PRE-& POST-OPERATIVE ANTIBIOTIC PROPHYLAXIS:

CAESARIAN SECTION WOUND COMPLICATION AND FACTORS

AFFECTING DURATION OF HOSPITAL STAY

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PRE-& POST-OPERATIVE ANTIBIOTIC PROPHYLAXIS: CAESARIAN SECTION WOUND COMPLICATION AND FACTORS AFFECTING DURATION OF HOSPITAL STAY

By

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CERTIFICATION

The undersigned certify that he has read and hereby recommend for acceptance by Muhimbili University of Health and Allied Sciences a dissertation entitled; ***Pre-& Post-Operative Antibiotic Prophylaxis: Caesarian Section wound Complication and Factors Affecting Duration of Hospital Stay,*** in (partial) fulfillment of the requirement for the Degree of Master of Pharmacy (Hospital and Clinical Pharmacy) of Muhimbili University of Health and Allied Science.

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Prof. Appolinary A. R. Kamuhabwa

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Date

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TABLE OF CONTENTS

Abstract

Background: Antibiotic prophylaxis has been reported to reduce the rate of caesarian section surgical site infection and other complications. Despite such advancement, duration of time spent in hospitals after delivery varies and is reported to be longer among the caesarian delivery mothers. Therefore, understanding the factors which influence the variation of time spent in hospitals after caesarian section is important in order to optimize antibiotic prophylaxis and other interventions.

Objective: Assessment of factors affecting length of hospital stay and wound complications after caesarian section among women who had received pre- or post-operative antibiotic prophylaxis at Muhimbili National Hospital

Methodology: This was a prospective observational study conducted from March to April, 2016 in the Department of Obstetrics and Gynecology at Muhimbili National Hospital. It involved 242 caesarian section delivered mothers who had received prophylactic antibiotics. Maternal age, body mass index (BMI), type of caesarian section or incision, number and type of antibiotics used for prophylaxis, pre or post-operative time antibiotic had been administered were the variables extracted from patient files, nurse intervention charts as well as anaesthetic charts. Pre and post-caesarian hemoglobin (Hb) concentrations were extracted from complete blood count ordered by the obstetrician. All collected data were filled in the case report form and analyzed using Statistical Package for Social Sciences (SPSS) version 20.

Results: All 242 caesarian delivered mothers received multiple doses of prophylactic antibiotics. Mode for pre-caesarian prophylactic antibiotics administration time was 60 minutes. The second doses were administered post-caesarian and had mode administration time of 120 minutes. Two hundred seventeen (89.67%) out of 242 participants were co-administered Ceftriaxone and intravenous Metronidazole. Median duration on Ceftriaxone and intravenous Metronidazole was 72 and 24 hours respectively. Hundred and nine (45%) women were prescribed an extension of five days course of oral antibiotics. Mean length of hospital stay was 4.19 ± 0.17 days. Eleven (4.55%) wound complications as dehiscence ± fever were recorded. Mean length of hospital stay was not influenced by BMI ($p = 0.71$), type of caesarian section ($p = 0.26$) and a type of incision ($p = 0.17$), pre-caesarian prophylactic antibiotics administration time ($p = 0.55$), duration on

post-caesarian Ceftriaxone (p = 0.42) and on intravenous Metronidazole (p = 0.30) as well as the type of post-caesarian oral antibiotics (p = 0.77). Type of antibiotics (p = 0.001), first dose post-caesarian prophylactic antibiotic administration time (p = 0.01) and post-caesarian Hb levels (p = 0.04) had statistical significance on mean length of hospital stay. Caesarian wound complications were not influenced by BMI (p = 0.678), type of caesarian (p = 0.514) or incision (p = 0.511), pre- (p = 0.10) and post- (p = 0.61) caesarian antibiotics administration time. Type of pre-operative antibiotic prophylaxis (p = 0.0001) and post-caesarian Hb levels (p = 0.013) had statistical significant effects on wound complications.

Conclusion: Mean length of hospital stay and caesarian wound complications were significantly influenced by type of prophylactic antibiotics used as well as post-caesarian Hb concentration. Pre-caesarian section antibiotic prophylaxis administration time had no influence on mean length of hospital stays. Administration of the second dose (first dose post-caesarian) within 120 minutes after caesarian section influenced the mean length of hospital stays. The combinations of one to two doses of 1g strength Ceftriaxone injection and one dose of 500mg intravenous Metronidazole resulted into shortened mean length of hospital stay, and significant reduction of caesarian wounds complications than either of the drug alone. A combination of Ceftriaxone injection with intravenous Metronidazole should be used as prophylactic antibiotics of choice in areas with limited diagnostic and patients monitoring facilities.

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

ANOVA	Analysis of Variance
BMI	Body Mass Index
CI	Confidence Interval
CRF	Case Report Form
DAAD	Deutscher Akademischer Austausch Dienst
EU	European Union
Hb	Hemoglobin
HIF-1	Hypoxia Induced Factor-1
MANOVA	Multivariate Analysis of VAriance
MNH	Muhimbili National Hospital
SPSS	Statistical Package for Social Sciences
SUMI	Subumbilical Midline Incision
USA	United States of America
WHO	World Health Organization

DEFINATION OF TERMS

Antibiotic prophylaxis: antibiotic therapy administered to reduce chances of infections to someone at high risk. For the purpose of this study, antibiotic prophylaxis denotes antibiotic administered to some mothers undergoing caesarian section in order to reduce the risk of surgical site infections.

Caesarian section: surgical procedure in which incision is made through mother's abdomen and uterus to deliver a baby.

Subumbilical midline incision (SUMI): is a vertical incision made through midline from below the umbilicus to just above the pubis symphis offering access to the abdomen.

