2023-11-10

Magnitude of Appropriate Use of Surgical Antibiotic Prophylaxis and Associated Factors Among Surgical Operated Patients in Tibebe Ghion Specialized Hospital, Bahirdar, Northwest Ethiopia

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THESIS REPORTTO BE SUBMITTED TO DEPARTMENT OF SURGERY SCHOOL OF MEDICINE, COLLEGE OF MEDICINE AND HEALTH SCIENCES BAHIR DAR UNIVERSITY, AS PARTIAL FULFILLMENT OF REQUIREMENTS FOR THE SPECIALTY CERTIFICATE IN GENERAL SURGERY

NOVEMBER, 2023

BAHIRDAR, ETHIOPIA

BAHIR DAR UNIVERSITY

COLLEGE OF MEDICINE AND HEALTH SCIENCE

SCHOOL OF MEDICINE

DEPARTMENT OF SURGERY

MAGNITUDE OF APPROPRIATE USE OF SURGICAL ANTIBIOTIC PROPHYLAXIS AND ASSOCIATED FACTORS AMONG SURGICAL OPERATED PATIENTS IN TIBEBE GHION SPECIALIZED HOSPITAL, BAHIRDAR, NORTHWEST ETHIOPIA

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I certify that I have supervised, read, and evaluated this thesis

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2. Dr. Bilikew Adigo Signature----------Date----------

Declaration

This is to certify that the thesis entitled “MAGNITUDE OF APPROPRIATE USE OF SURGICAL ANTIBIOTICS PROPHYLAXIS AND ASSOCIATED FACTORS AMONG SURGICAL OPERATED PATIENTS IN TIBEBE GHION SPECIALIZED HOSPITAL, BAHIRDAR, ETHIOPIA”, submitted in partial fulfillment of the requirements for the specialty certificate in general surgery department of surgery, BahirDar University is a record of original work carried out by me and has never been submitted to this or any other institution to get any other degree or certificates. The assistance and help I received during the course of this investigation have been duly acknowledged.

Dr. Mulat Agalu13/11/2023BDU, TGSH

Name of candidate Date place

ACKNOWLEDGEMENT

I would like to express my profound gratitude and deep regard to BahirDar university college of medicine and health sciences department of surgery and public health for giving me this chance to participate in community problem solving research and also to my advisors Mr. TadeleFentabilAnagaw(MPH/HP) and Dr. BilikewAdego(Consultant General surgeon) for their exemplary guidance, valuable feedback, constant encouragement, constructive advice and support since the beginning to the end of the thesis.

I would also extend my acknowledgment to the data collectors.

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List of abbreviations

ASHP----------American Society of Health System Pharmacist

BDU----------Bahirdar University

CDC----------Centers for Disease Control

DCRH----------DilChora Referral Hospital

DRC----------Democratic Republic of Congo

DRH----------Dessie Referral Hospital

HCAI----------Health Care Associated Infections

IDSA----------Infectious Disease Society of America

SAP----------Surgical Antibiotics Prophylaxis

SGH----------Sarawark General Hospital

SPHMMC----------Saint Paul's Hospital Millenium Medical College

SIS----------Surgical Infectious Society

SHEA----------Society of Health Care Epidemiology of America

SSI----------Surgical Site Infection

TASH----------TikurAnbessa Specialized Hospital

TGSH----------Tibebe Ghion Specialized Hospital

UoGTH----------University of Gondar Teaching Hospital

Abstract:

Excessive and inappropriate use broad spectrum antibiotics for surgical prophylaxis has led to development antimicrobial resistance, reduced treatment efficacy, a rise in morbidity and mortality and increased costs. The aim of this study is to assess magnitude of appropriate use and adherence of antimicrobial usage in surgical prophylaxis to the clinical antibiotics prophylaxis guidelines

Objective: To assess magnitude of appropriate use of surgical antibiotic prophylaxis and associated factors among surgical operated patients in Tibebe Ghion Specialized Hospital, Bahirdar city, Ethiopia, 2023

Methods: Hospital based cross-sectional study of all patients operated in general surgery wards in TGSH BahirDar city from January to August 2023 was conducted.Systematic sampling technique by was used and the final sample size for the study was 422.The data was collected using standard check list and using patient's medical record, inpatient and outpatient registry book, and OR logbook as a source of data. The collected data was entered into SPSS 27 for analysis. Bivariate and multivariate logistic regression was done at p-value 0.05 and model fitness was cheeked using hosmer and lemeshow. Binary regression model was used. The result is presented in tables, charts and graphs.

Results: A total of 412 patients medical records were evaluated and out of them 355(86.2%) of cases received prophylactic antibiotics. Among the patients for whom prophylaxis administered, 79(22.3%) of prescriptions were appropriate. Ceftriaxone and metronidazole were most commonly prescribed prophylactic agents in 209(58.9%)The mostcommon reasons for appropriate prophylaxis were dosage, 355(100%), indication, 328(92.4%), duration of administration, 238(67%), choice of antibiotics, 110(31%) and timing of administration, 91(25.6%). Availability of first line prophylactic antibiotics is 16.8 times increased appropriateness of surgical antibiotic prophylaxis use than non-availability at the time of prescription (AOR95%CI=16.834(7.687-36.865, p=0.01). Patients after prostatectomy received prophylactic antibiotics 4.115 times appropriately than patients after cholecystectomy (AOR=4.115(95%CI, 1.404-12.048, p-value=0.010)). Patients for whom thyroidectomy done

received SAP 23.255 times appropriately than patients after cholecystectomy (AOR=23.255(95%CI, 2.967-71.428, p value=0.001)) and patients after hernia repair received 48.64times more appropriately than patients after cholecystectomy (AOR=48.64(95%CI, 10.622-222.144, p value=0.000))

Conclusions: Appropriate use of surgical antibiotic prophylaxis is low in surgical wards of TGSH and ceftriaxone and metronidazole were most common prescriptions as surgical prophylaxis. To improve appropriate use, ensure availability of first line antibiotics, provision of continuouseducation and escalation of short-term training of prescribers for appropriate use ofantibiotics and preparation of local surgical antibiotics prophylaxis guidelines and protocols should be considered.

Key words: Surgical antibiotic prophylaxis, surgical ward, BahirDar University

1. Introduction:

1.1 Background

Antibiotic prophylaxis is the use of antibiotics before, during, and after a surgical procedure to prevent development of surgical site infections, and is a common practice in and around surgical wards and operating theaters(1). To prevent infection antibiotics prophylaxis can be used effectively however, inorder to avoid excess cost, toxicity and resistance its use should be limited to specific and well accepted indications. Antibiotic prophylaxis can be primary or secondary or can also be given to prevent infection by eliminating colonizing microbes(2).

Antimicrobial prophylaxis is one of the measures to decrease frequency of occurrences of surgical site infections (SSIs) by preventing development of infection caused by organisms colonizing or contaminating surgical site(3). The use of antibiotics is often incorrect despite the effectiveness of prophylactic antibiotics in preventing SSIs(4). The effectiveness of antibiotics prophylaxis is determined by appropriate selection of antibiotics, the number of dosages administered during operation, timing of initial administration, and postoperative treatment. Inappropriateimplementation of any of these factors can affect the rate at which surgical site infections occur(5).

In surgical wards, prophylactic and postoperative antibiotics are prescribed to treat or prevent postoperative infections or to treat infections that have already developed(6).The difference between prophylactic, empirical and therapeutic therapy should be recognized. Prophylactic antimicrobials must be given 30-60 minutes before skin incision and should cover the most likely contaminating microorganisms that are present in the tissues where the initial incision is made. Therapeutic therapy is prescribed to clear infection by an organism or to clear an organism that is colonizing a patient but is not causing infection(7).

Despite advancements in surgical techniques and a greater comprehension of the pathophysiology of surgical wound infections, post-operative wound infections remain a major worry for the surgical community(8). Antimicrobial prophylaxis should therefore be initiated before contamination, as this will considerably reduce the incidence of SSIs and control bacterial growth. Cephalosporin antimicrobials such as cefazolin are the drug of choice as prophylaxis for most surgical procedures. The goal is to target the most likely

microbes while avoiding broad spectrum antimicrobial prophylaxis that can lead to emergence of antimicrobial resistance(9).

The optimal time for administration of preoperative doses is within 30-60 min before surgical incision. Some agents, such as fluoroquinolones and vancomycin, require administration over one to two hours; therefore, the administration of these agents should begin within 120 min before surgical incision. For all patients, intraoperative re-dosing is needed to ensure adequate serum and tissue concentrations of the antimicrobial if the duration of the procedure exceeds two half-lives of the drug or there is excessive blood loss during the procedure(>1500ml). Shortened postoperative course of antimicrobials involving a single dose or continuation for less than 24 hours are provided(10)

1.2 Statement of the Problem

An evidence-based strategy to stop the emergence of SSI is the administration of surgical antibiotic prophylaxis (SAP) before surgery(11). To avoid SSI and usage of the proper prophylactic antibiotics, it is important to consider the kind of pathogen, the pharmacokinetics and pharmacodynamic profile of the antibiotics, as well as the right time, dosage, and route of administration.Antibiotic prophylaxis is usually indicated in contaminated wounds, penetrating wounds, abdominal trauma, compound fractures and wounds with devitalized tissue, which has a higher risk of infection(12).

