The Utility of SOFA Score and Acute Physiology and Chronic Health Evaluation (APACHE II) Score in Analysing Patients with Multiple Organ Dysfunction Syndrome and Sepsis

Dr. Ramyajit Lahiri [1*], Dr. Mohsin Rehan [2], Dr. Sudip Banerjee [3], Dr. Suchanda Gadre [4], Dr. Prolay Paul [5], Dr. Sobhan Gupta [6]

[1] Head Department & Consultant of Emergency Medicine, Narayana Superspeciality Hospital, Howrah, West Bengal, India
[2] Junior Consultant of Emergency Medicine, Narayana Superspeciality Hospital, Howrah, West Bengal, India
[3] Consultant of Emergency Medicine, Narayana Superspeciality Hospital, Howrah, West Bengal, India
[4] Medical Superintendent, Narayana Superspeciality Hospital, Howrah, West Bengal, India
[5] Clinical Pharmacologist, Narayana Superspeciality Hospital, Howrah, West Bengal, India
[6] Clinical Pharmacology- Intern, Narayana Superspeciality Hospital, Howrah, West Bengal, India

* Corresponding Author: **Dr. Ramyajit Lahiri**

Article Info

ISSN (online): 2582-8940
Volume: 03
Issue: 04
October-December 2022
Received: 13-10-2022;
Accepted: 02-11-2022
Page No: 18-47

Abstract
Sepsis with Multiorgan dysfunction syndrome (MODS) is a common cause of Intensive Care Unit (ICU) mortality and morbidity. The primary cause; infectious or non-infectious, triggers an uncontrollable inflammatory response. Sepsis can be reversed, but as sepsis progresses to severe sepsis and septic shock the mortality rate substantially increases. The diagnosis of sepsis relies on overt symptoms of systemic illness causing a change in the vital parameters of the patient as well as indication of infection through microbial cultures and serology. Various clinical biochemical and hematological parameters in septic patients serve as indicators of organ dysfunction and hence can be used to define the prognosis in a patient with sepsis. In our study, though mean APACHE II score was high among non survivors than survivors (23.28 v/s 18.75), it was of just suggestive significance (p=0.068+). In this study, extensive study of SOFA score was done from day 1 to the last day. The SOFA score on day 1 was high among non survivors and survivors which was statistically significant (10.17 v/s 7.94, p=0.014). However, the most significant difference was observed on day 3. The SOFA score was very high among non survivors as compared to survivors which was statistically very significant (13.42 v/s 6.84, p<0.001).

Keywords: Sepsis, Multiorgan dysfunction, APACHE, SOFA, Septic Shock, Dengue hemorrhagic

Introduction

Sepsis with Multiorgan dysfunction syndrome (MODS) is a common cause of Intensive Care Unit (ICU) mortality and morbidity [1]. The primary cause; infectious or non-infectious, triggers an uncontrollable inflammatory response. Sepsis can be reversed, but as sepsis progresses to severe sepsis and septic shock the mortality rate substantially increases [2]. Multiorgan dysfunction syndrome is well established as the final stage of the continuum [3]. Due to the high mortality associated with sepsis and its complications it is necessary to rapidly diagnose and treat the underlying cause.

The diagnosis of sepsis relies on overt symptoms of systemic illness causing a change in the vital parameters of the patient as well as indication of infection through microbial cultures and serology. Various clinical biochemical and hematological parameters in septic patients serve as indicators of organ dysfunction and hence can be used to define the prognosis in a patient with sepsis [4].

Patients admitted to the ICU need aggressive supportive management as well as detailed investigations to reverse the cause [5]. Early initiation of appropriate effective antimicrobial therapy is essential for a favorable outcome in the patient with sepsis [6, 7]. There is evidence that failure to initiate appropriate therapy correlates with increased morbidity and mortality [8].

Cultures and serology are available only after 24 to 48 hours. In the crucial hours which determine the prognosis of the patient the physician has to depend on clinical symptoms and demographic data to aid in diagnosis and management. Hence guidelines recommend empirical broad spectrum antibiotics that will cover all likely pathogens, as well as supportive care, early recognition and treatment of complications, and intensive monitoring to prevent worsening of sepsis [5]. In more than one third of the patients aetiology is never determined even till death or discharge [3].

In India, tropical infections causing multiple organ dysfunction add to the burden of sepsis in ICU. Most patients present with acute undifferentiated fever with clinical syndromes like such as fever–myalgia, fever–arthralgia, fever–icterus, fever–rash, or acute encephalitic syndrome [9]. Due to their varied presentation, multi system involvement and lack of clinical diagnostic criteria these tropical infections are often undiagnosed. The lack of sensitive tests to identify these infections, high cost and non-availability of isolation techniques, add to the diagnostic dilemma [10].

There is a need to identify the common tropical infections contributing to mortality in ICU. Studies in India have focussed on patients with sepsis due to established causes like malaria, leptospirosis or rickettsial infections. There are very few studies done to study the clinical course in patients presenting with acute undifferentiated fever [11]. When a patient is admitted in ICU the aetiology is usually not established. The intensivists have very little data to treat such patients in the first 24 to 48 hours which are crucial in reversing the process of sepsis and multi organ dysfunction. There are many scoring systems which are helpful in prognosticating the severity and outcome.

Scoring systems for use in the intensive care unit (ICU) have been developed from the past 30 years. They are widely used in the field of critical care medicine. They allow a quantification of the severity of illness and a probability of in-hospital mortality. A well performing ICU prognostic model helps to make meaningful comparison of the hospital‘s current performance with the past. This allows the hospital to identify the weakness and initiate interventions aimed at quality improvement and allow patients to choose health care providers based on performance. The use of these prognostic models help in providing meaningful information to physicians when discussing patient prognosis with the patient‘s relatives. There are many scores available at present. But our study focuses on mainly Acute Physiology and Chronic Health Evaluation II (APACHE II) and Sequential Organ Failure Assessment (SOFA) scores. Our study mainly aims at assessing morbidity and mortality of patients with multiorgan dysfunction syndrome in sepsis and prognosticating the patients by using defined scores like SOFA and APACHE II scores.

Aims and Objectives

- To assess morbidity and mortality of patients with multiorgan dysfunction syndrome in sepsis.
- To prognosticate the patients by using defined scores like SOFA and APACHE II scores.

Table 1: Sepsis definition

Bacteremia	**Presence of bacteria in blood, as evidenced by positive blood Cultures**
Septicemia Presence	Presence of microbes or toxins in blood
Systemic Inflammatory Response syndrome (SIRS)	**Two or more of the following conditions:** 1. Fever (oral temperature >38°C) or hypothermia (<36° C) 2. Tachypnea (>24 breaths/min); 3. Tachycardia (heart rate >90 beats/min); 4. Leukocytosis (>12,000/µL), leukopenia (<4,000/µL), or >10% bands; may have a noninfectious etiology
Sepsis	SIRS that has a proven or suspected microbial etiology
Severe sepsis (similar to "sepsis syndrome")	**Sepsis with one or more signs of organ dysfunction—for example:** 1. **Cardiovascular**: Arterial systolic blood pressure ≤ 90 mmHg or mean arterial pressure ≤ 70 mmHg that responds to administration of intravenous fluid 2. **Renal**: Urine output<0.5 mL/kg per hour for 1 hour despite adequate fluid resuscitation 3. **Respiratory**: PaO2/FIO2 250 or, if the lung is the only dysfunctional organ, ≤200 4. **Hematologic**: Platelet count <80,000/µL or 50% decrease in platelet count from highest value recorded over previous 3 days 5. **Unexplained metabolic acidosis**: A pH 7.30 or a base deficit 5.0 mEq/L and a plasma lactate level >1.5 times upper limit of normal for reporting lab. 6. **Adequate fluid resuscitation**: Pulmonary artery wedge pressure 12 mmHg or central venous pressure 8 mmHg
Septic shock	Sepsis with hypotension (arterial blood pressure <90 mmHg systolic, or 40mmHg less than patient's normal blood pressure) for at least 1 hour despite adequate fluid resuscitation; or need for vasopressors to maintain systolic blood pressure ≥90 mmHg or mean arterial pressure ≥70 mmHg
Refractory septic Shock	Septic shock that lasts for >1 hour and does not respond to fluid or pressor administration

Multiorgan dysfunction syndrome (MODS) is the presence of altered organ function in a patient who is acutely ill such that homeostasis cannot be maintained without intervention.16 Primary MODS is the direct result of a well-defined insult in which organ dysfunction occurs early and can be directly attributable to the insult itself. Secondary MODS develops as a consequence of a host response and is identified within the context of SIRS.16 The inflammatory response of the body to toxins and other components of microorganisms cause the clinical manifestations of sepsis.

In 2001 Society of Critical Care Medicine, The European Society of Intensive Care Medicine, The American College of Chest Physicians, The American Thoracic Society and The Surgical Infection Society agreed to revisit the definitions of sepsis and related conditions. They found no evidence to support a change in the definitions [17]. However, during that meeting SIRS came under heavy attack, because the criteria identified lots of patients who were not sick and because there

were sick patients who did not necessarily have SIRS.
SIRS criteria were indeed too sensitive and non-specific [18] and that, in preference to the SIRS criteria, it was suggested that an expanded list of signs and symptoms of sepsis should be used to reflect the clinical response to infection [17].

Current definitions of infection and sepsis
Infection: A pathologic process caused by the invasion of normally sterile tissue or fluid by pathogenic or potentially pathogenic microorganisms.
Sepsis: The presence of infection, documented or strongly suspected, with a systemic inflammatory response, as indicated by the presence of some of the features listed below.
Severe Sepsis: Sepsis complicated by organ dysfunction.
Septic Shock: Severe sepsis complicated by acute circulatory failure characterized by persistent arterial hypotension, despite adequate volume resuscitation, and unexplained by other causes.
Proposed change from SIRS to a longer list of signs for the diagnosis of sepsis [17].

General variables
- Fever (core temperature >380C).
- Hypothermia (core temperature <360C).
- Heart rate>90 beats /min or >2 Standard Deviations (SD) above normal range for age.
- Tachypnea
- Altered mental status.
- Significant edema or positive fluid balance (>20 ml/kg over 24 hours).
- Hyperglycemia (plasma glucose >120 mg/dL) in the absence of diabetes.

Inflammatory variables
- Leukocytosis: white blood cell count >12,000/µL.
- Leukopenia: white blood cell count <4000/µL.
- Normal WBC count with >10 per centimetre band forms.
- Plasma C-reactive protein >2 SD above normal value.
- Plasma procalcitonin>2 SD above normal value.

Organ dysfunction variables
- Arterial hypoxemia [PaO2/FiO2] <300.
- Acute oliguria: Urine output <.5 ml/Kg/h or 45 mmol/L for atleast two hours.
- Creatinine>2.0 mg/dL.
- Coagulation abnormalities: International Normalized Ratio [INR] >1.5 or activated partial thromboplastin time [aPTT]> 60 seconds.
- Thrombocytopenia (platelet count <100,000/ mL).
- Hyperbilirunemia (plasma total bilirubin>2.0 mg/ dl).

Tissue perfusion variables
- Blood lactate levels should be measured
- Hyperlactatemia (>2mmol/L)
- Decreased capillary refill or mottling

Haemodynamic variables
Arterial hypotension, systolic blood pressure <90 mm Hg, mean arterial blood pressure <65 mmHg, or systolic blood pressure decrease >40 mm Hg.
A new concept was proposed predominantly by John Marshall, from Toronto which arose from recognition that sepsis is a heterogeneous condition and that it may be possible to describe sepsis on the basis of four characteristics in the same way that cancer can be described on the basis of the TMN system [17]. PIRO model was presented which is a hypothetical model for staging sepsis. In the future it may better characterize the syndrome on the basis of predisposing factors and premorbid conditions, the nature of underlying infection, the characteristics of host response and the extent of resultant organ dysfunction.

PIRO Model [17]
P: Predisposing Factors
Innate: Genetic polymorphisms and deficiencies of immune response genes affecting innate immune response, coagulation system, complement receptors, Toll-like receptors and intracellular signalling.
Acquired: Burns, trauma, acquired immune deficiencies.
I: Infection
Site, quantity, intrinsic virulence, and local vs. systemic infection due to specific microbial pathogens.
R: Response
Differential responses based on hyperresponsiveness vs. hyporesponsiveness- immunosuppression; Response modifiers such as alcohol, age, sex, nutritional status, diabetes, other preexisting diseases, and physiologic status of host.
O: Organ dysfunction
Number, severity, and pattern of organ dysfunction in response to systemic infection, primary vs. secondary organ injury; and organ injury due to sepsis vs. pre- existing organ dysfunction.
The PIRO Model is currently more a framework for further research rather than a system that has immediate clinical application. Much work is required to characterize those factors within each domain that affect prognosis and response to therapy [19]. SIRS and MODS are not diseases or syndromes, but concepts. The four criteria that define SIRS are non-specific manifestations of physiologic severity, rather than distinctive manifestations of a disease process.
However, these syndromes are characterized considering that shared biologic mechanisms may permit the development of effective therapy for different diseases. The challenge lies in characterizing common pathologic processes for different diseases [20].

Epidemiology of sepsis
A study published by the Centre for Disease control in the United States indicates that the incidence of septicaemia has increased from 73.6 per 100 000 patients in 1979 to 175.9 per 100 000 patients in 1987 [21]. In one of the largest epidemiologic studies ofsepsis, published in 2001, Angus and colleagues estimated a national incidence of 751,000 cases in the United States [22].
Sands et al found that sepsis accounted for 2.0% of all hospitalizations and that 59% of patients with sepsis require ICU care. The mortality rate for severe sepsis still ranges from 13% to 50%, and is as high as 80% to 90% for septic shock and multiple organ dysfunction [1].
In addition to the high mortality associated with severe sepsis and septic shock, it also results in significant morbidity and financial burden. Based on previous data it has been predicted that the incidence of severe sepsis will increase at a rate of 1.5% per year, leading to more than a million episodes of severe sepsis annually in the United States by 2020 [23].
There is lack of statistical data concerning incidence of sepsis in India. The incidence and mortality rates are considered

higher than in the West. In a multicentre, prospective, observational study conducted in four intensive therapy units (ITUs) in India from June 2006 to June 2009 where a total of 5,478 ITU admissions were studied SIRS with organ dysfunction was found in 25% of patients, of which 52.77% were due to sepsis. The incidence of severe sepsis was 16.45% of all admissions. ITU mortality of all admissions was 12.08% and that of severe sepsis was 59.26% [24].

Factors responsible for growing incidence of sepsis and septic shock are an increased awareness and sensitivity for diagnosis, an increased number of patients who have immune compromised status, the increased use of invasive procedures, growing number of resistant organisms that are encountered in clinical settings and an increased number of elderly patients who are at a greater risk of developing sepsis and septic shock [1].

Medical illness is one of the major predisposing factors in the development of sepsis. If the prevalence of comorbidities is examined in patients with sepsis, it is found that certain pre-existing disease conditions like chronic obstructive pulmonary disease,

congestive heart failure, diabetes mellitus, and cancer predispose an individual to the development of sepsis [25]. Persons at the extremes of age or with compromised immune systems, indwelling catheters and devices, or disrupted natural defence barriers are at a greater risk for sepsis [1]. Patients with malignancies make up a substantial proportion of those diagnosed with sepsis, and they have nearly a 10-fold increase in their relative risk of developing sepsis when compared with those who do not have cancer. Pancreatic cancer has the highest associated risk of sepsis, followed closely by multiple myeloma, leukemia, and lung cancer, whereas gastrointestinal and breast malignancies are associated with a much lower predisposition to sepsis.26 Studies often exclude the very elderly, patients with Human Immunodeficiency Virus (HIV) disease, and patients with malignancy because these patients are at a higher risk of death and less likely to respond to treatment [22].

A patient may have a genetic predisposition for development of sepsis and increased mortality. Genetic polymorphisms have been identified for the genes for tumor necrosis factor, interleukin 6, interleukin 10 and interleukin 1 receptor antagonist, heat shock protein, lipopolysaccharide binding protein, toll-like receptor 2, and toll-like receptor 4 which determine a patients response to infection [27].

Studies have found that women did have lower age-adjusted severe sepsis rates. However, this could represent a difference in the distribution of risk factors, such as chronic obstructive pulmonary disease, or a difference in access to care [22]. Race clearly has an effect on predisposition to sepsis; African-American men in particular have increased rates of sepsis compared with the white population, with a younger age of onset and higher mortality [25].

In the investigation of seasonal variation in the incidence of sepsis, it was found that the lowest rates occur during the fall season, with incidence peaking during the winter months [28].

