Research Article

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Prevalence of Surgical Site infections among Surgical operated patients in Zewditu Memorial Hospital. Addis Ababa Ethiopia December 2020.

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Abstract

Background: *Surgical site infections are the most common kinds of hospital-acquired infections. It's a common complication that can cause serious morbidity and mortality after surgery. It is also the major cause of extended hospital stays, accounting for up to 20% of hospital expenses.*

Methods and materials: *A random sample of 144 surgical patients was analyzed utilizing a hospital-based retrospective cross-sectional study technique from January 1 to December 31, 2019. The information was acquired using a World Health Organization-developed modified standardized checklist for surgery safety and the national surveillance network for nosocomial infections. A rigorous random sampling strategy was used to choose study participants. Descriptive statistics such as frequency and percentage were used to describe the data.*

Result: *A total of 13 of the 144 patients who were operated on had surgical site infections (9.02 percent). Elective surgical cases made up 102 (71%) of the total, while emergency surgical cases comprised 42 (29%). Preventive antibiotics were administered to the remaining 99 (69%) research participants, with 73 (73%) receiving ceftriaxone, 3% receiving ampicillin, and 23 (24%) receiving a combination of ceftriaxone and metronidazole. There were 13 cases of surgical site infections in all (9.02 percent). Six (46%) were superficial surgical site infections, four (31%) were deep surgical site infections, and three (23%) were organ space surgical site infections. 11 (84%) patients were treated with IV antibiotics and wound treatment, 1 (8%) cases with wound debridement, and the remaining 1 (8%) cases with laparotomy, antibiotics, and wound management.*

Conclusion: *In this study area, surgical site infection is infrequent. The bulk of the population is made up of women. The use of prophylactic antibiotics and the age of the patients were both variables in the development of surgical site infections.*

Key words: Surgical site infections, post-operative care, prophylactic antibiotics, emergency surgical cases, elective surgical cases.

ABBREVIATIONS AND ACRONYMS

BPH- Benign Prostatic Hyperplasia
CDCs - Center for Disease Control and Preventions
CSA - Central Statistical Agency
HAIs - Hospital Acquired Infections
HEPA- high-efficiency particulate air
HIV - Human Immune Deficiency Virus
HMIS - Health Management Information System
LMICs - Low and Middle-Income Countries
NGO - Non-Governmental Organization
NINSS - Nosocomial Infection National Surveillance Scheme
NNIs - National Nosocomial Infections Surveillance System
PA- Prophylactic Antibiotic
PUD - Peptic Ulcer Disease
UTI- Urinary Tract Infection
USA - United States of America
RTI - Respiratory Tract Infection
WHO - World Health Organization

Introductions

Background of the study

In 1992, the Centers for Disease Control and Prevention (CDC) changed the name of surgical site infections from surgical wound infection to Surgical Site Infection [1]. Surgical site infections (SSIs) are the most prevalent type of hospital-acquired illness, and they are known to cause significant postoperative morbidity and mortality, as well as costing hospitals up to 20% more. Infections acquired in healthcare account for 14-16 percent of all

infections [2,3]. Surgical site infection was reported to occur at a rate of 2.1 percent for clean wounds, 3.3 percent for clean-contaminated wounds, 6.4 percent for contaminated wounds, and 7.1 percent for unclean or infected wounds per 100 procedures worldwide [4]. It is the second most frequent kind of nosocomial infection, accounting for 20% to 25% of all infections [5]. Surgical site infection (SSI) affects 2%–5% of patients undergoing surgical procedures in the United States each year, resulting in at least 500,000 infections, 3.7 million additional hospital days, and US$ 1.6 billion in increased hospital charges [6].

