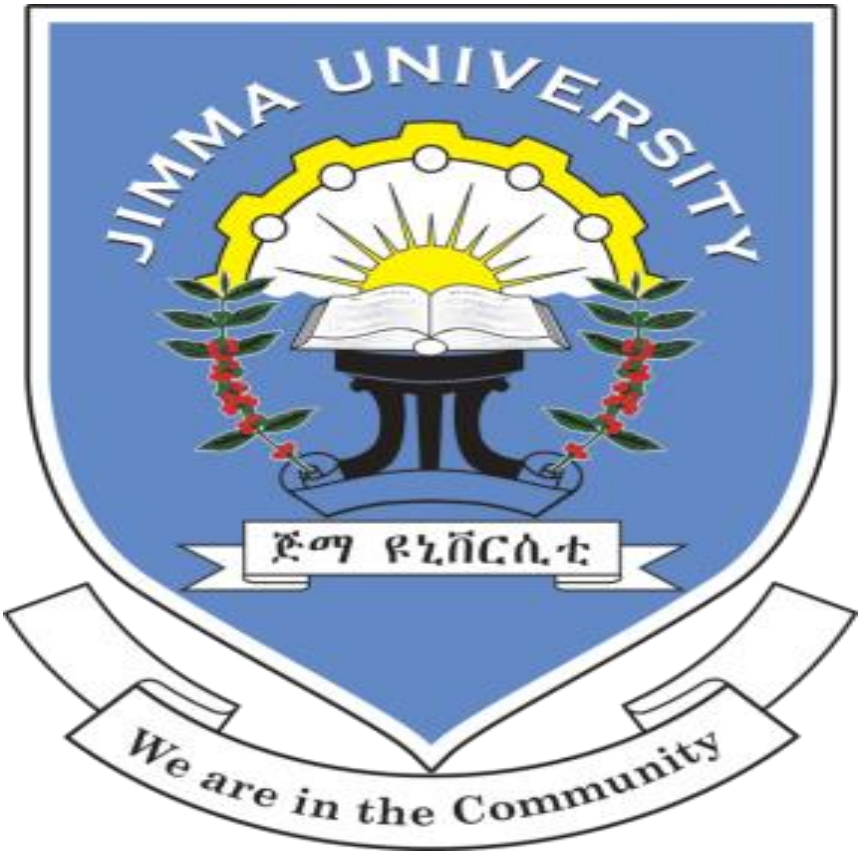
Management of Septic Shock in surgical patients in Jimma University Medical Centre April 2023- 0ctober 2023



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A research project submitted to the Department of General Surgery, School of Health Science, Jimma University; in partial fulfillment of the requirement of a Specialty Certificate in General Surgery.

November 2023

Jimma, Ethiopia

Title of the research: Management of Septic Shock in surgical patients in Jimma University Medical Centre April 2023- 0ctober 2023

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Jimma Ethiopia

DECLARATION

I, Dr. Langa James Oriho do hereby declare that this research which is being submitted in fulfillment of the partial requirements for the certificate of specialty in general surgery is the result of my own research performed under the supervision and that except where otherwise other sources are acknowledged and duly referenced, this work has not previously been accepted in substance for any degree and is not being concurrently submitted in candidature for any degree.
I hereby give permission for the department of general surgery to seek dissemination/publication of the research in any appropriate format. Authorship in such circumstances is to be jointly held between me as the first author and the project supervisors as subsequent authors.

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Abstract

Background: Sepsis and septic shock are major healthcare issues, affecting millions of people worldwide each year and killing between one in three and one in six of those with sepsis/septic shock. According to Sepsis-3 criteria, sepsis is a "life-threatening organ dysfunction caused by a dysregulated host response to infection". Septic shock "is a subset of sepsis in which underlying circulatory, cellular, and metabolic abnormalities are associated with a greater risk of mortality than sepsis alone.

Objective: to assess the management of septic shock among surgical patients at Jimma University Medical Centre April 2023- 0ctober 2023.

Methods: This prospective observational study was conducted at JUMC, located in Jimma town in southwest Ethiopia. The study period was from April 2023 to October 2023. All adult surgical patients who presented with/developed septic shock at Jimma University Medical Centre were included.

Results: There were a total of 61 patients during the study. The age group most affected was 15 to 39 years old, the median age of patients was 45 (IQR, 40-60) years, and 77% (n=47) of the patients were male. The most frequent source of infection in this study was community-acquired infection 83.3% (n=49). The most common focus of sepsis was intra-abdominal infection of the digestive system 82% (n = 50). Regarding management, measurement of lactate levels and blood cultures before administering antibiotics was not done in all patients. Source control surgery was performed in 52.5% (n = 32) of patients after developing septic shock, and 84.4% (n = 27) of surgeries were performed within 24 hours. The 30-day mortality rate was 49 (80.3%) with an ICU mortality rate of 78.94%. The median length of stay in the intensive care unit (ICU) was 3 (IQR, 1–5) days, and the median length of hospital stay was 6 (IQR, 2–15) days.

Discussion: There was poor compliance with Surviving Sepsis Campaign (SSC) 1-hour bundle, The 30 days mortality rate was high in this study, with hospital mortality of 80.1% and an ICU mortality rate of 78.94%, a study in Turkey also showed similar mortality of septic shock is 75 % according to SEPSIS-III definition and 70.4 % according to SEPSIS I. Sub-Saharan Africa found to have a higher mortality rate regardless of using standard guidelines compared with usual care.

Conclusion: The mortality rate in this study was higher compared to studies done in high-income and low-income countries. There was poor adherence and compliance to SSC (the 1-hour bundle). The hospital and the ICU length of stay was less compared to studies done in high-income countries.

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I would like to thank Jimma University for giving me such an invaluable chance to do this research. I would also like to thank my primary supervisors, Dr. Birhanu and Dr. Wongel, who guided me throughout this project. I would also like to thank my friends and family who supported me throughout the journey.

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List of Abbreviations

ARDS: Acute respiratory distress syndrome

CI: The confidence interval

CMS: The US Centers for Medicare and Medicaid Services

DVT: Deep vein thrombosis

EHR: .electronic health record

HICs: high-income countries

HIV: Human immunodeficiency virus

ICU: Intensive care Unit

JUMC: Jimma University medical center

LICs: low-income countries

LMICs: lower-middle-income countries

MEWS: Modified Early Warning Score

NEWS: National Early Warning Score

p: p-value, or probability value

PaO2: partial pressure of arterial oxygen

PACU: Post anesthesia care unit

q SOFA: quick Sequential Organ Failure Score

SIRS: systemic inflammatory response syndrome

SOFA: Sequential Organ Failure Assessment

SpO2: arterial oxygen saturation

μg : microgram

Chapter One: Introduction

1.1. Background

Septic shock is a serious healthcare issue that affects millions each year, with up to one in six people dying from it(1). Early identification of Septic shock is defined as a subset of sepsis in which underlying circulatory and cellular metabolism abnormalities are profound enough to substantially increase mortality (Proper management of it in the first few hours after it develops can lead to better results (1).

In 1991, sepsis was defined as a systemic inflammatory response syndrome (SIRS) due to a suspected or confirmed infection with 2 or more of the following criteria: Temperature below 36°C or above 38°C, heart rate more than 90/minute, respiratory rate of 20/minute or more, or arterial partial pressure of carbon dioxide less than 32 mm Hg, white blood cell count less than 4 × 109/L or more than 12 × 109/L, or more than 10% bands (2).

Severe sepsis was defined as the progression of sepsis to organ dysfunction, tissue hypoperfusion, or hypotension. Septic shock was identified as hypotension and organ dysfunction that persisted regardless of volume resuscitation, necessitating vasoactive medication, and with 2 or more of the SIRS criteria listed above (2,3).

In 2001, the definitions were revised to include clinical and laboratory parameters(3,4).

In 2004, the Surviving Sepsis Campaign created definitions that led to the creation of a protocol for sepsis care used worldwide. The US Centers for Medicare and Medicaid Services (CMS) then adopted these definitions to identify sepsis as having at least two SIRS criteria and an infection, severe sepsis as having organ dysfunction and serum lactate greater than 2 mmol/L, and septic shock as hypotension needing vasopressors with a lactate level of at least 4 mmol/L (3).

In 2016, the Sepsis-3 committee issued the following new definitions:

Sepsis defined as “life-threatening condition caused by a dysregulated host response to infection, resulting in organ dysfunction”(5). Septic shock defined as “Circulatory, cellular, and metabolic abnormalities in septic patients, presenting as fluid-refractory hypotension requiring vasopressor therapy with associated tissue hypoperfusion (lactate > 2 mmol/L)”. The term severe sepsis was removed (3).