Etiology of sepsis

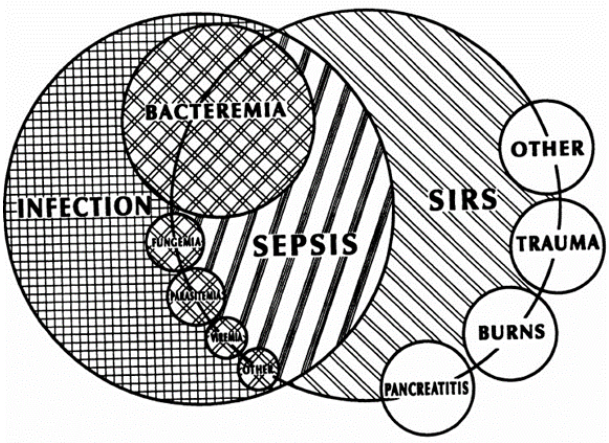

Fig 1

The etiology of sepsis has been determined by medical advances that has led to increased immunosuppression and increased use of invasive devices and antibiotics [22]. Historically, gram-negative rods were the predominant etiologic agent; however, the proportion of sepsis caused by gram-positive cocci began to rise steadily in the mid- 1980s and the proportion caused by fungal organisms began a similar rise in the mid- 1990s [25].

Severe sepsis can be a response to any class of microorganisms. Bacteremia is not essential for development of sepsis since local inflammation can elicit distant dysfunction and hypotension. Blood cultures are positive only in 20-40% of cases of severe sepsis and 40-70% of septic shock.2 Gram negative and gram positive bacteria account for 70% of these isolates and the remainder are attributed to fungi or mixed infections [2]. In patients whose blood cultures are negative, the etiologic agent is often established by culture or microscopic examination of infected material from a local site. In more than one third of the patients the cause for sepsis is never established [3].

Sands et al in their study on the epidemiology of sepsis in 8 tertiary care hospitals in the United States found that bloodstream infection was documented in 28% of patients with gram-positive organisms being the most frequent isolates [23].

Table 2: Microorganisms Involved in Episodes of Severe Sepsis at Eight Academic Medical Centres in the United States

Microorganisms	Episodes with bloodstream Infection, % (*n* = 436)	Episodes with documented infection but no bloodstream infection, % (*n* = 430)	Total episodes, % (*n* = 866)
Gram-negative Bacteria *a*	35	44	40
Gram-positive Bacteria *b*	40	24	31
Fungi	7	5	6
Polymicrobial	11	21	16
Classic Pathogens *c*	<5	<5	<5

a Enterobacteriaceae, pseudomonas, Haemophilusspp., other gram-negative bacteria.

b Staphylococcusaureus, coagulase-negative staphylococci, enterococci, Streptococcus pneumoniae, other streptococci, other gram-positive bacteria.

c Such as Neisseria meningitidis, S. pneumoniae, H.

influenzae, and Streptococcus pyogenes.

In a national survey of bloodstream infections in the United States, Escherichia coli was the most common cause of blood stream infections in older adults (age ≥65 years). However, in younger adults, Staphylococcus aureus was most frequent organism [29].

The most common sites of infection include respiratory and urinary tract. The respiratory and genitourinary systems combined are the source in 65.3% of patients with sepsis aged ≥65 years, vs. only 49.3% in those younger patients. In comparison, younger patients are at higher risk of gastrointestinal sources, skin, bone, and soft tissue sources compared to older adults [30]. Older patients with sepsis are more likely to have a Gram- negative pathogen than younger patients.

This is in part because of an increase in the genitourinary system as a source of infection.

We are in a way unfortunate in that we see not only the usual causes of sepsis and MODS encountered in the West, but also certain infections peculiar to tropical and developing countries.

These infections to which we are exposed are not just related to geography or climate, but are significantly related to environmental and socioeconomic conditions that prevail in our part of the world [31]. Infections like fulminant falciparum infections, severe leptospiral infections and haemorrhagic fevers sometimes cause life threatening organ dysfunction and have several overlapping features.

Falciparum Malaria

Plasmodium falciparum infection is responsible for about one million deaths every year [32]. Life-threatening malaria is invariably due to the intra-erythrocyte asexual form of the Plasmodium falciparum parasite. Cerebral malaria usually manifests as a diffuse symmetric encephalopathy without focal signs [2]. Seizures can occur especially in children. Acute tubular necrosis due to microcirculatory abnormalities in the kidney and secondary to hemoglobinuria results in oliguria which may require haemodialysis [2]. Acute Respiratory Distress Syndrome (ARDS) occurs due to release of cytokines that increase capillary permeability [33]. Hepatic dysfunction results from a combination of hemolysis, cholestasis and hepatocyte dysfunction. Hypoglycemia occurs due to reduced gluconeogenesis, reduced glycogenolysis, increased utilization of glucose by both the host and the parasite and the use of insulin secretagogues like quinine.34 Severe lactic acidosis, anemia and thrombocytopenia contribute to sepsis in malaria. Diagnosis is made by thick and thin peripheral smears for degree of parasitemia and speciation. Rapid, simple, sensitive, and specific antibody-based diagnostic stick or card tests that detect.

P. falciparum–specific, histidine-rich protein 2 or lactate dehydrogenase antigens in finger-prick blood samples have been introduced [35, 36]. Due to the easy availability of such techniques malaria is quickly diagnosed and can be treated appropriately.

Leptospirosis

This is a spirochetal disease caused by Leptospira interrogans. Infection occurs due to exposure to contaminated water. The disease has an incubation period of 5-14 days with an average of 10 days [37]. In its mild form, leptospirosis may present as an influenza- like illness with headache and myalgias. Severe leptospirosis, characterized by jaundice, renal dysfunction, and hemorrhagic diathesis, is referred to as Weil's syndrome. Vasculitis is responsible for the most important manifestations of the disease [2]. It causes centrilobular necrosis of the liver and renal tubular dysfunction by causing an interstitial nephritis and acute tubular necrosis.

A multicentric study in India showed that leptospirosis accounts for about 12.7% of cases of acute febrile illness attending hospitals [38]. Patients characteristically have retro orbital pain, headache, photophobia, conjunctival suffusion and severe muscle tenderness. Most patients become asymptomatic within 1 week which is the leptospiremic phase. After an interval of 1–3 days, the illness recurs in a number of cases. The start of this second (immune) phase coincides with the development of antibodies [39]. Often the fever is less pronounced and the myalgias are less severe than in the leptospiremic phase. Patients can develop aseptic meningitis, uveitis.

Weil's syndrome, the most severe form of leptospirosis, is characterized by jaundice, renal dysfunction, and hemorrhagic diathesis. There is pulmonary involvement in many cases; and mortality rates of 5–15% are recorded. Rhabdomyolysis, hemolysis, myocarditis, pericarditis, congestive heart failure, cardiogenic shock, adult respiratory distress syndrome, necrotizing pancreatitis, and multiorgan failure have all been described during severe leptospirosis [2, 37].

The white cell count is often <10,000/µL ranging from 3000-26000/µL. Mild thrombocytopenia occurs in up to 50% of patients and is associated with renal failure.

Urinalysis shows proteinuria, pyuria, granular casts and microscopic hematuria [37].

Cerebrospinal fluid may show aseptic meningitis like picture and the chest x-ray often shows dense confluent shadows suggestive of pulmonary hemorrhage. In contrast to patients with acute viral hepatitis, those with leptospirosis typically have elevated serum levels of bilirubin and alkaline phosphatase as well as mild increases (up to 200 U/L) in serum levels of aminotransferases. Levels of creatinine phosphokinase, are elevated in up to 50% of patients with leptospirosis [2].

Direct visualization of leptospires in blood or urine by dark field microscopic examination has been used for diagnosis. Leptospires can be isolated from blood and/or cerebrospinal fluid during the first 10 days of illness and from urine for several weeks beginning at 1 week. Cultures most often become positive after 2–4 weeks, with a range of 1 week to 6 months. Diagnosis is made with serology with the Microscopic Agglutination Test (MAT) as the gold acute febrile illness attending hospitals [38]. Patients characteristically have retro orbital pain, headache, photophobia, conjunctival suffusion and severe muscle tenderness. Most patients standard40with either a fourfold rise in titres or a single titre of >1:800 being diagnostic [41].

Other serologic tests are the Enzyme Linked Immunosorbent Assay (ELISA) and a commercially available dridot test which detects IgM antibody by an enzyme based dot immunoassay The ELISA test is commonly available, cost effective and a titre of 1:40 in on-endemic areas and a titre of 1:80 in endemic areas are considered as significant titre for leptospirosis in early stage [42].

Dengue fever

Dengue fever is an arbovirus disease transmitted by the bite of the Aedes mosquito. The virus initially replicates in the

skin and lymph nodes before dissemination in the blood stream [43].

The virus has an incubation period of 4-7 days though can range from 3-14 days. There are 3 main clinical subsets of dengue infection. Nonspecific febrile illness, classic dengue and dengue hemorrhagic fever/dengue shock syndrome [43].

Classic dengue presents with fever and severe headache and myalgias called break bone fever [44]. There may be associated lymphadenopathy, pharyngeal and ocular congestion and respiratory or GI symptoms. The fever lasts for 4-5 days and around the time of defervescence about half of patients develop a maculopapular rash that lasts 2-3 days and may be pruritic [2]. Rarely there may be myocarditis, hepatitis, pneumonitis and bleeding into internal organs.

Dengue hemorrhagic fever and dengue shock syndrome occur due to increased capillary permeability and vasodilatation 3-7 days after start of illness [45]. Shock often occurs 24 hours before or after defervescence and the shock lasts for a day or two.

Leukopenia occurs due to a direct suppressant effect on the bone marrow. Thrombocytopenia occurs mainly due to increased platelet destruction by adsorption of virus or antigen-antibody complexes on the platelet surface with subsequent immune destruction [44]. A coagulopathy may occur due to consumption of coagulation factors due to DIC, liver dysfunction and molecular mimicry between the viral proteins and coagulation factors [45].

The gold standard for diagnosis is the detection of antibodies by hemagglutination inhibition assay showing at least a fourfold rise in titre of neutralizing antibody in paired samples. ELISA test is for IgM antibodies which appear around the 6th day of illness and last for 1-3 months. IgG antibodies appear after 7-10 days and last for months to year [43]. Virus isolation techniques are not easily available. There is no specific treatment for dengue fever.

Most tropical infections initially present as acute undifferentiated fever. Patients present with fever, without any localized source of infection, of 7 to 14 days or less in duration. Myalgia, arthralgia, headache, altered sensorium, and jaundice are considered not to have localizing values [11]. If not identified and treated some of these patients can progress to multiorgan dysfunction. Since the serological test results are not available immediately the physician has to rely on clinical syndromes that provide clues to aetiology in these patients. Malaria is easily diagnosed on admission with a positive peripheral smear or a positive malarial rapid diagnostic test for P. falciparum. Hence Non Malarial Acute Undifferentiated Fever (NMAUF) is defined as acute undifferentiated fever negative for malaria.11 The following syndromes can be identified in patients with tropical infections.

Fever and thrombocytopenia

Diseases that commonly present with fever and thrombocytopenia are malaria (usually falciparum but also vivax), dengue fever, leptospirosis, rickettsial infections and viral fevers [46].

Quantitative changes in platelet counts associated with infection may result from decreased marrow production, hypersplenism, consumption due to widespread endothelial damage or disseminated intravascular coagulation, as well as immune- mediated platelet destruction.

The platelet counts can fall to as low as 5000/mm3 predisposing the patient to life threatening bleeding in the central nervous system or from the gastrointestinal and genitourinary tracts.

Both malaria and leptospirosis usually have an associated derangement of the prothrombin time and activated partial thromboplastin time [45].

Fever with arthralgia and rash

The triad of fever, arthralgia/myalgia and rash is typical of many arbovirus infections. A few are capable of causing epidemics: chikungunya, yellow fever, dengue, Japanese encephalitis and West Nile viruses.

Fever with hepatorenal dysfunction

Diseases that predominantly present with hepatorenal dysfunction are falciparum malaria, leptospirosis and scrub typhus. Patients are at increased risk of bleeding due to decreased clotting factor production by the liver, disseminated intravascular coagulation due to liver failure and infection, and uremia-induced platelet dysfunction. Renal failure in patients with severe malaria presents with oliguria whereas patients with leptospirosis usually have a non-oliguric renal failure with hypokalemia due to tubular dysfunction [45].

Fever with pulmonary renal syndrome

Diseases that present with pulmonary-renal dysfunction are falciparum malaria, leptospirosis, and scrub typhus. Patients usually develop ARDS or pulmonary hemorrhage due to thrombocytopenia. Malaria causes an ARDS type of syndrome while leptospirosis can cause ARDS or alveolar hemorrhage which is due to a combination of alveolo-capillary injury and thrombocytopenia. The X-ray in patients with leptospirosis often shows dense pulmonary infiltrates due to the hemorrhage [45].

Prognosis

The traditional outcome of critically ill patients admitted to the ICU has always remained hospital mortality. To assist the clinician in assigning the degree of risk, severity assessment, and in overall prognostication concerning the course of sepsis, a number of clinical tools have been proposed. Many useful scoring systems have been developed over years which started in 1974. Both first day scoring system and repetitive scoring systems are available. Details regarding scoring system with special reference to Acute Physiology and Chronic Health Evaluation II (APACHE 11) and Sequential Organ Failure Assessment (SOFA) scores are as follows:

Scoring System

The first ICU model of disease severity, the Therapeutic Intervention Scoring System (TISS), was proposed in 1974.47 25 years later a number of physiology based ICU scoring systems have developed in order to assess the in-hospital mortality rates. Scoring systems essentially consists of two parts:

- A severity score (generally the higher this is the more severe the condition).
- Calculated probability of mortality.

Most commonly, the latter is the risk of in-hospital mortality, though other outcome measures (e.g. survival to 28 days post-hospital discharge) can also be modeled.

Model creation

Predictor variables entered in the ICU model should be routinely available, reliable and should be independent of ICU treatment or intervention. Development of a prognostic model requires the identification of reliable predictive variables, the definition of predictor and outcome variables, collection of data on the predictive and outcome variables, analysis of the relationship between the predictor and outcome variables, and validation of this relationship in a new independent database.48 In general, the development of an ICU prognostic model requires a large database compiled from representative ICUs. The models should include the main prognostically important predictor variables that should be tested for their independent contributions and interactions.

Model performance

Outcome prediction models need to be subjected to the scrutiny or test before they are used in decisions that impact health care delivery and individual patient care.

Once a scoring system has been produced, its performance should be assessed and validated.

1. Model calibration

Calibration assesses the degree of correspondence or correlation between the estimated probability of mortality and that actually observed mortality. This can be tested using a goodness of fit test, most commonly the Hosmer–Lemeshow C statistic. Over the range of probabilities, the expected and observed mortality are compared and a P-value derived. Calibration is considered to be good if the predicted mortality is close to the observed mortality.49 E.g. If a scoring model predicts that a patient has a probability of in-hospital mortality of 0.25, it means that, in a sample population of 100 patients, 25 would be expected to die and 75 patients would survive. When the number of deaths in the actual population is near to that predicted by the scoring system, the model is said to be well calibrated.

2. Model discrimination

Model discrimination reviews the ability of the scoring model to discriminate or differentiate between patients who die (non survivors) from those who survive, based on the predicted mortalities. Methods include calculation of the area under the receiver operating characteristic (ROC) curve or by using a classification matrix [50]. The two most important parts of the classification matrix are the specificity and sensitivity. Typically, model developers require an AUC of the ROC curve to be >0.70.51 To counterbalance the deterioration, models are often subjected to customization by creating a new equation or changing the weights of the constituent variables or even the addition of new predictor variables [52, 53].

The ideal scoring system

The ideal scoring system would have the following characteristics:

1. On the basis of easily/routinely recordable variables
2. Well calibrated
3. A high level of discrimination
4. Applicable to all patient populations8
5. Can be used in different countries
6. The ability to predict functional status or quality of life after ICU discharge [55].

No scoring system currently incorporates all these features.

Classification of scoring systems

1. General important scores

- APACHE (Acute Physiology and Chronic Health Evaluation)
- MPM (Mortality Probability Model) LODS (Logistic Organ Dysfunction Score)
- SOFA (Sequential Organ Failure Assessment) [56, 57]
- SAPS (Simplified Acute Physiology Score) [58, 59]
- Multiple Organ Dysfunction Score [60]
- OSF(Organ System Failure)

They can also be classified as

Table 3: Classification of scoring systems

First Day scoring systems	Repetitive scoring systems
APACHE	OSF
SAPS	Multiple Organ Dysfunction Score
MPM	SOFA

The general scores can further be subdivided into the severity of illness scores and the organ dysfunction scores.

