SURGICAL SITE INFECTIONS AFTER ABDOMINAL SURGERY: PREVALENCE, CAUSES AND MANAGEMENT AT THE SURGICAL WARDS, KOMFO ANOKYE TEACHING HOSPITAL, GHANA.

BY:

JANET ADWOA OFOSUA AMEYAW, B. PHARM. (HONS)

A THESIS SUBMITTED TO THE DEPARTMENT OF CLINICAL AND SOCIAL PHARMACY KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY, KUMASI IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE IN CLINICAL PHARMACY

AT THE

DEPARTMENT OF CLINICAL AND SOCIAL PHARMACY

FACULTY OF PHARMACY

COLLEGE OF HEALTH SCIENCE

MAY, 2014

DECLARATION

I hereby declare that except for references to other authors, for which I have acknowledged, this work is my own and have not been submitted in any thesis for any award.

Pharm. Janet Adwoa Ofosua Ameyaw Signature: Date:

(Candidate) …….. .....……

Certified by:

Dr. Berko Panyin Anto Signature: Date:

(Supervisor) …….. ……

Certified by:

Dr. Kwame Ohene Buabeng Signature: Date:

(Head of Department) …….. …….

DEDICATION

This work is dedicated to my husband beloved Mr. Collins Ameyaw.

ACKNOWLEDGEMENTS

I wish to express my sincere gratitude to my supervisor, Dr. Berko Panyin Anto for his guidance throughout the study period. I am also grateful to Dr. Kwame Ohene Buabeng for his sound critique and directions during the study period. I will also like to show appreciation to clinical Pharmacist Lawrence Oppong Anokye for his support and encouragement. My sincere appreciation goes to the nurses-in-charge and surgeons who willingly allowed themselves to be interviewed.

I also thank my mum for her unflinching support during the study period. This piece of work is the doing of the Lord, and it's marvelous in my eyes.

ABSTRACT

BACKGROUND: Infections of surgical wounds are one of the most common post-operative adverse events which could impact significantly on cost of care and morbidity. Surgical site infections must be kept to the barest minimum levels. This study sought to determine the prevelance and causes of surgical site infections (SSI's) after abdominal surgery at Komfo Anokye Teaching Hospital, how they are managed and the outcomes of management.

METHOD: This was a prospective study involving all abdominal surgery patients 18 years and above, who had no cancer or HIV/AIDS and were admitted from 29th of October to 31st December, 2012. Eighty-Six patients were enrolled but 81 of them met the inclusion criteria and were thus studied. In addition, four general surgeons and four nurses-in-charge of the surgical wards were interviewed.

FINDINGS: The overall prevalence of SSI's was 40%. SSI prevalence rate according to wound class was 29% and 49% for clean and dirty wounds respectively. The average days for SSI's to develop and be detected were 8 days.

The most common causes of SSI's identified were unfavourable ward environment and reduced patient's immunity levels. Others were non adherence to aseptic techniques at the ward and theatres, improper demarcation of surgical cases on wards, large numbers of people in the operating room and improper preparation of incision sites before surgery.

Management steps of SSI's included opening and drainage of pus from wound, culture and sensitivity testing of wound swab/pus from wound in some cases along with dressing changes till healing took place. Pharmacologic management was in line

with the Clinical Guidelines 74 2008, UK, as well as the 2010 American Surgical Society and American Society of Infectious Diseases guidelines.

Ciprofloxacin and metronidazole were the most frequently used antibiotic combination and was well tolerated by most patients. However, intravenous lines were not flushed before and after the administration of one drug after the other. There was also non- compliance with the minimum 48 hours interval between the administration of calcium containing solution and ceftriazone.

CONCLUSION: The prevalence of SSI's after abdominal surgery was high. The causes of SSI's in patients at the ward included patients' low immunity status, contaminated theatre and ward environment and improper demarcation of cases at the ward. Patients who developed SSI during the study period were managed according to standard guidelines with good outcomes.

Pragmatic steps must be taken to reduce the prevalence of SSI's and emphasis placed on effective infection prevention and control practices.

Keywords: Surgical Site Infection, Incidence, KATH, Abdominal Surgery, Aseptic Techniques

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

`

ACRONYMS

AIDS - Acquired Immune Deficiency Syndrome

ASA - American Society of Anesthesiologists

CDC - Centre for Disease Control and Prevention

GISA - Glycopeptide intermediate S. aureus

HIV - Human Immune Virus

ID - Identification Number

IPC - Infection Prevention and Control

KATH - Komfo Anokye Teaching Hospital

KNUST - Kwame Nkrumah University of Science and Technology

NHS - National Health Scheme

NHIS - National Health Insurance Scheme MRSA- methicillin- resistant staphylococcus aureus

SSI - Surgical Site infection

UK - United Kingdom

CHAPTER ONE

INTRODUCTION

1.1 Background

Surgical Site infections (SSIs) are one of the most commonly encountered complications after surgery. They cause pain and inconvenience to patients, result in prolonged hospital stay and may be potentially fatal (Gibbons et al., 2012). Surgical site infections and its management are costly to both patients and the health facilities. Surgical site infections definitions can vary because they range from a relatively trivial wound discharge without complications to serious conditions that are fatal. Therefore, to encourage a uniform and standard approach among data collectors, the Center for Disease Control and Prevention (CDC) brought out definitions for each category (CDC, 2013). These are Superficial SSIs restricted to the skin and subcutaneous tissue; Deep Incisional SSIs involving the fascia and muscle layers; and Organ or space SSIs associated with the body organs and body spaces. These infections develop within 30 days after an operation or one year if an implant was placed (Mangram et al., 1999). Signs and symptoms are purulent discharge from the wound or around the insertion site of a drain, or spreading cellulitis from the wound. Generally, raised white blood cell count, increased pain or heat with tenderness, pyrexia, dehiscence at the incision site indicates infection (Swenne, 2006). Other indicators of infection are culture positive drainage and a physician diagnosis of infection with prescription of antibiotics (Loo, 2008).

It has been observed that chances of a patients getting infected after surgical operation largely depends on the hospital in which the operation was conducted which may also

be influenced by surgical management and other aspects of quality of health care (Gibbons et al., 2012).

Considering the conditions under which operations are carried out nationwide, the scarcity of experienced, skilled and qualified surgeons, lack of quality medicines sometimes, inadequate resources, high nurse to patient ratio, number of uninformed patients, etc, post operative infections seem inevitable, but this should be reduced to the barest minimum.

The Ghana Health service (2009) intimated that the health service is grappling with a barrage of challenges which are affecting the quality of health delivery in the country. It is estimated that the cost of post operative infections could be very high, thus its prevention could save a lot of resources especially in a developing country like Ghana.

1.2 Sources and Incidence of SSIs

SSIs are the most common healthcare-associated infection in surgical patients (Mangram et al., 1999), occurring in up to 5 percent of surgical patients (Cheadle, 2006). Perencevich et al., (2003) reported that, in the United States, between 500,000 and 750,000 SSIs occur annually.

According to the Komfo Anokye Teaching Hospital (KATH) Infection Prevention and Control Manual (2009), surgical site infection incidence varies from 0.5 – 5% depending on the type of operation and underlying patient status. A study conducted in UK on surgical site infections revealed that about 8.2% of surgery patients

developed healthcare associated infections while 4.65% of these patients developed SSI (Hospital Infection Society and Tissue Viability Nurses Association, 2007).

Several studies have suggested that SSI emanates from the operating theatre, but the sources of infection can be the patient, the theatre environment or the operating room staff. The causes of post surgical wound infections could be vast and varied, ranging from practices in the hospital before and after the surgery, poor hygienic practices from patients, non-adherence to aseptic wound dressing procedures and the inefficiency of antibiotics used for surgical prophylaxis.

Absence of optimal ventilation (Seal and Paul-Cheadle, 2003), inadequate surgical patient skin preparation (Parienti, 2002), the use of hand rubs with aqueous alcohol solution instead of the traditional surgical hand-scrubbing (Segers, 2006) and the non-decontamination of the nasopharynx and oropharynx (Harbath, 2008) are also some sources of surgical site infection.

1.3 Consequences of Infections

According to the KATH annual report for the year 2009, the length of stay associated with postoperative infections is estimated between 3 and 20 additional days. Plowman et al, (2000) in England found that, of 3,980 NHS patients, 7.8% of them developed a health care associated infection during their hospital stay. They also identified that SSIs alone increased hospital-incurred costs for each patient by £1,618 and increased length of stay in hospital by an average of seven days. It is reported that SSI is not limited to economic costs, but also contribute greatly to mortality. More than 20,000

deaths per year are due to SSIs in the USA (Woods et. al, 2005), and the chance of death in a surgical patient is doubled if an SSI occurs (Kirkland, 1999). Hollenbeak (2002) emphasized that the increased mortality is even more pronounced after coronary bypass surgery, where deep-chest SSI is associated with a mortality rate of 22 percent compared with 0.6 percent in those without an SSI.

The economic impact of SSI is great from several aspects. The patient pays, through loss of income and through insurance payments in the case of Ghana and in many other countries. The hospital pays for salaries to nursing staff, doctors, pharmacists and auxiliary staff. There are increased costs of care from the use of disposable and reusable equipment, drugs, and disinfection and sterilization of items (Mangram et al., 1999). Health workers agree with the fact that patients who develop an SSI need greater attention.

1.4 Risk factors

Pessaux et al., (2003) in a study of risk factors for postoperative infections, categorized risk factors of SSI into three main divisions; namely pre-operative, intra-operative, and post-operative. Age, height, loss of weight exceeding 10% of the patient's ideal weight, diabetes mellitus, cirrhosis, ascites, are some of the risk factor he identified. Other factors identified as influencing healing include corticosteroid therapy, chemotherapy, or both during the last 6 months before surgery. Previous abdomino-pelvic radiotherapy (irrespective of the interval since the end of treatment), anticoagulant therapy (preventive or curative dosage), emergency surgery, or a

deferred emergency because of the clinical reasons, are all risk factors for surgical site infections.

According to Pessaux et al., (2003) intra-operative risk factors include the following: type of abdominal incision, incision on a preexistent abdominal scar, associated surgical treatment of an abdominal hernia or defect, parietal protection (i.e., sterile drape, dry fields, antiseptic-soaked fields, or skirt) and pre-existence of a skin infection (i.e., inflammation, abscess, or necrosis, and gangrene). Opening of the bowel in the digestive tract, degree of intra-operative contamination (subjective evaluation by the surgeon as being absent, minimal, moderate, or major), placement of a suture or having an anastomosis of the bowel in the digestive tract, surgical excision for cancer (i.e., curative, palliative, or extensive), having a peritoneal or cutaneous closure, type of cutaneous closure and reinforcement (total number of stitches), having intra-abdominal or intra-parietal drainage (i.e., by blade, tube, or other) and the length of operative time are all intra-operative risk factors.

