

MAGNITUDE AND DETERMINANTS OF POST-CESAREAN SURGICAL SITE INFECTION: AT ABEBECH GOBENA MATERNAL & CHILD HEALTH CENTER, ADDIS ABABA, ETHIOPIA

Mekuanint Dessie¹, Dereje Nigussie², Brihanu Kebede², Woynabeba Damene³, Teferi Tesfaye³

ABSTRACT

BACKGROUND: Preventing surgical site infections (SSIs) is vital as surgical interventions, particularly cesarean sections (CS), are increasing worldwide. SSIs are a leading cause of morbidity and mortality post-CS, with about half of these infections being preventable through evidence-based strategies. This study aimed to assess the magnitude and determinants of post-cesarean SSI at Abebech Gobena Maternal & Child Health Center, Addis Ababa, Ethiopia.

METHOD: A facility-based cross-sectional study was conducted on women who underwent CS in 2022, using data extracted from electronic medical records. Descriptive and analytic statistics, including bivariable and multivariable logistic regression analyses, were performed using SPSS version 26. Results were presented in tables, with significance set at $p < 0.05$.

RESULTS: The prevalence of post-CS SSI was 9.1% (95% CI, 5.2–12.2). Significant factors associated with infections included prolonged rupture of membranes (AOR = 8.74; 95% CI: 1.04–72.98), extended hospital stays (AOR = 13.49; 95% CI: 3.72–48.29), and chorioamnionitis (AOR = 23.66; 95% CI: 1.91–292.56). Additionally, a postoperative hematocrit below 33% was linked with a twice increased risk of infection (AOR = 2.07; 95% CI: 1.04–4.12), and women with comorbidities had a threefold increased risk (AOR = 3.04; 95% CI: 1.30–7.12).

CONCLUSION: The SSI prevalence aligns with previous local findings. Key risk factors include chorioamnionitis, prolonged rupture of membranes, extended hospital stays, anemia, and comorbidities. These findings highlight the need for strengthening infection prevention strategies, timely management of obstetric complications, and close monitoring of women with identified risk factors to reduce the burden of postoperative infections.

KEYWORDS: Surgical site infections, prevalence, magnitude post-cesarean, Addis Ababa, Ethiopia.

(The Ethiopian Journal of Reproductive Health; 2025; 17; 53-61)

¹ Department of Obstetrics and Gynecology, School of Medicine, College of Medicine and Health Sciences, Mizan - Tepi University, Mizan-Teferi, Ethiopia.

² Yekatit 12 Hospital Medical College Abebech Gobena Maternal & Child Health Center, Addis Ababa, Ethiopia.

³ Federal Ministry of Health, Eka Kotebe General Hospital Department of Infection Prevention and Patient Safety, Addis Ababa, Ethiopia.

INTRODUCTION

Surgical site infections (SSIs), occurring within 30 days post-operation, present significant challenges in healthcare due to emerging antimicrobial-resistant pathogens and comorbidities, elevating treatment costs¹. Cesarean sections are especially susceptible to SSIs, leading to significantly elevated morbidity and mortality rates among post-cesarean patients^{2,3}. Preoperative factors, including the onset of labor, duration of membrane rupture, number of vaginal examinations, and hemoglobin levels, have been linked to the occurrence of SSIs^{1, 4, 5}. Research indicates that around half of SSIs are preventable through the use of evidence-based practices, emphasizing the critical role of public reporting and quality improvement initiatives^{1,5}.

The growing number of surgical procedures, especially CS, underscores the mounting challenge posed by SSIs. These infections affect nearly one-third of surgical patients, resulting in substantial morbidity, mortality, and financial strain. Managing SSIs leads to higher human and economic costs, including extended hospitalizations and increasing healthcare expenses^{1,3,4,6}. On a national scale, SSIs result in longer hospital stays and significant costs, as each readmission related to an SSI further increases mortality, morbidity, and healthcare expenditures^{1,5}. The onset of an SSI prolongs hospital stays and increases costs, emphasizing the significant economic impact³. Although prevalence rates of SSIs differ by region, they continue to represent a major global healthcare challenge. Preventing SSIs after cesarean sections is crucial. Identified risk factors, including the onset of labor, duration of membrane rupture, frequency of vaginal examinations, and hemoglobin levels, indicate key areas for targeted intervention^{6,7}.