Antimicrobial prophylaxis when administered appropriately before surgery significantly reduces postoperative infection, duration of hospital stay, treatment costs, morbidity and mortality, and helps quicker recovery of the patient to normal life(13). However, reports indicated that timing of administration, choice of antimicrobials and duration of prophylaxis was inappropriate in majority of cases. Commonly antibiotics are either given at the wrong time or continued for too long. Unnecessary use of antibiotics and prolonged antibiotic prophylaxis (more than 48 hours) are significantly associated with increased risk of antimicrobial resistant microorganisms(14)

The bigger issues related to the use of antibiotics for hospitalized patients are mirrored by the use of antimicrobials in the treatment of surgical patients. The key distinction is that prophylaxis is more frequently used than infection therapy(15). Due to the lack of proper

information and facility-based standard treatment recommendations for surgical antimicrobial prophylaxis in hospitals, mistakes in the antimicrobial prophylaxis for surgical patients continue to be one of the most common forms of drug errors. Therefore, prior to suggesting any desired alterations, baseline information on the usage pattern of prophylactic antibiotics should be available(16).Most antimicrobials used in hospitals are prescribed for surgical prophylaxis, which accounts for 30% to 50% of all prescriptions, and 30% to 90% of which are inappropriate. Excessive or improper use of antimicrobials has resulted in growing antibacterial resistance in microorganisms, treatment failures, increasingly frequent side effects, a rise in morbidity and mortality, and a rise in the cost of treatment(17).

Appropriately administered antibiotic prophylaxis reduces incidence of SSI, duration of hospital stay, treatment cost, mortality and quick return to work(18).However, reportsshow that timing of administration, selection of theantibiotic, and duration of prophylaxis was inappropriate in the great majorities of cases. In study done in Saudi Arabia antibiotic prophylaxis was inappropriate in 98.92%(19), 81.4% in Pakistan(20) and 99.7% inappropriate in DRC(21). In Ethiopia although studies done in magnitude of appropriate use of prophylaxis are rare, reports show higher magnitude of inappropriate use. 98.2% in UoGTH(22), 55.8% in SPHMMC(12) and 88.9% in TASH(23)

Since there is no study done in TGSH on the magnitude of appropriate use of surgical antibiotics prophylaxis, the aim of this study is to assess pattern and rationality of surgical antibiotics use, choice of antibiotics, timing and duration of administration and practice of intra-operative re-dosing in order to detect any appropriateness so that corrective measures could be suggested.

1.3 Significance of the study

The result of this study can serve as a baseline data for future studies to be done in this subject matter. This study will help to clearly identify and stratify patients who will benefit from appropriate use of surgical antibiotics prophylaxis. It can be used in developing institution-based guidelines for appropriate use of SAP to prevent development of SSI.

2.Literature Review

2.1Magnitude of antibiotics prophylaxis

A retrospective study in the regional wards of governmental hospital in Riydah hospital was done and 82.4% of patients received antibiotics and 18% of patients did not receive antibiotics. The most prescribed antibiotics were ceftriaxone (28.44%) and metronidazole (26.36%). Most of the patients received antibiotics for five to seven days and only 1.08% of patients received antibiotics appropriately for a maximum of one day(19). A three-month prospective observational study has been conducted in the surgical wards of Sarawak General Hospital (SGH). The most preferred antibiotic used was cefoperazone (63.2%). The choices of antibiotics in 78.2% of the cases were consistent with the guideline and around 80% of prophylactic antibiotics were given within 1hr before operation. Prophylactic antibiotics were discontinued within 24 hours post-operatively in 77% of the cases. Of those continued for > 24 hours, the majority (60%) were administered for unknown reasons(24)

A six-month prospective, observational, medical record-based study from January 1, 2017, to 71 September 30, 2017, was conducted in general surgical departments of Pakistan institute of Medical Sciences and Shifa International hospital, Islamabad. Out of 1512, 1474(97.5%) were given SAP and 2.5% didn't receive SAP. 48.3% received ceftriaxone, 16.7% received cefazolin. Appropriate choice of SAP was observed in (n=275; 18.6%) procedures and about half (n=719, 49%) received antibiotics within optimal timing. A total of 212(14%) procedures were completely correct in all steps(20). Other prospective, observational study was performed on patients undergoing surgery, in a tertiary care teaching hospital in India from June 2011 to June 2012, Most common antimicrobial prescribed postoperatively was Ceftriaxone in 208 (68.20%) patients and Amikacin in 184 (60.33%) patients. Most of the patients 113 (37.05%) received Ceftriaxone and Amikacin combination(25). Another simple descriptive study in Diff erent Surgical Wards of a Teaching Hospital in Ahvaz, Iran was conducted and Of the total 8586 patients who took antibiotics for preventive purposes, 4815 (56%) required antimicrobial prophylaxis, and 3771 (44%) patients did not. Unnecessary use of prophylactic antibiotics was observed in 3771 (44%) patients. Of the 4815 patients who received perioperative prophylaxis, 4182 (86.9%) cases received it appropriately, and 633

(13.1%) received it inappropriately, 397 (8.2%) cases received inappropriate dosage, and 457 (9.5%) cases received antibiotic longer than 24 hours(4).

Cross-sectional study was conducted at referral Medical-Educational Centers from northwest of Iran from Feb 2009 to Feb 2011. A total number of 409 antibiotics were prescribed. The most frequently prescribed classes of antibiotics were Cefazolin (90%), Vancomycin (1.8%), Ceftriaxone (8.5%), Metronidazole (4.5%), Erythromycin (1%) and gentamicin (18.5%). The use of antimicrobials in all the cases was empirical based on operating surgeon's clinical experience(26). An observational and prospective study was conducted over the period of 2 months in India. Out of 198, 192(97%) patients were given SAP and no antibiotics in six patients. 124(64.5%) patients were given antibiotics for < 24 h and 68(35.5%) for >24h. In all the patients, antibiotics were given minimum ½-h before incision(27)

Prospective and observational study from March 2020 to March 2021 in a Zonal Referral Hospital in Mbujimayi, Democratic Republic of the Congo (DRC) was conducted and the indication for SAP was compliant in 283(87.5%) but noncompliant in 41(12.65%). 96.5% received SAP after the procedure and 3.5 received at the beginning of procedure. Ceftriaxone was the most prescribed antibiotic in combination with metronidazole, gentamicin and amikacin. SAP had lasted more than 48hr in 100% of operated patients and wasadministered intravenously in all patients. Compliance was found to be 87.35%for the indication for administration; 0.31% for the choice of the molecule; 3.65% for the time of the first administration; none for the duration of antibiotic prophylaxis(21). Another study was done in a Regional Referral and Teaching Hospital in Uganda, 94.5% of patients received antibiotics and A combination of ceftriaxone and metronidazole was the most common regimen (609/907 patients, 67.1%). Most patients received prolonged SAP after surgery (96%) and 33/907(4%) completed therapy on the day of surgery(28). A cross sectional prospective study was conducted at Groote Schuur Hospital, a tertiary level teaching hospital in Cape Town, South Africa, over a period of one week. SAP was administered in 149 cases (82.8%) and withheld in 31 (17.2%). This was appropriate in 91.9% (137/149) and 77.4% (24/31) respectively. Twelve patients (6.7%) received inappropriate antibiotics and in seven (3.9%) it was inappropriately withheld. Of the 156 patients who should have received SAP,

choice of drug was correct in 121 (77.6%), dosage in 110 (70.5%) and timing in 87 (55.8%)(29)

The Prospective, Observational Study was carried out at Erode Trust hospital over 4 months periodOut of 150 patients who received the surgical prophylactic antibiotic indication, 110 (73.33%) patients received appropriate antibiotics and 141 (94%) received appropriate antibiotics at appropriate times. (26.67%) of patients received inappropriate antibiotics 9(6 %) of patients received inappropriate times(30)

A hospital-based cross-sectional study was conducted in patients admitted to surgical wards of SPHMMC, Addis Ababa, Ethiopia. Out of 413, most of the study participants (82.6%) received antibiotics for prophylaxis (72.1%) and treatment (27.9%) indications. 179 (79.7%), were managed by a single antibiotic for prophylaxis indication and followed by 2 antibiotics (50; 20.3%) for the same purpose and almost half of them (49.5%), were prescribed with ceftriaxone and metronidazole in injection form. The most preferred route of administration being parenteral (IV) route: 220 (89.4%) and 69 (72.7%), for prophylaxis and treatment indications, respectively. Half of the patients received antibiotics 30 minutes before surgery and the same number of study participants received the postoperative prophylaxis for ⩾48hours, which was the inappropriate duration. Of the patients (n=246) to whom SAP were given, 224(54.2%) had indication and 22(5.3%) had no indication to use. Of the patients (n=224) to whom SAP were indicated and administered; 205(91.5%) of them have inappropriate choice of antibiotics and 125 (55.8%) have been given for inappropriate duration. In 224(100%), route of administration and dose was correct(31).