Surgical site infections were directly responsible for 77 percent of surgical site infection-related mortality, with patients with surgical site infections being 2-11 times more likely to die than those who did not have surgical site infections. As a result, hospital stays and treatment expenses have increased [7,8]. The prevalence in African countries has been shown to be higher than in industrialized countries; a Tanzanian district hospital reported a 24 percent and 36 percent surgical site infection rate following cesarean section and hysterectomy, respectively [1]. Although SSI is suspected in Ethiopia, the extent of the problem is unknown; however, the total surgical site infection rate in Tikur Anbessa teaching hospitals' general surgical wards in Addis Ababa Ethiopia was determined to be 21%. [9]. The prevalence of surgical site infection has dropped dramatically as a result of developments in infection control techniques such as improved operating room ventilation, sanitation processes, Barriers, surgical technique, and the availability of antibiotic prophylaxis.

Surgical site infections remain the greatest cause of morbidity and mortality in surgical patients [10]. This contradiction is partly owing to an increase in the number of elderly and chronically ill patients [11]. Several factors have been found as increasing vulnerability to any wound infection, with some of these factors strongly predisposed to infection. Susceptibility is increased by pre-existing disease, the length of the surgery, the wound class, and wound infection [12]. Other risk factors for wound infections include extremes of age, malignancy, metabolic illnesses, malnutrition, immune suppression, cigarette smoking, remote site infection, emergency procedures, and a long period of preoperative hospitalization [13,14] Various studies in Ethiopia have found that the prevalence of post-surgical wound infection ranges from 14.8 percent to 60%. [4,15]. As a result, the purpose of this research was to determine the prevalence of surgical site infections at Zeweditu Memorial Hospital in Addis Ababa, Ethiopia. Also, providing baseline data for further inquiry. Infectious diseases that are resistant to many drugs, as well as the introduction of multidrug-resistant infectious microorganisms.

Literature Review

Infection rates for clean wounds were 1-2 percent or fewer before the widespread use of prophylactic antibiotics, 6-9 percent for clean-contaminated wounds, 13-20 percent for contaminated wounds, and around 40% for dirty wounds [14-16]. Infection rates in most exposed groups have dropped dramatically since the advent of frequent prophylactic antibiotic usage. Clean 2.1 percent, clean-contaminated 3.3 percent, contaminated 6.4 percent, and dirty 7.1 percent infection rates were recorded in the US national nosocomial infection surveillance (NNIS) system hospitals. However, depending on the type of operation performed, there is significant diversity in each class [17]

Prevalence and incidence of surgical site infections

There are rare reports of surgical wound site infection from the impoverished world, particularly from Africa. Nigeria has recorded frightening wound infection rates, with clean 14 percent, clean-contaminated 50 percent, contaminated 66.7 percent, and dirty 80 percent [10,17]. In industrialized countries, however, the average is 2-3 times greater. From January 2003 to December 2007, a retrospective record review research at Monmouth Medical Center in New Jersey, USA, found 312 surgical patients with SSI, with an average incidence of 0.56 percent SSIs per year across all surgical services. Colon resections, cesarean sections, appendectomies, and small bowel resections were the most prevalent procedures across all surgical services. It was also discovered that general surgery SSIs account for 33.7 percent of all SSIs. Colon resections, appendectomies, and small bowel resections were the most prevalent general SSIs, accounting for 41.9 percent, 25.7 percent, and 24.8 percent, respectively [1].

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In a prospective investigation of the etiological agents of abdominal wound site infection at Lagos University Teaching Hospital in Nigeria, 25 of the 144 patients investigated had surgical site infections (17.4%). In 28% of the cultures, Pseudomonas was the most commonly grown aerobic organism, whereas Bacteroides species, with a preponderance of Bacteroides, fragile, was the most commonly isolated anaerobe. In terms of bacterial sensitivity, the majority of aerobic agents in this investigation appear to be resistant to Ceftaxime, Ceftaxidine, and Gentamycin [17]. According to a study conducted in Tanzania, surgery times range from 40 minutes to 6 hours. The SSI rate was 20.9 percent in patients who had operations lasting less than 3 hours and 50 percent in those who had operations lasting more than 3 hours [3].