Pfannensteil incision: Is a slightly curved transverse caesarian surgical incision just above the pubis symphis which offer large central view of the pelvis and access to the abdomen.

Surgical site infection: Infection which occur in the wound created by surgical procedure.

Wound dehiscence: Is a surgical complication in which a wound ruptures along the surgical incision.

Wound complications: sustainable or recurrent fever beyond 24 hours post-caesarian or septicemia and dehiscence. For the purpose of this study composite measure of wound complication included either fever or wound dehiscence or septicemia or both.

CHAPTER 1

1.0 INTRODUCTION

Deliveries by caesarian sections are high and continue to rise both in developed and developing countries (Yoshiko, 2011). Many countries have exceeded the 15% upper limit set by WHO in the year 1985 (Chris et al, 2007). For instance, the rate of caesarian section in South Korea was 37% according to Fernando and colleagues (2006) report, while for Latin America it stood at 29.2% (Betran et al, 2007). In the United States (USA) delivery by caesarian section has increased from 20.1% in the year 1996 to 31.7% in 2005 (Michael, 2008). Other developed countries have reported about 21.1% rate of caesarian section (Betran et al, 2007). In Tanzania, a hospital-based panel study which was conducted at Muhimbili National Hospital from the year 2000 to 2011 has shown a steady rise of rate of caesarian section from 19% to 49% (Litorp et al, 2013).

Improvement of surgical and anesthesia techniques, reduced post-operative complications, care giver and patients perception regarding safety of the procedure, socio-demographic and nutritional factors, changes in health care system and patients demands are some of the reasons which have been reported to influence increased rates of delivery by caesarian section (Jose et al, 2006; Shiliang et al, 2007). Economic incentive obtained after caesarian section is among the driving force for private health facilities leading to unnecessary preference of the procedure (Jose et al, 2006; Luz et al, 2010).

Alleviation of labor pain, reduced anxiety about labor, reduced chance of urinary and fecal incontinence (Muda et al, 2006) and consideration of health safety of the baby are reported to be patients driving motive towards preferring elective caesarian section (Michael, 2008). A systematic review by Joshua and colleagues (2007) reported reduced risk of postpartum stress urinary incontinence from 16 to 9.8% in six cross sectional studies and from 22 to 10 % in 12 cohort studies for the caesarian delivery mothers groups. Malnutrition during early childhood ending into rickets is the most important cause of cephalopelvic disproportionate demanding caesarian section (Merewood et al, 2008).

Despite improvement, caesarian section contribute to substantial amount of morbidity, prolonged hospital stay, postpartum maternal infections such as fever, endometritis, bacteremia and other

infections such as pelvic abscess (collection of pus in the pelvis), septic shock, necrotizing fasciitis (tissue destruction in the uterine wall), and septic pelvic vein thrombophlebitis (inflammation and infection of vein in the pelvis) and urinary tract infections (Smaill and Gillian, 2010). A study conducted in 122 health facilities in Asia reported an increase in risk of maternal mortality and severe morbidity in women who deliver by caesarian section with no medical reason. Therefore women and obstetrician who choose caesarian section without medical justification have to make such decision with understanding of the increased risk (Pisake et al, 2010).

Antibiotics prophylaxis before or during caesarian section has resulted into significant reduction of surgical site infection (Olsen et al, 2008; Wloch et al, 2012). Without antibiotics prophylaxis the rate of wound infection is as higher as 25% (Smaill& Gillian, 2010). Other infections like endometritis also increase to as high as 20-85% (Smaill and Gillian, 2010). Prophylaxis using cephalosporins has shown favorable time-trend in reduction of surgical site infections following caesarian section (Olsen et al, 2008). Antibiotics administration within 60 minutes pre- or post-operative has shown favorable results as per different research reports (Olsen et al, 2008; Wloch et al, 2012).

Wound healing process involves four phases which are highly integrated and taking place in an overlapping manner. These phases are; hemostasis, inflammation, proliferation and remodeling (Guo and DiPietro, 2010). For successful wound healing, the four phases must take place in proper sequence, at specific time and specific duration at a balanced intensity. Any disturbance of the four phases results into impaired wound healing. There are number of factors which affect caesarian wound healing process. These factors may be local or systemic. They include; oxygen partial pressure at the wound site, infection at the wound or systemic, age of the patient, hormone balance, stress, co-morbidity, use of some medications, alcohol use, smoking, obesity, incision type and nutrition status (Guo and DiPietro, 2010; Loralei et al, 2012).

Although significant complications still exist, use of antibiotics for prophylaxis has a significant impact on the healing of caesarian section wound. Currently, it is suggested that efforts should be directed towards further reduction of complications, shortening time spent in hospital and economic burden to caesarian delivery mothers. In line with such efforts, this study aimed to

understand factors which influence time spent in the hospital after caesarian section among the recipients of prophylactic antibiotic therapy.

CHAPTER 2

2.0 LITERATURE REVIEW AND CONCEPTUAL FRAMEWORK

2.1.0 LITERATURE REVIEW

2.1.1 Length of hospital stays following delivery by caesarian section

Length of hospital stay following caesarian section depends on health-legal system of a given country, health insurance policy, delivery mother's health and perception, accommodation capacity of the health facility and caregivers decisions (Fink, 2011). For instance, in the USA before enactment of law concerning length of hospital stay after delivery, uncomplicated caesarian delivery mothers were allowed to spend 48 hours due to few beds, caregivers and medical insurance centered decision. Currently, the law has set the minimum time of 96 hours and patients are free to decide when to be discharged. In USA, 3% of caesarian delivered women spend more than four days in hospital due to surgical site infection (Smaill and Gillian, 2010). A study involving 65 caesarian delivery mothers in maternal and child clinic hospital in Islamabad, Pakistan documented an average hospital stay time of four days (Attia and Shakila, 2010). Bjϕnestad and colleagues (2005) reported a mean hospital stay of six days after emergency caesarian surgery among pregnant women who attended Hauckland Hospital in Norway. Sennen and colleagues (2009) conducted a study on cost-effectiveness after caesarian deliveries based on qualification of attended health care personnel. The study involved 2305 caesarian delivered mothers from six regional hospital of Burkina Faso and reported post-caesarian mean length of hospital stay of six days. These and other studies have shown that delayed caesarian section wound healing as a result of infection tend to prolong hospital stay as well as mortality, morbidity and readmission rate (Vanessa and Andrew, 2012).