A retrospective cross-sectional study was conducted on randomly selected 281 participants in the Surgical Ward of Public Hospital in Western Ethiopia. Surgical antibiotic prophylaxis was administered for more than three-fourth of patients (88.6%). 4.4%of prophylactic antibiotics were per-oral medications. 40.6% of antibiotic prophylaxis was given before 30 minutes of incision, while 82.8% of them were given between 30 minutes to 1 hour beforeincision.Ceftriaxone (45.4%), and ceftriaxone and metronidazole (33.3%) were the most frequently used prophylactic antibiotics. 94.4% of participants have appropriate indication, 92.8% have appropriate choice, 80.7% were given for appropriate duration and 94.4% have appropriate dose(32). Another prospective observational study was undertaken

from April 1 to April 30, 2017 in TikurAnbessa Specialized Hospital (TASH) Addis Ababa, Ethiopia; Among 131 patients, more than two-third of (68.7%) patients received preoperative antimicrobial prophylaxis. From all patients that took preoperative antimicrobial prophylaxis(88.9%) prophylaxis for greater than 24 h after surgery. The majority of patients received ceftriaxone 76 (84.5%). The most commonly prescribed regimen among the combination regimens was ceftriaxone plus metronidazole (13.3%)(23)

A retrospective cross-sectional study was conducted in the Orthopedics and Traumatology Surgical Unit of TASH, among 200 patients 160(80%) received preoperative antimicrobial prophylaxis among which 153 (96%) received postoperative antimicrobial prophylaxis as well. While 34 (17%) did not receive preoperative antimicrobial prophylaxis. 188 (94%) received postoperative antimicrobial prophylaxis. All prophylactic antimicrobial agents were administered via intravenous route and The most frequently prescribed antimicrobial agent was ceftriaxone 309 (70%) and the least prescribed was ciprofloxacin 5 (1%) both in the preoperative as well as in postoperative period(33). Another Facility based retrospective cross sectional study was conducted at DCRH, Dire Dawa city administration. Among 384 patients prophylactic antibiotics were given in all surgical procedures, 206(53.6%) were given Ceftriaxone while 159(41.4%) patients) were given combination of Ceftriaxone and Metronidazole. 338 (88%) was given antibiotics 1h before surgical procedures but the remaining were given just 30 min before the surgery. The majority 374(97.4%) of SAP was given as a single dose(34). Hospital-based prospective study was conducted in Gondar College of Medical Sciences Hospital Ethiopia. Out of 236 admitted surgical patients, 167(70.8%) were prescribed antibiotics whereas the remaining 69(29.2%) received no antibiotics. Antibiotics were prescribed for prophylaxis in 75 patients and for treatment in 92 patients. Frequently prescribed antibiotics or their combinations were ampicillin, chloramphenicol and gentamicin(35).

A retrospective study was conducted in tertiary level care hospital in UAE. Out of 199 participants, in 38(19.1%) of participants duration of surgery was prolonged more than 3hrs.However, no data was found about intraoperative administration for the surgeries that took more than 3hr(36). Prospective, Observational Study was carried out at Erode Trust hospital and out of 216 cases 26 cases have prolonged duration of surgery more than 3hrs and

no data was found on intraoperative administration of antibiotics(30). Prospective study was carried out in tertiary care teaching hospital in tribal region of central India and Intra-operative additional dose was given in 23(10.08%) surgeries(37). On prospective observational study conducted in general surgical wards of Sarawak General Hospital (SGH), in 24(27.6%) of cases surgery duration exceeded 4hrs but they were omitted from intraoperative re-dosing. Intraoperative re-dosing was given only in onecase, where cefoperazone was used, when the durationof surgery exceeded six hours(24)

Prospective observational study was conducted at Kamineni hospital from January 2019 to December 2020 and out of 960 cases, duration of surgery was more than 2hrs in 460(48%). When surgery was prolonged duration for morethan 3 hours repeat dose of antibiotic was given(38). A hospital-based cross sectional study was conductedin surgical wards of SPHMMC, Addis Ababa and out of 413 patients 32(7.7%) of them had prolonged surgery more than 3hrs. Re-dosing was not considered for any operations(17).An observational cross-sectional study on 583 patients undergoing surgery at a leading teaching hospital in Pakistan was conducted and the most prevalent use of antimicrobials was for dirty procedures (45.7%), followed by clean contaminated wounds (30.7%). antibiotics were considered as prophylactics in clean, clean contaminated and contaminated wounds, and were used for treatment in the case of dirty wounds(39).

2.2 Factors affecting appropriate use of antibiotics

A study was done in Dutch hospitals on adherence to local hospital guidelines for surgical antimicrobial prophylaxis. Barriers to the adherence to the guideline were a lack of awareness of appropriate guidelines, a lack of agreement of surgeons with the guideline recommendations, and logistic limitations in the surgical wards. Despite the availability of first-choice antibiotics, surgeons had been reported to fail to comply with the guideline recommendations(14). Retrospective descriptive study was done in tertiary-level care hospital in the UAE and inappropriate use of antimicrobial prophylaxis was seen more in clean and clean-contaminated wounds(36).

Another study was conducted in teaching hospitals in Rome, Italy on SAP appropriateness and 98.8% of inappropriate antimicrobial prescriptions were non adherent to local guidelines.

The most common reason of inappropriateness was mistakes in indication. Urologic and ENT surgical procedures were identified as main drivers of overall inaccuracy(37).

Hospital based prospective study was conducted in University of Gondar teaching Hospital from March 11 - May 10, 2013 on antibiotic utilization and female patients were4.691 times more likely received antibiotics inappropriately than male patients (COR95% CI 4.691(1.326-16.598) (P < 0.017). The likelihood of inappropriate antibiotic use were higher if prescribedantibiotics are not available when compared to availability of prescribed antibiotics and Antibiotics prescribed for patient with comorbidities wasslightly less inappropriate than patient without comorbidities(40). Hospital-based prospective cross-sectional study was conducted in surgical wards of SPHMMC and the most commonly used drugs for SAP were not availableat the time of the study. The high rate ofinappropriate choice of prophylactic antibiotic was due to the unavailability(31)

