



ST PAUL'S HOSPITAL MILLENNIUM MEDICAL COLLEGE

PREVALENCE AND RISK FACTORS ASSOCIATED WITH SURGICAL SITE INFECTIONS IN ABDOMINAL SURGERIES IN ST PAUL HOSPITAL MILLENNIUM MEDICAL COLLEGE A TWO YEARS REVIEW

BY

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ADVISORS:

DR BEFEKADU LEMU

MRS. SISAY TINAE

**A THESIS SUBMITTED TO St. PAUL'S HOSPITAL MILLENNIUM
MEDICAL COLLEGE DEPARTMENT OF PUBLIC HEALTH IN PARTIAL
FULFILLMENT OF THE REQUIREMENTS FOR THE DOCTOR OF
MEDICINE**

OCTOBER, 2017

ADDIS ABABA



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Acronyms

AIDS-	Acquired immune deficiency syndrome
ASA-	American society of anesthesiologists
BMI-	Body mass index
CDC-	Center for disease Control and Prevention
DM-	Diabetes mellitus
FMOH-	Federal ministry of health
HAI-	Hospital associated infections
HIV-	Human immune deficiency virus
MRSA-	Methicillin-resistant staphylococcus aureus
NNIS	National Nosocomial Infection Surveillance
RVI-	Retro viral infection
SD-	Standard deviation
SPHMMC-	St pauls's hospital millennium medical college
SPSS	Statistical Package for Social Sciences
SSI-	Surgical site infections
USA	United States of America
UTI-	Urinary tract infections

Summary

Background: One of the major complications after surgery is surgical site infection (SSI). The development of SSI is major cause of morbidity and mortality in surgical patients. It has an adverse impact on the hospital as well as on the patient. It is responsible for increasing length of stay of patient which results in social and economic loss to the patients and family. Host factors, local (site) factors and technique related factors are implicated in the causation of SSI.

Objectives: This study assessed the prevalence and risk factors associated with surgical site infections in abdominal surgeries and factors affecting at St. Paul's Hospital Millennium Medical College (SPHMMC), Addis Ababa Ethiopia

Methods: A retrospective hospital based analytical was conducted from January 2015-December 2016. All patients who have undergone emergency and elective abdominal surgeries at St. Paul's Hospital Millennium Medical College department of surgery during the study period were counted and reviewed to estimate the prevalence and risk factors affecting of surgical site infections. The secondary data was collected from patients' medical records using a structured questionnaire for analysis.

Results: Of the 249 patients, 39 suffered from SSI (15.5%). In 19.8% of the cases, the wound was infected. The average age for the patients was 30 years. The operations were elective in 52.4% of the cases and 47.6% were emergency. The average duration of the operation was 2.07 hours. The advanced age, increased operation time, increased hospital stay, electivity of the operation, surgical wound type, background disease, and the use of drain all significantly associated with SSI

Conclusion: In view of the a slightly higher rate of SSI reported here (15.5% compared with the 14% quoted in literature controlling the associated risk factors the SSI may be reduced to a more acceptable level.

1. Introduction

1.1 Background

Nosocomial infections constitute a major public health problem worldwide. They result in high morbidity and mortality, prolonged hospital stays, excessive use of antibiotics, and increased costs [1].

Surgical site infections are one of the most commonly encountered complications after surgery, along with pneumonia, urinary tract infections, and bloodstream infections are the most common nosocomial infections. They cause pain and inconvenience to patients and may be potentially fatal [2].

Surgical site infections definitions can vary because they range from a relatively trivial wound discharge without complications to serious conditions that are fatal. Therefore, to encourage a uniform and standard approach among data collectors, The CDC brought out definitions for each category. These are Superficial SSIs restricted to the skin and subcutaneous tissue; Deep SSIs involving the fascia and muscle layers; and Organ or space SSIs associated with the body organs and body spaces. These infections develop within 30 days after an operation or one year if an implant was placed. [2]

The SSI signs and symptoms are purulent discharge from the wound or around the insertion site of a drain, or spreading cellulites from the wound. Generally, raised white blood cell count, increased pain or heat with tenderness, pyrexia, dehiscence at the incision site indicates infection. Other indicators of infection are culture positive drainage and a physician diagnosis of infection with prescription of antibiotics [3]

In most patients, infection does not develop at operative site because innate host defenses are quite efficient in the elimination of contaminants at the surgical site. Pathogens that cause SSI are acquired either endogenously from the patient's own flora present on skin or from opened viscous or exogenously from contact with operative room personnel or the environment (hospital environment, food, other patients, staff, infected surgical instruments, dressings, and even drugs and injections)[4]

Several factors are to be taken into account for SSI, some of which are as follows: Extremes of age, BMI, site operated, shaving the site of incision, pre operative hospital stay, duration of the surgery, associated co-morbidities (diabetes, malnutrition, smoking, obesity, alcoholism, Steroid therapy, chemotherapy, radiotherapy), use of prophylactic antibiotics, class of wound contamination (Four wound classes with an increasing risk of SSIs were described: clean, clean-contaminated, contaminated and dirty wounds).[5].

SSI are associated with multiple adverse outcomes. They can double the length of time a patient stays in hospital and thereby increase the costs of health care. The healthcare costs are due to re-operation, extra nursing care and interventions, and drug treatment, great increase in the use of antibiotics which has become an increasing concern for development of drug resistance [6].

In many teaching and referral hospitals, abdominal surgeries play a vital role in therapeutic and diagnostic services [7].

In a research done on the incidence and risk factors of abdominal surgical site infection in Nigeria tertiary care center in 2015, the incidence was found to be 38.1% which is a significant number. To this end, this study will be conducted to examine the prevalence of SSIs following laparatomies, which will aid us to identify the gaps in our infection control protocols and identify the areas of focus to reduce the burden of SSIs.[8]

1.2 Statement of the problem

Recognizing, surgical site wound infection is common and has existed over centuries, and that after every major surgery, a patient has a 2- 5 % chance of developing an infection at the site of incision or that those who get these infections are two to three times more likely to die, five to six times more likely to be readmitted to the hospital, and likely to stay in the hospital twice as long as patients without infections.[9]

SSI account for 20% to 25% of all hospital acquired infections worldwide .Globally, surgical site infection rates have been reported to range from 2.5% to 41.9%. The risk of acquiring

hospital infection on hospitalized patients in relation to surgery is high, since about 77% of death of patients with hospital acquired infections was reported to be related with postoperative infections. The rate of HAIs is markedly higher in many developing countries.[10].They are found to complicate the recovery course of many patients

In a study done at Iranian teaching hospital in 2005, of the 802 patients studied who had undergone abdominal surgery, 139 (17.4%) suffered from SSI[6] .In another study done in Krishna institute of medical science ,Karad in 2016,14% was the total infection rate in abdominal surgeries[6] .Consequently after observing this disturbing figures, it is appropriate doing a study that focuses on surgical site infections in abdominal surgeries.

