PATTERN OF SEPSIS IN GENERAL SURGICAL WARDS AT KENYATTA NATIONAL HOSPITAL

A DISSERTATION SUBMITTED IN PART FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF MEDICINE (GENERAL SURGERY) OF THE UNIVERSITY OF NAIROBI.

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I hereby certify that this dissertation is my original work and has not been submitted for any degree in any institution.

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I am deeply grateful to the Almighty God for the chance to make a difference, and my family who have always encouraged me to never give up trying.

DEDICATION

To my family, friends and colleagues.

To future researchers in the field of surgical sepsis.

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SUMMARY

Background

Sepsis is defined as the presence of systemic inflammatory response syndrome with evidence of infection. In the absence of intervention, sepsis can lead to organ dysfunction which is a major cause of surgical mortality and morbidity. In our setting, the prevalence, presentation and outcome of surgical sepsis is unknown.

Objective

This study sought to establish the pattern of sepsis in general surgical wards of Kenyatta National Hospital (KNH).

Methodology

A longitudinal cohort study was carried out using consecutive non-random sampling of patients in the general surgical wards of KNH. Those with abnormalities in vital signs and abnormalities in white cell counts were assessed for presence of infection. Any intervention, duration of hospitalization and outcomes were noted.

Results

The study recruited four hundred and three patients admitted to the surgical wards. Sepsis was present in 16.1% (n=65), 40.1% of whom were managed for emergency conditions. Of the patients who had infection diagnosed at the time of surgery, 29.2% involved soft tissue. Fluids were administered to 81.5% of patients, and cephalosporins were the most commonly prescribed drugs. Majority of patients with sepsis were discharged within fourteen days of admission. The case fatality rate was 3.1%.

Conclusion

Sepsis in surgical patients at KNH is more likely to arise in young male patients with emergency conditions affecting the abdomen or soft tissue. There is currently no documented protocol for management of sepsis in surgical patients. As such, teams involved in the management should have a high index of suspicion for the diagnosis and improve outcomes by paying close attention to fluid therapy, antimicrobial treatment and early source control of infection. Further research on the subject will enable personalised, timely and appropriate therapy for each patient.

LIST OF ABBREVIATIONS

APTT :	Activated Partial Thromboplastin Time
EGDT:	Early Goal Directed Therapy
GCS:	Glasgow Coma Scale
HIV/ AIDS:	Human Immunodeficiency Virus/ Acquired Immune Deficiency Syndrome
ICU:	Intensive Care Unit
INR:	International Normalized Ratio
KNH:	Kenyatta National Hospital
MODS:	Multiple Organ Dysfunction Syndrome
NSQIP:	National Surgical Quality Improvement Program Perspective
SBP:	Systolic Blood Pressure
SIRS:	Systemic Inflammatory Response Syndrome.
USA:	United States of America

1.0 CHAPTER ONE: INTRODUCTION

1.1 Background

Sepsis is a complex multifactorial syndrome which is defined by the presence of the Systemic Inflammatory Response Syndrome (SIRS) and infection [(1)]. It results from the interaction between the infecting organism and the host, both of which influence its outcome [(2)]. When the host has organ failure and is unable to contain the infection due to microorganism virulence factors or antibiotic resistance, it progresses to severe sepsis. Circulatory dysfunction unresponsive to vasopressors in presence of severe sepsis is considered septic shock and can progress to multiple organ failure [(1)].

Annual worldwide incidence of sepsis is estimated to be up to thirty one million cases, twenty four million cases of severe sepsis with six million fatalities [(3)]. The incidence of severe sepsis outside modern Intensive Care Units (ICUs) especially in parts of the world where ICU care is scarce is largely unknown [(4)]. It is thought to result in the death of one in four (or more) affected patients [(5)]. In sub Saharan Africa, the Human Immunodeficiency Virus/ Acquired Immune Deficiency Syndrome (HIV/AIDS) is thought to be an important risk factor for sepsis, and the lack of essential drugs, equipment and personnel results in worse clinical outcomes[(3)].

Despite the frequency, morbidity and mortality and cost of sepsis, explicit patient phenotypes are lacking, necessitating a need for an organized approach to care for those affected [(6)]. Surgical patients account for a third of sepsis cases in the United States of America (USA) and it is one of the ten most common causes of death [(7)]. In addition to immunosuppression, patients undergoing prolonged high risk surgery are at increased risk of developing sepsis [(2)]. When such risk factors for the development of sepsis are identified, resources can then be focused on the patients most likely to develop severe sepsis and septic shock, potentially reducing sepsis related morbidity and mortality [(8)], as there is increased risk of death with transition from sepsis to septic shock[(1)].

Survival depends upon early recognition and targeted correction of aetiology accompanied by ongoing organ support [(7)]. Implementation of sepsis care bundles has been associated with improved outcomes especially in high income countries [(2,3,5)]. These have included both the initial management bundle accomplished within six hours of diagnosis and the ICU

management bundle which helps to avoid complications and deescalate care when necessary[2,4]. The incidence of sepsis has been increasing in the last three decades [9], and increased compliance with the septic care bundles was associated with a 25% relative risk reduction in mortality rate [10].

1.2 Research Problem

Challenges abound in the early identification of patients with sepsis due to low index of suspicion among health care workers leading to missed opportunities to screen, diagnose and treat sepsis [1,11]. The study sought to determine the pattern of sepsis in surgical patients in order that there may be increased awareness of patient characteristics and thus enable implementation of efficacious, targeted and individualized therapy.

1.3 Study Objectives

1.3.1 Main Objective

- To establish the pattern of sepsis in general surgical wards at Kenyatta National Hospital (KNH).

1.3.2 Specific Objectives

- To determine prevalence of sepsis among patients admitted to general surgical wards.
- To identify the sources of sepsis in surgical patients.
- To describe the management instituted for patients with sepsis.
- To determine the outcomes of surgical patients with sepsis.

1.4 Research Question

What is the pattern of sepsis in surgical patients at Kenyatta National Hospital?

1.5 Study Justification

Sepsis is a common occurrence in the surgical patient. A thorough search of the literature reveals paucity of information about this cohort of patients in resource constrained settings. The prevalence, presentation and outcomes in Kenya has not been studied. Elsewhere in the world, institution of timely interventions has been shown to result in reduction in morbidity and mortality. This study sought to describe the pattern of surgical patients with sepsis in Kenyatta National Hospital. The results provide valuable information about patient

demographics and it is hoped that they will enable early recognition, prompt diagnosis and improved management of patients presenting with or developing sepsis.

1.6 Operational Definitions

Infection: Presence of purulent discharge with or without a positive culture from any site thought to be causative or positive blood culture.

Sepsis: Presence of the Systemic Inflammatory Response Syndrome (SIRS) and infection.

Septic shock: SIRS, infection and acute cardiac dysfunction demonstrated by hypotension (Systolic Blood Pressure (SBP) <90mmHg or Mean Arterial Pressure (MAP) <70 mmHg) despite adequate fluid resuscitation unresponsive to inotropic or vasopressor therapy.

Severe sepsis: SIRS, infection and acute organ dysfunction. Organ dysfunction variables: Neurologic dysfunction: Glasgow Coma Scale (GCS) < 13 on recognition of sepsis or deteriorating GCS to < 13 during first 24 hours. Pulmonary dysfunction: Partial pressure of oxygen PaO_2/ FiO_2 < 250 (<200 if lung is the primary site of infection). Renal dysfunction: urine output <0.5ml/kg for at over an hour despite adequate fluid resuscitation, or increase in serum creatinine ≥0.5mg/dl from baseline or during first twenty-four hours of sepsis management despite adequate volume resuscitation. Coagulation dysfunction: International Normalized Ratio (INR) >1.5or platelets <80,000/mm^3 or Activated Partial Thromboplastin Time (APTT) >60 seconds. Intestinal dysfunction: presence of ileus (absent bowel sounds).

Surgical sepsis: SIRS and infection requiring surgical intervention for source control or SIRS and infection within fourteen days of a major surgical procedure. Source control includes emergency debridement of necrotic tissues, abscess drainage, removal of infected vascular access devices, or exploratory laparotomy. Major surgical procedures involve the administration of general anaesthesia for more than one hour.

Systemic Inflammatory Response Syndrome (SIRS) - Two or more of the following parameters present: Temperature >38^oC or <36^o C; Heart rate >90/ min; Respiratory rate >20/min or $PaCO_2$ <32mmHg; White cell count of <4000/ml or >12000/ml or > 10% band forms.