3. Conceptual framework

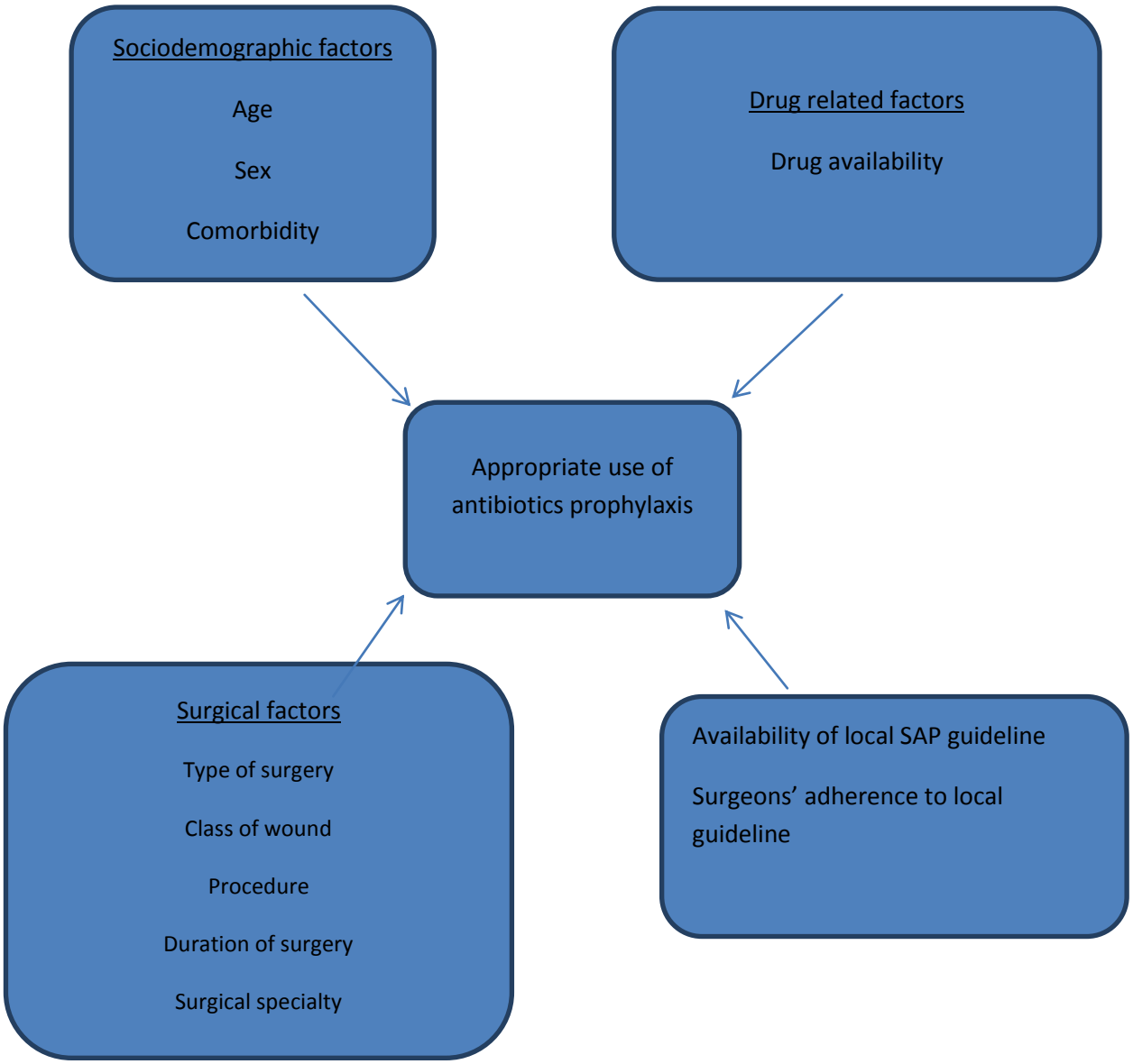

Figure 1conceptual framework on appropriate use of surgical antibiotic prophylaxis

4. OBJECTIVES

4.1 General objective

- To assess magnitude of appropriate use of surgical antibiotics prophylaxis and associated factors among surgically operated patients

4.2 Specific objectives

- To assess magnitude of appropriate use of antibiotics prophylaxis
- To assess associated factors

5. METHODS AND MATERIALS

5.1 Study Design

Hospital based cross sectional studywas conductedat public hospital in BahirDar city

5.2 Study Area

The study was conducted from January to August 2023 in BahirDar city at Tibebe Ghion Specialized Hospital(TGSH. BahirDar is the capital city of Amhara National Regional State, located 565 km Northwest of Addis Ababa with estimated population of 168,899 as per 2021 world population review. BahirDar University College of Medicine and Health Science was established in 2007 E.C, known as BahirDar University medical school, till 2009 when it became one of the four BahirDar University premier college. It is one of the youngest medical training institutions in Ethiopia; having been in the business of medical and health professionals training just over 10 years. Tibebe Ghion campus is located about 10 Km south from the city center and about 7Km from the new bus station ("AddisuMeneharia") on the way to Adet District and about 23 Km from the Blue Nile falls (locally called "Tis Abay). TGSH is one of specialized hospitals in Amhara regional state, which is a teaching hospital under College of Medicine and Health Sciences of BahirDar University located in BahirDar, Ethiopia. The hospital started its activity in November, 2018 G.C and is working in different departments of which surgery is one

5.3 Source population

All patients operated and admitted to surgical wards of TGSH from January to August 2023

5.4 Study population

All patients operated and admitted to surgical wards of TGSH from January to August 2023 with clean and clean contaminated wounds

5.5Sample size determination

The sample size is calculated by using single proportion formula. Assuming that expected level of patient receive antibiotic for prophylaxis to be 50%. So, sample size will determine by using 50% % proportion with marginal error 5% and the confidence interval of 95 %(Z=1.96) as follows.

n=$\frac{z2(pq)}{E2}$n= sample size

p= variability (standard deviation) it is taken as

z= standard error associated with the chosen level of confidence (typically 1.96)

q= 1-p

E= acceptable sample or marginal error= 0.05

Therefore the sample size is n= $\frac{(1.96)2\ (0.5x0.5)}{(0.05)2}$= **384**

With the assumption of 10% incomplete records, the number of patient to be participated in the study has to be 422

5.6 Sampling technique

Systematic random sampling technique will be employed. Average monthly operation done in TGSH including both emergency and elective operations was around 110 and total operation from January to August will be 880. Dividing it to sample size of 422 is 2.08 which was approximated to 2

The 1st case was selected by lottery method, then every 2nd case (k=4) was taken to get the study unit by systematic sampling

5.7. Inclusion and exclusion criteria

5.7.1 Inclusion criteria

All surgical patients operated and admitted to surgical wards during study period

5.7.2 Exclusion criteria

Patients admitted to gynecology, ENT and orthopedics wards

Patients who were operated in other hospitals and later referred to TGSH

Patients with contaminated and dirty wounds

5.8 Study variables

5.8.1 Dependent variables

- ✓ Appropriate use of surgical antibiotics prophylaxis

5.8.2 Independent variables

- ✓ Sociodemographic factors
- ✓ Drug availability
- ✓ Type of surgery
- ✓ Class of wound
- ✓ Duration of surgery
- ✓ Availability of local SAP guideline
- ✓ Physician adherence to guideline
- ✓ Ward patient admitted

5.9 Operational definitions

Appropriateuse of prophylaxis: when indication for use of prophylaxis, initial dosage and administration route, time of administration, duration of utilization and the starting time of SAP is compliant with the guidelines(41)

Inappropriate antibiotic use: refers to incorrect administration with respect toindication, choice, time of initiation, dose, and interval duration(40)

Antibiotics prophylaxis:brief course of antibiotics given before surgery to prevent surgical site infection (17)

Indication: Antibiotic administration for procedures in which SAP is not recommended (excess of indication) or lack of administration in cases where SAP is recommended (defect of indication)(40)

Appropriate duration: if prophylaxis is given single dose or maximum of 24 hours(40)

Time of administration: appropriate if given within 30-60 minute before skin incision(40)

Choice of antibiotics:prescription of a correct antimicrobial agent for the specific surgical procedure and for selected patient characteristics(40)

5.10 Data collection method

Data will be collected using structured data collection format from patient's charts

5.11 Data collection instruments

Data collection questionnaires were adapted from previous similar studies.Data was collected using a structured data collection format which contains of sociodemographic factors, drug related factors, patient related factors, operation related factors, type of antibiotics, dose, duration, timing and route of administration.

5.12 Quality assurance

To maximize quality of the data, training of the data collectors on how to fill the data collection instruments and extract the necessary information was conducted by principal investigator. Adequate supervision and monitoring was done by the investigator.The data collectionformat was pretested on 21 patients (5%of the sample size) in FelegeHiwot Referral Hospital.The final checklist was checked by data collectors & supervisors on daily basis for completeness, accuracy, validity and consistency of data. Finally, identified problems and errors were corrected daily before patient chart returned back to the archive

5.13 DataAnalysis

Data is cleaned, coded and entered into SPSS version 27 for analysis. Descriptive statistics was done to characterize surgically operated patients. Bivariate and multivariate logistic regression was done to identify factors associated with outcome variable. Variables with p value less than 0.25 in the bivariate logistic regression were identified as candidate for multivariable logistic regression. Association between the dependent and independent

variables wasdeclared in multivariable logistic regressionswith 95% confidence interval and p value of 0.05.

5.14 Ethical considerations

Ethical clearance was obtained from research ethics committee of BDU collage of medicine and health science review board. Accordingly, Permission letter to access charts of patients for retrieving data and to conduct the study was obtained from TGSH office of medical director and head of department surgery. Though it is not possible to obtain participants informed consent, Names and other personal information which can violate the confidentiality of the study participants was not exposed to third party for any other reason.

6. Results

6.1 patient characteristics and sociodemographic data

Medical records of 412 patients operated and admitted to surgical wards of TGSH during the study period were evaluated. 234(56.8%) of them were males and 178(43.2%) of them were females. Majority of patients, 316(76.7%) were in the age group 15-60 years. 234(75%) operations were elective and 178(25%) were emergency operations. 75(18.2%) of patients had clean wound and 337(81.8%) had clean contaminated wounds.

Table 1 demographic characteristics and surgical information of surgical patients in TGSH from January to August 2023

Variables	Category	Frequency(N)	Percent (%)
Age	15-39 years	197	47.8%
	40-60 years	119	28.9%
	Above 60 years	96	23.3%
Sex	Male	234	56.8%
	Female	178	43.2%
Comorbidity	Yes	12	2.9%
	No	400	97.1%
Type of operation	Elective	309	75%
	Emergency	103	25%
Class of wound	Clean wound	75	18.2%
	Clean contaminated	337	81.8%
Duration of surgery	Less than 1hour	104	25.2%
	1-2 hours	186	45.1%
	2-3 hours	110	26.7%
	More than 3 hours	12	2.9%
Estimated blood loss	Less than 1500ml	409	99.3%
	More than 1500ml	3	0.7%

6.2 Surgical clinics

Out of 412 participants, 312(75.7) were admitted to general surgery wards, 63(15.3%) admitted to urology wards, 19(4.6%) admitted to neurosurgery wards and 18(4.4%) were admitted in hepatobiliary wards.