A significant prevalence of wound infection is suspected in

Ethiopia as well, but the scope of the problem is unknown [5]. Surgical infection, however, is the most prevalent nosocomial infection, with clean 8 percent, clean-contaminated 14.8 percent, contaminated 22 percent, and dirty 44.1 percent in prior research. A high wound infection rate of 38.7% was reported among 129 abdominal wounds in North West Ethiopia, with a clean infection rate of 22.2 percent [18]. The overall abdominal wound site infection rate was 11.4 percent in another prospective descriptive investigation at Jimma University's Obstetric unit. 64.8 percent of individuals with surgical site infections had clean-contaminated wounds, whereas 35.2 percent had contaminated/dirty wounds.

Surgical Site has a statistically significant relationship with wound class at the time of surgery According to microbiological research on surgical site infection conducted at Black Lion Hospital and Hawassa Referral Hospital, Pseudomonas aeruginosa was the third most common isolate after Staphylococcus auras and coagulase-negative Staphylococci. The lowest resistance rate achieved was 25% for ampicillin, and the maximum resistance rate obtained was 100% for chloramphenicol [12,16]. Surgical site wound infection was documented in another prospective study in TikurAnbessa Hospital in 2015. The overall wound site infection rate following an operation conducted within 30 days was 14.8 percent. Infection rates were 8.0 percent, 14.8 percent, 22.0 percent, and 44.2 percent for clean, clean-contaminated, contaminated, and dirty wounds, respectively [15].

Methods and Materials

Study design, Area & Period

Between January 1st and December 31st, 2019, a hospital-based retrospective cross-sectional study on patient card review was conducted among all general surgery patients. (By the year 2019) was carried out at Ethiopia's capital and largest city, Addis Ababa's Zewditu Memorial Hospital. Addis Ababa has 12 government hospitals with a population of 3,384,569 people. 2007 (DHS). The Addis Ababa administration and neighboring communities use Zewditu Memorial Hospital as a referral hospital. It contains roughly 352 beds and four primary operation theaters. There are currently 776 technical and administrative employees on staff, as well as 74 doctors, 32 specialists (9 of them are general surgeons), 287 BSC nurses, 29 clinical nurses, 53 midwives, 8 psychiatry nurses, and 1 ophthalmology nurse.

Population & sampling

Source Population

All patients were admitted and underwent surgery at Zewditu Memorial Hospital in Addis Ababa, Ethiopia, between January 1st and December 31st, 2019.

Study Population

The study population were include all eligible patients who had surgery and were admitted to the surgical ward at Zewditu Memorial Hospital between January 1 and December 31, 2019.

Sample Size Determination and Sampling Technique

Sample Size calculation

The sample size for this particular study was calculated using the formula for a single population
Proportion considering the following assumptions

Assumptions: A 95% confidence level, margin of error (0.05), proportion of surgical site infection (p=14.8%, from previous study was substituted in the following single Population proportion formula.

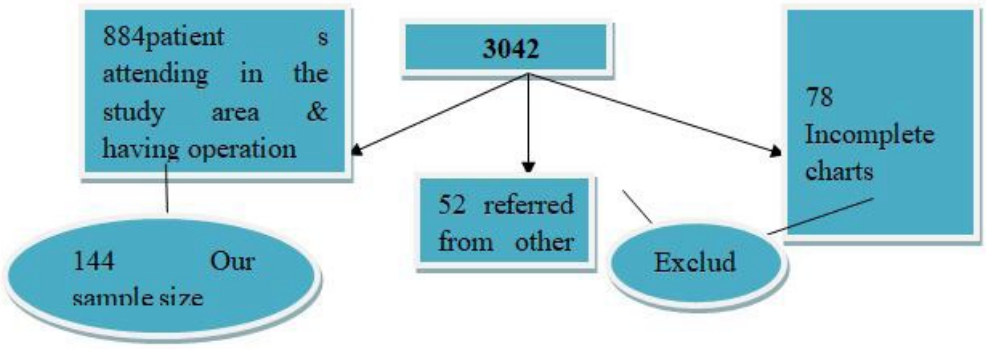
$n=z^2 p (1-p)/d^2$
Where n=sample size
z = statistic for level of confidence
p= estimated prevalence
d= precision
$z^2p (1-P)/d^2 = 1.962x 0.148(1-0.148)/0.052=193.6$ so our sample size is 194.