ICU Severity Prognositic models

There are four generations of ICU severity prognostic models.

Table 4: Generations of Scoring systems

First generation	Second generation	Third generation	Fourth generation
APACHE I	APACHE II	APACHE III	APACHE IV
	SAPS I1	SAPS II	SAPS III
	MPM I	MPM II	MPM III

Acute Physiology and Chronic Health Evaluation (APACHE)

The Acute Physiology and Chronic Health Evaluation (APACHE) score is probably the best-known and most widely used score. The original APACHE I score was first used in 1981 and scores for three patient factors that influence acute illness outcome (preexisting disease, patient reserve, and severity of acute illness). These included 34 individual variables, a chronic health evaluation, and the two combined to produce the severity score [61].

Knaus et al developed the next generation of APACHE scoring system- APACHE II [62].

The APACHE II is measured during the first 24 h of ICU admission; the maximum score is [71].

A score of 25 represents a predicted mortality of 50% and a score of over 35 represents a predicted mortality of 80%.

The APACHE II severity score has shown a good calibration and discriminatory value across a range of disease processes, and remains the most commonly used international severity scoring system worldwide [63, 64].

The score provides an estimate of ICU mortality based on a number of laboratory values and patient signs taking both acute and chronic diseases into account. The data used should be from the initial 24 hours in the ICU, and the worst value should be used.

Chronic Health Points

History of severe organ insufficiency	Points
Non-operative patients	5
Emergency postoperative patients	5
Elective postoperative patients	2

- Organ insufficiency or immunocompromised state must have preceded the current admission
- Immunocompromised if:
  - Receiving therapy reducing host defences (immunosuppression, chemotherapy, radiation therapy, long term steroid use, high dose steroid therapy) or
  - Has a disease interfering with immune function such as malignant lymphoma or leukaemia
- Hepatic insufficiency if:
  - Biopsy proven cirrhosis
  - Portal hypertension
  - Episodes of upper GI bleeding due to portal hypertension
  - Prior episodes of hepatic failure, coma or encephalopathy
- Cardiovascular insufficiency if:
  - New York Heart Association Class IV
- Respiratory insufficiency if:
  - Severe exercise restriction due to chronic restrictive, obstructive or vascular disease,
  - Documented chronic hypoxia, hypercapnia, secondary polycythaemia, severe pulmonary hypertension
  - Respirator dependency
- Renal insufficiency if:
  - On chronic dialysis

Age points

Table 5: Age points in APACHE II score

≤ 44 years	0
45 – 54 years	2
55 - 64 years	3
65 - 74 years	5
≥75 years	6

Table 6: Acute Physiology Score in APACHE II score

- 1= Rectal temp (C)
- 2 = Mean arterial pressure (mmHg)
- 3 = Heart rate (bpm)
- 4 = Respiratory rate (bpm)
- 5 = Oxygen delivery (ml/min)
- 6 = PO2 (mmHg)
- 7 = arterial pH
- 8 = Serum sodium (mmol/l)
- 9 = Serum potassium (mmol/l)
- 10 = Serum creatinine (mg/dl)
- 11 = Haematocrit (%)
- 12 = White cell count (10^3/ml)

	+4	+3	+2	+1	0	+1	+2	+3	+4
1	>41	39-40.9		38-38.9	36-38.4	34-35.9	32-33.9	30-31.9	<29.9
2	>160	130-159	110-129		70-109		50-69		<49
3	>180	140-179	110-139		70-109		55-69	40-54	<39
4	>50	35-49		25-34	12-24	10-11	6-9		<5
5	>500	350-499	200-349		< 200				
6					> 70	61-70		55-60	< 55
7	>7.7	7.6-7.69		7.5-7.59	7.3-7.49		7.25-7.3	7.15-7.2	< 7.15
8	>180	160-179	155-159	150-154	130-149		120-129	111-119	<110
9	>7	6-6.9		5.5-5.9	3.5-5.4	3-3.4	2.5-2.9		<2.5
10	>3.5	2-3.4	1.5-1.9		0.6-1.4		<0.6		
11	>60		50-59.9	46-49.9	30-45.9		20-29.9		< 20
12	>40		20-39.9	15-19.9	3-14.9		1-2.9		< 1

APACHE II=APS (acute physiology score) + Age points + Chronic health points To compute the predicted death rate of each individual based on diagnostic category weight:
Ln R/1-R = -3.517+ (APACHE II score x 0.146) + 0.603(only if emergency surgery) + diagnostic category weight of the patient's condition where R is risk of hospital death.
E.g. a Patient admitted with non-cardiogenic pulmonary edema (non-operative) with 15 APACHE II points would have the predicted risk of death as Ln R/1-R = -3.157+ (15 X 0.146) + (0 X 0.603) – 0.251 = - 1.578 Therefore R = 0.17 or 17% Where -0.251 is the diagnostic weight for the above disease APACHE III was introduced in 1991 and represented a dramatic change over its predecessor. The predictive models moved away from simplification by expanding the number of ICU admission diagnoses and physiological variables, remodeling of the weights for the physiologic variables, and adjusting for location and length of stay (LOS) before ICU admission. In addition, new equations were added to predict LOS, risk for active therapy, duration of mechanical ventilation, and equations for daily prediction of individual outcomes.
APACHE III also introduced the use of separate predictive models for patients who have had coronary artery bypass graft (CABG) surgery. Critical care outcomes change over time and each of the major critical care predictive models has recently been shown to considerably over predict mortality.
This model fade 'was seen in the APACHE III system despite the two updated partial revisions since its introduction in 1991. Therefore, using a more contemporary database, all of the APACHE III equations were revalidated, and when shown to perform poorly, new equations created.
This was the birth of the APACHE IV equation. Although the APACHE IV model uses the same physiological variables and weights as APACHE III, it is more complex (142 variables), mainly due to expansion in the number of disease groups (from 94 to 116) and new predictor variables.
The performance of the APACHE III and APACHE IV severity score is slightly better than that of APACHE II, but the former scores have not achieved widespread acceptance perhaps because the statistical analysis used to score and copyright control issues [65]. Markgraf et al compared the predictive capabilities of APACHE II, APACHE III and SAPS II and concluded that the three indices have good discriminating power and that APACHE II has the best calibration [66]. The traditional outcome of critically ill patients admitted to the ICU has always remained hospital mortality [67, 68].

Sequential Organ Failure Assessment (SOFA) Score

SOFA is the most widely used organ failure model. Most of the variables included in these systems are easily available and obtained from the critical care settings.
The sepsis-related organ failure assessment score, was developed to evaluate organ dysfunction in patients with sepsis. Later, it was renamed the sequential organ failure assessment (SOFA) score because its utility was not restricted merely to patients with sepsis.68 The SOFA system was created in a consensus meeting of the European
Society of Intensive Care Medicine in 1994 and further revised in 1996 [69]. The SOFA is a six- organ dysfunction/failure score measuring multiple organ failure daily. Each organ is graded from 0 to 4 providing a daily score of 0 to 24 points. Sequential assessment of organ dysfunction during the first few days of ICU admission is a good indicator of prognosis. Both the mean and highest SOFA scores are particularly useful predictors of outcome. Independent of the initial score, an increase in SOFA score during the first 48 hours in the ICU predicts a mortality rate of at least 50% [70, 71].

Table 7: SOFA score69

Organ system	0	1	2	3	4
Respiratory: PaO2/FiO2(mmHg	>400	≤400	≤300	≤200	≤100
Renal: creatinine (mg/dl)	< 1.2	1.2-1.9	2 - 3.4	3.5 – 4.9; urine output ≤500 ml/day	>4.9 urine output <200 ml/day
Hepatic: bilirubin (mg/dl)	<1.2	1.2-1.9	2 – 5.9	6 – 11.9	>11.9
Cardiovascular: hypotension	No hypotension	MAP <70 mmHg	Dopamine ≤5[a], dobutamine (any dose)	Dopamine >5[a] or epinephrine ≤0.1[a] or norepinephrine ≤0.1[a]	Dopamine >15[a] or epinephrine >0.1[a] or norepinephrineine>0.1[a]
Hematologic: platelet count (×10^3/ µl)	>150	≤150	≤100	≤50	≤20
Neurologic: Glasgow Coma Scale score	15	13–14	10–12	6–9	<6

[a] Adrenergic agents administered for at least one hour (doses given are in µg/kg per minute).

Vital organ dysfunctions developing after the onset of sepsis influence outcome markedly. Studies have shown the APACHE II score at the onset of sepsis or the SOFA score and the number of organ dysfunctions developing thereafter are independent prognostic factors for patients with sepsis [71, 72].
The prognosis associated with severe sepsis and septic shock is also dependent on the patient's underlying health status, development of adverse sequelae, and prevention of complications [4]. The mortality rate associated with severe sepsis and septic shock ranges between 13% and 50% in large clinical trials [47]. When severe sepsis is complicated by the development of shock and multiple organ dysfunction syndrome the mortality rate can rise to as high as 85% [47]. Recent studies have demonstrated higher mortality among men than in women and in non-white patient compared with white patients. This is in part related to the cytokine profile and hormonal makeup of men compared with women. Genetic patterns and genomic polymorphisms appear to increase both an individual's risk for sepsis and the severity of the septic response [50]. Clinical trials on sepsis often exclude the very elderly, HIV-positive individuals and patients with malignancies because they are at higher risk of death and less likely to respond to treatment [62].
The use of antibiotics with specific activity against identified pathogens was associated with survival in many studies.

Therefore a positive blood culture and targeted antibiotic therapy was associated with better prognosis and survival. In India tropical infections add to the diagnostic dilemma and most patients are left undiagnosed in regard to aetiology of sepsis. Therefore there is a need for studies that identify clinical syndromes which can give vital clues for establishing aetiology in patients.

Materials and Methods

A prospective study entitled "Usefulness of SOFA and APACHE II score in analysing patients with multiple organ dysfunction syndrome in sepsis" was undertaken at Narayana Superspeciality Hospital, Howrah after the approval from Ethics Committee.

The study was carried out in the period of October 2017 to September 2020 and 50 patients were included in the study.

The patients with sepsis as defined by the American College of Chest Physicians/Society of Critical Care Medicine (ACCP/SCCM) Consensus Committee in 1992 were included in the study.

The detailed history, clinical examination and all the relevant laboratory investigations were done including blood culture.

In the present study, the conditions were defined according to standard practice and based on relevant literature.

All the patients of sepsis admitted to emergency/ICU ward are being prognosticated on the basis of APACHE II score and SOFA score.

APACHE II is calculated on day of admission. The predicted mortality rate was calculated on the basis of this score.

To assess sequential involvement of organ we calculated SOFA score on every day. This gave us idea whether involvement of number of organ was increasing or decreasing and if the severity of particular organ was increasing.

The minimum SOFA score was 0 and maximum of 24.

We are analyzing various profiles between two groups; survivor group which include the patients who are successfully discharged after recovery and non-survivor group which include the patients who died.

Inclusion Criteria

- Patients above 18 years of age & below 70 Years.
- Patients with evidence of sepsis and MODS on admission.

Exclusion Criteria

- Patients who is on treatment with immunosuppressive agents.
- Patients with retroviral infection.
- Pregnant patients.
- Patients took DORB
- Cerebrovascular Accident
- Trauma

Statistical Methods

Descriptive and inferential statistical analysis has been carried out in the present study. Results on continuous measurements are presented on Mean SD (Min-Max) and results on categorical measurements are presented in Number (%). Significance is assessed at 5% level of significance. The following assumptions on data are made:

Assumptions: 1. Dependent variables should be normally distributed, 2. Samples drawn from the population should be random, Cases of the samples should be independent.

Student t test (two-tailed, independent) has been used to find the significance of study parameters on continuous scale between two groups Inter group analysis) on metric parameters. Leven1s test for homogeneity of variance has been performed to assess the homogeneity of variance. Chi-square/Fisher Exact test has been used to find the significance of study parameters on categorical scale between two or more groups.

1. Sample Size estimation

Proportion Known populations

$n = [(z2 * p * q) + ME2] / [ME2 + z2 * p * q / N]$

Proportion Unknown population

$n = [(z2 * p * q) + ME2] / (ME2)$

ME: is the margin of error, measure of precision and Z is 1.96 as critical value at 95%CI N: population size, n: Sample size, σ: Standard deviation

z: Critical value based on Normal distribution at 95% Confidence Interval

$$\sqrt{\frac{\sum(x-\bar{x})^2}{n-1}}$$

Standard deviation: SD =

2. Chi-Square Test: The chi-square test for independence is used to determine the relationship between two variables of a sample. In this context independence means that the two factors are not related. In the chi-square test for independence the degree of freedom is equal to the number of columns in the table minus one multiplied by the number of rows in the table minus one.

$$\chi^2 = \frac{\sum(Oi - Ei)^2}{Ei}$$

Where Oi is observed frequency and Ei is Expected frequency

With (n-1) df

The Assumptions of Chi-square test

The chi square test, when used with the standard approximation that a chi-square distribution is applicable, has the following assumptions:

- **Random sample:** A random sampling of the data from a fixed distribution or population.
- **Sample size (whole table):** A sample with a sufficiently large size is assumed. If a chi square test is conducted on a sample with a smaller size, then the chi square test will yield an inaccurate inference. The researcher, by using chi square test on small samples, might end up committing a Type II error.
- **Expected Cell Count:** Adequate expected cell counts. Some require 5 or more, and others require 10 or more. A common rule is 5 or more in all cells of a 2-by-2 table, and 5 or more in 80% of cells in larger tables, but no cells with zero expected count. When this assumption is not met, Fisher Exact test or Yates' correction is applied.

3. Fisher Exact Test: The Fisher Exact Test looks at a contingency table which displays how different treatments have produced different outcomes. Its null hypothesis is that treatments do not affect outcomes--that the two are independent. Reject the null hypothesis (i.e., conclude treatment affects outcome) if p is "small".
The usual approach to contingency tables is to apply the □2 statistic to each cell of the table. One should probably use the□2 approach, unless you have a special reason. The most common reason to avoid □2 is because you have small expectation values.

Table 8

	Class1	Class2	Total
Sample1	A	b	a+b
Sample2	c	d	c+d
Total	a+c	b+d	n

2x2 Fisher Exact Test statistic=

$$\sum p = \frac{(a+b)!(c+d)!(a+c)!(b+d)!}{n!} \quad \frac{1}{\sum a!b!c!d!}$$

4. Student t test (Two tailed, independent)
Assumptions: Subjects are randomly assigned to one of two groups. The distribution of the means being compared are normal with equal variances.
Test: The hypotheses for the comparison of two independent groups are: Ho: u1 = u2 (means of the two groups are equal)
Ha: u1 u2 (means of the two group are not equal)
The test statistic for is t, with n1 + n2 - 2 degrees of freedom, where n1 and n2 are the sample sizes for groups 1 and 2. A low p-value for this test (less than 0.05 for example) means that there is evidence to reject the null hypothesis in favor of the alternative hypothesis. Or, there is evidence that the difference in the two means are statistically significant. The test statistic is as follows:

t-Test: Two-Sample Assuming Equal Variances

$$S_p = \sqrt{\frac{(n_1-1)S_1^2 + (n_2-1)S_2^2}{n_1+n_2-2}}$$

In all work with two-sample t-test the degrees of freedom or df is:

$$df = n_1 + n_2 - 2$$

The formula for the two sample t-test is:

$$T = \frac{\overline{X} - \overline{Y}}{S_p\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$$

Pre-test: Test for variance assumption: A test of the equality of variance is used to test the assumption of equal variances. The test statistic is F with n1-1 and n2-1 degrees of freedom.

t-Test: Two-Sample Assuming Unequal Variances

$$T = \frac{\overline{X} - \overline{Y}}{\sqrt{\frac{S_X^2}{n_1} + \frac{S_Y^2}{n_2}}}$$

Note in this case the Degree of Freedom is measured by

$$df' = \frac{\left(\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}\right)^2}{\frac{\left(\frac{s_1^2}{n_1}\right)^2}{n_1 - 1} + \frac{\left(\frac{s_2^2}{n_2}\right)^2}{n_2 - 1}}$$

and round up to integer.

Results of the t-test: If the p-value associated with the t-test is small (< 0.05), there is evidence to reject the null hypothesis in favor of the alternative. In other words, there is evidence that the means are significantly different at the significance level reported by the p-value. If the p-value associated with the t-test is not small (> 0.05), there is not enough evidence to reject the null hypothesis, and you conclude that there is evidence that the means are not different.

