIC.

Among the patients of sepsis with organ dysfunction (n=57), we have seen one organ dysfunction in 63.16% (n=36) of cases, two organ dysfunctions in 22.81% (n=13) cases, three organ dysfunctions in 12.28% (n=7) cases and more than three organ dysfunction in 1.75% cases (n=1). In respiratory source of infection it was seen that renal dysfunction occur most commonly (23.68%). Pulmonary dysfunction just lag behind(21.05%).In GU source of infection coagulation dysfunction occur in a high percentage of cases(19.23%).Renal dysfunction (44.44%) and hepatic dysfunction (33.33%) occur most commonly with abdominal source of infection. Surprisingly when source of infection was not identified (SUI) there was no coagulation abnormality (Table 3).

Figure 1: figure showing the source of infection (SUI: source unidentified)



Abbreviations used :- CNS: central nervous system; GU: genitourinary; CVS: cardiovascular system; SUI: source unidentified; W & ST: wound and soft tissue]

Table 1: Table showing the comparison with other studies

Organ dysfunction	Angus DC et al. 2001	Mayr et al. 2010	Present study
Hepatic	1.3%	1.4%	7%
Cardiovascular	24.4%	22.9%	26.36%
Pulmonary	45.8%	34.4%	31.58%
Coagulation	20.6%	17.3%	22.81%
CNS	9.3%	8.1%	8.77%
Renal	22.0%	46.6%	45.61%

Table 2: Incidence of particular organ dysfunction in sepsis (n=100)

Organ dysfunction	No. (%)
Hepatic	4
Cardiovascular	15
Pulmonary	18
Coagulation	13
CNS	5
Renal	26

Among 100 patients selected for this study, blood culture was positive in 33% cases. Blood culture was most commonly positive (47.37%) in respiratory source of infection. It was positive in lowest number of cases in sepsis when source unidentified (9.09%) (Table 4). In abdominal sepsis blood culture positivity was also low(11.11%).

It had been seen that there was increased mortality in age>55 yr. (mortality 50%) than those patients in the age group of 14-55yr (group A: mortality 21.74%).It was also statistically significant (p=0.0053). Highest mortality was seen with infection when source was not identified. It was 45.45%, followed by respiratory source of infection, where mortality was 28.95%. Lowest mortality seen with abdominal source of infection (11%)

DISCUSSION

There have been very few studies from Eastern India which have looked into the organ dysfunction that occur in patients with sepsis. In our small observational study, we found organ dysfunction present in 57% of patients with sepsis. Respiratory system was the commonest source of infection for sepsis and renal and pulmonary dysfunctions were the commonest. Rate of blood culture positivity was very low (33%). Mortality increased with age.

Age is an important cofactor in sepsis associated morbidity. Elderly patients (more than 65 years of age) accounted for 64.9% of sepsis cases shown by a study in 2006 [9]. A study by Leeann Braun et al also showed that incidence of sepsis is higher beyond the age of 60 years [10]. Aging patients have more chance of bacteraemia, and the overall case fatality rate for older patients with bacteraemia is also higher. Our study showed the incidence of severe sepsis (i.e. sepsis with one or more organ dysfunction) to be 64.15% in those aged more than 55 years. The incidence of sepsis in elderly (>55yr) in our study is slightly lower than the study conducted in 2006 [9].

A recently published study by Florian B. Mayr et al in 2010 has looked at the source of infection in sepsis patients [11]. In their study, respiratory system was the commonest source of infection (~31%). In our study, respiratory source of infection was identified in 38%. However, in their study too, source of infection was unidentified in around 10% cases [11]. However, in this study of 2010 both medical and surgical ward patients were included; thus, skin and soft tissue infections were present in large numbers [11]. Since our study was confined only to medical ward patients, the aetiology of infection was different.

In our study incidence of severe sepsis was 36%, which is comparable to earlier studies [5]. But recent studies conducted at developed countries demonstrated a lower value than our study for incidence of severe sepsis [12]. Incidence of septic shock is highly variable among different studies, from 8% to 35% [5].

Table 3: Organ dysfunction in relation to source of infection

Source of infection	Organ dysfunctions (N; %)					
	Liver	CVS	Pulmonary	Coagulation	CNS	Kidney
Respiratory (n=38)	1 2.63%	4 10.53%	8 21.05%	4 10.53%	1 2.63%	9 23.68%
GU (n=26)	0 0%	4 15.38%	3 11.54%	5 19.23%	2 7.69%	7 26.92%
Abdomen (n=9)	3 33.33%	0 0%	0 0%	3 33.33%	0 0%	4 44.44%
W. & ST (n=6)	0 0%	2 33.33%	1 16.67%	0 0%	1 16.67%	1 16.67%
CNS (n=5)	0 0%	1 20%	0 0%	0 0%	0 0%	0 0%
SUI (n=11)	0 0%	4 36.36%	4 36.36%	0 0%	1 9.09%	4 36.36%
Others (n=5)	0 0%	0 0%	2 40%	1 20%	1 20%	1 20%

Incidence of MODS was 21% in our study, not much different from other published literature [11].

We have compared the pattern of organ dysfunction in our study with the study by other authors [Table 1] [4, 11]. Almost similar results are found except the incidence of hepatic dysfunction, which is higher in our study compared to other two studies.

