



Antibiotic Practices and The Rate of Surgical Site Infection Following Cesarean Section

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ABSTRACT

Background: Cesarean section (CS) is the most performed operation globally. It's a clean-contaminated surgery with higher surgical site infections (SSIs) risk. The mortality rate associated with cesarean section in Africa is 50 times greater than in high income settings, 11 women die per 1000 CS in sub-Saharan Africa and 14% of women suffer complication (SSIs). Proper antibiotic use can reduce this burden however effective antibiotics are running out due to inappropriate use. This study aimed to assess the pre-cesarean and post-cesarean antibiotic practices and the rate of SSIs following CS at Mbale regional referral hospital (MRRH)

Methods: The study was a retrospective and descriptive cross-sectional on CS mothers between 1st January 2020 and 31st December 2022 at MRRH. Out of the 2432 patient files reviewed, an equal number (104) of women who developed SSIs and those that did not develop SSIs (104) were selected by simple random sampling, total sample size of 208.

Result: More than half (n=148; 71.2 %) received antibiotic prophylaxis. Majority received I.V ceftriaxone (38.0%) within 15minutes (mean duration) before skin incision. 35.1% of 208 that received antibiotic prophylaxis developed SSIs. I.V Metronidazole and Ceftriaxone were the most administered after CS and Oral metronidazole was the most prescribed upon discharge.

Conclusion : The rate of SSIs at MRRH was 3% similar to that of Mbarara regional referral hospital at 3.5%. Lack of antibiotics prophylaxis and poor antibiotic prophylaxis timing could explain this rate underscoring compliance to International, National and Hospital surgical bundles.

Keywords: Antibiotic; surgical site infections (SSIs); cesarean section

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Introduction

Cesarean section (CS) is an operative procedure by which a fetus, placenta, and membranes are delivered through the abdomen^{1,2}. Globally, the CS rate has increased to 21% above the recommended 15%.³ This poses a very high risk to developing complication such as surgical site infections (SSIs).^{4,5} Surgical site infections are infections which occur at the incision/operative site (including drains) within 30 days after surgical operation if no implant is left in place.⁶

The mortality rate associated with cesarean section in Africa is 50 times greater than in high income settings, 11 women die per 1000 cesarean sections in sub-Saharan Africa and 14% of women suffer complications.⁷ Uganda has a high maternal mortality ratio (MMR) of 336/100,000 live births with a prevalence of Post-Cesarean SSIs at 15.5%.⁸

Surgical site infections (SSIs) are caused by bacteria that penetrate the surgical site causing infection (Sepsis), 70% incidences of SSIs can be prevented and controlled through strict adherence to infection control protocols and appropriate antibiotic use.⁹⁻¹² Despite the use of antiseptic solutions in preparation of the skin and administration of an appropriate prophylactic antibiotic 30 minutes before skin incision, surgical site infections continue to be registered lengthening hospital stay, treatment cost as well as causing maternal morbidity and mortality.^{4,13}

In Uganda, sepsis is the leading cause of maternal mortality followed by obstetric hemorrhage causing 31% and 22% maternal deaths respectively¹⁴. Mbarara Regional Referral Hospital's policy, every mother for CS receives single dose of prophylaxis (ampicillin or ceftriaxone), 3-days post-CS Ceftriaxone and Metronidazole followed by oral Cefixime for 5 days post-discharge.¹⁵ This is a similar practise at Mbale Regional Referral Hospital in Eastern Uganda.

The WHO recommend that one dose of prophylactic antibiotics is sufficient and is no less effective than three doses and should be given 30–60 minutes before operation.¹⁶ Oral antibiotics are not necessary after stopping IV antibiotics.¹⁷

Resistant bacteria kill more than 700,000 people worldwide¹⁸ and inappropriate antibiotic practices are increasing.^{11,19}

Up to 60% of SSIs are preventable.²⁰ However we are running out of effective antibiotics.^{21,22} attributed to the overuse and misuse of anti-bacterial drugs.²³ Numerous studies have addressed the preoperative prophylactic antibiotic and other risk factors than those about the postoperative use of antibiotics in cesarean section.²⁴

Knowledge on the antibiotic practices as a factor associated to surgical site infection (SSIs) is a one step to antibiotic stewardship and an essential strategy for the development of preventive and control measures to reduce the risks of SSIs and improved maternal health outcomes following Cesarean section. The aim of the study was to find out the rate of SSIs and the pre and post-Cesarean section antibiotic practices at Mbale Regional Referral Hospital (MRRH).

Methods

It was descriptive and retrospective cross-sectional study conducted on mothers who delivered by CS between 1st-January-2020 and 31st-December-2022 at MRRH. Mbale Regional Referral Hospital (MRRH). It is an approximately 650-bed serving more than six districts of Uganda.