1.3 Significance of the study

Laparotomy is one of the most commonly performed surgeries at the surgical department of ST PAUL'S HOSPITAL MILLENNIUM MEDICAL COLLEGE. It has diagnostic and therapeutic importance for the patients as well as basis of training for specialization in the General Surgery course at the Hospital. Among the outcomes of laparotomies is an adverse effect of surgical site infection. With the rising incidence and associated morbidity of SSI, various studies have looked at ways to better optimize patients prior to surgery or improve surgical technique and management of patients during their recovery period in order to prevent SSIs. Data regarding a hospitals rate of SSIs are becoming increasingly used as outcome measures for assessing the quality of their surgical services.

Many previous studies focused on surgical site infections as a whole, qualitative analysis of the problem in each of the surgical procedures is worth investigating. Understanding this gap, this study focuses on SSI after laparotomies performed in both emergency and elective cases. And, it is aimed at assessing the prevalence and risk factors affecting surgical site infections in abdominal surgeries and setting a trend for future studies in other sub-groups of operations at this referral and teaching hospital.

2. Literature review

2.1 Definitions and Concepts

The infection of a wound can be defined as the invasion of organisms through tissues following a breakdown of local and systemic host defenses, leading to cellulitis, lymphangitis, abscess and bacteraemia.[12]

As defined by the centers of disease control and prevention surgical site infections are infections which typically occur within 30 days of of an operation at the site or part of the body where surgery took place or within a year if implant is left in place. The infection of most surgical wounds is referred to as superficial surgical site infection. The other categories include deep SSI and organ space infection .superficial (incisional) surgical site infection is defined as[21]

2.2.1 Superficial incisional SSI

Infection occurs within 30 days after an operative procedure, and involves only skin and subcutaneous tissue of the incision and patient has at least one of the following:

1. Purulent draining from the superficial incision.
2. Organisms isolated from an aseptically obtained culture of fluid or tissue from the superficial incision (incisional drainage).
3. At least one of the following signs or symptoms of infection: pain or tenderness, localized swelling, redness or heat, and superficial incision is deliberately opened by surgeon, and is culture positive or not cultured.
4. Diagnosis of superficial incisional SSI by the surgeon or attending physician

The following conditions are not reported as SSI

1. Stitch abscess (minimal inflammation and discharge confined to the points of suture penetration).
2. Infection of an episiotomy or newborn circumcision site.
3. Infected burn wound and localized stab wound infection (considered as skin or soft tissue infection depending on its depth).
4. Incisional SSI that extends into the fascial and muscle layers [21]

2.2.2 Deep incisional SSI

Infection occurs within 30 days after operative procedure and involves deep soft tissues (fascial and muscle layers) of the incision and patient has at least one of the following:

1. Purulent drainage from the deep incision but not from the organ/space component of the surgical site.
2. A deep incision spontaneously dehisces or is deliberately opened by a surgeon and is culture positive or not cultured and when the patient has at least one of the following signs or symptoms: fever ($>38^{\circ}\text{C}$), localized pain, or tenderness, unless site is culture negative.
3. An abscess or other evidence of infection involving the deep incision is found on direct examination, during reoperation, or by histopathologic or radiologic examination.
4. Diagnosis of a deep incisional SSI by a surgeon or attending physician.[21]

2.2.3 Organ/Space SSI

Infection occurs within 30 days after operation and involves any part of the anatomy (organs or spaces), other than the skin incision, fascia or muscle layers that is opened or manipulated during an operation and at least one of the following:

1. Purulent drainage from a drain that is placed into the organ/space.
2. Organisms isolated from an aseptically obtained culture or fluid or tissue in the organ/space.
3. An abscess or other evidence of infection involving the organ/space that is found on direct examination, during reoperation, or by histopathologic or radiologic examination.
4. Diagnosis of an organ/space SSI by a surgeon or attending physician.[21]

2.2.4 Wound classification and risk of acquiring SSI

Operative wound classification was developed by US National Research Council group in 1964. Four wound classes with an increasing risk of SSIs were described: clean, clean-contaminated, contaminated and dirty wounds.[12]

Clean -no viscus opened no break in technique. with infection rate of 1–2% Eg. Elective inguinal hernia repair

Clean-contaminated wounds- when the operative procedure enters into a colonized viscus or cavity of the body, but under controlled circumstances with minimal spillage, with infection rate of <10%.

Contaminated wounds- operations with major breaks in sterile technique (e.g. open cardiac massage) or gross spillage from the gastrointestinal tract, entry into biliary or genitourinary tract in the presence of infected bile or urine and incisions in which acute, non purulent inflammation is encountered are included in this ,with infection rate of 15–20%.

Dirty wounds- Surgical procedures performed when active infection, pus or perforation, or incision through an abscess is already present are considered dirty wounds, with infection rate of <40%.

2.2 Risk Factors Associated with SSIs

The risk of developing a surgical wound infection is largely determined by three factors: the load, type of microbial contamination of the wound and host susceptibility [13]

Microorganisms are normally prevented from causing infection in tissues by intact epithelial surfaces, most notably the skin. These surfaces are broken down by trauma or surgery. Reduced resistance to infection has several causes.

Certain conditions which diminish the efficacy of the immune response and delays wound healing such as: Cigarette smoking causes constriction of peripheral blood vessels, leading to tissue hypovolemia and hypoxia, therefore interfere with primary wound healing. Studies have shown that obesity is strongly associated with increased risk of SSI. Adipose tissue is poorly vascularised and the consequent effect on oxygenation of the tissues and functioning of the immune response is thought to increase the risk of SSI. Diabetes mellitus is a major predictor of post-surgical mortality and morbidity because of the pre-existing complications of chronic hyperglycaemia, which include vascular atherosclerotic disease and peripheral as well as autonomic neuropathies. Serum albumin level is most commonly used to assess nutritional status, patients who are malnourished have less competent immune response and are at increased risk for acquiring infections.[21]

Colonization and translocation in the gastrointestinal tract, The chance of developing an SSI after surgery is also determined by the pathogen city of the organisms present and by the size of the bacterial inoculums. Devitalized tissue, excessive dead space or hematoma, all the results of poor surgical technique, increase the chances of infection. The same applies to foreign materials of any kind, including sutures and drains.[12]

Similar to SSI in general surgeries abdominal surgeries have been caused by different risk factors these include the patients age , pre operative physiologic status ,the type of operation involved ,the surgical technique ,the urgency of the procedure, the use of pre operative antibiotics prophylaxis are among the few of them(6)

In support of the above statement in a research done in Nigeria tertiary hospital the risk factors identified were being an emergency procedure, prolonged operative hours,presence of contaminated and dirty wound ,the use of drain ,retroviral infections .