Evidence-based strategies can prevent nearly half of these infections. In Ethiopia, although the pooled incidence of SSIs after cesarean sections was shown to be approximately 0.72%⁸, other literature has reported rates around 8–10%, reflecting higher rates possibly due to resource limitations, poor infection control practices, and healthcare

infrastructure challenges. Acknowledging that nearly half of SSIs are preventable, this study aims to identify the determinant factors among patients undergoing cesarean sections. The findings will assist in developing preventive strategies and guide professionals working in resource-limited settings, such as Ethiopia, to prioritize resources for those at higher risk of SSI. Additionally, this research will help establish the prevalence of SSIs among mothers who have undergone cesarean delivery in the hospital.

Patients and Methods

Study Area and Period

This study was conducted at Abebech Gobena Maternal and Child Health Center in Addis Ababa. Established three years ago, Abebech Gobena Maternal and Child Health Center is one of the leading referral and tertiary training hospitals in the country for surgical procedures. The facility performs over 900 deliveries each month, with an average of 385 cesarean sections conducted monthly.

Source and Study Population

All those who underwent CS at the center were considered the source population, and those who developed infections among those who had CS delivery and fulfilled the inclusion criteria comprised the study population.

Inclusion and Exclusion Criteria

Inclusion Criteria

All women who underwent CS during the specified study period were included.

Exclusion criteria

Medical records with incomplete data for the outcome and important predictor variables were excluded

Sample size

The following assumptions were made: expected prevalence of SSI to be 9.72% (8), desired margin of error to be 2.5% and 95% confidence level .

$$n = \frac{z^2 p(1-p)}{d^2} \quad \text{where } n = \text{sample size}$$

$$z = 1.96$$

$$P = 9.72\% (0.0972)$$

$$d = 0.025$$

$$n = \frac{(1.96)^2 (0.0972) (0.9028)}{(0.025)^2} = 539.37 = 540$$

Sample size was $n=540$

Sampling Procedure

The sampling frame for all cesarean deliveries during the study period (January 1, 2022, to December 31, 2022) was established by reviewing the operation room registry books and the labor and obstetric ward records. A total of 4,622 cesarean deliveries were recorded during this period. The sample size was set at 540, resulting in a sampling interval of eight. A lottery method was used to randomly select the third number from a list of numbers one to eight. Subsequent samples were then chosen using a systematic random sampling technique, selecting every eighth case. If any important variable data were found to be incomplete, the next number in the sampling frame was selected.

Study Variables

Dependent Variable

Post-CS surgical site infection

Independent Variables

Socio-demography (sex, residency); obstetrics (parity, GA, ANC visit, membrane status, presence of meconium, number of vaginal examinations, duration of labor, chorioamnionitis); operation/process (level of physician, type of operation, duration of surgery, type of skin incision, prophylactic antibiotic, preoperative HCT, postoperative HCT, postoperative hospital stay, blood transfusion); comorbidity (anemia, HIV/AIDS, DM, hypertension).

Operational Definitions

Surgical Site Infection: Surgical site infection was diagnosed when one or more of the following symptoms and signs appeared within 30 days of the operation: purulent discharge or pus from the incision, pain, localized swelling, redness, warmth, or wound dehiscence. All types of SSI—superficial, deep, and organ space—were included in the study.

Prolonged Rupture of Membranes (PROM): Refers to rupture of the amniotic membranes occurring 18 hours or longer before delivery, identified from patient medical records or partograph documentation²⁰.

Chorioamnionitis: Identified through clinical symptoms such as fever, uterine tenderness, and maternal or fetal tachycardia²¹.

Comorbidity: Mothers who have one or more medical illnesses (diabetes, hypertension, HIV) (22).

Data Collection

A data collection format was developed and coded in the KoBo Toolbox after reviewing variables in patients' medical records. Five residents working in the hospital were selected and trained on the data collection format to review patient medical records and collect data using the format on their smartphones. The principal investigator closely oversaw the overall data collection activity.