Screening tools for sepsis are created to identify it early on. They involve either manual methods or the electronic health record. There is variation in the diagnostic accuracy of these tools, and most have not been proven to be very accurate, but a few have been linked to improvements in care(6,7). There are many tools used for screening of sepsis/septic shock, such as systemic inflammatory response syndrome (SIRS) criteria, vital signs, signs of infection, quick Sequential Organ Failure Score (qSOFA) or Sequential Organ Failure Assessment (SOFA) criteria, National Early Warning Score (NEWS), or Modified Early Warning Score (MEWS) (8,9).

The quick SOFA Score (qSOFA), introduced in Sepsis-3, is a tool to predict the risk of death and extended ICU length of stay (1). However, it is not, per se, intended to be an early warning sign of sepsis or to identify which patients should be transferred to ICU. Two cohort studies showed that the validity of the qSOFA score criteria, which includes altered mentation (Glasgow Coma Scale score <15), respiratory rate >22, systolic blood pressure <100 mmHg, and with and without serum lactate greater than >2 mmol/L, were good indicators to predict hospital mortality same as the SOFA score(5,9). Unfortunately, outside the ICU sepsis group, 30% had no SIRS criteria, and 41% had no SOFA points (11–13).

The National Early Warning Score (NEWS) and Modified Early Warning Score (MEWS) based on the clinical parameters of temperature, heart rate, respiratory rate, oxygen saturation, systolic blood pressure, and state of consciousness were presented. They are better suited for both outside the emergency department and the intensive care unit to help monitor and detect sepsis patients early. Recent data seemed to indicate that the sensitivity of the NEWS criteria is superior to MEWS and qSOFA scores. NEWS ≥5 has a sensitivity of 79%, which is comparable to the SIRS criterion ≥2 (80% sensitivity) and higher than qSOFA ≥2 (74% sensitivity). AUROC for NEWS (AUROC = 0.65; 95% CI, 0.61 to 0.68) was similar to qSOFA (AUROC = 0.62; 95% CI, 0.59 to 0.66). A sensitivity comparison of in-hospital mortality revealed NEWS ≥5. The sensitivities for the MEWS ≥5, qSOFA ≥2 and SIRS ≥2 criteria were 95.1%, 71.4%, 68.7% and 93.8%, respectively (10,11).

MANAGEMENT OF SEPTIC SHOCK

Evaluation of the patient in septic shock begins with an assessment of the adequacy of their airway and ventilation. Severely obtunded patients and patients whose work of breathing is excessive require intubation and ventilation to prevent respiratory collapse. Because vasodilation and a decrease in total peripheral resistance may produce hypotension, fluid resuscitation and restoration of circulatory volume are essential. The Surviving Sepsis Campaign has updated treatment guidelines with a most recent goal for care within the early hour (3).

ANTIMICROBIAL THERAPY

Prompt administration of broad-spectrum antibiotics is vital. The mortality is high when appropriate antibiotics are delayed, and the appropriate antibiotics antimicrobial agents should be administered within the first hour after diagnosis of sepsis after relevant culture samples have been collected unless the administration of antibiotics is significantly delayed. The first antibiotic should have a broad spectrum of action covering all possible pathogens. Combination therapy is recommended to ensure adequate coverage, especially in septic shock. Empirical selection of antibiotics should consider the site of infection, previous use of antibiotics, local pathogen susceptibility patterns, immunosuppression, and risk factors for resistant organisms. Antifungal use should be considered in at-risk patients, including patients receiving total parenteral nutrition, recent exposure to broad-spectrum antibiotics, perforated abdominal viscera, immunocompromised patients, or high clinical suspicion of fungal infection (1,3).

FLUID RESUSCITATION

The Pathophysiology of sepsis/ septic shock includes vasodilation, capillary leakage, and decreased effective circulating blood volume, thereby reducing venous return. These hemodynamic effects lead to impaired tissue perfusion and organ dysfunction. The goals of resuscitation in sepsis and septic shock are to restore intravascular volume, increase tissue oxygenation, and reverse organ dysfunction. A 30 mL/kg crystalloid bolus is recommended within 3 hours after diagnosis of severe sepsis or septic shock. However, data supporting the benefits of this recommendation are limited, and there is growing evidence of harm from maintaining a positive fluid balance (1,3).

Physicians should refrain from using static measurements to assess volumetric status. Central venous pressure, the static measurement most commonly used to guide resuscitation, is less accurate than thermodilution with a pulmonary artery catheter when assessing changes in cardiac output with volume administration. A 2017 meta-analysis showed that the use of dynamic assessment in targeted therapy was associated with lower risk of death, shorter ICU stays, and shorter duration of ventilator use (12).

High mortality associated with elevated lactate levels (>4 mmol/L) is reduced using Lactate-guided resuscitation. Elevated lactate levels during sepsis may be due to tissue hypoxia, increased glycolysis due to adrenergic excess, drugs (epinephrine, beta-2-agonists), or liver failure. Measurement of lactate levels is an objective method of assessing response to resuscitation, outperforms other clinical markers, and continues to be an integral part of the sepsis definition and care package of survival sepsis campaigns (1,3).

In sepsis and septic shock, Crystalloid solutions (isotonic saline or balanced crystalloids) are recommended for volume resuscitation. Although there is still debate about which solution is most appropriate, balanced solutions for critically ill patients have become popular over the past decade. There is increasing evidence that balanced crystalloids (lactated Ringer's solution, Plasma-Lyte) are associated with lower incidence of renal injury, lower need for renal replacement therapy, and lower mortality in critically ill patients. In addition, isotonic saline has been associated with hyperchloremia and metabolic acidosis and may reduce blood flow in the renal cortex (1,3).

EARLY SOURCE CONTROL

Source control is essential when treating sepsis and septic shock. Inadequate source management can lead to organ dysfunction and hemodynamic instability despite appropriate resuscitation measures. A thorough examination and appropriate imaging studies should be performed to determine the best way to control the source and to assess the risks associated with each intervention. If necessary, source control should be achieved within 6 to 12 hours after diagnosis after initial resuscitation is completed. Source management ranges from removal of infected endovascular devices to chest tubes for empyema to percutaneous or surgical interventions for cholecystitis and pyelonephritis (1,13).

RESTORING BLOOD PRESSURE

Sustained hypotension and tissue hypo perfusion after adequate fluid resuscitation are caused by loss of normal sympathetic vascular tone, resulting in vasodilation, neurohormonal imbalance, myocardial depression, microcirculatory dysregulation, and mitochondrial dysfunction (1,3).

Vasopressors and cardiotonic agents restore tissue oxygenation by increasing arterial pressure and cardiac output respectively. Mean arterial pressure is the preferred blood pressure to target during resuscitation. The recommended starting goal is 65 mmHg (1,3).

Noradrenaline is the first choice of vasopressor. Few large, multicenter, randomized, controlled trials have been conducted to identify the most effective initial and combination vasoactive agents in septic shock. Norepinephrine has been shown to have a lower risk of arrhythmias and survival benefit than dopamine. Adding his second vasopressor or inotropic to another sympathomimetic such as vasopressin or epinephrine can achieve target mean arterial pressure or reduce norepinephrine requirements. A second vasopressor is added periodically if the norepinephrine dose exceeds 40 or 50 μg/min (1,3).

ROLE OF CORTICOSTEROIDS

Corticosteroid actions include downregulating of maladaptive inflammatory response seen in sepsis and helping control relative adrenal insufficiency caused by adrenal suppression or glucocorticoid tissue resistance. In septic shock, they act as vasopressor-sparing agents, shortening the duration of shock, ventilator use, and ICU stay. When corticosteroids are used for septic shock, current guidelines recommend hydrocortisone 200 mg/day intravenously as a continuous infusion or 50 mg in four divided doses given as a bolus for at least 3 days. (1).

ADDITIONAL THERAPIES

Additional therapies, whether directly related to sepsis or complications of serious sepsis-related illness, focused on supportive care e.g. Blood products administration, glycemic control, sedation, stress ulcers, and DVT prophylaxis (1).

Low tidal volume ventilation strategy with plateau pressure limitation for patients with sepsis-related ARDS and use of prone position for moderate-to-severe ARDS and sepsis induction to limit and overlap with other guidelines, a low tidal volume approach was proposed for all patients with respiratory failure (2, 4).