According to the available data and published articles, the distribution of pathogens isolated from SSI's has not changed markedly over the past 17 years. *Staphylococcus aureus*, coagulase negative *staphylococci*, enterococcus spp. and *E. Coli* remain the most frequently isolated pathogens, An increasing proportion of SSI's are caused by antimicrobial resistant pathogens, such as MRSA or by *Candida albicans*. Outbreaks or clusters of SSI's have also been caused by unusual pathogens, such as *Clostridium perfringens* *Norcadia farcinia*, *Legionella dumoffi* and *Pseudomonas* These rare outbreaks have been traced to contaminated dressing, elastic bandages, colonized personnel or contaminated disinfectant solutions.[11]

Antimicrobial resistance has been a problem in the field of surgery, as advances in control of infections have not completely eradicated this problem. The widespread uses of antibiotics, together with the length of time over which they have been available have led to major problems of resistant pathogens contributing to morbidity and mortality.[13]

2.3 Estimates of Surgical Site Infections in Abdominal Surgeries

A recent prevalence study found that SSIs were the most common healthcare-associated infection, accounting for 31% of all HAIs among hospitalized patients². The CDC

healthcare-associated infection prevalence survey found that there were an estimated 157,500 surgical site infections associated with inpatient surgeries in 2011, for an overall SSI rate of 1.9% between 2006-2008.[14] The Current International SSI's rates for abdominal surgery is 20%.

In prospective study done in Tehran teaching hospital ,802 patients who had undergone abdominal surgeries were studied, among these, 139 suffered from SSI (17.4%).[4] In another prospective study which was done over a period of 2 years in department of surgery , subharati medical college, in patients who underwent abdominal surgery out of 983 patients 952 were followed and of them 112 had SSI i.e. 11.7%.emergency cases had higher number of SSI (23.8%) as compared to elective cases (7.4%).[16]

In a study aimed to determine the incidence of and identify the risk factors responsible for SSI following laparotomies in patients in a Nigerian tertiary care facility. This prospective study carried out over one year included 291 patients during the study period, out of which 223 met the inclusion criteria Surgical site infection was diagnosed in 85 patients giving an incidence rate of 38.1%. [8]

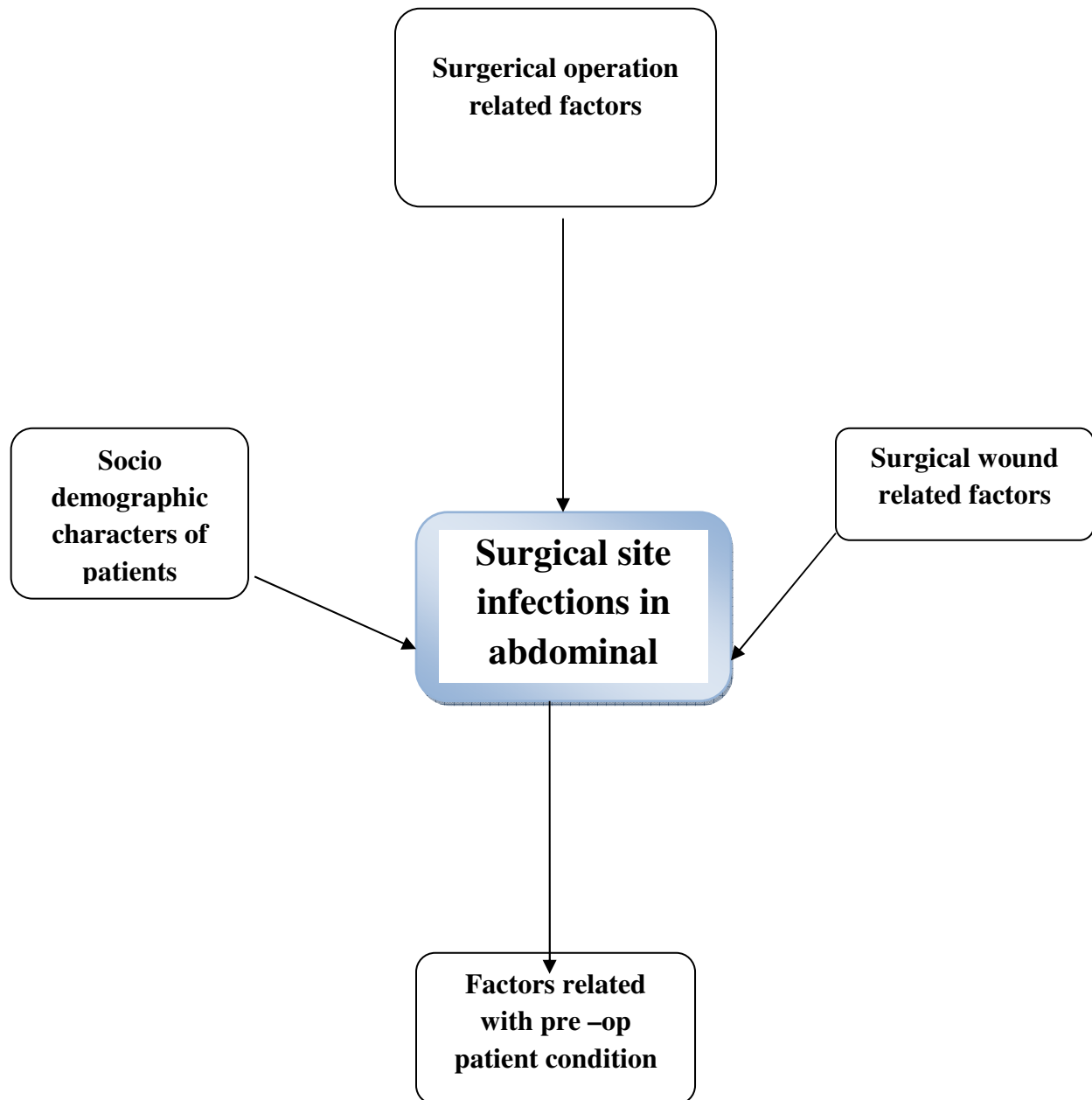
The overall infection rate of 7.44% was observed among 685 patients included in a study. Undergoing various abdominal surgical procedures admitted in department of general surgery over a 20 months period in northern Indian tertiary care hospital[17]

In another study carried out over 1 year in Civil hospital Ahmebadar involving 100 patients who went through abdominal surgeries the overall rate was 16%. [6]

In another prospective study done over a period of 2 years done in Osmania general hospital the study has involved 450 operated cases among them 99 patients have developed SSI making the overall pre valence 22.2%. [8]

Furthermore in another prospective study done in kosovo a total of 253 surgical interventions were done and 225 patients were evaluated with the overall incidence of SSI 12%. [1]

3. **Conceptual Frame Work for Prevalence and Factors Affecting Surgical Site Infections in Abdominal Surgeries**



4. Objectives

4.1 General Objective

- ❖ To assess the prevalence of surgical site infections in abdominal surgeries and risk factors affecting it at ST Paul's Hospital Millennium Medical College

4.2 Specific Objectives

- ❖ To assess the prevalence of surgical site infections in abdominal surgeries
- ❖ Identify the risk factors associated with the development of surgical site infections in abdominal surgeries

5. Methods and materials



St. Paul's Hospital was built in 1969 (was named St Paul General Specialized Hospital until 2008) by Emperor Haile Selassie in collaboration with the German Evangelical Church, as a source of medical care for underserved populations. It currently has 392 beds, with an annual average of 200,000 patients and a catchment population of more than 5 million. Approximately 75% of the patients receive medical care free of charge. There are over 1300 clinical and non-clinical staffs in over 13 departments. The department of surgery accounts for the 3 in patient wards having a total of 119 beds.

