College of Health Science, School of medicine

Department of obstetrics and gynecology

Factors associated with surgical site infection after cesarean deliveries in TASH, ZMH and GMH, Addis Ababa, 2024/2025 G.C.

By Dr Lulit Fekadu (OBGYN resident)

Advisor: -Dr. Yirgu Gebrehiwot (Associate professor, Obstetrician and gynecologist, gyn-oncology subspecialist)

A thesis submitted to the department of obstetrics and gynecology, School of medicine, college of health science, Addis Ababa University for partial fulfillment of the requirements for the specialty inobstetrics and gynecology.

July, 2025

Addis Ababa, Ethiopia

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Declaration

I, Dr. Lulit Fekadu, hereby declare that this research thesis, "Factors associated with surgical site infection after cesarean deliveries in TASH, ZMH and GMH, Addis Ababa, 2024/2025 G.C" in line with the requirement of graduate studies was fully undertaken by me under the guidance of my advisors and that I have, to the best of my knowledge and effort, avoided plagiarism or duplication of materials unless and otherwise cited and/or acknowledged and that it has not been yet submitted for consideration or proposal application.

Investigator Dr. Lulit Fekadu _____ _____

We attest that, under our supervision this research thesis, "Factors associated with surgical site infection after cesarean deliveries in TASH, ZMH and GMH, Addis Ababa, 2024/2025 G.C**"** can be submitted to the DRPC for further administrative processing and documentation of the proposal by the Department as part of the resident's research undertaking for her partial fulfillment of the Degree of Specialty in Obstetrics and Gynecology.

Advisors _____ _____

List of Acronyms and Abbreviations

ACOG American collage of obstetric and gynecologist

AOR Adjusted Odd Ratio

BMI Body mass index

CD cesarean delivery

CDC Center for diseases control

CI Confidence interval

CS Cesarean section

GMH Gandhi memorial hospital

OR Odd Ratio

PROM Prolonged rupture of membrane

SSA Sub-Saharan Africa

SSI Surgical site infection

TASH Tikur Anbessa specialized hospitals

ZMH Zewditu memorial hospital

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Abstract

Background: -Surgical site infection is a common major complication after cesarean sections worldwide. Post-CS SSI incidence varies the income level of the country. The magnitude of morbidity and mortality related to post-CS SSI still remains major despite improvements in surgical techniques and preventive strategies.

Objective: -To determine factors associated with surgical site infection after cesarean deliveries in TASH, ZMH and GMH, Addis Ababa, 2025 G.C.

Method: -Hospital based case control study was conducted at three hospitals of Addis Ababa University (TASH, GMH and ZMH). A total of 366 participants were included with 1:2 ration of SSI and non-SSI participants from January1/2024 to May 30/2025.Study participants were selected using random sampling method.

Descriptive statistics were used for determining the associated factors of SSI. Presence and degree of association between outcome and independent variables were computed through bivariate logistic regression analysis. For factors having P value of ≤ 0.05, the multivariate logistic regression analysis were used.

Result: -The study identified several significant predictors of SSI. Women who underwent emergency cesarean sections were 3.6 times more likely to develop SSI compared to those who had elective procedures (AOR = 3.6; 95% CI: 1.97–13.74). Similarly, participants residing outside Addis Ababa had a 2.2-fold increased risk (AOR = 2.2; 95% CI: 1.88–5.62). The presence of maternal comorbidity increased the risk by 3.2 times (AOR = 3.2; 95% CI: 1.50–6.67), while clinical chorioamnionitis was associated with a 6.3-fold rise in SSI risk (AOR = 6.3; 95% CI: 1.06–37.92). Cesarean sections performed during the second stage of labor were 2.6 times more likely to result in SSI (AOR = 2.6; 95% CI: 1.13–6.09). Additionally, women with grade III meconium-stained amniotic fluid had a 10.9 times higher risk of developing SSI compared to those with grade I meconium (AOR = 10.9; 95% CI: 1.97–13.74).

Conclusion: Conclusion: Multiple maternal, clinical, and procedural factors were independently associated with increased risk of SSIs following cesarean sections. Targeted interventions focusing on improved intrapartum care, infection control measures, and surgical training are essential to reduce the incidence of SSIs.

Key word: -cesarean delivery, superficial surgical site infection, Addis Ababa university

1.1 Introduction

1.1 Background

Cesarean section is one of the commonest major surgical procedures in obstetrics. When properly utilized, it can save the mother's and the fetus's lives and avoid adverse obstetric outcomes. However, as the number of caesarean scars has increased worldwide, there is a growing worry about the associated risk of maternal morbidity. Postpartum endometritis, hemorrhage, thromboembolic disorders, anesthesia-related complications, and wound infections are among the major risks linked to cesarean delivery. (1-2)

Despite being a clean, sterile procedure, there is always a chance of surgical site infection with cesarean sections. It has been demonstrated that the use of preventative antibiotics greatly lowers the infection morbidity following cesarean delivery. In the event that this is not feasible, the most recent committee opinion from the American College of Obstetricians and Gynecologists (ACOG) suggests that antibiotics be given as soon as possible after a cesarean section. (3).

The majority of cesarean sections recover without incident in a predictable amount of time. Only a small percentage of patients will experience surgical site infection. Therefore, even in hospitals with the most up-to-date facilities and standard preoperative preparation and antibiotic prophylactic measures, surgical site infections remain the most frequent postoperative complications. (4).

The World Congress of Gynecology and Obstetrics reports that 6.2 million unneeded cesarean sections are performed annually (5).The total cesarean section (CS) rate in Sub-Saharan African nations was 12.4%, with a range of 1.0% to 41.9%, according to a review study. In this region, 15.6% of SSIs after cesarean sections were superficial, while 93% of infections were superficial (6-7). According to estimates, 21.7 million births worldwide in 2015 were due to CS. (8,9,10).

The definition of surgical site infection (SSI) given by the Centers for Disease Control (CDC) in the United States of America is used to define SSI. SSI is considered if it happens within 30 days

of the procedure and has at least one of the following signs and symptoms: fever, pain or tenderness, localized swelling, redness, malodor, and purulent drainage from the wound (11).

Since CS raises the risk of postpartum infections by five to even twenty times when compared to vaginal delivery, SSI continues to increase in morbidity, mortality, and healthcare-associated costs, even with recent improvements in surgical parameters and antibiotic prophylaxis (12–14). The number of postpartum infections among women is predicted to escalate as a result of the continuous global increase in the prevalence of cesarean deliveries. After CS, the mother, her family, and the community are burdened financially, emotionally, and physically by the SSI (12–13).

Worldwide, surgical site infections are a significant consequence following cesarean sections. They are mostly to blame for greater rates of maternal morbidity and mortality, patient and family discomfort, longer hospital stays, and more expensive treatment (15–16). Post-CS SSI is more common in low- and middle-income settings than in those with high incomes. SSI causes 0.3% to 0.8% of deaths and 3% to 16% of morbidity in wealthy countries (17). Incidence can reach 25% when compared to low- and middle-income environments (9, 18, 19). Advanced hospital infection control services and effective application of evidence-based recommendations for SSI preventive strategies are to blame for this large difference (20).

The occurrence of SSI is dependent on complex factors, including the mother's age, nutritional status, pre-morbid health status, the presence of prolonged premature rupture of the membrane, the duration of CS of more than an hour, and the surgical method used (20, 21).