5. Significant figures
+ Suggestive significance (p value: 0.05<p<0.10)
* Moderately significant (p value: 0.01<p□ 0.05)
** Strongly significant (p value: p□0.01)

Statistical software: The Statistical software namely SAS 9.2, SPSS 15.0, Stata10.1, MedCalc 9.0.1, Systat 12.0 and R environment ver.2.11.1 were used for the analysis of the data and Microsoft word and Excel have been used to generate graphs, tables etc.

Observations and Results
The study was carried out in the period of October 2017 to September 2020 and 50 patients were included in the study
In our study, subjects were in the age group of 18 to 90 years.
In our present study, out of 50 cases of sepsis with MODS, 28 were male and 22 were females.
Out of 50 patients, all 50 had fever with breathlessness present in 16 patients.
Comorbidities observed were diabetes, hypertension and COPD.

Table 9: Age distribution of patients studied

Age in years	Number of patients	%
18-20	3	6.0
21-30	9	18.0
31-40	6	12.0
41-50	10	20.0
51-60	8	16.0
61-70	12	24.0
>70	2	4.0
Total	50	100.0

Mean ±SD:48.36±17.16

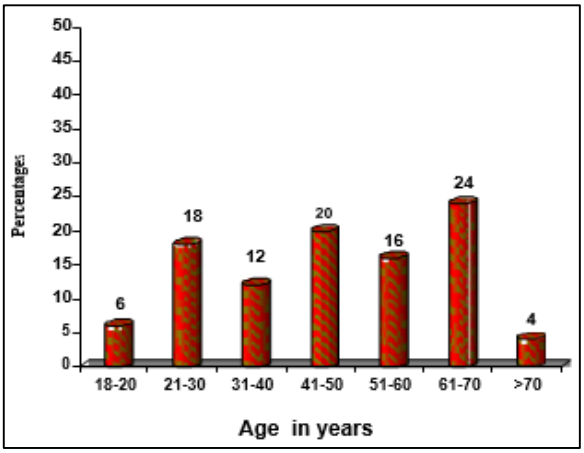

Fig 2

Highest numbers of cases were seen the age group of 61 to 70 years i.e. 12 patients (24%) followed by 41 to 50 years in 10 cases (20%), 21 to 30 years in 9 cases (18%). Youngest patient in the study is 18 years old. Oldest patient is 90 years.

Table 10: Gender distribution of patients studied

Gender	Number of patients	%
Male	28	56.0
Female	22	44.0
Total	50	100.0

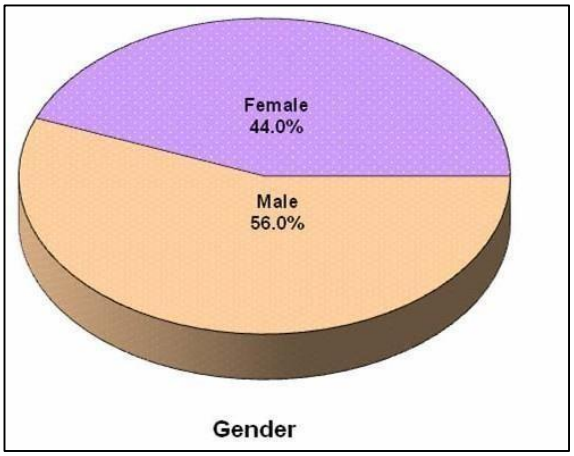

Fig 3

Out of 50 patients, 28 were males and 22 were females.

Table 11: Distribution of symptoms & signs of patients studied

Symptoms & signs	Number of patients n=50)	%
1.Fever	50	100.0
2.Headache	4	8.0
3.Cough	13	26.0
4.Breathlessness	16	32.0
5.Altered Sensorium	2	4.0
6.Vomiting	12	24.0
7.Jaundice	4	8.0
8.Decreased Urine output	16	32.0
9.Abdominal Pain	16	32.0
10.Chest pain	3	6.0
11.Loose stools	5	10.0

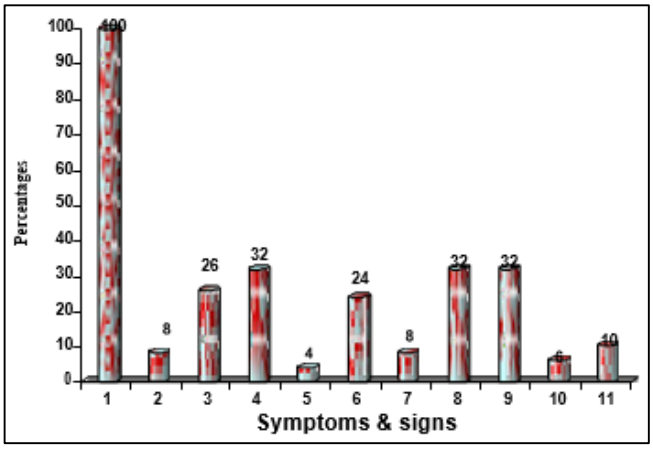

Fig 4

The commonest symptoms in our study population is fever in 50 patients (100%) followed by breathlessness, decreased urine output, abdominal pain vomiting etc.

Table 12: Distribution of comorbidities of patients studied

Comorbidities	Number of patients (n=50)	%
Nil	26	52.0
Present	24	48.0
▪ Diabetes	14	28.0
▪ Hypertension	10	20.0
▪ Paraplegic	1	2.0
▪ COPD/IHD	2	4.0

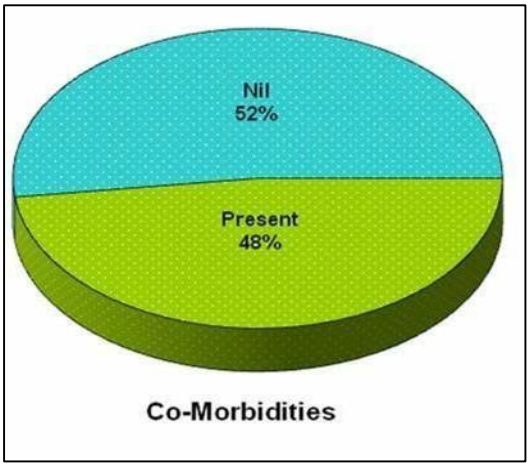

Fig 5

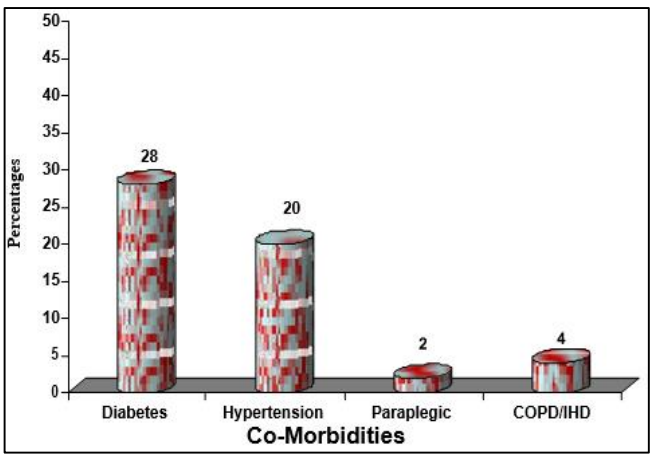

Fig 6

Table 13: Distribution of Vital parameters of patients studied

Vital parameters	Number of patients (n=50)	%
Temperature(F)		
▪ 100(F)	1	2.0
▪ 101(F)	8	16.0
▪ 102(F)	18	36.0
▪ 103(F)	14	28.0
▪ 104(F)	9	18.0
Pulse rate (bpm)		
▪ <60	-	-
▪ 60-80	-	-
▪ 80-100	-	-
▪ >100	50	100.0
BP (mmHg)		
▪ <90/60	20	40.0
▪ >90/60	30	60.0
Respiratory Rate (cpm)		
▪ <20	7	14.0
▪ 20-40	43	86.0
▪ >40	-	-

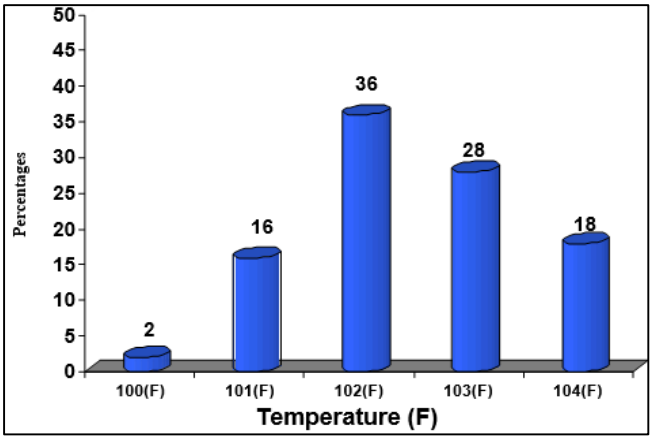

Fig 7

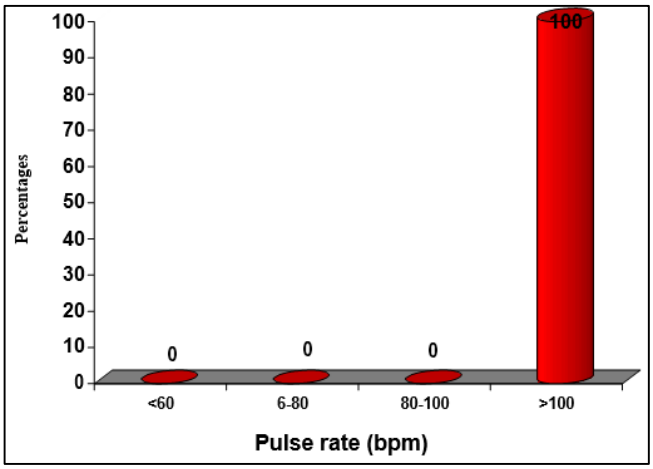

Fig 8

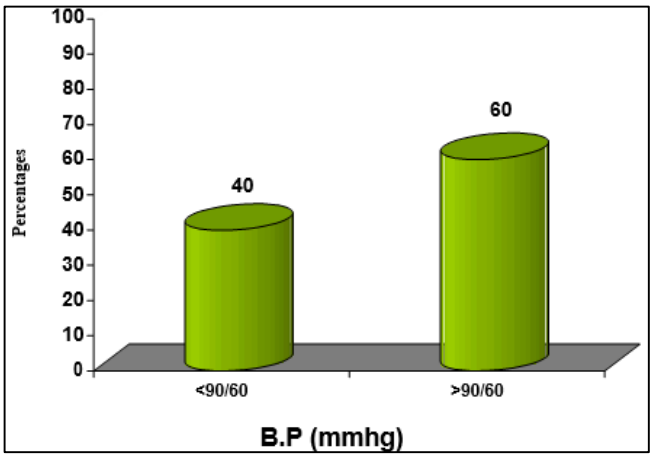

Fig 9

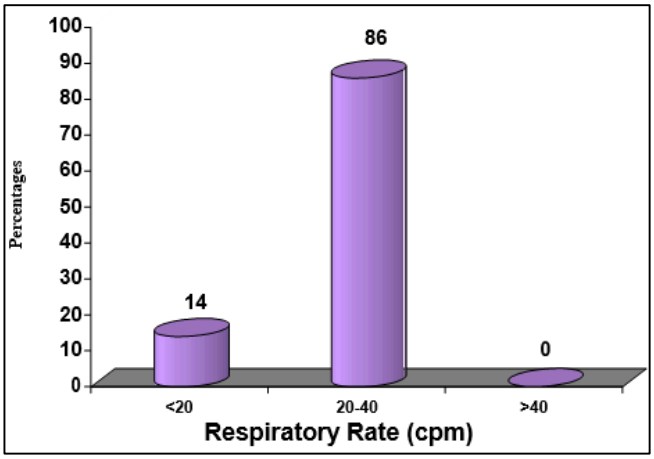

Fig 10

All patients had temperature above 1000 F and pulse rate above 100 beats per minute. 20 patients (40%) had blood pressure less than 90/60.

Table 14: Distribution of Pallor, Icterus, and Cyanosis of patients studied

Pallor, Icterus, Cyanosis	Number of patients (n=50)	%
No	37	74.0
Yes	13	26.0
▪ Icterus	1	2.0
▪ Pallor	12	24.0

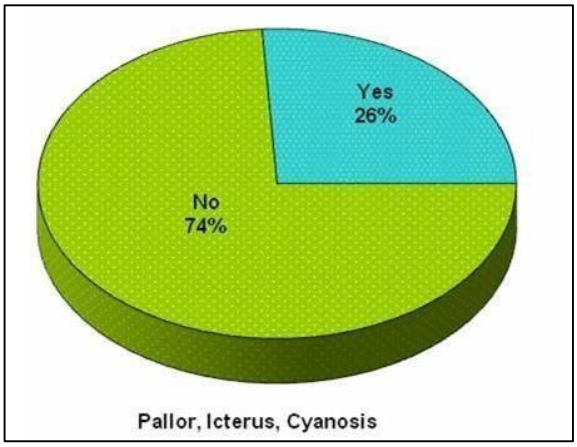

Fig 11

12 patients (24%) had pallor

Table 15: Distribution of systemic disease of patients studied

Systemic disease	Number of patients (n=50)	%
RS	30	60.0
CVS	3	6.0
CNS	17	34.0

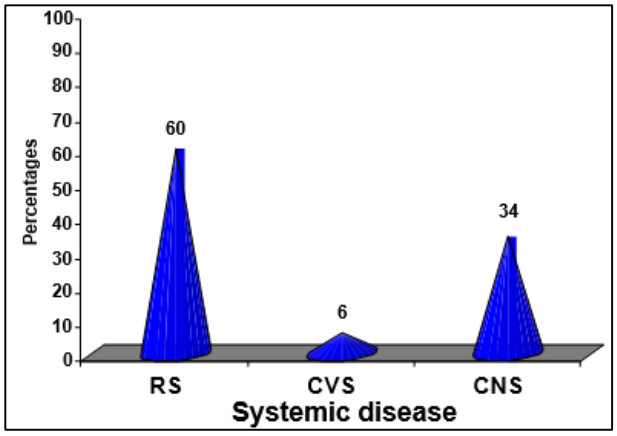

Fig 12

The commonest system involved among the patients studied was respiratory system (60%).