2.1.2 Incidence of caesarian section wound infection and risk factors

Caesarian wounds may be contaminated, colonized or locally infected/ critically colonized or invaded by microbes and act as an entry point of microbes into systemic circulation. Incidences of post-caesarian wound infection vary from hospital to hospital. For example, Kaplan and colleagues reported 8.1% of mothers with infected caesarian wounds in Jordan (Kaplan et al, 2003), while Jido and Garba (2012) reported 9.1% of mothers with infected caesarian wounds at

Aminu Kano Teaching Hospital in Nigeria. In the USA the mean rate of caesarian wound surgical site infection was reported to be 3.15% (Smaill and Gillian, 2010).

Schneid and colleagues (2005) retrospectively studied 19,416 caesarian section deliveries at Ben Gurion University Soroka hospital and documented the risk factors towards caesarian section wound infections. The risk factors reported in this study were obesity, diabetes mellitus, hypertension, premature rupture of membranes, emergency caesarian section and delivery of twins (Schneid et al, 2005). Other factors which pose risk to caesarian wound infection are socio-economic status of the women, anemia, number of prenatal visits, vaginal examination during labor, internal fetal monitoring, urinary tract infections, chorioamnionitis, blood loss, general anesthesia, surgical techniques, length of operation time and operator's skill (Piret et al, 2005; Hans et al, 2007; Smaill& Gillian, 2010; Demisew et al, 2011).

2.1.3.0 Factors affecting effectiveness of pre- and post-caesarian section antibiotics prophylaxis

2.1.3.1 Timing of antibiotics administration

Timing of administration of antibiotics for prophylaxis has been shown to influence prognosis after caesarian incision. At Muhimbili National Hospital, the practice involves the use of single or combination of antibiotics in multiple doses. Ceftriaxone and intravenous Metronidazole are the two antibiotics routinely used. Ceftriaxone injection is given as 1g pre-operatively followed by 1g after every 24 hours for three consecutive days. Intravenous Metronidazole is given as 500mg pre-operatively followed by 500mg after every eight hours post-caesarian for 24 hours. Systematic review and meta-analysis of randomized controlled trials comparing effectiveness of pre-operative versus cord clumping administration of cefazolin has shown that, there is insignificant reduction in caesarian wound infection among women receiving pre-operative cefazolin (Juxiang et al, 2013). Review by Dalton and Castillo (2014) has emphasized on pre-operative administration of prophylactic antibiotics owing to superior trends compared to immediately after cord clumping. Range of preoperative time from 15-60 minutes has been documented to provide favorable results (Olsen et al, 2008; Wloch et al, 2012; Freahiywot et al, 2015).

2.1.3.2 Influence of caesarian section surgical techniques on the effectiveness of antibiotics prophylaxis

Apart from antibiotics prophylaxis, caesarian section wound complications are also influenced by type of operation techniques used. Suture, incision type and surgical techniques used to close incision site have been associated with caesarian surgical site infection in which monofilament, subcuticular sutures, and lower transverse incision provide lower risk compared to vertical incision, staple closure and polyfilament (Johnson et al, 2006; Suzanne et al, 2010; Loralei et al, 2012). Single-layer closure of the uterus has low chance of post-operative infection rate and other wound complications compared to double-layer closure allowing short hospital stay (Gretchen, 2014; Hasdemir et al, 2015). Modified MisgavLadach method has also shown lower postoperative caesarian complications as well as low use of postoperative antibiotics therapy compared to conventional Pfannenstial-Dorffler caesarian section (Kulas et al, 2008; Hasdemir et al, 2015).

2.1.3.3 Obesity versus dose of prophylactic antibiotics

Regardless of patient weight, prophylactic antibiotics are normally administered at a constant dose posing a higher risk among obese pregnant women. With respect to the use of cefazolin, many centers have been found to administer 2g as prophylactic dose to any patients despite of inherent body weight variation (Dalton and Castillo, 2014). Subcutaneous adipose tissues increase risk of caesarian wound complications such as infections, dehiscence, hematoma and seroma formation due to hypoperfusion and ischemia (Antonio et al, 2010; Loralei et al, 2012). Extra-harboring of bacteria along skin folds, poor penetration of antibiotics and tension along the wound edges (Hans et al, 2007; Wloch et al, 2012) are among the reasons for aforementioned wound complications. It has been reported that, obese women may benefit from combination of extended spectrum antibiotics such as Cephalosporin plus Azithromycin (Vanessa and Andrew, 2012).

2.1.3.4 Type, dose and duration of antibiotics prophylaxis for caesarian section surgery

Spectrum of activity, toxicity profile, safety record, ability of antibiotic to reach site of incision at sufficient concentration prior to procedure versus prevalent bacteria species liable to contaminate and infect the surgical wound are matter of concern for choosing the type of

antibiotics for prophylaxis (Vanessa and Andrew, 2012; Hawn et al, 2013). Anaerobes, aerobes gram negative, gram positive cocci (Staphylococci and streptococci) are prevalent endogenous genital-urinary tract polymicrobes which ascend to incision site. Caesarian wounds are also at high risk of being colonized by skin's normal flora bacteria such as Staphylococci. Narrow spectrum antibiotics are ideally good to minimize emergence of resistant bacteria, but antibiotics with broad spectrum coverage are more preferred during emergency caesarian section.