GOALS OF CARE AND LONG TERM OUTCOMES

Due to the heavy toll of long-term effects of sepsis, the SSC guidelines now include a section about how to help a person recover from it. They suggest screening for economic and social support for the patient and family, involving them in the discharge planning process, updating their medications, including info about sepsis in the discharge summary, and assessing for any physical, cognitive, or emotional issues after they leave the hospital. They also recommend having a transitional program during the ICU stay, using of handoff process during transitions of

care, providing verbal and written education about sepsis, and referring the patient to peer support programs, follow-up programs, and rehab programs. They couldn't make a recommendation for early cognitive rehab or when to do post-hospital follow-up because of the lack of evidence. All of these recommendations are relevant to other critically ill and hospitalized patients, but the panel thought they should be especially included in the sepsis guidelines due to the high risk of long-term effects (2, 2, 11).

1.2. Statement of the problem

In 2017, 48.9 million cases of sepsis (95% uncertainty interval [UI] 38.9-62.9) were reported worldwide and 11 million sepsis-related deaths (10.1-12.0 million), of which 19% were sepsis-related accounted for 7% (18.2-21.4 million) of deaths. global death toll (14).

Although sepsis can affect anyone in the world, there are large regional variations in incidence and mortality, with the highest incidence in low- and middle-income countries (LMICs). Additionally, managing sepsis is expensive, with the average hospital-wide cost of sepsis estimated at over $32,000 per patient, although these estimates are based almost entirely on data from high-income countries (HIC) (14).

The incidence and mortality of sepsis varied greatly by region, with the highest prevalence in sub-Saharan Africa, Oceania, South Asia, East Asia, and the Southeast. Of all sepsis cases in 2017, 33.1 million people suffered from ill health due to underlying infectious diseases, and 15.8 million occurred in people suffering from underlying injuries or non-communicable diseases (14).

Diarrheal illness was the most common underlying cause of sepsis across all age groups, genders, and locations in each year from 1990 to 2017, with 1,500 cases of sepsis due to diarrheal illness in 1990. 9.21 million (3.56-20.9) in 2017. In 2017, the most common underlying injury causing sepsis was road traffic accidents (457,495 [95% UI 282,177-715]), and maternal disorders were the most common non-communicable disease complicated by sepsis (5·7 million [3·4–9·2] cases of sepsis. Among children <5 years of age, diarrheal disease was the most common cause of sepsis in 2017 (5.9 million [95% UI 2.1-14.2] sepsis cases [27.9%, 95% UI 12.0]). -50.8]), neonatal disorders (sepsis 5.1 million [29-89] [25.7%, 13.7-40.9]), lower respiratory tract infections (3,3) million [1.8-6.3] sepsis [16.5%, 0.1-29.3];) (14).

In 2017 Global age-standardized sepsis incidence was common among females than males (716·5 [95% UI 560·2–925·1] cases per 100 000 vs 642·8 [507·7–834·8] cases per 100 000; table 1). Overall, sepsis incidence increases in early childhood, with a second peak in incidence among older adults. In 2017, there were an estimated 20·3 million (95% UI 14·0–29·7) incident sepsis cases worldwide among children younger than 5 years, 4·9 million (3·5–7·0) among children and adolescents aged 5–19 years, and 23·7 million (20·1–28·8) incident sepsis cases among adults 20 years and older (14).

Accurate tracking of sepsis incidence and outcome in LMIC is limited by changing definitions, lack of diagnostic codes and health records, and understaffing. Improving sepsis treatment in

LMIC requires prospective studies of outcomes so that appropriate definitions, scoring systems, and treatment guidelines can be established. The aim was to examine the burden of sepsis and septic shock in LMIC, the development, and applicability of definitions to LMIC and its management (15).

In Ethiopia, a study aimed to assess the prevalence and outcome of sepsis and septic shock in ICUs in Addis Ababa. The prevalence of sepsis and septic shock was found to be 26.5 per 100 ICU admissions. Based on SEPSIS-3, 15.1% of patients had sepsis, and 8.9% of patients had septic shock during ICU admission. The limitation of the study was that it was not a nationwide study, and it only assessed the prevalence and outcome of sepsis and septic shock in Addis Ababa ICUs. (16).

Programs to improve sepsis performance generally consist of sepsis screening, education, measurement of sepsis bundle performance, patient outcomes, and actions on identified opportunities (9,17). Despite some inconsistencies, a meta-analysis of 50 observational studies on the effects of performance-enhancing programs showed that these programs were associated with improved adherence to the sepsis bundle and reduced mortality.(18). No particular component of performance improvement appears to be as important as implementing programs that include sepsis screening and metrics (1).

1.3. Significance of the study

Generally, the purpose of this research was to understand the management of Septic shock in resource-limited low-income countries (LICs) settings, specifically the management of septic shock in adult surgical patients who present with septic shock or develop septic shock as a complication of a surgical condition. It is also important that we either define how well sepsis definitions, scoring systems, and protocols derived mostly from HICs can be applied in LMICs or we must continue to hone definitions and protocols derived from LMICs. This study will help us measure the adherence to existing sepsis management guidelines, understand where the basic pitfalls in management are, and assess the outcomes of our patients in this light.

Specifically for Jimma University Medical Center, this research will help us understand the management of septic shock based on our hospital setup. This study will help us identify specific gaps in the management and outcome.

Based on our findings we will be able to make recommendations and provide baseline data to protocol design and policy making. This study will help the decision-makers allocate more resources to the management of septic shock in resource-limited low-income and middle-income countries (LMICs) settings.

Chapter Two: Literature Review

Sepsis is a life-threatening organ dysfunction caused by an abnormal host response to infection (5). Septic shock is a subset of sepsis in which underlying circulatory, cellular, and metabolic disturbances are associated with a higher mortality risk than sepsis alone. Adult patients with septic shock require the use of vasopressors to maintain mean blood pressure above 65 mm Hg, have serum lactate levels above 2 mmol/L, and are clinically hypotensive with persistent hypotension after adequate fluid resuscitation (5).

In LMIC, limited staff and technical resources and limited data collection make it more difficult to track the incidence and outcome of sepsis and septic shock (15).

In the United States, a retrospective cohort study included adult patients hospitalized with sepsis in New York State and control states (Florida, Maryland, Massachusetts, and New Jersey) using all-payer hospital discharge data (January 1, 2011-September 30, 2015) and a comparative interrupted time series analytic approach was done. The final analysis included 1,012,410 sepsis patients admitted to 509 hospitals. The average age was 69.5 years old, and 47.9% were female. In New York and control states, 139,019 and 289,225 patients were enrolled before sepsis regulations went into effect, and 186,767 and 397,399 patients were enrolled after sepsis regulations went into effect. Regarding outcome, the unadjusted 30-day in-hospital mortality rate was 26.3% in New York State. 22.0% in the control states before the regulations, and 22.0% in New York State, and 19.1% in the control states after the regulations. Adjusted for patient and hospital characteristics as well as preregulation temporal trends and season, mortality after implementation of the regulations decreased significantly in New York State compared to the control states. This regulation resulted in no significant difference in ICU admission rates, relatively large reductions in length of stay, relatively large reductions in Clostridium difficile infections, and relatively large reductions in central venous catheter has increased significantly (19).

In Germany, a prospective, multicenter, longitudinal observational study, all patients already in the ICU at 0:00 on 4 November 2013 and all patients admitted to a participating ICU between 0:00 on 4 November 2013 and 2359 hours on 1 December 2013 were included. Patients were evaluated for the development of severe sepsis or septic shock (SEPSIS-1 definition) during their ICU stay. A total of 11,883 patients from 133 intensive care units of 95 hospitals in Germany participated in the study, of whom 1,503 (12.6%) were diagnosed with severe sepsis or septic shock. Altogether, 643 (42.8%) cases of sepsis were contracted outside of a hospital and required hospitalization. Out of the 860 infections, 57.2% were from hospital origin, and almost half of those came from the ICU, making up 25.7%. Infections that were acquired in the wards were 21.2% of all infections. Only a minority of infections were acquired in inpatient care facilities (4.6 %). The most common sites of infections were the lower respiratory tract (n = 700, 46.6 %), the gastrointestinal tract (n = 431, 28.7 %) and the urogenital tract (n = 190, 12.6 %). In 82.3% of all septic patients, blood cultures were taken. Positive cultures were found in 449 (29.9%) cases. The blood cultures indicated more of a presence of gram-positive bacteria (55.5%), whereas cultures taken from the infection site were more likely to show gram-negative bacteria (58.7%).