The data collected included variables related to demography, obstetrics, operation/process, comorbidity, and post-CS SSI status. Age and residence were the only demographic characteristics collected. Data on obstetric characteristics included parity (number of pregnancies carried to fetal viability), gestational age (measured in weeks from the last menstrual period or ultrasound to the date of CS), presence of labor before operation, duration of labor, membrane status before operation, duration of membrane rupture before operation, and chorioamnionitis.

Regarding comorbidity, data on diabetes mellitus, hypertension, Human Immunodeficiency Virus/Acquired Immunodeficiency Syndrome (HIV/AIDS), and anemia were collected. Variables

related to the CS operation/process included the professional level of the physician conducting the operation, operation type (elective versus emergency), duration of operation, type of anesthesia (regional versus general), prophylactic antibiotic use, preoperative hematocrit level, blood transfusion, type of abdominal incision (lower transverse versus vertical), postoperative hospital stay in days, and post-CS SSI status.

SSI was the outcome variable (which included superficial and deep organ space infections) diagnosed by a physician or surgeon as a wound infection at postnatal, emergency, gynecology outpatient department, or ward.

Data Quality Assurance

Data were checked for completeness by the respective data collectors and cross-checked by the principal investigator for accuracy.

Statistical Analysis

The data were exported into SPSS version 26 for analysis. Descriptive statistics, including frequencies and percentages, were used to summarize the data. Bivariate and multivariable binary logistic regression analyses were performed to identify factors associated with SSI. Variables with a statistically significant association ($p < 0.2$) in the bivariate analysis were included in the multivariable model. In the multivariable analysis, factors with a p-value less than 0.05 were considered statistically significant. Adjusted odds ratios (AOR) with 95% confidence intervals (CI) were used to determine the strength of association.

Results

Socio-demographic and medical characteristics:

A total of 4,622 cesarean deliveries (CSs) were performed during the study period, with the medical records of 540 mothers included in the analysis. The mean age was 27.7 years ($SD \pm 4.6$), those under the age of 30 years account for 75%. The majority, 405 (75%) were younger than 30. Only 28 mothers (5.20%) came from outside Addis Ababa, while the remaining 512 (94.80%) resided within the city.

In terms of parity, nearly half of the mothers, 272 (50.40%), were primiparous, while only 8 (1.50%) were grand multiparous, and the remaining 260 (48.10%) were multiparous. fifty two (9.6%), underwent cesarean delivery before 37 weeks of gestation, and 21 (3.90%) had no antenatal care (ANC) visits. At the time of cesarean delivery, 169 (31.30%) had intact membranes, while the majority had ruptured membranes: 259 (48.00%) for less than 12 hours and 112 (20.70%) for more than 12 hours. Six (1.10%), had chorioamnionitis. More than a quarter, (28.30%), was not in labor, and half, 267 (49.40%), delivered within 12 hours after labor onset. However, 120 (22.20%) experienced prolonged labor, and 183 (33.90%) underwent more than five vaginal examinations before delivery. The majority of CSs, 362 (67%), were performed by Year-II residents, with 157 (29.00%) conducted by Year-III and above residents, and 21 (3.90%) by obstetricians and gynecologists. Nearly a quarter, 128 (23.70%), of the CDs were elective, 30 (5.60%), lasted more than an hour. Only 14 (2.60%) of the CDs were performed using a midline abdominal wall incision. Out of the 540 mothers, 22 (percentage?) received blood transfusions with cross-matched blood. Almost all mothers received both preoperative (98.0%) and postoperative (98.50%) prophylactic antibiotics.

Among the 540 mothers, 64 (11.90%) had a preoperative hematocrit level of less than 33%, and 175 (32.50%) had a postoperative hematocrit level below 33%. Additionally, only 88 (16.3%) of the mothers had co-morbidities (Table 1).

Table 1: Clinical variables in mothers who underwent cesarean delivery s at Yekatit 12 Hospital Medical College/ Abebech Gobena MCH, Addis Ababa, from January 2022 to December 2022.