Third generation cephalosporins like ceftriaxone have shown similar effectiveness as first generation such as Cefazolin. To reduce emergence of resistant bacteria species, a common risk after the use of broad spectrum antibiotics, cefazolin is more preferred over ceftriaxone (Mark et al, 2015). Cephalosporins and penicillins have shown similar trend in outcomes (Smaill and Gillian, 2010), but other authors consider cephalosporins to be superior to other antibiotics (Olsen et al, 2008). Allergy to β-lactum antibiotics, prevalent nosocomial bacteria at a given institution (Jan et al, 2007; Joel, 2012) as well as individual patient's endogenous flora may also allow extension of choice to other antibiotics such as clindamycin, vancomycin (for area with high methicillin resistant staphylococcus species), metronidazole and erythromycin (Vanessa and Andrew, 2012).

Single dose of antibiotics prophylaxis has shown similar outcome to multiple doses. Shakya and Sharma (2010) studied the outcome after cefazolin plus metronidazole single dose versus multiple doses and reported similar outcomes. It has been noted that, further administration of antibiotics has no impact after wound has been sutured. A study was conducted by Vicente et al (2003) to compare caesarian wound infection rate, length of hospital stay and cost-effectiveness among women who received single dose combination made up of gentamycin (160mg) and metronidazole (500mg) versus those who were given conventional week-long post-operative antibiotics in Mozambique. Authors reported insignificant differences on infection rate and length of hospital stay post-caesarian section among the two groups. But there was significant difference in the cost incurred by the conventional post-operative week-long antibiotics therapy group (Vicente et al, 2003). A similar study was conducted at Bugando Hospital in Tanzania and reported similar findings as those of Vincente et al (Fadhili et al, 2013). Subsequent dose of antibiotic prophylaxis should be administered in case the duration of surgery exceeds 3 hours or is more than the antibiotic's half-life (Dalton and Castillo, 2014).

2.1.3.5 Interplay of prophylactic antibiotics and immune system; systemic glucocorticoids drawback

Antibiotics at incision site tend to lower the level of microbes to the level easily suppressible by the host immune system during and after operation. Systemic glucocorticoids derivatives delay wound healing by acting broadly as anti-inflammatory agents, suppress multiple cellular wound healing process, increase risk of wound infection and inhibit production of hypoxia-induced factor-1 (HIF-1) key transcriptional factor during wound healing (Guo and DiPietro, 2010). In a study conducted at the Messina Hospital in Italia involving 212 pregnant women who had caesarian section, Antonio and colleagues reported correlation of corticosteroids use with complications of caesarian wound healing (Antonio et al, 2010).

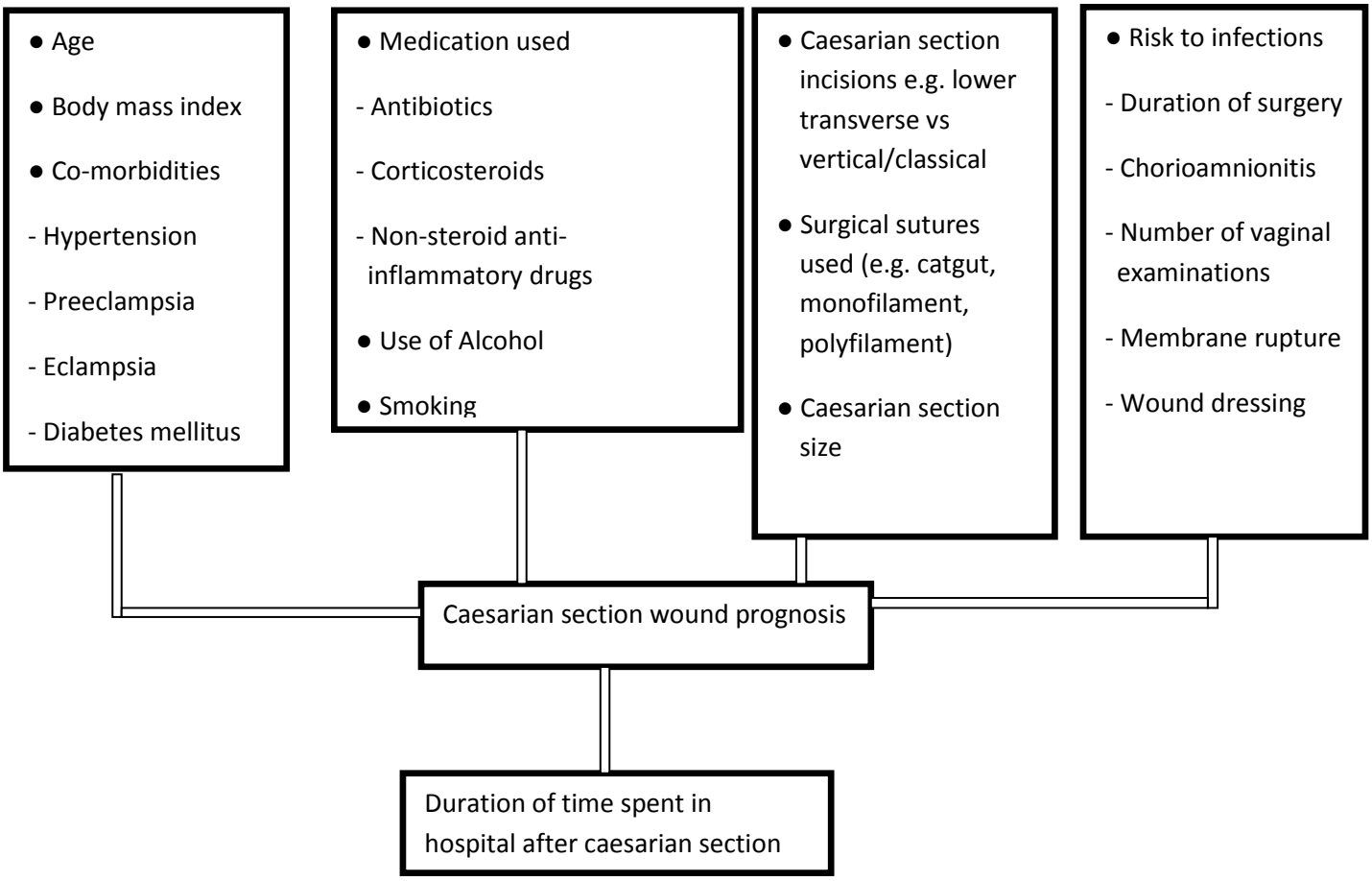
2.1.3.6 Synergism of pre-operative skin disinfectant and prophylactic antibiotics during caesarian section surgery