Reddy (2012) also categorized the SSIs risk factors into three main groups. These are patient factors, environmental factors and treatment factors. These are presented in Table 1.1

Table 1.1: Risk factors for the development of SSI

Patient factors:	**Treatment factors:**	**Environmental factors:**
Diabetes Malnutrition (under nutrition & obesity) Extremes of age Skin disease at operation site Irradiation at operation site Peripheral vascular disease (for lower limb surgeries) Hypoxemia Postoperative anemia Steroid therapy Chronic inflammatory conditions Infection at remote sites Staphylococcal carriers	Emergency procedures Inadequate and inappropriate antibiotic prophylaxis Prolonged preoperative hospitalization Prolonged operative time Hypothermia Surgical drains	Inadequate skin antisepsis Inadequate sterilization of instruments Inadequate ventilation Contaminated medications

Physical activity level; present and past smoking history; and previous experience with anaesthetic agent are also important risk factors. Smoking is a risk factor for SSIs that should be screened for in the pre-admission phase. Pre-operative smoking cessation is recommended to prevent wound dehiscence.

A study of 44 hospitals that targeted achieving normothermia, good oxygenation and appropriate glucose control, decreased the SSI rate from 2.3 to 1.7% (Pronovost et al, 2006).

Again, Graham and Pedler (2003) identified three risk factors for development of SSIs and these are the patient's ability to fight invading microorganisms, the risk of microorganisms contaminating the wound during surgery and the risk of micro-organisms already being present in the wound.

Table 1.2: Classification of surgical procedures by risk of infections

Type of procedure	Definition	Wound infection rate (%)
Clean	Atraumatic; no break in technique; gastrointestinal, genitourinary and respiratory tracts not entered	1 – 2
Clean-Contaminated	Gastrointestinal or respiratory tract entered but without spillage; oropharynx, sterile genitourinary or biliary tract entered; minor break in technique	2 – 4
Contaminated	Acute inflammation; infected bile or urine; gross spillage from gastrointestinal tract	7 – 10
Dirty	Established infection	10 – 40

Source: Graham and Pedler (2003)

The risk of SSI also depends on the extent of contamination at the site of operation as well as the patient's physical health status before surgery. Surgical wounds are classified as clean, clean-contaminated, and contaminated and dirty (see Table 1.2).

Table 1.3: American Society of Anesthesiology (ASA) classification of physical health status

ASA score	Physical status
1	A normal healthy patient
2	A patient with mild systemic disease
3	A patient with a severe systemic disease that limits activity but is not incapacitating
4	A patient with an incapacitating systematic disease that is a constant threat to life
5	A moribund patient that is not expected to survive 24 hours with or without operation

Source: Graham and Pedler (2003)

1.5 Infection prevention and Control in SSI

Surgical procedures by their very nature interfere with normal protective skin barrier and expose the patient to microorganisms from the environment causing infections. Infection resulting from this exposure may not be limited to the surgical site but may produce widespread effects. The control and prevention of SSIs has longed been identified as closely linked to the quality of health care provided by health institutions. Graves et al., (2007) have said that without preventive efforts, at least 3% of patients undergoing clean surgery and up to 30% of those undergoing contaminated or dirty surgery develop SSI. In view of this, most hospitals have instituted surveillance structures to ensure early detection and better control of SSIs. Prevention of SSIs is also of primary concern to surgeons, thus standards of prevention have been developed for every step of a surgical procedure to help reduce the exposure to microorganisms (Loo, 2008).

KATH like any other hospital has instituted some protocols aimed at preventing infections. According to the Policy Document made in the year 2009 for the hospital, prevention of infection requires an integrated and monitored system, which includes the following key components:

- Limiting transmission of organisms between patients in direct patient care through adequate hand washing and glove use, and appropriate aseptic practice, isolation strategies, sterilization and disinfection practices, and laundry practices;
- Controlling environmental risks for infection;
- Protecting patients with appropriate use of prophylactic antimicrobials, nutrition, and vaccinations;
- Limiting the risk of endogenous infections by minimizing invasive procedures, and promoting optimal antimicrobial use;
- Surveillance of infections, identifying and controlling outbreaks;
- Prevention of infection in staff
- Enhancing staff patient care practices, and continuing staff education.

Several printed materials and references relating to prevention and control of SSIs are unanimous in their approach. These include: hand washing/scrub, usage of hand gloves, wearing of surgical gowns and face and eye protection equipment (Yale Medical Group, 2003; KATH Infection Prevention and Control Manual, 2009).

To reduce SSI rates, it has been recommended that factors that are amenable to intervention in all three stages (pre-operative, during the surgery itself and post-operative are targeted, although it is obvious that in certain groups of patients one particular parameter may be more amenable to modification than others. Surveillance of SSI by surgeons, operating theatre staff and others, has also been found to contribute to the recognition of SSIs and result in reduced rates (Department of Health CMO, 2003). Houtman et al., (2004) reported that in the conduct of the German national nosocomial infection surveillance system, it was observed that there was a reduction in SSIs following hip procedures and a trend towards reduced SSI rates for knee procedures without specific interventions. In The Netherlands, where surveillance as part of quality systems is better developed than in many other countries, it has been detected that, a number of simple, not necessarily expensive interventions have been associated with a reduction in SSIs. These include undertaking orthopaedic procedures in theatres with better ventilation control, ample rinsing of the surgical site, producing an educational program for all operating theatre staff and abolishing the wearing of jewelry by the surgical team (Castella et al., 2006).

1.6.0 Pharmaceutical Care

Hepler and Strand (1990) defined pharmaceutical care as the direct, responsible provision of medication-related care for the purpose of achieving definite outcomes that improve a patient's quality of life. The principal elements of pharmaceutical care are that it is medication related, and care is directly provided to the patient. It is provided to produce definite outcomes, and these outcomes are intended to improve

the patient's quality of life. The provider accepts personal responsibility for the outcomes (American Society of Hospital Pharmacists, 1993).

Helper and Strand (1990) further argued that the goal of pharmaceutical care is to improve an individual patient's quality of life through achievement of definite (predefined), therapeutic outcomes such as cure of a patient's disease, elimination or reduction of a patient's symptoms, arresting or slowing of a disease process and prevention of a disease.

Pharmaceutical care thus involves three major functions: (1) identifying potential and actual medication-related problems, (2) resolving those problems, and (3) preventing potential medication-related problems. A medication-related problem is an event or circumstance involving medication therapy that actually or potentially interferes with an optimum outcome for a specific patient.

1.6.1 Surgical Antibiotic Prophylaxis

Several studies in the prevention and control of SSIs have concluded that the appropriate use and timing of surgical antimicrobial prophylaxis is a significant intervention in preventing SSIs (Walenkamp, 2003; Humphreys and Cunney, 2008). Carignan et al., (2008) opined that timing of antibiotic prophylaxis is critical to the prevention and control of SSI's. It has been said that, if the prophylaxis is given too soon, the antibiotic level will have fallen before the first incision. If the antibiotic is given too late, (i.e. less than 30 minutes before incision), blood and tissue antibiotic levels will be highest just after the period of greatest risk which is the initial phase of surgery. In a prospective observational study of 3,836 surgical procedures, the optimal

time for prophylaxis using Cefuroxime was determined to be between 30 and 59 minutes before the procedure (Carignan et al., 2008).

When the surgical procedure is prolonged, prophylaxis is continued beyond one or two doses.

Subsequent doses of prophylactic antibiotics beyond 24 hours post operatively are not recommended because of the association between overuse of antibiotics and the emergence of resistant strains of bacteria (Consumers Association 2001, 2003; 2004a).

Excessive use of antibiotics has led to the emergence of multi-drug resistant microorganisms such as methicillin- resistant staphylococcus aureus (MRSA) and multi-drug resistant Enterococcus strains.

Such complicated situations have reemphasized the need to focus on infection prevention steps as essential component of preventive medicine (Sepkowitz, 1995). Caution is required as even one to two doses may have adverse events. In particular, *Clostridium difficile* ribotype 027 has been associated with peri-operative antibacterial prophylaxis (Woodhead et al, 2002).

Again the antibiotic prophylaxis must be aimed at the bacteria most likely to infect the wound. (Griffin, 2005)

A wide variety of antibiotics, either singly or in combination, have been used. With regards to surgical prophylaxis, the data from studies support several recurring themes (Department of Surgical Education, 2006). Some protocols as documented by ICSI in 2010 are in Table 1.4.

Table 1.4: Recommended Drugs Protocols as documented by ICSI in 2010

Procedure	Likely Pathogen(s)	Recommended Drug	Alternative Regimen
Cardiothoracic	*Staph epidermidis, Staph aureus, Streptococcus, Corynebacteria*, enteric-Gram-negative bacilli	Cefazolin	Clindamycin
General Surgery	Enteric Gram(-) bacilli		
• Appendectomy (non-perforated)	Enteric Gram(-) bacilli, *Enterococcus*, anaerobes	Cefazolin + Metronidazole	Clindamycin + Aminoglycoside
• Colorectal Surgery		Cefazolin +	Clindamycin +
• High-risk esophageal, gastroduodenal, or biliary surgery	Enteric Gram(-) bacilli, Gram(+) cocci	Metronidazole	Aminoglycoside
• Penetrating abdominal trauma	Enteric Gram(-) bacilli, *Enterococcus*, anaerobes	Cefazolin Cefazolin + Metronidazole	Clindamycin + Aminoglycoside Clindamycin + Aminoglycoside
Gynecologic Surgery			Clindamycin +
• C-section (after cord-clamping)	*Staph epidermidis, Staph aureus*, Group B *Strep*, *Enterococcus*	Cefazolin	Aminoglycoside Clindamycin + Aminoglycoside
• Hysterectomy	Enteric Gram(-) bacilli, Group B *Strep*, *Enterococcus*	Cefazolin	Clindamycin + Aminoglycoside
Head and Neck Surgery	Anaerobes, *Staph aureus*, Gram(-) bacilli	Clindamycin	Cefazolin + Metronidazole
Neurosurgery	*Staph aureus, Staph epidermidis*		
• Clean	Anaerobes, *Staph epidermidis, Staph aureus*	Cefazolin Cefazolin	Clindamycin Clindamycin
• Skull fracture, CSF leak			
• Penetrating trauma	*Staph, strep*, Gram(-) bacilli, anaerobes	Ceftriaxone, Clindamycin	N/A
• Spine	*Staph aureus, Staph epidermidis*	Cefazolin	Clindamycin
Orthopedic Surgery			
• Closed fracture	*Staph epidermidis, Staph aureus*	Cefazolin	Clindamycin
• Open fracture	*Staph, strep*, Gram(-) bacilli, anaerobes	Cefazolin + Gentamycin	Clindamycin + Gentamycin
Urologic Surgery			
• Genitourinary (high risk only)e	Gram(-) bacilli	*Enterococcus* Cefazolin	Ciprofloxacin
Vascular Surgery	*Staph epidermidis, Staph aureus*, Gram(-) bacilli, E*nterococcus*	Cefazolin	Clindamycin

Source: Department of Surgical Education, Orlando Regional Medical Center, USA

1.7 Management of Surgical Site Infections

Stevens et al., (2005) have reported that the common practice, endorsed by expert opinion, in managing surgical site infections is to open all infected wounds, drain the pus and remove any infected material and continue dressing changes until wound heals. Table 1.5 outlines the treatment of SSIs.