The point prevalence was 17.9 % (95 % CI 16.3–19.7). The calculated incidence rate of severe sepsis or septic shock was 11.64 (95 % CI 10.51–12.86) per 1000 ICU days. The most common criteria for SIRS were tachypnea (respiratory dysfunction), tachycardia, and leukocytosis/leucopenia (81.0, 80.9 and 76.7 %), Fever or hypothermia was seen in only 61.1% of patients in the early stages of sepsis, but respiratory distress (66.1%), septic encephalopathy (43.9%), oliguria (44.2%), metabolic acidosis (43.4%) were the most frequent. After 24 hours, the rate of metabolic acidosis decreased to 28.5%. The mortality rate for those in the ICU with severe sepsis or septic shock was 34.3%, while only 6% of those without sepsis passed away. Overall, 40.4% of people with severe sepsis/septic shock died while in the hospital. Defined by the new SEPSIS-3 definition, the mortality rate of septic shock was quite high- 44.3% and 50.9% in ICUs and hospitals respectively. People with severe sepsis or septic shock tended to stay in ICUs and hospitals longer than those without sepsis, with 11 and 24 days being the average stays in ICUs and hospitals respectively. For those with septic shock specifically, they were in the ICU for an average of 12 days and in the hospital for 24 days (20).

A systematic review and meta-analysis of studies conducted in China reporting the incidence and mortality of sepsis, severe sepsis, and septic shock was conducted in China from 1 January 1992 to 1 June 2020. The pooled frequency of sepsis was estimated to be 33.6% (95% CI 25.9% to 41.3%, I2 = 99.2%; p<0.001) and the pooled mortality of sepsis, severe sepsis, and septic shock was 29.0% (95% CI). 25.3% - 32.8%, I2 = 92.1%; p=0), 31.1% (95% CI 25.3% to 36.9%, I2 = 85.8%; p<0.001), and 37.3% (95% CI 28.6% -46.0% I = 93.5%, p < 0.001) (21).

In Another study in China, researchers conducted a review of studies about sepsis done up until March 2, 2022, looking at the number of people with sepsis in hospitals and ICUs. They found that about 324,020 people were studied, with 9,587 of them having sepsis. Across 301,272 hospital patients, the prevalence and mortality rate was 3.8% and 26% respectively, with a 95% confidence interval. In 22,748 ICU patients with sepsis, the prevalence and mortality rate were 25.5% and 40% respectively, with a 95% confidence interval. The average age of patients ranged from 36.8 years to 81 years. When looking at sepsis specifically in ICUs, it was found that more males had it 17% (95% CI 9–24%, I2 = 99.6%), lung infections had the highest prevalence at 66% (95% CI 54–77%, I2 = 98.7%), and infections with Gram-negative bacteria 37% (95% CI 26–47%, I2 = 98.3%). The prevalence of sepsis, severe sepsis, and septic shock was 25.5%, 19%, and 13% respectively. The average amount of time spent in the ICU and hospital was 4-8 days and 8-22 days. Out of the nine studies conducted, hospital mortality of sepsis was estimated to be 26% for the hospital as a whole and 40% for ICU sepsis (22).

A survey was done in China about Compliance with the Surviving Sepsis Campaign (SSC) guideline 1-hour bundle for septic shock between January 1, 2018, and December 31, 2018, 1,420 hospitals were enrolled in the Quality Improvement of Critical Care Program, led by the China National Critical Care Quality Control Center. The outcomes were adherence to the SSC guidelines (2018 update). Monitoring indicators include a 1-hour bundle and its sub-indicators (measure lactate level and remeasure lactate level if initial lactate is >2 mmol/L, obtain blood cultures before administering antibiotics, administer broad-spectrum antibiotics, begin rapid administration of 30 mL/kg crystalloid for hypotension or lactate ≥4 mmol/L, apply vasopressor

if hypotension is present during or after fluid resuscitation to maintain a mean arterial pressure ≥65 mmHg). Every monitoring indicator was stratified by the median, which was defined as 1 if greater than or equal to the median, and 0 if not. Compliance with the Surviving Sepsis Campaign guideline 1-hour bundle in tertiary hospitals was significantly higher than in secondary hospitals (P<0.05). However, there were no differences in SSC 1-hour bundle compliance in public hospitals and private hospitals. (23).

In Australia a before and after cohort study was done between 01 July 2017 to 31 March 2020. 1802 patients (732 baseline, 1070 post-intervention) met inclusion criteria. The median (IQR) age of the patients was 72.0 years (62.0-81.0) and 72.0 years (60.0-82.0), the percentages of male patients 57.5% and 54.3%,Time to antibiotics in 1-hour 73.7% vs 85.1% (OR 1.9 [95%CI 1.1-3.6]) and the 3-hour bundle compliance (48.2% to 63.3%, OR 1.7, [95%CI 1.4 to2.1]) improved post-intervention, accompanied by a significant reduction in Intensive Care Unit (ICU) admission rates (26.5% vs17.5% (OR 0.5, [95%CI 0.4 to 0.7]). Compliance with 1-hour septic shock bundle (septic shock) was 42.1% for baseline and 47% for the post-intervention phase. There were no significant differences in-hospital and 30-day post-discharge mortality between the two phases. In a post-hoc analysis of the post-intervention phase, sepsis pathway compliance was associated with lower in-hospital mortality (9.7% vs 14.9%, OR 0.6, 95%CI 0.4 to 0.8). The proportions of appropriate antimicrobial prescription at baseline and post-intervention respectively were 55.4% vs 64.1%, (OR 1.4 [95%CI 0.9 to 2.1]). There ICU (median [IQR] 2.3[0.9-4.2] vs 2.3[1.1-4.9]) days, the hospital stay was (median [IQR] 5.4 (2.7-10.3) vs 5.2[2.9-9.8]) (24).

A cross-sectional study was conducted in Mexico in 2020. 2,379 patients were admitted to the participant's emergency department. 307 (12.9%) were diagnosed with sepsis, of whom 41 (13.35%) went into septic shock. The average age was 53.6 years. 172 (50.6%) were female. The prevalence of sepsis and septic shock was 12.9%. The most common infection was urinary tract infection, followed by community-acquired pneumonia. 168 cultures were obtained from 120 patients (39.08%), of which 19.64% were positive. Only 287 patients received antibiotics during their stay at emergency departments; in 29.96% they were started during the first hour. Among patients for whom the ≥30ml/kg fluid balance goal was not achieved, a reduction in 30-day mortality was observed, in comparison with those in whom it was achieved; the average in survivors was significantly lower than in nonsurvivors. 4 out 9 patients in whom recommended resuscitation measures were complied with the 1st hour and 48 of 298 patients whom they did not comply died; with a positive association between not meeting the goals and lower mortality (OR-0.240, 95% CI +0.062-0.0926, P= 0.038). As for the implementation of recommended measures within three and six hours, an association between non-compliance and lower 30-day mortality risk was observed (OR =0.0143, 95% CI +0.031-0.659, P= 0.013). Overall mortality was 16.93%, in which cases of sepsis was 9.39% and those of septic shock was 65.85% (25).

In Turkey, a multicenter point-prevalence study was done total of 132 ICUs from 94 hospitals participated. January 27, 2016 to January 28, 2016. 260. (17.3%) had severe sepsis without shock, and 203 (13.5%) had septic shock. The most common site of infection was the respiratory system (71.6%), followed by the bloodstream (8.9%) and urinary system (7.8%). 503 (58.3%)

had positive microbial isolates. 78.7% of the positive isolates were gram-negative, the most common Comorbidities with patients of septic shock is Chronic respiratory disease 24 (23%) and the most common organ dysfunction was Respiratory 74 (71.2%) Mechanical ventilation was required in 87.2% of patients with severe sepsis. Inotropic/vasopressor agents 49.0%, corticosteroids 26.7%, and renal replacement therapy (RRT) 23.7%. The mortality rates were higher in patients with severe sepsis (55.7%) and septic shock (70.4%). According to SEPSIS-III, 104 (6.9%) patients had septic shock (mortality rate, 75.9%). ICU length of stay was 17 (10–30) days (26).

In Sri Lanka in 2019, a 6 month Descriptive Study on Sepsis was done at a tertiary care hospital. There were 387 patients: 163 males and 224 females. The age range was 15-95 with a mean age of 63. The most frequent source of infection was urine (82 (21.2%)) followed by the bloodstream (105 (27.1%)) and skin and soft tissue (114 (29.5%)). qSOFA was one in 124 (32%), two in 162 (41.9%), and three in 46 (11.9%). One-hour SSC bundle compliance is as follows: administration of intravenous fluids: 42 (10.9%), blood cultures before antibiotics: 225 (58.1%), first dose antibiotic: 15 (3.9%), and arterial blood gas: 60 (15.5%). Inotropes were given to 61 (15.8%) patients within the first 6 hours. The study mortality rate was 37%. Binary logistic regression indicates that quick sequential organ failure assessment score (qSOFA) is a significant predictor of mortality, other predictors as age, sex, adherence to sepsis care bundle, and comorbidities, were not significant (27).