2.0 CHAPTER TWO: LITERATURE REVIEW

Sepsis is a deleterious host response to infection which if unaddressed leads to severe sepsis which is acute organ dysfunction due to suspected or documented infection, and septic shock [2,5]. Surgical sepsis is SIRS with infection that requires surgical intervention for source control; or SIRS and infection occurring within fourteen days of a major surgical procedure. Major surgical procedures are those that require general anaesthesia for over an hour [1].

2.1 The Burden of Sepsis

The epidemiology of sepsis varies worldwide [3]. In the USA, it was estimated that two hundred and ninety patients per hundred thousand were affected by sepsis in the year 2000; with a mortality rate of 17.9% and increasing at 9% per annum[12] . Severe sepsis affects three hundred patients in every hundred thousand with a mortality rate of 28.6% [12]. European figures put mortality due to sepsis in ICU admissions at 36%, while those due to septic shock account for 81.8%[13]. In Latin American ICUs, 61.4 out of every thousand patient days are due to sepsis resulting in a mortality rate of 34.7%, while severe sepsis is responsible for 47.3% and septic shock for 52.2% of deaths [13]. Overall, mortality has been shown to increase with progression from SIRS to sepsis to septic shock [1,14].

Data on the burden of sepsis is confined to high income countries [15]. Analysis of data from New Jersey from 1990- 2006 revealed that 2.9% of surgical procedures were complicated by sepsis (16). Among 363,897 general surgery patients from 121 hospitals in the USA between 2005 to 2007, 8350 (2.3%) had sepsis, and 5977 (1.6%) had septic shock [8]. Post operatively, 1.21% of 78699 patients developed sepsis when elective surgical procedures were analysed (17). It is estimated that by 2020, annual cases of sepsis will be more than a million in the USA(6). In low and middle income countries, mortality due to sepsis is thought to be in the range of fifty percent or higher but exact data on the prevalence and pattern of sepsis in these areas is lacking [15]. Because sepsis is a heterogeneous entity and patient subsets are different in terms of co-morbidities, social factors, pathogens and health systems when high income and low income countries are compared, there is need to study such populations to enable implementation of targeted, efficacious and personalized therapy [2,15].

In a study comparing the occurrence of sepsis in the ICU and ward, 32% of patients received ICU care. The hospital mortality for sepsis was 12.8%; 20.7% for severe sepsis and 45.7% of those with septic shock. Most cases of shock were due to community acquired infection[18].

SIRS in surgical ICU was responsible for eight hundred and fifty-seven per thousand patient days in comparison to three hundred and twenty per thousand patient days in the general surgical ward.

2.2 Factors Associated With Sepsis

After the first post-operative day, sepsis is the commonest aetiology of shock. Abdominal sepsis accounts for 63% of patients, lungs 17%, wound or soft tissue 10%, urinary tract 7% others 4% [(7)]. In a USA study, procedures performed on the oesophagus, pancreas and stomach represented the greatest risk of development of post-operative sepsis. After the diagnosis of sepsis, the procedures most likely to result in mortality were those performed for thoracic, adrenal and hepatic disease[(17)].

From the National Surgical Quality Improvement Program Perspective (NSQIP) data, risk factors associated with the development of sepsis included age over sixty years, presence of co-morbidities and need for emergency surgery [(19)]. Among the emergency procedures most likely to result in sepsis were in descending order of frequency: partial removal of colon, removal of small intestine, arterial bypass graft, partial removal of pancreas and the removal of colon. Septic shock was more likely to develop in patients who had partial removal of colon, removal of small intestine, arterial bypass graft, removal of colon and exploration of the abdomen[(8)].

There are several factors thought to be responsible for the increased risk of sepsis. They include the increasing use of central venous catheters, enhanced reliability of sepsis diagnosis, the increased prevalence of HIV/AIDS and prolonged survival of HIV/AIDS patients with subsequent enhanced duration of risk [(20)]. In critical care set ups, the patients who were at increased risk of developing sepsis and were therefore recommended to undergo close monitoring included those with co-morbidities like diabetes, renal failure, immunosuppression, (due to cancer, HIV, steroids or post-transplant; trauma including burns, patients undergoing abdominal surgery), post-partum patients and those with meningitis[(21)].

Infection due to gram positive bacteria is found in 50-60% of cases, while gram negative pathogens are responsible for 35-40% [(20)]. Fungi including candida are found in 5% and have a mortality rate of up to 40% [(21)].

2.3 Treatment and Outcomes of Sepsis.

In the absence of intervention, sepsis progresses to severe sepsis. This is diagnosed when sepsis is associated with organ dysfunction. Failure of the circulatory system in the presence of sepsis is considered septic shock which if unmanaged leads to multiple organ dysfunction and ultimately death. [1,5]

Early goal directed therapy (EGDT) has been shown to improve outcomes in sepsis and is largely responsible for the decrease in mortality in recent years [1,5,7,10,22]. It is applicable within six hours and aims to ensure tissue function, hemodynamic stability and adequate oxygen delivery [9]. Targets include central venous pressures of 8-12mmHg, mean arterial pressures ≥ 65mmHg, urine output of ≥ 0.5ml/kg/hour, and mixed venous oxygen saturations ≥65% central venous (superior vena cava) oxygen saturations of 70%. The main principles of EGDT are resuscitation, antimicrobial use and source control [22,23] and have come to form part of sepsis care bundles [4,5,22].

Intravenous fluids are used in the initial care bundles for resuscitation. Crystalloids are infused at 30ml/kg especially for patients with low levels of lactate <4mmol/l that are indicative of inadequate tissue perfusion [5,7]. More rapid infusions may be necessary in some patients, as well as the use of vasopressors [5]. Blood transfusion is recommended only when haemoglobin levels fall to less than 7g/dl in the absence of other indications for transfusion such as haemorrhage [24]. With progression of sepsis, transfusions have shown no added benefit [2,5].

Prior to starting antimicrobial therapy, cultures should be obtained from any indwelling device, pus, secretions, wound drainage and blood from a peripheral location [7]. Antimicrobial therapy should begin within an hour of diagnosis of sepsis, as delays have been strongly associated with increased mortality [5,25]. The antibiotics used should be broad spectrum, guided by local epidemiological data, patient's medical history including previous infections, details and timing of surgical procedures, exposure to antimicrobial drugs and susceptibility profiles of colonizing microbes [3,7]. Antifungal therapy is indicated for those patients in whom candidemia is likely for instance in immunosuppression, neutropenic patients, those who had received prior antibiotic therapy, or those with fungal colonization. Antivirals should be started in those with no clear bacterial infection and sepsis due to a viral infection is suspected [7]. In terms of patient outcome, combination therapy is no better than monotherapy and is associated with more adverse events [3].

Source control encompasses such procedures as drainage of infected fluid collections, wound exploration, debridement of necrotic tissue, removal of implanted devices and correction of any abnormality that increases the risk of development of infection [1,7,12]. The commonest source of sepsis in surgical patients is intraabdominal infection, seen in up to 60% [1]. Studies have revealed that delay to surgical intervention and the inability to obtain source control are the main determinants of outcome. As a result, there has been implementation of damage control surgery with abbreviated laparotomy and deferred anastomosis in addition to temporary abdominal closure. When combined with early intensive care, this offers patients with abdominal sepsis the best chance for survival [26].

Failure of response to the initial management efforts should make the health care worker suspect an unidentified source of infection, antimicrobial resistance or inadequacy of source control [12].

The initial management bundle is followed by the ICU management bundle which entails the monitoring and support of organ function, de-escalation of care and avoidance of complications [4]. Lung protective strategies are employed with tidal volumes maintained at 6ml/kg which has been shown to decrease mortality [2,6]. In acute lung injury with shock, airway pressures are maintained at <30 cm H_2O [27]. De-escalation of invasive monitoring and life support at the earliest possible time reduces the risk of ventilator associated pneumonia [6]. Acute kidney injury is prevented by adequate resuscitation and replacement of intravascular volume, maintenance of adequate perfusion pressures and avoidance of nephrotoxic agents [27]. In patients with established kidney injury, early renal replacement therapy should be offered. Continuous or daily dialysis has yielded better results than alternate day renal replacement therapy [28].

Other measures instituted for support of the critically ill patient with sepsis are prophylaxis for deep venous thrombosis and the use of stress ulcer prophylaxis in those with risk factors for upper gastrointestinal bleeding [5–7]. Enteral nutrition is preferred over parenteral with strict control of blood sugar levels. This is because hyperglycemia is associated with impaired neutrophil function and reduced immunity [5,29].

Sepsis has far reaching consequences, including long term functional cognitive and psychological deficits, not to mention longer stay in hospital and ICU in the short term [11]. Implementation of a sepsis screening program in conjunction with a protocol for delivery of evidence based care and rapid source control has led to improved patient outcomes following

establishment of the surviving sepsis guidelines [1,5]. With increased awareness among health care workers, aggressive sepsis screening and rapid implementation of time sensitive interventions will lead to improved patient outcomes [1,11,19].