Obesity and chorioamnionitis were found to be prevalent risk factors for the overall SSI in a systematic analysis of the maternal intrinsic risk variables related to SSI after cesarean delivery (22). Additional variables include the length of labor , emergency CS (23), the lack or inappropriate use of preoperative prophylactic antibiotics, and the duration of membrane rupture (24–26).

In underdeveloped nations, SSIs account for 5.6% of surgical procedures and are the main causes of morbidity and mortality globally. The frequency of surgical site infections (SSIs) varies between 1.2 and 23.6 per 100 surgical procedures, according to a World Health

Organization (WHO) assessment. Furthermore, each year, SSIs jeopardize the lives of millions of patients and worsen the development of antibiotic resistance (27).

The extent of surgical infection-related morbidity and mortality is still the leading nosocomial postoperative complication worldwide, despite improvements in surgical techniques, preventive measures, and methods intended to lower post-wound infections, as well as the availability of prophylactic antibiotics (28).

In less developed and developing nations, especially those in Africa, surgical site infections after cesarean sections are not only the most frequent postoperative sequelae but also a major risk factor for the general reluctance to have cesarean sections (29). According to a prospective cohort research carried out at Debre Markos Referral Hospital, 25.4% of patients had SSI. Approximately 84% of individuals who had SSI also had emergent CS (30).

1.1 Statement of the problem

According to World Health Organization (WHO) global health report (2014), direct (obstetric) infections are the third most common cause of maternal mortality, representing about 10.7% of maternal deaths, with the largest toll estimated in low-income and middle-income countries (LMICs) at 10.7% compared with high-income countries. When done with indication, cesarean delivery is effective in saving maternal and infant life. The ideal rate for CS is between 10% and 15% (31)

From the cause of maternal morbidity and mortality, cesarean delivery is the most important known variable associated with an increased postpartum bacterial infection when compared with vaginal birth, with reported rates of infection ranging from 1% to 25%, about 5 to 20 times higher than that of vaginal delivery (32).

The following factors were found to be significantly associated with surgical site infection following caesarean section: pregnancy-induced hypertension, prolonged labor duration, type of surgery, prolonged operation time, multiple vaginal examinations during labor, chorio-amnionitis, presence of meconium, intraoperative blood loss and perioperative blood transfusion, younger age, and premature rupture of the membranes. (33-37).

Cross-sectional research revealed that variables including age, pregnancy hypertensive disorders, duration of labor, and prophylactic treatment were linked to post-cesarean surgical site infection (SSI), which varied from 8.81% to 15% in Ethiopia (38–40).

The purpose of this study is to improve the surveillance system, provide information on the percentage of post-wound infections following cesarean sections, and to alert medical personnel regarding the need to prevent post-CD surgical site infections at Addis Ababa University's affiliates.

1.2 Significance of the study

By identifying key determinants of SSIs, healthcare providers can implement targeted interventions to reduce the infection rates, thereby improving surgical outcomes for cesarean deliveries.Identifying the determinants of SSIs can also highlight areas where healthcare providers may need additional training or resources, leading to better infection control practices. The findings from the study can inform the development of evidence-based guidelines and protocols to prevent SSIs, ensuring consistent and high-quality care across healthcare facilities.

Reducing the incidence of SSIs enhances patient safety, decreases the need for readmissions, and minimizes the use of antibiotics, which also contributes to combating antibiotic resistance.Preventing SSIs in cesarean deliveries can lead to significant cost savings for healthcare systems.

The study can contribute to the existing body of knowledge by identifying unique or underexplored factors that influence the incidence of SSIs in cesarean deliveries, which may vary by hospital practices, or patient demographics.The results can serve as a foundation for future research, including the development of new interventions or policies aimed at reducing SSI rates after cesarean deliveries.

2. Literature review

SSI following cesarean deliveries is a significant concern in obstetrics, impacting maternal morbidity, increasing healthcare costs, and extending hospital stays. Understanding the incidence and determinants of SSIs in this context is crucial for developing effective prevention strategies. The incidence of SSI following cesarean sections varies widely across different regions and healthcare settings. A systematic review reported an incidence range of 3% to 15%, depending on factors such as geographic location, socioeconomic conditions, and healthcare practices high-Income vs. low-income Settings (41).

In high-income countries, the incidence tends to be lower due to better infection control practices and access to resources. In contrast, studies from low- and middle-income countries. The reported higher rates of SSIs, often exceeding 10%, due to factors like overcrowded hospitals, limited access to antibiotics, and suboptimal surgical environments (42).

2.1The incidence of surgical site infection

The pooled prevalence of surgical site infections among patients was 2.5% (95% CI: 1.6, 3.7), according to a systematic review research on the worldwide burden of surgical site infections. The incidence of SSI was 2.7% for the WHO area and 2.5% for the survey period, according to the subgroup analysis. According to research done between 1996 and 2001, the greatest frequency was 2.9% and 7.2% in the African Region (43).

According to a Nepalese research, 97 out of 1135 cesarean section cases, or 8.54% of the total, developed SSI. Of them, 5.15% were deep SSI and 94.85% were superficial (45).

From the total of 206 study participants who underwent cesarean section in Ayder Comprehensive Specialized Hospital, 24 (11.7%) of them had post CS infection (46).

According to Debretabor General Hospital study finding the total 334 study participants, 27 of the post op mothers had developed SSI, making proportion of 8.1% (95%Cl: 5.4, 11.6). All SSI cases were superficial wound infection and developed from emergency CS (47).

The Magnitude of surgical site infection following to cesarean section in public hospital in Ethiopia was 26(6.8%). Fourteen (53.8%) case stayed at hospital more than seven days (48). The magnitude of surgical site infection after cesarean section was 7.8% (5.2–10.5), according to this research. Out of 30 women who had post CS infections, 23 (76.7%) and 7 (23.3%) had surgical site infections that were superficial and deep, respectively. In terms of the surgical site infection detection time, 22 (73.3%) cases were found following discharge. (49).

A study conducted at the Addis Ababa Government Hospital found that 25 (15%) of the 166 participants who finished the 30-day follow-up had SSI. Of them, 17 (68%) had superficial SSI, which simply needed to be treated with broad-spectrum antibiotics and an outpatient dressing. However, 8 (32%) experienced deep SSI, necessitating an extended hospital stay. Additionally, 15 (60%) of the SSIs were found between days 11 and 17, followed by days 1–10, which were 9 (36%) of SSIs, and 1 between days 25–30 (39).

2.2 The determinant factor of Surgical site infection

According to a cross sectional study done at Hawassa University Teaching and referral hospital, independent risk factors for post-cesarean SSI are operating time 38 min; p0.026, unadjusted OR2.5 (95% CI: 1.1-5.2), adjusted OR 2.4. Based on operation time, the group was split up into quartiles, and the probability of infection was computed for each quartile. The risk of infection was then found to be similar in the first three quartiles and higher in the fourth. 38 minutes separated the fourth quartile from the other quartiles. Adjusted OR2.8 (95% CI: 1.3-6.2), BMI30; p0.007. Nine (29%) of the 31 women in the high-risk group with a BMI of 30 and an operating duration of 38 minutes had SSI, according to a cross-tabulation of the two risk variables and SSI (40).

According to the study finding in Ayder Comprehensive Specialized Hospital, women who were from rural area were 5.6 times more likely to develop post CS infection than those from an urban area (AOR=5.666). Women with a history of PROM were 8.8 times more likely to develop post-

CS infection than those not having (AOR=8.818). Additionally, post-CS infection was sixteen times (AOR=16.17) more common in women with chorioamnionitis. The risk of post-CS infection was six times (AOR=6.064) higher for women who experienced protracted labor. Similarly, post-CS infection is seven times (AOR=6.982) more common in women with HIV than in those without the infection. Lastly, women who lost less than 1000 milliliters of blood had an almost 90% (AOR=0.097) lower risk of developing a post-CS infection than women who lost more than 1000 milliliters. (46).