They added, that if there is minimal surrounding evidence of invasive infection (5 cm of erythema and indurations) , and if the patient has minimal systemic signs of infection (a temperature of <38.5 ^{o}C and a pulse rate of <100 beats/min), antibiotics are unnecessary but for patients with a temperature of >38.5 ^{o}C or a pulse rate of >100 beats/min, a short course of antibiotics, usually for a duration of 24–48 h, may be required to adequately manage SSIs. Clinical Guideline (2008) indicates that antibiotic choice is usually empirical but can be supported by findings of Gram stain and results of culture of the wound contents.

Table 1.5: Treatment of Acute SSIs (Stevens et al., 2005)

Time	Action

<48 hours after procedure	• Overall, an SSI is unlikely at this time. Look for symptoms and signs
	  • True soft-tissue emergencies are necrotizing clostridial or mixed anaerobic cellulitis, or streptococcal necrotizing fasciitis. In this situation, the most important management steps include the following:
	• Urgent surgical consultation
	• Administration of a first dose of empiric antimicrobial therapy, based on likely causative microorganisms. Consultation with a pharmacist and consider using:
	  • Penicillin G + clindamycin
	  • Cefazolin + metronidazole
	  • Vancomycin + metronidazole

>48 hours after procedure	• Look for symptoms and signs
	• Open the wound, and culture for microorganisms
	• Consider ultrasound to rule out underlying abscess
	• For surgical procedures conducted above the waist (i.e., trunk, head, neck or upper extremities), consider the following antimicrobial therapy:
	  • Cefazolin
	  • Clindamycin
	  • Vancomycin
	• For surgical procedures involving the abdomen, perineum, genitourinary tract or lower extremities, consider the increased likelihood of surgical site contamination with microbial flora originating from the gut ("fecal veneer"). Consider the following antimicrobial regimens:
	  • Cefazolin + metronidazole (or clindamycin)
	  • Clindamycin + ciprofloxacin
	  • Vancomycin + metronidazole + ciprofloxacin

1.8.1 Wound Dressing

Clinical Guideline (2008) recommends an aseptic non-touch dressing technique which has been found to promote healing and prevent infection. This approach has been considered as the gold standard in the management of postoperative wounds and

prevents microorganisms on hands, surfaces and equipment from being introduced into the wound. Cleansing of surgical wounds is done with sterile saline solution.

Aside improving patient wellbeing, excess wound exudate or any mobile slough and wound debris is removed. The presence of dead (necrotic) or damaged (slough) tissue within a surgical wound healing by secondary intention almost certainly delays healing and acts as a medium for bacterial proliferation and therefore should be removed (the process of debridement) (Clinical Guideline, 2008).

Interactive dressings are used for wounds that are healing by secondary intention. Topical antimicrobial agents are not used on wounds that are healing by primary intention and eusol, gauze or moist cotton gauze or mercuric antiseptic solutions are not used for wounds that are healing by secondary intention.

1.8.2 The wound healing process

The normal wound healing process as described by the Clinical Guidelines (2008) in a publication titled `Surgical site infection prevention and treatment' is as described below.

The 'normal' wound healing process has been identified as involving three overlapping major phases which are inflammation, with cascades of processes that can be further subdivided into early (first 24 hours) and late phases (normally up to 72 hours), regeneration and maturation.

The wound healing process is a complex one that involves many interacting cells, cytokines and growth factors, carbohydrates and proteins, all of which cascade into

and act within the wound margins and across the wound bed at different rates and at different speeds.

The key cells that are involved in these processes have been identified as platelets, neutrophils, lymphocytes and macrophages for inflammation and macrophages and fibroblasts, for regeneration and maturation – the latter of which are linked with the deposition and regulation of collagen as well as wound contraction (myofibroblasts).Clinical Guidelines (2008) further explained that early inflammation (the first 24 hours) begins with haemostasis through vasoconstriction, thrombin formation and platelet aggregation. Platelets release cytokines and other factors that directly influence leukocyte and monocyte activity. Late inflammation (24–72 hours) involves the release of vasodilators and other agents that increase the permeability of the local capillary bed allowing serum and white cells to be released into the area surrounding the wound, through complex interactions of adhesion molecules, and other systems, in margination and diapedesis.

The function of this phase of wound healing is to ensure that the wound bed is free of bacteria and other contaminants creating the optimum environment for the production of granulation tissue and subsequent epithelialisation.

Regeneration follows over the next few days to weeks and this phase of the wound healing process is characterised by an increase in fibroblast mitogenic activity and endothelial cell mitotic activity, with epithelial cell migration and the synthesis of collagen and metalloproteinases. This is a very dynamic balance of synthesis and breakdown of tissues and cells (Clinical Guideline, 2008).

Maturation, which is also known as the remodeling phase, is the final phase of wound healing and can take up to 2 years to complete. Granulation tissue gradually matures into scar tissue, which over time pales (as the neovascularisation required for healing by scar tissue redresses), shrinks and thins (Waldrop et al 2000). This repair process is governed by fibroblasts and proteases that normally maintain a balance between deposition and degradation of tissue. Over time, immature collagen fibrils are replaced by mature collagen fibres, improving the tensile strength of the scar tissue, but only to 80% of that of normal skin (Waldrop et al., 2000).

1.9 Problem Statement

Recognizing, surgical wound infection is common and has existed over centuries, and that after every major surgery, a patient has a 2 to 5 percent chance of developing an infection at the site of incision (Shute, 2005), or that those who get these infections are two to three times more likely to die, five to six times more likely to be readmitted to the hospital, and likely to stay in the hospital twice as long as patients without infections, about 56 hospitals in the United States of America, in 2005, collaborated in the bid to improve their operations and ultimately reduce post surgical infections to the barest minimum (Dellinger et, al., 2005). If the hospitals in the advanced countries have recognized the danger posed by post-operative infections and are doing all they can to reduce its emergence, it would be improper for health institutions in Ghana to ignore these issues.

The Annual Report of the Surgery Directorate, KATH for the year 2012 indicates that, 4408 major operations were performed giving an average of 12 patients per day

in KATH alone. In-patient services in the directorate for that year were also 4016. The report also indicates mortality rate for the same period to be 242 patients representing 6.2 per cent. The report failed to indicate the contribution of post surgical infections to this worrying trend. Preliminary review of available literature in the country in the area of post surgical infections did not yield much. Considering the number of surgeries performed annually, it would be unfair to the people of Ghana if a study is not carried out in this area to ascertain the extent to which patients' surgical incisions are infected, causes and how they are managed.

The purpose of this study is to determine the prevalence, causes and management of post-operative infections in the surgical wards, and proffer some solution if problems are found.

1.10.0 Aims and Objectives

1.10.1 Aim

The primary goal of the study is investigate the prevalence, causes, management and outcomes of post surgical infections at the Komfo Anokye Teaching Hospital.

1.10.2 Specific objectives:

The specific objectives are;

- To identify the extent of post-surgical infections at the ward
- identify the possible causes of the post-surgical infections at the ward
- Assess the quality management of these infections at the wards against standard protocols and outcomes of management.
- To identify and resolve Pharmaceutical care issues.

CHAPTER TWO

RESEARCH METHODS

2.1 Research questions

The main research questions that were derived from the objectives set were:

a. What was the extent of post operative infections at the surgical directorate of KATH within the study period?

b. What were the causes of these infections?

c. How were these infections managed?

d. What were the outcomes to the treatment for such infections?

e. What were pharmaceutical care issues?

2.2 Research Strategy

The research strategy adopted included both quantitative and qualitative approaches. Neuman (2003) argued that though quantitative and qualitative research differs in many ways, they complement each other, thus both methods were seen as appropriate strategy to help in answering the research questions and were therefore adopted for the study.

Patient records and interviews were the major research tools used in investigating the research questions. Basically, data were collected via the following steps: (1) extracting of information with data collection sheets (Appendix I) from patient's folders; (2) interview procedures were used to ask prescribed questions and answers recorded; (3) answers analyzed.

2.3 Research focus and Sampling

The study focused on adult patients who had undergone abdominal surgery and were admitted to the ward. All four wards where abdominal surgery cases are usually admitted (B1, B2, C3 and C4) were covered. All surgeries, in which the abdominal cavity was entered, except obstetrics and gynaecology cases, were considered. Patient excluded were those under 18 years, patients whose surgical procedure required the use of implant and the immuno-suppressed (HIV-AIDS and cancer patients).

Patton (2001) has said that, the most important issue in sampling for qualitative research is to cover variation and make sure that different situations and views are represented in the data. Sharkey and Larsen (2005) also stressed that, this sample allow for theoretical generalization in the data analysis. In the light of the above, four specialist surgeons and four nurses-in-charge were interviewed. To identify other pharmaceutical care issues, a follow-up interview was conducted with one nurse from each of the four wards.

2.4 Access, role and ethics

As a Clinical Pharmacy student, my independence as a researcher was strengthened while at the same time complicating the insider-outsider characteristic of my position (Sharkey and Larsen, 2005). Permission was sought from the directorate in which the study was carried out. The study was also registered at the research and development unit, and approval sought from the ethics committee KATH/KNUST.

Patients consent was also sought before data collecting sheets were used in extracting information from patient folders. The rights of patients who declined to divulge information about their health and treatments was respected. They were not included in the study. (See appendix 1 for copy of patient consent form).

2.5 Data Collection

A mixed-method approach was used in data collection for the study. This was to help achieve the research objectives. To achieve the first objective, which was, to identify the prevalence of surgical site infections at the wards, several approaches were adopted. Mead et al, (1986) have said that, the direct method, with daily observation of the surgical site by the infection prevention and control professional starting, is the most accurate method of surveillance. Anderson et al, (2008) argued that even though the direct method is the "gold standard" for studies, it is rarely used in practice because of its resource utilization requirements and impracticality.

Surveillance by way of, observation of surgical wound dressing procedures, review of patient medical records and microbiology reports and, screening for readmission of

these surgical patients, were adopted to aid in answering the objective number one. This approach has been found to be less time consuming and can readily be performed (Anderson et al, 2008). It has also been described as both reliable with the accuracy of sensitivity as high as 84% - 89% and specificity 99.8% as compared with the "gold standard" of direct surveillance (Baker et al., 1995).

Participants were monitored for thirty (30) days after the operation. Surgical site infection was diagnosed if any of the following signs were observed: serous or purulent discharge from the wound, fever > 38˚C , tenderness at the surgical site, wound dehiscence or wound deliberately opened up by a surgeons because of localised or serous purulent collection.

2.6 Analysis

The data collected from the patients' folders and interviews conducted with the surgeons were entered unto and analysed using descriptive statistics with the aid of Microsoft Excel. Further, the interviews were transcribed and content analysed which helped to determine and measure agreement of perception of the respondents.

CHAPTER THREE

RESULTS

This chapter presents results of the exploratory interviews with some selected surgeons and nurses at the study area as well as the results of the data collected from patient's folders.

3.1 Respondents Profile

There were 264 beds in the directorate of surgery with the total number of patients in the general surgery wards being 144.

Number of patients who consented and were enrolled was 86.

Number of patients who met the inclusion criteria was 82.

Number of patients with incomplete data set was 1.

The number of patients whose forms were completed was 81 giving a percentage of 98.8%.