Variables	Categories	Frequency (N=540)	Percentage (%)
Parity	Primipara(Para I)	272	50.400
	Multipara(Para II-IV)	260	48.1
	Grandmultipara (≥IV)	8	1.50
Gestational Age	<37 week	52	9.60
	≥37 week	488	90.40
ANC	No	21	3.90
	Yes	519	96.10
Fetal Membranes Status	Intact	169	31.30
	Ruptured <12hrs	259	48.00
	Ruptured ≥12hrs	112	20.70
Chorioamnionitis	Yes	6	1.10
	No	534	98.90
Duration of Labor	Not in Labor	153	28.30
	< 12 Hrs	267	49.40
	≥12 Hrs	120	22.20
Number of Vaginal Examination (n= 399)	1-4	216	40.00
	≥5	183	33.90
Level of physician who operated on the patient	Obstetrician and Gynecologist	21	3.90
	≥Year-III Resident	157	29.10
	≤ Year-II Resident	362	67.00
Type of Operation	Elective	128	23.70
	Emergency	412	76.30
Type of abdominal wall Incision	Vertical	14	2.60
	Transverse	526	97.40
Blood Transfusion	Yes	22	4.10
	No	518	95.90
Pre-operative Prophylaxis Antibiotic	Yes	529	98.00
	No	11	2.00
Post-operative Prophylaxis Antibiotic	Yes	532	98.50
	No	8	1.50
Post-Operative Hospital Stay	≤ 7 Days	525	97.20
	≥ 7 Days	15	2.800
Pr-operative Hct	< 33%	64	11.9
	≥ 33%	476	88.10
Post-operative Hct	< 33%	175	32.40
	≥ 33%	365	67.60
Co morbidity	Yes	88	16.30
	No	452	83.70

The duration of surgery was less than 1 hour in 510 (94.40%) and more than 1 hour in 30 (5.60%) of the cesarean deliveries.

The prevalence of Surgical Site Infection

Of the 540 mothers included in the study, 49 (9.10%) developed a surgical site infection (SSI) following cesarean delivery.

Factors associated with surgical site infection after cesarean delivery

Twenty-two variables were considered in the bivariate analysis. These included maternal age, residency, parity, gestational age, ANC visits, duration of labor, membrane status, frequency of vaginal examinations, presence of meconium, chorioamnionitis, type of surgery (elective or emergency), level of the professional performing the cesarean section, use of prophylactic antibiotics, type of abdominal wall incision (lower transverse or midline sub-umbilical), duration of surgery, blood transfusion, preoperative and postoperative hematocrit levels, length of postoperative hospital stay, and presence of comorbidities.

Out of these variables, twelve were associated with SSI at a p-value of <0.2 and were therefore included in the multivariate analysis. In the multivariate model, five variables were found to be statistically significant. (Table 2).

Mothers with chorioamnionitis had 23.66 times higher odds of developing surgical site infections (SSIs) compared to their counterparts (95% CI: 1.91-292.56). Additionally, the odds of SSI increased by 8.74 times (95% CI: 1.04-72.98) among mothers with prolonged rupture of membranes.

When comparing postoperative hospital stays, those who stayed for 7 days or more had a significantly higher risk of SSI, with an adjusted odds ratio (AOR) of 13.49 (95% CI: 3.72-48.29), compared to those who stayed less than 7 days. A postoperative hematocrit level of less than 33.00 % was also associated with SSI, with an AOR of 2.07 (95% CI: 1.03-4.12). Furthermore, women with comorbidities had 3.04 times higher odds (95% CI: 1.30-7.12) of developing SSIs than those without comorbidities (Table 2).

Table 2: Factors associated with post-cesarean delivery surgical site infections (SSIs) at Yekatit 12 Hospital Medical College/ Abebech Gobena MCH, Addis Ababa, from January 2022 to December 2022.