Laparotomy and cholecystectomy were most commonly performed procedures each accounting for 81(19.7%) followed by, appendectomy, thyroidectomy, stoma reversal,prostatectomy and open renal stone removalaccounting for47(11.4%), 46(11.2%), 43(10.3%), 38(9.2%)and 24(5.8%) respectively.

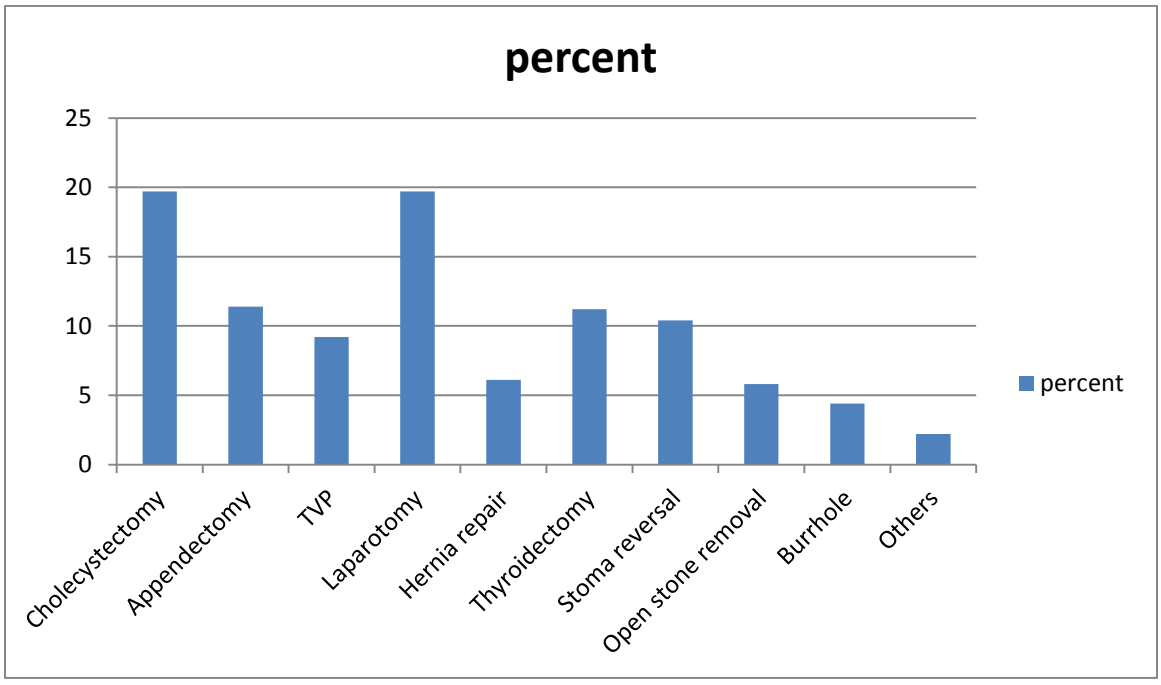

Figure 2Distribution of procedures performed in TGSH from January to August 2023

6.3 Antibiotics usage

6.3.1 Surgical Antibiotic Prophylaxis Usage Pattern

Among the total patients, 355(86.2%) of patients received prophylactic antibiotics.In 329(79.9%)of patients antibiotics was indicated and given, in 57(13.8%), prophylaxis was not indicated and was not given and in 26(6.3%) of patients prophylaxis was not indicated but was given. The most commonly prescribed prophylactic antibiotics were ceftriaxone and metronidazole, 208(58.6%), followed by ceftriaxone, ciprofloxacin, cefazolin accounting for 47(13.2%), 44(12.4%), and 36(10.1%) of prescriptions respectively. 228(64%) of patients received combination of two antibiotics and 127(37%) of patients received single antibiotics. All prophylactic antibiotics were administered by intravenous (IV) route

Table 2Distribution antibiotic prophylaxis, indication and choice of antibiotics among operated patients in TGSH from January to August 2023

Variables	Category	Frequency	Percent
Antibiotic Prophylaxis	Received	355	86.2%
	Not received	57	13.8%
Indication for prophylaxis	Indicated and received	328	79.6%
	Not indicated but received	57	13.8%
	Not indicated and not received	26	6.3%
Choice of antibiotics	Ceftriaxone	47	13.2%
	Ceftriaxone + metronidazole	209	58.9%
	Cefazolin	36	10.1%
	Ciprofloxacin	44	12.4%
	Cefazolin + metronidazole	11	3.1%
	Ciprofloxacin + metronidazole	8	2.3%

6.3.2Duration of surgical prophylaxis

Among 355 patients who received prophylactic antibiotics, the duration of prophylaxis was single dose in 23(6.5%) of them, 24 hours in 215(60.6%), 48 hours in 43(12.1%), 72 hours in 24(6.8%) and more than 72 hours in 50(14.1%) of patients. Intraoperative re-dosing was not considered for any procedures(figure 5).

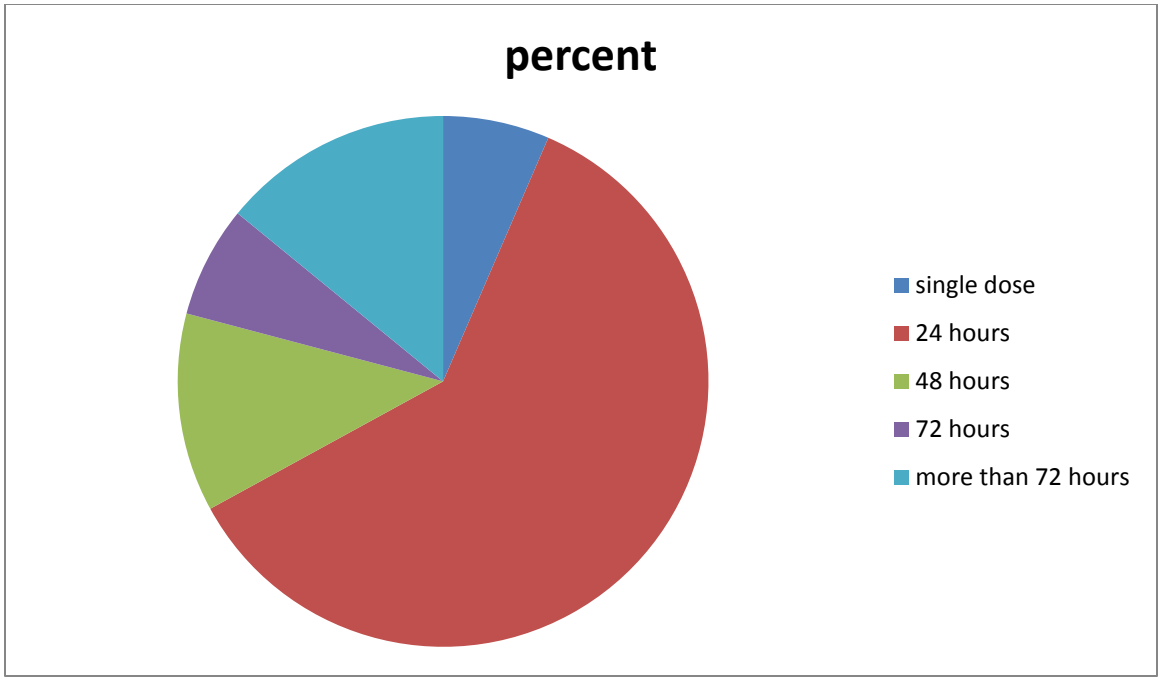

Figure 3 distribution of duration of administration of prophylactic antibiotics in surgical patients of TGSH from January to August 2023

6.3.3 Timing of first prophylaxis administration

Out of 355 patients who received prophylaxis, Timing of first antibiotic prophylaxis administration was less than 30 minutes before skin incision in 122(34.9%), after induction of anesthesia in 118(33.2%), within 30-60 minutes before skin incision in 91(25.6%) and after skin incision in 22(6.2%) of patients. Timing was appropriate in 95(26.8%) of patients and inappropriate in 260(73.2%) of patients.