Table 16: Distribution of Hepatomegaly& Splenomegaly of patients studied

Hepatomegaly & Splenomegaly	Number of patients (n=50)	%
Hepatomegaly		
▪ No	44	88.0
▪ Yes	6	12.0
Splenomegaly		
▪ No	43	86.0
▪ Yes	7	14.0

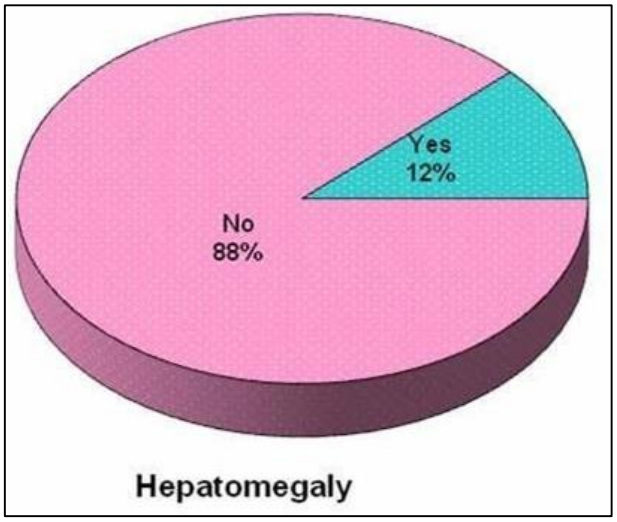

Fig 13

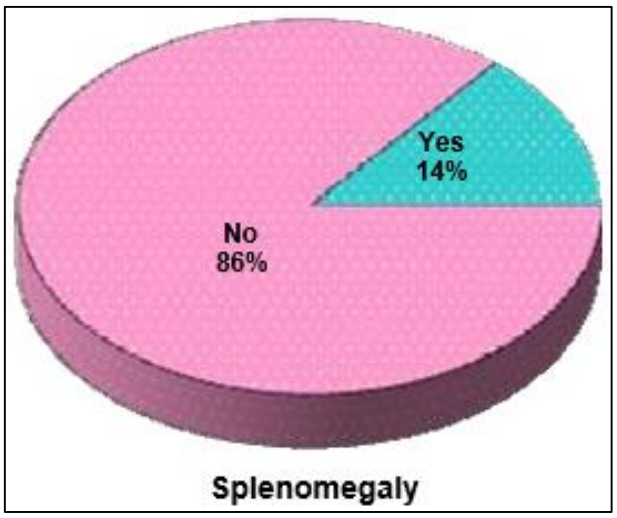

Fig 14

Out of 50 patients, 6 had hepatomegaly and 7 had splenomegaly

Table 17: Distribution of hematological parameters of patients studied

Hematological parameters	Number of patients (n=50)	%
Hemoglobin %		
▪ <10	16	32.0
▪ 10-12	23	46.0
▪ >12	11	22.0
TLC(/mm3)		
▪ <4000	4	8.0
▪ 4000-11000	8	16.0
▪ >11000	38	76.0

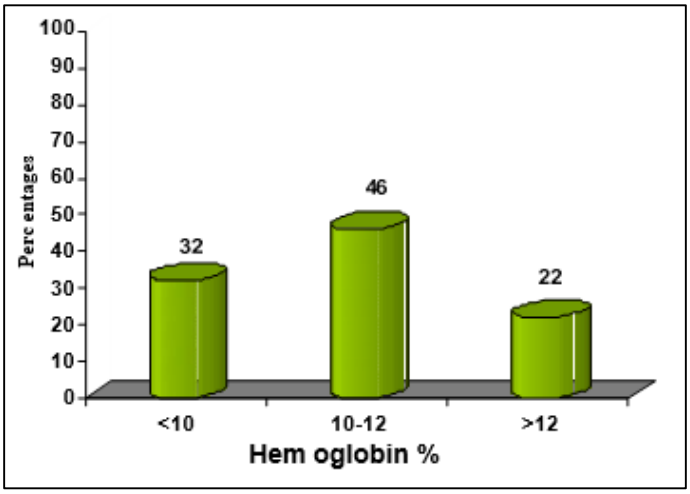

Fig 15

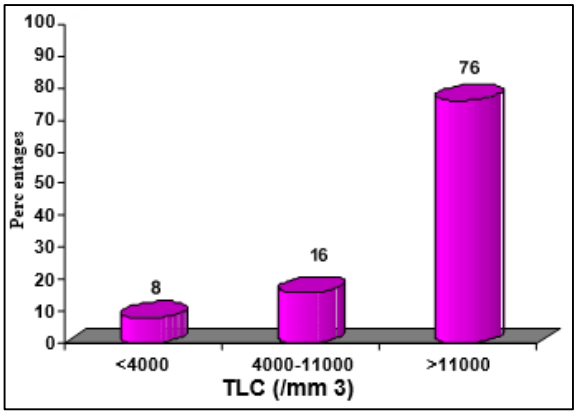

Fig 16

In the population studied, 16 patients (32%) had hemoglobin less than 10 gram%. In the patient studied 38 patients (76%) had total leukocyte count greater than 11000 per mm3, 4 patients had less than 4000 per mm3.

Table 18: Distribution of electrolytes of patients studied

Electrolytes	Number of patients (n=50)	%
Serum sodium		
▪ <135	38	76.0
▪ 135-146	12	24.0
▪ >146	-	-
Serum potassium		
▪ <3.5	13	26.0
▪ 3.5-5.5	33	66.0
▪ >5.5	4	8.0

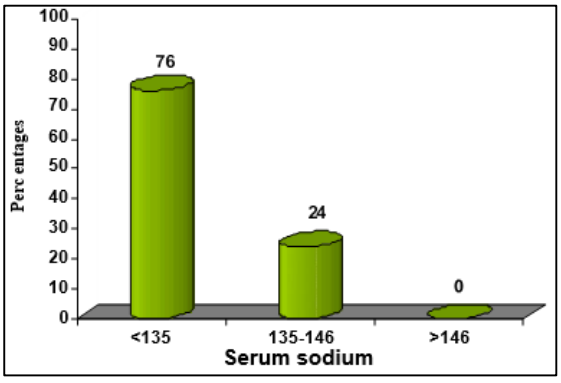

Fig 17

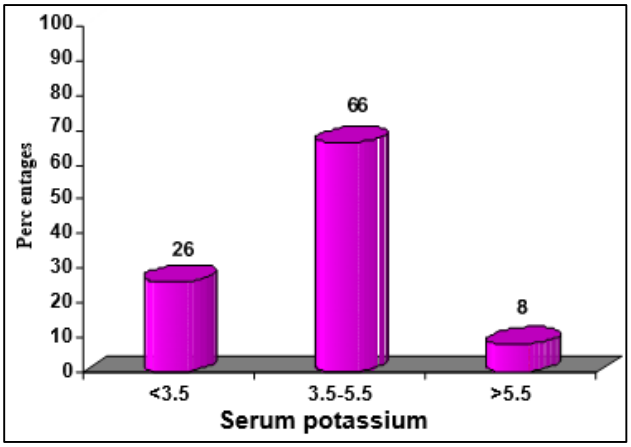

Fig 18

On the day of admission 38 patients (76%) had hyponatremia, 13 patients (26%) had hypokalemia and 4 patients (8%) had hyperkalemia.

Table 19: Distribution pH of patients studied

pH	Number of patients (n=50)	%
<7	-	-
7.0-7.35	41	82.0
7.35-7.45	6	12.0
>7.45	3	6.0

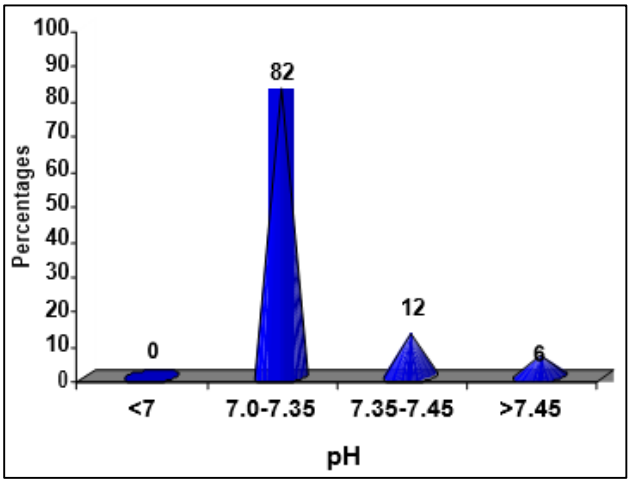

Fig 19

Out of 50 patients, 41 patients (82%) had acidic pH on the day of admission

Table 20: Distribution QBC for MP of patients studied

QBC for MP	Number of patients	%
Negative	50	100.0
Positive	-	-
Total	50	100.0

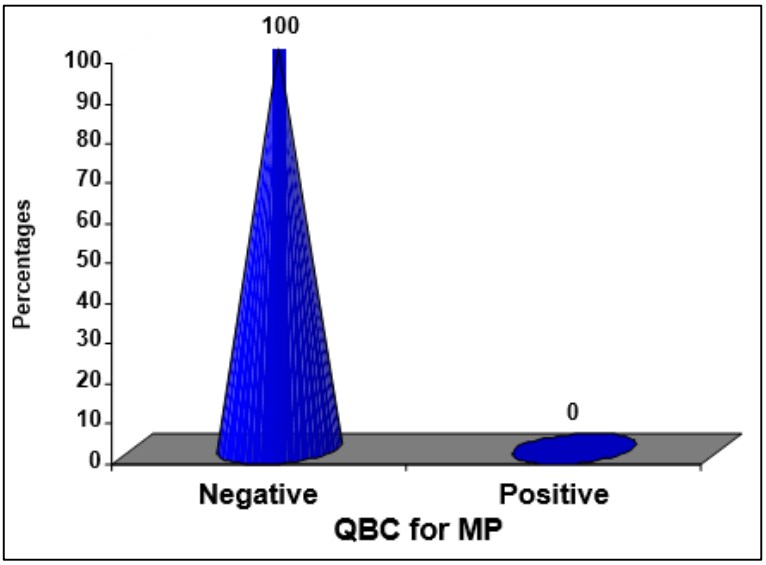

Fig 20

Table 21: Distribution of radiological parameters of patients studied

Radiological parameters	Number of patients (n=50)	%
ECG		
1. Sinus tachycardia with P pulmonale	2	4.0
2. LVH with strain	1	2.0
3. Sinus tachycardia	45	90.0
4. Sinus tachycardia with LVH	1	2.0
5. T Wave inversion in V1,V2	1	2.0
Chest x-ray		
1. Normal	11	22.0
2. ARDS	5	10.0
3. Lower zone consolidation	17	34.0
4. Pleural effusion	11	22.0
5. Cardiomegaly	1	2.0
6. Emphysema	1	2.0
7. TB	1	2.0
8. Pleural thickening	1	2.0
9. Subsegmental	1	2.0
10. Paracardiac	1	2.0
Urine routine		
Normal	35	70.0
Abnormal	15	30.0
ECHO		
1. Normal	37	74.0
2. Concentric LVH	4	8.0
3. LVD/MVP	4	8.0
4. RA & RV dilated	2	4.0
5. Aortic value	3	6.0

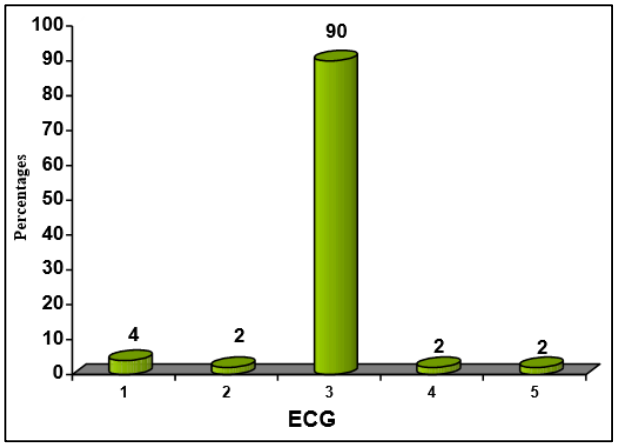

Fig 21

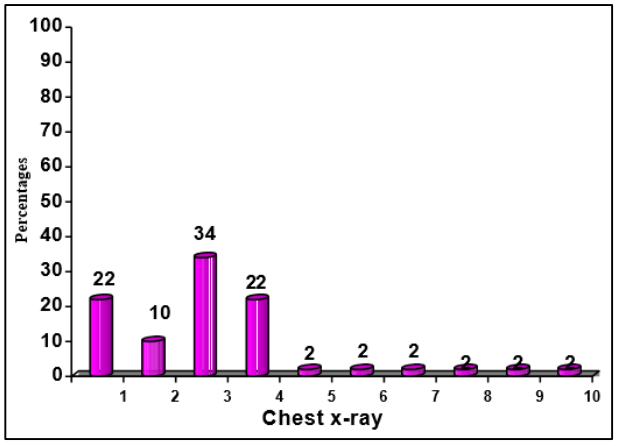

Fig 22

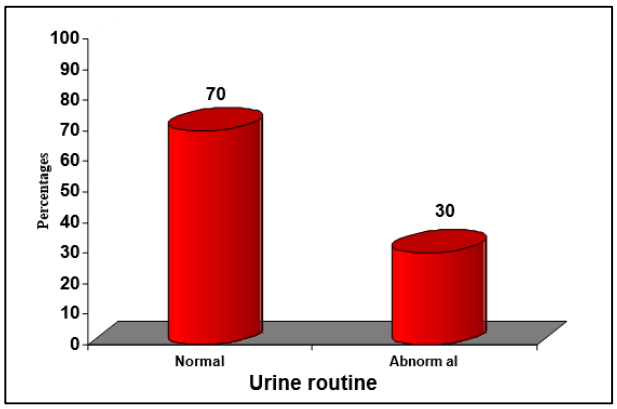

Fig 23

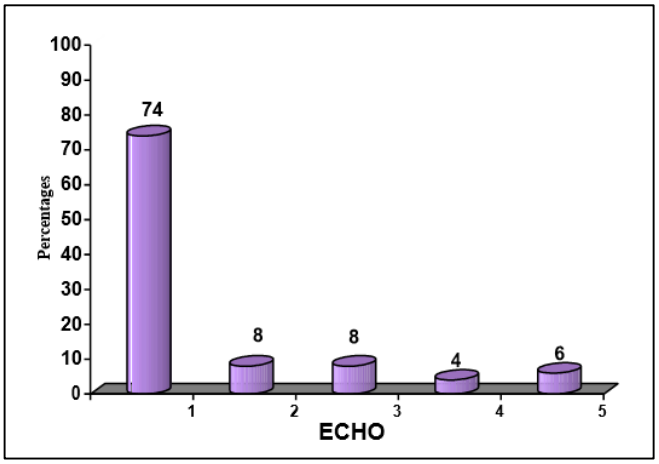

Fig 24

Table 22: Distribution of blood culture of patients studied

Blood culture	Number of patients	%
No growth	50	100.0
Growth	-	-
Total	50	100.0

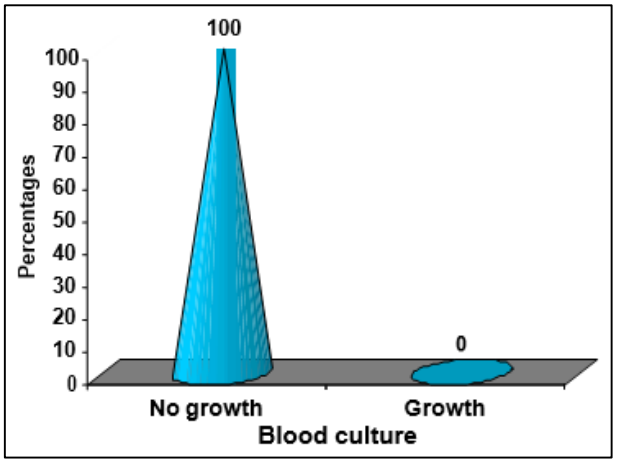

Fig 25

Table 23: Distribution of Dengue Profile of patients studied

Dengue Profile	Number of patients	%
Negative	41	82.0
Positive	9	18.0
Total	50	100.0

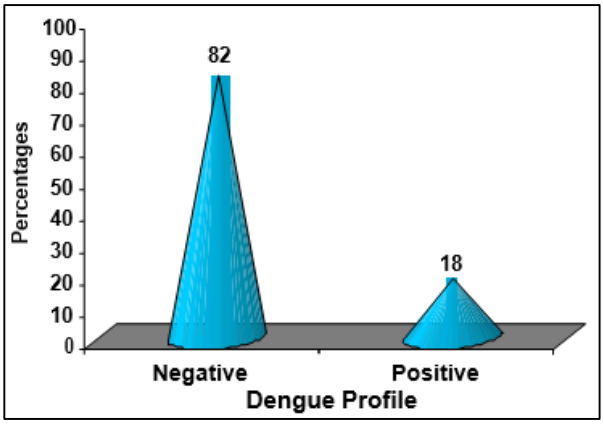

Fig 26

Out of 50 patients studied, 9 are dengue positive proved by serology

Table 24: Distribution of Leptospira antibody of patients studied

Leptospira antibody	Number of patients	%
Negative	48	96.0
Positive	2	4.0
Total	50	100.0

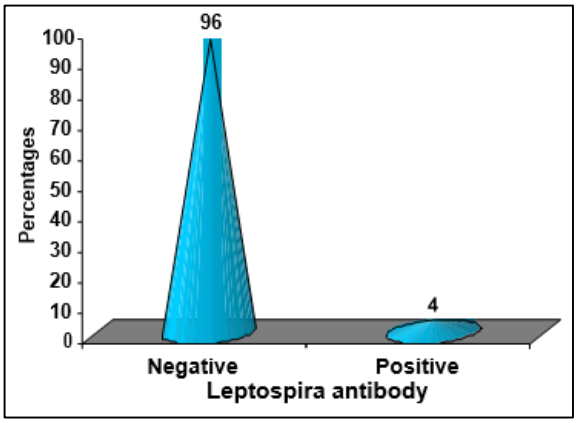

Fig 27

Only 2 out of 50 patients had leptospira antibody positive.