The sample size was calculated considering the proportion of surgical site infection 14.8 %(Taye M, 2015;) estimated prevalence. 5% precision (d=0.05) and5% level of confidence (z=1.96) the sample size is estimated to be 194.
The source populations are 477 so it is less than 10,000 population sources so the reduction formula was used.
n= no194
1+no/N 1+ 194/477=137.58 + 5% none response rate it is **144** our corrected sample size.

Sampling Technique

From January 1 to December 31, 2019, the operation room, emergency OPD, adult surgical ward, and adult OPD logbooks were used to track all records of general surgeries done at Zewditu Hospital. Among the 1014 surgical operations, there were 78 full charts, 52 patients referred from other hospitals, and 884 patients who came to the study region and were operated on. 144 of the 884 patient charts were chosen using systematic random sample processes. The ward nurse assisted in obtaining a list of all postoperative patients from the ward registers. Patients in the register books were chosen at random from the first K unit to identify the beginning point. The systematic sampling interval was calculated by dividing the sample size by the entire population of patients in the register.

Sampling interval (k) =N/n; 884/144=6.13. Therefore, the sampling interval determined was 6. Hence every Six (6) patients were chosen to participate in the study from the list (1+6), (7+6), (13+6), (19+6), (25+6), (31+6)……. Therefore our sample was 1, 7, 13, 19, 25, 31, 37,-



Data collection tools and procedure

The WHO surgery safety checklist was used, and the nosocomial infection national surveillance scheme (NINSS) (Culver DH 2001) was modified to fit the study's goals and environment; this tool was used to collect data from study participants. Data was gathered by experienced data collectors who followed a data collection checklist. The study cases were discovered in operating rooms, inpatient charts, and logbooks that contained socio-demographic data.

Data quality assurance

The checklist and consent paperwork were first created in English and subsequently translated into Amharic for data gathering reasons. Finally, subject matter specialists collaborated with a translation professional to re-translate the data into English in order to ensure consistency. Individual medical records were inspected for completeness and consistency at the end of each day during data collection to assure data quality, and correct handling of the data was monitored often in the hospital for further data. The data was meticulously inputted by the principal investigator.

Data Processing, & Analysis

The data was manually coded on hard copy and processed and analyzed by SPSS version 26 after it was reviewed for completeness, inconsistencies, and missing information. In order to examine the relationship between the outcomes, the descriptive statistics in the chart were developed to identify (frequencies, percentages, and rates) in order to describe the research population in relation to socio-demographic and other significant factors. The table and figures were used to present the findings.

Terms and operational definition

Operation: A surgical procedure usually carried out with instruments but sometimes using the hands.

Surgical site Infection: Occurs at site of surgery infection can occur at an incision site within 30 days of an operation, the diagnosis will be based on the following criteria: review of the file for documentation of the presence of pus, serous or purulent discharge from surgical site, signs of inflammation (edema, redness, heat, fever, indurations and tenderness).

Nosocomial infection: Known as hospital acquired infection. An infection acquired during hospital care, which will be not present or incubating at the time of admission, infection which occurs more than 48 hours after admission.

Clean wound: Review of the file that, no inflammation is encountered and respiratory, alimentary or genitourinary tracts are not entered.

Clean contaminated: Review of the files, in which the respiratory, alimentary or genitourinary tracts are entered but without significant spillage are recorded.

Contaminated wound: Visible contaminated wound post operatively documented, where acute inflammation is encountered, or there is visible contaminated wound.

Dirty wound Contaminated: Wound documented in the presence of pus, where there is a previously perforated hollow viscous or compound open injury more than four hours old.