Table 3timing of first prophylaxis administration for surgical patients in TGSH

Timing of administration	Frequency (N)	Percent %
After induction of anesthesia	118	33.2%
30-60 minutes before skin incision	91	25.6%
Less than 30 minutes before incision	122	34.9%
After skin incision	22	6.2%

6.3.4 Evaluation of surgical antibiotics prophylaxis (SAP)

Among the patients who received surgical antibiotic prophylaxis (n=355), 328(92.4%) of them have indications for prophylaxis. Of the patients to whom antibiotics was indicated and administered, 209(54.1%)of antibiotics were selected appropriately.

Of the patients who received SAP, 355(100%) of their administered dose was appropriate and 355(100%) of them had right route of administration. Majority of patients 234(66%) received prophylaxis for a maximum of 24 hours but 117(33%) of patients received prophylaxis forprolonged duration. Timing of first prophylactic administration was appropriate in 91(25.6%) of patients and was inappropriate in 228(74.4%) of participants.

The most common reasons for inappropriate surgical antibiotics prophylaxis use were inappropriate choice of antibiotic, 245 (69%), inappropriate duration, 117 (33%), inappropriate timing 266(74.4%) and inappropriate indication 27(7.6%)

Table 4 Evaluation of appropriateness of prophylactic antibiotics according to WHO guidelines in TGSH from January to August 2023

Variables	Categories	Frequency (N)	Percent (%)
Indication for prophylaxis	Appropriate	328	92.4%
	Inappropriate	27	7.6%
Choice of antibiotics	Appropriate	110	31%
	Inappropriate	245	69%
Dosage appropriateness	Appropriate	355	100%
	Inappropriate	0	0%
Post-operative duration of prophylaxis	Appropriate	238	67%
	Inappropriate	117	33%
Route of administration	Correct route	355	100%
	Incorrect route	0	0%
Timing of prophylaxis administration	Correct	91	25.6%
	Incorrect	266	74.4%
Overall appropriateness	Appropriate	79	22.3%
	Inappropriate	276	77.7%

6.4 factors associated with appropriate use of prophylactic antibiotics

Bivariate logistic regression was done to identify variables candidate for multivariable logistic regression at p-value<0.25. Sex, class of wound, surgical specialty, type of operation, drug availability and procedure were candidates for multivariable logistic regression.

Accordingly, in a multivariable logistic regression, procedure and drug availability were significantly associated with appropriate use of surgical antibiotic prophylaxis. Availability of first line prophylactic antibiotics is 16.8 times increased appropriateness of surgical antibiotic prophylaxis use than non-availability (AOR95%CI=16.834(7.687-36.865). Patients after prostatectomy received prophylactic antibiotics 4.115 times appropriately than patients after cholecystectomy(AOR=4.115(95%CI, 1.404-12.048, p-value=0.010)). Patients for whom thyroidectomy done received SAP 23.255 times appropriately than patients after cholecystectomy (AOR=23.255(95%CI, 2.967-71.428, p value=0.001)) and patients after hernia repair received 48.64times more appropriately than patients after cholecystectomy (AOR=48.64(95%CI, 10.622-222.144, p value=0.000))

Table 5bivariate and multivariate logistic regression of factors associated with appropriate use of SAP in TGSH from January to August 2023

Variables	Categories	Overall Appropriateness		COR	p-value	AOR(95%CI)	P-value
		Appropriate	Inappropriate				
Class of wound	Clean	57	18	11.062(6.139-19.932)	0.001		
	Clean contaminated	75	262	1.000*			
Sex	Female	73	105	2.062(1.355-3.138)	0.001		
	Male	59	175	1.000*			
Type of operation	Elective	122	187	6.067(3.040-12.109)	0.001		
	Emergency	10	175	1.000*			
Drug availability	Available	64	60	21.333(10.588-42.983)	0.001	16.834(7.687-36.865)	**0.001***
	Not available	11	220	1.000*			
Surgical specialty	Urology	32	31	2.288(1.321-3.962)	0.003		
	General surgery	97	215	1.000*			
Procedure	Prostatectomy	21	17	3.115(1.398-6.942)	0.005	4.115(1.404-12.048)	
	Cholecystectomy	23	58	1.000*			**0.010***
	Thyroidectomy	31	15	5.212(2.382-11.404)	0.001	23.255(2.967-71.428)	**0.001***
	Hernia repair	21	4	13.239(4.096-42.796)	0.001	48.64(10.622-222.144	**0.000***

NB * reference

7. Discussions

Antimicrobial prophylaxis when administered appropriately before surgery significantly reduces postoperative infection, duration of hospital stay, treatment costs, morbidity and mortality, and helps quicker recovery of the patient to normal life(13). Standard antibiotic prophylaxis guidelines recommend use of these agents prior to surgery. Inappropriate and excessive use of prophylactic antimicrobials is a worldwide problem and has wide discrepancies between clinical practice guidelines for prophylaxis and clinical practice(10). Proper use and effectiveness of SAP depends on appropriate indication, appropriate selection, appropriate timing of initial administration, dosage and appropriate port-operative duration of use(5). The aim of this study is to assess magnitude of appropriate use of antibiotic prophylaxis. We assessed different criteria (indication, choice of prophylaxis, timing of administration, dosage, route and duration of administration) to evaluate appropriateness of prophylaxis usage in 355 patients in which prophylaxis is administered by using WHO clinical practice guidelines for antimicrobial prophylaxis for surgery developed jointly by American Society of Health System pharmacists (ASHP), the Infectious Disease Society of America (IDSA), the Surgical Infectious Society (SIS) and Society for HealthCare Epidemiology of America (SHEA) as a reference.

Out of 412 cases, 355(86.2%) of cases received prophylactic antibiotics which is slightly higher than similar studies conducted in Saudi Arabia (82.4%)(19), Iran(56%)(4) and Ethiopia, SPHMMC (82.6%)(17) and lower than studies conducted in Iran(27), Uganda(28), Pakistan(20), and western Ethiopia(32), 97%, 94.5%, 97.5% and 88.6% respectively. All parameters of appropriateness of antibiotic prophylaxis suchas indication, choice of the antibiotics, the timing of administration of the first dose,and the duration of the prophylaxis were analyzed.Out of 355 patients for whom antibiotics prophylaxis was administered, overall appropriateness of antibiotics prophylaxis usage was found to be 22.3%. This result is higher than similar studies conducted in Saudi Arabia (1.08%)(19), Pakistan 212(14%)(20)and UoGTH in Ethiopia (1.8%)(41)but it was lower than study done in Iran (86.9%)(4). This could be due unavailability of first line prophylactic antibiotics, lack of local surgical antibiotics prophylaxis guidelines, lack of awareness of ASHP guidelines by prescribers suchas medical resident and interns and lack of adherence of prescribers to the guidelines.

With regards to indication for prophylaxis, among 355 patients prophylaxis administered, 328(92.4%) had appropriate indication but 27(7.6%) of cases prophylaxis was not indicated but was administered. The result is higher than studies conducted in South Africa (6.7%)(29), SPHMMC (5.3%)(31), Western Ethiopia (5.6%)(32). According to SAP guidelines, prophylaxis is not indicated for clean surgeries except in patients with impaired host defenses or patients in whom the consequences of infection may be catastrophic, for example neurosurgery, open heart surgery and ophthalmic surgery. This inappropriate administration of prophylactic antibiotics for non-indicated patients may be due to lack of understanding of prescribers'to distinguish whichsurgical cases need antibiotics or not, consideration of contamination of operation room and the prescribers' lack of awarenesson ASHP guidelines

The choice of appropriate antibiotics for specific patients should take into account characteristics of the ideal agent,efficacy, adverse-effect profiles and patient drug allergies.The chosen antibiotics must reflect local, disease-specific information about thecommon pathogens and their antibiotics susceptibility, types of incision, and riskfactors(10). ASHP guidelines recommend the use of narrow spectrumantibiotics for surgical prophylaxis. Cefazolin is first line of choice in clean and many clean-contaminated operations because it is the most widely studied antimicrobial agent, proven efficacy, has a desirable duration of action, spectrum of activity against organisms commonly encountered in surgery, reasonable safety, and low cost.However, forprocedures of the alimentary tract, genitourinary tract and Hepatobiliary system,coverage should additionally be influenced by site-specific flora, such as gram-negativeand anaerobic microorganisms. In such cases, second generation cephalosporins,cefotetan or cefoxitin is a suitable agent(10).Choice of antibiotic regimen is appropriate in 110(31%) of cases which is higher than that seen in Pakistan (18.6%)(20), Democratic Republic of Congo (0.31%)(21) and Malaysia (21.8%)(24) but lower than that seen in Iran(86.9%)(4) and south Africa (77.6%)(29). Ceftriaxone and metronidazole was most commonly administered SAP, 258(72%). Similar to results seen in Uganda (67.1%)(28), and India (68.2%)(25). In another studies ceftriaxone was most commonly administered antibiotics. Cefazolin is primarily recommended SAP regimen but in this study only 36(10.1%) of cases received cefazolin for prophylaxis. In this study, metronidazole was commonly used in hepatobiliary and upper gastrointestinal procedures and occasionally in urologic procedures which is inconsistent with the clinical guidelines. This non-adherence to the guideline may be due to lack of antimicrobial agent, lack of awareness of

appropriate guidelines, lack of agreement of surgeons with the guideline recommendations, and logistic limitations in the surgical wards.