In Ethiopia, a prospective observational study was conducted from March 2017 to February 2018 in four selected ICUs in Addis Ababa from a total of twelve hospitals having ICU services. The overall prevalence of sepsis and septic shock was 26.5 per 100 ICU admissions. Based on SEPSIS-3, 15.1% (n = 173) of patients had sepsis, and 8.9% (n = 102) of patients had septic shock during ICU admission, the most sources of sepsis and septic shock were respiratory (53.1%), urinary tract (19.3%), and intra-abdominal (18.9%) infections. Twenty-six (9.4%) patients had more than one source of infection. The most common comorbidity was HIV (19.3%), followed by diabetes mellitus (15.6%) and malignancy (12.4%). Male sex, mSOFA score ≥10 on day 1 of ICU admission, and comorbidity of HIV or malignancy were the independent predictors of 28-day mortality. The most common bacterium isolate was Pseudomonas aeroginosa (34.5%). The antibiotic choice in the majority (89.5%) of patients was done empirically, and it was combination therapy in 78.8% of patients. The ICU and 28-day mortality rate was 41.8% and 50.9%. The median length of stay in the ICUs was 5 (IQR, 2–8) days (16).

In Conclusion, Sepsis/Septic shock research is usually prospective and needs high funding, technical resources, a good hospital/Healthcare setup, and an advanced/efficient data collection system. It is challenging for low-income countries (LICs) to conduct such research due to lack of funding and hospital/Health care setup. Management protocols like Surviving Sepsis Campaign: International Guidelines for Management of Sepsis and Septic Shock are hard to implement in LICs because of a lack of recourses and setup, so measurement of the effectiveness of such protocols in LICs with poor hospital setup is challenging.

Chapter Three: Objectives of the Study

3.1. Main objective

To assess the management and outcome of septic shock among surgical patients in Jimma University Medical Centre (JUMC) from April 2023 to October 2023.

3.2. Specific Objective

1. To identify the focus of infection among surgical patients at JUMC
2. To assess adherence to surviving sepsis guidelines in managing surgical patients with septic shock
3. To assess the outcome (30 days mortality and postoperative complications) of patients with septic shock.
4. To determine factors contributing to bad outcomes in patients managed with septic shock

3.3. Hypothesis

Early detection and early surgical intervention have good outcomes and low rates of postoperative complications.

Chapter Four: Methodology

4.1. Study Area

The study was conducted at Jimma University Medical Center (JUMC), located in Jimma town in southwest Ethiopia, 352 km from Addis Ababa. Jimma zone comprises Jimma town and its nearby woredas with an estimated population of 2,486,155. JUMC has endured time as one of the oldest public hospitals in Ethiopia. Currently, it is the only teaching and referral hospital in the southwestern part of the country, providing services for approximately 15,000 inpatients, 160,000 outpatient attendants, 11,000 emergency cases, and 4500 deliveries in a year coming to the hospital from the catchment population of about 15 million people.

4.2. Study period

The study was conducted from April 2023 to October 2023.

4.3. Study Design:

This study was a prospective observational study to be conducted at Jimma University Medical Centre.

4.4. Study population:

In this study, we prospectively recruited surgical patients aged ≥15 years who presented with or developed septic shock according to The Third International Consensus Definitions for Sepsis and septic shock (SEPSIS-3) criteria at Jimma University Medical Center..

4.4.1. Source of population:

All Adult surgical patients ≥15 years at Jimma University Medical Center.

4.5. Sample size:

A single population proportion sample size determination formula was employed. The sample size (n) was determined using the following statistical formula for a single proportion:

$$n = \frac{Z^2 * P * (1- P)}{d^2},$$

Where n = sample size, d = margin of error between the sample and the population (0.05)
Z = 95% confident interval (1.96) p= 0.089

$$n = \frac{(1.96)^2 \times 0.089 * (1- 0.089)}{(0.05)^2} = 125$$

4.6. Inclusion Criteria:

All Adult surgical patients at Emergency OPD, Surgical Ward, Medical/Surgical ICU, and PACU with at least one of the following:

- Those Presented with septic shock according to the Sepsis-3 definition and criteria
- Those who develop septic Shock as a complication throughout their stay at the hospital
- Patients from other departments in the hospital who presented or/developed septic shock due to surgical condition and surgery department consulted.

4.7. Exclusion Criteria

- Pediatric patients < 15 years presented with shock.
- Patient with obstetric or gynecological condition as a cause of septic shock
- Surgical Patient develop septic shock after being discharge from the hospital.

4.8. Variables of the study

4.8.1. Dependent

- Outcome (post-operative complications, 30 days mortality)
- Hospital/ICU Length of stay

4.8.2. Independent:

- Socio-demographic factors (age, sex, marital status, , residence, and Educational status)
- Clinical factors (physical condition, comorbidities).
- Biomedical factors (organ failure at presentation, Anemia)
- Primary diagnosis and cause of septic shock.
- Time of presentation, arrival and time of intervention
- Sepsis screening tool (SIRS/ MSOFA score)
- Management steps of septic shock (Ventilator support, Fluid resuscitation, Vasopressor, Antibiotics administration, Culture/Sensitivity, Surgical intervention, blood products transfusion, glycemic control, stress ulcer/DVT prophylaxis, counselling)

4.9. Operational Definitions:

Sepsis: Is defined as life-threatening organ dysfunction caused by a dysregulated host response to infection. Organ dysfunction can be identified as an acute change in total SOFA score 2 points consequent to the infection. The baseline SOFA score can be assumed to be zero in patients not known to have preexisting organ dysfunction(5)

Septic shock: Can be identified with a clinical construct of sepsis with persisting hypotension requiring vasopressors to maintain MAP 65mmHg and having a serum lactate level >2 mmol/L (18mg/dL) despite adequate volume resuscitation.

Community-onset sepsis: was defined as the onset of sepsis within 2 days of hospital admission. When the date of admission counts as hospital day 1.

Hospital-Onset sepsis: requires onset date to be on hospital day 3 or later, counting the date of admission as hospital day 1.

Postoperative complications/Outcome: According to the Clavien-Dindo classification is defined as any deviation from the normal postoperative course, meaning that the severity ranges from non-life-threatening complications with no lasting disability to fatal outcomes. It includes Grade I, Grade II, Grade IIIa/IIIb, Grade IVa/IVb and Grade V.

Grade I: Any deviation from the normal postoperative course without the need for pharmacological treatment or surgical, endoscopic and radiological interventions
Allowed therapeutic regimens are: drugs as antiemetics, antipyretics, analgetics, diuretics and electrolytes and physiotherapy. This grade also includes wound infections opened at the bedside.

Grade II: Requiring pharmacological treatment with drugs other than such allowed for grade I complications. Blood transfusionsand total parenteral nutritionare also included.

Grade III: Requiring surgical, endoscopic or radiological intervention, IIIa: Intervention not under general anesthesia, and IIIb: ntervention under general anesthesia.

Grade IV: Life-threatening complication (including CNS complications)* requiring IC/ICU-management, IVa: single organ dysfunction (including dialysis) and IVb: Multi organ dysfunction.

All participating patients were followed until 30 days of stay. Patients who were discharged before 30 days were monitored for the outcome at 30 days using their follow-up records and phone calls.

SIRS criteria: SIRS (Systemic Inflammatory Response Syndrome) Two or more of:

- Temperature >38°C or <36°C
- Heart rate >90/min
- Respiratory rate >20/min or PaCO2 <32mmHg (4.3 kPa)
- White blood cell count >12 000/mm3 or <4000/mm3or >10% immature bands

MSOFA (Modified Sequential Organ Failure Assessment): a **SOFA** score combines a clinical assessment of two organ systems, cardiovascular and central nervous system, with laboratory measurements for evaluation of other organ systems: respiratory, hematologic, liver, and renal. **MSOFA** score eliminates the platelet count, replaces partial pressure of arterial oxygen (PaO2) with arterial oxygen saturation measured by a pulse oximeter (SpO2), and replaces serum bilirubin with clinical assessment of scleral icterus or jaundice. The only laboratory value required for the MSOFA is creatinine, which can be measured using a bedside point-of-care testing device. 0 to 7 points: 4% Mortality, 8 to 11 points; 31% Mortality12 to 19 points: 58% Mortality.

4.10. Data Collection:

A semi-structured Checklist containing the variables to be measured was designed, developed, and utilized based on previous literature with different modifications and incorporations.

4.11. Data Quality

Adequate training on how to collect the data will be obtained from the principal investigator. The principal investigator will also control the accuracy, completeness, and consistency of the data collection during data collection.

4.12. Data analysis

The Data was entered into epidata and exported into and analyzed using SPSS Version 25 statistical package software. Descriptive statistics as percentages, mean, median, IQR, and standard deviation were calculated to summarize the data. Bivariate and multivariable logistic regression analyses were performed to determine the association between variables.