The respondents were made up of four surgeons, four nurses and eighty-one (81) patients. Details of the respondents profile is presented in Table 3.1. Eighty -Six patients were enrolled but eighty-one (81) were studied. Four did not meet the inclusion criteria and there was one incomplete data set for a patient. Sixty-Nine percent (n=56) of patients were male and 31% were females. Out of the 81 patients

more than 60% were between the ages of 21 – 40 years. A detail of the age profile is presented in figure 1.

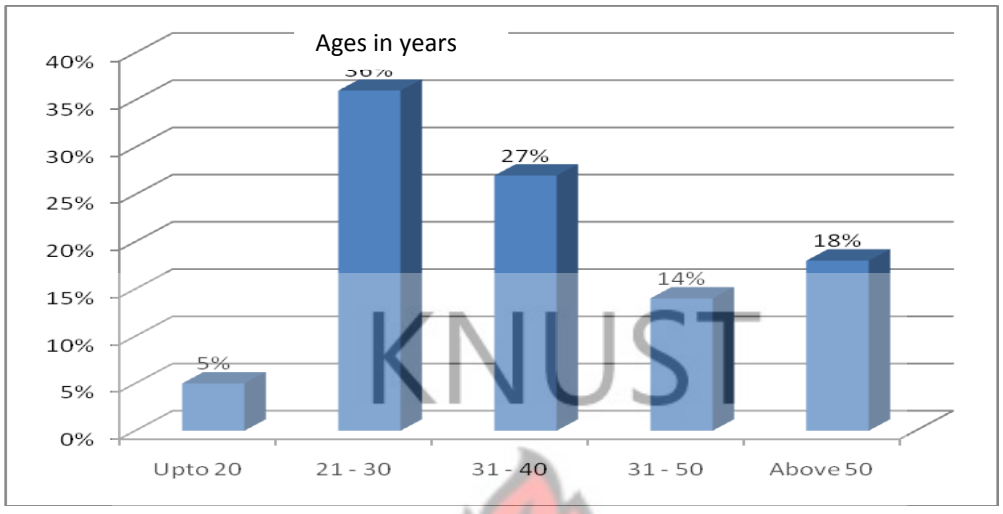

Figure 1: Age of Patients

Table 3.1: Detailed Respondents Profile- General Surgeons and Nurses

Surgeons	**Rank**	**Years of Experience**
S1	Consultant surgeon	3 years (as consultant,) 7yrs as specialist surgeon, 13yrs as doctor
S2	Senior Specialist	12 years (as surgeon),19years (as a doctor)
S3	specialist surgeon	10 years (as a doctor)
S4	Senior Specialist	8 years (as surgeon),15years (as a doctor)
Nurses	**Rank**	**Years of Experience**
N1	Senior nursing officer	17 years(as a nurse)
N2	Principal nursing officer	23 years (as a nurse)
N3	Principal nursing officer	5 years in surgery directorate
N4	Principal nursing officer	13 years in surgery directorate

3.2 Prevalence of SSI

On surgical site infection, 32 had infected surgical wound out of 81 patients, representing 40% surgical site infection rate at the ward.

Majority of the patients (n=28), had SSI whilst on the ward with only 4 detected after discharge.

It was also discovered that, it took an average of 8 days for SSI's to develop and be detected. It was observed that 65% of the patients surveyed spent a maximum of 10 days whilst 5 patients representing 6% spent more than 30 days at the hospital. Details of the days spent at the hospital are presented in figure 2. On average, a patient spent a total of 11 days at hospital after surgery. Two patients died representing a death rate of 2% of the patients surveyed within the two months period of the study.

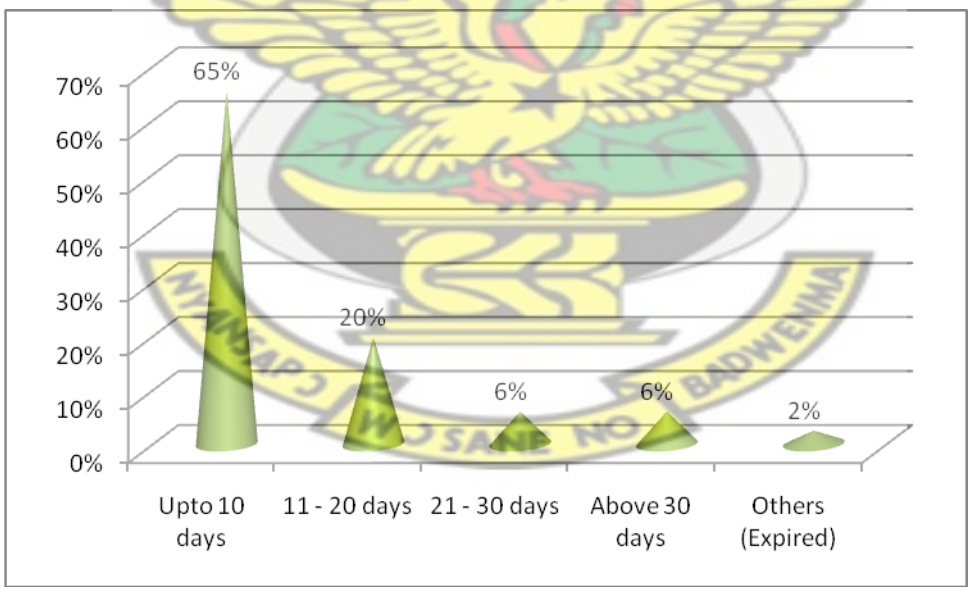

Fig 2: Number of day's patients spent at the ward

The infection rate according to wound class was 29% (n=2) in clean wounds and 49% (n=18) in dirty wounds (Table 3.2).

Table 3.2: Surgical Site Infection According to Wound Class at KATH

Wound Class	No. of Cases	No. Infected	Percentage Infected
Clean	7	2	29%
Clean Contaminated	30	9	30%
Contaminated	7	3	43%
Dirty	37	18	49%
Total Infected	81	32	40%

The study detected eight (8) types of abdominal surgical procedures (Table 3.3). They were Laporatomy, Splenectomy, Cholecystectomy, gastric surgery, Appendicectomy, small bowel surgery, colon surgery and Herniorrhaphy. The majority of the cases were small bowel surgeries, Appendicectomy, laparotomies and Herniorrhaphy. The category, (surgical procedure) with the highest SSI percentage was small bowel surgery 70% (n=7). Again, a correlation is noted between the wound infection rate and the contamination of the wound. The least counted was Splenectomy of which none got infected.

Table 3.3: Surgical Site Infection According to Surgical Procedure

Surgical Procedure	No of cases (N=81)	No. Infected (N=32)	Percentage
Colon Surgery	4	2	50%
Small bowel surgery	10	7	70%
Herniorrhaphy	21	7	33%
Appendicectomy	14	3	21%
Gastric Surgery	4	1	25%
Cholecystectomy	2	0	0
Laparotomy	23	12	52%
Splenectomy	3	0	0

3.3 Causes of SSI

To determine the possible causes of SSIs presented in tables 3.4 and 3.5, respondents were asked to indicate what they perceived as possible sources of SSIs in the wards and the theatres. One nurse-in-charge (N1) cited the fact that some nurses failed to use proper procedures/steps during wound care. By inference, another nurse (N2) agreed with this assertion by admitting that contamination or infection of surgical wounds could be attributed to some actions and inactions of the hospital staff. This assertion was echoed by two (2) of the surgeons (S1 and S2) interviewed.

They attributed surgical wound infection at the hospital to non-adherence to aseptic techniques by hospital workers.

Another factor that immerged prominent from the interview was low immunity levels of patients. Two nurses and two surgeons agreed on this score. It was suggested that some patients report late and arrive when they are severely ill and are immuno-compromised.

One surgeon (S2) in his response to the causes of SSIs reported that contamination at the site of surgery and improper preparation of site before incision are major causes.

Ward environment was also identified as critical to the infection rate at the hospital. Two surgeons and two nurses associated surgical site infection to deplorable ward and theatre conditions. The respondents opined that the wards and theatres were not clean and favorable enough, and there were no proper grouping of cases thereby increasing infection acquisition and transfer between patients. This situation was compounded when there were electricity outages and water shortages. This situation was described by one of the surgeons (S1) as “absence of sterility” at the wards.

Table 3.4: Results of Interview on Causes of SSI's -Surgeons

Questions	S1	S2	S3	S4
Q1. What are the causes of SSI's?	-Non-adherence to aseptic technique (lack of instruments, shortage of water, electricity outages) -Talking too much during surgery -Too many people in the theatre (students population too high-20/theatre) -Sterility is absent in the ward -no proper demarcation of cases on ward	-Non-adherence to aseptic technique -Impropriate preparation of incision site -contamination at site of surgery	-Immune compromise -obesity, organ failures and nature of surgery -wrong suture materials	-Ward environment not clean
Q2. What is done at the theatre to prevent/reduce SSI's?	Scrubbing of hands	-Wearing clean gown, prescribed foot wears -Sterilizing instruments -Removal of extras (rings, other jewelry etc.)	-Wearing of sterile gloves -draping of site with sterile towels -Double gloving is done	-The wearing of theatre gown and foot wear
Q3. How is hand decontamination done prior to operation?	Scrub with carbolic soap for 5min 1st case and 2mins in between subsequent cases	Scrub hands up to distal $^1/_3$ arm with hibiscrub, chlohexidine between 5 – 10 minutes	Scrub hands up to 5mins with hibiscrub, or chlohexidine from finger tips to elbow.	-Using savlon or carbolic acid -Scrub from finger tips to elbow for at least 5mins.
Q4. Are SSIs common on your wards?	Yes	No	Yes	Yes

One surgeon also commented that most of the time there were too many people in the operating room in the theatre especially students, which results in frequent opening and closing of doors. Additionally, too much talking during surgery also can lead to increased infection in the surgical patient.

The results from the exploratory interview on the causes of surgical site infections obtained are: non adherence to aseptic techniques both during wound dressing at the wards and in the theatre, "absence of sterility "of wards and theater, improper demarcation of surgical cases, large number of people in the theatre operating rooms during surgical operations, improper preparation of incision sites and patients' health status before surgery (co-morbidities or immuno suppression).The key issues identified as transcribed from the interview are presented in Table 3.4 & 3.5.

Table 3.5: Results of Interview on Causes of SSI's -Nurses

Questions	**N1**	**N2**	**N3**	**N4**
Q1. What are the causes of SSI's	Non-adherence to aseptic technique	Infection from Staff and patients themselves	Low immunity of patients, wound class & 'septic wound dressing'	_
Q2.What are the possible causes of SSI's at the ward	-unfavorable ward environment -nutritional status of patients -Lack of antibiotics for prophylaxis -Non adherence to aseptic wound dressing	_	Immobility of patients after surgery	-Ward and theatre environment -Patients immunity -Patients skin flora
Q3. Are SSI's common at the ward	Some how	Yes	Yes	Not common
Q4. What do you do to prevent SSI's	-Efforts are to adhere to Aseptic techniques	-Using sterile gloves when dressing wounds	Aseptic wound dressing -Alcohol hand rob in wound dressing -Serve pt. medication	-Cleaning ward environment -wounds are dressed from clean to dirty -Using sterile instruments -sterile gloves

3.4 Management of SSI

The results from the survey indicate that, 28 (88%) of the 32 infected cases were treated with antibiotics and dressing changes. Details of antibiotics used are presented in figure 3.