PIH (AOR=4.75), chorioaminitis (AOR=4.37), midline skin incision (AOR=5.19) and post-operative hemoglobin less than 11g/dl (AOR= 5.28,) were significantly associated with development of surgical site infection using multivariate logistic regression analysis (47).

Types of abdominal incisions, length of labor, and rupture of the membrane before cesarean section were all substantially correlated ($p<0.05$) in the multiple logistic analysis. The incidence of surgical site infections was 3.48 times higher for mothers who were in labor for more than 24 hours prior to cesarean section than for those who were in labor for less than 24 hours (AOR=3.48). The chance of developing surgical site infections that had rupture of membrane before cesarean section was 3.68 times more likely than intact membrane (AOR=3.678). Mothers who had midline abdominal incision were 5.73 times more likely to develop surgical site infections as compare with Pfannenstiel abdominal incision (AOR=5.733) (48).

Women whose membrane ruptured prior to cesarean section had a 13.9-fold increased risk of surgical site infections compared to those whose membrane remained intact (AOR = 13.9), according to a multivariable logistic regression employing backward stepwise regression. Compared to women who had a Pfannenstiel or transverse abdominal incision, those who received a vertical or longitudinal abdominal incision had a 4.77 higher risk of surgical site infection (AOR = 4.77). Women who had surgeries longer than 30 minutes had a 4.9-fold higher risk of surgical site infection than those who had surgeries shorter than 30 minutes (AOR = 4.9). W omen with interrupted skin closure had a greater risk of surgical site infections than women with subcuticular skin closure (AOR = 6.29) (49).

Age, gestational age, and operation length all exhibited associations in the multivariate analysis with a P value of < 0.05. The latter analysis indicates that the chance of developing SSI increases

by 1.5 times (AOR=1.504) for every year of age increment. In a comparable manner, the probability of developing SSI increases by 1.1 times (AOR=1.108) for every minute that the procedure adds. Additionally, compared to post-term births, giving delivery via CD at term was shown to be 98.1% protective (AOR=0.019) against the risk of SSI. (39).

The results of the case control research SSI conducted at Dire Dawa Public Hospital showed that women aged 20–34 had a five-fold higher risk of post-cesarean srugical site infection than women aged 19 and under (AOR: 5.4). Mothers who had emergency cesarean sections had a nine-fold higher chance of developing a surgical site infection following the procedure than women who had elective cesarean sections (AOR: 8.9). Women who had four or more vaginal exams had a four-fold higher chance of developing a surgical site infection following a cesarean section than those who had one to three vaginal examinations (AOR: 4.2). Compared to their counterparts who had no chorioamnionitis, women with a history of the condition were five times more likely to get a surgical site infection following a cesarean section (AOR: 5).Women who had previous history of cesarean section are 6 times more likely to have post-CS surgical site infection as compared with those of who had no previous history (AOR: 6.2). Mothers who had not taken antibiotics as a prophylactic had a threefold higher chance of developing surgical site infections following cesarean sections than mothers who had taken antibiotics as a prophylactic (AOR: 3.2). The risk of surgical site infection following cesarean delivery was seven times higher for women with a preoperative hematocrit level below 30% than for those with a level over 30% (AOR: 6.9). Women whose membrane rupture lasted more than 12 hours had a five-fold higher chance of developing a post-cesarean surgical site infection than those whose rupture lasted less than 12 hours (AOR: 5.4). (50).

2.3 CONCEPTUAL FRAMEWORK

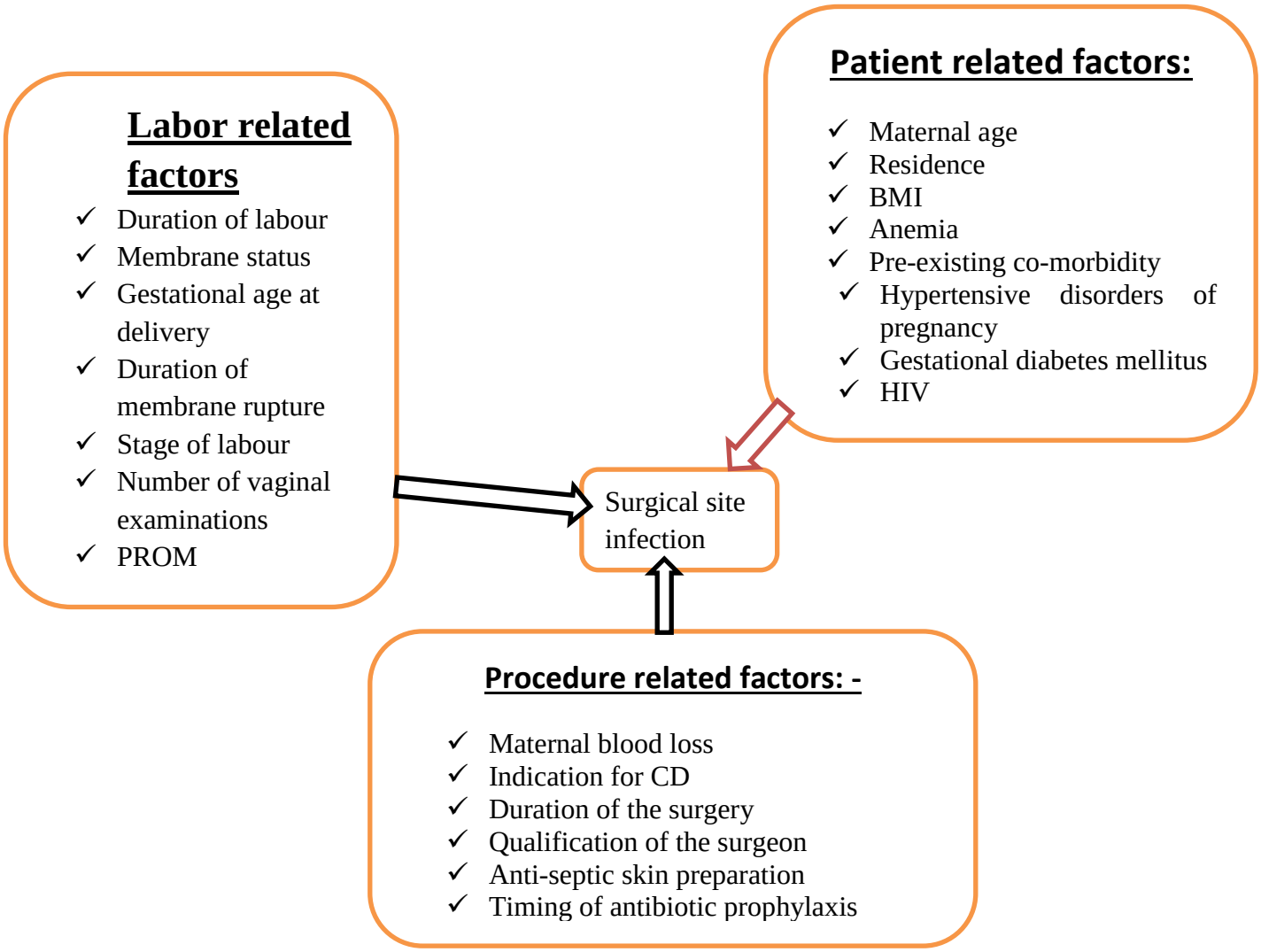

Figure 1:Conceptual framework for surgical site infection following cesarean delivery and factors associated.