The Medical School opened in 2007, the new Millennium era of the Ethiopian calendar. It is intended to alleviate the severe shortage of medical doctors in the country. In line with various encouraging efforts performed by the Ministry of Health in this regard. It has a unique integrated and modular educational model. The college has its own senate and governed by a board under FMOH.

5.2 Study Design

A hospital based retrospective record review was conducted from January 2015-December 2016

5.3 Study Population

All patients who were admitted to the department of general surgery and had undergone emergency and elective abdominal surgeries and that meet the inclusion criteria for this study.

5.3.1 Inclusion Criteria

- ❖ patients who have undergone emergency and elective abdominal surgical procedures

5.3.2 Exclusion Criteria

- ❖ patients with deficient medical records
- ❖ patients who had undergone surgical interventions at another hospital and then referred to SPHMMC
- ❖ all patients who died during the surgical procedures

5.4 Sample size determination

The current International SSI's rates for abdominal surgery are 20% [2]. Using this, the sample size was computed by using the single population proportion formula;

$$n = \frac{Z^2 p (1-p)}{d^2}$$

Z=1.96 corresponding to 95% confidence interval

n =sample size

p= prevalence of abdominal wound infections which is estimated to be 20%

d= degree of precision within (+ or -) 5% of the true value

$$n = \frac{1.96^2 (0.20 \times 0.8)}{0.05^2}$$

$$n = 249$$

5.5 Sampling technique

The medical records of patients who underwent surgery during the study period were identified and from those the ones who underwent abdominal surgeries were selected. The total number of the abdominal surgeries done were divided to the sample size and every 8th patient who met the inclusion criteria were selected. Systematic sampling technique was employed in this study.

5.6 Variables

5.6.1 Dependant variable

The dependant variable is abdominal surgical site infection

5.6.2 Independent variables

- Age
- Sex
- Pre op hospital stay
- Type of surgery
- Operative procedure
- Duration of surgical operation
- Class of wound contamination
- Associated co-morbidities
- Use of drainage
- Use of prophylactic antibiotics

5.7 Data collection

The data was collected on data collection form .The CDC standardized surveillance criteria for defining surgical site infections which involve interpretation of clinical and laboratory findings were used to detect infections. The tool used was a questionnaire designed to extract relevant information from the medical records. It was filled by the data collector. The medical records in the study period were obtained from the medical record office.

5.8 Data analysis and management

The data was entered and analyzed using IBM SPSS 20 for windows. Descriptive statistics methods were used to produce percentages, mean and range of variables. Categorical variables were compared using chi-square test and binary correlation was used as needed. A p value of less than 0.05 was considered significant.

5.10 Ethical considerations

This study was commenced after approval by the Ethical and Research committee of SPHMMC. Permission was obtained from the department of public health and provost office . Confidentiality was observed and no names were quoted. All patients' files were considered private and confidential as per hospital ethical and research committee regulations

5.12 Operational definitions

Surgical site infection- Infection occurs within 30 days after an operative procedure, and patient has at least one of the following Purulent draining from the superficial incision. Organisms isolated from an aseptically obtained culture , At least one of the following signs or symptoms of infection: pain or tenderness, localized swelling, redness or heat, and superficial incision is deliberately opened by surgeon, and diagnosis by physician.

Clean wound- *Clean* -no viscus opened no break in technique.

Clean-contaminated wounds- when the operative procedure enters into a colonized viscus or cavity of the body, but under controlled circumstances with minimal spillage

Contaminated wounds- operations with major breaks in sterile technique, non purulent inflammation is encountered are included in this

Dirty wounds- Surgical procedures performed when active infection, pus or perforation, or incision through an abscess is already present

5.13 Dissemination of the results

The approved research report will be submitted to st paul hospital millennium medical college . Efforts will be exerted to present the findings of this study in different seminars and workshops.

6. RESULT

6.1 Socio-demographic characters

A total of 249 abdominal surgical procedures were included into this study. Of the total, the respondents 53.5% (133) were male and 46.5% (116) were female.

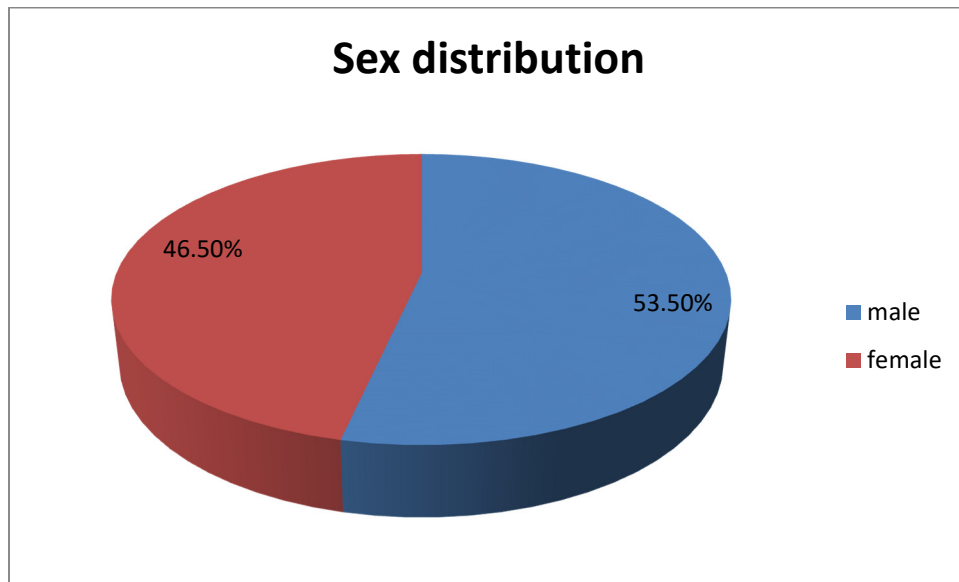


Figure 1 Sex distribution of patients who have undergone abdominal surgeries in SPHMMC from January 2015-december 2016

About 37.4% of the patients were single, 55.1% were married, 4.85 % were divorced and 2.75% were widowed. The minimum age of the respondent was 18 and the maximum was 43 with a mean age of 30.28 ± 5.49 SD. About 27.9% of the patients were below the age of 25, 53.7% of them were between the age of 25-65 and 17.9% of patients were above the age of 65 years. About 21.9% of the patients were illiterate, 8.64% of them were able to read and write, 25.7% of them attained primary education, 26.7% of them have attained secondary level and 17.1% of them were above the secondary level of education.

Table 1 Socio-demographic characteristic of patients who have undergone abdominal surgeries in SPHMMC from January 2015-December 2016

Characteristics		Frequency
Age	<25	46(27.9%)
	25-65	134(53.7%)
	>65	46(17.9%)
Marital status	Married	137(55.1%)
	Divorced	12(4.85%)
	Single	93(37.4%)
	Widowed	7(2.75%)
Respondent's education	Illiterate	54(21.9%)
	Read and write	22(8.64%)
	Primary education	64(25.7%)
	Secondary education	66(26.7%)
	Higher education	43(17.1%)

6.2 General data

6.2.1 Type of operations

There were 130(52.4%) elective surgical operations and 118(47.6%) emergency procedures, Table1. This demonstrated that the bulk of general surgical operations were elective conditions.