Result

Socio-Demo graphic Characteristics of the Study Population

A total of 144 study cases were included in the investigation. Females (59%) and men (41%), respectively, made up the bulk of respondents. 16 (11%) of the study participants were between the ages of 10 and 19, 45 (31%) were between the ages of 20 and 29, 37 (26%) were between the ages of 30 and 39, 18 (13%) were between the ages of 40 and 49, while elders over the age of 50 were 28. (19 percent) Eighty-one percent (81%) of the respondents were from Addis Ababa, while 59 percent (19%) were from elsewhere in Ethiopia. (Seetables.docx table 1)

Table 1: Socio-demographic characteristics of a study participant in Zewditu Memorial Hospital 2020 Addis Ababa, Ethiopia

Age	Frequency (N=144)	Percentage (%)
10-19 years	16	11
20-29 years	45	31
30-39 years	37	26
40-49 years	18	13
>=50 years	28	19
Sex	Female	Male
	85	59
	59	41
Residence	In Addis	Out of Addis
	116	28
	81	29

Clinical characteristics of study participant

Acute appendicitis accounted for 32 (22.22%) of general surgical cases, while cholelithiasis accounted for 27 (18.75%), large and small gut obstruction accounted for 21 (14.58%), goiter accounted for 13 (9%), hernia accounted for 12 (8.33%), breast cancer accounted for 11 (7.64%), perforated peptic ulcer (PUD) accounted for 9 (6.25%), and penetrating (2.12 percent. (See table 2)

Table 2: Clinical characteristics of study participant clients in Zewditu Memorial Hospital 2020 Addis Ababa, Ethiopia

Sr.no	Diagnosis	Frequency (N=144)	Percent (%)
1	Acute appendicitis	32	22.22 %
2	Cholilithiasis	27	18.75 %
3	Bowel obstruction	21	14.58 %
4	Goiter	13	9 %
5	Hernia	12	8.33 %
6	Breast cancer	11	7.64 %
7	Perforated PUD	9	6.25 %
8	Penetrating abdominal injury	7	4.86 %
9	Benign prostatic hyperplasia (BPH)	5	3.47 %
10	Testicular torsion	4	2.78 %
	Others	3	2.12 %
	Total	144	100 %

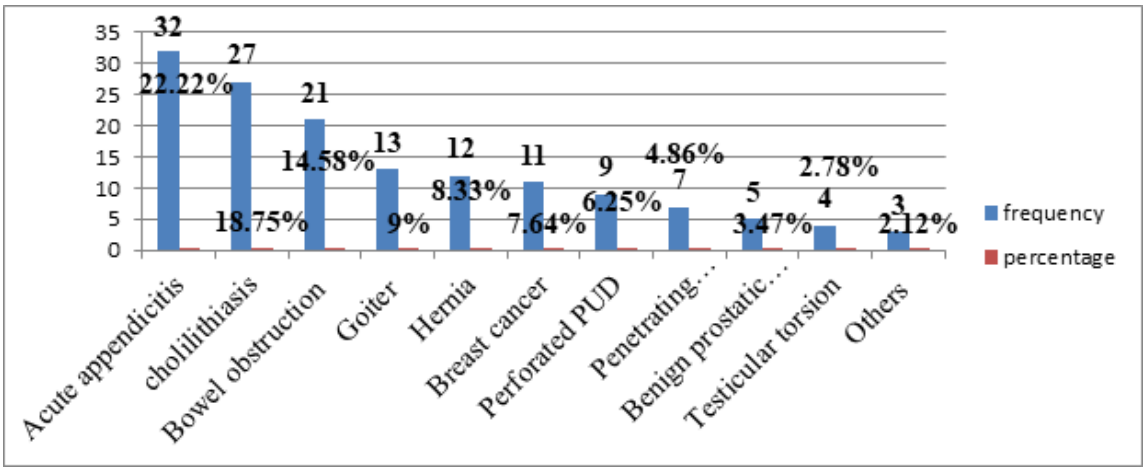


Figure 1: Clinical characteristics of study participant clients in Zewditu Memorial Hospital 2020 Addis Ababa, Ethiopia

Operational related characteristics

From the total of 144 procedures 102(71%) were Elective and 42(29%) were emergency procedures. 99 (69%) patients took Prophylactic antibiotic & 45pateints (31%) not given prophylactic antibiotics.(see Table 3) .