Skin preparation prior to incision also has a significant influence on determining the risk for superficial and subcutaneous tissue infection regardless of antibiotics prophylaxis. Chlorhexidane is more superior for skin sterilization prior incision compared to povidone-iodine (Dalton and Castillo, 2014; Mark et al, 2015). Brian and colleagues (2011) conducted a study on predictors of surgical site infection among patients attending Bugando hospital. The authors reported a significant association of risk to acquire the infection with the use of iodine alone to disinfect the skin prior incision.

2.1.4 Areas of research

It is obvious that many researchers have concentrated on surgical site infection while caesarian section wound related factors which influence length of hospital stay among recipients of prophylactic antibiotics have not been adequately researched. The purpose of this study was to provide information concerning caesarian section related factors which influence time spent in hospital to discharge and wound complications among women who had prophylactic antibiotics therapy.

2.2 CONCEPTIAL FRAMEWORK



Host factors which tend to influence caesarian section wound prognosis are age, body mass index (BMI), co-morbidities such as **(**hypertension, preeclamspsia, eclampsia**)** and diabetes mellitus. Antibiotics tend to assist wound healing while corticosteroids and non-steroid anti-inflammatory drugs tend to delay the process. Alcohol use and cigarette smoking are important factors which tend to disturb normal mechanism of wound healing process. Incision type & size as well as surgical sutures are important physical factors which influence wound healing. Surgical site infection whose risk factors include duration of labor or surgery, membrane rupture, chorioamnionitis, number of vaginal examination, internal fetal monitoring and wound dressing are also important factors which tend to influence the prognosis of caesarian section wound.

This study assessed the influence of the type of prophylactic antibiotics used, time of administration and dose, BMI, caesarian and incision type and hemoglobin concentration on the length of hospital stay. Primary outcome measure was the length of hospital stays as a result of caesarian wound prognosis since the day of operation to discharge.

CHAPTER 3

3.0 PROBLEM STATEMENT, STUDY QUESTIONS, RATIONALE OF THE STUDY AND STUDY OBJECTIVES

3.1 PROBLEM STATEMENT

Delivery by caesarian section keeps on increasing as many countries have surpassed the 10-15% limit set by WHO (Chris et al, 2007). Hospital-based panel study which was conducted at Muhimbili National Hospital from the year 2000 to 2011 has shown a steady rise of rate of caesarian section from 19% to 49% (Litorp et al, 2013). Caesarian delivery is a potential risk factor towards infection. In ascending order of risk; clean, clean-contaminated and contaminated/dirty surgical wound requires care to avoid mortality, morbidity and prolonged hospital stay. In line with that, all caesarian delivery mothers require administration of pre-or post-operative antibiotics prophylaxis. The role of antibiotic prophylaxis is to inhibit growth of microbes to a level easily cleared by host immune. In Tanzania, information for bacteriology and antibiogram profile for caesarian wounds isolated bacteria have been reported (Joel, 2012). However, factors that affect wound healing and hospital stays in women after caesarian section have not been well documented.

The literature has highlighted important factors which may affect prognosis of caesarian wound healing among recipients of antibiotics prophylaxis. Antibiotics choice, time of administration, dose, BMI, incision and caesarian section type, and hemoglobin (Hb) levels are the important determinants of prognosis following the procedure. In Tanzania, there is scarcity of information on whether the aforementioned factors influence length of hospital stay or not. Therefore, this study was conducted to assess caesarian section wound healing related factors which influence the length of hospital stay among women who had received prophylactic antibiotic therapy.

3.2 STUDY QUESTIONS

i. Is there a difference in mean length of hospital stays as well as wound complications after caesarian section among women who had received antibiotic prophylaxis based on BMI?
ii. Is type of pre- or post-caesarian antibiotics an influential factor on length of hospital stays as well as caesarian wound complications?

iii. Is a pre- or post-operative antibiotic administration time affects time to discharge or caesarian wound complications after caesarian section?
iv. After antibiotic prophylaxis, is there a difference in mean time to discharge or wound complications between mothers who delivered by Pfannensteil versus Subumbilical midline caesarian incision techniques?
v. Does derangement of hemoglobin influence the time spent in hospital or wound complications after caesarian section among recipients of prophylactic antibiotics?