3.0 CHAPTER THREE: MATERIALS AND METHODS

3.1 Study Design

This was a longitudinal cohort study to investigate the pattern of sepsis in surgical patients at the general surgical wards in KNH. Patients were followed up from the time of recruitment into the study through the duration of their hospital stay and details of presentation, interventions and various outcomes obtained.

3.2 Study Setting

The study was conducted at the three general surgery wards of KNH. The majority of those admitted into these wards are emergency and elective cases requiring general surgery and urology management. In addition to these, patients with emergency neurosurgical and cardiothoracic surgical diagnoses are also admitted.

3.3 Study Population

The target population for this study was the patients admitted with various diagnoses in the general surgical wards who met the inclusion criteria.

3.4 Inclusion Criteria

All patients admitted to the general surgical wards during the duration of the study who consented to participate.

3.5 Exclusion criteria

Patients who were less than eighteen years of age.
Patients admitted to the intensive care unit (ICU) from the emergency department with surgical diagnosis without first being admitted in surgical wards.

3.6 Ethical Consideration

Approval to carry out the study was sought from the Department of Surgery, University of Nairobi and the Kenyatta National Hospital Ethics and Research Committee (KNH/ERC), approval number P794/12/2015. The purpose of the study was explained by the researcher to all participants and informed signed consent was obtained prior to recruitment. Ethical principles of autonomy, justice, beneficence and confidentiality were adhered to.

3.7 Sampling Technique

Consecutive non-random sampling technique was used. Patients admitted in the surgical wards during the period under study and managed for various conditions were recruited.

3.8 Sample Size

Fisher's formula was used for sample size calculation.

Since the prevalence of sepsis in surgical patients was unknown, 50% was used as the prevalence rate.

$$N = \frac{\mathrm{P}(1-\mathrm{P}) \times \mathrm{Z}^2}{\mathrm{E}^2}$$

N = is the sample size

E = margin of error (±5%)

Z= standard normal deviation corresponding to 95% confidence interval (1.96)

P= prevalence of sepsis 50%

N= $1.96^2 \times 0.5$ (1-0.5)/ $(0.05)^2$= 384

Adding 5% of the calculated sample size to cater for attrition rate (19 patients).

The sample size was calculated as 403 patients.

3.9 Recruitment and methods

Informed consent was obtained from the time of first contact with the patient in the surgical ward at admission. Patients who were initially admitted in the surgical ward, consented and later transferred from the ward to the ICU within the first fourteen days of their hospital stay were followed up there. Vital signs and white cell count level was obtained from all patients who were admitted to the surgical ward from the outpatient department at the time of admission. Follow up of each patient was performed on day three, seven and fourteen for any changes in the vital signs.

Those who had vital signs or leucocyte counts within normal ranges during the admission were deemed not to have SIRS. Those with SIRS at any time during the admission were evaluated further for a source of infection. A source of infection was determined to be present

if in the course of treatment, purulent discharge was noted from a site thought to be causative or the team managing the patient requested for cultures that were positive for microorganisms. The study did not involve collection of any samples.

Any interventions undertaken in the management of the patient and the timing thereof was documented including administration of fluids, antimicrobial treatment, surgery and intra operative findings.

3.10 Data Collection Techniques

Questionnaires were used for data collection. They were filled by the principal researcher. Demographic data was collected on the patient age and gender. Clinical data collected was on the vital signs at the time of admission, and on days three seven and fourteen of admission; white cell counts and source of infection. The diagnosis was documented, in addition to the type of interventions undertaken such as antimicrobial therapy, intravenous fluid administered, and surgery. Outcomes were noted up to and including on the fourteenth day of hospitalization.

3.11 Variables

Independent variables for the study were age, gender, type of surgery (elective or emergency), antimicrobial treatment and fluid administration. Dependent variables were the duration of hospital stay, organ failure and mortality.

3.12 Data Management, Analysis and Presentation

Patient names were not recorded. All the questionnaires were coded and stored under lock and key by the principal researcher. Data accrued from the study was entered into a password protected database and access restricted to the principal researcher and data research manager.

Analysis was done using the Statistical Package for Social Sciences (SPSS) version 22. Descriptive statistics (mean, mode, median and standard deviation) were used for continuous variables. Analysis was done at 95% confidence interval and a level of significance of 0.05%. Bar graphs, tables and pie charts have been used for presentation of results.

3.13 Study Limitation

Infective complications of the illness that arose after the first fourteen days of hospitalization in the participants were not documented.

Selection bias may have arisen as a result of consecutive non-random sampling used in this study.

4.0 CHAPTER FOUR: RESULTS

4.1 Patient characteristics

Four hundred and three (n = 403) patients admitted to the general surgical wards of KNH were recruited in the study. Table 1 and 2 present the demographic characteristics of participants. The mean age of the patients was 38.8 years (SD ± 14.9), and most (64.3%, n=259) patients were aged between 18 and 39 years. There were 287 (71.2%) males and the ratio of male-to-female surgical patients was 5:2.

Table 1: Age of patients in surgical wards at KNH

	n	%
Age		
18-39	**259**	**64.3**
40-59	**90**	**22.3**
≥60 years	**54**	**13.4**
Total	**403**	**100**

Table 2: Gender of patients in surgical wards at KNH

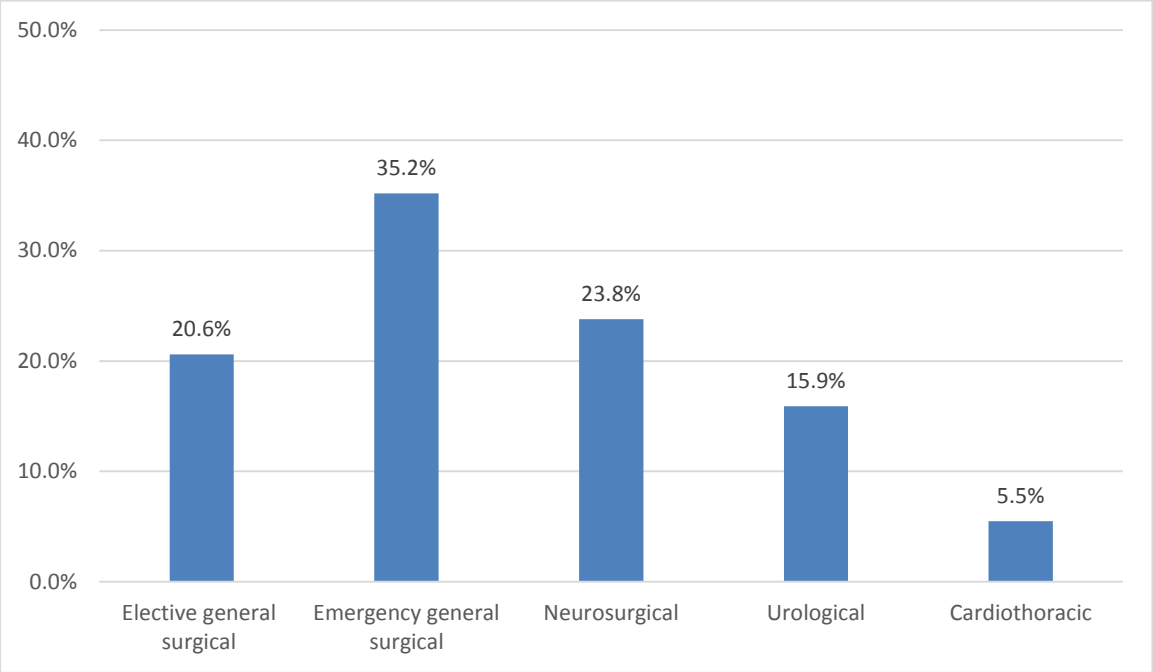
	n	%
Sex		
Male	**287**	**71.2**
Female	**116**	**28.8**
	403	**100**

4.2 Diagnosis

Most (35.2%, n=142) admissions in general surgical wards in KNH were emergency general surgical cases (Figure 1). There were 96 (23.8%) neurosurgical and 83 (20.6%) elective surgical cases admitted in KNH.

n

Figure 1: Admission diagnosis in patients admitted to general surgical wards in KNH



Surgical diagnosis at admission was associated with patients' age except for emergency and cardiothoracic surgeries (Table 3). The prevalence of neurosurgical diagnosis declined with age from 29.3% in patients aged 18-39 years to 18.9 and 5.3% in those aged 40-59 and ≥ 60 years, respectively ($p < 0.001$). Urologic diagnosis increased in prevalence with increasing age: 11.6% in 18-39-year olds, 14.4% and 38.9% in 40-59-year olds and ≥ 60 years. The prevalence of elective general surgical cases was 15.5% before 40 years, 30% in 40-59-year olds and 27.8% after 60 years ($p= 0.006$).