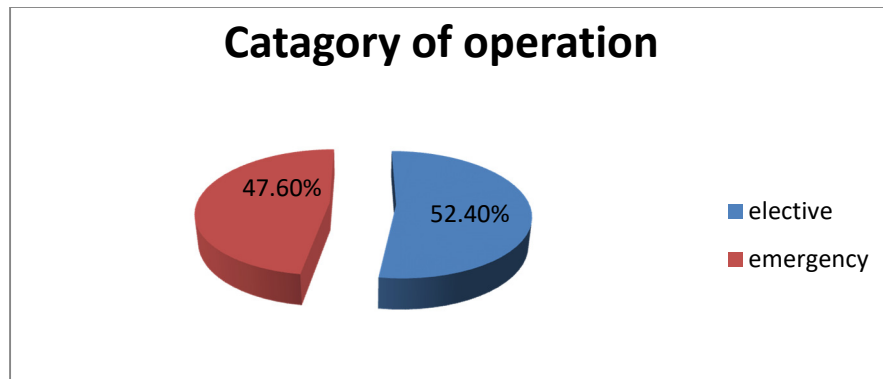


Figure 2 Outlines Category of operation based on electivity in abdominal surgeries done in SPHMMC from January 2015-December 2016

6.2.2 Pattern of procedures

The most commonly performed procedure was surgery pertaining to the appendix accounting for 24.1% of the overall laparotomy incidence. Other common procedures were exploratory laparotomy and chlecystectomy.

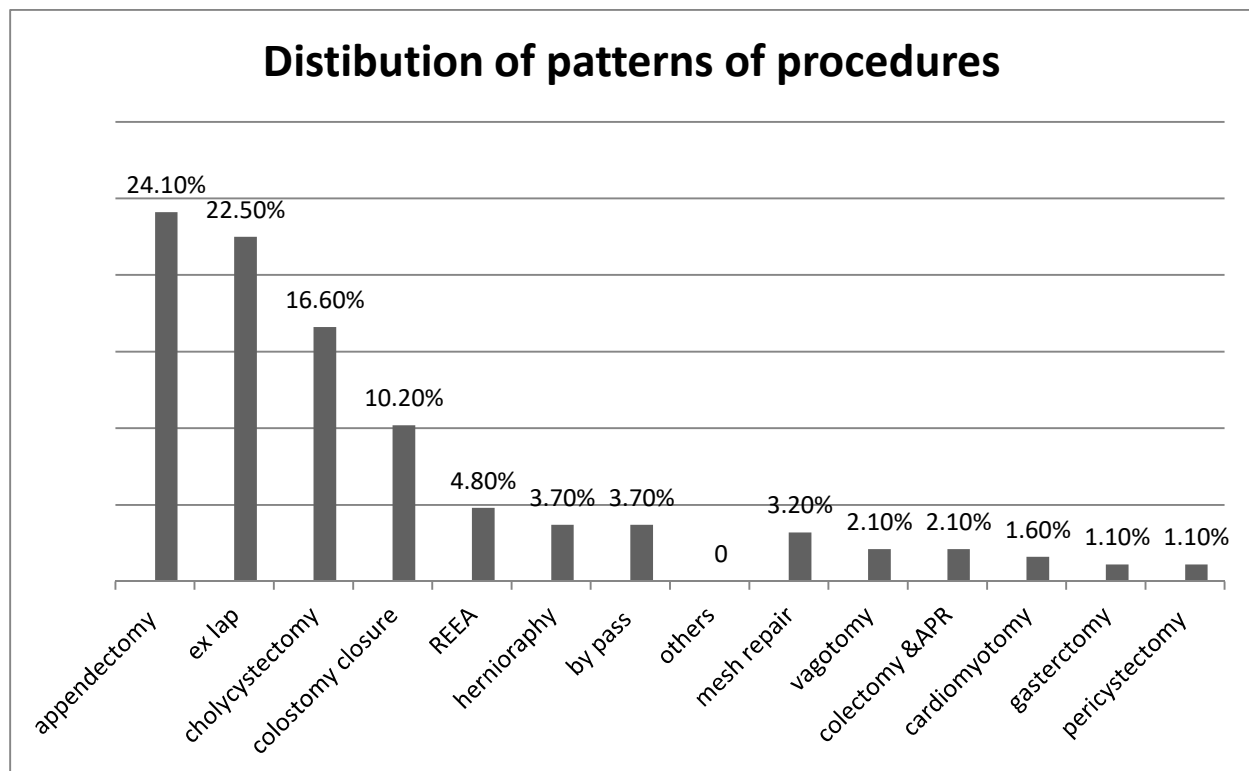


Figure 3 Outlines the pattern of procedures done in abdominal surgeries in SPHMMC from January 2015-December 2016

6.2.3 Pre-operative hospital stay

Among patients included in the study, 44.7% have undergone surgery on emergency basis 31.6% of them stayed for less than 7 days and 23.7% of them stayed for more than 7 days preoperatively.

Table 2 Pre operative hospital stay of patients who had abdominal surgeries in SPHMMC from January 2015- December 2016

PRE OP STAY	FREQUENCY	PERCENTAGE
Emergency	111	44.7%
<=7 days	79	31.6%
>7 days	59	23.7%
Total	249	100

6.2.4 Duration of surgical procedures

The operation time was defined as the time from the skin incision to that of wound closure. This was derived from the anaesthetic chart. The shortest duration recorded was half an hour of surgery, while one procedure lasted 4.20 hours.

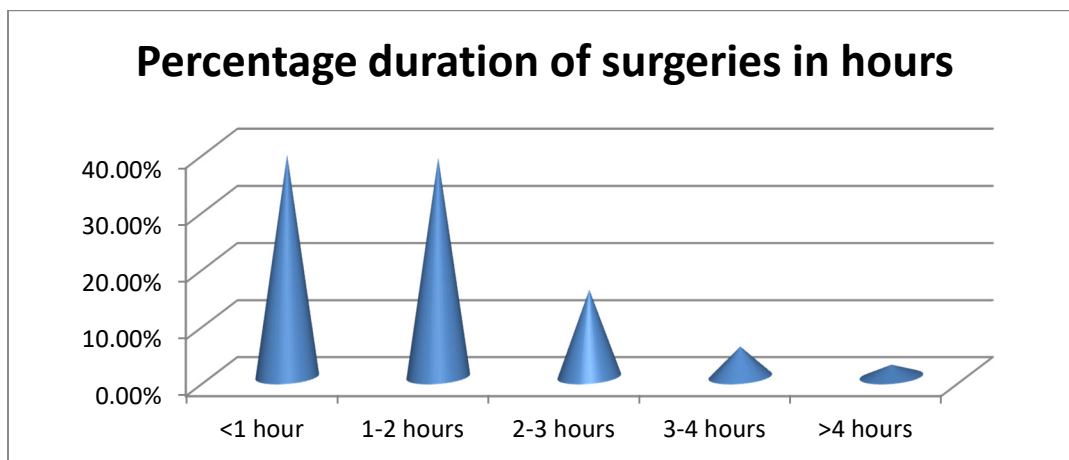


Figure 4 Duration of surgeries in hours the abdominal surgeries lasted done in SPHMMC from January 2015- December 2016