Table 3: Operational related characteristics of the study participant, in Zewditu Memorial Hospital 2020, Addis Ababa Ethiopia

Variables	Category	Frequency (N=144)	Percentage (%)
Type of surgery	Elective	102	71 %
	Emergency	42	29 %
Type of anesthesia	General	115	80 %
	Spinal	17	12 %
	Other	12	8 %
Level of surgeon	Junior (R2)	68	47 %
	Senior (R3/4, Consultant)	76	53 %
Prophylactic antibiotic given	Yes	99	69 %
	No	45	31 %
	No	45	31 %
Time antibiotic given	Preoperatively	37	37 %
	Postoperatively	62	43 %
Kind of prophylactic given	Ceftrixone	73	73 %
	Ampiciline	3	3 %
	Ceftrixone + Metridazole	23	24 %
Type of antiseptic for skin preparation	Iodine + Alcohol	129	90 %
	Alcohol	9	6 %
	Iodine	6	4%

Preoperative Factors

From the total cases 24 (17%) of cases have co morbid illness like diabetic, hypertension and immune suppression diseases and the remaining 120 (83%) study participant have no past medical history. (See Table 4)

Table 4: pre-operative factors associated with SSI's (past medical history) in the study participants in Zewditu Memorial hospital, 2020 Addis Ababa Ethiopia

Variable	Category	Frequency (N=144)	Percentage (%)
Past medical history	Yes	24	17%
	No	120	83%
Diseases category	Immune suppression	11	46%
	Hypertension	9	38%
	Diabetic	2	8%
	Others	2	8%

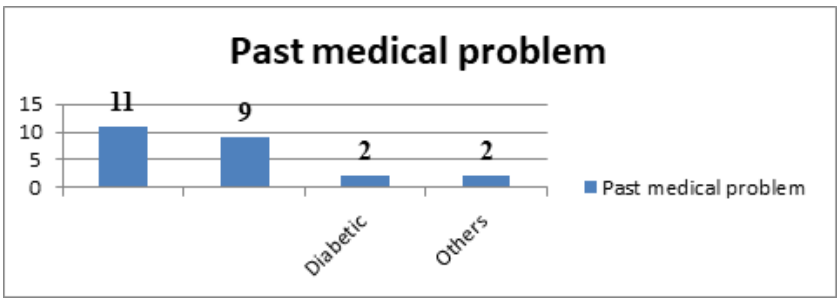


Figure 2: pre-operative factors associated with SSI's (past medical history) in the study participants in Zewditu Memorial hospital, 2020 Addis Ababa Ethiopi

The total duration of hospital stay of study participant 60 (42%) was admitted to hospital for 4-7 days, 44 (31%) of study participant was admitted to hospital for 1-3 days, 19 (13%) of study participant was admitted in hospital for 8-10 days, 12 (8%) of study participant was admitted in hospital for 11-14 days and 9 (6%) of study participant was admitted in hospital for > 15 days. (See Table 5)

Table 5: pre-operative factors associated with SSI's (Total duration of hospital stay) in the study participants in Zewditu Memorial hospital, 2020 Addis Ababa Ethiopia

Variable	Category	Frequency (N=144)	Percentage (%)
Total duration of hospital stay	1-3 days	44	31%
	4-7 days	60	42%
	8-10 days	19	13%
	11-14 days	12	8%
	>15 days	9	6%