4.13. Ethical Consideration

This study was approved by the Institutional Review Board of Jimma University Medical Centre through a formal letter written by the Research Directorate of the university, permission was obtained from the managing director of the hospital as the University has a mandate to approve studies that can be conducted nationally. Patients' consent was sought and respected and confidentiality of medical records including patient name and demographic data was regarded. This research was observational, so normal management of patients was according to existing management guidelines in the hospital, and no test or procedure was done as part of the research.

4.15 Limitation of the Study

This study was facility-based, and the duration was only six months. The hospital has no capacity for doing investigations like serum lactate levels or arterial blood gases.

Chapter Five: Results

5.1 Socio-demographic data

There were a total of 61 patients during the study. The median age of patients was 45 (IQR, 40-60) years, and 77% (n=47) of the patients were male. Regarding education level, 42% of patients can at least read and write, and 57.4% were illiterate. The majority, 68.9% of septic shock patients, reported being professionally active and (31.1%) unemployed.

Figure 1: Age distribution of septic shock in surgical patients in Jimma University Medical Center (JUMC), Jimma, Ethiopia, 2023.

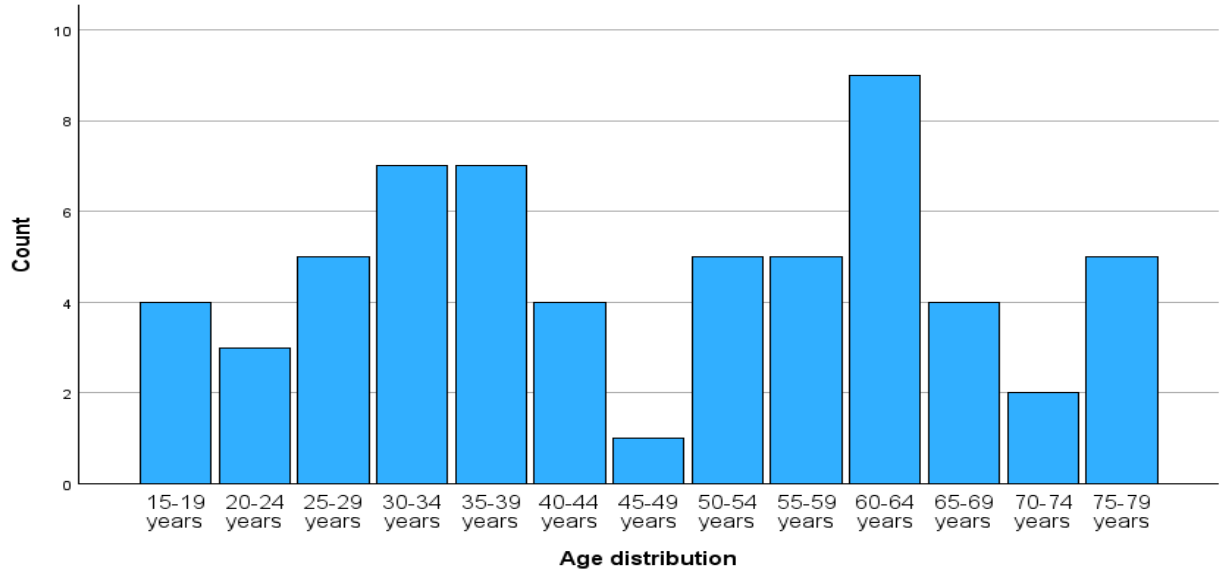


Figure 2: Gender of surgical patients with septic shock in Jimma University Medical Center (JUMC), Jimma, Ethiopia, 2023.

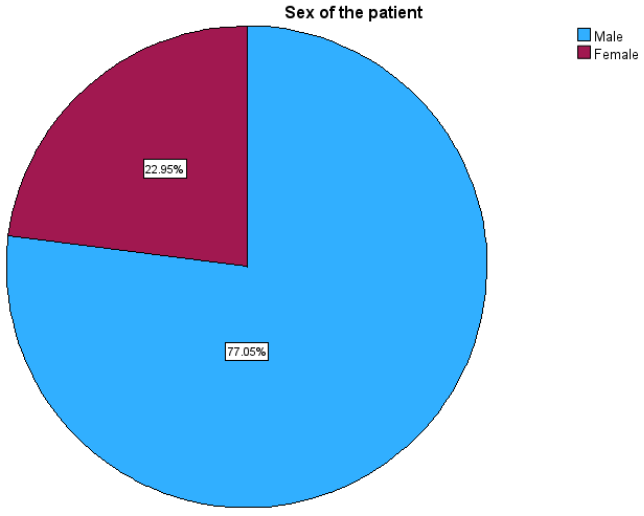


Table 1: General characteristics of septic shock patients in surgery in Jimma University Medical Center (JUMC), Jimma, Ethiopia, 2023.

Variable		Patients presented with shock N=32	Patients admitted then develop shock N=29	All patients with septic shock n (%). N=61
Sex of the patient, n (%)	Male	22	25	47 (77%)
	Female	10	4	15 (23%)
Marital status of the patient, n (%)	Married	23	25	48 (78.7%)
	Single	8	4	12 (19.7%)
	Divorced	1	0	1 (1.6%)
	Widowed	0	0	0
	Other	0	0	0
Educational status, n (%)	Able to read and write	15	11	26 (42.6%)
	Unable to read and write	17	18	35 (57.4%)
Employment status, n (%)	Employed	22	20	42 (68.9%)
	Unemployed	10	9	29 (31.1%)
Address of the patient, n (%)	Urban	5	3	8 (13.1%)
	Rural	28	26	53 (86.9%)
Source of infection, n (%)	Community-Onset sepsis	30	19	49 (80.3 %)
	Hospital Onset sepsis	2	8	10 (16.4 %)
	ICU onset Sepsis	0	2	2 (3.3%)
Focus of Sepsis, n (%)	Intraabdominal	26	24	50 (82%)
	Genitourinary system	2	0	2 (3.3%)
	Musculoskeletal	2	0	2 (3.3%)
	Respiratory	2	5	7 (11.5%)
ICU length of stay (day), median (IQR)				3 (1–5)
Hospital length of stay (day), median (IQR)				6 (2–15)
Outcome 30 days, n (%)	Survival	7	5	12 (19.7%)
	Death	25	24	49 (80.3%)

5.2 Causes of Septic Shock

The most frequent source of infection in this study was community-onset sepsis 83.3% (n=49). The most common focus of infection in septic shock in surgical patients in this study was the intra-abdominal infection of the digestive system 82% (n = 50), followed by the respiratory system 11.5% (n = 7), genitourinary system 3.3% (n = 2), and musculoskeletal system 3.3% (n=2). Of the 61 patients in this study, 29.5% (n = 18) had comorbidities, and 9.8% (n=6) had two or more comorbidities. The most common comorbid condition was malignancy in 11.47 %(n=7) of patients. Only 13.1% (n=8) of patients in the study were tested for HIV. 1 patient was positive, and seven were negative for HIV. ICU admission was 62.3% (n=38), and the median MSOFA score at admission was 10.

Table 2: Comorbidity of surgical patients with septic shock in Jimma University Medical Center (JUMC), Jimma, Ethiopia, 2023.

Comorbidity	Frequency
Malignancy	7
Hypertension	6
Community-acquired pneumonia	2
PAD	2
CKD	2
IHD	1
Asthma	1
TB	2
Mania	1
Adult onset malnutrition	1
≥ 2 comorbidities	6

PAD: Peripheral arterial disease, CKD: chronic kidney disease, IHD: Ischemic heart disease, Tb: Tuberculosis.

5.3 Management of Septic Shock

Of 61 surgical patients with septic shock, 68% (n = 42) received mechanical ventilator support, 38 patients received mechanical ventilator support on admission to the intensive care unit, and only two patients received in the operating room.

Regarding fluid management, 55.7% (n=34) of patients received 30 ml/kg of crystalloid within 3 hours, 42.6% (n=26) received more than 30 ml/kg of crystalloid, and only One patient (1.6%) received crystalloid infusion less than 30 ml/kg in 3 hours. Serum lactate level measurement was not done for all the patients.

Table 3: Management Steps for surgical patients with septic shock in Jimma University Medical Center (JUMC), Jimma, Ethiopia, 2023.