6.2.5 Total duration of hospital stay

It was observed **that** 72.6% of surveyed patients spent a maximum of 15 days and 27.4% of patients more than 15 days at the hospital .On average a patient spent a total of 9 days at a hospital after surgery

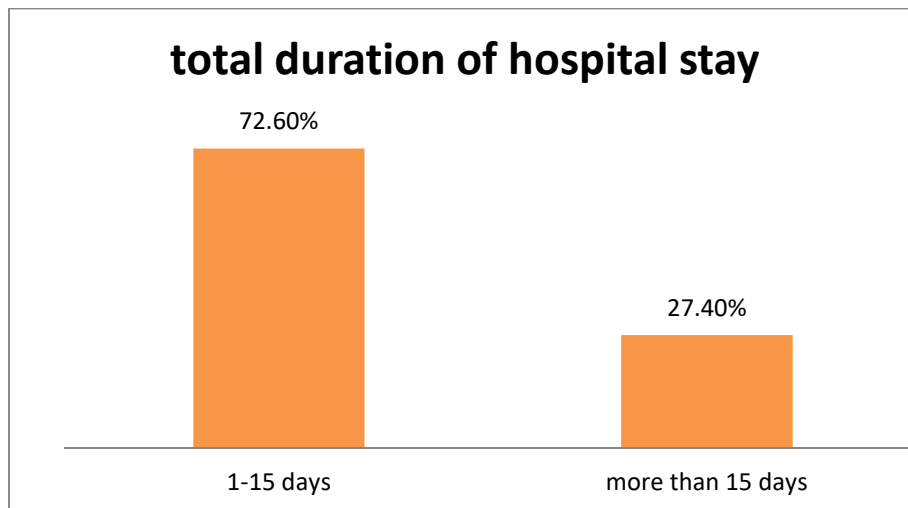


Figure 5 Total duration of hospital stay of patients who had abdominal surgeries in SPHMMC from January 2015-December 2016

6.2.6 Classification based on wound class

Among the patients who have undergone abdominal surgeries studied, the wounds are classified as 49.7% of them clean, 20.9% are clean contaminated wounds, 9.1% contaminated and 19.85% of them are dirty.

Table 3 Classes of wound of abdominal surgeries done in SPHMMC from January 2015-December 2016

CLASS OF WOUND	FREQUENCY	PERCENTAGE
Clean	124	49.7%
Clean contaminated	52	20.9%
Contaminated	24	9.1%
Dirty	49	19.85%

Total	249	100%
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6.2.7 Co- morbidities

Of the 249 patients included in the study, 186 (74.7%) didn't have associated co-morbidities, 63 of them had various co- morbidities. Figure 7 below outlines percentage distribution of the co- morbidities.

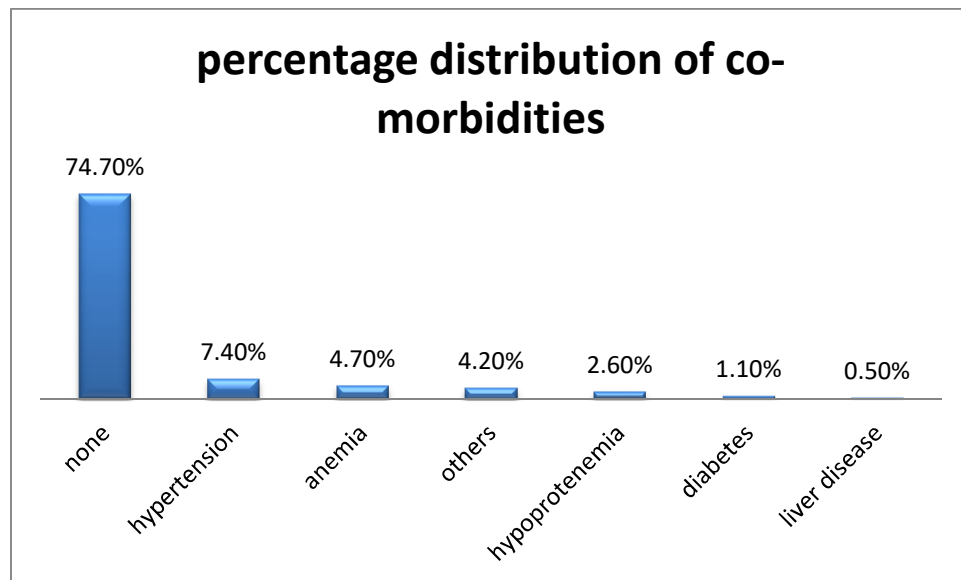


Figure 6 Outlines percentage distribution of co-morbidities the patients had who went through abdominal surgeries done in SPHMMC from January 2015- December 2016

6.2.8 Use of prophylactic antibiotics

Among the patients who have undergone abdominal surgeries, 232(93.2%) were given prophylactic antibiotics and 17(6.8%) had not received prophylactic antibiotics.

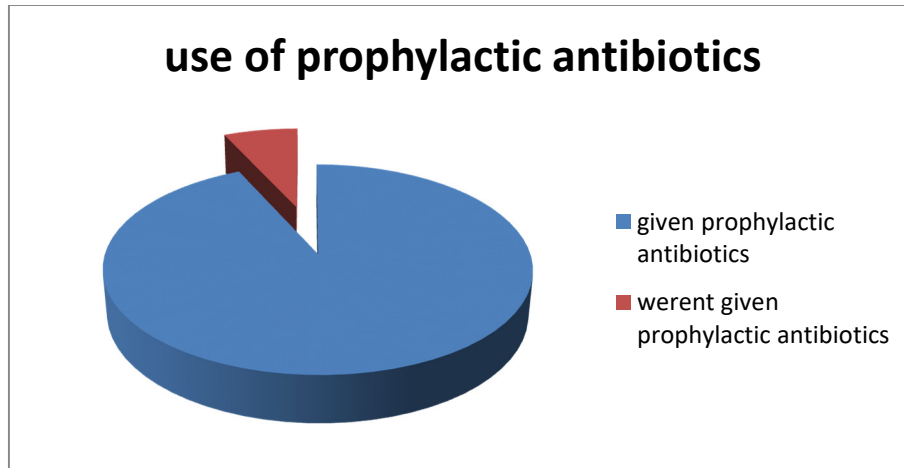


Figure 7 Use of prophylactic antibiotics in abdominal surgeries done in SPHMMC from January 2015-December 2016

6.2.9 Use of drains

Out of 249 patients, surgical drain was post-operatively used in 60(24.2%) patients and in 189 (75.8%) of them drains were not used .