3.3 RATIONALE OF THE STUDY

Understanding factors which influence length of hospital stay and wound complications following caesarian section among mothers who had antibiotics prophylaxis will help in providing evidence based revision of routine practice. Such information will also serve as literature repository for different research communities and ministry responsible for health. Therefore this study was carried out to generate such useful vital information.

3.4.0 STUDY OBJECTIVES

3.4.1 Broad objective

To asses factors affecting length of hospital stay and wound complications after caesarian section among women who had received pre- or post-operative antibiotic prophylaxis at Muhimbili National Hospital (MNH)

3.4.2 Specific objectives

i. To determine the effects of BMI on length of hospital stays and wound complications among caesarian delivered mothers who received antibiotic prophylaxis.
ii. To determine the effects of number and type of antibiotic prophylaxis on duration of time spent in hospital and wound complications among caesarian delivered mothers.
iii. To determine the effects of antibiotic prophylaxis administration time on length of hospital stay and wound complications among caesarian delivered mothers.
iv. To determine the effects of type of caesarian section incision techniques on length of hospital stays and wound complications among recipients of prophylactic antibiotic.

v. To determine the effects of Hb concentration on length of hospital stays and wound complications among caesarian delivered mothers who received antibiotic prophylaxis.

CHAPTER 4

4.0 METHODOLOGY

4.1 Study area

This study was conducted in the Department of Obstetrics and Gynecology at Muhimbili National Hospital (MNH). MNH is a National and university teaching hospital in Tanzania. Due to its level as the National and University teaching hospital, MNH has a number of specialists in different fields and well equipped diagnostic and treatment facilities. Majority of the pregnant women who attended obstetrics wards were referral cases from different parts of Dar-es- Salaam and other parts of Tanzania.

4.2 Study design

Prospective observational study was employed to obtain the required data with respect to this study. Follow-up started at the moment a pregnant woman was assigned to caesarian section delivery until she was discharged home.

4.3 Study population

This study recruited pregnant women who delivered by caesarian section with the following inclusion and exclusion criteria:

4.3.1 Inclusion criteria

- Received antibiotics prophylaxis pre- or peri- or post-operative
- Gestation age > 28 weeks.

4.3.2 Exclusion criteria

- Critically ill patients
- History of diabetic mellitus
- Under regular conventional antibiotic treatment prior to caesarian section

4.4 Sample size calculation

Using prevalence of surgical site complications of 25% when the use of prophylactic antibiotics is not strictly adhered as it has been reported in the review study by Smail and Gillian (2010), setting significance level at 95% (Z=1.96) and margin of error (ε) at 5.5%, the calculated sample

size was 238. Adding 2% (≈4 participants) for lost to follow-up, the total sample size (n) for the study was 242 caesarian delivered mothers.

- $n = (Z^2P(1-P))/ \varepsilon^2 = (1.96^2X0.25(1-0.25))/0.055^2 = 238$
- Adding 2% (≈4 participants) of lost to follow-up, the total sample size = 242

4.5 Sampling procedure

Convenient sampling procedure was employed during recruitment of study participant. Women who were assigned to deliver by caesarian section were consulted to participate in this study. They were provided with informed consent forms prior or after the procedure. Those who agreed to participate in the study were assessed to ensure they fulfill inclusion criteria for the study. Those meeting inclusion criteria were followed on daily basis to get important data with respect to this study. The follow-up time was the time a caesarian delivery mother stays in the ward due to caesarian section wound related health care. Time spent in hospital as a result of neonatal care was not included as part of length of hospital stays for a given caesarian delivered mother.

4.6.1 Data collection

Important independent variables were age, BMI, type and number of pre- and post-caesarian antibiotics prophylactic administered, pre-and post-caesarian antibiotics administration time, post-caesarian duration on antibiotics, type of caesarian, reason for caesarian section and type of incision. Other variables included history of alcohol use, cigarette smoking, duration of surgery and frequency of wound dressing.

Length of hospital stays following caesarian section was the primary dependent outcome measure with regard to this study. The time considered ‘length of hospital stay’ was the time related to care a caesarian delivered mother had to receive for the purpose of ensuring wound healing. Time spent in hospital as results of neonatal care was not included as part of length of hospital stays for the respective caesarian delivered mother. Secondary dependent outcome measure was caesarian wound complications. During the follow-up time, two midwives who were trained as research assistants and the investigator observed the caesarian delivered mother’s wound prognosis during ward round when the team of obstetricians were making routine assessment. Important complications in this study were fever, wound dehiscence and septicemia. Wound complication was recorded as separate individual variables namely fever, wound

dehiscence and septicemia or as a composite outcome "wound complication" when one of the complication had been recorded with or without the presence of other wound complications. Other data were further extracted from caesarian delivered mother's file. Data of body temperature were obtained from caesarian delivered mother's files. Data were collected using a case report form (CRF) enclosed as appendix II. The CRF has four sections, namely socio-demographic information, medical and medication history as well as laboratory results.

Maternal age, BMI, marital and occupational status as well as cigarette and alcohol consumption were important variables comprising the socio-demographic information relevant to this study.

Body weight and height were recorded from Antenatal Clinic card. Then body weight for each caesarian delivered mother was divided by meter square of the respective patient's body height to obtain the BMI. Based on the measured BMI, women were categorized as underweight (<18 kg/m^2), normal (18-25kg/m^2), overweight (25-30kg/m^2), and obese (>30kg/m^2).

Patient files were used as a source of data for medical and obstetric history for a particular caesarian delivered mother. These data were entered into CRF section of Medical history which was divided into general medical history including past or current co-morbidities. Gravidity, gestation age and parity status were recorded in the obstetrics history sub-section of the CRF. Data about variables such as type of caesarian section, type of incision and surgical suture used were extracted from anaesthetic charts. Research assistants and investigator observed caesarian wound care such changes of gauze and plaster requested by the obstetricians during ward round. Other information about caesarian wound care was extracted from patient files. Number of wound care and material used were further recorded in CRF sub-section for current caesarian section surgery.