Table 3: Diagnosis at admission to general surgical wards and patient age

	18-39 years	**40-59 years**	**≥ 60 years**	**Chi (χ2)**	**P**
	n = 259	n = 90	n = 54		
Elective general surgical	41(15.8)	27(30.0)	15(27.8)	10.2	0.006
Emergency general surgical	98(37.8)	29(32.2)	15(27.8)	2.4	0.295
Neurosurgical	76(29.3)	17(18.9)	3(5.6)	15.5	<0.001
Cardiothoracic	17(6.6)	5(5.6)	0(0.0)	3.7	0.155

Urological	30(11.6)	13(14.4)	21(38.9)	25.1	<0.001

4.3 Prevalence of Sepsis in General Surgical Admissions

The criteria for diagnosing sepsis was presence of a source of infection in a patient with SIRS evidenced by two of the following: abnormal vital signs (temperature, respiratory rate and heart rate) or abnormal leucocyte count. Out of the 403 patients; there were 74 (18.4%) patients with a localised source of infection, while 145 (36%) had abnormal leucocyte count and 167 (41.1%) had abnormal vital signs. The prevalence of sepsis in general surgical admissions in KNH was 16.1% (n= 65; 95 % CI 12.5 to 19.7). Table 4 summarises the diagnostic criteria applied in identifying sepsis cases among general surgical admissions in KNH.

Table 4: Diagnostic criteria for sepsis in general surgical patients admitted in KNH

	n	**%**
Abnormal leucocyte count	145	36.0
Abnormal vital signs	167	41.1
Source of infection		
Abdominal infection	31	7.7
Cellulitis	40	9.9
Urinary tract infection	3	0.7
Sepsis (source of infection and positive SIRS)	65	16.1

4.4 Prevalence of Sepsis by Patient Attributes

Table 5 shows that there was no association between prevalence of sepsis and patients age ($p = 0.541$) or sex ($p = 0.7$). Sepsis occurred in 15.7% of males and 17.2% of females. Prevalence of sepsis by patient age groups was 18-39 years (16.6%), 40-59 years (11.1%) and 60 years and above (11.1%).

The prevalence of sepsis was higher in emergency compared to elective cases (40.1 versus 3.1%, $p < 0.001$). Sepsis was less prevalent in elective cases (1.2 versus 20%, $p < 0.001$),

neurosurgical cases (1 versus 20.8%, p < 0.001), and cardiothoracic cases (0 versus 17.1%, p = 0.034). Sepsis prevalence did not differ between urologic and non-urologic cases (9.4 versus 17.4%, p = 0.109).

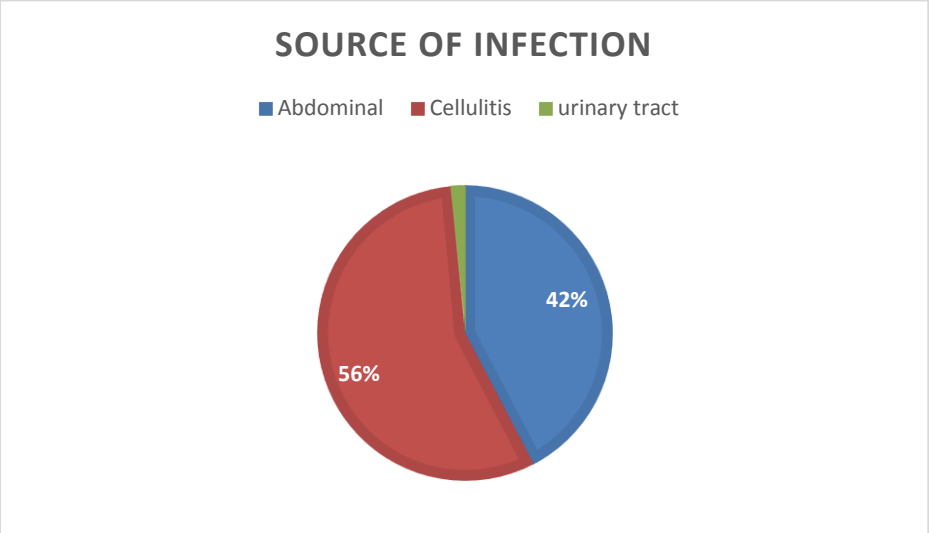
Table 5: Prevalence of sepsis among general surgical admissions

		Sepsis	**No sepsis**	**P**
Age	18-39 years	43(16.6)	216(83.4)	0.541
	40-59 years	16(17.8)	74(82.2)	
	60 years and above	6(11.1)	48(88.9)	
Sex	Male	45(15.7)	242(84.3)	0.7
	Female	20(17.2)	96(82.8)	
Elective	Yes	1(1.2)	82(98.8)	<0.001
	No	64(20.0)	256(80.0)	
Emergency	Yes	57(40.1)	85(59.9)	<0.001
	No	8(3.1)	253(96.9)	
Neurosurgical	Yes	1(1.0)	95(99.0)	<0.001
	No	64(20.8)	243(79.2)	
Cardiothoracic	Yes	0(0.0)	22(100.0)	0.034
	No	65(17.1)	316(82.9)	
Urology	Yes	6(9.4)	58(90.6)	0.109
	No	59(17.4)	280(82.6)	

4.5 Sources of Infection for the Patients with Sepsis.

Cellulitis accounted for 37 (59.8%) of the sources of infection among the 65 septic surgical patients, followed by abdominal infection that was associated with 28 (43.1%) of infections (Figure 2).

Figure 2: Sources of Infection in Surgical Patients with Sepsis in KNH Wards



4.6 Laboratory Findings and Vital Signs for Sepsis Patients

Out of the 65 patients with sepsis, 70.8% had abnormal leucocyte count and 89.2% had abnormal vital signs (Table 6). Increased heart rate (84.6%) and increased respiratory rate (75.4%) were the more common vital sign abnormalities.

Table 6: Abnormal leucocyte count and vital signs among surgical patients with sepsis

Variable		**n**	**%**
Abnormal leucocyte count	Yes	46	70.8
	No	19	29.2
Abnormal vital signs	Yes	58	89.2
	No	7	10.8
Temperature (<36 or >38.5)	Yes	25	38.5
	No	40	61.5
Heart rate (> 90)	Yes	55	84.6
	No	10	15.4
Respiratory rate (>20)	Yes	49	75.4
	No	16	24.6

4.7 Time to Surgical Intervention

In patients with sepsis, the mean duration to surgical intervention from the time of admission was 17.5 hrs while mean duration to surgery in all other surgical admissions was 15.7 hours. This included the time that the patients found to have infection at the time of admission took to have surgery for source control. The patients who did not have infection were noted to have surgery sooner than those with an infection source.

Table 7: Time to surgical intervention in admitted patients

	n	**%**
Time to surgery in patients with sepsis		
Within 1 hour	3	4.6
1-6 hours	6	9.2
6-24 hours	28	43.1
25-48 hours	10	15.4
Time to surgery in all patients		
Within 1 hour	4	1.7
1-6 hours	32	13.6
6-24 hours	176	74.9
25-48 hours	23	9.8

4.8 Type of Operation/ Surgical Intervention for Patients with Sepsis

Out of the 65 general surgical patients who had a diagnosis of sepsis in this study; 19 (29.2%) had surgical procedures involving soft tissues (Table 8). Other systems that were commonly involved were small bowel 14 (21.5%) and peritoneum 11 (16.9%). There were 41 (63%) cases of intraoperative infection and these infections followed surgical procedures involving soft tissue 15 (23.1%), small bowel 9 (13.8%), peritoneum 9 (13.8%), and less frequently colorectal (1.5%), gastric (3.1%), pelvic (4.6%), and other (3.1%) procedures.

Table 8: Systems involved in surgical intervention in septic patients in KNH

	Surgical procedure		Infection	
	n	**%**	**n**	**%**
Hepatobiliary	1	1.5	-	-
(1.5%), gastric (Small bowel	14	21.5	9	13.8
Colorectal	2	3.1	1	1.5
Gastric	4	6.2	2	3.1
Pelvic	4	6.2	3	4.6
Soft tissue	19	29.2	15	23.1
Peritoneum	11	16.9	9	13.8
Neurosurgical	1	1.5	-	-
Other	2	3.1	2	3.1
Total	58	89.2	41	63

4.9 Fluid and Blood Transfusion for Patients with Sepsis

Crystalloids were administered in 53 (81.5%) of the patients with sepsis and blood transfusion was given in 5 of them (7.7%). Of the 53 patient who had crystalloids administered 36 (55%) received infusions ranging between 2 and 3 litres per day. Fluids were given routinely, without adherence to sepsis bundles or defined protocols for their administration.