The preferred route of administration varies with the type of procedure, but for a majority of procedures, intravenous (i.v) administration is ideal because it produces rapid, reliable, and predictable serum and tissue concentrations.In our study route of administration is intravenous in all cases. This result is similar to studies conducted in Mbujimayi, Democratic Republic of the Congo (DRC)(21) and SPHMMC(31).

Timing of antibiotic prophylaxis administration is critical. Successful prophylaxis requires delivery of antibiotics to the site of operation before contamination occurs. According to clinical antibiotic prophylaxisguidelines, prophylactic antimicrobials should be administered 30 to 60 minutes before surgery. The first dose should always give before the skin incision performed. For longer procedures, re-administration of the antibiotics was indicated at intervals of one or two times the half-life of the drug. Administration too early or late is reduces efficacy of antibiotics(10). In our study timing of initial administration was appropriate according to the guidelines in 91(25.6%) of cases. This result is lower compared to studies conducted in SGH (80%)(24), Pakistan (49%)(20), DCRH (88%)(34)and western Ethiopia (82.8%)(32). Duration of surgery was prolonged in 3 cases but intra-operative re-dosing was not considered. This omission of intraoperative administration is similar to studies done in UAE (36), Erode Trust Hospital (30) and Sarawak General Hospital (SGH)(24). Inappropriate timing of administration may be due to lack of understanding about most appropriate timing of administration and patient not arriving to operation room on time.

With regards to the duration of prophylaxis, the clinical practice guideline for antimicrobial prophylaxis in surgery does not recommend that an additional dose be administeredpostoperatively. However, a prophylactic antibiotic administered within 24 hours following surgery is considered appropriate except in cardiothoracic surgery that is extended for up to 72 hours(10). In this study, 118(33%) of cases had antimicrobial prophylaxis prolonged for more than 24 hours post-operatively and 237(67%) of cases received prophylaxis appropriately for less than 24 hours. This inappropriate practice is higher compared to similar study in Malaysia that is 23%(24) and western Ethiopia (19.3%)(32) and is lower than similar study done in Democartic Republic of Congo(100%)(21), Uganda (96%)(28), TASH (88.9%) (23) and

SPHMMC (50.8%)(17). In another similar study done in Saudi Arabia, most of patients received prophylaxis for five to seven days and only 1.08% of patients received antibiotics appropriately for a maximum of 24hours(19). Unnecessary and prolonged use of antimicrobial prophylaxis is associated with emergence of resistant microorganisms, increased cost and increased length of hospital stay.

The identified factors that contribute to appropriate use of SAP are patient factors (age, sex, and comorbidity), surgical case related factors (elective, emergency, surgical specialty and class of wound) and drug factors (drug availability).In this study, factors associated with appropriate use of antibiotic prophylaxis were drug availability, procedure and surgical specialty patient was admitted. Availability of first line prophylactic antibiotics is 16.8 times increased appropriateness of surgical antibiotic prophylaxis use than non-availability (AOR95%CI=16.834(7.687-36.865, p value=0.001). Patients after prostatectomy received prophylactic antibiotics 4.115 times appropriately than patients after cholecystectomy (AOR=4.115(95%CI, 1.404-12.048, p-value=0.010)). Patients for whom thyroidectomy done received SAP 23.255 times appropriately than patients after cholecystectomy (AOR=23.255(95%CI, 2.967-71.428, p value=0.001)) and patients after hernia repair received 48.64times more appropriately than patients after cholecystectomy (AOR=48.64(95%CI, 10.622-222.144, p value=0.000))

8 limitations of study

Since the study is cross sectional, cause and effect relationship was not investigated. The study was conducted only in general surgery, hepatobiliary, urology and neurosurgery wards. Therefore, it was not generalizable to other surgical specialties and there was wrong documentation of medical records of patients that led to retrieval of charts of non-surgical patients.

9 conclusions:

Antibiotics are one of measures for treatment and prevention of SSIs but inappropriate use causes increased cost, increased morbidity and mortality, development of antimicrobial resistance and prolonged hospital length of stay. This study showed that majorityof patients

received prophylactic antibiotics. Ceftriaxone and metronidazole were most commonly prescribed prophylactic agents. This practice of prophylactic antibiotics showed gap between international clinical guidelines and local practices and needs intervention to improve inappropriate use. Use of SAP agents with broad spectrum of action than recommended and extending duration of administration beyond recommended on international guidelines was observed in our study. Appropriate practice of SAP was seen in urology wards than general surgery wards. Metronidazole also was used inappropriately in hepatobiliary, upper gastrointestinal and urology procedures without recommendations.

10. Recommendations

- **To health care providers**
  - ✓ Inappropriate use of SAP may be due to lack of awareness.Therefore, health care providers should be aware of surgical antibiotic prophylaxis guidelines, practice accordingly and reduce rate of inappropriate use of prophylactic antibiotics
  - ✓ Availability of first line agents increases appropriate use of SAP. Therefore, the institution should avail most of recommended first line SAP agents especially cefazolin
  - ✓ Perform continued surveillance of SAP practice and continuous educational programs all surgical wards
- **To policy makers**
  - ✓ Set strategies including provision of local SAP guidelines, giving training on appropriate use of SAP and create awareness on appropriate practice
- **To researchers**
  - ✓ Researchers are encouraged to do additional studies on factors associated with appropriate use of SAP

11. References

1. Owens R. Donskey CJ Gaynes R, Loo C, Muto C. Antimicrobial-associated risk factors for Clostridium difficile infection. Clin Infect Dis. 2008;46:19-31.
2. Enzler MJ, Berbari E, Osmon DR, editors. Antimicrobial prophylaxis in adults. Mayo Clinic Proceedings; 2011: Elsevier.
3. Gouvêa M, Novaes CdO, Pereira DMT, Iglesias AC. Adherence to guidelines for surgical antibiotic prophylaxis: a review. Brazilian Journal of Infectious Diseases. 2015;19:517-24.
4. Alavi SM, Roozbeh F, Behmanesh F, Alavi L. Antibiotics use patterns for surgical prophylaxis site infection in different surgical wards of a teaching hospital in Ahvaz, Iran. Jundishapur journal of microbiology. 2014;7(11).
5. Steinberg JP, Braun BI, Hellinger WC, Kusek L, Bozikis MR, Bush AJ, et al. Timing of antimicrobial prophylaxis and the risk of surgical site infections: results from the Trial to Reduce Antimicrobial Prophylaxis Errors. Annals of surgery. 2009;250(1):10-6.
6. Mohamoud SA, Yesuf TA, Sisay EA. Utilization assessment of surgical antibiotic prophylaxis at Ayder Referral Hospital, Northern Ethiopia. J Appl Pharm. 2016;8(02):1-5.
7. Crader MF, Varacallo M. Preoperative antibiotic prophylaxis. 2017.
8. Bhadauria AR, Hariharan C. Clinical study of post operative wound infections in obstetrics and gynaecological surgeries in a tertiary care set up. International Journal of Reproduction, Contraception, Obstetrics and Gynecology. 2013;2(4):631-9.
9. Hammad MA, AL-Akhali KM, Mohammed AT. Evaluation of surgical antibiotic prophylaxis in aseer area hospitals in kingdom of Saudi Arabia. J Phys Clin Sci. 2013;6:1-7.
10. Dale W. Bratzler. Clinical Practice Guidelines for Antimicrobial Prophylaxis in Surgery. surgical infections. 2013;14.
11. Ban KA, Minei JP, Laronga C, Harbrecht BG, Jensen EH, Fry DE, et al. American College of Surgeons and Surgical Infection Society: surgical site infection guidelines, 2016 update. Journal of the American College of Surgeons. 2017;224(1):59-74.
12. Alemkere G. Antibiotic usage in surgical prophylaxis: A prospective observational study in the surgical ward of Nekemte referral hospital. PloS one. 2018;13(9):e0203523.
13. Jan WA, Khan SM, Jehanzeb M, Muazzam M. Surgical site infection and pattern of antibiotic use in a tertiary care hospital in Peshawar. Journal of Ayub Medical College Abbottabad. 2010;22(3):141-5.
14. Van Kasteren M, Kullberg BJ, De Boer A, Mintjes-de Groot J, Gyssens I. Adherence to local hospital guidelines for surgical antimicrobial prophylaxis: a multicentre audit in Dutch hospitals. Journal of Antimicrobial Chemotherapy. 2003;51(6):1389-96.
15. Burke JP. Maximizing appropriate antibiotic prophylaxis for surgical patients: an update from LDS Hospital, Salt Lake City. Clinical Infectious Diseases. 2001;33(Supplement_2):S78-S83.
16. Rehan HS, Kakkar AK, Goel S. Pattern of surgical antibiotic prophylaxis in a tertiary care teaching hospital in India. International journal of infection control. 2010;6(2).
17. Alamrew K, Tadesse TA, Abiye AA, Shibeshi W. Surgical antimicrobial prophylaxis and incidence of surgical site infections at Ethiopian Tertiary-Care Teaching Hospital. Infectious Diseases: Research and Treatment. 2019;12:1178633719892267.
18. Sajja WAa. Surgical site infection and pattern of antibiotics use in tertiary care hospital. J Ayub Med; 22(3).55-60. surgical infections. 2010.
19. Ahmed N, Balaha M, Haseeb A, Khan A, editors. Antibiotic usage in surgical prophylaxis: A retrospective study in the surgical ward of a governmental hospital in Riyadh region. Healthcare; 2022: MDPI.
20. Zakir K, Ahmed N, Khan FU, Rahman H. Pattern of surgical antibiotic prophylaxis for surgical site infections in at two teaching hospitals, Islamabad, Pakistan. Journal of Microbiology and Infectious Diseases. 2019;9(03):104-11.