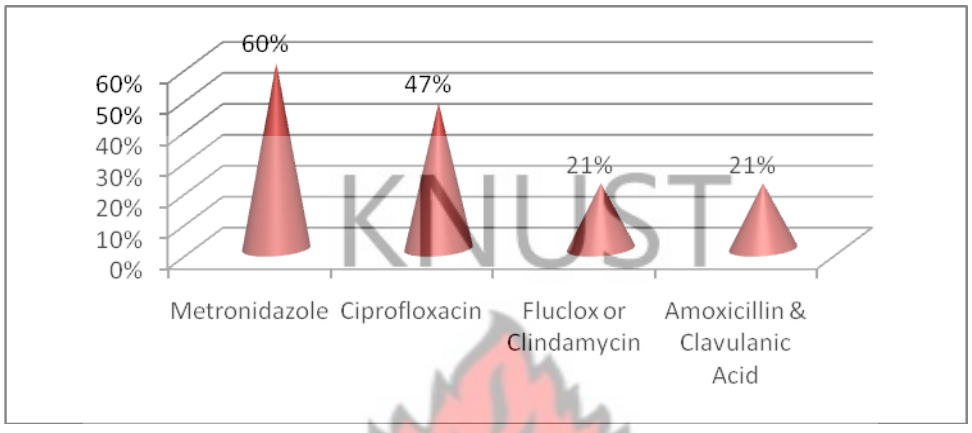

Fig.3: Antibiotics Used

Almost 60% (n=19) of these patients with SSIs received the antibiotic metronidazole for those cases which were possibly infected with anaerobic microorganisms. This was usually the case if the intestinal tract was entered. Clindamycin which also provides gram-positive anaerobic coverage was prescribed in some cases.

About 47% (n=15) of patients received ciprofloxacin, a quinolone antibiotic that is effective against both gram negative and gram positive bacteria.

Again, almost 10% (n=3) of these patients received ceftriazone, a third generation cephalosporin antibiotic and about 7% (n=2) had Cefuroxime in their treatment regimen. Only one (3%) was given ceftazidime after her wound swab result showed E. coli, a gram-negative bacillus, as the infecting organism.

Twenty one percent were given either Flucloxacillin or clindamycin to treat infections likely to be caused by gram-positive organisms, the most common being staphylococci.

Similarly, 21% (n=7) were given amoxicillin plus clavulanic acid which possess activity against both gram-negetive and gram positive bacteria and some anaerobes.

The most frequently prescribed combination was ciprofloxacin and metronidazole given to about 31% (n=10) of the patients because of the wide spectrum the combination provides against enteric bacteria, also because these two antibiotics are always available and affordable and as well covered under NHIS. Details of management of the SSI's surveyed are presented in Table 3.6.

The topical agent used in dressing changes of the wound was mostly 0.9% sodium chloride, an isotonic solution used in the cleansing of wounds. The topical antimicrobial agents mainly povidone iodine and acetic acid (1% or 2%) were used only when the wounds became dirty or infected. Acetic acid has activity on Pseudomonas spp and so it was used when wound swab culture and sensitivity results yield this organism or is suspected by the surgeon to have colonized the wound (turns greenish).

In managing these infections, samples of pus/wound swab were taken to the laboratory for culture and sensitivity testing in 12 cases representing 38% but results were obtained for only 8 of them. *Klebsiella species* was found in 2 cases, *Pseudomonas species* in 3 cases, coliforms in 2 cases and *E. coli* and MRSA both isolated in one case. Anaerobic bacteria cultures were not done in the cases surveyed.

Seventeen patients representing 53% had their infection empirically treated in combination with dressing changes with topical antimicrobial agents like povidone iodine, sometimes Acetic and hydrogen peroxide lavage, whereas three cases were managed with only dressing changes with topical antimicrobial agents.

3.5 Pharmaceutical Care Issues

A follow-up interview of nurses from each of the four wards on drug administration revealed a number of care issues of pharmaceutical importance which include; (1) Separation of the administration of calcium containing solutions from that of ceftraixone by a minimum of 48 hours was not done (2) flushing of intravenous lines before and after the administration of metronidazole was also not done. Other pharmaceutical care issues identified from prescriptions in the patients folders are presented in Table 3.6.

Table 3.6: Management of surgical site infections

Patient Code	Age (yrs)	Management				Results and Remarks	Pharmaceutical Care Issues
		Oral Drugs Therapy	Parenterals	Topical Agent for dressing	Culture and Sensitivity of Wound swab		
P2	43	Tb ciprofloxacin 500mg bid x 7 Tb. Metronidazole 400mg tds x 7	IV ceftriaxone 1g bid x 72hrs IV metronidazole 500mg tds x 72hrs. IV Raniditine 25mg bd x 5	_	No	_	Should not be given with solutions containing calcium
P4	56	Tb. Nifedipine 30mg daily x 30 Tb. A/L 4bd. x 3	IV Ceftazidime 1g tds x 5 IV N/S - 2L x 24hrs	5% acetic acid	Yes	Gram negative rods present, E. coli isolated, sensitive to Amikacin, Ceftazidime, Greenish wound	Carbon dioxide generated must be expelled before injection
P6	29	Discharged on Cap Flucloxacillin 500mg qds x 7	IV. Astymin 200ml tds x 5, IV. Celepid 500ml dly x 5, im. Pethidine 50mg qid x 24hrs. IV N/S - 2L x 24hrs, IV R/L - 2L x 24hrs	_	Nil	Yellowish pus	Flucloxacillin may cause cholestatic jaundice and hepatitis

Table 3.6: Management of surgical site infections cont'd

Code	Age (yr)	Management				Remarks	Pharmaceutical Care Issues
		Oral Drug Therapy	Parenterals	Topical Agent for dressing	Culture and Sensitivity		
P8	29	Discharged on Tb. Ciprofloxacin 500mg bd x 7 Tb. Metronidazole tds x 7	IV Ceftriaxone 2g daily x 3 Inj. Diclofenac 75mg bd x 3 inj Pethidine 50mg qid x3	_	Yes	*Klebsiella spp* isolated, sensitive to Amikacin, Could not afford Amikacin.	Should not be given with solutions containing Ca^{2+}, monitor for side effects, GI ulceration increased.
P9	21	Tb. Metronidazole 400mg tds x 7 Tb. Ciprofloxacin 500mg bid x 7	_	Povidine Iodine	No	Infection detected on review	_
P12	31	Tb. Amoxicillin/clavulanic acid 625mg bid x 7 Tb. Metronidazole tds x 7	IV R/L IL, IV D/S 2L	_	No	Infection detected on post-discharge review	_
P14	65	Tab Diclofenac 50mg tds x 5	IV Ceftriaxone 2g daily x 3 IV Metronidazole 500mg tds x 3 IV N/S 1.5L IV R/L 1L, IV D/S 1L	Povidine Iodine solution(10%w/v)	No	Readmitted with greenish wound	Should not be given with solutions containing calcium

Table 3.6: Management of surgical site infections cont'd

Code	Age (yr)	Management				Remarks	Pharmaceutical Care Issues
		Oral Drug Therapy	Parenterals	Topical Agent for dressing	Culture and Sensitivity		
P18	58	Discharged on Tb. Amoxicillin/clavulanic acid 1g bid x 7 Tb. Metronidazole 400mg tds x 7	_	_	No	_	_
P19	42	Tb. Ciprofloxacin 500mg bid x 5 Tb. Metronidazole 400 mg tds x 7	Rocephine 2g bd x 72hrs	_	No	_	Should not be given with solutions containing calcium
P20	18	_	Pethidine 50mg tds x 72 hrs In N/S 1.5L daily, Iv RIL 1.5L daily x 48hrs	_	No	Abscess at epigastrum, Wound dehiscence, I&D done.	_
P24	91	I.v Amoxicillin/clavulanic acid 1.2g tds. x 3 i.v Metronidazole 500mg tds x 3	_	_	No	Died 4 days post-op	_

Table 3.6: Management of surgical site infections cont'd

Code	Age (yrs)	Management				Remarks	Pharmaceutical Care Issues
		Oral Drugs Therapy	Parenterals	Topical Agent for dressing	Culture and Sensitivity		
P26	20	Discharged on Tb. Metronidazole 400mg tds x 7 Ciprofloxacin 500mg bid x 7	–	–	No	–	–
P31	21	Tb. Ciprofloxacin 500mg bid x 5 Tb. Metronidazole 400mg tds x 7	–	–	Yes	Result not retrieved	–
P32	*52*	Discharged on Cap. Clindamycin 300mg qid. x 7	IV Metronidazole 500mg bd x 3 IV Ciprofloxacin 400mg tds x 3, then, IV Gentamycin 80mg tds x 3 after wound swab results. Im. Diclofenac Im. Pethidine	Povidine Iodine solution	Yes	*Pseudomonas spp* isolated. Sensitive to Amikacin, Ciprofloxacin, Gentamycin, Ceftazidime	Inappropriate frequency of administration of both ciprofloxacin and metronidazole
P33	49	Tb. Amoxicillin/clavulanic acid 625mg bid x 14 Tb. Metronidazole 400mg tds x 14	–	–	Yes	Results not retrieved	–

Table 3.6: Management of surgical site infections cont'd

Code	Age (yrs)	Management				Remarks	Pharmaceutical Care Issues
		Oral Drugs Therapy	Parenterals	Topical Agent for dressing	Culture and Sensitivity		
P35	55	Discharged on Tb Cefuroxine 500mg bid x 7	IV Cefuroxine 1.5g stat, 750mg tds x 72hrs IV Metronidazole 500mg tds x 72hrs	_	Yes	_	_
P36	*30*	Amikacin 300mg tds x 7 after wound swab results.	_	1% acetic acid	Yes	*Pseudomonas spp* Isolated, Sensitive to Amikacin.	_
P40	92	Tb. Amoxicillin/clavulanic acid 625mg bd. x 7 Tb. Ciprofloxacin 500mg bid x 7 Tb Amlodipine 5mg daily Tb Lisinopril 10mg dly	Im Fragmin 5000 iu SC dly x 7 IV Fluids	Dressing at KNUST. Hospital	No	Infection detected on post-discharge review	_
P43	18	Metronidazole 400mg tds x 7 Cap. Flucloxacillin 500mg qid. x 7	_	Povidine Iodine	No	Pus accumulation at some points on wound(on review)	_
P44	*65*	Tb. Amoxicillin/clavulanic acid 625mg bd. x 7	IV N/S 1L	Povidine Iodine after cleaning with normal saline	Yes	*Pseudomonas spp*	_