Prevalence of surgical site infection

Among 144 operated clients the total prevalence of surgical site infections was 13 (9.02 %) of patients who develop surgical site infections postoperatively. Of 13 cases of Surgical site infections 6 (46%) were superficial surgical site infection, 4 (31%) were deep surgical site infections and the remaining 3 (23%) was organ space surgical site infections. The surgical site infections were managed through 11 (84%) of cases were managed by giving IV antibiotics and wound management, 1 (8%) of cases were managed by surgery and the remaining 1 (8%) of cases were managed through surgery, antibiotics, and wound management. Emergency surgical patients accounted for 42 percent of the total, while elective cases accounted for 102 percent. The remaining 99 (69%) study cases were given preventive antibiotics, with 73 (74%) receiving ceftriaxone, 3 (3%) receiving ampiciline, and 23 (23%) receiving ceftriaxone plus metronidazole. (see Table 6)

Table 6: Prevalence of surgical site infection of clients who had surgical site infection in Zewditu Memorial Hospital 2020, Addis Ababa, Ethiopia

Variables	Category	Frequency (N=144)	Percentage (%)
Patient develops SSI post operatively	Yes	13	9.02%
	No	131	90.98%
Classification of SSI	Superficial	6	46%
	Deep	4	31%
	Organ space	3	23%
How the infection is managed	Antibiotic and wound cleansing	11	84%
	Surgery	1	8%
	Surgery, Antibiotic and wound cleansing	1	8%

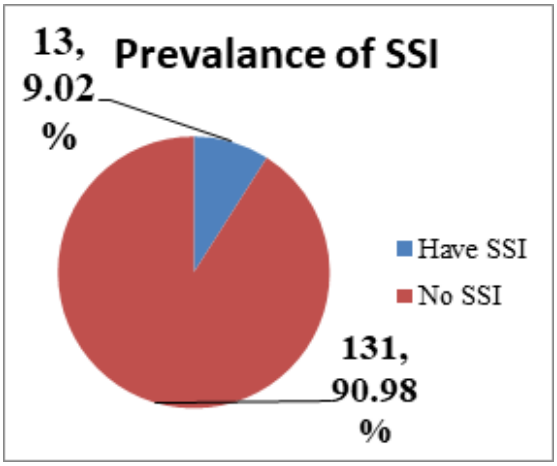


Figure 3: Prevalence of surgical site infection of clients who had surgical site infection in Zewditu Memorial Hospital 2020, Addis Ababa, Ethiopia

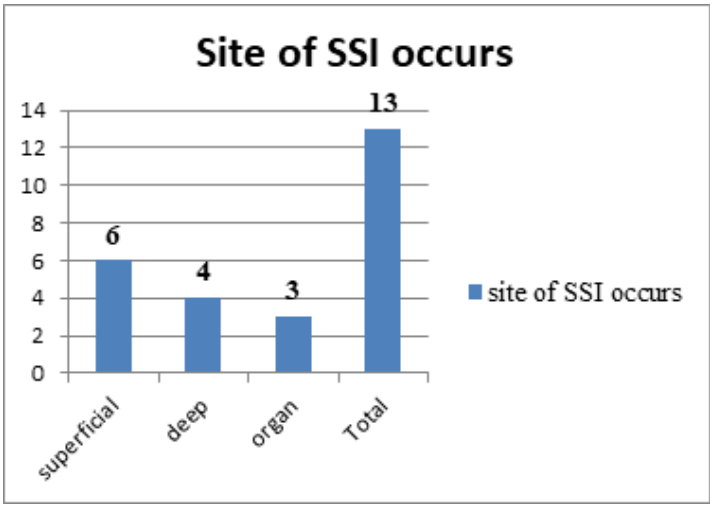


Figure 4: Site of surgical site infection of clients who had surgical site infection in Zewditu Memorial Hospital 2020, Addis Ababa, Ethiopia