Management Steps		Outcome (30 days)		Total N (%)	Significant P-value
		Survival (n)	Death (n)		
Management Respiratory	Mechanical Ventilator	6	36	42 (68.9%)	
	Face mask Oxygen	1	9	10 (16.4%)	
	Intranasal Oxygen	5	3	8 (13.1%)	0.001
	No Respiratory support	0	1	1 (1.6%)	
Fluid Administration	30ml/kg within 3 hours	10	24	34 (55.7%)	0.032
	>30ml/kg within 3 hours	2	24	26 (42.6)	0.042
	<30ml/kg within 3 hours	0	1	1 (1.6%)	
Vasopressor type	Adrenaline	12	46	58 (95.1%)	
	Not given	0	3	3 (4.9%)	
Other Vasopressor Added	Yes	1	4	5 (8.2%)	
	No	11	41	52 (85.2%)	
Culture	Yes	2	9	11 (18%)	
	No	10	40	50 (82%)	
Blood Transfusion	Given According to transfusion trigger of 70 g/L	1	4	5 (8.2%)	
	Given not According to transfusion trigger of 70 g/L	10	34	44 (72.1%)	
	Not Given	1	11	12 (19.7%)	
Stress Ulcer prophylaxis	Given	8	30	38 (63%)	
	Not Given	4	19	23 (37.7%)	
DVT Prophylaxis	Given	5	19	24 (39.3%)	
	Not Given	7	30	37 (60.7%)	
Steroids	Given	4	23	27 (44.3%)	
	Not Given	8	26	34 (55.7%)	
Glycemic Control (Insulin administered)	Done	2	3	5 (8.2%)	
	Not done	10	46	56 (91.8)	

The initial vasopressor administered was adrenaline to 95% (n = 58) of patients with septic shock, whereas in 4.9% (n = 3) of patients, the vasopressor was not administered because of unavailability. In 82% (n = 50) of patients, vasopressors were initiated within 1 to 6 hours after the diagnosis of septic shock. In 5 patients, vasopressors were in combination to maintain the mean arterial pressure (MAP).

Microbial culture samples were collected in 18% (n=11) of patients, whereas cultures were not performed in the remaining 82% (n=50) of patients for various reasons. Five patients had no microbial growth, and six had microbial growth: 3 Escherichia coli, 1 Acinetobacter spp., 1 Pseudomonas spp., and 1 Staphylococcus aureus. All samples for cultures and sensitivity in this study were collected after empirical antibiotics were given.

All 61 patients in the study received empiric antibiotics, and 95% (n=58) of patients received antibiotics within 1 hour. The most frequently used antibiotic combination was ceftriaxone/metronidazole 55.7% (n=34), followed by ceftazidime/vancomycin/metronidazole 18% (n=11) and ceftriaxone/vancomycin/metronidazole 11.5% (n =7). Only one patient received antibiotics based on culture and sensitivity results

Source control surgery was performed in 52.5% (n = 32) of patients after developing septic shock, and 84.4% (n = 27) of surgeries were performed within 24 hours of presentation. 47.5% (n=29) of patients did not receive surgery after septic shock. The reason for not performing surgery was because 11 patients had septic shock immediately after surgery, 7 patients were not optimized for surgery, 5 were moribund patients not fit for surgery, and 5 patients were for a planned 2nd look surgery and died before surgery, one patient did not receive surgery for an unknown reason. Reoperation or 2nd look surgery was done on 23% (n=14) of the patients. Regarding postoperative complications, 45.9% (n=28) of the patients in the study developed postoperative complications in the ward due to intervention or previous intervention. The most common postoperative complication was surgical site infection 16.39% and hospital-acquired pneumonia in 16.39%.

Table 4: Postoperative complications of surgical patients with septic shock in Jimma University Medical Center (JUMC), Jimma, Ethiopia, 2023.

Post-operative complication	Frequency
Hospital-acquired pneumonia	10
Surgical site infection	10
Hypernatremia	4
Abdominal wound dehiscence	3
Acute kidney injury	3
Anemia	3
Hypoalbuminemia	3
Hypokalemia	2
Hypochloremia	2
Aspiration pneumonia	2
Bed sores	2
Postoperative intussusception	1

High output fistula	1
Intraabdominal collection	1
Heart failure	1
Tracheoesophageal fistula	1
≥ 2 postoperative complication	16

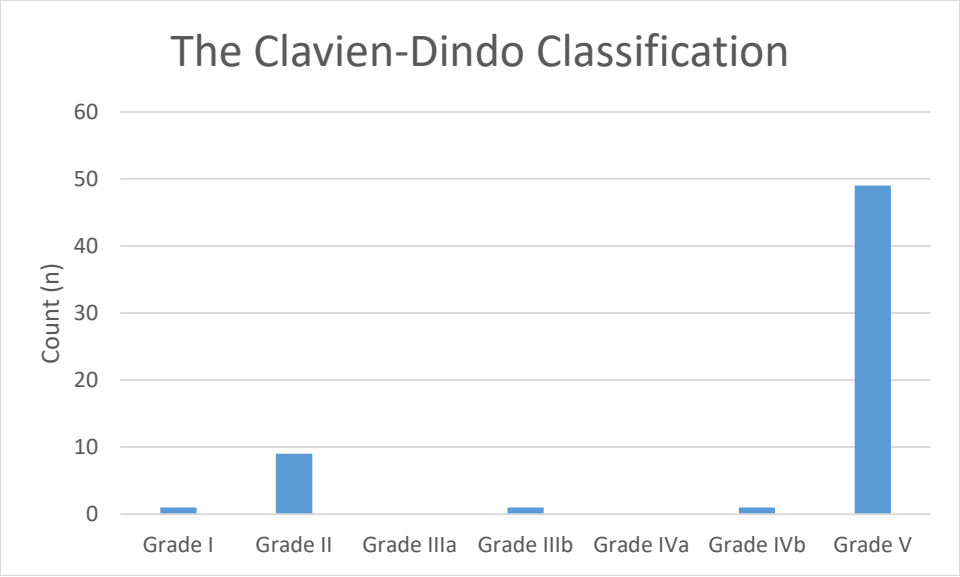
Corticosteroids were administered to 44.3% (n=27) of patients, DVT prophylaxis to 39.3% (n=24) of patients, and stress ulcer prophylaxis to 62.3% (n=38) of patients. All patients or their relatives received some advice about the prognosis of septic shock and the limits of support.

5.4 Outcome of Septic Shock

Septic shock was diagnosed in 61 patients, of which 49 (80.3%) died within 30 days, with an ICU mortality rate of 78.94%. Outcome according to Clavien-Dindo classification: In most patients was Grade V 80.3% (n = 49), Grade II was 14% (n = 9), Grade I was 1. 6% (n = 1), Grade IIIa 0% (n=0), Grade IIIb was 1.6% (n=1), Grade IVa 0 % (n=0) and Grade IVb 1.6% (n=1). The median length of stay in the intensive care unit was 3 (IQR, 1–5) days, and the median length of hospital stay was 6 (IQR, 2–15) days.

Multiple linear regression showed no relation between early detection of septic shock and early surgical intervention to the outcome.

Figure:3: The Clavein-Dindo classification of septic shock surgical patients in Jimma University Medical Center (JUMC), Jimma, Ethiopia, 2023.



Chapter Six: Discussion

In this prospective study, 61 surgical septic shock patients were identified with septic shock according to the SEPSIS-III definition. The most common sex affected were males which is similar to previous studies done in Addis Ababa/Ethiopia and Turkey (16,26). Most of the infections in our study are community-onset sepsis 83.3% which is similar to previous study done in Addis Ababa/Ethiopia (16,26). For most of the patients in this study the focus of sepsis was intraabdominal compared to other studies done in Germany, Turkey, and in Addis Ababa/Ethiopia, these studied showed the respiratory tract as the focus of sepsis (16,20,26). In studies done in Sri Lanka and Mexico, the most common cause of infection was urine (25,27). The most common comorbid condition in our study was malignancy followed by hypertension which is different from previous studies(26,27), and most of our patients were from rural areas. HIV was found as the most comorbid condition in studies done in Africa, a study in Ethiopia stated HIV comorbidity of (19.3%) (16), but unfortunately in our study, only 13.1% of the patients were screened for HIV due to the unavailability of a testing kit.

Management of septic Shock

All the patients with septic shock required ICU care because of multiple organ dysfunction (The mean mSOFA score at admission was 10 in our study). 68% of patients with septic shock in our study received mechanical ventilator support compared to the study done in Turkey in which 87.2% of the patient was on mechanical ventilation, due to our limited hospital resources (26).