Table 25: Distribution of Haematocrit of patients studied

Haematocrit	Number of patients	%
<25	3	6.0
25-40	27	54.0
>40	20	40.0
Total	50	100.0

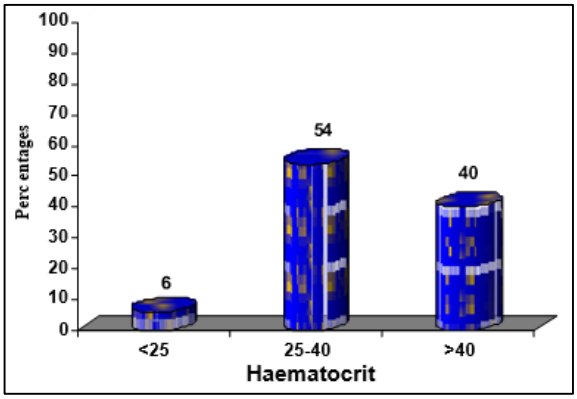

Fig 28

Table 26: Distribution of ventilator support, inotropic support, dialysis, Duration of ICU stay in patients studied

	Number of patients (n=50)	%
Ventilator Support		
No	20	40.0
Yes	30	60.0
Inotropic support		
No	22	44.0
Yes	28	56.0
Dialysis		
No	40	80.0
Yes	10	20.0
Duration of ICU stay		
<7	44	88.0
>7	6	12.0

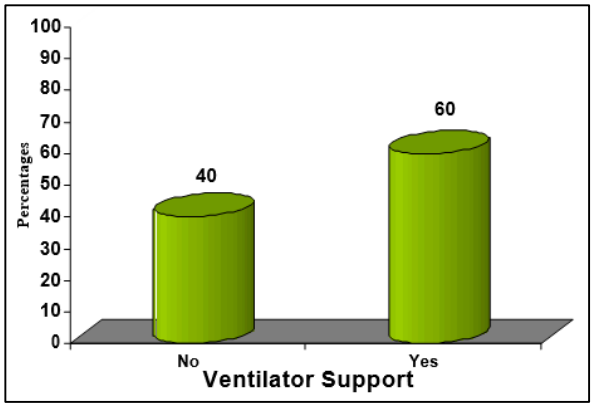

Fig 29

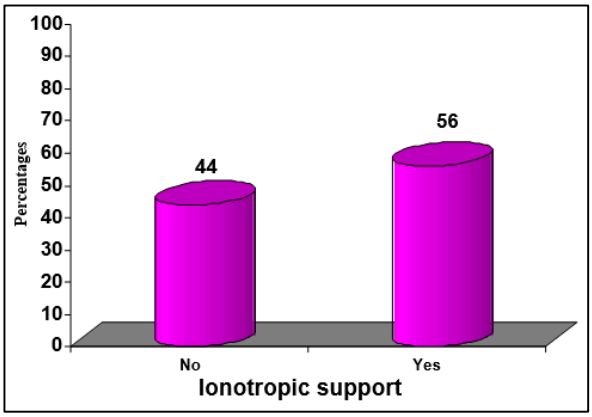

Fig 30

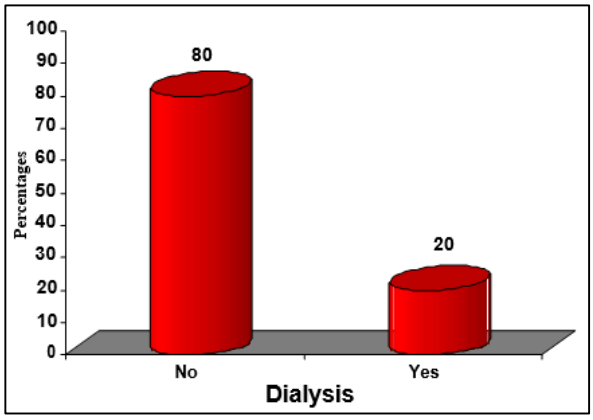

Fig 31

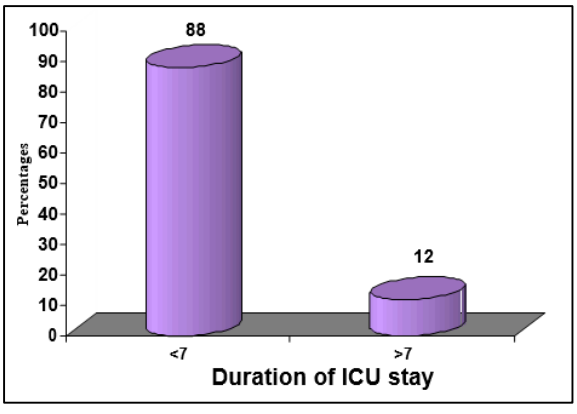

Fig 32

Out of 50 patients, 30 patients (60%) required ventilatory

support, 28 patients (56%) required inotropic support, 10 patients (20%) required dialysis. Duration of ICU stay was less than 7 days in 44 patients.

Table 27: Distribution of survived of patients studied

Survived	Number of patients	%
Non survived	18	36.0
Survived	32	64.0
Total	50	100.0

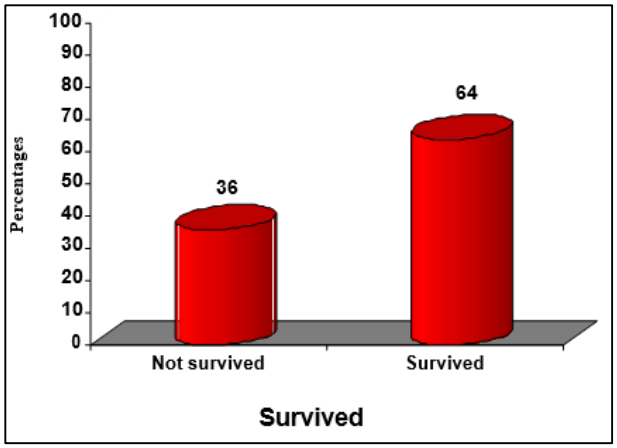

Fig 33

Out of 50 patients studied, 18 patients died with mortality rate of 36%.

This study further focuses on comparison between survivor and non-survivor groups

Table 28: Comparison of symptoms with survivors and non-survivors of patients studied

Symptoms	Survived				p value
	Non survived (n=18)		Survived (n=32)		
	No.	%	No.	%	
1.Fever	18	100.0	32	100.0	1.000
2.Headache	2	11.1	2	6.2	0.612
3.Cough	5	27.8	8	25.0	1.000
4.Breathlessness	7	38.9	9	28.1	0.532
5.Altered Sensorium	1	5.6	1	3.1	1.000
6.Vomiting	4	22.2	8	25.0	1.000
7.Jaundice	2	11.1	2	6.2	0.612
8.Decreased Urine output	4	22.2	12	37.5	1.000
9.Abdominal Pain	5	27.8	12	37.5	1.000
10.Chest pain	2	11.1	3	9.3	1.000
11.Loose stools	2	11.1	3	9.3	1.000

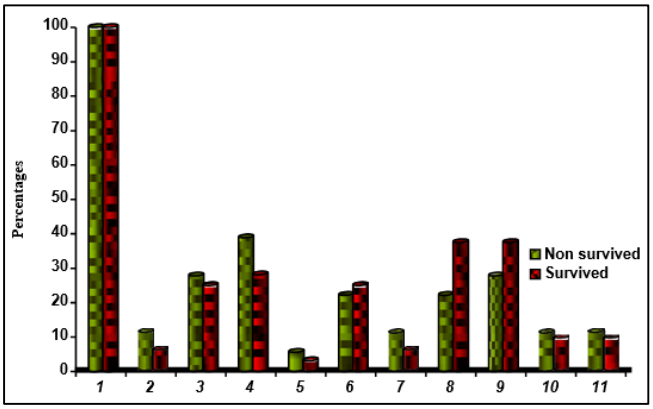

Fig 34

Table 29: Comparison of comorbidities with survivors and non-survivors of patients studied

Comorbidities	Survived			
	Non survived (n=18)		Survived (n=32)	
	No.	%	No.	%
Nil	8	44.4	18	56.2
Present	10	55.5	14	43.7
Diabetes	6	33.3	8	25.0
Hypertension	5	27.8	3	9.3
Paraplegic	1	5.6	0	0.0
COPD/IHD	2	11.1	1	3.1

Comorbidities are statistically similar in two groups with p=0.423

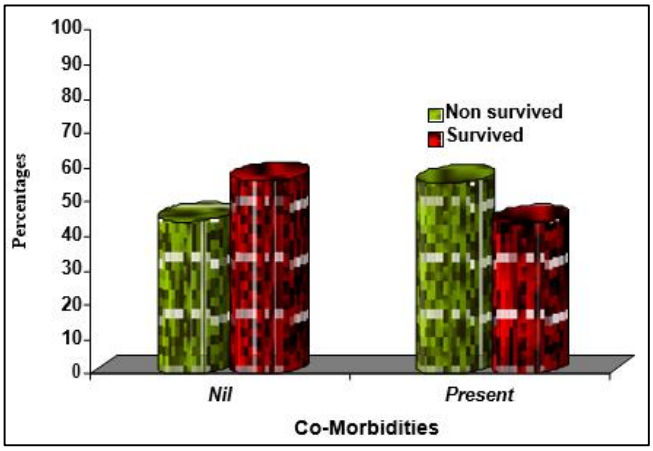

Fig 35

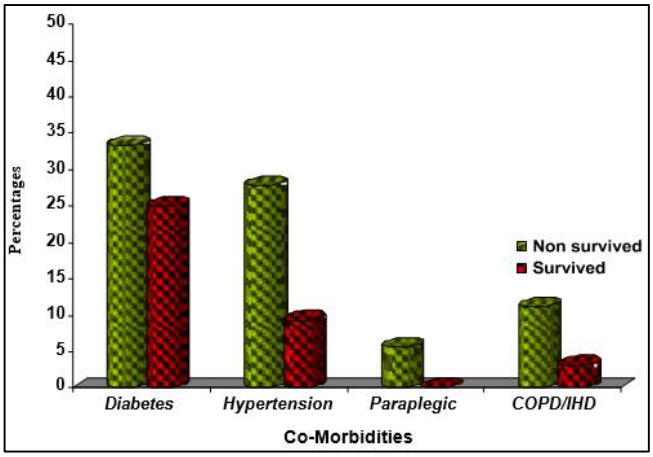

Fig 36

Comorbidities are statistically similar in two groups with p=0.42

Table 30: Comparison of Pallor, Icterus, and Cyanosis with survivors and non survivors of patients studied

Signs	Survived			
	Non survived (n=18)		Survived (n=32)	
	No.	%	No.	%
No	13	72.2	24	75.0
Yes	5	27.8	8	25.0
Icterus	0	0.0	1	3.1
Pallor	5	27.8	7	21.9

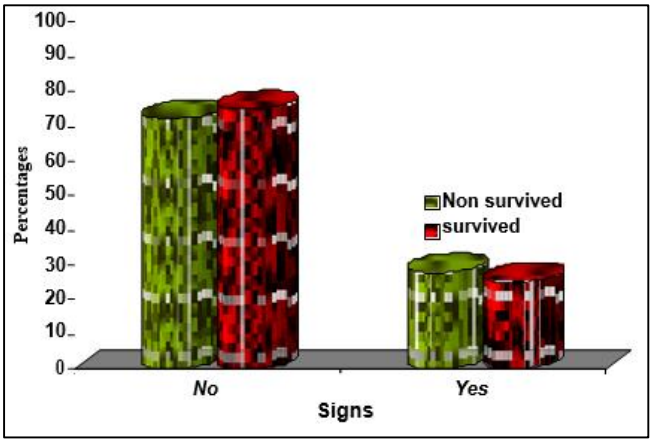

Fig 37

In our study, 5 among non survivors and 7 among survivors had pallor

Table 31: Comparison of systemic disease with survivors and non survivors of patients studied

Systemic disease	Survived				p value
	Non survived (n=18)		Survived (n=32)		
	No.	%	No.	%	
RS	9	50.0	21	65.6	0.279
CVS	1	5.6	2	6.2	0.921
CNS	10	55.6	7	21.8	0.0169*

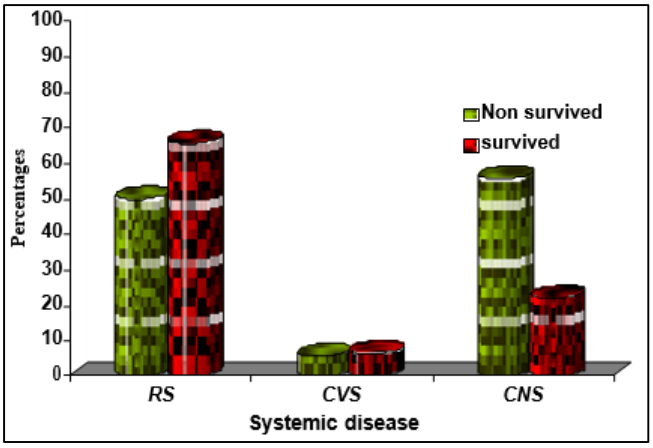

Fig 38

Table 32: Comparison of Hepatomegaly & Splenomegaly with survivors and non survivors of patients studied

Hepatomegaly& Splenomegaly	Survived				p value
	Non survived (n=18)		Survived (n=32)		
	No.	%	No.	%	
Hepatomegaly					
No	15	83.3	29	90.6	
Yes	3	16.7	3	9.3	0.446
Splenomegaly					
No	18	100.0	25	78.1	
Yes	0	0.0	7	21.8	0.032*

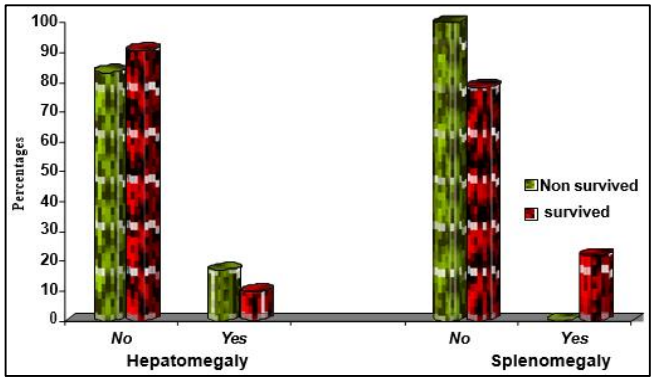

Fig 39

In our study, 7 among 32 survivors (32.1%) had splenomegaly.

Table 33: Evaluation of study variables with survivors and non survivors of patients studied

Variables	Non-survived	Survived	p value
Age in years	51.06±19.59	46.84±15.77	0.411
Temperature	102.48±1.06	102.61±1.01	0.658
Pulse rate	123.44±13.51	117.63±5.04	0.033*
Respiratory rate	27.22±5.54	26.5±5.47	0.658
Hemoglobin	11.14±4.02	10.89±2.04	0.770
Total count	15827.78±8423.69	22893.75±24048.53	0.236
Serum sodium	132.83±4.79	130.53±3.92	0.072+
Serum potassium	4.24±0.67	3.96±0.85	0.236
PH	7.24±0.13	7.24±0.1	0.989
Serum amylase	20.56±11.55	17.69±5.97	0.251
Haematocrit	37.54±9.67	38.58±4.39	0.605