Table 3.6: Management of surgical site infections Cont'd

Code	Age (yrs)	Management				Remarks	Pharmaceutical Care Issues
		Oral Drugs Therapy	Parenterals	Topical Agent for dressing	Culture and Sensitivity		
P46	23	Tb metronidazole 400mg tds x 7 Tb. Ciprofloxacin 500mg bid x 7 Discharged on: Tb. Cefuroxime 500mg bid x 7 Metronidazole 400mg tds x 7	Im Pethedine 50mg qid x 48 im Diclofenac 75mg bd x 48hrs	_	No	_	Increased the risk of bleeding/hemorrhage. Possible increased risk of convulsions
P48	33	Cap. Clindamycin 300mg qds x 10	Im Pethidine 50mg qid x 48hrs IV N/S 1L, IV R/L 2L x 48hrs	Povidine Iodine	No	_	Could cause pseudomembranous colitis which requires discontinuation of drug
P52	24	Cap. Clindamycin 300mg qid. x 7 Tb. Metronidazole 400mg tds x 7	im Diclofenac 50mg bd x 5	Povidine Iodine/ Hydrogen peroxide	Yes	Result not retrieved	Could cause pseudomembranous colitis which requires discontinuation of drug

Table 3.6: Management of surgical site infections cont'd

Code	Age (yrs)	Management				Remarks	Pharmaceutical Care Issues
		Oral Drugs Therapy	Parenterals	Topical Agent for dressing	Culture and Sensitivity		
P55	35	Tb. Ciprofloxacin 500mg bid x 14	Im Diclofenac 50mg bd x 5, Im Pethidine 50mg qid x 48hrs IV N/S 3L, Iv R/L 1L Inj ATS 1500 stat	Povidine Iodine	No	Wound greenish. *Pseudomonas* Infection detected on review	Possible increased risk of convulsions
P59	65	Tb. Ciprofloxacin 500mg bid x 14	*Im Pethidine 100mg tds x 48hrs* Im Diclofenac 50mg bd x 5	Povidine Iodine/ Hydrogen peroxide for, lavage then Acetic acid +Normal Saline +Hydrogen peroxide lavage	No	_	Possible increased risk of convulsions
P61	40	Discharged on: Tb. Ciprofloxacin 500mg bid x 7 Cap. Flucloxacillin 500mg qid. x 7	IV Amikacin 500mg od x 72hrs	_	Yes, c/s blood	No bacterial growth after 5 days incubation	Flucloxacillin could cause cholestatic jaundice and hepatitis

Table 3.6: Management of surgical site infections cont'd

Code	Age (yrs)	Management				Remarks	Pharmaceutical Care Issues
		Oral Drugs Therapy	Parenterals	Topical Agent for dressing	Culture and Sensitivity		
P62	39	Tab Albendazole 400mg bd x 28 days	IV Ciprofloxacin 400mg tds x 5 IV Metronidazole 500mg bd x 5 IV R/L 2L, 1L N/S x 24hrs IV Astymin & Celepid bd administration	_	No	_	Monitoring of liver function required, Inappropriate frequency of administration of both Ciprofloxacin and Metronidazole
P69	38	Tb. Ciprofloxacin 500mg bid x 10 Tb. Metronidazole 400mg tds x 10	IV Zinacef 1.5g then 750mg tds x 3days	_	No	_	_
P71	68	Cap. Flucloxacillin 500mg qds x 5	IV Amikacin 250mg od x 5 Im Pethidine 50 mg 6hrly x 48hrs IV R/L 1L, IV 5% Dextrose 2L x 72hrs Sc Clexane 40mg dly x 7	Povidine Iodine	Yes	Coliforms isolated, Sensitive to Amikacin and Ceftazidime	Fluclox could cause cholestatic jaundice and hepatitis

Table 3.6: Management of surgical site infections cont'd

Code	Age (yrs)	Management				Remarks	Pharmaceutical Care Issues
		Oral Drugs Therapy	Parenterals	Topical Agent for dressing	Culture and Sensitivity		
P72	45	Tb. Ciprofloxacin 500mg bid x 7	Im Pethidine 50 mg qid 48hrs Im Diclofenac 75mg bd 48hrs Iv Celemin + Celepid	_	No	Dressing soaked with greenish fluid.	Increased risk of CNS stimulation, seizures.
P75	35	Cap. Clindamycin 300mg qid. x 5	I.V Vancomycin 500mg 6hourly x 5 i.v Levofloxacin 500mg bid x 72hrs	_	Yes	1. E. coli 2. MRSA	_
P78	*42*	Tb. Amoxicillin/clavulanic acid 625mg bid x 10	Im Diclofenac 75mg bd x 2 Im Pethidine 50mg qid x 2 Sc Fragmin 5000 iu x 7	Povidine iodine	Yes	*Klebsiella spp* isolated sensitive to Ceftazidime, Amikacin. Could not afford these.	_

CHAPTER FOUR

DISCUSSION

4.1 Prevalence of SSI's

Previous studies in the year 2009 showed that surgical sites infections varies from 0.5 – 5% depending of the type of surgery (lnfection Prevention and Control Manual, KATH, 2009). This study however revealed an alarming rate of 40% overall prevalence rate after abdominal surgery. it is above the infection rate in so many places. The incidence in America is reported as 5% (Cheadle, 2006) and 4.65% in England (Hospital Infection Society and Tissue Viability Nurses Association, 2007). The high infection rate identified in this current study suggests there has either been a dramatic increase over these last few years or the rate as quoted in the manual was an underestimation. A dramatic increase seems more likely because two of the nurses frankly admitted that SSIs were common on the wards. Again three out of four surgeons confirmed SSIs were common on the wards.

Such a high prevalence revealed by the study requires urgent attention by all, bearing in mind the financial implication to both patients and hospital management. It is important to suggest that steps are taken to reduce the rate of infections to an acceptable level. The surgical procedure with the highest SSI percentage was small bowel surgery (70%) because the small bowel as well as the large, is colonized by lots of bacteria increasing the risk of infection in that category.

It needs to be mentioned that the percentages for small bowel category) obtained could be due to the small numbers of the different cases presented as well as the short

study period, thus it is suggested that further studies are done with a larger number and longer duration.

4.2 Causes of SSI's

Reddy (2012) categorized the causes of SSI's into three groups, namely patient factors, environmental factors and treatment factors. The result from the interview on the causes of SSI's revealed some environmental factors which include; poor ward and theatre environment which were cited by 4 respondents. Additionally S1 gave, "absence of sterility on wards", improper demarcation of surgical cases, and large number of people in the theatre operating rooms during surgical operations as causes in his opinion. Treatment factors mentioned were; improper preparation of incision sites, non-adherence to aseptic technique, from N1, N3, S1, and S2, using wrong suture materials(S3), lack of instruments(S1), and lack of antibiotics from N1. Patients' health status (co-morbidities or immune- suppression) before surgery said by S3, N3, N4, N1, contamination at site of surgery by S2 and N3 and patient's mobility (N3) were patient factors iterated. Frequent Shortages of water and power outages were also mentioned by S1.

Having so many people in the operating room has the tendency to increase the rate infection because large number of microbes is disseminated in that atmosphere as a result of too much movement, opening and closing of doors and from all these individuals. Therefore the practice where large number of students congregates around a surgical patient during a procedure could explain, in part, the high prevalence rate attained and needs to be addressed.

Another factor identified as causing SSI's in this study was improper demarcation of surgical cases on the wards, i.e. when patients who undergo clean procedures lie next to those who have had contaminated or dirty surgery. This will ultimately promote cross infection among patient on the ward and more so when aseptic wound dressing is not adhered.

Patients' immunity level was also identified as a risk factor to SSI which was mentioned by four respondents suggesting that it is common among these patients admitted thus contributing to the rate observed. When immunity is low, wound healing is delayed and infection risk is increased.

Poor ward and theatre environment and non-adherence to aseptic technique as were said by, again, four respondents undoubtedly contributed immensely to causing SSIs. The effect is increased microbial density on surfaces and on objects in these places which can easily be transferred to the patient.

It appears that even though the KATH Infection Prevention and Control manual has iterated steps and procedures to be used both at the wards and theatre to prevent infection and create a hygienic environment for patients and staff, these are not being followed strictly and this has become evident in the high incidence of SSI revealed by the study. All these problems should be addressed by hospital management through the IPC team.

4.3 Management of SSIs.

Infections of surgical wounds have long been identified as the single most common adverse events affecting hospitalized patients who have undergone surgery (Brennan et al., 1991).

Patients undergoing surgery are said to be exposed to infection (Graves et al 2007). This suggests that SSIs may be inevitable and that its management is essential to reducing mortality.

The primary, and most important, therapy for SSI is to open the incision, evacuate the infected material, and continue dressing changes until the wound heals by secondary intention (Stevens et al., 2005).

Even though the prescription and subsequent giving of antibiotics in SSI's has been found to have little or no evidence of benefit, this is the practice in the wards surveyed. (Huizinga et al. 1986, Stevens et al., 2005).

As has been indicated in the results of this study, twelve of the infected cases had culture and sensitivity testing done whilst the rest (i.e.20 cases) and those whose microbiological reports could not be retrieved were empirically treated.

Of those that were empirically treated, it is assumed *S. aureus* and *streptococcal species* were the likely pathogens. In the clean procedures, mixed gram positive and gram negative flora are expectetd. Anaerobic organisms are expected in cases where the intestinal tract or hollow viscus is entered (Stevens et al, 2005). In traumatic wounds and ruptured viscera coliforms, anaerobes, S*treptococcus spp*, and clostridia spp are implicated.

To properly treat mixed aerobic and anaerobic infections, antibiotics effective against both aerobic and anaerobic components of the infection must be selected. Metronidazole, penicillin plus a beta lactamase inhibitor (e.g. amoxicillin and clavulanate in cases P12, P18, P24, P33, and P40), carbapenems (e.g. imipenem, meropenem,) and a newer quinolones (i.e. moxifloxacin,) are effective against *B. fragilis* group (The 2010 American Surgical Society and American Society of Infectious Diseases guidelines).

Antibiotics effective against *Enterobacteriaceae* are aminoglycosides, fourth generation cephalosporin; (e.g. cefepime, ceftazidime in case P4) and quinolones were used in cases P2, P62, P72, P69, and P75. Single-agents such carbapenems or penicillin plus a beta lactamase inhibitor are as effective (seen in cases P44 and P78) as combination therapies but sometimes are not effective against hospital-acquired resistant bacteria. *S. aureus* present in an abscess is treated with anti-staphylococcal agents. MRSA is treated with Vancomycin or rifampicin. In case P75, where MRSA were isolated, Vancomycin was used for its treatment.

The 2010 guidelines also recommends that aminoglycosides should not be used routinely or another second agent effective against gram-negative facultative and aerobic bacilli when there is no evidence that the infection is caused by resistant organisms that require such therapy. This recommendation was demonstrated in the management of SSI's in the cases surveyed (P4, P32, P36, and P71) where E. coli, pseudomonas spp, other coliforms were isolated with subsequent prescription of ceftazidime, Amikacin, and Gentamycin which is evident in Table 3.5. The others, though had such evidence could not afford them (P8, P78). This recommendation

stems from the fact that routine use will predispose patients to adverse effects like ototoxicity and nephrotoxicity unnecessarily.