The data about medication used were extracted from anaesthetic charts, patient files and nurse intervention charts. Information about prophylactic antibiotics and other medications used before and after caesarian section were further recorded in the medication history section of the CRF. Generic and brand names of the specific antibiotics, dose, route of administration, reason for use of respective antibiotics and duration were documented in this section. Other medications co-administered such as corticosteroids, non-steroidal anti-inflammatory drugs and others were also recorded.

Data about pre and post-operative Hb concentrations were also the important variables with regard to this study. Pre- and post-caesarian Hb concentrations data were extracted from complete blood count records ordered by obstetrician. Anemia was categorized based on Hb levels i.e mild (9.0-10.9g/dL), moderate (7.0-9.0g/dL) and severe (<7g/dL) (Asgeir et al, 2008).

4.7 Data management

Numbers were used as identity in order to maintain confidentiality of study participants. Collected data were stored in secured place accessible only to investigator. Raw data in physical storage were transferred into electronic form for cleansing and data analysis. Accessibility to all storage formats were only under custody of investigators in assurance with consideration for ethical issues.

4.8 Data analysis

Data were analyzed by Statistical Package for Social Sciences (SPSS) computer software, version 20. Measure of central tendency (mean, mode, and median) and measures of dispersion (range, variance and standard deviation) were employed for quantitative/numerical variables such as length of hospital stay, maternal age, gestation age, number of pre- and post-caesarian antibiotics and duration on post-caesarian antibiotic prophylaxis. Proportion(s) were applied for categorical data such as type of antibiotics, type of caesarian or incision, BMI and Hb categories. Histograms, bar charts, contingency tables and pie charts were also utilized during results presentation accordingly. Comparison of two means for instance length of hospital stay among normal versus obese individuals within the sample or with other research report mean were carried out by simple student t-test. Analysis of variance (ANOVA) statistical model was used to test for statistical significance of more than two means for a given variable. Multivariate analysis was also employed for testing the influence of different fixed variables and covariate on dependent variables. Binary logistic regression was also used to calculate odds ratio for the influence of numerical and categorical predictors of caesarian wound complications. Pearson and Fisher's exact test Chi-square were employed for testing statistical significance for frequency distribution of categorical data such as exposure to a given antibiotic type versus wound complications. The results were statistically significant at a P value of ≤ 0.05.

4.9 Ethical clearance

The study proposal was approved by Muhimbili University of Health and Allied Science institution ethical review board. And study commenced after obtaining ethical clearance from Muhimbili University of Health and Allied Sciences Research and Publications committee. Permission to conduct the study in the hospital was sought from the director of research at Muhimbili National Hospital. Each study participant signed freely obtained informed consent form (Appendix I) before proceeding with data collection. For confidentiality purposes, each participant was assigned identity number instead of her name.

CHAPTER 5

5.0 RESULTS

During study time the total number of deliveries was 1059 at Muhimbili National Hospital. Six hundred eighteen (58.4%) out of 1059 women delivered by caesarian section. Normal deliveries were 441 (41.6%) out of 1059 deliveries. Table 1 shows socio-demographic and obstetrics characteristics of caesarian delivered mothers. The total number of participants was 242 pregnant women who delivered by Caesarian section and had received at least one dose of prophylactic antibiotics. The overall mean ± SD maternal age was 30.17 ± 5.45 years. Twenty two (9.1%) participants reported to use alcohol and none used cigarette. Two hundred and five (84.7%) women were overweight (25-30kg/m^2) or obese (>30kg/m^2). One hundred seventy seven (73.14%) participants had history of conceiving one to three pregnancies. One hundred and ninety three (79.75%) out of 242 participants had history of giving birth to a living/died fetus aged >24 gestation weeks. The mean gestation age among the 242 pregnant women delivered by caesarian section was 37.26 ± 2.22 weeks.

Table : Socio-demographic and obstetrics characteristics of caesarian delivered mothers

Variables	Number of women	Percentage	Mean ± SD
Maternal age (years)			30.17 ± 5.45
16-25	45	18.6	
26-35	150	62.0	
36-45	47	19.4	
BMI (kg/m^2)			30.42±5.65
Below normal (<18)	2	0.8	
Normal (18-25)	35	14.5	
Overweight (25-30)	81	33.5	
Obese (>30)	124	51.2	
Alcohol use	22	9.1	
Gravidity			2.67±1.38
1-3	177	73.1	
4-6	64	26.5	
>7	1	0.4	
Gestation age (weeks)			37.26 ± 2.22
<30	2	0.8	
31-36	25	10.3	
>37	215	88.8	

Mean ± SD represent the overall value for a given variable

During the study time, no woman died as the result of caesarian section; 235 babies were born alive, eight as stillbirth and four neonatal deaths were recorded. Eleven (4.55%) out of 242 women experienced wound complications. Seven (2.9%) women had wound dehiscence and 4 (1.7%) experienced dehiscence and fever.

5.2.0 Prophylactic antibiotics administration time

All 242 caesarian delivered mothers received one dose of pre-caesarian antibiotic prophylaxis followed by one or multiple doses post-caesarian. The length of operation time was (mean ± SD) 55.54±15.43 minutes. Table 2 shows the results of antibiotics administration time. The median pre-caesarian antibiotic prophylaxis administration time was 109.5 minutes. The time between pre-caesarian to the first post-caesarian antibiotic prophylaxis was 479.89 ± 120 minutes. The median administration time for first post-caesarian antibiotic prophylaxis was 230 minutes.