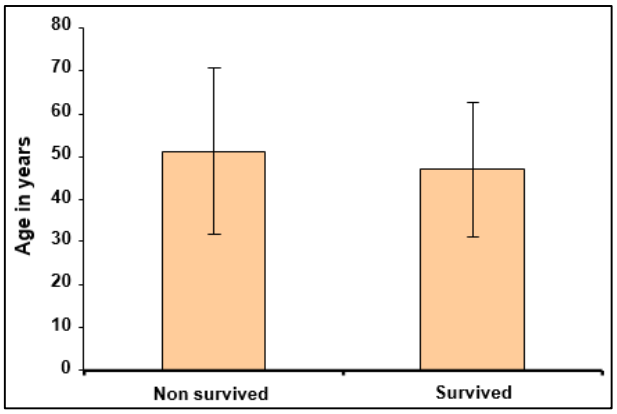

Fig 40

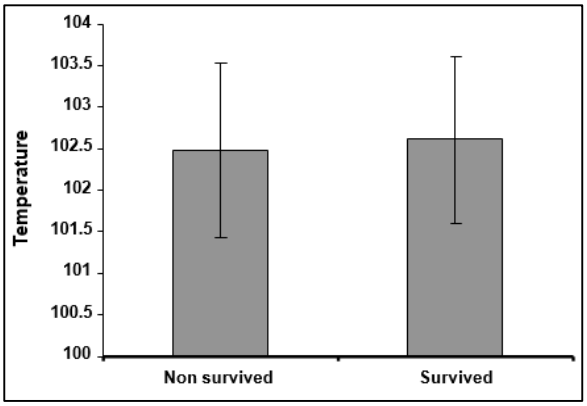

Fig 41

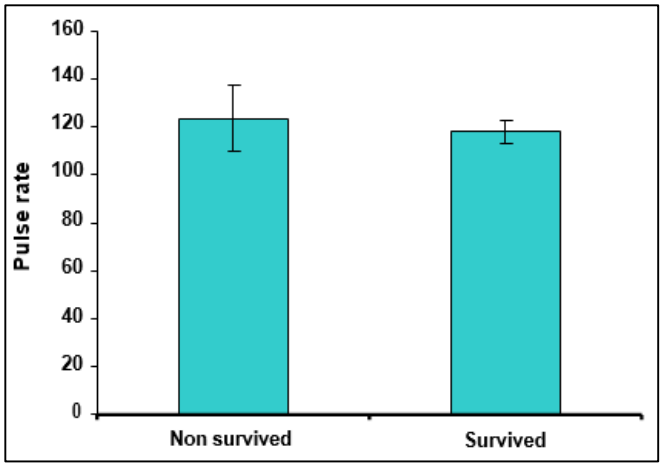

Fig 42

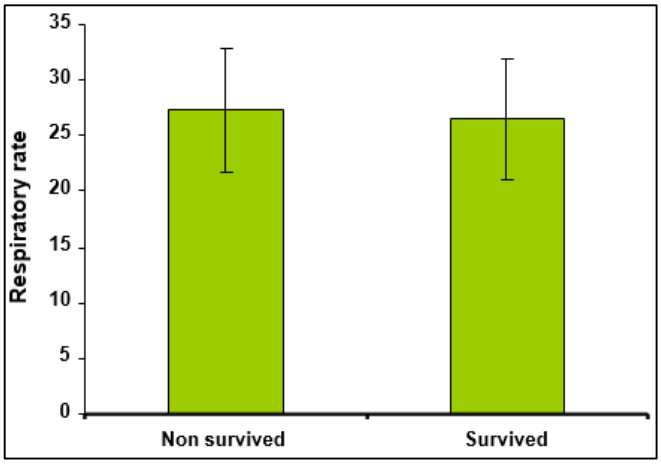

Fig 43

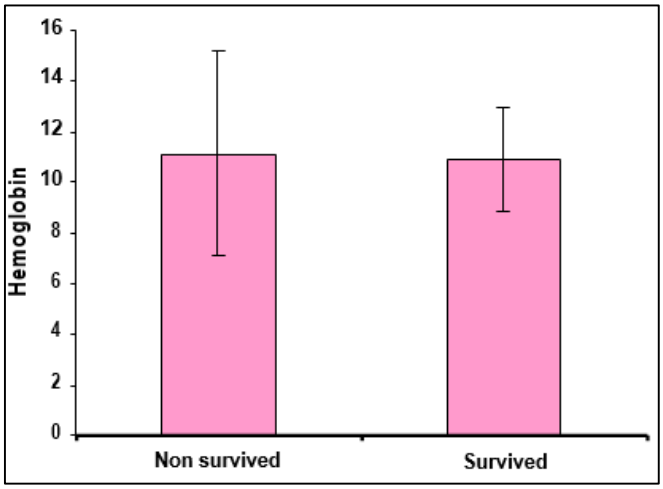

Fig 44

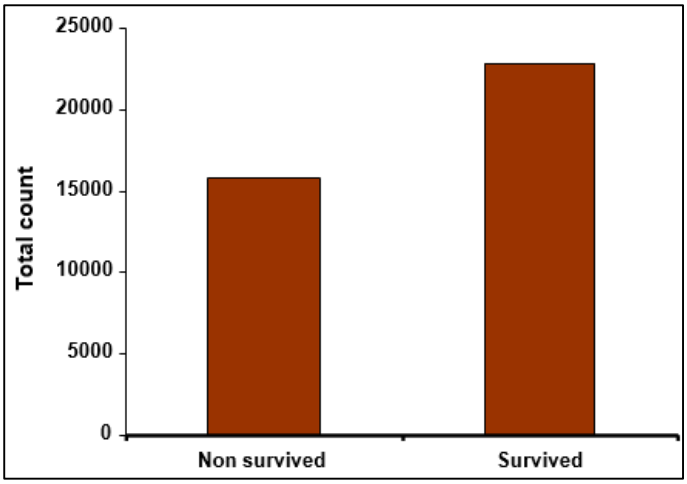

Fig 45

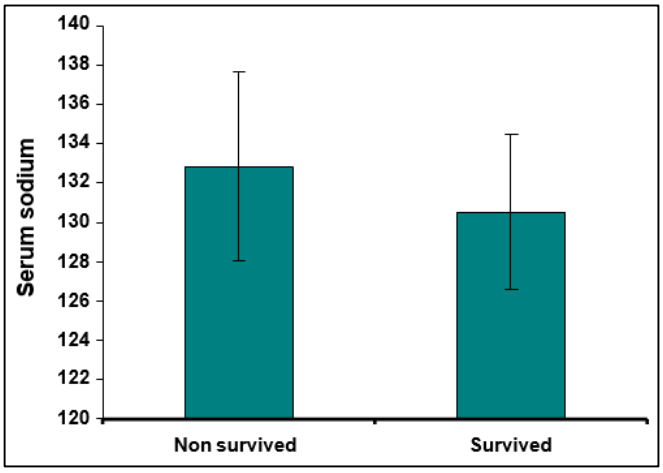

Fig 46

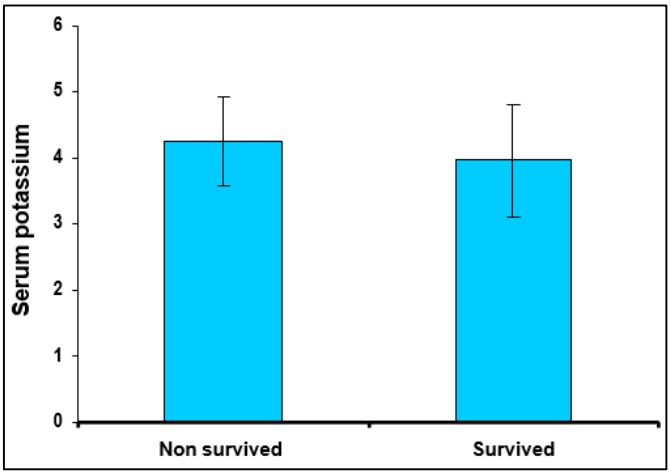

Fig 47

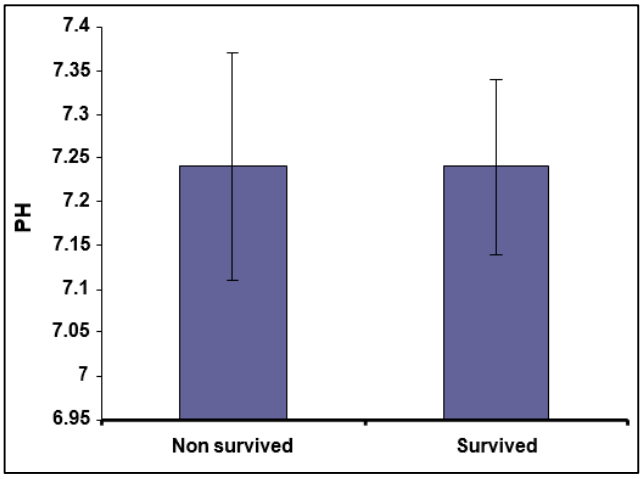

Fig 48

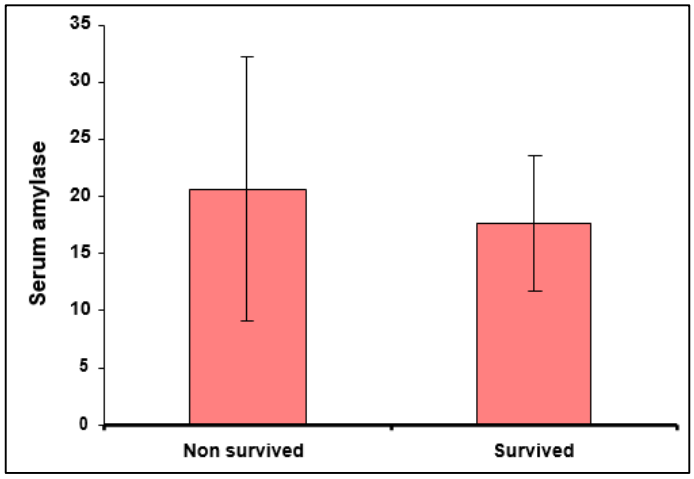

Fig 49

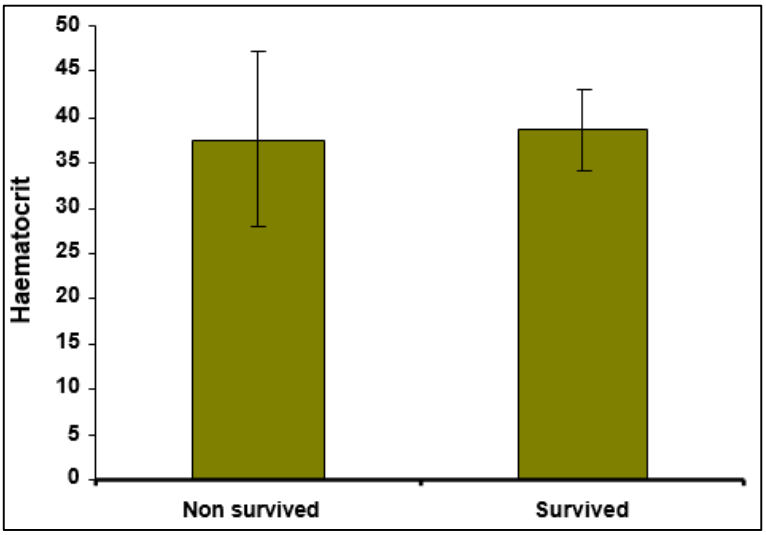

Fig 50

Out of 50 patients studied, non survivors had higher pulse rate than non-survivors with the rest of parameters being statistically similar

Table 34: Evaluation of GCS with survivors and non survivors of patients studied

GCS	Non Survived	Survived
Day 1	10.06±5.57	14.19±1.99
Day 2	10.5±5.22	13.84±2.26
Day 3	9.23±5.18	14.03±2.09
Day 4	9.33±5.02	14.41±1.6
Day 5	8±5.63	14.5±1.55
Day 6	7.38±5.63	14.63±1.35
Day 7	8.2±4.66	14.92±0.41
Day 8	8.2±4.66	15±0
Day 9	8.8±4.82	15±0
Day 10/last day	8.67±5.13	13.75±4.33

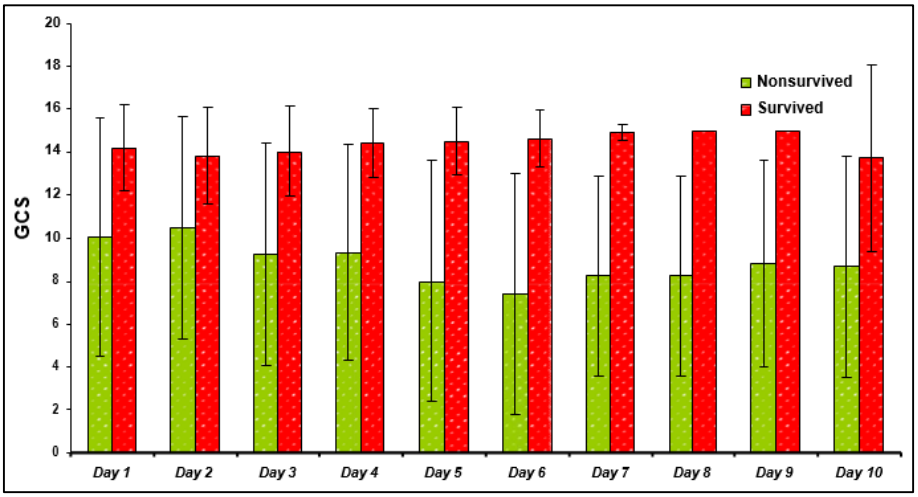

Fig 51

GCS was statistically high in case of survivors as compared to non-survivors on all days

Table 35: Evaluation of platelet count with survivors and non-survivors patients studied

SOFA score	Non survived	Survived
Day 1	1.3±1.59	1.41±1.53
Day 2	1.16±1.6	1.39±1.46
Day 3	1.05±1.58	1.4±1.3
Day 4	1.53±2.04	1.54±1.19
Day 5	1.09±1.85	1.55±1.05
Day 6	1.21±1.54	1.86±1.11
Day 7	1.47±1.86	1.8±0.74
Day 8	1.5±1.6	2.09±0.75
Day 9	1.78±1.91	2.06±0.82
Day 10/LAST DAY	2.22±2.31	2.29±0.75

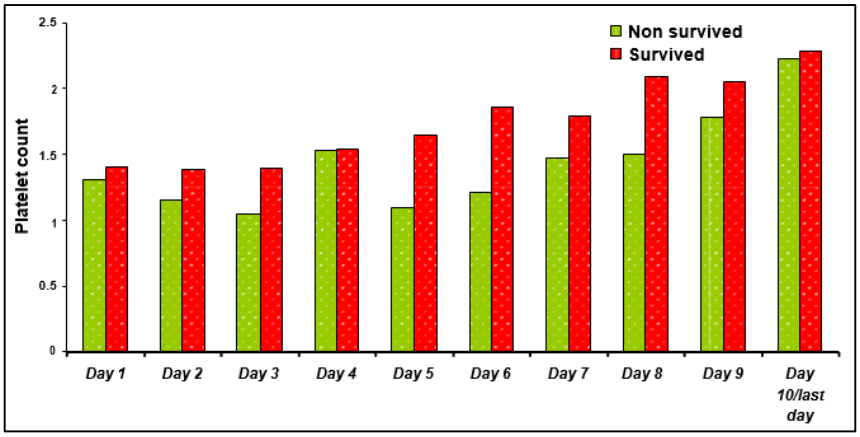

Fig 52

Table 36: Evaluation of Serum Creatinine (mg/dl) with survivors and non-survivors patients studied

Serum Creatinine(mg/dl)	Non survived	Survived
Day 1	1.76±1.06	2.77±2.43
Day 2	2.15±1.14	2.75±2.1
Day 3	2.28±0.89	2.23±1.48
Day 4	2.36±1.22	2.13±1.41
Day 5	2.54±1.8	2.17±1.46
Day 6	2.49±1.97	1.94±1.42
Day 7	1.88±1.02	1.77±1.12
Day 8	2.4±1.12	1.58±0.86
Day 9	2.48±1.19	1.46±0.73
Day 10/last day	2.58±1.56	1.26±0.5

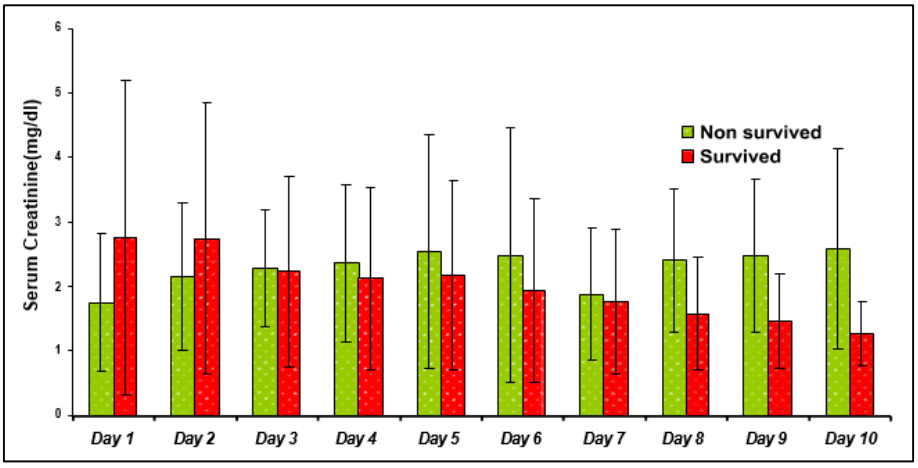

Fig 53

Out of 50 patients studied, there was no statistical difference between survivors and non survivors on serum creatinine value

Table 37: Evaluation of serum bilirubin with survivors and non-survivors patients studied

Serum bilirubin	Non survived	Survived
Day 1	2.19±1.41	2.78±2.55
Day 2	2.15±1.36	2.48±2.27
Day 3	2.72±1.98	2.43±2.6
Day 4	2.4±2.23	1.99±1.92
Day 5	2.71±2.6	1.73±1.66
Day 6	2.74±2.48	1.53±1.48
Day 7	3.1±2.66	1.63±1.96
Day 8	3.18±2.34	1.71±1.91
Day 9	3.5±2.82	1.44±1.04
Day 10/last day	5.7±0.71	1.29±0.64

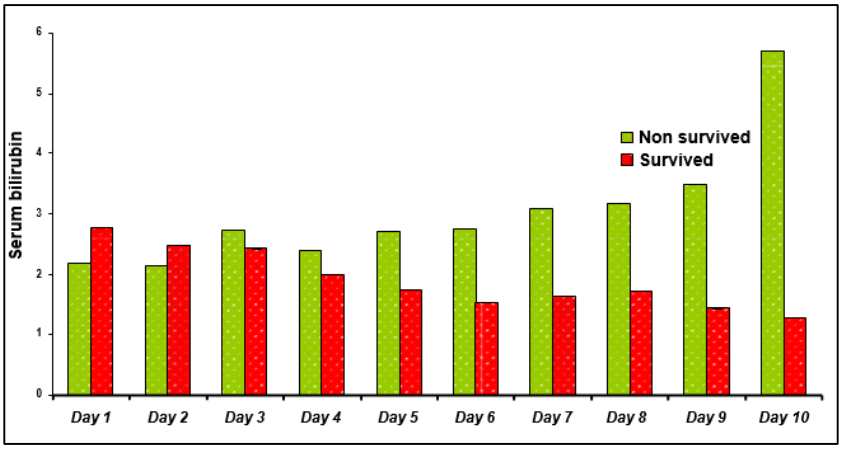

Fig 54

Out of 50 patients studied, there was no statistical difference between survivors and non survivors on serum bilirubin value

Table 38: Comparison of ventilator support, dialysis, inotropic support and duration of ICU stay with survivors and non survivors patients studied

	Non survived (n=18)	Survived (n=32)	P value
Ventilator support	16(88.9%)	14(43.8%)	0.002**
Dialysis	2(11.1%)	8(25.0%)	0.295
Inotropic support	13(72.2%)	15(46.9%)	0.083+
Duration of ICU stay	3.72±3.08	3.75±2.02	0.969

16 out of 18(88.9%) among non survivors required ventilator support whereas 14 out of 32(43.8%) among survivors required ventilator support suggesting significant respiratory system involvement among non survivors (p=0.002). The mean duration of ICU stay did not vary between non-survivors and survivors (3.72 v/s 3.75).