Variables		Post-Cesarean Delivery Surgical Site Infection		COR (95%, CI)	AOR (95%, CI)
		Yes (N, %)	No (N, %)		
Chorioamnionitis	Yes	5(10.20%)	1(0.20%)	55.68(6.36,487.22)	23.66(1.91,292.56)
	No	44(89.80%)	490(98.80%)	1	1*
Duration of membrane rupture	Intact	7(14.30%)	162(33.00%)	1	1*
	<12 hrs	17(34.70%)	242(49.30%)	1.63(2.108,7.93)	2.76(0.834,9.12)
	≥ 12 hrs	25(51.0%)	87(17.70%)	6.65(2.765,15.99)	8.74(1.047,72.98)
Post-operative hospital stay	≤ 7 Days	41(83.70%)	484(98.60%)	1	1*
	>7 Days	8(16.30%)	7(1.40%)	13.49(4.65,39.06)	13.49(3.77,48.29)
Post-Operative Hct	< 33%	30(61.20%)	145(29.50%)	3.77(2.054,6.91)	2.07(1.039,4.12)
	≥ 33%	19(38.80%)	346(70.50%)	1	1*
Co morbidity	Yes	20(40.80%)	68(13.80%)	4.29(2.297,8.01)	3.05(1.304,7.12)
	No	29(59.20%)	423(86.20%)	1	1*

DISCUSSION

The study revealed that the magnitude of post-CD SSI at the study hospital was high at 9.0%. It also identified several modifiable factors influencing these infections. The prevalence of SSIs observed in this study aligns closely with findings from Ethiopia and other developing countries. Among those, a study conducted at Hawassa University Specialized Hospital reported that the incidence of SSI was 11.00% among women who underwent cesarean delivery¹¹. Similarly, a study conducted in public hospitals in Harar indicated an SSI rate of 12.30% among women who had cesarean sections², while an institutional cross-sectional study in Nekemte town's public hospitals in 2020 reported an SSI prevalence of 8.90%¹². The variation in rates may be attributed to differences in hospital infection control practices, surgical procedures, patient populations, and resource availability. On the other hand, a systematic review from Ethiopia has also highlighted varied pooled prevalence rates of SSIs, including 8.81%, 9.72%, and 12.30%⁹.

Studies from three African countries also showed varied prevalence rates of SSIs compared to this finding. A study on the prevalence and predictors of SSIs after cesarean sections at a rural district hospital in Rwanda found a prevalence of 10.90%⁷, while a case-control study from Peru showed a lower prevalence of 2.40%³, and a study from Egypt revealed an SSI rate of 5.34%⁶. This variation is probably due to better infection prevention provisions or a larger delivery rate than in our setting. In this study, mothers with prolonged rupture of membranes faced a significantly higher risk of developing SSIs compared to those without this condition. Similar findings have been reported in studies from Egypt⁶, Washington¹³, Hawassa¹¹, Harar², and various systematic reviews conducted in Ethiopia^{4,8}. Prolonged rupture of membranes can lead to colonization of amniotic fluid by normal flora from the lower genital tract, resulting in contamination of the surgical wound and peritoneal cavity, leading to SSI.

Moreover, the findings related to chorioamnionitis are similar to studies conducted in both developed and developing countries, including those from Washington³, Vietnam¹⁴, and Egypt⁶, as well as previous research in Ethiopia^{4,8}. This may be attributed to the pathogens associated with chorioamnionitis, which could result from ascending infection from vaginal flora, leading to metritis and severe infection, thereby facilitating the development of surgical site infections (SSIs) irrespective of the settings.

The study identified a significant relationship between postoperative anemia and the occurrence of SSIs. Generally, low hemoglobin levels decrease oxygen tension in the wound, which can compromise macrophage function¹⁵ and hinder the healing process, thereby increasing the risk of infection¹⁶. Similar findings have been reported in studies from Peru³ and Vietnam¹⁴. Various institutional cross-sectional studies^{11,12} and systematic reviews^{4,8} have also yielded comparable results.

In this study, we observed that a postoperative hospital stay of seven days or more was associated with over a 13-fold increase in the risk of surgical site infections (SSIs) after cesarean delivery, with an adjusted odds ratio (AOR) of 13.49 (95% CI: 3.72–48.29). This finding is consistent with evidence from various studies conducted in different settings^{2,9}. Prolonged hospitalization after cesarean delivery increases the risk of nosocomial infections, and these patients may have underlying conditions that necessitate an extended stay, which can delay wound healing.