Table 9 : Fluid management and blood transfusion in general surgical patients with sepsis

Variable		**n**	**%**
Crystalloids	Yes	53	81.5
	No	12	18.5
Crystalloid volume	< 2 L/ day	4	6.2
	2-3 L/ day	36	55.4
	3-4 L/ day	13	20
Blood transfusion	Yes	5	7.7
	No	60	92.3

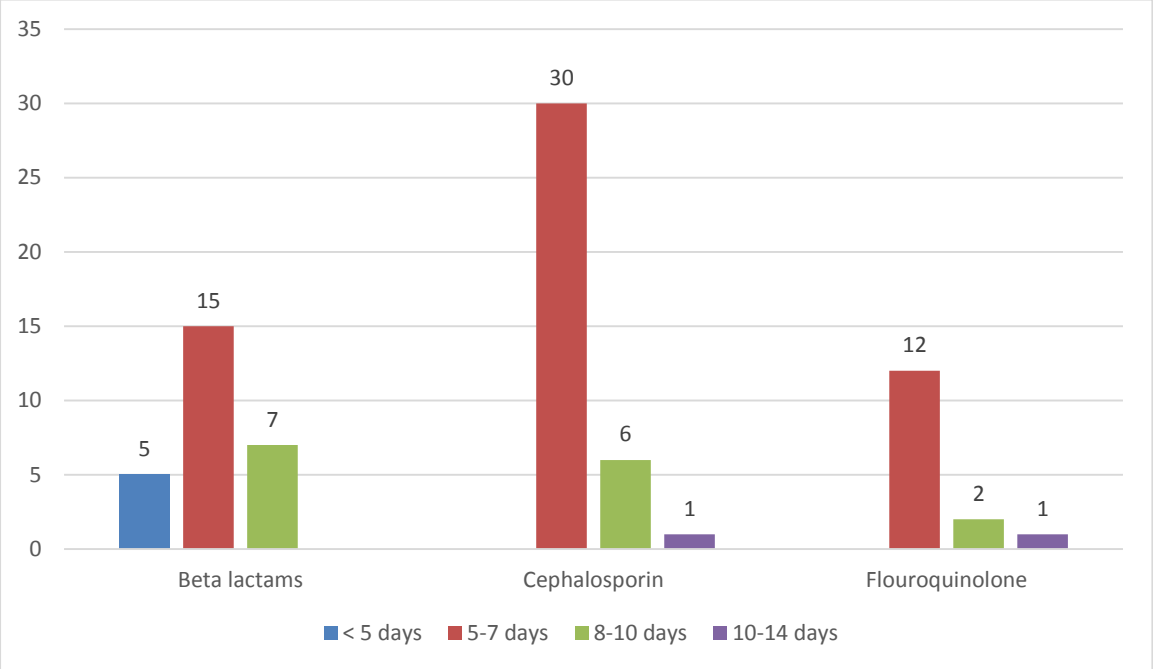
4.10 Antimicrobial Treatment

Some patients managed for sepsis during the study period originally had one type of antimicrobial treatment instituted at the time of admission (previous treatment) and subsequently had it changed after the diagnosis of sepsis was made (current treatment) as shown in table 10.

Table 10 : Antimicrobial treatment in general surgical patients with sepsis

	Previous treatment	**Current treatment**
Beta lactams	8(12.3)	20(30.8)
Cephalosporin	8(12.3)	29(44.6)
Fluoroquinolones	8(12.3)	7(10.8)
Aminoglycosides	1(1.5)	0(0)

Figure 3 : Duration of Antimicrobial treatment in general surgical patients with sepsis



4.11 Outcomes of Surgical Patients with Sepsis

Forty (61.5%) patients had been discharged by the end of the study period at follow up on day 14 (Table 11). The mean length of stay in general surgical wards for these patients was 7.1 days (SD ±3.8). There were 25 (38.5%) patients who were discharged within the first week of admission. One (1.5%) patient was admitted to ICU and stayed in ICU for 3 days.

There were two deaths among the 65 cases yielding a case fatality rate of 3.1% for sepsis. Both patients died in the general surgical wards, with the first death occurring on day 2 and the second death on day 4 of inpatient stay.

Table 11 : Outcomes of surgical patients developing sepsis

Variable		**n**	**%**
Length of stay in wards	1-7 days	25	38.5
	8-14 days	15	23.1
	> 14 days	25	38.5
ICU length of stay	1-7 days	1	1.5
Died	Yes	2	3.1
	No	63	96.9

5.0 CHAPTER FIVE: DISCUSSION, CONCLUSION AND RECOMMENDATION

5.1 Discussion

Sepsis was present in 16.1% of the patients in the study. This compares to the range estimates for the USA, (15-30%) [15] . However, it does not follow the hypothesis put across by Riviello et al that sepsis is a likely possibility in up to half of patients in low and middle-income countries worldwide including Sub Saharan Africa[15]. A study done in South Africa however showed that post-operative sepsis complicated 15.5% of surgical patients, but these findings do not compare because of differences in the methodology [30]. The study in South Africa was done before the surviving sepsis campaign had begun, therefore their definition of sepsis did not involve presence of SIRS. It was also only conducted on post-operative patients and focussed on sepsis mainly due to wounds, unlike the current study that focussed on all the admissions to surgical wards.

In this study, most of the patients with sepsis were young, (66%, n=43) and there was no statistically significant association of sepsis with age unlike the data available from South Africa where the incidence of sepsis increased with increasing age [9]. Patients in the South African study were more likely to have sepsis if they were older. Moore et al found that risk factors for sepsis in the USA included need for emergency surgery which was evident in this study ($p<0.001$) however the other factors that they associated with sepsis did not similarly compare, such as age of patient over sixty years and presence of comorbidities [8,19]. This could be attributed to the differences in patient populations among low, middle and high-income countries and the paucity of data about sepsis in the former. In addition, our study did not assess the presence of comorbidities among the patients who had sepsis, this data was therefore not available for comparison.

Infection acquired in the community prior to admission was responsible for 98.4% of sepsis diagnosis in our patients, and this was in keeping with the findings of Esteban et.al where a majority (71%) of in patients with sepsis had community acquired infection[18]. Our study found that there was a large number of patients who were admitted with cellulitis as a source of infection in surgical wards. Only a small proportion (2.3%) of them had uncomplicated

infection without positive SIRS, and thus did not meet the criteria for diagnosis of sepsis. This was especially so in patients with purulent discharge in localised areas such as the scrotum and breast. On the other hand, there were patients who had positive SIRS without a focus of infection such as those with pancreatitis and neuro trauma, as has been shown in other patient populations[20,31].

Similar to studies elsewhere [7,9] tachycardia was noted to be the most prevalent derangement in vital signs of patients with sepsis (84.6%). This may be possibly due to the fact that tachycardia heralds the onset of inadequate tissue perfusion which is one of the hallmarks of sepsis at the cellular level [7]. Tachycardia is also thought to result from myocardial dysfunction, hypovolemia and alterations in the tone of blood vessels [9].

According to the surviving sepsis campaign, early source control of infection results in better outcomes [5,24]. In this study however, the patients who developed sepsis had delays between the time of diagnosis and the time that surgical intervention was instituted (mean duration 17.5 hours) as compared to other patients (mean duration15.7 hours). This could have been attributed to resource constraints;- for instance delays awaiting skilled staff or emergency theatre space, and is likely to have had a negative impact on eventual outcome and prolonged hospital stay.

The commonest location of infection causative for sepsis as diagnosed intra operatively was intraabdominal 36.8% which compares to studies elsewhere[1,7]. Data from developed countries however attributes sepsis in the peritoneal cavity to different aetiology compared to that revealed by this study. Whereas oesophageal, colorectal, pancreatic and gastric procedures were most likely to result in post-operative sepsis in patients in developed nations, small bowel procedures were the commonest cause of sepsis in our patients [8,16]. This could have been as a result of the larger number of patients presenting with small bowel pathology in our setting, and delays in presentation of emergency cases, which complicated the post-operative recovery period with infection.

In the management of patients with sepsis, crystalloids are considered the initial choice of intravenous fluids which are recommended to be administered at a rate of 30ml/kg as soon as possible after the diagnosis is made[5,7,24]. This translates for an average man to a two-litre bolus of fluid after which frequent reassessment for the functional hemodynamic status should be made, and further fluid administration adjusted accordingly[24]. This was not

adhered to in the management of the sixty-five patients diagnosed to have sepsis in the study since only 20% of patients received fluids more than four litres in a day. However, maintenance fluids were administered to 75% of patients, and over three fourths of patients received some volume of intravenous fluid administered. There were no colloids given to any of the patients as is recommended in the guidelines[7,24,32]. Reasons for blood transfusion among this population were mainly during surgical procedures.