21. Mbuyamba HT, Muamba CM, Binene SK, Uwonda SA. Evaluation of the practice of surgical antibiotic prophylaxis in a Zonal Referral Hospital in Mbujimayi, Democratic Republic of the Congo (DRC). BMC surgery. 2023;23(1):28.
22. Gashaw b. Evaluation of Antibiotic Utilization in Surgical Ward of University of Gondar Teaching Hospital, Northwest Ethiopia. 2013.
23. Halawi E, Assefa T, Hussen S. Pattern of antibiotics use, incidence and predictors of surgical site infections in a Tertiary Care Teaching Hospital. BMC research notes. 2018;11:1-6.
24. Oh AL, Goh LM, Azim NAN, Tee CS, Phung CWS. Antibiotic usage in surgical prophylaxis: a prospective surveillance of surgical wards at a tertiary hospital in Malaysia. The Journal of Infection in Developing Countries. 2014;8(02):193-201.
25. Mistry V, Pandya A, Chaudhari J, Sondarva D, Pillai A, Hotchandani S. Use of antimicrobial prophylaxis in clean elective orthopedic surgical procedures and identifying common infective organisms. Int J Med Sci Public Health. 2013;2(4):994-1000.
26. Saleh P, Bastani P, Piri R, Goldust M, Naghavi-Behzad M. Antimicrobial prophylaxis for surgical site infections in surgical wards in Northwest Iran. Life Science Journal. 2013;10(2):1977-81.
27. Mehta MD. Study on use of antibiotics for prophylaxis of surgical site infection and compare with standard guidelines. National Journal of Physiology, Pharmacy and Pharmacology. 2020;10(07).
28. Saito H, Inoue K, Ditai J, Weeks AD. Pattern of peri-operative antibiotic use among surgical patients in a regional referral and teaching hospital in Uganda. Surgical infections. 2020;21(6):540-6.
29. Schuster DS, Fagan JF, Flint MF, Basera WB, Porrill OP, Piercy JP. Compliance with surgical antibiotic prophylaxis guidelines: a prospective descriptive study at a tertiary level hospital in Cape Town, South Africa. Southern African Journal of Anaesthesia and Analgesia. 2020;26(6):300-5.
30. Arulprakasam K, Krishnapriya C, Arulprakasam K, Pharm M. Assessment of surgical antibiotic prophylaxis in the surgery ward of a tertiary care hospital–an observational study.
31. Alamrew K. Assessment of Antibiotics Use as surgical Prophylaxis and PostOperative Treatment at Saint Paul's Hospital Millennium Medical College; Cross-sectional Study. surgical infections. 2018;1.
32. Kefale B, Tegegne GT, Degu A, Molla M, Kefale Y. Surgical site infections and prophylaxis antibiotic use in the surgical ward of public hospital in Western Ethiopia: a hospital-based retrospective cross-sectional study. Infection and Drug Resistance. 2020:3627-35.
33. Argaw NA, Shumbash KZ, Asfaw AA, Hawaze S. Assessment of surgical antimicrobial prophylaxis in orthopaedics and traumatology surgical unit of a tertiary care teaching hospital in Addis Ababa. BMC research notes. 2017;10(1):1-8.
34. Ayele Y, Taye H. Antibiotic utilization pattern for surgical site infection prophylaxis at Dil Chora Referral Hospital Surgical Ward, Dire Dawa, Eastern Ethiopia. BMC research notes. 2018;11(1):1-5.
35. Abula T, Kedir M. The pattern of antibiotic usage in surgical in-patients of a teaching hospital, northwest Ethiopia. The Ethiopian Journal of Health Development. 2004;18(1).
36. Vippadapu P, Gillani SW, Thomas D, Ahmed F, Gulam SM, Mahmood RK, et al. Choice of antimicrobials in surgical prophylaxis-overuse and surgical site infection outcomes from a tertiary-level care hospital. Frontiers in Pharmacology. 2022;13:849044.
37. Jaiswal N, Dudhgoankar S, Jaiswal KM, Raghute L, Vaishnao LS. Perioperative antimicrobial prophylaxis in surgery and adherence to guidelines. Journal of Pharmaceutical and Biological Sciences. 2019;6(2):67.
38. Sridhar Punyapu SK, Anusha Mynam, Satyanarayana Gorthi. Evaluaton of Antbiotc Prophylaxis in Preventon of Surgical Site Infectons. prospective observational study. 2021.
39. Saleem Z, Ahsan U, Haseeb A, Altaf U, Batool N, Rani H, et al. Antibiotic utilization patterns for different wound types among surgical patients: findings and implications. Antibiotics. 2023;12(4):678.
40. Binega G. Evaluation of Antibiotic Utilization in Surgical Ward of University of Gondar Teaching Hospital, Northwest Ethiopia. healthcare. 2013.

41. Bunduki GK, Mukululi MP, Masumbuko CK, Uwonda SA. Compliance of antibiotics used for surgical site infection prophylaxis among patients undergoing surgery in a Congolese teaching hospital. Infection Prevention in Practice. 2020;2(3):100075.

12. ANNEXES

BahirDar University College of Medicine and Health Science, Department of surgery, data collection format for assessment of magnitude of appropriate use of surgical antibiotics prophylaxis and associated factors among surgical operated patients in Tibebe Ghion Specialized Hospital in BahirDar city

Dear respondent, my name is Dr, Mulat Agalu. I am final year resident at department of surgery, College of medicine and Health sciences, BahirDar University. I am conducting a study to assess magnitude of appropriate use of surgical antibiotics prophylaxis among surgical patients in TGSH. The ultimate purpose of this study is to assess appropriateness of SAP in terms of indication, choice of antibiotics, timing, dosage and post-operative duration of administration and factors associated with appropriate use of SAP.To attain this purpose your honest and genuine participation is very important and highly appreciable. I, therefore, kindly request you to answer for all possible questions during the data collection as accurately and carefully as much as possible.

Please be assured that all the information gathered will be kept strictly confidential and you do not need to write your name or any special identification that might disclose who you are, on any of the questionnaire page. Only the researcher has the access of the information and used it for the study purpose only. You have a full right not to participate in this study

Data Collector,

Are you Volunteer to participate?

1. If yes continue
2. If no stop

Name of data collector_____signature_____date_____

Name of supervisor_____signature_____date_____

1. Name of the ward		MRN	
I: Sociodemographic characteristics			
2. What is the age of the patient?		3. What is sex of the patient?	A)Male B) Female
4. Is there comorbidity?	A) Yes B) No	5. If yes to question no 4, what is the comorbidity?	---------- ----------
II: Type of surgery			
6. What is type of surgery?	A) Elective B) Emergency	7. What is diagnosis?	----------
8. What is class of wound?	A) I B) II C) III D) IV	9. What was duration of surgery in hours?	----------
10. What was the procedure?		11. What is estimated blood loss	----------
III: Antibiotics use			
12. Was antibiotics given	A) Yes B) No	13. If yes to Q12, fill the following A) Name of antibiotics B) Dose C) Route of administration	_____ _____ _____
14. What is the time of first antimicrobial prophylaxis	A) At the time of induction B) <30 minutes	15. Was there intraoperative administration?	A) Yes B) No

administration?	before skin incision C) 30 minutes-1hr D) >1hr before E) After skin incision F) Not known	16. If yes to Q15, fill the following A) Name of antibiotics B) Dose C) Route of administration	_____ _____ _____
17. What was duration of antibiotics given	A) Single dose B) For 24 hours C) 48-72 hours D) Specify	18. Was antibiotics given after the end of operation	A) Yes B) No