6.3 Infection data

6.3.1 Prevalence of Surgical site infections

In the present study, SSI was observed to be present in 38 patients no infection were observed in the other 211 of the patients, giving a prevalence rate of 15.5%. Of which 22 (59%) were men and 16 (41%) were women. Patients whose age above 65 years had infection rate of 27.2%. emergency surgical procedures were performed in 22.5% of patients who had SSI. Exploratory laparotomy was associated with the highest incidence (26.2%) of SSI amongst all the surgical procedures followed by appendectomy (21.7%).it was also found that among the patients who have developed SSI an average of 12 days has passed until presentation

6.3.2 Types of surgical site infections

Using the CDC definition, of the 38 cases; superficial SSI was found in 62.1%, deep incisional SSI 24.1% whereas organ/space in 13.8%. These are shown in table below

Table 4 Outlines the type of surgical site infections among patient who developed SSI after abdominal surgeries done in SPHMMC from January 2015-December 2016

TYPE OF SSI	FREQUENCY	PERCENTAGE
Superficial	24	62.1%
Deep	9	24.1%
Organ space	5	13.8%

6.3.4 Clinical picture of SSIs

Among the patients who have developed SSIs the commonest clinical presentation was presence of serous discharge or pus (20.7%) others presented with fever, pain, erythema, swelling , separation of tissues and combination of the above.

Table 5 Outlines clinical pictures patients with SSI manifested with for whom abdominal surgeries were done in SPHMMC from January 2015-December 2016

Clinical pictures	Percentage
Fever	3.4%
serous discharge or pus	20.7%
Fever, pain & discharge	13.8%
Pain & discharge	20.7%
Pain, discharge & separation of tissues	20.7%
fever, discharge & swelling	17.2%
Erythema & discharge	3.4%

6.5.4 Factors affecting surgical site infections

The study demonstrated that the prevalence of surgical site infections is 15.5%. The patients age, electivity of the surgery, pre-op hospital stay, category of surgical wound, presence of co-morbidities, total duration of surgery the use of drain were found to be significantly associated with the development of surgical site infections.

Patients whose ages above 65 years(27.2%) were found to have more infection rates compared to those whose ages are between 25-65.(p value-0.0016)

Another important determinant was the presence of associated co-morbidities positively influenced the development of surgical site infections. The commonest co-morbidities identified were anemia (33.3%) and hypoproteinemia (40%). The others being hypertension, retroviral infection, diabetes and smoking.(p value-0.003)

Similarly electivity of surgical procedures was found as one of the most important predictors' of infection development. Emergency procedures are highly associated with SSIs than elective counterparts. Among the 38 patients who have developed surgical site infections 22.5% of them have undergone emergency surgeries while only 9.2% had surgery on elective basis. (p value-0.001)

\Another factor that was found to be associated was the pre-op hospital stay. Patients who have undergone surgery on emergency basis had the highest infection rate. Additionally patients who stayed in the wards for more than 7 days tended to have less infection risk than who stayed less. Among the patients who have developed infections 15.9% stayed for more than 7 days while only 6.8% stayed for less excluding the emergency cases. (p value-0.004)

SSIs were found to be influenced by the duration of surgery. 13.7% developed SSI in surgeries of duration less than 1 hour, 15.5% between 1 - 2 hours, and 27.2% patients developed SSI in surgeries lasting for more than 2 hours. (p value-0.0036)

Category of surgical wound is also an important determinant of surgical site infection . In clean wounds, there were 9 surgical site infections observed. In the clean-contaminated procedures there were 8 Surgical site infections. A total of 5 procedures categorized as contaminated, became complicated with surgical site infections. There were 15 procedures classified as dirty which complicated with Surgical site infections. (p value-0.002)

The use of drain was also found to be associated with surgical site infection. Among the patients who have developed SSI, in 23.9% of them a tube drain was used. (p value-0.004)

Sex of the patient, marital status, educational status, and antibiotic prophylaxis did not show a significant association with the development of surgical site infections.

Table 6 Outlines factors affecting surgical site infections in abdominal surgeries done in SPHMMC from January 2015-December 2016

Variables	SSI Present	P- value
Age of the patient		0.001
<25 years	9.4%	
25-65	16.3%	
>65	1127.2%	
Pre op hospital stay		0.004
<=7days	5(6.8%)	
>7 days	9(15.9%)	
Presence of co-morbidities		0.003
None	14(12.9%)	
present	24(87.1%)	
Duration of surgery		0.0036
,1hour	7(13.7%)	
1-2 hours	8(15.5%)	
>2 hours	15(27.2%)	
Electivity of surgery		0.001
Emergency	28(22.5%)	
Elective	10(9.2%)	
Wound category		0.002
Clean	9(23%)	
Clean contaminated	5(20%)	
Contaminated	5(12.8%)	
Dirty	15(38.4%)	
Use of drain		0.004
Yes	21(23.9%)	

No	17(12.8%)	
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7.0 Discussion

7.1 Prevalence of surgical site infections in abdominal surgeries

It is an established fact that most third world countries have similar health care problems that have been identified to contribute to the high incidence of SSI. These conditions include poor operating room environment, lack of infection surveillance and control strategies as well as patient-related factors which include late presentation to hospital and poor pre-operative physiological status. On the contrary, lower infection rates have been reported from the western world and these have been credited to active infection surveillance protocols which are lacking in many developing countries. [2]

The approach used in this study was designed to evaluate the magnitude of SSI in SPHMMC following abdominal surgeries. With the increasing interest in medico-legal aspects and in cost effectiveness of hospital care true estimates of the morbidity and economics of SSI are of growing importance.

The overall rate of SSI in abdominal surgery was 15.5%. This is indeed lower than quoted in literature which was 17.4%. The study was done in the year 2016 and has included 802 patients undergoing abdominal surgery at the Iranian teaching hospital found overall rate of 17.4% with 24.7% in acute surgery and 75.7% in elective procedures. [11]

Previous studies in the year 2009 showed that surgical site infections varies from 0.5-5% depending on the type of surgery. In a study done in 2014 at Komfo Ankoeye teaching hospital in Ghana it revealed an alarming rate of 40% over all prevalence which is above the infection rate in so many places. In another prospective study which was done over a period of 2 years in department of surgery, Subharati Medical College, in patients who underwent abdominal surgery out of 983 patients 952 were followed and of them 112 had SSI i.e. 11.7%. Emergency cases had higher number of SSI (23.8%) as compared to elective cases (7.4%). [16]. The incidence in America is reported as 5% and 4.65% in England. This study's 15.5% prevalence is significantly lower than the above figure..

However, are comparable with those reported from other third world nations like Tanzania (15.6%), Pakistan (13.5%) and Vietnam (14.9%). [11]

The varying in the prevalence of surgical site infections in different set up is that it may be due to the different operative environment of institutions, varying per operative patient care,

timing of patient presentation and the strength of infection surveillance and control in the institution

7.2 Risk Factors affecting surgical site infections in abdominal surgeries

SSI rates among males is 58.6% and among females is 41.4%. There is no statistical significance different of SSI among males and females in agreement with previous findings. In a study done on the year 2016 at Iranian teaching hospital SSI wasn't found to be correlated with sex. [4]

The most common age group developing SSI was > 65 years (27.2%), for both males and females. Most studies in literature show an increase in the incidence of SSI with increasing age. In a study done in Osmania general hospital, Hyderabad, commonest age group to develop SSI was age above 60 accounting about 33.3%. [19] The above results probably reflecting the deteriorating immune status, poor compliance to treatment and development of co-morbidities as age advances.