The ideal antimicrobial therapy for sepsis should be broad spectrum agents administered in combination, selected according to the susceptibility of potential causative pathogens, administered within an hour of the diagnosis then de-escalated appropriately based on culture results [3,5,7,24]. This study did not document cultures taken from the sources of infection for the patients that had sepsis, contrary to the guidelines which advocate for blood cultures to be obtained before starting antimicrobial therapy [5,24]. It is documented that the commonest bacteria responsible for sepsis elsewhere are gram negative in 50-60% [20] and this may have informed the decisions to prescribe empiric broad spectrum cephalosporins more than beta lactam antibiotics in the 16.1% of patients with sepsis in this study. Since culture results were unavailable for the sepsis patients, an audit of the appropriateness of the antimicrobial therapy could not be performed. The average duration of in-patient anti-microbial treatment was between five and seven days.

There were as many patients with sepsis who were discharged within the first week of admission as there were those who stayed in the ward longer than fourteen days (38.5%). This data may not be representative of delays in recovery from sepsis or progression of illness, because a number of patients with a prolonged hospital stay had financial constraints and were thus still in the ward by the fourteenth day after admission. A patient diagnosed with sepsis received ICU care after development of cardiac arrhythmias during the surgical procedure for sigmoid volvulus, as he was a known hypertensive patient non-compliant on medication. During his three days stay in ICU, he did not require vasopressor support, and his post-operative recovery was uneventful. The case fatality rate for sepsis in this study was 3.1% (n=2), which does not compare to the values documented elsewhere of 12.8% in hospital mortality(18). One patient was admitted with acute kidney failure, altered mental status and Fournier's gangrene. Intensive care was not immediately available and he died within two days of admission. The second patient was a referral from a peripheral facility with positive SIRS, intra-abdominal infection following emergency laparotomy for mesenteric ischemia and acute kidney injury. He had intermittent renal replacement therapy

begun shortly after admission, but succumbed to his illness on day four of admission. The finding of acute kidney injury in the patients who succumbed to sepsis in this study compared to that found by White et al as a predictor of the decreased likelihood of discharge despite instituting dialysis [33].

5.2 Conclusion and Recommendations

Having identified that the patients more likely to develop sepsis are young males admitted with emergency conditions with soft tissue or abdominal diagnoses, this is the cohort of patients who are more likely to benefit from institution of sepsis screening programs if the health care workers in the surgical wards of KNH have a high index of suspicion.

In addition, the study revealed that there was no documented protocol for management of surgical patients with sepsis and no adherence to the surviving sepsis campaign guidelines. There were inadequacies in fluid administration, delays in surgical intervention for source control of infection and no justification for antimicrobial treatment given the lack of blood cultures. Attention to these areas especially for patients with intra-abdominal and soft tissue infection is likely to lead to an improvement in outcome.

There being resource constraints in low and middle-income countries and minimal data available on surgical sepsis, there is need for more research to enable personalized, timely and appropriate therapy for each patient. This study can form the basis for generating research questions on the subject in the future.

REFERENCES

1. Moore LJ, Moore FA. Epidemiology of Sepsis in Surgical P a t ients. Surg Clin NA [Internet]. Elsevier Inc; 2012;92(6):1425–43.
2. Russell JA. Management of Sepsis. N Engl J Med. 2006;355(16):1699–713.
3. Cohen J, Vincent J-L, Adhikari NKJ, Machado FR, Angus DC, Calandra T, et al. Sepsis: a roadmap for future research. Lancet Infect Dis [Internet]. 2015 May [cited 2015 Apr 21];15(5):581–614.
4. Angus DC (Pitt), van der Poll T. Severe sepsis and septic shock. N Engl J Med [Internet]. 2013;369(9):840–51.
5. Dellinger RP, Levy MM, Rhodes A, Annane D, Gerlach H, Opal SM, et al. Surviving Sepsis Campaign: international guidelines for management of severe sepsis and septic shock, 2012. Intensive Care Med [Internet]. 2013 Feb [cited 2014 Jul 11];39(2):165–228.
6. O'Brien JM, Ali NA, Aberegg SK, Abraham E. Sepsis. Am J Med [Internet]. 2007 Dec [cited 2015 May 19];120(12):1012–22.
7. Green JM. Essentials of Sepsis Management. Surg Clin North Am [Internet]. Elsevier Inc; 2015;95(2):355–65.
8. Moore LJ, Moore FA, Todd SR, Jones SL, Turner KL, Bass BL. Sepsis in general surgery: the 2005-2007 national surgical quality improvement program perspective. Arch Surg [Internet]. American Medical Association; 2010 Jul 1 [cited 2015 May 11];145(7):695–700.
9. Radford H. Sepsis , severe sepsis and septic shock in adults and anaesthesia. South African J Anaesth Analg. 2002;8(2):30–42.
10. Martin-Loeches I, Levy MM, Artigas A. Management of severe sepsis: advances, challenges, and current status. Drug Des Devel Ther [Internet]. Jan [cited 2015 May 15];9:2079–88.
11. Daniels R. What next for sepsis? Lancet Infect Dis [Internet]. Elsevier Ltd; 2015;15(5):499–501.
12. Sihler KC, Nathens AB. Management of Severe Sepsis in the Surgical Patient. Surg Clin NA. 2006;86:1457–81.
13. Angus DC, Alberto C, Pereira P, Silva E, Paulo S. Epidemiology of Severe Sepsis Around the World. Endocrine, Metab Immune Disord Drug targets. 2006;6(2):4–9.
14. Rangel-Frausto MS, Pittet D, Costigan M, Hwang T, Davis CS, Wenzel RP. The

Natural History of the Systemic Inflammatory Response Syndrome (SIRS). JAMA [Internet]. American Medical Association; 1995 Jan 11 [cited 2015 Nov 17];273(2):117.

15. Riviello ED, Sugira V, Twagirumugabe T. Sepsis research and the poorest of the poor. Lancet Infect Dis [Internet]. 2015;15(5):501–3.
16. Vogel TR, Dombrovskiy VY, Lowry SF. Trends in postoperative sepsis: are we improving outcomes? SurgInfect(Larchmt) [Internet]. 2009;10(1096–2964 (Print)):71–8.
17. Vogel TR, Dombrovskiy VY, Carson JL, Graham AM, Lowry SF. Postoperative sepsis in the United States. Ann Surg [Internet]. 2010 Dec [cited 2015 Sep 29];252(6):1065–71.
18. Esteban A, Frutos-Vivar F, Ferguson N, Penuelas O, Lorente JA, Gordo F, et al. Sepsis incidence and outcome: Contrasting the intensive care unit and with the hospital ward. Crit Care Med [Internet]. 2007 [cited 2015 Nov 17];35(5):1284–9.
19. Moore LJ, Moore FA, Jones SL, Xu J, Bass BL. Sepsis in general surgery: a deadly complication. Am J Surg [Internet]. 2009 Dec [cited 2015 May 11];198(6):868–74.
20. Boontham P, Chandran P, Rowlands B, Eremin O. Surgical sepsis: dysregulation of immune function and therapeutic implications. Surgeon [Internet]. Royal College of Surgeons of Edinburgh and Royal College of Surgeons in Ireland; 2003;1(4):187–206.
21. King JE. Sepsis in critical care. Crit Care Nurs Clin North Am [Internet]. 2007 Mar [cited 2015 May 19];19(1):77–86.
22. Yealy DM, Huang DT, Delaney A, Knight M, Randolph AG, Daniels R, et al. Recognizing and managing sepsis: what needs to be done? BMC Med [Internet]. 2015 Jan [cited 2015 May 18];13(1):98.
23. Rivers EP, Coba V, Visbal A, Whitmill M, Amponsah D. Management of Sepsis: Early Resuscitation. Clin Chest Med. 2008;29(4):689–704.
24. Andrew Rhodes LEE, Waleed Alhazzani, Mitchell M. Levy, Massimo Antonelli, Ricard Ferrer, Anand Kumar, et al. Surviving Sepsis Campaign: International Guidelines for Management of Sepsis and Septic Shock: 2016. Intensive Care Med [Internet]. 2017 [cited 2017 May 15];(43):304–77.
25. Kumar A, Roberts D, Wood KE, Light B, Parrillo JE, Sharma S, et al. Duration

of hypotension before initiation of effective antimicrobial therapy is the critical determinant of survival in human septic shock. Crit Care Med. 2006;34(6):1589–96.