This study found a significant association between diabetes mellitus and the occurrence of surgical site infections (SSIs). This finding is consistent with other similar research^{6,9}. Previous studies have indicated that patients with pre-existing conditions like diabetes mellitus are at a higher risk of developing SSIs due to compromised immune function, which can hinder the healing process¹⁷.

There are some important limitations of the study. As data were obtained through medical record reviews, some important confounding variables, such as

vaginal cleansing before cesarean delivery, body mass index, indications for cesarean delivery, types of prophylactic antibiotics used, microbiological data on surgical site infections, mortality rates, and estimated blood loss, were not captured. Therefore, the findings should be interpreted with caution. In the multivariable model, some independent variables exhibited wide confidence intervals for the odds ratios, suggesting that the sample size may have been insufficient. Additionally, this study is subject to the limitations inherent in cross-sectional research, which weakens the ability to establish causal relationships between independent factors and outcome variables.

Conclusion and Recommendations

The prevalence of surgical site infections (SSIs) after cesarean delivery at Yekatit 12 Hospital Medical College/Abebech Gobena Maternal and Child Health Center was notable, with nearly one in ten mothers affected. Significant associations were found between post-CD SSIs and factors such as chorioamnionitis, prolonged rupture of membranes, extended postoperative hospital stays, low postoperative hematocrit levels, and the presence of comorbidities. Therefore, it is crucial for the institution to establish guidelines and provide training for care teams on the careful assessment and management of membrane status, minimizing unnecessary hospital stays, timely correction of postoperative anemia, and optimizing care for mothers with comorbidities to reduce the risk of preventable SSIs and maternal morbidity.

Abbreviations

- CD: Cesarean Delivery
- CDC: Center for Disease Prevention and Control
- DM: Diabetes Mellitus
- EGOPD: Emergency Gynecology Outpatient Department
- HIV: Human Immunodeficiency Virus
- SSI: Surgical Site Infection

Acknowledgments

I would like to express my gratitude to Yekatit 12 Hospital Medical College and Abebech Gobena Maternal and Child Health Center for providing the support needed to conduct the study.

Funding

This research was funded by Yekatit 12 Hospital Medical College.

Ethical Approval

Ethical approval for the study was granted by the Institutional Review Board (IRB) of Yekatit 12 Hospital Medical College (Ref. No: 178/23). Permission from the medical director's office was also obtained. All client identifiers, including names, were removed from the data.

Competing Interests

The authors declare no competing interests.

Availability of Data and Materials

The datasets used and/or analyzed during the current study are available from the corresponding author on request by email-negussiedt@gmail.com

Correspondent Author

Dereje Negussie Tuijie

Email: negussiedt@gmail.com

REFERENCES

- Berriós-Torres SI, Umscheid CA, Bratzler DW, Leas B, Stone EC, Kelz RR, et al. Centers for disease control and prevention guideline for the prevention of surgical site infection, 2017. Vol. 152, JAMA Surgery. American Medical Association; 2017. p. 784–91.
- Alemye T, Oljira L, Fekadu G, Mengesha MM. Post cesarean section surgical site infection and associated factors among women who delivered in public hospitals in Harar city, Eastern Ethiopia: A hospital-based analytic cross-sectional study. PLoS One. 2021 Jun 1;16(6 June).
- Yerba K, Failoc-Rojas V, Zeña-Nañez S, Valladares-Garrido M. Factors Associated with Surgical Site Infection in Post-Cesarean Section: A Case-Control Study in a Peruvian Hospital. Ethiop J Health Sci. 2020 Jan 1;30(1):95–100.
- Getaneh T, Negesse A, Dessie G. Prevalence of surgical site infection and its associated factors after cesarean section in Ethiopia: Systematic review and meta-analysis. BMC Pregnancy Childbirth. 2020 May 20;20(1).
- World Health Organization. Global guidelines for the prevention of surgical site infection. 184 p.
- Gomaa K, Abdelraheim AR, El Gelany S, Khalifa EM, Yousef AM, Hassan H. Incidence, risk factors and management of post cesarean section surgical site infection (SSI) in a tertiary hospital in Egypt: a five year retrospective study. BMC Pregnancy Childbirth. 2021 Dec 1;21(1).
- Nkurunziza T, Kateera F, Sonderman K, Gruendl M, Nihwacu E, Ramadhan B, et al. Prevalence and predictors of surgical-site infection after caesarean section at a rural district hospital in Rwanda. Br J Surg. 2019 Jan 1;106(2):e121–8.
- Adane F, Mulu A, Seyoum G, Gebrie A, Lake A. Prevalence and root causes of surgical site infection among women undergoing caesarean section in Ethiopia: A systematic review and meta-analysis. Vol. 13, Patient Safety in Surgery. BioMed Central Ltd.; 2019.
- Shiferaw WS, Aynalem YA, Akalu TY, Petrucka PM. Surgical site infection and its associated factors in Ethiopia: A systematic review and meta-analysis. BMC Surg. 2020 May 18;20(1).
- Birhanu Y, Endalamaw A. Surgical site infection and pathogens in Ethiopia: A systematic review and meta-analysis. Vol. 14, Patient Safety in Surgery. BioMed Central Ltd.; 2020.
- Wodajo S, Belayneh M, Gebremedhin S. Magnitude and Factors Associated With Post-Cesarean Surgical Site Infection at Hawassa University Teaching and Referral Hospital, Southern Ethiopia: A Cross-sectional Study. Ethiop J Health Sci. 2017 May 1;27(3):283–90.
- Ayala D, Tolossa T, Markos J, Yilma MT. Magnitude and factors associated with surgical site infection among mothers underwent cesarean delivery in Nekemte town public hospitals, western Ethiopia. PLoS One. 2021 Apr 1;16(4 April 2021).
- Kawakita and Landy Maternal Health, Neonatology, and Perinatology (2017) 3:12 DOI 10.1186/s40748-017-0051-3
- Dr. Nguyen Thi Thuy. Risk Factors for Postcesarean Surgical Site Infection. VOL. 95, NO. 3, MARCH 2000
15. National Collaborating Centre for Women's and Children's Health (UK). Surgical Site Infection: Prevention and Treatment of Surgical Site Infection. London: RCOG Press; 2008 Oct. PMID: 21698848.
- Gordillo GM, Sen CK. Revisiting the essential role of oxygen in wound healing. Am J Surg. 2003 Sep;186(3):259-63. doi: 10.1016/s0002-9610(03)00211-3. PMID: 12946829.
- Delamaire M, Maugendre D, Moreno M, Le Goff MC, Allannic H, Genetet B. Impaired leucocyte functions in diabetic patients. Diabet Med. 1997 Jan;14(1):29-34. doi: 10.1002/(SICI)1096-9136(199701)14:1<29::AID-DIA300>3.0.CO;2-V. PMID: 9017350.
- Yekatit 12 Hospital Medical College. (n.d.). About us. Retrieved from Yekatit 12 Hospital Medical College
- World Health Organization (WHO). (2021). Ethiopia: Health system summary. Retrieved from WHO Ethiop Hassan, M. H., & Hossain, M. M. (2016).
- Prolonged rupture of membranes: Incidence and maternal and neonatal outcomes. Journal of Bangladesh College of Physicians and Surgeons, 34(1), 6-11. doi:10.3329/jbcps.v34i1.26577. ia Health System
- Hauth, J. C., & Goldenberg, R. L. (2005). Chorioamnionitis and the risk of preterm birth: An overview. American Journal of Obstetrics and Gynecology, 192(2), 352-356. doi:10.1016/j.ajog.2004.08.020.
- Zahra, N. A., & Fathizadeh, H. (2019). Maternal comorbidities and their association with adverse maternal and neonatal outcomes: A systematic review. Archives of Gynecology and Obstetrics, 299(4), 1045-1057. doi:10.1007/s00404-019-04952-5.