3. OBJECTIVES

3.1 General Objective

- To identify the Factors associated with surgical site infection after cesarean deliveries in TASH, ZMH and GMH, Addis Ababa, 2024/2025 G.C.

3.2 Specific objective

- ✓ To assess the patient related factor of surgical site infectionamong cesarean deliveries in three hospitals of Addis Ababa University.
- ✓ To determine the labor and delivery related factor of surgical site infection among cesarean deliveries in three hospitals of Addis Ababa University.
- ✓ To identify the procedure related factor surgical site infection among cesarean deliveries in hospitals of Addis Ababa University.

4. Methodology

4.1 Study area and period

The study was done in Addis Ababa, the capital city of Ethiopia, as of 2021 the city had estimated 5 million inhabitants. Currently the city has more than 12 public, 25 private Hospitals and more than 98 health centers, 35 health posts and more than 500 clinics. Of the 12 public Hospitals 3 of them are purposely selected and included in the study. These are referral hospitals receiving high risk and complicated pregnancies from 70 public Health centers and patients from other regions in Ethiopia. The hospitals are Tikur Anbessa Specialized hospital which is under Addis Ababa University Hospital, Zewditu Memorial hospital and Gandhi memorial hospital the latter two are regional Hospitals under Addis Ababa Health Bureau affiliated to Addis Ababa University. These hospitals are capable in providing comprehensive care to pregnant women, labor and delivery services including critical maternal and neonatal care.

The largest teaching and referral hospital in Ethiopia is Tikur Anbessa Specialized Hospital, which also serves as the primary obstetrics and gynecology training facility. With deliveries approximating 429 per month, the obstetric department treats a large number of patients, many of whom are complex or urgent cases.

With about 100 beds dedicated for obstetrics and gynecology patients and 720 deliveries per month, Gandhi Memorial Hospital is a regional public referral for maternity and newborn care. Nurses, midwives, OB-GYN residents, and consultants are among the staff. It offers complete maternity treatments as well as emergency obstetric care.

With approximately 446 deliveries, Zewditu Memorial Hospital is a public referral hospital that offers extensive emergency obstetric care to a sizable urban population. It also has nurses, midwives, OB-GYN residents, and consultants among the staff. Other departments include those for internal medicine, surgery, and pediatrics.

4.2. Study Design and period

A five-month hospital-based case control study design was conducted in post-partum unit among women who were give birth by cesarean section from January-1/2025-May 30, 2025 for five months

4.3. Source Population

Women who gave birth via CS and come for postnatal care follow up in the three hospitals of AAU during the study period.

4.4. Study population

Women who delivered via CS and had an assessment of surgical site infection for cases and those with no surgical site infection for control with in thirty days of post operative period in the three hospitals of AAU in the study period.For the control, women who come at seventhday of postnatal visit were picked and confirmed at 30 days of postoperative by phone call for SSI.

4.5. Sample size determination

Sample size was calculated by using single and double population proportion formula using epi-info calc software.

Sample size for first objective							
variable	proportion	Confidence level	Margin of error	Sample size	No response	Final sample size	Reference
Patient have superficial infection	68%	95%	5%	334	10%	366	39

Sample size for the second objective								
variable	% of outcome	% of outcome exposed	Odd ratio	power	Sample size	10% non-response	Final sample	Reference
Labour duration >24hrs	9.3	43.0	3.48	80	64	6	70	48

sample size per group is given by:

$n = (Z_{\alpha/2}+Z_{\beta})^2 * (p_1(1-p_1)+p_2(1-p_2)) / (p_1-p_2)^2$

Symbol	Meaning
n	Sample size per group
p1, p2	Estimated proportions in the two groups
$P=\frac{p1+p2}{2}$	Average of the two proportions
$Z1-\alpha/2$	Z-value for the desired confidence level (1.96 for 95%)
$Z1-\beta$	Z-value corresponding to the desired power (0.84 for 80% power)
α	level of significance (0.05)
β	Type II error rate (1 - power)

Final sample size is 366.

4.6 Data collection tool

The data collection tool was adapted from literatures. It contains questions that assess: maternal characteristics such as; age, gravidity, parity, co-existing morbidities; peripartum maternal conditions like; maternal health condition, PROM, number of vaginal examinations, trial of labor before CD; and procedural characteristics like; duration of operation, type of surgery, type of anesthesia, level of the surgeon, type and timing of antibiotics administration, pre-operative skin preparation and the likes.

4.7 Illegibility criteria

4.7.1 inclusion Criteria

For case

Women who delivered via CSand come with an assessment of SSI within 30 days of post operation at the three hospitals of AAU during the study period and who are willing to participate in the study.

For control

Women who delivered via CS and had not developed SSI within 30 days of operation

4.7. 1 Exclusion Criteria

Those who have CS from other health facilities and come for postnatal care service in the study facility.

4.9. Variables

4.9.1 Dependent variable:

Surgical site infection.

4.9.2 Independent variables

- **Patient related factors:**
- ✓ Maternal age
- ✓ BMI
- ✓ Anemia
- ✓ Pre-existing co-morbidity
- ✓ Hypertensive disorders of pregnancy
- ✓ Gestational diabetes mellitus

- **Labor related factors**
- ✓ Duration of labor
- ✓ Membrane status
- ✓ Gestational age at delivery
- ✓ Duration of membrane rupture
- ✓ Stage of labor
- ✓ Number of vaginal examinations
- ✓ PROM
- Procedure related factors: -
- ✓ Maternal blood loss
- ✓ Indication for CD
- ✓ Duration of the surgery
- ✓ Qualification of the surgeon
- ✓ Anti-septic skin preparation
- ✓ Timing of antibiotic prophylaxis

4.10. Data Quality Control

The questionnaire was developed in English, translated into Amharic, and then translated back into English to ensure data consistency. Data collectors received training on how to complete the questionnaire and the full data collection procedure prior to the actual data collection period. Additionally, all necessary corrections were done. Data were checked for correctness and consistency during the collection procedure.

4.10 Data Collection procedure

Face-to-face interviews and a systematic evaluation of the medical chart were used in collecting data and evaluation by the assigned health provider. For the control group, after taking the necessary information during postnatal care I reconfirm after 30days post operation about the healing process of the incision site. The ratio of the case and control is 1:1. For each case two consecutive controls were picked. A structured questionnaire (Annex III) adapted from the result of different researches done on SSI among women who delivered by CS were used. The questionnaire includes Patient related factors, labor related factors and procedure related factors, sociodemographic characteristics and obstetric characteristics. In each research location, three general practitioners were recruited and trained on data gathering techniques. In order to familiarize data collectors with the data collecting instrument, interview style, eligible research participants, sample techniques, and ethical concerns, the investigator provided them with appropriate instruction. Data was collected after obtaining oral informed consent (both for the interview and to review the medical chart and phone call for those of the control).

Each individual participant was requested to respond to the interview after informed consent and screening for exclusion criteria. The participants were taken from postnatal care unit among women who visit within 30 days post operative period in selected health facilities. Until the maximum sample size was reached, all SSI case was selected during the study period. One health professional was assigned to collect data in each hospital.

Data collectors were supervised, and the validity of the questionnaires was assessed every day by checking them for accuracy and completeness. The primary investigator provided the proper intervention for any issues that arose throughout the data gathering procedure.