Discussion

Postoperative surgical site infections are still one of the primary causes of morbidity in surgically treated patients. More nursing care, additional wound care, potential readmission to the hospital, and additional surgical procedures all result in higher costs for these patients. Surgical site infections were common in this study, as they are in other studies in Africa and other poor continents, at 9.02 percent. Females account for the majority of the population, maybe because they are more prone to infection. In comparison, the overall surgical site infection rate in the United States is 2-3 percent [4]; in Seoul, South Korea, it is 3.3 percent [19]; and in mainland China, it is 4.5 percent. In a prospective study of the etiological agents of abdominal wound site infection at Lagos University Teaching Hospital in Nigeria, 25 (17.4%) of the 144 patients assessed developed surgical site infections [19]. In comparison to this study, this is quite high. This study was identical to those conducted in three Sub-Saharan African nations (DRC, Burundi, and Sierra Leone) with 9.3% and Guwahati, Assam with 9.03 percent [18]. These results were much lower than those in Zimbabwe, which were significantly higher (29 percent). This disparity could be explained by the fact that the previous study was a cohort prospective study conducted in two large referral teaching hospitals in the countries, whereas the current study was conducted in a general hospital. Infection is a risk issue when people crowd inwards [7]. According to a prospective descriptive study conducted at Jimma University, the overall abdominal wound site infection rate in Ethiopia was 11.4 percent [18]. In 2015, TikurAnbessa Hospital did another prospective study on surgical site wound infection. After a 30-day procedure, the total wound site infection rate was 14.8%. [9].

These findings suggest to a lack of good postoperative care and a failure to maintain sterility during surgical procedures, as well as inadequate infection control due to poor cleanliness, resource and structural constraints, and a general lack of knowledge of nosocomial infections. Technological improvements in infection management, such as the use of high-efficiency particulate air (HEPA) filters in theaters to reduce bacterial loads, are still lacking in the African setting, which may contribute to the high incidence of SSI. As a result, the most credible explanation for observed variations in infection rates remains the highest levels of health care in industrialized countries.

Limitation

As a result, there were numerous missing values, which could have influenced the true conclusion of the study, and the data were collected retrospectively, which reduced the ability to ensure data quality. The study was cross-sectional in nature. The exposure and outcome variables were difficult to pinpoint.

Conclusion

The prevalence of surgical site infection in this study area is relatively low. Females make up the majority of the population, maybe because they are more susceptible to infection. The use of preventive antibiotics and the patient's age were both factors in the development of Surgical Site infection in patients. Enhanced the health facility's prompt surveillance and supervision mechanism for surgical site infection To reduce Surgical site infections, surgical wards should be equipped with sufficient and appropriate equipment for post-surgical infection prevention, appropriate antibiotic prophylaxis should be used, and health care providers should provide proper wound care, screen and manage comorbidities such as diabetes, and educate patients about the effects of smoking cigarettes.

Recommendation

• The surgical ward's head and staff should have reinforced the health facility's prompt monitoring and supervision mechanism on surgical site infections, and provided surgical wards with sufficient and appropriate equipment for post-surgery infection prevention.

• Further research into the factors that contribute to inadequate surgical site infection prevention in all operations, as well as good perioperative patient care, is required.

Ethical Consideration

The Research and Ethical Review Committee of Menelik II College of Health Sciences in Addis Ababa, Ethiopia, approved and ethically cleared the study protocol. The hospital received an official letter of collaboration from the Menelik II Health Science College Department of Surgical Nursing, as well as approval,

informed consent, and signatures from the hospital clinical head. The hospital administrators and operating room physicians were given information on the study, including its goals and methods. Personal identifiers such as names or IDs were not used during the data collection, analysis, or publishing of findings to safeguard the confidentiality of the information. Only numerical codes could be used to identify the study participants.

Competing interests - Authors declare that they have no competing interests.

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Author contributions.

All authors contributed significantly to the conception and design, data acquisition, and data analysis and interpretation; participated in the drafting of the article or critically revised it for important intellectual content; agreed to submit it to the current journal; gave final approval of the version to be published; and agreed to be accountable for all aspects of the work.

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