Empiric use of agents effective against enterococci is recommended as shown in majority of the cases (P2, P9, P12, P19, P26, P31, P40, P46, P55, P59, P62, P69, and P72). This is understandable after abdominal surgery and especially when the bowel is entered because members of the genus enterococcus are common flora of the intestinal tract. Conversely agents effective against methicillin-resistant *S. aureus* (MRSA) or yeast is also not recommended without evidence of infection due to such organisms, (American Surgical Society and American Society of Infectious Diseases guidelines, 2010). In case P75, MRSA was isolated.

Empiric antibiotic therapy for *health care-associated intra-abdominal infections* should be driven by local microbiological data and covering likely pathogens may require multiple drug regimen made up of agents with expanded spectra of activity against gram-negative aerobic and facultative bacilli. These include meropenem, or ceftazidime or cefepime in combination with metronidazole. Aminoglycosides are another option.

Looking through table 3.5, it is clear that the choices of antibiotic are in line with written guidelines such as the 2010 American Surgical Society and American Society of Infectious Diseases guidelines, Clinical Guidelines (2008) and others protocols such as that used in the surgical Department of the Orlando regional medical center, USA.

4.4 Pharmaceutical care issues

P8 had intravenous ceftriaxone as part of his regimen. Ceftriazone, is a third-generation cephalosporin, which has activity against mainly gram-negative bacteria, and a few gram-positives and anaerobes. Ceftriazone may be given in a solution of 5% or 10% dextrose or sodium chloride 0.9% via drip tubing. It may be given concomitantly with aminoglycosides, but must not be in the same infusion because of mutual inactivation. They may however be given at separate sites concurrently. Again ceftriazone should not be infused in calcium containing solutions (e.g. ringer's lactate) because a precipitate of ceftriazone calcium can form and occlude the veins. All calcium containing solutions that need to be administered should be separated by at least 48 hours after ceftriazone. It was observed from interaction with the nurses at the ward that this cautionary advice was overlooked.

Ciprofloxacin and metronidazole were given to 10 patients (31%). Intravenous ciprofloxacin is compatible with physiological saline 0.9%, Ringers Lactate, 5% Dextrose and 10% Dextrose. It is also compatible with Gentamycin, Amikacin, metronidazole and potassium chloride, but intravenous lines must be flushed before and after the administration of any other drug. This was not done in most of the cases surveyed. Also the frequency administration was inappropriate for P32 and P72 and should have been administered at 12 hourly intervals in the case of ciprofloxacin and 8 hourly in the case of metronidazole. Ciprofloxacin may increase the risk of central nervous stimulation and thus seizures may be increased with concurrent use of non-steroidal anti-inflammatory drugs. Four patients who received this combination were monitored for seizures. Side effects include diarrhoea, hapatic enzyme abnormalities, nausea and vomiting.

Metronidazole is active against anaerobic bacteria and protozoa. All solutions were pre-diluted and ready to use. Contact with aluminum in needles must be avoided to prevent any colour changes. Also the frequency administration was inappropriate for P32 and P72 and should have been administered at 8 hourly intervals.

Abdominal pain, allergic reactions, anorexia, diarrheoa, hypotension, jaundice, metallic taste, nausea, oliguria, pseudomembraneous colitis (requires discontinuation and appropriate treatment), urticaria, vomiting are some side effect patients may experience.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

The study revealed that there was 40% infection rate after abdominal surgery, which is quite high. Pragmatic steps are thus needed to reduce the infection rate to acceptable levels.

The causes of surgical site infection identified at the ward include contaminated theatre and ward environment, patients' low immunity status and non-adherence aseptic techniques both in the theatres and the wards.

The management of surgical site infection was in the form of dressing of the surgical wounds with topical agents like acetic acid and povidone iodine.

The quality of management of SSI at the ward was good and in line with standard protocols. Mortality rate was low.

The antibiotics given for the wound infections were mostly Ceftriaxone, Cefuroxime, Ciprofloxacin, Clindamycin, Amoxicillin plus clavulanic acid combination, Flucloxacillin, and Metronidazole.

The study observed that the frequency of drug administration in the management of SSI's at the wards was inappropriate in only 6% (n=2) of cases. Ciprofloxacin and metronidazole, the most frequently used combination was well tolerated by most patients but the intravenous lines were not flushed before and after the administration of other drug.

5.2 Recommendations

Based on the findings, it is recommended that:

1. The surgical cases encountered at the hospital should be properly group according to wound class at the ward to avoid cross transfer of infections. Such demarcations should be strictly adhered and not flouted.

2. Strict adherence to aseptic wound dressing technique should be enforced during each procedure on the ward to reduce the prevalence of SSIs;

3. Strict surgical technique should be adhered to, in the theatres during surgery

4. The infection prevention and control (IPC) team should consistently be supplied with needed logistics so they can maintain the highest possible standards of hygiene at the wards, in theatres, and the hospital environment at large.

5. The number of people, as well as the opening and closing of doors of the operating rooms should be restricted to reduce contamination.

6. As a result of the pharmaceutical care issues, it is important that at least a pharmacist is assigned and stationed on each ward to ensure that all drug treatment are properly administered with the necessary precautions, issues solved and monitoring as well as discharge counseling appropriately done to reduce drug related problems during and after admission.

REFERENCES

American Society of Hospital Pharmacists (1993). ASHP statement on pharmaceutical care. Am J Hosp Pharm. 1993; 50, pp. 1720–3.

Anderson D. J., Kaye, K. S., Classen D., Arias, K.M. et al. (2008). Strategies to Prevent Surgical Site Infections in Acute Care Hospitals, supplement article: shea / idsa practice recommendation, October 2008, (29).

Annual Report (2009). Ghana Health Service Report, pp. 44 Available on: www.**gh**anahealthservice.org/.../FINAL_DRAFT_2009_GHS_**Annu**al Accessed on 24th Jan. 2012

Annual Report (2009). Komfo Anokye Teaching Hospital, Kumasi. Pp. 33

approaches, Boston: Pearson Education, Inc.

Baker C, Luce J, Chenoweth C, Friedman C. (1995). Comparison of case-finding methodologies for endometritis after cesarean section. *Am J Infect Control* 1995; 23, pp. 27-33.

Brennan TA, Leape LL, Laird NM, et al. (1991). Incidence of adverse events and negligence in hospitalized patients: results of the Harvard Medical Practice study I. N Engl J Med 1991; 324, pp. 370–6.

Carignan A, Allard C, Pépin J, et al., (2008). Risk of Clostridium difficile infection after perioperative antibacterial prophylaxis before and during an outbreak of infection due to a hypervirulence strain, Clinical Infectious Disease, 2008;46, pp. 1838–43.

Castella A, Charrier L, Di Legami V, et al., (2006). Surgical site infection surveillance: analysis of adherence to recommendations for routine infection control practices, Infect Control Hosp Epidemiology, 2006;27, pp. 835–40.

Centre for disease control and prevention (CDC) (2013). CDC/NHSN Protocols Corrections, clarifications and Additions. Available on: http://www.cdc.gov/nhsn/PDFs/pscManual/9pscSSIcurrent.pdf.

Cheadle W. G. (2006). Risk factors for surgical site infection. Surgical Infections.; 7 Supplements 1, pp. 7-11.

Clinical Guideline (2008). Surgical site infection prevention and treatment of surgical site infection. Published by the RCOG Press at the Royal College of Obstetricians and Gynaecologists, 27 Sussex Place, Regent's Park, London NW1 4RG.www.rcog.org.uk.

Consumers' Association (2001). Antimicrobial prophylaxis for orthopaedic surgery. *Drug Therapeutic Bulletin* 39(6): 43–6 Consumers' Association (2003) Antibacterial prophylaxis in surgery: 1 – Gastrointestinal and biliary surgery. *Drug Therapeutic Bulletin* 41(11), pp. 83–6

Consumers' Association (2004a). Antibacterial prophylaxis in surgery: 3 – Arterial surgery on the abdomen, pelvis and lower limbs. *Drug Therapeutic Bulletin* 42(6), pp. 43–7

Consumers' Association (2004b). Antibacterial prophylaxis in surgery: 2 — Urogenital, obstetric and gynaecological surgery. *Drug Therapeutic Bulletin* 42(2), pp. 9–13

Dellinger EP, Hausmann SM, Bratzler DW, et al., Hospitals collaborate to decrease surgical site infections, Am J Surgery, 2005;190, pp. 9–15

Department of Health CMO (2003). *Winning Ways: Working Together to Reduce Healthcare Associated Infection in England*. London: Department of Health; 2003.

Department of Surgical Education (2006). Antibiotic Prophylaxis In Surgery. Orlando Regional Medical Center

Gibbons, C., Bruce, J., Carpenter, J., Wilson A.P., Wilson, J., Pearson, A., Lamping, D.L., Krukowski, Z.H. and B.C. Reeves (2012), "Identification of risk factors by systematic review and development of risk-adjusted models for surgical site infection", Health technology assessment From: Clinical Governance: An International Journal, Volume 17, Issue 1

Graham J. C. and Pedler S.J. (2003). Surgical Antibiotic Prophylaxis. Clinical Pharmacy and Therapeutics in Roger Walker and Clive Edwands. 3rd edition, pp. 573

Graves N, Halton K, Lairson D. (2007). Economics and Preventing Hospital-Acquired Infection: Broadening the Perspective. Infect Control Hosp Epidemiology; 28, pp. 178-184.

Griffin FA (2005) Best-practice protocols: Preventing surgical site infection. Nursing Management 36(11), pp. 20–26

Health Protection Agency (1997). *Surveillance of Surgical Site Infection in England: October 1997–September 2005*. London: Health Protection

Health Protection Agency (2006). Surveillance of surgical site infections in England. October 1997 – September, 2005. London

Hepler, C.D., Strand, L.M (1990). Opportunities and responsibilities in pharmaceutical care. Am J Hosp Pharm. 1990; 47, pp. 533–43.

Hollenbeak CS, Murphy DM, Koenig S, et al. (2002). The clinical and economic impact of deep chest surgical site infections following coronary artery bypass graft surgery. Chest. August; 118(2), pp. 397-402.

Hospital Infection Society and Tissue viability Nurses Association (2007). Third Prevalence Survey of Health care Association Infections in Acute Hospitals 2006. England summary of Preliminary Results.

Houtman P, et al., (2004) Promoting quality through surveillance of surgical site infections: Five prevention success stories, Am J Infect Control, 2004;32, pp. 424–30.

http://www.bidmc.org/QualityandSafety/SpecificServiceMeasures

Huizinga WK, Kritzinger NA, Bhamjee A. (1986).The value of adjuvant systemic antibiotic therapy in localised wound infections among hospital patients: a comparative study. J Infect 1986; 13, pp. 11–16.

Humphreys H, Cunney R, (2008) Performance indicators and the public reporting of healthcare-associated infection rates, Clinical Microbiological Infections, 2008;14, pp. 892-894.

ICSI (2010). Antibiotic Prophylaxis for Surgical Site Infection Prevention in Adults Forth Edition, October, 2010. Available on:www.icsi.org (Retrieved on: 22nd April, 2012)

KATH (2009). Infection Prevention and Control Policy for Komfo Anokye Teaching Hospital, Kumasi

Kirkland KB, Briggs JP, Trivette SL, et al. (1999). The impact of surgical-site infections in the 1990s: attributable mortality, excess length of hospitalization, and extra costs. Infect Control

Loo G. V. (2008). Infection Control in Surgical Practice. ACS Surgery: Principle and Practice.