4.12. Data Analysis

SPSS version 25 was used to code, input, verify, clean, and analyze the information collected. Descriptive statistics were used to calculate the percentage of CS SSI, and then bivariate and multivariable logistic regression were used to determine the statistical relationship between the independent and dependent variables. In the multivariable logistic regression analysis, factors exhibiting a significance level of less than 0.2 in the bivariate logistic regression analysis were taken into account. Using an odds ratio with a 95% CI and a p value < 0.05, the existence and strength of the relationship between the outcome and the independent factors were calculated.

4.13. Operational Definition

- SSI: - definition in this study is based on the classification and definition of the term by Centre for Disease Control and Prevention.
- Surgical site infection: infection that occurs within 30 days of the operation and has at least one of the following symptoms:
  - ✓ Purulent discharge from the incision site
  - ✓ Localized swelling at the operation site
  - ✓ Wound dehiscence.
  - ✓ Tenderness/pain
  - ✓ Redness
  - ✓ Fever (>38°C)
- Wound dehiscence- Fascia is open
- Superficial incisional SSI – involves only skin and subcutaneous tissue
- Deep incisional SSI – involves skin, subcutaneous tissue, fascia and muscle
- Organ space SSI- involves any part of the body deeper than muscle layer

4.14. Ethical Consideration

The DRPC approved ethical clearance after the proposal was submitted to the department of Obstetrics and Gynecology. An information document (annex 1) was used to explain the research's goal to all study participants, and verbal consent was obtained prior to the interview (annex 2). The participants were informed of the study's goal, that it takes a few minutes, and that it is not a component of clinical assessment for management and evaluation. The respondents were informed that at any time during the administration process, they might decline to participate or end their involvement. They were also told that their involvement was a significant step toward the study's findings and that the data each responder submitted would be kept private. The report is written without mentioning any particular respondent.

4.15. Dissemination of the Result

The result of the study will be first presented in Addis Ababa University department of gynecology and obstetrics and Ethiopian Ministry of Health.

5. Result

5.1 Sociodemographic related characteristics of the study participants

Majority of the participants were in the age group of 21–30 years (59.8%), among those 67 (54.9%) were cases and 79 (64.8%) were controls with overall mean of 26.67. Most participants resided in Addis Ababa (82%), including 89 (73%) of the cases and 111 (91%) of the controls. Orthodox was the most common religion (52%), with nearly equal proportions among cases (64) and controls (63). Regarding marital status, the vast majority were married (89.8%), with 109 cases and 110 controls.

In terms of educational level, most participants had secondary education (63.9%), among whom 77 were cases and 79 controls. Those with primary education accounted for 23% (30 cases and 26 controls), while 9% were illiterate (11 in each group), and only 4.1% had college education or higher, split between 4 cases and 6 controls—showing little variation between cases and controls.Housewives were the largest group (37.3%), including 46 cases and 45 controls. Other common occupations included government employees (30 cases and 28 controls).The average household monthly income was 11,329.9 ETB, with cases having a lower mean income (10,789.3 ETB) compared to controls (11,870.5 ETB).

Table 1. Socio-demographic characteristics of the study participants

variable	Total (%)	Cases (%)	Control (%)
Age in years			
<20	32(13.1)	14(11.5)	18(14.8)
21-30	146(59.8)	67(54.9)	79(64.8)
>30	66(27)	41(33.6)	25(20.5)
Residency			
Addis Ababa	200(82)	89(73)	111(91)
out of Addis Ababa	44(18)	33(27)	11(9)
Religion			
Orthodox	127(52)	64(52.5)	63(51.6)

Protestant	35(14.3)	17(13.9)	18(14.8)
Muslim	82(33.6)	41(33.6)	41(33.6)
Marital status			
Married	219(89.8)	109(89.3)	110(90.2)
Single	17(7)	10(8.2)	7(5.7)
Divorced	8(3.3)	3(2.5)	5(4.1)
Educational level			
Illiterate	22(9)	11(9)	11(9)
primary	56(23)	30(24.6)	26(21.3)
Secondary	156(63.9)	77(63.1)	79(64.8)
Collage and above	10(4.1)	4(3.3)	6(4.9)
Occupation			
housewife	91(37.3)	46(37.7)	45(36.9)
Government employee	58(23.8)	30(24.6)	28(23)
private employee	45(18.4)	21(17.2)	24(19.7)
student	19(7.8)	10(8.2)	9(7.4)
merchant	12(4.9)	6(4.9)	6(4.6)
daily labour	19(7.8)	9(7.4)	10(8.2)
Household monthly income			
Mean	11329.9	10789.3	11870.5
range	5058	5173	4903

5.2 Obstetric and medical characteristics of the studyparticipants

The majority of participants were primiparous (62.7%), with 76 (62.3%) among cases and 77 (63.1%) among controls. Multiparous women accounted for 36.1% of the total, including 45 cases and 43 controls.A high proportion of women had attended antenatal care during pregnancy (87.3%), with 107 (87.7%) of cases and 106 (86.9%) of controls reporting ANC follow-up. Among those who received ANC, 67.1% attended health centers, including 73 cases and 70 controls, while the remaining 32.9% attended hospitals (34 cases and 36 controls).

Regarding comorbid conditions, 44.3% of all participants had at least one comorbidity. However, a significantly higher proportion of cases (54.9%) had comorbidities compared to controls (33.6%).

Among the 147 women with comorbidities, hypertension was the most common, reported by 52 women (48.1%), with a notably higher occurrence among cases (41, or 61.2%) compared to controls (11, or 26.8%).Anemia was present in 27 women (25%), with 19 cases and 8 controls affected.Diabetes Mellitus (DM) was found in 19 women (7.8%), with similar proportions in

cases (12, or 17.9%) and controls (7, or 17.1%).Concerning previous cesarean sections, 20.9% of participants had a history of CS, including 24 cases (19.7%) and 27 controls (22.1%).

Table 2. Obstetric and medical characteristics of the study participants

variable	Total (%)	case (%)	Control (%)
Parity			
Primiparous	153(62.7)	76(62.3)	77(63.1)
Multiparous	88(36.1)	45(36.9)	43(35.2)
Grand multiparous	3(1.2)	1(0.8)	2(1.6)
ANC			
Yes	213(87.3)	107(87.7)	106(86.9)
no	31(12.7)	15(12.3)	16(13.1)
Place of ANC			
Health center	143(67.1)	73(68.2)	70(66)
hospital	70(32.9)	34(31.8)	36(34)
Comorbidity			
Yes	108(44.3)	67(54.9)	41(33.6)
no	136(55.7)	55(45.1)	81(66.4)
List of comorbidities			
Anemia	27(25)	19(28.4)	8(19.5)
DM	19(7.8)	12(17.9)	7(17.1)
HTN	52(48.1)	41(61.2)	11(26.8)
HIV	13(12)	11(16.4)	2(4.9)
History of previous CS			
Yes	51(20.9)	24(19.7)	27(22.1)
No	193(79.1)	98(80.3)	95(77.9)

5.3 Labor related characteristics of the study participants

Nearly all participants (95.5%) had established labor before undergoing cesarean section, with 117 (95.9%) among cases and 116 (95.1%) among controls.The majority of women (77.7%) underwent more than two vaginal examinations, including 99 cases (84.6%) and 82 controls (70.7%). Membrane rupture before delivery was reported in 95.5% of participants, with 96.7% of cases and 94.3% of controls.