13 out of 18 (72.2%) among non-survivors required inotropic support whereas 15 out of 32(46.9%) among survivors

required inotropic support suggesting statistically significant hypotension among non-survivors (p=0.083). However, dialysis was required more among survivors than non-survivors (25% v/s 11.1%, p=0.295) but was not statistically very significant.

Serum creatinine among survivors who underwent dialysis varied between 6mg/dl to 10 mg/dl

Table 39: Evaluation of SOFA score with survivors and non-survivors patients studied

SOFA score	Non survived	Survived	p value
Day 1	10.17±3.45	7.94±2.64	0.014*
Day 2	11.63±4.33	8.28±2.62	0.002**
Day 3	13.42±4.06	6.84±2.96	<0.001**
Day 4	10.78±3.77	5.94±3.41	0.001**
Day 5	12.25±4.8	4.55±3.27	<0.001**
Day 6	12.29±6.1	3.39±2.77	<0.001**
Day 7	14.2±3.9	2.82±2.61	<0.001**
Day 8	13±3.39	2.45±2.5	<0.001**
Day 9	13.8±4.09	1.81±1.72	<0.001**
Day 10/last day	13.5±5.69	1.33±1.23	<0.001**

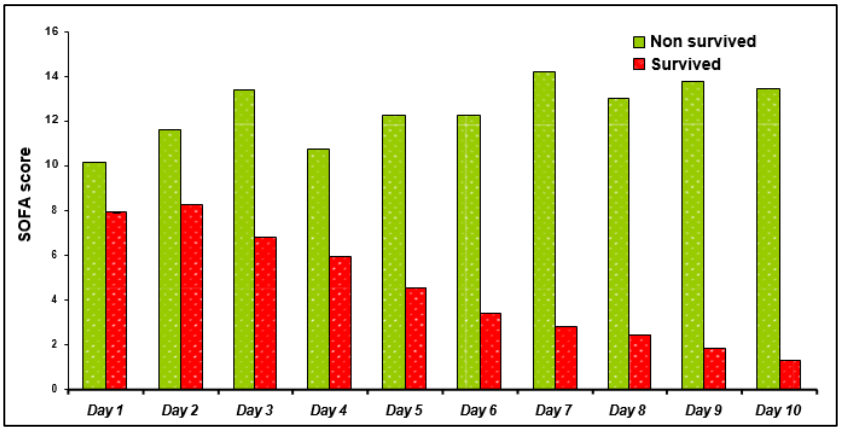

Fig 55

Out of 50 patients studied, SOFA score was significantly low especially on day 3 (6.84±2.96) in survivor group as compared to non survivor group whose mean day 3 value being (13.42±4.060).

Table 40: Comparison of APACHE II score with survivors and non-survivors patients studied

APACHE II	Non survived	Survived
<10	2(11.1%)	4(12.5%)
10-20	5(27.8%)	16(50.0%)
20-30	8(44.4%)	10(31.3%)
>30	3(16.7%)	2(6.3%)
Total	18(100.0%)	32(100.0%)
Mean ±SD	23.28±9.65	18.75±7.34

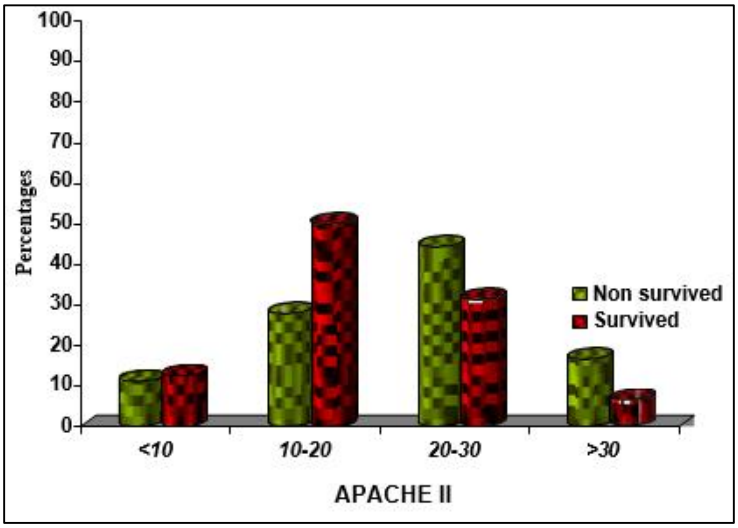

Fig 56

APACHE II score is significantly more in non-survived patients with p=0.068+.

Discussion

The clinical profile of 50 patients with sepsis with MODS was studied. There were 28 males and 22 females in this cohort. The age of patients varied from 18 years to 90 years. The mean age was 48.36 years. Similar studies in India have shown male preponderance with most patients in the fourth to fifth decade.24 Even in our study, most patients were in fourth to fifth decade .Comorbidities were present in 24 patients with diabetes mellitus being present in 14 patients.

All patients had fever with breathlessness being the next predominant symptom observed in 16 patients. Even decreased urine output was observed in 16 patients accounting for acute kidney injury. Among the several disorders encountered in sepsis, acute kidney injury (AKI) is one of the most important because it is a life-threatening condition, increases the complexity and cost of care, and is an independent risk factor for mortality.73 74

The mean SOFA score on the day of admission was 8.74 and the mean APACHE II score on the day of admission was 20.14 suggesting there was significant organ dysfunction in all patients. In our study, 30 patients required ventilator support,

28 patients required inotropes, 10 patients required dialysis. This again suggests significant organ dysfunction. The mortality recorded in this study is 36%. In large clinical trials, the mortality associated with severe sepsis and septic shock ranges between 13% and 50%.1

Finding the cause was not the main objective of the study. However, 9 cases of dengue were indentified. 2 cases of leptospirosis was observed. There was not a single case of malaria in this study. In 4 cases of UTI, organisms were isolated: 3 were caused by Eschieria coli, 1 being klebsiella species. 1 sputum culture revealed Streptococcus pneumonia species.1 case of H1N1 was identified. 1 special case in which anti- HAV was positive. It was not sure whether hepatitis A caused sepsis or it was an incidental finding. About 17 patients had lower lobe pneumonia. However, only 1 sputum C/S revealed Streptococcus pneumonia species and others had no growth Chest x-ray revealed 17 patients had lower zone consolidation and 5 had ARDS.ECG showed all 50 had sinus tachycardia with 2 also had P-pulmonale, 2 had LVH.

Clinical predictors of mortality

In our study, 18 patients died and 32 patients survived. The mean age among non-survivors was little high compared to survivors (51.7 v/s 46.84) which was not statistically significant (p=0.411). 7 patients among non-survivors and 9 patients among survivors had breathlessness which was statistically similar (p-0.532). Even comorbidities are statistically similar in two groups with p=0.423. Presence of pallor, icterus are statistically similar in non-survivors and survivors group with p=0.830.

The non-survivors had a higher pulse rate (mean 123.44 v/s 117.63 p=0.033) and a lower blood pressure and therefore a greater requirement for inotropes compared to survivors. In our study, mortality rate among septic shock patients was 72.2%. Septic shock is associated with a higher mortality as shown with studies in Europe.76 Degoricija et al recorded a mortality rate of 72.1% in patients with septic shock in Croatia.75 Studies in India have recorded a mortality of 59.26% in patients with severe sepsis and septic shock.24

The respiratory rate was high in non survivors than survivors (27.22 v/s 26.5) which was not statistically significant (p=0.658). Leukocytosis and leukopenia is often associated with mortality and normal white blood cell counts are associated with survival.76,79

In our study however non-survivors had a mean total count of 15,827/ µL and survivors had a mean total count of 22, 893 /µL at admission. The difference was not statistically significant.

Studies have shown that the Glasgow coma scale at admission is an independent predictor of mortality.77,78 In our study, the mean GCS among survivors was high compared to non survivors on all days (day1, 14.19 v/s 10.19) and was statistically very significant (p<0.001).

In our study, mean serum creatinine did not significantly differ among non- survivors and survivors on day 1 and also on initial few days (day1, 1.76 v/s 2.77, p=0.101). Even mean serum bilirubin was significantly different among survivors and non-survivors (day 1, 2.19 v/s 2.78, p=0.375).

In our study, 16 out of 18(88.9%) among non-survivors required ventilator support whereas 14 out of 32(43.8%) among survivors required ventilator support suggesting significant respiratory system involvement among non-survivors (p=0.002). The mean duration of ICU stay did not vary between non survivors and survivors (3.72 v/s 3.75). It may be attributable to early death among non-survivors and early recovery among survivors.

In our study, 13 out of 18 (72.2%) among non-survivors required inotropic support whereas 15 out of 32(46.9%) among survivors required inotropic support suggesting statistically significant hypotension among non-survivors (p=0.083). However, dialysis was required more among survivors than non-survivors (25% v/s 11.1%, p=0.295) but was not statistically very significant.

Many studies have shown that high APACHE II score at the time of admission was associated with high mortality.74 In this study, though mean APACHE II score was high among non-survivors than survivors (23.28 v/s 18.75), it was of just suggestive statistical significance (p=0.068+).

SOFA score has been validated extensively for prognostification. In our study, extensive study of SOFA score was done from day 1 to the last day. The SOFA score on day 1 was high among non survivors and low among survivors which was statistically significant (10.17 v/s 7.94, p=0.014).

However, the most significant difference was observed on day 3. The SOFA score was very high among non-survivors as compared to survivors which was statistically very significant (13.42 v/s 6.84, p<0.001). This was similar to many studies that have been done. Vosylius et al in their study on 117 ICU patients with sepsis showed that the changes in the severity of organ dysfunction were closely related to the outcome of the patients admitted to ICU. The SOFA score on day 3 was better compared with SOFA score on day 1 as the tool for outcome prediction.77 Vincent et al in their study in 40 ICU‘s in 16 countries showed that the total SOFA score increased in 44% of the non- survivors but in only 20% of the survivors.56 Saulius Vosylius, Jurate Sipylaite77 in Vilnius, Lithuania observed that SOFA score on day 1 and day 3 was significantly higher in non-survivors than those in survivors. Flavi Lopez Fereria; Daliana Peres Bota70 in Belgium found initial SOFA score up to 9 predicted mortality of less than 33% while an initial SOFA score of greater than 11 predicted

a mortality rate of 95%.

Studies have shown that in the SOFA scores; cardiovascular, neurological, and respiratory, renal, haematological and hepatic dysfunctions were independent risk factors for mortality.56,77 In our study, also the same have been observed as described above for respiratory, cardiovascular and neurological variables. However, renal and hepatic parameters did not vary much among non survivors and survivors.

Limitations of the Study

- With a sample size of 50 patients this model requires external validation.
- The time of admission to ICU for each patient is different. Lead time bias is possible.
- Nosocomial complications and socio economic constraints are difficult to model in studies.
- History of prior antibiotic usage could not be ascertained by history.

Summary and Conclusion

Summary

Sepsis with multiorgan dysfunction syndrome (MODS) is a common cause of Intensive Care Unit (ICU) mortality and morbidity. Sepsis can be reversed, but as sepsis progresses to severe sepsis and septic shock the mortality rate substantially increases.

Multiorgan dysfunction syndrome is well established as the final stage of the continuum. Due to the high mortality associated with sepsis and its complications it is necessary to rapidly diagnose and treat the underlying cause.

Scoring systems for use in the intensive care unit (ICU) have been developed from the past 30 years. They are widely used in the field of critical care medicine. They allow a quantification of the severity of illness and a probability of in-hospital mortality. A well performing ICU prognostic model helps to make meaningful comparison of the hospital‘s current performance with the past. This allows the hospital to identify the weakness and initiate interventions aimed at quality improvement and allow patients to choose health care providers based on performance. The use of these prognostic models help in providing meaningful information to physicians when discussing patient prognosis with the patient‘s relatives. Our study focussed on Acute Physiology and Chronic Health Evaluation II (APACHE II) and Sequential organ failure assessment (SOFA) scores.

The objectives of our study were to assess morbidity and mortality of patients with multiorgan dysfunction syndrome in sepsis and to prognosticate the patients by using defined scores like SOFA and APACHE II scores.

The study was carried out in the period of November 2010 to September 2012 and 50 patients were included in the study. The patients with sepsis as defined by the American College of Chest Physicians/Society of Critical Care Medicine (ACCP/SCCM) Consensus Committee in 1992 were included in the study. The detailed history, clinical examination and all the relevant laboratory investigations were done including blood culture. In our study, the conditions were defined according to standard practice and based on relevant literature. All the patients of sepsis admitted to ICU/emergency ward were prognosticated on the basis of APACHE II score and SOFA score. APACHE II is calculated on day of admission. The predicted mortality rate was calculated on the basis of this score. To assess sequential involvement of organ we calculated SOFA score on every day. This gave us idea whether involvement of number of organ was increasing or decreasing and if the severity of particular organ was increasing.

We have analyzed various profiles between two groups, survivor group which include the patients who are successfully discharged after recovery and non-survivor group which include the patients who died.

There were 28 males and 22 females in this cohort. The age of patients varied from 18 years to 90 years. The mean age was 48.36 years. In this study, 18 patients died and 32 patients survived.

The non-survivors had a higher pulse rate (mean 123.44 v/s 117.63 p=0.033) and a lower blood pressure and therefore a greater requirement for inotropes compared to survivors.

The respiratory rate was high in non survivors than survivors (27.22 v/s 26.5) which was not statistically significant (p=0.658). In this study, the mean GCS among survivors was high compared to non survivors on all days (day1, 14.19 v/s 10.19) and was statistically very significant (p<0.001).

In our study, though mean APACHE II score was high among non survivors than survivors (23.28 v/s 18.75),it was of just suggestive significance(p=0.068+)

In this study, extensive study of SOFA score was done from day 1 to the last day. The SOFA score on day 1 was high among non survivors and survivors which was statistically significant (10.17 v/s 7.94, p=0.014). However, the most significant difference was observed on day 3. The SOFA score was very high among non survivors as compared to survivors which was statistically very significant (13.42 v/s 6.84, p<0.001).

Serial measurement of SOFA score during first week is very useful tool in predicting the outcome. The trend of SOFA score was progressively declining in survivors while non-survivors had stable higher score during the first week. The APACHE II score on day of admission, though reliable, is not very effective in predicting the mortality rate. Once the organ failure sets in, even the most aggressive and expert critical care may be not enough. Thus to conclude, sepsis is a very fatal disease with a high mortality rate for MODS.

Conclusion

- Serial measurement of SOFA score during first week is very useful tool in predicting the outcome. The trend of SOFA score was progressively declining in survivors while non-survivors had stable higher score during the first week.
- The APACHE II score on day of admission, though reliable, was not very effective in predicting the mortality rate.

Abbreviations

PCT- Procalcitonin

MICU- Multi disciplinary intensive care unit ICU- Intensive care unit

ACCP- American College of Chest Physicians CRP- C-Reactive protein

RBS- Random blood sugar TLC- Total leucocyte count HB-Hemoglobin

NPV- Negative predictive value

SIRS- Systemic inflammatory response syndrome

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