Mangram AJ, Horan TC, Pearson ML, Silver LC, Jarvis WR, (1999). The Hospital Infection Control Practices Advisory Committee. Guideline for the prevention of surgical site infection, 1999. Infect Control Hosp Epidemiol.;20, pp. 247-280.

Mead PB, Pories SE, Hall P, Vacek PM, Davis JH Jr, Gamelli RL (1986). Decreasing the incidence of surgical wound infections: validation of a surveillance- notification program. *Arch Surgery* 1986; 121, pp. 458-461.

Neuman,W . L. (2003). Social research methods: qualitative and quantitative

Parienti JJ, Thibon P, Heller R, et al., (2002). Hand-rubbing with an aqueous alcoholic solution versus traditional surgical hand scrubbing and 30-day surgical site infection rates, J Am Med Assoc, 2002;288, pp. 722–7.

Patton, M. Q. (2001). Qualitative Evaluation and Research Methods, 3rd edition. Newbury Park, CA: Sage

Perencevich EN, Sands KE, Cosgrove SE, et al. (2003). Health and economic impact of surgical site infections diagnosed after hospital discharge. Emergency Infectious Diseases. February; 9(2), pp. 196-203.

Pessaux P.; Msika S., Atalla D.; Hay J.; Flamant Y. (2003). Risk Factors for Postoperative Infectious Complications in Noncolorectal Abdominal SurgeryA Multivariate Analysis Based on a Prospective Multicenter Study of 4718 Patients. The French Associations for Surgical Research *Arch Surg*. (2003) 138(3), pp. 314-324. Retrieved from http://archsurg.jamanetwork.com/article. aspx? articleid= 394474. (Accessed on:14th August, 2012)

Plowman, R. Graves, N Griffin, MA et al (2001). The rate and cost of hospital-acquired infections occurring in patients admitted in selected specialties of district general hospital in England and the national burden imposed. Journal of Hospital Infections.

Pronovost P, Needham D, Berenholtz S, et al., An intervention to decrease catheter-related bloodstream infections in the ICUs, N Engl J Med, 2006;355, pp. 2725–32.

Reddy, B. R. (2012). Management of culture-negative surgical site infections. Journal of Medical & Allied Sciences. 2 (1), pp. 02-06. (Available on: www.jmas.in)

Seal LA, Paul-Cheadle D, A (2003). Systems approach to preoperative surgical patient skin preparation, Am J Infect Control, 2003;32, pp. 57–62

Segers, P .(2006). Prevention of Nosocomial infection in Cardiac surgery by decontamination of the nasopharynx and oropharynx with chlohexidine gluconate, a randomized control trial. JAMA. The Journal of American Medical Association

Sepkowitz, K.A. (1995). AIDS, tuberculosis, and the health care worker. Infect Diseases 1995; 20, pp. 232

Sharkey S. and Larsen J. A. (2005) Ethnographic exploration: participation and meaning in everyday life, Qualitative Research in Health Care, Open University Press, pp. 169 – 186

Shute, N. (2005), How to get rid of post-operative infections. Available on: http://health.usnews.com/usnews/health/articles/050706/6doctor.htm?track=rss.(Accessed in 24 Jan. 2012)

Stevens DL, Bisno AL, Chambers H, et al (2005). *Practice guidelines for the diagnosis and management of skin and soft-tissue infections. Clinical Infectious Diseases 2005;4, pp. 373-406*

Swenne C. L. (2006). Wound Infection Following Coronary Artery Bypass Graft Surgery. Risk Factors and the Experiences of Patients. ACTA Universities Upsaliensis UPPSALA 2006.

The Third Prevalence Survey of Healthcare Associated Infections in Acute Hospitals (2006). Summary of Preliminary Results. www.his.org. uk/_db/_documents/summary_of_preliminary_ results_for_england.pdf (Last accessed 24th May 2012)

Waldrop J, Doughty D. Wound healing physiology. In: Bryant R, editor. *Acute and Chronic Wounds: Nursing Management*. 2nd ed. St Louis, MO, London: Mosby; 2000, pp. 17–80.

Woodhead K, Taylor EW, Bannister G, et al., (2002). Behaviours and rituals in the operating theatre, J Hospital Infection, 2002; 51, pp. 241–55.

Woods A (2005). Key points of the CDC's Surgical Site Infection Guideline. Adv Skin Wound Care. 18(4): pp. 215-220.

Yale Medical Group (2003). Infection Control Policies and Procedures. Office of the Environmental Health and Safety. Available on: *www.yale.edu/oehs.* (Accessed June 2012)

APPENDIX I

PATIENT DATA COLLECTION SHEET

Surveillance of Surgical Site Infections at KATH

PATIENT DATA COLLECTION SHEET

1. Patient code:……
2. Inpatient ID:……
3. Weight:……
4. Age:……..
5. Sex:……
6. Ward:……..
7. Date Admitted:……
8. Date Discharged:……
9. Co-morbidities:……
10. Telephone No:……
11. Date of Operation:……
12. Type of surgery/surgical procedure

A.

13. Preoperative Diagnosis:……

14. Preoperative Medication:……

……

Operation findings:……

15. Post operative Diagnosis:……

Post operative medication……

16. Type of surgery/surgical procedure:……

17. Surgical Site Infected? Yes ( ) No ( )

18. Date infection was detected:……

19. Type of infection: a. superficial ( ) b. Deep incisional ( ) c. organ space ( )

d. unknown ( )

20. Signs of surgical site infection or post operative infection

a) Fever Yes ( ) No ( )

b) Swelling of sight Yes ( ) No ( )

c) Erythema Yes ( ) No ( )

d) Pain or tenderness Yes ( ) No ( )

e) Serous discharge or pus from site Yes ( ) No ( )

f) Separation of the deep tissues Yes ( ) No ( )

g) Diagnosis of superficial/deep incisional surgical site infection by "clinician"

Yes ( ) No ( )

B) Management

Culture and sensitivity done? Yes ( ) No ( )

Drugs:	Resistant to	sensitive to:
	1.	1.
	2.	2.
	3.	3.
	4.	4.
	5.	5.

Drug Therapy Yes ( ) No ( )

……

……..……

Frequency of wound dressing……..……..

Topical agent used:

Discharge medication if different:

Additional costs incurred:

Insertion of implants:

Post Discharge surveillance:

Readmission

APPENDIX II

INTERVIEW GUIDE FOR SURGEONS

KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY

COLLEGE OF HEALTH SCIENECES

DEPARTMENT OF CLINICAL AND SOCIAL PHARMACY

Research Topic: Postoperative infections, prevalence, causes and management

INTERVIEW GUIDE FOR SURGEONS

1. WHAT are the possible causes of SSIs?
2. What do you do in the theatre to prevent or reduce the risk of surgical site infections?
3. How is hand decontamination done prior to the first operation on the list and then for subsequent operations?
4. In which procedures are antibiotics prophylaxis indicated?
5. Which procedures routinely do not require antibiotics prophylaxis?
6. What informs your decision on the choice of antibiotics?
7. Is there any local antibiotics formulary available to help in the choice of antibiotics?
8. How and when are the antibiotics given for each procedure?
9. Are SSIs common on your wards?
10. What percentage of surgical wounds do you presume get infected on your ward?
11. What do you do at your ward to prevent SSIs?
12. How often do you dress each patient's surgical wound?
13. What determines the frequency of wound dressing?

APPENDIX III

INTERVIEW GUIDE FOR NURSES

KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY

COLLEGE OF HEALTH SCIENECES

DEPARTMENT OF CLINICAL AND SOCIAL PHARMACY

Research Topic: Postoperative infections, prevalence, causes and management

INTERVIEW GUIDE FOR NURSES

1. WHAT are the possible causes of SSIs?
2. WHAT are the possible causes of SSIs at the ward?
3. Are SSIs common on your wards?
4. What percentage of surgical wounds do you presume get infected on your ward?
5. What do you do at your ward to prevent SSIs?
6. What is the role of the nurse in the management of SSIs?
7. How often do you dress each patient's surgical wound?

APPENDIX IV

PATIENT INFORMATION AND CONSENT FORM

Surveillance of surgical site infections at the surgical wards of Komfo Anokye Teaching Hospital, Ghana.

PATIENT INFORMATION AND CONSENT FORM

BACKGROUND

You are being invited to take part in a research study. Before you decide it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and discuss it with friends, and relatives if you wish. Ask us if there is anything that is not clear or if you would like more information. Take time to decide whether or not you will volunteer to take part in this research study.

The purpose of this research is to learn about the incidence, causes and management of **surgical site infections at the surgical wards of Komfo Anokye teaching hospital**. This will serve as a baseline data that can be used for prevention and control of infection at the wards.

If you agree to participate in this study, you will be part of an assessment of your surgical wound to maintain and improve the health of surgical patients on the wards. From the information gathered, possible interventions will be developed to help improve the health of patients after surgery. The principal investigator is Pharmacist ADWOA AMEYAW, KATH.

STUDY PROCEDURE:

Your medical records will be examined from your folder.

DURATION OF THE STUDY

You will be followed for a period of 30 days.

CLINICAL EXAMINATION

Your surgical wound will be examined by the investigator. It is important to know that even if you do not consent to this study you will still be treated.

FOLLOW UP VISIT

You will be monitored for 30 days either through visits or telephone call.

RISKS

There is no major risk, except of the loss of privacy and confidentiality that could occur with the examination of wound(s)

BENEFITS

This study will help us learn more about the prevalence/incidence of **surgical site infections at the surgical wards** and how they may be prevented and properly managed in surgical patients who are admitted into the wards in the future.

ALTERNATIVE PROCEDURES:

You may choose not to participate in this study.

CONFIDENTIALITY

All study data will be kept in a password protected computer file. We will keep all research records that identify you private to the extent allowed by law. Results of the study may be published; however, your name and other identifying information will be kept private.

PERSON TO CONTACT:

For any questions about this study or related matters, please contact Pharmacist ADWOA OFOSUA AMEYAW on 0244955131.

VOLUNTARY PARTICIPATION

It is up to you do decide whether or not you will take part. If you do decide that you will take part you will be asked to sign this consent form. If you decide to participate in the study you are still free to withdraw at any time and without giving a reason.

This will not affect the relationship you have with the investigator or staff nor the standard of care you receive.

RIGHT OF INVESTIGATION

You may withdraw from the study at any time without penalty.

COST OF SUBJECTS AND COMPENSATION:

Participation in this study will cost you nothing. There will be no compensation for your participation in this study.

NUMBER OF SUBJECTS

We will invite all patients within the ward to participate, which we expect to number approximately 100……

CONSENT

I confirm that I have read and understand this consent and have had the opportunity to ask questions. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving any reason, without my medical care or legal rights being affected.

I agree to participate in this research study and permit you to use and disclose health information about me for this study, as you have explained in this document.

_____

Patient's Name

_____ _____

Patient's Signature Date

_____

Name of Person Obtaining Consent

_____ _____

Signature of Person Obtaining Consent Date