In terms of duration of membrane rupture, 64.8% had rupture lasting 8 hours or more, which included 85 cases (72%) and 66 controls (57.4%). Among those who received antibiotics for premature rupture of membranes (PROM), the most commonly used was ampicillin (94.2%), with similar coverage in cases (95.8%) and controls (92.4%).

When looking at duration of labor, 67% of women labored for 8–16 hours, with 70 cases (59.8%) and 86 controls (74.1%) in this category. However, a greater proportion of cases (15.4%) labored for more than 16 hours compared to controls (8.6%). The SSOL was more common among cases (49.6%) than controls (25.9%), while the latent first stage (LFSOL) was more common among controls (50.9%) than cases (30.8%).

Regarding urinary tract infection (UTI) during pregnancy, 20.1% of all women had a diagnosis, including 23 cases (18.9%) and 26 controls (21.3%). However, clinical chorioamnionitis was diagnosed in 13 cases (10.7%) compared to 6 controls (4.9%). Meconium-stained amniotic fluid was present in 74.2% of deliveries, with nearly equal proportions between cases (74.6%) and controls (73.8%). However, when examining the grade of meconium, Grade III (thick meconium) was more frequently observed among cases (38.5%) compared to controls (15.6%), while Grade I was more common in controls (32.2%) than in cases (11%). This indicates that higher grades of meconium might be associated with higher infection risk.

Table 3. Labour related characteristics of the study participants

variable	Total (%)	Cases (%)	Control (%)
Labor established before CS			
Yes	233(95.5)	117(95.9)	116(95.1)
No	11(4.5)	5(4.1)	6(4.9)
Number of vaginal examinations*			
≤2	52(22.3)	18(15.4)	34(29.3)
>2	181(77.7)	99(84.6)	82(70.7)
Membrane rapture before delivery			
Yes	233(95.5)	118(96.7)	115(94.3)
no	11(4.5)	4(3.3)	7(5.7)
Duration of rapture before delivery			
<8hr	82(35.2)	33(28)	49(42.6)
≥8hr	151(64.8)	85(72)	66(57.4)
Types of antibiotics given for PROM			
Metronidazole and ceftriaxone	2(1.4)	0	2(3)
Ceftriaxone	6(4.3)	3(4.2	3(4.5)
Ampicillin	130(94.2)	69(95.8)	61(92.4)
Duration of labour in hours			
<8	49(21)	29(24.8)	20(17.2)
8-16	156(67)	70(59.8)	86(74.1)
>16	28(12)	18(15.4)	10(8.6)

Stage of labour at CS decision			
LFSOL	95(38.9)	36(30.8)	59(50.9)
AFSOL	50(21.5)	23(19.7)	27(23.3)
SSOL	88(37.8)	58(49.6)	30(25.9)
Diagnosis of UTI in this pregnancy			
Yes	49(20.1)	23(18.9)	26(21.3)
No	195(79.9)	99(81.1)	96(78.7)
Clinical chorioamnionitis			
Yes	19(7.8)	13(10.7)	6(4.9)
No	225(92.2)	109(89.3)	116(95.1)
Presence of meconium			
Yes	181(74.2)	91(74.6)	90(73.8)
no	63(25.8)	31(25.4)	32(26.2)
Grade of meconium			
Grade I	39(21.5)	10(11)	29(32.2)
Grade II	93(51.4)	46(50.5)	47(52.2)
Grade III	49(27.1)	35(38.5)	14(15.6)

* Based on available data on WHO on vaginal exam.

5.4 Operation related characteristics of the study participants

Most cesarean sections were performed as emergency procedures (87.3%), including 113 (92.6%) of cases and 100 (82%) of controls. Elective CS was more common among controls (18%) than cases (7.4%).Regarding gestational age, 65.6% of procedures were conducted at term, with nearly equal distributions between cases (66.4%) and controls (64.8%). Preterm and post-term deliveries accounted for 16.4% and 18% respectively.

In terms of skin antiseptic used prior to surgery, alcohol and iodine were the most frequently used agent (72.1%), applied in 84 cases (68.9%) and 92 controls (75.4%), while chlorohexidine and iodine were used in 27.9% of participants. The most common indications for cesarean section were CPD(33.2%), followed by NRFHBP (19.3%) and G3MSAF(14.8%). When assessing level of residency, the majority lived in residency level II (59.8%) with identical distribution among cases and controls. However, a higher proportion of cases (23.8%) were from residency level I compared to controls (16.4%).

Table 4. Operation related characteristics of the study participants

Variable	Total (%)	Cases (%)	Control (%)
Types of CS			
Emergency	213(87.3)	113(92.6)	100(82)
elective	31(12.7)	9(7.4)	22(18)
Gestational age at CS			
Preterm	40(16.4)	19(15.6)	21(17.2)
Term	160(65.6)	81(66.4)	79(64.8)
Post term	44(18)	22(18)	22(18)
Antiseptic used			
Alcohol and iodine	176(72.1)	84(68.9)	92(75.4)
Chlorohexidine and Iodine	68(27.9)	38(31.1)	30(24.6)
Indication for CS			
APH	26(10.7)	11(9)	15(12.3)
Cord prolapses	1(0.4)	1(0.8)	0
CPD	81(33.2)	39(32)	42(34.4)
CS Scar	11(4.5)	5(4.1)	6(4.9)
failed induction	5(2)	2(1.6)	3(2.5)
LFSOL with G3MSAF	36(14.8)	22(18)	14(11.5)
NRBPP	2(0.8)	1(0.8)	1(0.8)
NRFHBP	47(19.3)	25(20.5)	22(18)
PLFSOL + G2MSAF	35(14.3)	16(13.1)	19(15.6)
Type of anesthesia			
Spinal	238(97.5)	119(97.5)	119(97.3)
General anesthesia	6(2.5)	3(2.5)	3(2.5)
Level of residency			
RI	49(20.1)	29(23.8)	20(16.4)
RII	146(59.8)	73(59.8)	73(59.8)
RIII	33(13.5)	15(12.3)	18(14.8)
RIV	16(6.6)	5(4.1)	11(9)
Level of abdominal incision			
Midline sub-umbilical	4(1.6)	2(1.6)	2(1.6)
Transverse	240(98.4)	120(98.4)	0120(98.4)
Type of prophylactic antibiotics given			
Ampicillin	236(96.7)	118(96.7)	118(96.7)
Ceftriaxone	8(3.3)	4(3.3)	4(3.3)
Dose of antibiotics			
One	17(7)	8(6.6)	9(7.4)
Two	207(84.8)	105(86.1)	102(83.6)
three	20(8.2)	9(7.4)	11(9)
Time antibiotics given			
within 1hour	242(99.2)	121(99.1)	121(99.2)
after 1 hour	2(0.8)	1(0.8)	1(0.8)

5.5The incidence of Surgical Site Infection

During the study period, a total of 2583 women gave birth by cesarean section at the study facility. Among them, 122 women developed surgical site infections (SSI) following cesarean section, resulting in an incidence rate of 4.7%. This indicates that for every 100 cesarean deliveries performed; approximately 4 to5 women experienced an SSI.

5.5 The list of types of surgical site infection

The analysis of surgical site infections (SSI) among the 122 affected women revealed that the majority were classified as superficial infections, accounting for 93.4% (114 cases). Deep SSIs were much less common, observed in only 6.6% (8 cases).