The infection rate is higher in patients undergoing emergency surgery than elective procedure which was 22.5% Vs 9.2%. Similarly in a study done in civil hospital, Ahmedabad patients with emergency surgery was 24.1% while in patients operated electively the rate was 12.6%. [20] The high rates of infection in emergency surgeries can be attributed to inadequate pre-operative preparation, the underlying conditions which predisposed to the emergency surgery and the greater frequency of contaminated or dirty wounds in emergency surgeries.

In this study the individual distribution of SSIs occurrence based on wound class was clean (7.5%), clean contaminated (15.4%), contaminated (23.5%) and dirty infected were 29.7%. which showed the similar increasing trend of infection as the degree of contamination increases on comparison with other studies. In a study done on the year 2013 in Subharti medical college, Meerut, SSIs occurrence based on wound class was clean (5.0%); clean contaminated (7.9%); contaminated (21.2%); and dirty infections (29.5%) . [16]

Prolonged preoperative hospital stay was found to be associated with higher rate of infection . In present study in patients who stayed for less than 7 days 6.8% of them developed SSI while in patients who stayed more than 7 days preoperatively 15.9% developed SSI. Similarly in a study done In Kososvo teaching hospital 33.3% of patients who developed SSI stayed for less than 7 days while 66.6% of them who developed SSI stayed for more than 7

days. [1] Prolonged preoperative hospital stay leads to colonization with antimicrobial resistant microorganisms and itself directly affects patient's susceptibility to infection either by lowering host resistance or by providing increased opportunity for ultimate bacterial colonization.

In the present study the numbers of SSIs were found to be influenced by the duration of surgery. 13.7% developed SSI in surgeries of duration less than 1 hour, 15.5% between 1 - 2 hours, and 27.2% patients developed SSI in surgeries lasting for more than 2 hours. This is in conformity with another study conducted at an Indian teaching hospital which reported 2.6% SSI in surgeries of duration less than 1 hour, 4.8% SSI in surgeries between 1 - 2 hours and 5.4% SSI in surgeries that lasted for more than 2 hours.[17] The simplest explanation for an increased infection rate with longer procedure is that a longer exposure time will increase level of contamination of the wound and subsequently the degree of damage to tissues and greater fatigue among members of surgical team will lead to break to sterile technique.

Among the patient-related risk factors observed in this study, incidence of SSI among patients who had anemia and hypoproteinemia were 33.3% and 40% respectively .The two were the commonest co morbidities identified to be associated with SSIs. Anemia as a predisposing factor could cause a reduced tissue oxygen level; resulting in a hypoxic and nutritionally depleted wound micro-environment that favors bacterial multiplication. Comparable results were observed in a study done in Krishna institute of medical science, Karad, The infection rate in patients with anemia is 31.25%, hypoproteinemia is 25% and in patients with diabetes mellitus is 31.25%.[6]

In the present study, wounds in which drains were used showed a higher incidence of SSI (23.9%) as compared to those without usage of drains (12.8%) The mechanism of drains may not completely exclude the peritoneal cavity from the exterior, hence retrograde ascent of microorganisms may be unhindered. Patients who had drains inserted had a higher incidence of SSI and this observation agrees with earlier reports. Other scientific reports exploring such a correlation have also emphasized that drain usage potentiated the development of SSI. In a study done in north India tertiary hospital the rate of SSI in wounds with drain and without drain were 15.7% and 1.93% respectively.[17] Similar pattern of results were also observed in a study done in Nigeria.

Antibiotic prophylaxis was received by 93.2% cases studied, which has consistently proven to reduce SSI rates in various studies world-wide.

The most critical factors in the prevention of postoperative infections, the sound judgment and proper technique of the surgeon and surgical team, were difficult to quantify in this study. The conditions responsible for SSI other than included in this study are personal hygiene, immunological disorders, BMI, techniques of surgery, duration of surgical scrub, pre-operative skin preparation, failure to obliterate dead space, and inadequate sterilization of instrument

8. Limitations of the study

- Incomplete data recording on the medical charts of patients
- Most of the researches done and used for comparison with this study were prospective studies
- Confounding factors are difficult to avoid in this study

9. Conclusion and recommendation

9.1 Conclusion

The incidence of SSI in our environment is still high when compared to the developed world. This study identified a 15.5%% SSI rate in abdominal surgery. Comparable to what were found in other literatures rates ranging from 14-17%. The SSI rate was higher in the older age group. Emergency laparotomy poses a great risk to developing SSI as compared to the elective. Various factors which were proved to be causing surgical site infections were increase in the time of surgery, the presence of associated co morbidities(anemia, low albumin level, diabetes, RVI), prolonged pre operative hospital stay, an increase in the degree of contamination of the wounds and use of drains were among them.

9.2 Recommendations

- ✓ Treating existing co morbidities whenever possible in elective surgery prior to operation
- ✓ Minimum pre operative hospital stay
- ✓ The hospital's records department needs computerization of records
- ✓ Surveillance mechanisms should be developed for the control of SSI.

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11. Annexes

Annex 1: Study tool

Questionnaire to assess prevalence and risk factors affecting surgical site infections in abdominal surgeries

Part I Socio demographic characters

1. Patient code.....

2. Sex

☐ Male

☐ Female

3. Age

<25 ☐

25-60 ☐

>60 ☐

3 Marital status

Single ☐

married ☐

divorced ☐

widowed ☐

4 Educational status

Illiterate ☐

read and write ☐

primary ☐

secondary ☐

above secondary ☐

Part II General data

5. Date Admitted :.....

6. Date of surgery.....

7. Date of Discharge

8. Type of surgery/surgical procedure.....

9. Category of operation

Emergency ☐

Elective ☐

9. Surgical site wound category

Clean ☐

Clean-contaminated ☐

Contaminated ☐

Dirty and infected ☐

10. Duration of surgery/Operation.....Hours

11. Is antibiotic prophylaxis given?

Yes ☐

No ☐

12. Was drain used?

Yes ☐

No ☐

13. Co-morbidities:.....

Part III Infection data

14. Is there any surgical site infection

Yes ☐

No ☐

15. If yes; please categorize

Superficial ☐

Deep incisional ☐

Organ/space ☐

16. Signs of surgical site infection or post operative infection

a) Fever	Yes ☐	No ☐
b) Swelling of sight	Yes ☐	No ☐
c) Erythema	Yes ☐	No ☐
d) Pain or tenderness	Yes ☐	No ☐
e) Serous discharge or pus from site	Yes ☐	No ☐
f) Separation of the deep tissues	Yes ☐	No ☐
g) Diagnosis of superficial/deep incisional surgical site infection by clinician	Yes ☐	No ☐

Annex 2 Assurance of the principal investigator

I the undersigned agree to accept all responsibilities for the scientific and ethical conduct of the research project. I will provide timely progress report to my advisors and seek the necessary advice and approval from them in the course of the research.

Name of the investigator: Tsedenia Kebede Tesfaye

Signature: _____

Date: _____

Approval of the clinical advisor

Name of the clinical advisor: Dr Befekadu Lemu

Signature: _____

Date: _____

Approval of the public health advisor

Name of the public health advisor: Mrs Sisay Tinae

Signature: _____

Date: _____