26. Leppäniemi A, Kimball EJ, De Laet I, Malbrain MLNG, Balogh ZJ, De Waele JJ. Management of abdominal sepsis - a paradigm shift? Anaesthesiol Intensive Ther [Internet]. 2015 May 14 [cited 2015 May 15];
27. Venkataraman R, Kellum J a. Sepsis: Update in the Management. Adv Chronic Kidney Dis [Internet]. Elsevier Ltd; 2013;20(1):6–13.
28. Gutsche J, Deutschman CS. Sepsis, Systemic Inflammaroty Response Syndrome, and Multiple Organ Dysfunction Syndrome. In: Complications in Anesthesia [Internet]. Elsevier; 2007 [cited 2015 May 19]. p. 496–9.
29. Hotchkiss RS, Karl IE. The Pathophysiology and Treatment of Sepsis. N Engl J Med. 2003;348(2):138–50.
30. Birkenstock WE. Surgical sepsis. S Afr Med J. 1973;47(10):436–41.
31. Santucci CA. Title: Leukocytosis as a Predictor of Severe Injury in Blunt Trauma. J Issue West J Emerg Med [Internet]. 2008;9(2).
32. Dellinger RP, Levy MM, Rhodes A, Annane D, Gerlach H, Opal SM, et al. Surviving Sepsis Campaign: Crit Care Med [Internet]. 2013;41(2):580–637.
33. White LE, Hassoun HT, Bihorac A, Moore LJ, Sailors RM, McKinley BA, et al. Acute kidney injury is surprisingly common and a powerful predictor of mortality in surgical sepsis. J Trauma Acute Care Surg [Internet]. NIH Public Access; 2013 Sep [cited 2017 May 15];75(3):432–8.

APPENDICES

Appendix I: Informed Consent

PATTERN OF SEPSIS IN GENERAL SURGICAL WARDS AT KENYATTA NATIONAL HOSPITAL.

English version.

This Informed Consent form is for patients admitted to the general surgical wards of the Kenyatta National Hospital. This consent will be administered to the patients or next of kin. We are requesting these patients to participate in this research project whose title is "PATTERN OF SEPSIS IN GENERAL SURGICAL WARDS AT KENYATTA NATIONAL HOSPITAL**.**"

Principal investigator: **Dr. Wambui F. Njoroge.**

Institution: School of Medicine, Department of surgery- University of Nairobi

Supervisors:

1. **Dr D. K. Ojuka**
2. **Dr J. K Wanjeri**

This informed consent has three parts:

- Information sheet (to share information about the research with you)
- Certificate of Consent (for signatures if you agree to take part)
- Statement by the researcher

Each participant will be given a copy of the full Informed Consent Form.

Part I: Information sheet

Introduction.

My name is Dr. Wambui Njoroge. I am a post-graduate student at the University of Nairobi, School of Medicine, Department of Surgery. I am carrying out a study to determine the pattern of sepsis in general surgical wards of Kenyatta National Hospital (KNH). This will

be possible through data collection by filling in questionnaire and follow up of these patients post admission for the first fourteen days of hospitalization.

Purpose of the Research.

Information obtained from this study will reveal to the doctors the magnitude of sepsis in surgical wards at KNH to enable us to manage the condition appropriately and avoid complications where possible. This study is also a requirement for any doctor who aspires to graduate from our college as a surgeon.

Voluntary participation/right to refuse or withdraw.

An invitation to participate in this study is hereby extended to you. You will have the opportunity to ask questions before you decide on your participation. You may seek clarification regarding any bit of the study from me should any part be unclear.

Confidentiality.

All the information which you provide regarding yourself or kin will be kept confidential; only the researcher will access this information. The questionnaire will be identified by a number and only the researcher can relate the number to the patient. All the information you give us will be used for research only.

Sharing of the results.

The information will not be shared with anyone else unless authorized by the Kenyatta National Hospital/University of Nairobi – Ethics and Research Committee (KNH/UoN-ERC).

This dissertation has been reviewed and approved by the KNH/UoN-ERC which is a committee whose work is to make sure research participants are protected from harm.

Risks.

This study will not expose you or your kin to any risk.

Cost and compensation.

There will be no extra cost incurred for participating in this study and no compensation will be offered.

Part II certificate of consent.

I have read the above information, or it has been read to me. I have had the opportunity to ask questions about it and any questions that I have asked have been answered to my satisfaction. I consent voluntarily to participate in this research.

Print Name of Participant _____

Signature of Participant _____

Date _____

If Illiterate;

I have witnessed the accurate reading of the consent form to the potential participant, and the individual has had the opportunity to ask questions. I confirm that the individual has given consent freely.

Print Name of witness_____

Left thumb print of participant

Signature of witness _____

Date _____

Who to Contact

The contact information is given below if you wish to contact any of them for whatever reason;

Secretary, KNH/UoN-ERC

P.O. Box 20723 KNH, Nairobi 00202

Tel 726300-9

Email: uonknh_erc@uonbi.ac.ke

University of Nairobi research supervisors

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Principal researcher:

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Department of Surgery, School of Medicine, University of Nairobi

P.O. Box 19676 KNH, Nairobi 00202

Mobile phone 0722 563810

PART III: Statement by the researcher

I have accurately read out the information sheet to the participant, and to the best of my ability made sure that the participant understands that the following will be done:

- Refusal to participate or withdrawal from the study will not in any way compromise the treatment planned.
- All information given will be treated with confidentiality.
- The results of this study might be published to facilitate knowledge of sepsis in general surgical wards of KNH.

I confirm that the participant was given an opportunity to ask questions about the study, and all the questions asked by the participant have been answered correctly and to the best of my ability. I confirm that the individual has not been coerced into giving consent, and the consent has been given freely and voluntarily.

A copy of this Informed Consent Form has been provided to the participant.

Name of researcher taking consent: ……

Signature of researcher taking consent: …….

Date: ……

Maelezo kwa Kiswahili.

Fomu ya makubaliano ya kujiunga na utafiti

SWALA LA UTAFITI: PATTERN OF SEPSIS IN GENERAL SURGICAL WARDS AT KENYATTA NATIONAL HOSPITAL.

Fomu hii ya makubaliano ni kwa wale wagonjwa waliolazwa katika vyumba vya wagonjwa wanaohitaji upasuaji na wanaougua ugonjwa-kolea kwa lugha ya kitaalamu 'sepsis.' Nakualika kuwa mmoja wa wale watakaofanyiwa uchunguzi huo katika utafiti huu kwa hiari yako.

Mtafiti mkuu: Dkt. Wambui F. Njoroge

Kituo: Kituo cha utabibu, idara ya upasuaji, Chuo Kikuu cha Nairobi.

Fomu hii ya makubaliano ina sehemu tatu:

1) Habari itakayo kusaidia kukata kauli
2) Fomu ya makubaliano (utakapoweka sahihi)
3) Ujumbe kutoka kwa mtafiti

Utapewa nakala ya fomu hii.

<u>SEHEMU YA KWANZA: Ukurasa wa habari</u>

Kitambulizi

Jina langu ni Dkt. Wambui F. Njoroge. Mimi ni daktari ninayesomea uzamili katika idara ya upasuaji Chuo Kikuu cha Nairobi. Ninafanya utafiti kwa anwani ya, "PATTERN OF SEPSIS IN GENERAL SURGICAL WARDS AT KENYATTA NATIONAL HOSPITAL". Dhamira ya utafiti huu itawezekana kupitia kujaza dodoso na kisha kufuatiliwa kwako au mgonjwa wako kwa muda ataokuwa hospitali.

Nia ya utafiti huu

Ujumbe utakaopatikana kutokana na utafiti huu utakuwa mwanga kwa madaktari kuelewa uwepo na uzito wa ugonjwa-kolea kwa wale wagonjwa waliolazwa kwa minajili ya upasuaji.

Aidha, utafiti huu ni mojawapo ya mahitaji anayohitajika mtafiti kuhitimisha katika kiwango cha uzamili kama daktari wa upasuaji.

Haki ya kukataa utafiti

Kushiriki kwako kwa utafiti huu ni kwa hiari yako. Una uhuru wa kukataa kushiriki, na kukataa kwako hakutatumiwa kukunyima tiba. Unayo haki ya kujitoa katika utafiti wakati wowote unapoamua.

Taadhima ya siri

Ujumbe kuhusu majibu yako yatahifadhiwa. Ujumbe kuhusu ushiriki wako katika utafiti huu utaweza kupatikana na wewe na wanaoandaa utafiti na wala si yeyote mwingine. Jina lako halitatumika bali ujumbe wowote kukuhusu utapewa nambari badala ya jina lako.