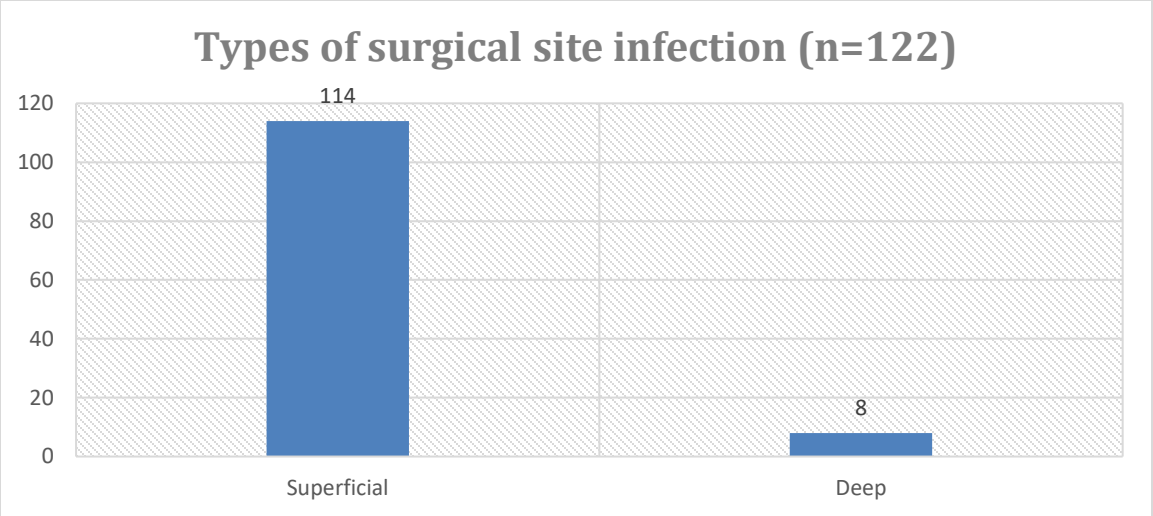

Figure 2. The list of types of surgical site infection

5.6 The determinant factors of surgical site infection

In the bivariate logistic regression analysis, several factors were found to be significantly associated with surgical site infection (SSI). This included residency, comorbidity, number of vaginal examinations, duration of membrane rupture before delivery, labor status at cesarean section (CS), clinical chorioamnionitis, grade of meconium, and type of CS.

In the multivariate logistic regression model, the following factors remained significant predictors of SSI: residency, comorbidity, labor status at CS, clinical chorioamnionitis, and grade of meconium.

Participants residing outside Addis Ababa were 2.2 times more likely to develop SSI compared to those living in Addis Ababa (AOR = 2.2; 95% CI: 1.88, 5.62). The odds of developing SSI were 3.2 times higher among those with having comorbid compared to those of its counterpart (AOR = 3.2; 95% CI: 1.50, 6.67).Cesarean sections performed during the second stage of labor were associated with a 2.6-fold increase in the risk of SSI compared to those performed during the latent first stage (AOR = 2.6; 95% CI: .13, 6.09).Furthermore, participants with clinical chorioamnionitis had a 6.3-fold increased risk of SSI compared to those without the condition (AOR = 6.3; 95% CI: 1.06, 37.92). The presence of grade III meconium was associated with a 10.9-fold higher risk of SSI compared to grade I meconium (AOR = 10.9; 95% CI: **1.97, 13.74**) and the timing cesarean section with an emergency were 3.6folds increase its surgical site infection (AOR 3.6, 95%CI=**1.97, 13.74).**

Although randomly selected, most variables affecting outcome are similar and not intentional.

Table 5. Association between SSI and its independent variable of among who gave birth by CS at TASH, ZMH and GMH 2025, bivariate and multivariate logistic regression

Variable	SSI		COR (with 95%CI)	AOR (with 95%CI)
	yes	no		
Residency				
Addis Ababa	89(73)	111(91)		
out of Addis Ababa	33(27)	11(9)	3.7(1.79, 7.82)	**2.2(1.88, 5.62)**
Comorbidity				
Yes	67(54.9)	41(33.6)	2.4(1.43, 4.04)	**3.2(1.50, 6.67)**
no	55(45.1)	81(66.4)		
Number of vaginal examinations(n=351)				
≤2	18(15.4)	34(29.3)		
>2	99(84.6)	82(70.7)	2.3(1.20, 4.33)	1.9(0.73, 4.87)
Duration of membrane rapture before delivery				
<8hr	33(28)	49(42.6)		
≥8hr	85(72)	66(57.4)	1.9(1.11, 3.30)	1.6(0.72, 3.50)
Labour status at CS				
LFSOL	36(30.8)	59(50.9)		
AFSOL	23(19.7)	27(23.3)	1.4(0.69, 2.78)	1.8(0.59, 5.28)
SSOL	58(49.6)	30(25.9)	3.2(1.73, 5.80)	**2.6(1.13, 6.09)**
Clinical chorioamnionitis				
Yes	13(10.7)	6(4.9)	2.3(0.85, 6.28)	**6.3(1.06, 37.92)**
No	109(89.3)	116(95.1)		
Grade of meconium				
Grade I	10(11)	29(32.2)		

Grade II	46(50.5)	47(52.2)	2.8(1.24, 6.48)	2.6(0.92, 7.27)
Grade III	35(38.5)	14(15.6)	7.2(2.81, 18.73)	**10.9(3.22, 37.14)**
Types of CS				
Emergency	113(92.6)	100(82)	2.8(1.22, 6.28)	**3.6(1.97, 13.74)**
elective	9(7.4)	22(18)		

6. Discussion

During the study period, an incidence rate of 1.65% of surgical site infections (SSI) was observed among women who underwent cesarean delivery, suggesting that approximately 1 to 2 out of every 100 cesarean births resulted in an SSI. This incidence is less than the 2.5% (95% CI: 1.6–3.7%) global pooled prevalence of SSIs, according to a comprehensive study. The incidence was 2.7% by WHO area and 2.5% by survey period, according to subgroup analysis. The largest burden was recorded in the African region at 7.2% and in studies carried out between 1996 and 2001 (2.9%) (43).Compared to individual hospital-based studies, the incidence observed in this study remains substantially lower. For instance, a study conducted in Nepal found an SSI rate of 8.54% among 1,135 cesarean deliveries, with 94.85% being superficial infections and 5.15% deep SSIs, with no organ-space type reported (45). Similarly, in Ayder Comprehensive Specialized Hospital in Ethiopia, the SSI incidence was reported to be 11.7% among women who underwent cesarean section (46). Another study conducted in Debretabor General Hospital found that 8.1% of mothers developed SSI (95% CI: 5.4–11.6), and all of them were superficial infections following emergency cesarean sections (47).

In this study, a total of 244 participants were included, comprising 122 cases with SSI and 122 controls, based on a 1:1 case-control ratio. Among the identified SSIs, the majority were superficial, accounting for 99.2% (n=110), followed by deep SSIs at 9% (n=10), and only one case of organ-space SSI (0.8%).This distribution is consistent with findings from similar studies conducted in Nepal (45) and Debre Tabor General Hospital (47), where superficial SSIs were also predominant. The high prevalence of superficial SSI observed in our study aligns with the understanding that these types of infections are the most commonly occurring form of SSIs,

typically presenting earlier and being more readily diagnosed postoperatively. However, the proportion of deep SSIs in our study appears to be lower than that reported in studies conducted in government hospitals in Addis Ababa (39). This discrepancy might be attributed to differences in surgical techniques, perioperative care, patient characteristics, or variations in SSI surveillance. Additionally, the relatively low rate of organ-space infections could be due to a true low incidence.