Among 100 patients selected for our cross-sectional study, blood culture was positive in 33% cases. In severe sepsis blood culture yields positive results in only 20% to 40% cases [3]. In septic shock blood culture shows positivity was 40% to 70% cases [3]. Our findings are in tune with these published figures from round the world.

It was also revealed in our study that when the source of infection was unidentified, then the mortality was maximum 45.45%. This is in agreement with the published literature [4].

The PROGRESS study enrolled sepsis patients from different countries including India [13]. In this study, a wide variation in organ dysfunction and outcomes were noted. This shows that any study of organ dysfunction in sepsis cannot be generalized to all sets of patients. Average age of patients, comorbidities, level of industrialisation or other factors can affect the organ dysfunction prevalence. Thus each country needs to have its own algorithm for sepsis management. A recent Indian study found that cytokine

Table 4: Source of infection and blood culture positivity (n=100)

Source of infection	No. of positive blood culture (%)
Respiratory (n=38)	18 (47.37%)
GU (n=26)	8 (30.77%)
Abdomen (n=9)	1 (11.11%)
W & ST (n=6)	1 (16.67%)
CNS (n=5)	2 (40%)
SUI (n=11)	1 (9.09%)
Others (n=5)	2(40%)
Total (n=100)	33 (33%)

profiles in sepsis patients can predict the subsequent outcome and mortality [14]. Thus, measuring the cytokines like IL-6 and TNF can be a valuable tool in sepsis management.

CONCLUSION

The present study is limited by the small number of patients, cross sectional nature of the study and lack of use of newer methods of diagnosis of infection like procalcitonin or gallium scan. Still, this small study shows the extent of organ dysfunction in sepsis patients. A larger study with multi ethnic participation is warranted to actually define the organ system involvement in sepsis and thus an action plan can be formulated.

REFERENCES

1. Blanco J, Muriel-Bombín A, Sagredo V, Taboada F, Gandía F, Tamayo L et al. Incidence , organ dysfunction and mortality in severe sepsis : a Spanish multicentre study .Crit Care 2008;12:R158.epub2008
2. Shapiro N, Howell MD, Bates DW, Angus DC, Ngo L, Talmor D. The association sepsis syndrome and organ dysfunction with mortality in emergency department patients with suspected infection. Ann Emerg. Med 2006; 48:583-90.
3. Munford RS. Severe sepsis and septic shock. In Harrison's principles of Internal Medicine 17th edition 2008; McGraw Hill :pp1695-702.
4. Angus DC, Linde-Zwirble WT, Lidicker J, Clermont G, Carcillo J, Pinsky MR. Epidemiology of severe sepsis in the United States: analysis of incidence, outcome, and associated costs of care. Crit Care Med. 2001;29:130310.
5. Alberti C, Brun-Buisson C, Burchardi H, Martin C, Goodman S, Artigas A et al. Epidemiology of sepsis and infection in ICU patients from an international multicentre cohort study. Intensive Care Med 2002, 28:108-21.
6. Tran DD, Groeneveld ABJ, Vander Meulen J, Nauta JJP, Strack Van Schijndel RJM, Thijs LG. Age, chronic disease, sepsis, organ system failure, and mortality in a medical intensive care unit. Crit Care Med. 1990;18: 474-9.
7. Deitch EA. Multiple organ failure: pathophysiology and potential future therapy. Ann Surg. 1992; 216:117-34.
8. Vincent JL, Moreno R, Takala J, Willatts S, De Mendonça A, Bruining H, et al. The SOFA (Sepsis-related Organ Failure Assessment) score to describe organ dysfunction/failure. On behalf of the Working Group on Sepsis-Related Problems of the European Society of Intensive Care Medicine. Intensive Care Med 1996 ;22:707-10
9. Martin GS, Mannino DM, Moss M. The effect of age on the development and outcome of adult sepsis. Crit care Med. 2006 Jan; 34(1):15-21.
10. Braun L, Riedel AA, Cooper LM. Severe Sepsis in Managed Care: Analysis of Incidence, One-Year Mortality, and Associated Costs of Care. J Manag Care Pharm. 2004; 10:521-30.
11. Mayr FB, Yende S, Linde-Zwirble WT, Peck-Palmer OM, Barnato AE, Weissfeld LA et al. Infection Rate and Acute Organ Dysfunction risk as Explanations for Racial Differences in Severe Sepsis. JAMA. 2010;303:2495-503.
12. Finfer S, Bellomo R, Lipman J, French C, Dobb G, Myburgh J. Adult-population incidence of severe sepsis in Australian and New Zealand intensive care units. Intensive Care Med 2004, 30:589-96
13. Beale R, Reinhart K, Brunkhorst FM, Dobb G, Levy M, Martin G et al. Promoting Global Research Excellence in Severe Sepsis (PROGRESS): lessons from an international sepsis registry. Infection. 2009 Jun;37(3):222-32
14. Kumar AT, Sudhir U, Punit K, Kumar R, Ravikumar VN, Rao MY. Cytokine profile in elderly patients with sepsis. Indian J Crit Care Med. 2009 ; 13: 748.