Using Kish and Leslie, and adjusting for 10% for incompleteness of data; N=208 files that met the inclusion criteria were selected until the required size was obtained.

Out of the 2432 women that under went cesarean section reviewed, an equal number (104) of women who developed surgical site infection (SSIs) and those that did not develop SSIs (104) were selected by simple random sampling to make a total sample size of 208 participants). For this study SSIs was defined by a diagnostic code "infection of the surgical site, or sepsis or wound infection as stated in the patient file by the doctor.

All mothers' files who delivered by cesarean section and those that developed surgical site infections (SSIs) within 30-days post-cesarean between 1st January 2020 up to

31st December 2022 at Mbale Regional Referral Hospital (MRRH).

Mothers' files who delivered by caesarean and were referred. Mothers' files operated elsewhere and were managed for SSIs at MRRH and mothers' files with missing operation notes and incomplete data about the study variables.

The dependent variable (primary outcome) was surgical site infection following cesarean section. The independent variables included the following: Pre-cesarean antibiotic practice (prophylaxis administration, the type and duration of administration) and post-cesarean antibiotic practices (antibiotic type administered, dosages and oral prescription).

An independent Obstetrician, not part of the research team checked the empty and completed data collection sheets.

Result

Pre-cesarean antibiotic practices

More than half (n=148; 71.2 %) of the 208 mothers received antibiotic prophylaxis. Half of the antibiotics prophylaxis recipients (n=73; 35.1%) and none recipients (n=31; 14.9%) developed surgical site infection (Table 1).

The most administered antibiotic prophylaxis was Ceftriaxone (n=79; 38.0%) followed by Ampicillin (n=58; 27.9%) in both mothers that developed surgical site infection and those that did not (Table 2). The mean duration between antibiotic prophylaxis administration and skin incision was 15 minutes (Table 3).

Table 1. Antibiotic prophylaxis administration

	N= 208	Developed SSIs		Total
		No	Yes	
		n (%)	n (%)	
Antibiotic prophylaxis administered	No	29 (13.9)	31 (14.9)	60 (28.8)
	Yes	75 (36.1)	73 (35.1)	148 (71.2)
	Total	104 (50.0)	104 (50.0)	208(100.0)

Table 2. Type of antibiotic prophylaxis administered.

If Yes: N= 148		Developed SSIs		Total
		No	Yes	
		n (%)	n (%)	
Which one?	Ceftriaxone	42(20.2)	37 (17.8)	79 (38.0)
	Metronidazole	3 (1.4)	8 (3.8)	11 (5.3)
	Ampicillin	30 (14.4)	28 (13.5)	58 (27.9)
	Total	75 (36.1)	73 (35.1)	148 (71.2)

Table 3. Mean duration (minute) between antibiotic prophylaxis administration and skin incision.

	N	Minimum	Maximum	Mean
Mean duration (minutes)	148	4	40	15.41
N	148			

Post-cesarean antibiotic practices

Almost all mothers (n= 203; 97.6%) received intravenous Ceftriaxone & Metronidazole post-cesarean, half of these (n=103; 49.5%) developed surgical site infections (Table 4).Half of the mothers (n=110; 52.9%) were prescribed oral Metronidazole followed by Gramocef and Cefixime at (n=32; 15.4%) and (n=31; 14.9%) respectively. 43 of the mothers that were prescribed oral metronidazole developed surgical site infection accounting to 20.7 % followed by those prescribed oral Cefixime (n=24; 11.5%) (Table 5).

Table 4. Post-cesarean section intravenous antibiotics administered to the mothers.

	N=208	Developed SSIs		Total
		No	Yes	
		n (%)	n (%)	
Post-CS antibiotics administered	Ampicillin & Metronidazole	4 (1.9)	1 (0.5)	5 (2.4)
	Ceftriaxone & Metronidazole	100 (48.1)	103 (49.5)	203 (97.6)
	Total	104 (50.0)	104 (50.0)	208 (100.0)

Table 5: Post-Cesarean section Oral antibiotic prescribed

		Developed SSIs		Total
		No n (%)	YES n (%)	
Oral Antibiotics prescribed on discharge	Metronidazole	67 (32.2)	43 (20.7)	110(52.9)
	Amoxicillin	11 (5.3)	8 (3.8)	19 (9.1)
	Cefixime	7 (3.4)	24 (11.5)	31 (14.9)
	Ampiclox	0 (0.0)	16 (7.7)	16 (7.7)
	Gramocof	19 (9.1)	13 (6.3)	32 (15.4)
Total		104 (50.0)	104 (50.0)	208 (100.0)