Women residing outside Addis Ababa were found to be nearly three times more likely to develop SSIs than those living Addis Ababa (AOR = 2.2). This is comparable to findings from Ayder Comprehensive Specialized Hospital, where rural women had a 5.6-fold increased risk (46). A possible explanation for this is that rural residents may face barriers to timely healthcare access, including delays in reaching facilities, lower health literacy, and reduced access to antenatal care, all of which contribute to poor pre- and postoperative outcomes.

Comorbid conditions were also significantly associated with increased SSI risk in this study (AOR = 3.2), the finding was in line with other reports in the Ayder study (46). Comorbidities can impair immune function and wound healing, making patients more vulnerable to infections postoperatively.

In the current study, women who underwent emergency cesarean section were found to be 3.6 times more likely to develop surgical site infection compared to those who had elective procedures (AOR = 3.6). This finding emphasizes the increased infection risk associated with unplanned or urgent surgical interventions, likely due to factors such as inadequate preoperative preparation, prolonged labor, or underlying maternal or fetal complications. This outcome is consistent with a case-control study that was carried out in public hospitals in Dire Dawa, which reported that the likelihood of developing post-cesarean SSI was 9 times higher among women who had emergency CS compared to those with elective procedures (AOR = 8.9) (50).

Clinical chorioamnionitis was the most significant predictor of SSI in this study, increasing risk by over tenfold (AOR = 6.3). This finding is in agreement with Ayder's data (AOR = 16.17) (46) and Dire Dawa (AOR = 5.0) (50). Chorioamnionitis, being an established intrauterine infection, increases the bacterial burden during surgery and weakens tissue integrity, making postoperative infection more likely. Likewise, the presence of grade III meconium was linked to a 10.9-fold

increase in SSI risk, likely due to the association between thick meconium, fetal distress, and possible intrauterine infection or inflammation that may compromise sterile surgical fields.

7. Conclusion

This study identified several key factors significantly associated with an increased risk of SSI following cesarean section. The presence of comorbid conditions and residency outside Addis Ababa are significant factors. Additionally, cesarean sections performed during the second stage of labor, emergency CS, the presence of clinical chorioamnionitis, and the presence of meconium stained amniotic fluid significantly elevated SSI risk.

8. Limitations

The results from this study show significantly lower incidence of SSI compared to the global pooling incidence and individual hospital based studies done in previous studies. Possible explanation is there are many health centers under each hospital that are catchments and post partum women with SSIcould have been evaluated and managed in their respective HCs from which they were referred.

There are possible unmeasured confounders like intraoperative technique variations and sterilization practices which may influence results.

Reliance on medical records could introduce documentation bias including antibiotic type, the time it was given at, number of vaginal examinations.

9. Recommendations

- Train healthcare providers to adhere to guidelines limiting the number of vaginal examinations unless clinically indicated, reducing infection risk from repeated exam and document it.

- Prioritize early diagnosis and management of chorioamnionitis and meconium stained amniotic fluid
- Consider microbiologic confirmation in future researches

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Annexes

Annex 1: Information sheet for the participants

My name is _____. I am working as data collector in the research conducted by Dr. Lulit who is conducting her research for partial fulfillment of the requirements for the Department of obstetrics and gynecology at Addis Ababa University in partial Fulfillment of the requirements for a specialty certificate in Obstetrics and Gynecology.

This study aims to assess factors associated with surgical site infection after cesarean deliveries among women who gave birth at the three hospitals (TASH, GMH, ZMH). I would appreciate your truthful response.

Procedure: Participation in this research project is encouraged in order to determine the determinants of surgical site infection. Participants need to explicitly understand and give consent to our questionnaire before they fill.

Risk and/or Discomfort: You may feel some discomfort specially on taking your time (about 30 minutes) while participating in this research. There is no risk in participating in this research project.

Benefits: You will not get direct benefit by participating in this research report, but your participation is likely to help us for future post-CS SSI-related complication prevention and management.

Incentives: You will not be provided any incentive to take part in this project.

Confidentiality and Anonymity: The information that I collect from this research project will be kept confidential. Information about you that was collected from the study will be stored in a file, which will not have your name on it. It will not be revealed to anyone except the principal investigator.

Right to Refuse or Withdraw: You can decline to take part in this study at any time. You have the option to decline to answer some or all of the questions. Your access to medical care at this facility will not be impacted if you choose not to participate. You still have all of your rights as a client of our institution, including the freedom to leave the study whenever you want.

Persons to contact- For further information, you can contact

Dr Lulit Fekadu

+251910893909

Annex 2. Consent form of the participants

I have received written information about this study and have been fully informed about its purpose. I am also aware that the results will aid to enhance the surgical site infection outcome for mothers. I am aware that taking part in this study has no risks. I consent to taking part in this research. I am aware that by taking part, I will not be eligible for any preferential treatment, compensation, or rewards. I was informed that the data collected would be kept private. I am aware that any information that may be used to identify me will not be used in any publications or reports. Only this study is covered by this permission. Are you willing to participate in the study? 1- Yes 2 - No

If the answer is yes, thanks! Conduct the interview. If the answer is no, Thanks!

SUBJECT INFORMATION SHEET

Questionnaire

Part I. Socio demographic data

1. Procedure day _____
2. Age _____ (in years)
3. Residence

A. Addis Ababa

B. Outside AA

4. Religion
   A. Orthodox
   B. Protestant
   C. Muslim
   D. Others (specify) _____
5. Marital status
   A. Married
   B. Single
   C. Divorced
   D. Widowed
6. Educational status
   A. Tertiary education
   B. Secondary education
   C. Primary education
   D. Read and write
   E. Illiterate
7. Monthly family income in Birr _____
8. Occupation
   A. Student

B. House wife
C. Daily laborer
D. Merchant
E. Government employee
F. Private employee

Part II. Obstetric and medical characteristics of the study participants

9. Parity
   A. Primiparous (1)
   B. Multipara (2- 4)
   C. Grand multipara (>= 5)
10. ANC A. Yes B. No
11. Place of ANC A. HospitalB. Health center C. Private set up
12. Presence of Co-morbidity A. Yes B. No
    A. Diabetes mellitus A. Yes B. No
    B. Hypertension A. Yes B. No
    C. HIV status A. Yes B. No
    D. Anemia A. Yes B. No
    E. Others (specify)_____
13. Number of vaginal examinations _____
14. Clinical chorio-amnionitis A. Yes A. No
15. Presence of meconium A Yes B. No
16. If yes Q16 write its Grade_____

Part III. Operation related characteristics of the study participants

17. Type of CS A. Emergency B. Elective
18. Gestational age at CS _____ (weeks and days)
19. Labor status/ duration A. No labor B. ≤ 12 hours C. >12 hours
20. Rupture of membrane A. No ROM B. (ROM) before CS and ≤ 12 hours C. ROM > 12 hours
21. History of previous CS A. Yes B. No

22. Antiseptic Used A. Chlorhexidine_ Alcohol B. Alcohol _ iodine C. Chlorohexidine_ Iodine D. Others (Specify)_____
23. Duration of operation _____ (in minutes)
24. Indication for CS _____
25. Type of anesthesia A. Spinal B. General
26. Level of surgeon A. Junior (R2) B. Senior (R3/R4/ C. Consultant
27. Type of abdominal incision A. Transverse B. Midline sub-umbilical
28. Type of prophylactic antibiotics given A. Ampicillin B. Ceftriaxone C. No antibiotics given
29. Time antibiotics given _____
30. How many doses _____
31. Amount of blood loss _____ml
32. Length of hospital stay _____
33. Type of SSI A. Superficial B. Deep C. Organ space