Hatari unayoweza kupata

Hakuna hatari yoyote ambayo yaweza kutokea kwa sababu ya kuhusishwa kwa utafiti huu. Aidha, kukataa au kujitoa katika ushiriki wako kwa huu utafiti kwa wakati wowote ule hakutakuletea hatari yoyote ya matibabu.

Hifadhi ya matokeo.

Matokeo ya utafiti huu yatachapishwa kwa nukuu mbali mbali za sayansi kupitia kwa idhini ya mtafiti mkuu. Nakala za chapisho zitahifadhiwa katika idara ya upasuaji, chuo kikuu cha Nairobi na katika maktaba ya sayansi za Afya, kitivo cha utabibu. Hivyo basi, matokeo ya utafiti huu hayatasambazwa kwa umma au jukwaa lisiloidhinishwa kihalali. Ujumbe ulio kwa dodoso hautahifadhiwa baada ya uchanganuzi wa matokeo.

Gharama au fidia.

Utafiti huu hautakugharimu zaidi ya matibabu yako ya kawaida. Vilevile, hakuna malipo yoyote au fidia utakayopokea kutokana na kujiunga kwako katika utafiti huu. Muda wako ndio utakaotumiwa wakati wa kukubali kushiriki katika utafiti.

SEHEMU YA PILI: Fomu ya makubaliano

Nimeelezewa utafiti huu kwa kina. Nakubali kushiriki katika utafiti huu kwa hiari yangu. Nimepata wakati wa kuuliza maswali na nimeelewa kuwa iwapo nina maswali zaidi, ninaweza kumwuliza mtafiti mkuu au watafiti waliotajwa hapa juu.

Jina la Mshiriki : ……

Sahihi ya mshiriki: …….

Tarehe : ……

Kwa wasioweza kusoma na kuandika:

Nimeshuhudia usomaji na maelezo ya utafiti huu kwa mshiriki. Mshiriki amepewa nafasi ya kuuliza maswali. Nathibitisha kuwa mshiriki alipeana ruhusa ya kushiriki bila ya kulazimishwa.

Jina la shahidi:…….. Alama ya kidole cha gumba cha mshiriki

Sahihi la shahidi: ……..

Tarehe : …….

Anwani za Wahusika

Ikiwa uko na maswali ungependa kuuliza baadaye, unaweza kuwasiliana na:

Mtafiti Mkuu:
Dkt. Wambui F. Njoroge

Idara ya upasuaji, Shule ya Afya, Chuo Kikuu cha Nairobi,

SLP 19676 KNH, Nairobi 00202.

Simu: 0722 563 810

Wahadhiri husika:

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MBCh.B, M.MED (Gen Surg.), FACS,

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Shule ya Afya, Chuo Kikuu cha Nairobi,

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(MB.Ch.B, MMED (Gen Surg.) UoN, IPTM (Tel Aviv), MPH

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Wahusika wa maslahi yako katika Utafiti:

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SEHEMU YA TATU: Ujumbe kutoka kwa mtafiti

Nimemsomea mshiriki ujumbe kiwango ninavyoweza na kuhakikisha kuwa mshiriki amefahamu yafuatayo:

- Kutoshiriki au kujitoa kwenye utafiti huu hakutadhuru kupata kwake kwa matibabu.
- Ujumbe kuhusu majibu yake yatahifadhiwa kwa siri.
- Matokeo ya utafiti huu yanaweza chapishwa kusaidia kuhamasisha uwepo na uzito wa ugonjwa-kolea katika wagonjwa waliolazwa kwa minajili ya upasuaji.

Ninathibitisha kuwa mshiriki alipewa nafasi ya kuuliza maswali na yote yakajibiwa. Ninahakikisha kuwa mshiriki alitoa ruhusa bila ya kulazimishwa.

Mshiriki amepewa nakala ya hii fomu ya makubaliano.

Jina la mtafiti : …….

Sahihi ya Mtafiti: …….

Tarehe: ……

Appendix II: Questionnaire

Questionnaire Number

Demographic details: Patient initials: Sex: Ward: Admission date:

Age	18-39	40-59	>60

Clinical details.

1. Diagnosis at admission:

Elective general surgical	
Emergency general surgical	
Neurosurgical	
Cardiothoracic	
Urological	

2. Vital Signs.

Parameters	Values	Day 1	Day 3	Day7	Day 14
Temperature ^{o}C	<36				
	36.1-37.9				
	>38				
Heart Rate per min	≤89				
	>90				
Respiratory rate	≤20				
	>20				
$PaCO_2$	>32mmHg				
	<32mmHg				

3. Source of Infection: (tick all that apply)

Cannula infection,	
Respiratory infection	
Abdominal Infection	
Cellulitis or Soft Tissue Infection	
Urinary Tract Infection	
Culture	
Other (specify)	

4. Blood leucocyte count (mm^3):

Value	Reading	Interpretation
$<4000/ml^3$		Low
$4000\text{-}11000/ml^3$		Normal
$>11000/ml^3$		High

5. Interventions undertaken:

Time to intervention:

Within 1hour	1-6 hours	6-24 hours	25-48 hours

Surgery:

Elective	Emergency

Intra operative findings:

System Involved	Procedure Done	Infection (Y/N)	Repeat surgery & date
Hepatobiliary			
Pancreatic			
Small bowel			
Colorectal			
gastric			
Retroperitoneum			
Pelvic			
Soft tissue			
Peritoneum			
Neurosurgical			
Cardiothoracic			
other			

Fluids

Type/ Volume	<2L/day	2-3L/ Day	3-4L/Day	> 4L/Day
Crystalloids				
Colloids				
Blood				

Antimicrobial treatment

Type of drug	Prior Treatment	Current treatment	Dose	Duration (a-e)
Beta lactams				
Macrolides				
Cephalosporins				
Fluoroquinolones				
Sulfonamides				
Tetracycline				
Aminoglycosides				
Oxazolidinones				
Glycopeptides				
Chloramphenicol				
Ansamycins				
Streptogramins				
Lipopeptides				
Anti fungals				
Anti virals				

a- <5/7 b- 5-7/7 c-8-10/7 d-10-14/7 e->14/7

6. Outcomes: Duration of hospital stay

	Ward	ICU
<1/7		
1-7		
8-14		

Other Outcomes

Cardiovascular Failure	
Respiratory Failure	
Gastrointestinal failure	
Neurological dysfunction	
Renal failure	
Hematological failure	
Mortality	
Other	

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PATTERN OF SEPSIS IN GENERAL SURGICAL WARDS AT KENYATTA NATIONAL HOSPITAL by Wambui Njoroge
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8th April, 2016

KENYATTA NATIONAL HOSPITAL APPROVED 08 APR 2016 KNH/UON-ERC P.O Box 20723-00202 NAIROBI

Dr. Wambui F. Njoroge
Reg. No. H58/79490/2012
Dept. of Surgery
School of Medicine
College of Health Sciences
University of Nairobi

Dear Dr. Njoroge,

Revised Research Proposal: Patterns of Sepsis in General Surgical Wards of Kenyatta National Hospital (P794/12/2015)

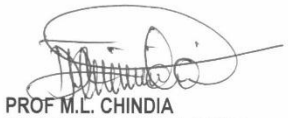
This is to inform you that the KNH- UoN Ethics & Research Committee (KNH-UoN ERC) has reviewed and **approved** your above proposal. The approval period is from 8th April 2016 – 7th April 2017.

This approval is subject to compliance with the following requirements:

a) Only approved documents (informed consents, study instruments, advertising materials etc) will be used.
b) All changes (amendments, deviations, violations etc) are submitted for review and approval by KNH-UoN ERC before implementation.
c) Death and life threatening problems and serious adverse events (SAEs) or unexpected adverse events whether related or unrelated to the study must be reported to the KNH-UoN ERC within 72 hours of notification.
d) Any changes, anticipated or otherwise that may increase the risks or affect safety or welfare of study participants and others or affect the integrity of the research must be reported to KNH- UoN ERC within 72 hours.
e) Submission of a request for renewal of approval at least 60 days prior to expiry of the approval period. (*Attach a comprehensive progress report to support the renewal*).
f) Clearance for export of biological specimens must be obtained from KNH- UoN ERC for each batch of shipment.
g) Submission of an *executive summary* report within 90 days upon completion of the study. This information will form part of the data base that will be consulted in future when processing related research studies so as to minimize chances of study duplication and/ or plagiarism.

For more details consult the KNH- UoN ERC website **http://www.erc.uonbi.ac.ke**

Yours sincerely,



PROF M.L. CHINDIA
SECRETARY, KNH-UoN ERC

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