Discussion

Rate of surgical site infections

The rate of surgical site infection in this study was 3%, almost similar to 3.5% in a study by Kurigamba et al., (2018) at Mbarara Regional Referral Hospital in Uganda. This rate falls within the range 1% to 25% reported in different literature.²⁵ However lower than 18.8% reported in Pinang Malaysia.²⁶ and the range of Cesarean SSIs in sub-Saharan Africa that vary between 9-33%.¹⁵ This could be attributed to the surveillance methods used to identify infections, the patient population, and the design of study used in this study.²⁶

Pre-cesarean antibiotic practices

Cesarean section like other surgeries predisposes mothers to infections increasing cost of treatment and hospital stay.^{7,27} Antibiotic prophylaxis is recommended for all women undergoing cesarean delivery.²⁸

In this study, more than half (71.2%) of the mothers received antibiotic prophylaxis as compared to a study by Mpogoro *et al.*, (2014) were 99.7% received antibiotic prophylaxis. 73 (35.1%) and 31 (14.9%) mothers developed surgical site infections despite having received I.V ceftriaxone and ampicillin respectively. This phenomenon is similar to Kuwaitis study were 64.4% patients developed SSIs irrespective of having received antibiotic prophylaxis and this was explained by surgical procedure, suture skin closure and improper or misuse of antibiotics that occurs in 25–50% of operations.³⁰ Adherence to prophylaxis guidelines has been proven effective in

reducing infection rates and antibiotic resistance.³¹⁻³⁵

The mean duration between antibiotic prophylaxis and skin incision in this study was 15 minutes. The WHO guidelines and other literature recommend 30 to 60 minutes before skin incision as this improves drug circulation in the tissues and reduces risk of postoperative infection by almost 70%.^{7,15,26,32,34,36,37} Poor timing and lack of antibiotic prophylaxis explained the higher odds of infection in a study done in Norway.³⁴

In a limited resource setting poor reception of antibiotic prophylaxis could be attributed to facility antibiotic stock-outs and poor knowledge on the antibiotic prophylaxis guidelines. It is recommended to give a repeat dose of antibiotic prophylaxis when the operation is longer than the half-life of the antibiotic given.³² However our study could not obtain this data from records review.

In our study, intravenous (IV) ceftriaxone was the most administered antibiotic prophylaxis followed by Ampicillin and Metronidazole at 38.0%, 27.9% and 5.3% respectively. As compared to a study in India the most common prophylactic antibiotic administered was intravenous ampicillin followed by intravenous ceftriaxone along with metronidazole.³⁸ Ceftriaxone is reported being widely used for majorly surgical prophylaxis and this because Ceftriaxone is highly sensitive to all organisms.^{39,40}

37 (17.8%) mothers in this study that received ceftriaxone developed SSIs as compared to 28 (13.5%) mothers that received Ampicillin. Differing from a study in Tanzania were the rates of SSIs were observed more among patients who received Ampicillin than non- Ampicillin based regimen.²⁹ This could be attributed to poor timing of antibiotic prophylaxis and resistance expressed against ampicillin.²³ A study in Uganda reported that all organisms had 100% resistance to ampicillin.⁴⁰

Post-operative antibiotic practices

Post-operative antibiotic treatment differs from antibiotic prophylaxis as in that the former is intended to resolve an established infection, typically requiring a longer course of

therapy whereas the latter is intended to prevent infection.³¹

In this study almost all mothers (97.6%) received intravenous (I.V) Ceftriaxone & Metronidazole post-cesarean. A study by Yan *et al.*, (2022) reported that all women who gave birth by CS typically received antibiotic treatment for 5 days. The antibiotics of choice is Cephalosporin ± Metronidazole for post-cesarean²⁴. This is a similar practice reported in India where post-operatively I.V Ceftriaxone was given and I.V Metronidazole for three days⁴¹. Mbarara regional referral hospital antibiotic policy in Uganda recommends 3-days post-CS Ceftriaxone and Metronidazole followed by oral Cefixime for 5 days post-discharge.¹⁵

The ministry of health of Uganda discourages routine post-operative antimicrobial administration as it causes a waste of limited resources and unnecessary side effects⁴², however hospital have the opportunity to create their own CS surgical bundle to decrease surgical site infection while taking measures to control antimicrobial resistance through rationale antibiotic use¹⁷ 52.9% of all 208 mothers were prescribed oral metronidazole and either or Gramocef (15.4%). About 14.9% were prescribed Cefixime. Different from the Mbarara regional referral antibiotic policy that recommends oral Cefixime for 5 days post-discharge.¹⁵ The price of Cefixime is higher as compared to Metronidazole and Gramocef that are cheaper and easily accessible though less effective than Cefixime which is broad-spectrum cephalosporin.⁴³ This could explain the higher numbers of mothers (20.7%) that developed s. Lack of antibiotics prophylaxis and poor timing as well as poor compliance to guidelines could explain the rate of surgical site infections in this study. Compliance to surgical guidelines and hospital surgical bundles and antibiotic policies. There is need to improve the surveillance of surgical site infections following cesarean section.

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