Surviving sepsis campaign (SCC) Hour-1 Bundle elements include obtaining blood cultures before administering antibiotics, administering broad-spectrum antibiotics, starting appropriate fluid resuscitation, measuring serum lactate, and beginning vasopressors if clinically indicated(1,23). In this study surviving sepsis campaign hour-1 bundle was as follows: measurement serum lactate level was 0%, the blood cultures obtained before administering antibiotics was 0%, 95.1% of patients received antibiotics within 1 hour, administration of intravenous fluids was 55.7%, and vasopressor adrenaline was given to 61% of patients within the first 6 hours, All the patients in our study received antibiotics, and for most patients, the antibiotic choice was done empirically and it was as combination therapy (85.2%), a previous study done in Addis Ababa/Ethiopia showed (89.5%) of patients antibiotics were done empirically and it was combination therapy in 78.8% of patients (16). Blood cultures should be obtained before initiation of the antibiotics. In our study, samples were obtained after initiation of empirical antibiotics, and cultures were obtained in only (18%) of patients, which was less compared to the study in Addis Ababa/Ethiopia in which microbiological culture sample for (32.4%) of patients (16), and a study from Sri Lanka showed blood cultures taken before antibiotics was (58.1%) (27). This showed that most of the antibiotic therapy in our study was not based on cultures and sensitivity results, and there was no understanding of the need for proper cultures and administration of antibiotics. In this study, all initial vasopressor given was adrenaline. According to the surviving sepsis campaign guideline, noradrenaline is the first line to be used for restoring blood pressure and adrenaline can be used if noradrenaline is not available(1). Measurement of serum lactate level was not done to all the patients because it was

not available in the facility, lactate level measurement one of the recommendation for surviving sepsis guidelines 2021, and it is essential for Lactate-guided resuscitation that significantly lessen the high mortality rate associated with elevated lactate levels (> 4 mmol/L)(1,3). Many studies have shown that adherence to surviving sepsis management guidelines was effective in managing sepsis and septic shock, but these studies have mainly been conducted in high-income countries(1,19). A study in Australia showed SSC bundle compliance was associated with lower mortality and ICU admission rates in patients with sepsis but countries with low resources may experience a different impact(1). In conclusion, other studies showed poor compliance to surviving sepsis campaign 1-hour bundle but with a low mortality rate compared to this study.

Mortality of septic shock

Patients with septic shock often have a high mortality rate(3,5). A systematic review and meta-analysis done between 2009 and 2019 showed 30-day septic shock mortality being 33.7% (95% CI 31.5–35.9) in North America, 32.5% (95% CI 31.7–33.3) in Europe and 26.4% (95% CI 18.1–34.6) in Australia, also a study in Germany found that the mortality rate for septic shock according to the SEPSIS-III definition was 50.9%(20), these studies were performed on medical and surgical patients, but our study included only adult surgical patients. In our study, the 30-day mortality rate was as high as 80.1%, and the ICU mortality rate was 78. 94%, a study in Turkey also showed a high mortality rate, 75% according to the SEPSIS-III definition and 70.4% according to SEPSIS I (26). The study in Addis Ababa/Ethiopia revealed that patients with septic shock had more than twice higher mortality rate (75.5%) than those without shock (36.4%). The median hospital stay was 6 (IQR, 2–15) days, and the ICU stay was 3 (IQR, 1–5) days in our study, which correlates with the study conducted in Addis Ababa/Ethiopia, which showed a median ICU stay of 5 (IQR, 2– 8) days (16). Other studies in high-income countries such as Germany, the United States, and China have shown increased lengths of hospital and intensive care stay, largely due to advanced ICU care and better medical outcomes of mortality rates in these countries. (20,22,28,28) .

Chapter seven: Conclusion

Mortality in this study was much higher than in other studies done in high-income and low-income countries. The study revealed poor compliance and adherence to surviving sepsis management guidelines. The hospital and the ICU length of stay was less compared to studies done in high-income countries.

Weakness of the study

- The study sample size was small because data collection time was inadequate.
- The study was conducted for only 6 months, so the prevalence of septic shock was not determined.
- HIV test was not done on most of the patients, most of our patient's status was unknown.
- Serum lactate level was not determined for all the patients because of unavailability.

Chapter Eight: Recommendations

Recommendation for hospital administration

- Hospital management should ensure the availability of serum lactate and HIV testing kits.
- Hospital administration, in coordination with the hospital infection and prevention committee, should develop septic shock management guidelines to be followed by hospital staff.
- Hospitals must have intensive care beds with appropriate nurse/patient ratios.

Recommendations for surgeons.

- Surgeons must ensure that all patients with septic shock have blood cultures obtained before initiating antibiotic therapy.
- Empiric antibiotics should be used based on the surgical condition and the hospital's microbiology report.

Recommendations for the department of surgery

- Surgical departments should ensure that the management of septic shock is carried out according to agreed guidelines.
- The Department of Surgery should encourage postgraduate students to conduct more prospective studies on septic shock in surgical patients with long study periods.

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Annex. 1

Management of Septic Shock at Jimma University Medical Center 2023

Research Data Collection Tool Serial No:

Name: Medical Record Number: Date of Admission:

Age: Sex ☐ Male ☐ Female:

Marital Status: ☐ Married ☐ Single ☐ Divorced ☐ Widow ☐ Other

Address: ☐ Urban ☐ Rural

Social Economic status: ☐ Employed: ☐ Unemployed

☐ Can read and write ☐ Cannot read and write

Referral: ☐ No ☐ If Yes facility:

If yes: ☐ No Ambulance ☐ Ambulance without Oxygen Support ☐ With O2 support

Presented with shock: ☐ if, Admitted then develop shock: ☐ after how many days:

Location: ☐ Emergency OPD: ☐ Surgical Ward: ☐ ICU ☐ Others

Presentation: Within 24hr ☐ 24- 72hr ☐ 3- 5 days ☐ >5days ☐

Vital Signs at Presentation:

BP: MAP:

PR:

RR:

Temp:

SPO2:

UOP:

GCS:

Investigation:

CBC: WBC: Neutrophil %: HGB: HCT: PLT:

OFT: LFT: Cr: Urea: PICT:

Diagnosis at the time of Septic Shock:

Diagnosis before developing septic shock:

Comorbidities:

Criteria:

SIRS:

Parameter	Yes= 1	No = 0	Score
Temperature > 38 degrees C or < 36 degrees C			
Heart rate > 90			
Respiratory rate > 20 or P_aCO_2 < 32 mmHg			
WBC > 12,000 / mm3 or < 4,000 / mm3 or > 10% bands			

Modified Sequential Organ Failure Assessment (MSOFA) Score

Organ System	**0**	**1**	**2**	**3**	**4**	**Score**
Respiratory SpO2/FiO2	>400	≤400	≤315	≤235	≤150	
Liver	No scleral icterus or jaundice			Scleral icterus or jaundice		
Cardiovascular, hypotension	No hypo-tension	MAP <70 mm Hg	dopamine≤5 or dobutamine any dose	dopamine>5 epinephrine≤0.1 norepinephrine≤0.1	dopamine>15 epinephrine>0.1 norepinephrine>0.1	
CNS, Glasgow Coma Score	15	13-14	10-12	6-9	<6	
Renal, Creatinine mg/dL	<1.2	1.2-1.9	2.0-3.4	3.5-4.9	>5.0	

0 to 7 points: 4% Mortality
8 to 11 points: 31% Mortality
12 to 19 points: 58% Mortality

Management Steps:	
1.	Respiratory: ☐ Mechanical ventilator ☐ Facemask O2 ☐ Intranasal O2 ☐ Without O2
2.	Fluid Administration: ☐ 30ml/Kg within 3 hrs ☐ >30ml/Kg within 3 hrs ☐ < 30ml/Kg within 3 hrs
3.	Vasopressor: Type: Timing: Dose: Duration: Response : ☐ No ☐ if Yes; MAP: PR: UOP:
4.	Culture: ☐ No ☐ if Yes; Organism Isolated: Sample type:
5.	Antibiotics ☐ No ☐ If Yes: empirical antibiotic: Type: Timing: Duration: Based on Culture: Type: Timing Duration
6.	Blood products transfusion: ☐ No ☐ if Yes; Type: Units:
7.	Prophylaxis: Stress Ulcer : ☐ No ☐ If Yes; Type: Duration: DVT: ☐ No ☐ If Yes; Type: Duration:
8.	Blood Glucose: Glycemic Control: ☐ Not Done ☐ Done
9.	Steroids: ☐ Not given ☐ If Given; Type: Dose:
10	Surgical Intervention: ☐ Not Done Reasons: ☐ if done; Type: timing: ☐ Within 24 hrs ☐ 24- 48 hrs ☐ 48- 72 hrs ☐ >72 Hrs
11	Re laparotomy /Relook: ☐ Not Done ☐ If Done; How many times:
12	Limitation of support: ☐ Prognosis of the patient discussed with the family ☐ Not discussed

Postoperative Complications:

Hospital Length of Stay: ICU Length of stay (If ICU Admitted):

Outcome (30 days): ☐ Alive ☐ Died Time of Death:

Data Collected By: Reviewed by: