# PROPHYLACTIC ANTIBIOTICS PRACTICES AT MNH TANZANIA 2013

**Zuberi Iddi, MD**

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# PROPHYLACTIC ANTIBIOTICS PRACTICES AT MNH TANZANIA 2013

**By**

**Zuberi Iddi, MD**

**A dissertation Submitted in (partial) Fulfillment of the Requirements for the Degree of Master of Medicine (General Surgery) of Muhimbili University of Health and Allied Sciences**

**Muhimbili University of Health and Allied Sciences**
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## CERTIFICATION

The undersigned certify that he has read and hereby recommend for acceptance by Muhimbili University of Health and Allied Sciences a dissertation entitled: ***Prophylactic antibiotics practices at MNH Tanzania 2013*** in (Partial) fulfillment of the requirements for the degree of Master of Medicine (General Surgery) of Muhimbili University of Health and Allied Sciences.

_____

**Professor Charles Mkony**

(Supervisor)

_____

**Date**

## DECLARATION

## AND

## COPYRIGHT

I, **Dr. Zuberi Iddi** declare that this **dissertation** is my own original work and that it has not been presented and will not be presented to any other university for a similar or any other degree award.

**Signature…**……. **Date**……..

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## DEDICATION

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## LIST OF ABBREVIATIONS

| | |
|---|---|
| SSI | Surgical Site Infection |
| MNH | Muhimbili National Hospital |
| MUHAS | Muhimbili University of Health and Allied Sciences |
| CABG | Coronary Artery Bypass Graft. |
| CDC | Centers for Disease Control |
| ABP | Antibiotic Prophylaxis |
| QAHI | Queen Alia Heart Institute |
| NNIS | National Nosocomial Infections Surveillance |
| ASA | American Society of Anaestheologists |
| PA | Prophylactic Antibiotics |
| ASHP | American Society of Hospital Pharmacists |
| DVU | Direct Vision Urethrotomy |
| TURP | Trans Urethra Resection of the Prostate |
| BSO | Bilateral Subcapsular Orchydectomy |

## DEFINITION OF TERMS

***Antibiotic*** is a substance, such as penicillin or streptomycin, produced by or derived from certain fungi, bacteria, and other organisms or synthetic molecules that can destroy or inhibit the growth of other microorganisms.

***Prophylactic antibiotic*** is administration of an antibiotic prior to/or in the absence of contamination of previously sterile tissues or fluids. The use of antimicrobials for dirty and contaminated procedures is not considered prophylaxis.

***Presumptive antibiotic therapy*** is administration of an antibiotic when there is a strong possibility, yet unproven infection.

***Antibiotic treatment*** is the administration of an antibiotic when an established infection has been identified.

**A *wound*** is defined by the Centers for Disease Control (CDC) as an interruption or break in the continuity of the external surface of the body or the surface of an internal organ caused by surgical or other forms of injury or trauma.

**A *Surgical Site Infection* (SSI**) is clinically defined as the presence of pain at a surgically created wound, which is accompanied by erythema, induration and local tenderness or presence of purulent discharge at the wound site.

## ABSTRACT

**Background**

Antibiotic prophylaxis is used to reduce the incidence of postoperative infection. For antibiotics to be used as prophylaxis duration should not exceed 24 hours in many of the procedures. Single preoperative dose of antibiotics is as effective as full day course therapy assuming uncomplicated procedure.

It should target anticipated organism and is unnecessary if the patient is already receiving antibiotics that cover the likely pathogens. It should be given within one hour before incision commonly at the time of induction of anaesthesia and during prolonged procedures antibiotics should be readministred every 3hours with the exception of vancomycin, aminoglycosides and fluoroquinolones. However, many studies show that these guidelines are not followed. Many studies show use of prophylactic antibiotics when there is no clear indication for antibiotic prophylaxis, inappropriate drug use or duration of prophylaxis may be prolonged leading to increasing length of hospital stay, hospital cost, morbidity and mortality. This study was conducted to evaluate prophylactic antibiotics practices in elective surgical operation at MNH.

**Methods**: Hospital based descriptive study of prophylactic antibiotics use among elective surgical patients. A total of 1146 elective operation done from July 2012 to January 2013 were included in the study. Prospective surgical audit of these elective surgeries were done using a structured questionnaire which was used to collect information on social demographic profile, operative information of timing of prophylactic antibiotics admininistration, postoperative antibiotic time, type of operation and choice of antibiotic given was done.

**Study population**: All elective surgeries done during July 2012 to January 2013

**Data analysis**: was done using an SPSS computer program.

**Results**: The majority of the respondents had primary education 68.8% with higher education being the least (3.7%). Among elective operation done there were 743(64.8%) male and 403(35.2%) female. Proportionally more patients were sixty years and above at 27.7%. Among elective surgery done at MNH 84.5% received prophylactic antibiotics.

Eighty eight point four percent (88.4%) of clean contaminated wound which was eligible for prophylactic antibiotics received prophylactic antibiotics. However 72.1% of clean wound, 25% of contaminated and 83.3% of dirty wound received prophylactic antibiotics. Prophylactic antibiotic was administered to 89.4% of elective surgery patients in which there were external incision and 64% in which there were no external incision. The majority (57.3%) received prophylactic antibiotics one hour before surgery, and few (8.3%) received prophylactic antibiotics intraoperatively. The majority 836(86.4%) stopped prophylactic antibiotics more than five days post operatively while a few 0.9% stopped prophylactic antibiotics within twenty four hours post surgery. No additional prophyalactic antibiotics was given Intraoperatively. The majority of patients who underwent thyroidectomy(58.2%) received both metronidazole and ceftriaxone. Patients who underwent cystectomy almost half (47.8%) received ceftriaxone alone and half (47.8%) received both ceftriaxone and metronidazole. Overall combination of ceftriaxone and metronidazole were the most used prophylactic antibiotics (47.2%) followed by ceftriaxone alone (42.2%).

**Conclusion:** Elective clean surgeries received unnecessary prophylactic antibiotics. Some clean contaminated surgeries did not receive prophylactic antibiotics. Contaminated and dirty elective surgeries received prophylactic antibiotics. Prophylactic antibiotic has been given post surgery in some of the surgeries. No additional prophyalactic antibiotics was given intraoperatively for the elective surgeries lasting more than 3hours. Prophylactic antibiotics has been prolonged post surgeries given in more than five days in the majority of elective surgeries. Combination of ceftriaxone and metronidazole was the most used prophylactic antibiotics followed by ceftriaxone alone.

**Recommendations**: MNH should establish prophylactic antibiotics guideline which should be open and accessible by every member of the surgical team. Medical checklist should be practiced effectively. Frequent audit of prophylactic antibiotics use is needed to improve proper practices (prophylactic antibiotics uses). Surgeons should adhere to prophylactic antibiotics guidelines.

# CHAPTER ONE

## 1.0 INTRODUCTION AND LITERATURE REVIEW

### 1.1 Background

Antibiotic prophylaxis is used to reduce the incidence of postoperative infections. Patients undergoing procedures associated with high infection rates, those involving implantation of prosthetic material, and those in which the consequences of infection are serious should receive perioperative antibiotics. Treatment, rather than prophylaxis, is indicated for procedures associated with obvious preexisting infection (i.e. abscess, pus, or necrotic tissue). Cephalosporins (such as cefazolin) are appropriate first line agents for most surgical procedures, targeting the most likely organisms while avoiding broad-spectrum antimicrobial therapy that may lead to the development of antimicrobial resistance. The duration of prophylaxis should not exceed 24hours.[1]

In administration of prophylactic antibiotic it is important to adhere to the following principles:

A single preoperative dose of antibiotic is as effective as a full 5-day course of therapy assuming an uncomplicated procedure.

Prophylactic antibiotics should be administered within 1 hour prior to incision.

Complicated, contaminated, or dirty procedures should receive additional postoperative coverage.

Prophylactic antibiotics should target the anticipated organisms.

For the majority of procedures, prophylaxis should not exceed 24 hours.

Prophylaxis is unnecessary if the patient is already receiving antibiotics that cover likely pathogens.

The timing of antibiotic administration should be adjusted to maximize prophylactic efficacy.

During prolonged procedures, antibiotic prophylaxis should be readministered every 3 hours (with the exception of vancomycin, aminoglycosides, and fluoroquinolones.

Surgical site infection (SSI) is the commonest hospital acquired infection that occurs in early postoperative period in surgical patients and accounts for 38% of infections in surgical patients and 31.1% of all infections in trauma patients. Its frequency increase parallels increase in number of risk factors. Prevention of perioperative infection necessitates management directed at optimizing of patient factors like smoking, nutritional factors, immune-suppression, obesity and cardiovascular status. Use of principles like antibiotic prophylaxis, aseptic theatre conditions, respect of soft tissues during operation, local therapy and other modern patient safety practices is mandatory. Antibiotic prophylaxis should be started early pre-operatively at least 30-60 minutes before incision and antibiotic level exceeding minimal inhibitory concentration for infecting organism or before inflation of a tourniquet if applicable to closure of wound.

Aiming at short preoperative stay in hospital, and pre- washing of the area concerned before cleaning with antiseptic are also imperative in reducing SSI. Perioperative antimicrobial prophylaxis is recommended for various surgical procedures to prevent surgical site infections. Optimal antimicrobial agents for prophylaxis should be bactericidal, nontoxic, inexpensive, and active against the typical pathogens that can cause surgical site infection postoperatively. To maximize its effectiveness, intravenous perioperative prophylaxis should be administered within 30 to 60 minutes before the surgical incision. Antimicrobial prophylaxis should be of short duration to decrease toxicity and antimicrobial resistance and to reduce cost.[1-6]

In January 2003, leadership of the Medicare National Surgical Infection Prevention Project hosted the Surgical Infection Prevention Guideline Writers Workgroup (SIPGWW) meeting came with the consensus that infusion of the first antimicrobial dose should begin within 60 minutes before surgical incision and that prophylactic antimicrobials should be discontinued within 24 h after the end of surgery. This advisory statement provides an overview of other issues related to antimicrobial prophylaxis, including specific suggestions regarding antimicrobial selection.[7]

Preoperative skin preparation is an important element in prevention of infection, but removes only up to 80% of skin flora. Standard surgical antisepsis is an accepted method and involves scrubbing with antiseptic solutions. Chlorhexidine gluconate compared with povidone iodine showed a prolonged reduction in skin contamination and with less toxicity and skin irritation. Aqueous surgical hand scrubs are equivalent to traditional scrubs with regard to reduction of skin contamination, with higher surgeons protocol compliancy compared to traditional scrubs. The use of laminar flow and ultra- violet light in theatre is associated with decreased rates of postoperative skin infections and contamination. Respect of soft tissues during surgery through decrease in excessive use of diathermy, contusions and excessive tension is advised. Wound closure without tension and no dead space is encouraged. Issues of wound drainage have not been shown to reduce rates of infection. When used, closed suction drainage is better than open drain. SSI is a common complication and it is in the interest of the surgeon and the patient that it is prevented as it can be associated with morbidity, mortality and increased resource utilization.[8]

Up to one half of all antibiotics prescribed for hospitalized patients are for prevention, not treatment, of infection. With occasional exceptions, most antibiotic prophylaxis is given to surgical patients. Thus, surgical antibiotic prophylaxis represents a large expenditure of money and drugs. In many instances there may be no clear indication for prophylaxis; the timing of prophylaxis may be inappropriate, or the duration of prophylaxis may be excessive[2]

In a study done in 1985 USA, multiple errors in antimicrobial prophylaxis were identified; these involved errors of both omission and commission. Antimicrobial prophylaxis was not given in 345 (21%) of 1621 operations in which prophylaxis was necessary. It was given unnecessarily in 822 (50%) of 1642 in which it was of unproven value. Antimicrobial prophylaxis was needlessly continued beyond 48 h for 1088 (40%) of 2691 patients. Moreover, it was not given preoperatively (within 2 h before the surgical incision, except for patients undergoing cesarean sections) in 983 (60%) of 1621 operations in which prophylaxis was indicated.[3]

Surgical site infections (SSI′s) have a significant impact on patients, increasing length of hospital stay, contributing to an overuse of antibiotics and increased associated costs, contributing to increased morbidity and mortality. Antibiotic prophylaxis reduces the incidence of surgical wound infection. It is uniformly recommended for all clean-contaminated and contaminated procedures. It is considered optional for most clean procedures, although it may be indicated for certain patients and clean procedures that fulfill specific risk criteria.[4]

An estimated 40–60 percent of SSIs are preventable with appropriate use of prophylactic antibiotics. Overuse, underuse, improper timing, and misuse of antibiotics occur in 25–50 percent of operations. A large number of hospitalized patients develop infections caused by Clostridium difficile, and 16 percent of this type of infection in surgical patients can be attributed to inappropriate prophylaxis use alone. Inappropriate use of broad spectrum antibiotics or prolonged courses of prophylactic antibiotics puts all patients at even greater health risks due to the development of antibiotic resistant pathogens.[4]

### 1.2 The Outcome for Antibiotic Prophylaxis Practices

The consensus of prophylactic antibiotic guidelines is that prophylactic antibiotics should not exceed twenty four hours postoperatively for most of the surgical procedures and not exceed seventy two hours for the cardiac operations. Prolongation of prophylactic antibiotic postoperatively has been associated with increase in hospital cost, length of hospital stay and antibiotic resistance.[9-12]

In a study done in India in 2007-2008 forty-eight hours of a prophylactic antibiotic combination using a third-generation cephalosporin and an aminoglycoside was as effective as a 72 h regimen for preventing surgical site infection in patients undergoing CABG and valve surgery.[10]

A comparative prospective study done at Bugando Medical Center showed the risk factors for Surgical site infection (SSI) were presence of pre-morbid illness (OR = 6.1), use of drain (OR = 15.3), use of iodine alone in skin preparation (OR = 17.6), duration of operation ≥ 3 hours (OR = 3.2) and cigarette smoking (OR = 9.6) significantly predicted surgical site infection (SSI).[13]

A Meta analysis done at Brazilian hospital identified 24 relevant articles originating from nine countries in sub-Saharan Africa. The methodological quality of these publications was diverse, with inconsistency in definitions used for SSI, however all studies concluded that appropriate prophylaxis reduces rate of surgical site infection. Although it was difficult to synthesize information between studies, there was consistent evidence that use of single-dose pre-operative antibiotic prophylaxis could reduce, sometimes dramatically, the risk of SSI.[14]

A study done by Schussler, ("Should we Change Antibiotic Prophylaxis for Lung Surgery? Postoperative Pneumonia (POP) Is the Critical Issue"), it was shown that the incidence of POP decreased by 45% during the second period (*P* 0.0027). A significant reduction in antibiotic therapy requirement for postoperative infections (*P* 0.0044) was also observed. Thirty day mortality decreased from 6.5% to 2.9% (*P*-0.06). Multivariate analysis showed that type of

resection, intraoperative colonization, chronic obstructive pulmonary disease, gender, body mass index, and type of prophylaxis were independent risk factors of POP. A case control study that matched patients of the two periods according to these risk factors (except for antibiotic prophylaxis) confirmed that the incidence of POP was lowered during the second period. Targeted antibiotic prophylaxis may decrease the rate of POPs after lung resection and improve outcome.[15]

A five-month prospective survey of surgical-site infections (SSI) was conducted in the department of general surgery at Kilimanjaro Christian Medical Center, Tanzania and it was shown that Significant risk factors for developing SSI during hospital stay were: operations classified as contaminated or dirty, operations lasting for more than 50 min and the length of preoperative stay.[16]

A study conducted at the local surgeons suggestion in an 82-bed department of general surgery, obstetrics and gynecology, urology and orthopedics at the St. Francis Designated District Hospital (SFDDH) in Ifakara, Tanzania showed the SSI-rate of 21.6%.The analyses of this study identified two major risk factors for SSI in clean and clean-contaminated surgical procedures: Inadequate timing of administration of routine antimicrobial prophylaxis (AMP) and inappropriate selection of antibiotics not covering the most commonly observed pathogens.[17]

A study by Ameh et al, ("Surgical site infection in children: prospective analysis of the burden and risk factors in a sub-Saharan African setting Ahmadu Bello University Teaching Hospital, Zaria, Nigeria"), revealed that degree of incisional contamination and a long duration of surgery (≥ 2 h) are important risk factor for **SSI** .[18] Prophylactic antibiotic reduces rate of SSI. In a study done in Thailand in 2003, antibiotic prophylaxis was significantly associated with a decreased risk of SSI regardless of whether the antibiotic was administered preoperatively or intraoperatively.[11]

Antibiotic prophylaxis prior to percutaneous endoscopic gastrostomy insertion reduces both

percutaneous endoscopic gastrostomy site and systemic infections in patients without malignant disease. Short term prophylactic antibiotic usage is feasible in patients who undergo gastric cancer surgery and where there are no grave comorbidities or combined resection postoperative antibiotics should be avoided.[19]

A study was done in a tertiary, private general hospital in Ribeirã o Preto, Sã o Paulo Brazil ("Replacing a 24-hour regimen with a 1-dose antibiotic prophylaxis for elective surgery would not increase rates of surgical site infection and would decrease costs"), it was shown high compliance to 1-dose prophylaxis was achieved through an educational intervention encouraged by the hospital director and administrative measures that reduced access to extra doses.[20]

In a district rural hospital in Uganda, 850 surgical patients were evaluated prospectively over a 3 year period to compare the clinical efficacy of conventional postoperative penicillin therapy with single-dose ampicillin prophylaxis for hernia repair and ectopic pregnancy, and with single dose ampicillin-metronidazole prophylaxis for hysterectomy and caesarean section. The high rate of postoperative infection usually encountered in African hospitals after conventional treatment with penicillin for 7 days was significantly reduced with the new regimen: from 7·5 to 0 per cent in hernia repair and from 10·7 to 2·4 per cent in ectopic pregnancy; from 20·0 to 3·4 per cent in hysterectomy and from 38·2 to 15·2 percent in caesarean section. Length of hospital stay and post operative mortality rates were also significantly reduced. Single dose ampicillin prophylaxis with or without metronidazole, although rarely used in developing countries, is more cost effective than standard penicillin treatment.[21]

In a retrospective cohort of patients who underwent "clean" neck dissection from 1976 to 1989 were evaluated. Antibiotic administration (yes or no), post-operative wound infection (yes or no), and duration and cost of hospitalization were assessed and found wound infection developed in 10 (10%) of 99 patients who did not receive antibiotics. Of 93 patients who received perioperative antibiotics, three (3.3%) developed wound infection. This difference was not statistically significant[22].

A study done by Gopinath to compare the efficacy of single dose antibiotic prophylaxis versus five day course in the prevention of surgical site infections (SSI), in clean soft tissue procedures, and to assess any delay in wound healing it was found there was no statistically significant difference observed in the rate of post operative infection and wound healing time between the two groups. Single pre-operative dose of parenteral antibiotic is efficient as five day course to prevent infection in clean soft tissue procedures.[23] Higgins et al 1999 showed use of prophylactic antibiotics does not decrease the rate of wound infections in elective laparoscopic cholecystectomy.[24]

In a study done in Indonesia, ("The role of prophylactic antibiotics in preventing perioperative infection"), antibiotic prophylaxis administration significantly reduced the incidence of surgical site infection up to four-fold. Short-term antibiotic is given prior to incision in order to reduce the contamination of bacterial inoculums during surgery. The decision to administer antibiotic prophylaxis should be made by considering their risk and benefits. One of them includes utilization of the National Nosocomial Infections Surveillance (NNIS) score system, which considers three factors, i.e. wound class, ASA physical status scale, and duration of operation. The selection on timing and appropriately administered antibiotic prophylaxis is critical to maximize the benefits.[25]

A prospective double blind, randomized study was performed in 100 patients undergoing major elective thoracic surgery to assess a new method of prophylaxis of wound infection using one pre incisional intraparietal infiltration of cefuroxime sodium along the line of proposed incision as the sole protection against wound infection was done by Parry et al concluded that reductions in wound and pulmonary infection rates equivalent to those produced by conventional multiple dose parenteral regimens were achieved by this technique.[27]

A prospective descriptive study design was conducted with the aim of determining the surgical site infection rate on all 770 women who had surgery for delivery from April 1, 2009 to March 31, 2010 in obstetric ward of the hospital revealed the overall surgical site infection rate was 11.4%. Of those who had surgical site infections, 64.8% had clean-

contaminated wound and 35.2% had contaminated /dirty wound. Wound class at time of surgery has a statistically significant association with Surgical Site infections ($p < 0.001$).The Surgical Site infections rate was similar for cesarean section and abdominal hysterectomy but higher for destructive delivery under direct vision. The majority of the operation were made for emergency Obstetric conditions (96.6%) and the Surgical Site Infections rate was two times higher compared to that of elective surgery. Chorioamnionitis, presence of meconium, large intraoperative blood loss and Perioperative blood transfusion were associated with increased severity of SSIs with $p < 0.001$. Absence of antenatal care follow up was also associated with increased severity of Surgical Site Infections. It has been revealed that Surgical Site Infections rates are higher than acceptable standards indicating the need for improving Antenatal care, increasing the number of skilled birth attendants at the local clinics, increasing basic and comprehensive emergency obstetric care services, applying improved surgical techniques and improving infection prevention practices to decrease infection rate to acceptable standard.[28]

Surgery was performed on 6140 consecutive patients from February 2002 through October 2002 (period 1) and 6159 consecutive patients from December 2002 through August 2003 (period 2). Studied surgeries included orthopedic, gastrointestinal, urology, vascular, lung, head and neck, heart, gynecologic, oncology, colon, neurologic, and pediatric surgeries. The study excluded patients with infection at the time of surgery. Decreasing the 24-hour prophylactic antibiotics regimen to 1-dose antibiotic prophylaxis. Surgical site infections in both periods measured by in-hospital surveillance and post discharge surveillance; compliance with 1-dose prophylaxis; and costs with cephazolin their hospital stay; post discharge surveillance increased significantly from 2717 patients (44%) to 3066 patients (50%, $P$ .001). One-dose prophylaxis was correctly followed in 6123 patients (99% compliance) rate. Twelve thousand two hundred and ninty nine( 12 299 ) patients were followed up during of surgical site infection did not change in either period (2% and 2.1% respectively, $P = .67$).[32]A meta analysis of studies involving prophylactic antibiotics and SSI in Cochrane database revealed that prophylactic antibiotics prevent SSI.[29]

A cohort study was carried out at the Marilia Medical School Hospital Brazil 2004 and showed those who received appropriate prophylactic antibiotics had a lower rate of SSI than those who received inappropriate antibiotics [RR=0.49/95%; CI=0.25-0.90]. Patients who received prophylactic antibiotics correctly in the post-operative period had a lower risk of SSI than those who did not [RR=0.21/95%; CI=0.70-0.63]. The mean length of hospital stay was shorter among patients whose prophylactic treatment was correctly employed than among for which it was not [6.1 (±9.8) and 11.1 (±13.5) days, p=0.25].In addition, inadequate antibiotic use increases costs by increasing the length of stay in the hospital.[30]

In another study done at Srinagarind Hospital in Thailand two hundred and fifty women had undergone gynecologic surgery during the study period. There were 168 total abdominal hysterectomy (TAH), 12 vaginal hysterectomy (VH), 30 salpingooophorectomy (SO), 3 myomectomy, 30 diagnostic laparoscopy and 7 laparoscopic ovarian cystectomy (LOC). Twenty private staff and twenty residents conducted these operations. The overall rate of appropriate prophylactic antibiotic use was 75.2% (95% CI 69.28-80.33). Main type of inappropriate use were multiple doses and indication not fulfilled. The overall rate of appropriate antibiotic prophylaxis among surgeries conducted by private staff was 53.19% (95% CI 42.66-63.46) and the overall rate of appropriate antibiotic prophylaxis among surgeries conducted by residents was 88.46% (95% CI 82.13-93.83). The rate of early postoperative infection between both groups was not different (p = 0.529). There was no drug complication in all subjects. The overall rate of appropriate antibiotic prophylaxis in gynecologic surgery was 75.2% (95% CI 69.28-80.33).In this study residents used prophylactic antibiotics more appropriately than private staff.[31]

### 1.3 The Process of Prophylactic Antibiotics Practices

Multiples studies and articles have recommended that prophylactic antibiotics should be given preferably one hour before operation so as to achieve maximum therapeutic concentration when the surgeon makes an incision.

A study done in USA in 2000 showed that continuing antibiotic prophylaxis (ABP) beyond 48 hours after Coronary Artery Bypass Graft (CABG )surgery is still widespread; however, this practice is ineffective in reducing SSI, increases antimicrobial resistance, and should therefore be avoided. Surgeons and all concerned physicians are argued not to ignore the potentially harmful and costly effect of prolonged ABP after CABG surgery.[9]

In a study done in United Kingdom prophylactic vs postoperative antibiotic use in complex septorhinoplasty surgery it was shown at follow-up, there were no significance difference in infection rate between those who received prophylactic and postoperative antibiotic and prophylaxis when given one hour before operation and postoperative when given antibiotic postoperatively up to seven days.[32]

In a study done in USA in1981, antimicrobial prophylaxis in surgical patients, the use of antibiotic prophylaxis was prospectively evaluated in 1,021 surgical patients from 27 hospitals in metropolitan Minnesota. The majority of patients had undergone general surgical (23%), obstetric and gynecologic (13%), orthopedic (26%), and urologic (12%) procedures. One half of the courses of antibiotic prophylaxis were given to patients undergoing clean (class 1) surgery. Antibiotics were first administered in the four hours preceding the start of surgery in only 41% of the patients[33]. Kumar et al 2005 showed Injectable antibiotic was administered within 1 hour before surgery in 95% cases and 1-2 hrs before surgery in 5% cases in the present retrospective study which was done in 100 patients who had undergone elective genitourinary surgery in a tertiary care hospital to investigate the rationality of prophylactic use of antibiotics in genitourinary surgery.[34]

Forty five percent (95% CI: 36–54) of the patients operated in Lund Sweden 2008 and 57% (CI: 50–64) of the TKAs randomly selected from the SKAR received the preoperative antibiotic 15–45 min before the start of surgery. 53% (CI: 46–61) received antibiotics 15–45 min before inflation of a tourniquet. The inadequate timing of prophylactic antibiotics indicates that the standards of strict antiseptic and aseptic routines in arthroplasty surgery are falling. The use of a simple checklist to ensure the surgical safety may be one way of reducing infections in arthroplasty surgery. [35]

In another study done 2000-2002 Malasia of 419 cases, there were 55 (13.1%) colorectal procedures, 97 (23.2%) cholecystectomies and 267 (63.7%) inguinal hernia repairs. Antibiotics were administered in a total of 306 (73%) cases, with single-dose prophylaxis in only 125 (41%) of these. Prophylaxis was inappropriately prolonged in 80%, 52% and 31% of colorectal, cholecystectomy and inguinal hernia cases, respectively. The corresponding mean duration of antibiotic administration was 2.4+/-2.2, 1.6+/-1.8 and 1.1+/-1.3 days, respectively. Antibiotic prophylaxis in elective surgery continues to be administered haphazardly. This study supports close surveillance of antibiotic utilization by a dedicated team, perhaps consisting of microbiologists or pharmacists, to minimize inappropriate administration.[36]

In a study of the application of guidelines on pre-operative antibiotic prophylaxis in León, Nicaragua, van Disseldorp et al. (2006) estimated that antibiotic choice was discordant with the hospital guidelines in 69% of the cases, dose in 20% of the cases, and both the timing of administration and duration in 78% of the cases. Overall adherence was achieved in 7% of patients. This study represents the first attempt to assess the degree of adherence to antimicrobial prophylaxis practice standards in cardiac surgery performed in the only official referral hospital for cardiac patients in Jordan. This is an important step in developing strategies in Jordan and in other hospitals with similar conditions[37].

A retrospective observational analysis was performed on consecutive patients undergoing non-cardiac surgical procedures at a university-affiliated hospital in USA in 2005 prior to and after the institution of a computerized reminder system and come to conclude that use of the reminder system resulted in an Increase in the appropriate redosing of antibiotics from 20% prior to institution of the reminder to 58% after institution (p 0.001). A computerized reminder system is an effective tool to assist in appropriate intra operative redosing of prophylactic antibiotics during lengthy surgical procedures.[38]

Several studies have noted that there is irrational use of prophylactic antibiotics that is patients who need prophylactic antibiotics are not given while those who do not need are given. Protocol violations are frequent in preoperative antibiotic prophylaxis in Nicaragua leading to considerable over prescription. Educational strategies to reinforce protocolised antibiotic use are essential for reducing costs and antibiotic resistance rates.[39]

Another study done in China in 2000, ("Rational antibiotic use in China: lessons learnt through introducing surgeons to Australian guidelines Australia and New Zealand Health Policy 2006") showed that while agreement was reached on the principles of antibiotic prophylaxis there was no consensus on detail. Of 180 patients undergoing clean surgery throughout all phases of the study, antibiotic prophylaxis was administered to 78% compared to 98% of the 180 patients undergoing clean-contaminated surgery. Second and third generation cephalosporin antibiotics predominated in both low-risk clean and clean-contaminated operations. The timing of prophylaxis was correct in virtually all patients. The duration of prophylaxis was less than 24 hours in 96% of patients undergoing clean surgery compared to only 62% of patients undergoing clean contaminated surgery. The intervention produced no improvement in the duration of prophylaxis nor the overuse and inappropriate choice of unnecessary broad-spectrum and expensive drugs. Interviews and focus groups revealed that an important explanation for the latter problem was Chinese government policy which expected hospitals to support themselves largely through the sale of drugs.[40]

In a study done USA in 2005, preoperative antibiotics and mortality in the elderly showed that of the patients, 44.8% underwent a clean surgical operation and 55.2% underwent a clean-contaminated surgical operation. Inguinal hernia repair and laparoscopic cholecystectomy were the commonest operations in each category. Second generation cephalosporins were the most frequently prescribed antibiotics, in 67%. Although only 78.5% of procedures required prophylaxis, it was administered in 97.5%, so it was not justified and inappropriately administered in 19%. It was revealed that 100% of patients received antibiotic prophylaxis on time. The choice of antimicrobial agent was appropriate in 70% and the duration of prophylaxis was optimal in 36.3%. The overall compliance rate of surgeons with guidelines for antibiotic prophylaxis was 36.3%. For general surgery, the odds of dying within 60 days were less than an half in those treated with preoperative antibiotics within 2 hours of incision as compared with those without such treatment: (odds ratio 0.44; 95% confidence interval, 0.32– 0.60), P 0.0001). For orthopedic surgery, no significant mortality reduction was observed (OR 0.85; 95% confidence interval, 0.54 –1.32; P 0.464). [41]

Another study done in Korea ("Association between the pattern of prophylactic antibiotic use and surgical site infection rate for major surgeries in Korea"), the proportion of patients who received their first prophylactic antibiotics 1 hour before incision was 65.5%, who received inappropriate PAs was 80.8%, and the proportion of patients whose PA was discontinued within 24 hours of surgery was 0.5%. The average duration of prophylactic antibiotic use after surgery was 9 days. The relative risk (RR) of SSI in patients who received their first PA more than 1 hour before incision was significantly higher than for those who received it within 1 hour prior to incision (RR=8.20, 95% CI=4.81-13.99). Inappropriate PA selection increased SSI rate, albeit with marginal significance (RR=1.97, 95% CI=0.96-4.03). Also, prolonged prophylactic antibiotic use following surgery had no effect on SSI rate. Errors in the timing of prophylactic antibiotic use and of PA selection increase SSI rate. SSI rate remained unaltered following prolonged prophylactic antibiotic use after surgery.[42]

In another study done in USA 2009, ("Surgical Infections and Prophylactic Antibiotics: 341 Consecutive Cases of Gallbladder"), it was shown that the infection rate of patients having an open cholecystectomy was significantly greater than the laparoscopic group (12.9% versus 1.8%, $p$ <.001). In the laparoscopic group of patients who met the criteria for PA and received PA there were no infections as compared with those who had criteria for but did *not* receive PA (0% versus 22%, $p$ <.05). Only 27% of all elective cholecystectomy patients received cefazolin while 73% of patients received extended spectrum antibiotics. In 63.2% of patients antibiotics were used with no indication for PA. In 73% of patients, an extended spectrum drug was used when a less expensive and narrower spectrum agent would have sufficed. Open cholecystectomy has a significantly higher infectious rate than closed cholecystectomy.[43]

Assessment of the pattern of antibiotic usage in surgical in-patients of a teaching hospital in north west of Ethiopia Hospital-based prospective cross-sectional study was conducted on surgical in-patients for a duration of three months (Jan.-Mar.2002). Out of 236 patients who have been admitted to the surgical ward during the study period, 167(70.8%) received antibiotics for prophylaxis (32%) and treatment (38.8%) purposes mainly on empirical basis. The average number of antibiotics per patient was 2.17 for prophylaxis and 2.18 for treatment; and the mean duration of therapy was 3.2 days for prophylaxis and 8.7 days for treatment. Frequently prescribed antibiotics or their combinations were ampicillin, chloramphenicol and gentamicin. The average number of antibiotics and the mean duration of particularly prophylactic antibiotic therapy were somehow increased. The use of antibiotics on empirical basis was a routine prescribing practice .[44]

Evaluation of the appropriateness of antibiotic prophylaxis administered before surgery at a major referral hospital in Shiraz, against the American Society of Hospital Pharmacists (ASHP) guidelines was done and showed that of 155 patients included in the analysis, 98% received prophylactic antibiotic before surgery; according to ASHP guidelines, prophylaxis was needed in only 106 (68.4%).Of these 106, only 8 patients received the correct antibiotic regimen. The commonest regimens administered were cefazolin+ gentamicin (47.6%), cefazolin (20.5%) and cefuroxime (8.5%). Antibiotic

prophylaxis was continued in 83% of cases, while this was necessary in only 37%. In only 1 surgical procedure were all evaluated parameters correct.[45]

A study done on appropriateness and compliance of antibiotic prophylaxis practices in cardiac surgery in a tertiary hospital in United Arab Emirates (UAE) using three international guidelines were assessed. Based on the international guidelines, only 89.1 and 79.3% of the patients received the recommended pre and postoperative antibiotics, respectively. On the other hand, 93.5% of the patients received the right antibiotic dose while the total duration of all antimicrobial agents used for prophylaxis was concordant with the guidelines (48 h) in only 67.4% of the patients. Adherence to international antimicrobial prophylaxis guidelines for cardiac surgery was found to be suboptimal in the study hospital in Dubai. Various interventions are needed via developing local evidence-based protocols in collaboration with surgeons, and also to strengthen regulations for ensuring adherence to these guidelines.[46]

A survey of 23 pediatric cardio vascular surgery programs demonstrated uniform use of prophylactic antibiotics for open heart operations. Only 65% of the programs used prophylaxis for repair of patent ductus arteriosus. Cephalosporins were the most frequently used antibiotics, but aminoglycosides in combination with penicillins were used in approximately 25% of the operations. Antibiotics were most often started prior to operation (89.7%) and continued for less than five days. These data demonstrate that the use of prophylaxis in pediatric cardiovascular operations conforms to current guidelines.[47]

Evaluation of the adherence of general surgeons to guidelines for antimicrobial prophylaxis was held from January 2000 until October 2000 in a General Surgery Clinic in a hospital in Athens, Greece in which eight hundred and ninety-eight patients were enrolled and operated on electively. Second generation cephalosporins were the most frequently prescribed antibiotics, in 67%. Although, only 78.5% of procedures required prophylaxis, it was administered in 97.5%, so it was not justified and inappropriately administered in 19%. It was revealed that 100% of patients received antibiotic prophylaxis on time. The choice of antimicrobial agent was appropriate in 70% and the duration of prophylaxis was optimal in 36.3%. The overall compliance rate of surgeons with guidelines for antibiotic prophylaxis was 36.3%. Adherence to separate aspects of guidelines for surgical prophylaxis has to be improved. The duration of antibiotic prophylaxis was the main parameter of interest. Interventions have to be made about the development, distribution and adoption of adequate guidelines in collaboration with surgeons.[64]

Evaluation of quality of perioperative antibiotic prophylaxis (PAP) and to calculate the cost per procedure in a Turkish university hospital was done in 352-bed teaching hospital in Denizli, Turkey. Aprospective audit was performed between July and October 2010 and it was shown that the most frequently used antimicrobials were cefazolin and sulbactam/ampicillin. [48]

The study was done by Gorreckie et al on the appropriateness of antibiotic administration in a cohort of surgical patients undergoing elective and emergency surgery in a department of surgery in an urban, community-based, private, 560-bed teaching hospital was retrospectively reviewed. Many surgeons are not familiar with the spectrum of antimicrobials and often do not distinguish between prophylactic and therapeutic administration. Antibiotic usage in current surgical practice is often inappropriate, excessive, and chaotic.[49]

The study by Gorreck et al on the Surgical Infection Society (SIS) guidelines for antibiotic (AB) usage minimally changed the surgical practice. The authors believed that clinical evidence of the safety, advantage, and effectiveness of SIS guidelines may improve inappropriate usage of Ab it was revealed that). Results: Group A included 124 patients and Group B, 254. There were no intergroup differences in age, sex, and clean/contaminated/dirty ratio of procedures. The mean duration of Ab treatment was 3.9 days in group A, versus 7.1 days in group B (s), with overall rate of appropriateness of 77% versus 36% (s) and no differences in mortality and morbidity rates. Perhaps these results may change AB usage.[50]

In study done in Halibet Hospital, Asmara, Eritrea to document the practice of perioperative prophylactic antibiotic use in a teaching hospital in Eritrea the prospective study was conducted in 2009. One hundred and one patients were enrolled in the study. Sixty nine percent received prophylactic antibiotics. Of these, 30% were preoperatively and 39% postoperatively. Twenty one percent the majority of whom were in the clean/contaminated group did not receive the required prophylaxis. The surgery site infection rate was 6% mostly from emergency operations recognized during the period of hospitalization. The use of prophylactic antibiotics in Halibet Hospital needs to be standardized and monitored based on evidence and international benchmarks.[51]

A study done by Haemeet et al India 2010 on the pattern of prophylactic antibiotics in different surgeries in a large tertiary care teaching hospital it was found that third generation cephalosporins were the most commonly prescribed class of antibiotics. Although only 67% of cases required prophylaxis, it was utilized in 86% of procedures, being unjustified in 19% of cases. Mean timing of administration of antibiotics was 3.22 ± 1.03 hours prior to first incision and the patients received post operative antibiotics for a mean duration of 5 days during their hospital stay thus, surgical prophylaxis was inappropriate in terms of choice of antimicrobial agent, timing of administration as well as the total duration of prescription, in majority of the cases. Interventions are warranted to promote the development, dissemination and adoption of evidence based guidelines for antimicrobial prophylaxis.[52]

A cohort study was carried out at the Marilia Medical School Hospital Brazil 2004. Prophylaxis was indicated in 73.2% of the surgeries. The antibiotics most used for prophylaxis were first generation cephalosporins. In 78.9% of the surgeries, the antibiotic was correctly chosen. In 15.9% of the surgeries, the initial antibiotic administration was correctly timed. The use of antibiotics in the post-operative period was appropriate in 29.8% of the cases. The independent risk factors for surgical site infection (SSI), as determined by logistic regression analysis adjusted to class of wound risk, were the choice of antibiotic to be used prophylactically and the duration of antibiotic treatment in the post-operative period.[53]

In study done by Kunins et al, antibiotic prophylaxis was started postoperatively in 68% of the primary care hospital cases. Though prophylaxis was always perioperative in the tertiary care hospital, the postoperative duration was more than 7 days in one third of cases. The nosocomial infection rate in those given prolonged prophylaxis was higher than those who received antibiotics for less than 72 hours. Antibiotics were started empirically in 78% of tertiary hospital care cases and 100% of cases in the primary hospital. Though culture sensitivity was done in 80% of the tertiary care cases, more than half the specimens were sent after multiple doses of antibiotics were started. The choice of antibiotic did not always correlate with the sensitivity report. Though cost effective drugs were chosen in 50% of cases, in more than 20% of cases expensive drugs were started. The study highlights the need for an antibiotic audit and suggests the necessity of having an ongoing audit.[54]

### 1.4 Structure for Prophylactic Antibiotics Practices

A questionnaire was sent to 120 United Kingdom cardiac surgeons to ask for information on their use of prophylactic antibiotics in adult cardiac surgical London patients. Despite having knowledge of guidelines, participants perceived consistent failure in the proper timing of antibiotic administration. This study suggests that proper antibiotic timing is thwarted by significant obstacles. The gap between evidence-based guidelines and practice is populated by individual values, professional conflicts, and organizational conflicts which must be addressed in order to achieve optimal practice in this domain. Thematic analysis revealed a number of obstacles to the observance of guidelines including: (1) low priority, (2) inconvenience, (3) workflow, (4) organizational communication, and (5) role perception. Workflow and role perception were the dominant obstacles. Using group interviews to reveal these factors to team members and managers may be a first step to resolving the gap and reducing surgical site infections.[55]

In a retrospective process quality control trial done in Department of Surgery, University Hospital Zürich, proper use of antimicrobial prophylaxis in gastroduodenal operations according to the standard guidelines was studied and concluded that antimicrobial prophylaxis policy is an important issue, targeting lower morbidity or avoidable costs.[56]

To identify the factors associated with inappropriate antibiotic use during elective general surgeries. Cross-sectional analysis of administrative dataset Sixty two acute-care hospitals in Japan. The adherence rates for drug selection and treatment duration were 53-84 and 38-68% depending on surgical procedures, respectively. Patient age, sex and risk factors for surgical-site infections were not associated with inappropriate use of antibiotics after adjustment of other factors. The large size of the hospitals was significantly associated with inappropriate antibiotic usage. In hospitals with high surgical volume, the treatment duration was appropriate while antibiotic selection was relatively consistent but not adherent to the guidelines, implicating the presence of local practice routines.[57]

In another study done in China 2006, "Effect and cost of perioperative use of antibiotics in coronary artery bypass grafting",the postoperative hospitalization days of the intervention group were significantly fewer than that for the control group ($P<0.05$). The time of antibiotic use and post-infection treatment time were also significantly less in the intervention group than in the control group ($P<0.05$). The average hospital daily cost and total cost of antibiotics were less in the intervention group than in the control group ($P<0.05$).[58]

Antibiotic prophylaxis for endoscopic retrograde cholangiopancreatography (ERCP) is controversial. Our audit of South African endoscopists who perform ERCPs took the form of a questionnaire. For the literature review a Pubmed search was performed from 1978 to March 2008, and these findings were compared with the current practice in South Africa. There was also a wide spectrum of antibiotic types that were being used. The Pubmed search revealed only 7 randomized controlled trials, with little consensus between them as to the absolute indications for prophylactic antibiotics in ERCP. Guidelines on antibiotic prophylaxis for ERCP are based on poor evidence. Varied opinions on its indications in South Africa may reflect the situation in other countries as well.[59]

A study done by Crossley et al "Antimicrobial prophylaxis in surgical patients" 1981 it was shown that the mean duration of prophylaxis was 3.4 days. About one third of the patients received prophylaxis for more than 72 hours; this group accounted for 65% of patient-days of antibiotic administration. More than one half of the patients received cephalosporin. Analysis of patient charges suggests that 18% to 50% of the cost of perioperative antibiotic prophylaxis might be saved by limiting the duration of drug administration.[60]

A study by Nareen et al, Baseline performance demonstrating poor compliance with guidelines was determined by retrospective analysis of over 300 sequential cases lasting over four hours over an 18-month period and has been published previously it revealed educational intervention alone can improve compliance with antibiotic prophylaxis guidelines, however the effect falls far short of expectations and does not impact SSI rates. The combination of academic detailing with logistics and work flow changes as well as compulsory mechanisms will likely be necessary to improve performance.[61]

Well-controlled, prospective, blinded studies have outlined many of the areas in which antibiotic prophylaxis is of benefit, as well as those clinical situations in which the risks of antibiotic prophylaxis outweighed the expected value. Historically, the most common errors in usage include the widespread use of antibiotic prophylaxis in clean surgery and the faulty timing of administration. The most common error today (in the use of prophylactic antibiotics in surgical practice) is continuation of the agents beyond the time necessary for maximal benefit. In order to appropriately administer prophylactic antibiotics in the various clinical settings on the surgical service, in which this practice has been of proved value, one must be aware of the following nuances including (1) choice of the antibiotic agent based on the type of organisms usually causing infection, (2) route of its administration, (3) the dosage necessary to attain efficacious tissue or serum levels, and (4) the timing of administration which offers the maximum benefits without risking the adverse effects.[62]

Comparison of the efficacy of prophylactic vs postoperative antibiotic use in complex septorhinoplasty and strengthen the evidence base for antibiotic use in nasal surgery showed that there was no significant difference in infection rates between the prophylactic and post-operative arms on $X^2$ analysis.[63]

A study done in Livingstone General Hospital, Zambia 2006, in the areas of suitability, combinations, duration, cost and incidence of SSI revealed that lack of prophylactic protocols and resultant ad-hoc antibiotic administration that sometimes lacked pharmacological rationale. In spite of evidence in the literature to the contrary, dosing was continued in all cases for several days. The absence of a prophylactic protocol results in increased expenditure on antibiotics without proven patient benefit and may contribute to surgical site infections with resistant organisms. The occurrence of surgical site infections was 23% and is associated with a significant cost of €133.84 per infection. In the context of limited health budgets in developing countries, this result is likely highly significant. The implementation of single dose prophylactic protocols can be expected to result in significant financial savings and may reduce the cost of treating surgical site infections. Investigation into financially feasible

modifiable factors contributing to SSI would lead to significant savings and improved patient outcome.[64]

The study was done by Ozgun et al 2010 in Turkey aimed to determine the propriety of perioperative antimicrobial prophylaxis, to evaluate the effects of a training intervention on correction revealed before the intervention, 312 procedures were recorded compared with 322 after the intervention. Total compliance rate decreased from 34.3% to 28.5% after the intervention, though insignificantly ($p=0.59$). Educational training intervention did not change the rate of inappropriate antibiotic choice statistically, and prolonged antibiotic use was significantly higher after the intervention ($p=0.01$). The positive impact of the intervention was observed in decreased "not indicated but administered" rate ($p=0.009$) and absence of procedures with "indicated but not administered" and "inappropriate antibiotic dose" which also decreased significantly (both $p<0.001$). The total cost of irrational antibiotic use was US$26,230.2. Although this educational intervention study achieved improvements in indications, choice, and dosing of surgical antimicrobial prophylaxis, it failed to improve prolonged use and total compliance rate, and to lower the costs sufficiently. It will probably provide better results by means of compulsory measures for surgeons to comply with available protocols and guidelines, as well as education programs, in order to change the antibiotic utility habits on surgical prophylaxis and to achieve accurate prophylactic administration.[65]

## 1.5 Statement of the Problem

Use of prophylactic antibiotics is important because it is associated with reducing SSI, shortening length of hospital stay, reducing morbidity and mortality, reducing hospital cost and antibiotic resistance.

However many studies done outside Tanzania show practices of prophylactic antibiotic use are inappropriate either in timing of prophylactic antibiotic, prolongation of prophylactic antibiotic post operatively, patients who need prophylactic antibiotics are not given and those who do not need are given prophylactic antibiotics.

Inappropriate use of prophylactic antibiotic is associated with increasing SSI, length of hospital stay, mortality, antibiotic resistance and hospital cost.[1-5]

Most studies done inside Tanzania are on necessity of prophylactic antibiotic on prevention of SSI but not on appropriateness of prophylactic antibiotic. [38-44]

## 1.6 Rationale

No study has been done to assess the appropriateness of use of prophylactic antibiotic in elective surgical patients in our set up so this study is needed to get baseline data which will fill the gap in knowledge hence aiding in improving our practices of prophylactic antibiotic use at MNH. Following this study it will be possible to recommend institutional policy on rational use of prophylactic antibiotics in patients undergoing elective surgery. Adherence to such recommendation will lead to important consequences: reduction in medication cost, hospitalization duration, morbidity and mortality, SSI and antibiotic resistance.[7-10]

Secondly, this dissertation is done as part of fulfillment for completion of a study programme, Master of Medicine degree in General Surgery.

## 1.7 Research Question

Does the surgical team adhere to appropriate use of prophylactic antibiotics in elective surgeries at MNH?

# CHAPTER TWO

## 2.0 OBJECTIVES

### 2.1 Broad Objective

To evaluate prophylactic antibiotics practices in elective surgical patients at MNH

### 2.2 Specific Objectives

1. To determine demographic profile of patients undergoing elective surgery at MNH.
2. To document the proportion of patients undergoing elective surgery receiving prophylactic antibiotics.
3. To determine the commonly used prophylactic antibiotics for specific type of elective surgery at MNH.
4. To document the timing of prophylactic antibiotics in surgical patients at MNH.
5. To determine duration of prophylactic antibiotics post operatively among surgical patients at MNH.

# CHAPTER THREE

## 3.0 METHODOLOGY

### 3.1 Study setting

Department of General Surgery, Muhimbili National Hospital from July 2012 to January 2013. Department of general surgery is composed of firm 1,firm 2,urology unit, paediatric surgery unit, plastic surgery and burn unit and cardiovascular surgery unit.

Muhimbili National Hospital is a public university teaching hospital and a national referral centre for Tanzania with a bed capacity of 1,500 out of which 120 beds are dedicated to adult general surgery services and it is positioned to serve patients from different parts of the country and is, in effect, the apex of the public health service hierarchy in Tanzania. Tanzania is an East African country with approximately 44 million people.

### 3.2 Study design

This was a prospective cross section hospital based study conducted for 7 months from July 2012 to January 2013.

### 3.3 Study population

The study included all patients in general surgical ward who underwent elective surgical procedures in the operating theater during the study period.

### 3.4 Sample size

Sample size was convenient sampling in which all patients who had elective operation and met inclusions criteria was included. A total elective operation done were 1146 were included in the study.

### 3.5 Inclusions and Exclusions criteria

**Inclusion criteria**

All elective surgeries done in operating theatre

**Exclusion criteria**

Emergency surgeries

Patients who did not undergo surgical procedure in operating theater

### 3. 6 sampling technique

Convenient enrollment technique was employed in which all patients in surgical department who underwent elective operation in MNH theatre in Dar-es-salaam from July 2012 to January 2013 were enrolled.

### 3.7 Study procedure:

Prior to data collection the hospital administration visited to explain the purpose of the study. The principal investigator and one research assistant made a pretest of the questionnaire and were responsible for data collection. Audit of elective surgeries was done by collecting information on timing of administering first dose of prophylactic antibiotic, length of

operation, types of surgery, choice of antibiotic used, timing of stopping prophylactic antibiotics from case notes and observation. A Structured questionnaire was used to collect information.

### 3.8 Monitoring

Research information was gathered everyday and followed, and the resources, quality/quantity of activities reviewed frequently. This helped to identify gaps and problems which could be solved early and avoid affecting the research.

### 3.9 Data processing and analysis.

Data recorded on the data collecting tool was processed and checked for completeness and consistency using SPSS version 16 program followed by data cleaning and coding then data analysis using frequency tables and cross tabulation with respective statistical tests. After analysis of the data followed by interpretation, report was written and presented.

### 3.10 Ethical issues

This study was carried out in accordance with existing ethical guidelines. Ethical clearance for the study was sought from the MUHAS ethical committee.

Before being implemented, the proposal was reviewed and discussed at different levels in MUHAS, and finally be approved by the MUHAS Research and Publications committee.

A written consent was obtained from MNH administration office after giving them the description of the study to ensure that they understand about the study so as to make independent informed choice to allow the study to be carried out.

All patients' information were kept confidentially and not accessed by people not concerned in the study.

### 3.11 Limitation of the study

The study was done at single institution.

The study does not involve other surgical departments such as ENT, obstretic and gynaecology and others.

### 3.12 Training of research assistant

One week of training of research assistant was conducted by principal investigator. One research assistant who was qualified medical doctor selected and trained. He was trained on the purpose of the study and how to collect the data using structured questionnaire.

### 3.13 Dissemination of report

From the dissertation Publication of the research findings in medical journal

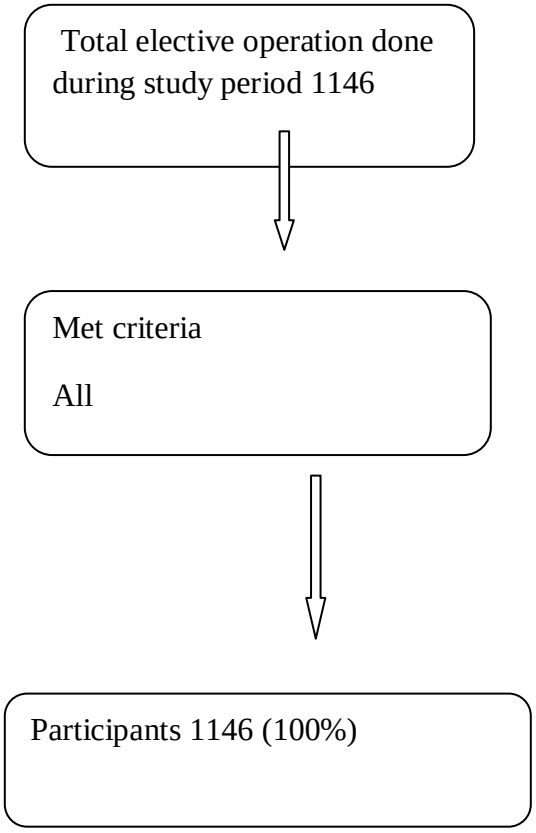
Presentation in scientific conference such as College of Surgeons of East, Central and Southern Africa as conference paper or a poster.

# CHAPTER FOUR

## 4.0 RESULTS AND DISCUSSION

### 4.1 RESULTS

During the study period 1146 elective operation were done and all these operation were audited on practices of prophylactic antibiotics use.




Age of study population ranges from 0.01years to 100years with mean and standard deviation of 40.42±24.8. Male were the majority with a ratio of (64.8:35.2)

**Table 1: Social demographic distribution of study population**

| **Sex** | | **N=1146** | **Percent** |
|---|---|---|---|
| | Male | 743 | 64.8 |
| | Female | 403 | 35.2 |
| **Education** | No education | 102 | 8.9 |
| | Primary | 789 | 68.8 |
| | O level | 160 | 14 |
| | High level | 53 | 4.6 |
| | Higher education | 42 | 3.7 |
| **Age** | | | |
| | <20 | 262 | 22.9 |
| | 20-39 | 281 | 24.4 |
| | 40-59 | 286 | 25.0 |
| | ≥60 | 317 | 27.7 |
| **Antibiotic status** | Yes | 968 | 84.5 |
| | No | 178 | 15.5 |

The majority of the respondents had primary education (68.8%) with higher education being the least (3.7%). Among elective operation done there were 743(64.8) for male patients and 403(35.2%) for female patients. Proportionally more patients were sixty years old and above at 27.7%. Among elective surgery done at MNH 84.5% received prophylactic antibiotics.

**Table 2: Administration of prophylactic antibiotic vs wound class.**

| TYPES OF WOUNDS | Eligibility for antibiotics prophylaxis | | |
|---|---|---|---|
| | Yes (%) | No (%) | Total (%) |
| **Clean** | 160 (72.1) | 62 (27.9) | 222 (100) |
| **Clean contaminated** | 785 (88.4) | 103 (11.6) | 888 (100) |
| **Contaminated** | 20 (83.3) | 4 (16.7) | 24 (100) |
| **Dirty** | 3 (25) | 9 (75) | 12 (100) |
| **Total** | 968 (84.5) | 178 (15.5) | 1146 (100) |

Eighty eight point four percent (88.4%) of clean contaminated wound received prophylactic antibiotics. However 72.1% of clean wounds, 25% of dirty and 83.3% of dirty wound which was not eligible to receive prophylactic antibiotic received prophylactic antibiotics.

**Table 3: Prophylactic antibiotic vs incision**

| | prophylactic antibiotic | | |
|---|---|---|---|
| **Incision** | Yes (%) | No (%) | Total (%) |
| **Yes** | 826 (89.4) | 98 (10.6) | 924 (100) |
| **No** | 142 (64) | 80 (36) | 222 (100) |
| **Total** | 968 (84.5) | 178 (15.5) | 1146 (100) |

Prophylactic antibiotic was administered to 89.4% of elective surgeries in which there were external incision and 64% in surgeries in which there were no external incision.

**Table 4: Distribution of timing of prophylactic antibiotic given to the study population**.

| | | Total | % |
|---|---|---|---|
| Timing of prophylactic antibiotic | Intraoperatively | 83 | 8.6 |
| | 1 hour before operation | 555 | 57.3 |
| | Post operatively | 330 | 34.1 |
| Timing of stopping prophylactic antibiotics post surgery | <24hours | 9 | 0.9 |
| | 24-48hours | 18 | 1.9 |
| | 48-120hours | 105 | 10.8 |
| | ≥120Hours | 836 | 86.4 |
| Frequency of prophylactic antibiotic administration intraoperatively | Once | 968 | 100 |
| | Twice | 0 | 0 |
| | Thrice or more | 0 | 0 |

The majority (57.3%) received prophylactic antibiotic one hour before surgery, followed by 34.1% who received prophylactic antibiotic post surgery and few (8.3%) received prophylactic antibiotics intraoperatively. The majority 836(86.4%) stopped prophylactic antibiotics more than five days post operatively while a few (0.9%) stopped prophylactic antibiotics within twenty four hours post surgery. No additional prophyalactic antibiotics was given intraoperatively.

**Table 5: Administration of prophylactic antibiotic according to type of surgery**

| | Prophylactic antibiotic | | | | | |
|---|---|---|---|---|---|---|
| Surgery type | YES | % | NO | % | TOTAL | % |
| Open prostactomy | 48 | 81.4 | 11 | 18.6 | 59 | 100 |
| Urethroplasty | 49 | 94.2 | 3 | 5.8 | 52 | 100 |
| Cystectomy | 23 | 85.2 | 4 | 14.8 | 27 | 100 |
| Nephrectomy | 10 | 58.8 | 7 | 41.2 | 17 | 100 |
| Herniorrhyaphy | 55 | 85.9 | 9 | 14.1 | 64 | 100 |
| Wide local excision | 34 | 72.3 | 13 | 27.7 | 47 | 100 |
| Amputation | 60 | 78.9 | 16 | 21.1 | 76 | 100 |
| DVU+CYSTOSCOPY | 143 | 80.8 | 34 | 19.2 | 177 | 100 |
| TURP | 23 | 71.9 | 9 | 28.1 | 32 | 100 |
| SKIN GRAFTING | 109 | 87.9 | 15 | 12.1 | 124 | 100 |
| LAPARATOMY | 108 | 92.3 | 9 | 7.7 | 117 | 100 |
| LAPARASCOPIC SURGERY | 11 | 84.6 | 2 | 15.4 | 13 | 100 |
| OTHERS | 153 | 90 | 17 | 10 | 170 | 100 |
| THYROIDECTOMY | 55 | 94.8 | 3 | 5.2 | 58 | 100 |
| BSO | 42 | 71.2 | 17 | 28.8 | 59 | 100 |
| MASTECTOMY | 41 | 85.4 | 7 | 14.6 | 48 | 100 |
| CONTRACTURE RELEASE | 4 | 66.7 | 2 | 33.3 | 6 | 100 |
| TOTAL | 968 | 84.5 | 178 | 15.5 | 1146 | 100 |

The majority of patients who underwent herniorrhaphy, DVU and cystoscopy, thyroidectomy and mastectomy which are clean procedures received prophylactic antibiotics (85.9%),( 80.8%), (94.8%) and (85.4) respectively.

**Table 6: Surgery type vs Choice of antibiotic chosen.**

| Surgery type | Choice of antibiotic chosen | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | cef | % | met | % | Met+cef | % | others | % | Total | % |
| **Open prostatectomy** | 18 | 37.5 | 3 | 6.3 | 26 | 54.2 | 1 | 2.1 | 48 | 100 |
| **Urethroplasty** | 25 | 51.0 | 5 | 10.2 | 18 | 36.7 | 1 | 2.0 | 49 | 100 |
| **Cystectomy** | 11 | 47.8 | 1 | 24.4 | 11 | 47.8 | 0 | 0 | 23 | 100 |
| **Nephrectomy** | 1 | 10 | 1 | 10 | 8 | 80 | 0 | 0 | 10 | 100 |
| **Herniorrhyaphy** | 19 | 34.5 | 5 | 9.1 | 30 | 54.5 | 1 | 1.8 | 55 | 100 |
| **Wide local excision** | 17 | 50.0 | 3 | 8.8 | 14 | 41.2 | 0 | 0 | 34 | 100 |
| **Amputation** | 24 | 40 | 4 | 6.7 | 29 | 48.3 | 3 | 5 | 60 | 100 |
| **DVU+CYSTOSCOPY** | 82 | 57.3 | 12 | 8.4 | 48 | 33.6 | 1 | 7 | 143 | 100 |
| **TURP** | 13 | 56.5 | 1 | 4.3 | 8 | 34.8 | 1 | 4.3 | 23 | 100 |
| **SKIN GRAFTING** | 75 | 68.8 | 9 | 8.3 | 6 | 5.5 | 19 | 17.4 | 109 | 100 |
| **LAPARATOMY** | 22 | 20.4 | 5 | 4.6 | 80 | 74 | 1 | 1 | 108 | 100 |
| **LAPAR SURGERY** | 6 | 54.5 | 0 | 0 | 4 | 36.4 | 1 | 9.1 | 11 | 100 |
| **OTHERS** | 33 | 21.6 | 17 | 11.1 | 102 | 66.7 | 1 | 1 | 153 | 100 |
| **THYROIDECTOMY** | 20 | 36.4 | 3 | 5.5 | 32 | 58.2 | 0 | 0 | 55 | 100 |
| **BSO** | 12 | 28.6 | 5 | 11.9 | 25 | 59.5 | 0 | 0 | 42 | 100 |
| **MASTECTOMY** | 25 | 61 | 0 | 0 | 16 | 39 | 0 | 0 | 41 | 100 |
| **CONTRA RELEASE** | 4 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 100 |
| **TOTAL** | 407 | **42.2** | 74 | **7.6** | 457 | **47.2** | 29 | **3** | 968 | 100 |

Majority of patients who underwent thyroidectomy (58.2%) received both metronidazole and ceftraxone while ceftriaxone alone could enough. Patients who undergo cystectomy almost half(47.8%) received ceftriaxone alone and half(47.8%) received both ceftriaxone and metronidazole but this surgery need both ceftriaxone and metronidazole as prophylactic antibiotic. Overall combination of ceftriaxone and metronidazole were the mostly used prophylactic antibiotic (47.2%) followed by ceftriaxone alone (42.2%).

## 4.2 DISCUSSION

Our study was concerning "Prophylactic antibiotics practices at MNH Tanzania". From this study it can be revealed that among elective surgery done at MNH 84.5% received prophylactic antibiotics. Prophylactic antibiotic was given to 72% of clean wound 88.4% of clean contaminated wound,83.3% of infected wound and 25% of dirty wound. The results correspond with results in other studies done in the world which shows how the use of prophylactic antibiotic is inappropriate. The study done at MNH by Kaali et al shows that prophylactic antibiotic is not needed in clean, surgery but in this study 72% clean wound received prophylactic antibiotic.[66] Similarly In the study done by Górecki et al, it was shown in 156 patients (74%) the administration was considered inappropriate. Antibiotic usage in current surgical practice is often inappropriate, excessive, and chaotic.[50]

Antibiotic prophylaxis was given to clean wound but was not given in some clean contaminated wounds in which it was necessary. This corresponds to the study done in USA in 2005, preoperative antibiotics and mortality in the elderly showed that although only 78.5% of procedures required prophylaxis, it was administered in 97.5%, so it was not justified and inappropriately administered in 19%.[17]Similarly several studies done in Phillipines, Brazil, Africa and USA reported inappropriate use of prophylactic antibiotic.[19-31]

The fact that prophylactic antibiotics prescribed haphazardly might be due to lack of written local guidelines for prophylactic antibiotics in surgery patients. This is wastage of resource and increase antibiotic resistance.[67]The high degree of inappropriateness might be caused by lack knowledge, guidelines sometimes fear of environment where these surgeries are being done that aseptic techniques are not executed completely.

From this study it was shown the majority (57.3%) received prophylactic antibiotic one hour before surgery, followed by 34.1% who received prophylactic antibiotic post surgery and few (8.3%) received prophylactic antibiotic intraoperatively. Majority 836(86.4%) stopped prophylactic antibiotic more than five days post operatively while a few (0.9%) stopped prophylactic antibiotic within twenty four hours post surgery. All elective surgeries received prophyalactic antibiotic only once during surgery (Intraoperatively).

These results correspond with results done in other parts of the world. Most studies done shows prolongation of prophylactic antibiotic post surgery and prophylactic antibiotic not given at appropriate time before surgery. Large prospective clinical trial further specified the 2 hour pre-incision period as the ideal interval for the delivery of prophylactic antibiotics, as administration after incision resulted in a fourfold increase in SSIs (the incidence of wound infection of patients who received antibiotics within the 2 hour period before incision was 0.6% compared with an incidence of 2.6% when the antibiotics were given after incision).[22]

A study done on appropriateness and compliance of antibiotic prophylaxis practices in cardiac surgery in a tertiary hospital in United Arab Emirates (UAE) using three international guidelines were assessed. Based on the international guidelines, only 89.1 and 79.3% of the patients received the recommended pre and postoperative antibiotics, respectively. On the other hand, 93.5% of the patients received the right antibiotic dose while the total duration of all antimicrobial agents used for prophylaxis was concordant with the guidelines (48 h) in only 67.4% of the patients.[50] Studies done in Asia, North and South America, Europe and Africa gave the results which resembles with our results.[3, 9, 17, 31, .35, 54, 60, 63, 65 .]

The findings in our study might be attributed by surgeons at MNH being not confident on the environment(Aseptic techniques) at which surgeries are being done that is why some decide to prolong prophylactic antibiotic more than five days in majority of surgeries fearing that patients might get SSI.

In this study it was shown that all patients received prophylactic antibiotic intraoperatively once even if in some of elective surgery the operation was done over more than three hours. Studies shows that for prolonged surgery of more than three hours prophylactic antibiotic should be provided every three hours except for vancomycin, aminoglycosides and fluoroquinolones so the results of this study was contrary to the present guidelines of prophylactic antibiotic use[1'2]

However giving prophylactic antibiotic intraoperatively, post surgery or only once in the surgeries lasting more than three hours might be lack of knowledge or reminder system.

Despite this evidence, proper timing of prophylactic antibiotics remains problematic. A major 1996 study by the Antibiotic Prophylaxis Study Group (APSG) found that, although 86% of patients received antibiotic prophylaxis for postoperative wound infections, only 61% received these medications within a 2 hour preoperative period. In a Canadian survey of hip fracture patients, only 30% of 352 patients who underwent surgery with insertion of prosthetic foreign material received prophylactic antibiotics within the time.[49].These studies shows that still surgical team does not adhere to the principles of prophylactic antibiotic administration.

From our study it can be seen that majority of patients who underwent thyroidectomy(58.2%) received both metronidazole and ceftraxone but this is clean surgery which does not need prophylactic antibiotic. Ahmad et al, No need of prophylactic antibiotics in clean elective surgery done in aseptic conditions[5]. Similarly D'Amico et al give the same results. If at all prophylactic antibiotic could be needed, single dose of ceftriaxone would be enough. Patients who undergo cystectomy almost half (47.8%) received ceftriaxone alone and half (47.8%) received both ceftriaxone and metronidazole but from the literature single dose of prophylactic antibiotic could be enough. Overall combination of ceftriaxone and metronidazole were the mostly used prophylactic antibiotic (47.2%) followed by ceftriaxone alone (42.2%).

The result differ from that done by study done by Vessal et al "Evaluation of prophylactic antibiotic administration at the surgical ward of a major referral hospital", Islamic Republic of Iran in which the most prescribed prophylactic antibiotic was cefazolin and gentamycin[53]. A prospective double blind, randomized study was performed in 100 patients undergoing major elective thoracic surgery to assess a new method of prophylaxis of wound infection using one pre incisional intraparietal infiltration of cefuroxime sodium along the line of proposed incision as the sole protection against wound infection was done by Parry et al concluded that reductions in wound and pulmonary infection rates equivalent to those produced by conventional multiple dose parenteral regimens were achieved by this technique.[27]

There is variability in choosing prophylactic antibiotic. In the literature they recommend cefazolin as prophylactic antibiotic in many of the surgeries.[4] However studies done elsewhere

in world revealed that choice of prophylactic antibiotic differ, for a example study done in USA 2005 second generation cephalosporin was the most used prophylactic antibiotic. However in a study done by Pity et al the most used prophylactic antibiotic were the second and third generation cephalosporin.[16, 30] One-dose antibiotic prophylaxis did not lead to an increase in rates of surgical site infection and brought a monthly savings of $1980 considering cephazolin alone. High compliance to 1-dose prophylaxis was achieved through an educational intervention encouraged by the hospital director and administrative measures that reduced access to extra doses.[2O, 23]

Contrary to the above, a study at Marilia Medical School revealed that first generation cephalospolin was the most prescribed prophylactic antibiotic.[36] Variability of choice of prophylactic antibiotic varies probably due the fact that cephalosporin has wide antibiotic spectrum and availability of a particular antibiotic.[4] A survey of 23 pediatric cardio vascular surgery programs demonstrated uniform use of prophylactic antibiotics for open heart operations. Only 65% of the programs used prophylaxis for repair of patent ductus arteriosus. Cephalosporins were the most frequently used antibiotics, but aminoglycosides in combination with penicillins were used in approximately 25% of the operations. Antibiotics were most often started prior to operation (89.7%) and continued for less than five days. These data demonstrate that the use of prophylaxis in pediatric cardiovascular operations conforms to current guidelines.[47]

The study by Gorreck et al on the Surgical Infection Society (SIS) guidelines for antibiotic (AB) usage minimally changed the surgical practice. The authors believed that clinical evidence of the safety, advantage, and effectiveness of SIS guidelines may improve inappropriate usage of Ab it was revealed that). Results: Group A included 124 patients and Group B, 254. There were no intergroup differences in age, sex, and clean/contaminated/dirty ratio of procedures. The mean duration of Ab treatment was 3.9 days in group A, versus 7.1 days in group B (s), with overall rate of appropriateness of 77% versus 36% (s) and no differences in mortality and morbidity rates. Perhaps these results may change AB usage.[50]

A study done by Haemeet et al India 2010 on the pattern of prophylactic antibiotics in different surgeries in a large tertiary care teaching hospital it was found that third generation cephalosporins were the most commonly prescribed class of antibiotics.[52]

The differences choices of antibiotics and whether to use prolonged combination prophylaxis or single dose therapy might be due to different study setting and availability of those antibiotics. In our setting in which we are not sure with aseptic techniques in operating environment made surgeon to give prophylactic antibiotics even in clean surgeries contrary to the guidelines and administering prophylactic antibiotics in multiple prolonged therapy instead of single short therapy. Combination of ceftriaxone and metronidazole was the most used prophylactic antibiotics because these are the antibiotics which are available widely covering most bacteria, ceftriaxine covering mostly gram positive and metronidazole covering mostly gram negative.

# CHAPTER FIVE

## 5.0 CONCLUSION AND RECOMMENDATIONS

### 5.1 Conclusion

This study has indicated that some prophylactic antibiotics practices at MNH is inappropriate. Elective clean surgeries received prophylactic antibiotics. Some clean contaminated surgeries did not receive prophylactic antibiotics. Contaminated and dirty elective surgeries received prophylactic antibiotics while it was to be given as treatment. Prophylactic antibiotic has been given post surgery in some of the surgeries. There was no additional prophylactic antibiotic for the elective surgeries lasting more than 3hours intraoperatively. Prophylactic antibiotic has been prolonged post surgeries given in more than five days in the majority of elective surgeries. Combination of ceftriaxone and metronidazole was the most used prophylactic antibiotic followed by ceftriaxone alone.

### 5.2 Recommendations

MNH should establish prophylactic antibiotics guideline which should be open and accessible by every member of the surgical team. Medical checklist should be practiced effectively Frequent audit of prophylactic antibiotic use is needed to improve proper practices (prophylactic antibiotics uses).Surgeons should adhere to prophylactic antibiotics guidelines.

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# APPENDICES

## Appendix i: Classification of Operative Wounds and Risk of Infection

| Type of wound | criteria | Percentage infection risk |
|---|---|---|
| Clean | Elective, not emergency, non-traumatic, primarily closed; no acute inflammation; no break in technique; respiratory, gastrointestinal, biliary and genitourinary tracts not entered | <2% |
| Clean Contaminated | Urgent or emergency case that is otherwise clean; elective opening of respiratory, gastrointestinal, biliary or genitourinary tract with minimal spillage (e.g., appendectomy) not encountering infected urine or bile; minor technique break | <10% |
| Contaminated | Non purulent inflammation; gross spillage from gastrointestinal tract; entry into biliary or genitourinary tract in the presence of infected bile or urine; major break in technique; penetrating trauma < 4 hours old; chronic open wounds to be grafted or covered | ˜20% |
| Dirty | Purulent inflammation (e.g., abscess); preoperative perforation of respiratory, gastrointestinal, biliary or genitourinary tract; penetrating trauma > 4 hours old | ˜40 |

**Appendices ii Questionnaire (English Version)**

**DATA COLLECTION TOOL**

S/No……..

1. Introduction ----------Identification data.

Hospital registration number ----------

Patient age ---------- Sex----------

Patient level of education ;(a)No formal education

(b) Primary Education

(c) Form iv

(d) Form vi

(e) Higher education

2. Types of operation

3. Wound class

4 .Did the patient receive prophylactic antibiotic

(a) (Yes)

(b) (No)

If no jump to question 13

5 Types of antibiotics used

6. Postoperative administration of prophylactic antibiotics in days

7. Timing of antibiotics prophylaxis

(a) Intra operatively.

(b) Within 1hour before operation

(c) Post operatively.

8. Operation duration

(a) 0-3hours

(b)>3hours

9. Frequency of prophylactic antibiotics administrations peri operatively

(a)Once

(b)Twice

(c)Thrice or more

10. Duration of antiobiotics given post operatively

(a)Up to 24hours

(b)>24-<48hours

(c) 48-120hours

(d)≥120hours

11. Did patient receive antibiotic post surgery

(a) Yes

(b) No

12. Was there external incision?

(a) Yes

(b) No

**Appendices iii: Dodoso (Toleo la kiswahili)**

**ZANA YA KUKUSANYIA TAARIFA.**

Namba……..

1.Utangulizi

Nambayausajiliyahospitali ----------

Umri ---------- Jinsia ----------

Kiwango cha elimu ;

(a)Sikusoma

(b)Elimuyamsingi

(c)Kidato cha nne

(d)Kidato cha sita

(e)Elimu ya juu

2. Aina ya upasuaji

3. Aina ya kidonda

4.Je mgonjwa alipata dawa ya kuzuia maambukizi?

(a) Ndio

(b) Hapana

Kama jibu hapana nenda swali la 13

5. Aina ya antibaiotic iliyotumika

6. Muda ambao dawa iliendelea kutolewa baada ya upasuaji -days.

7. Muda ambao dawa ilitolewa.

(a)Wakati upasuaji unafanyika

(b)Ndani ya saa moja kabla upasuaji

(c)Baadayaupasuaji.

8. Muda ambao upasuaji ulitumia

(a)Mpakamasaa matatu

(b)Zaidi yamasaa matatu

9. Mara ngapi dawa ilitolewa wakati wa operation?

(a)Mara moja

(b)Mara mbili

(c)Mara tatu au zaidi.

10.Muda ambao dawa iliendelea kutolewa baada ya upasuaji

(a)Masaa 24 baada ya upasuaji

(b)Kati yamasaa 24 namasaa 48 baadayaupasuaji

(c) Kati ya masaa 48 na masaa120 baada ya upasuaji

(d)Zaidi ya masaa 120

11.Je mgonjwa alipata dawa baada ya upasuaj?

(a)Ndio

(b)Hapana

12. Je mgonjwa alichanwa nje ya mwili?

(a)Ndiyo

(b)Hapana