Table : Pre- and post-caesarian antibiotics administration time

Prophylactic antibiotics	**Administration time (minutes)**		
	Mode	**Median**	**Mean ± SD**
Pre-caesarian	60	109.5	136.15±123
First dose post-caesarian	120	230	283.74±258.36
Pre to first-post caesarian prophylaxis	360	420	479.89±120.57

SD = Standard deviation

5.3.0 Distribution of pre- and post-caesarian prophylactic antibiotics

5.3.1 Distribution of pre-caesarian antibiotic prophylaxis

Median number of pre-operative antibiotics was two. Figure 1 shows the distribution of prescribed pre-operative antibiotics. These included Ceftriaxone plus intravenous Metronidazole (89.7%), Ceftriaxone injection alone (5.4%) and intravenous Metronidazole alone (5%). The pre-

operative dose of Ceftriaxone injection was constant at a strength of 1000mg. For those who received intravenous Metronidazole, the dose was constant at a strength of 500mg.

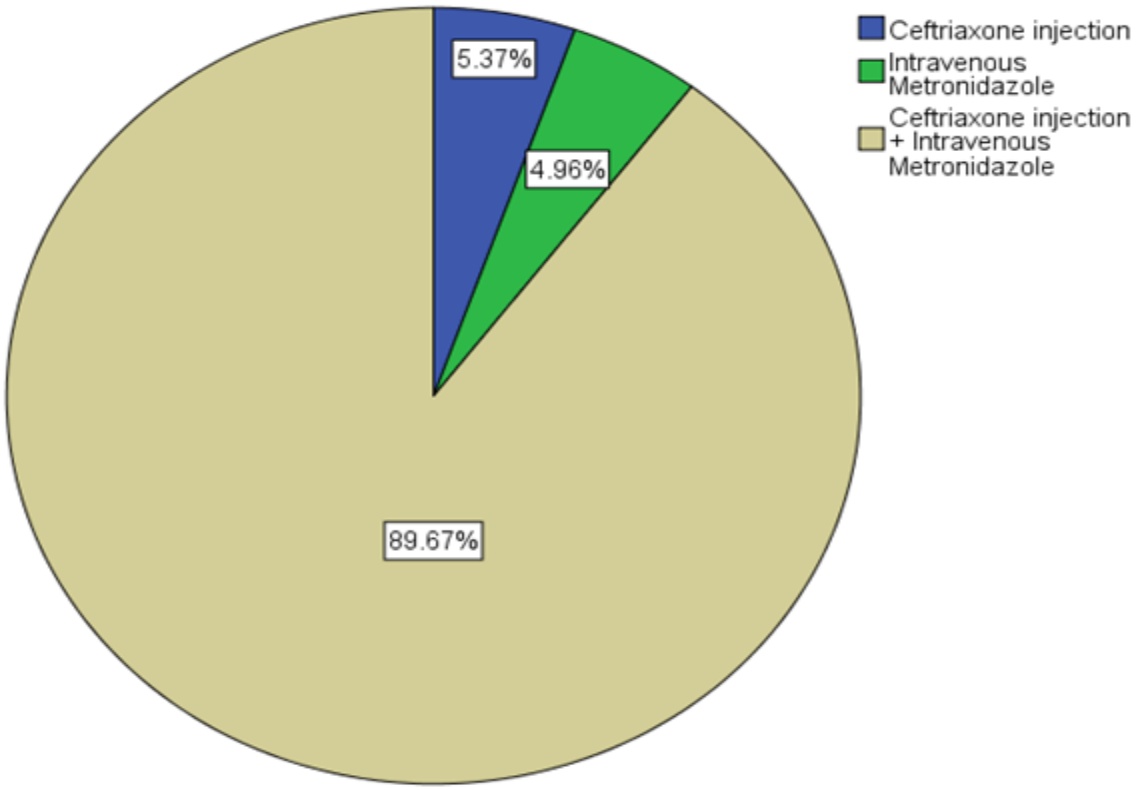


Figure : Distribution of pre-caesarian prophylactic antibiotics among caesarian delivered mothers

5.3.2 Distribution of post-caesarian antibiotic prophylaxis

The median number of post-operative antibiotics administered to caesarian delivered mothers was four. Table 3 shows the distribution of intravenous and oral post-caesarian antibiotics. These included Ceftriaxone plus intravenous Metronidazole (89.3%), Ceftriaxone alone (10.3%) and intravenous Metronidazole alone (0.4%). Post- caesarian oral antibiotics which were prescribed included Metronidazole tablets plus Amoxicillin capsules (44.2%), Amoxclav capsule (2.1%), Amoxicillin capsules (0.4%), Cephalexin capsules (0.4%) and Azithromycin tablets (0.4%).

Table : Frequency distribution of post-operative antibiotics used by caesarian delivered mothers

Prophylactic antibiotics	Number of caesarian delivered mothers	Percentage
Ceftriaxone injection + intravenous Metronidazole	216	89.3
Ceftriaxone injection	25	10.3
Intravenous Metronidazole	1	0.4
Oral antibiotics		
Metronidazole tablets + Amoxicillin capsules	107	44.2
Amoxicillin capsules	1	0.4
Amoxiclav capsules	5	2.1
Azithromycin tablets	1	0.4
Cephalexin capsules	1	0.4

5.3.3 Dose, frequency and duration of post-caesarian antibiotic prophylaxis

Table 4 shows the results of dose, frequency and duration of post-caesarian prophylactic antibiotics among study participants. Ceftriaxone injection was administered at a constant dose of 1g after every 24 hours. The dose of intravenous Metronidazole was also administered at constant strength of 500mg after every eight hours.

Table : Dose, frequency and duration of use of post-operative prophylactic antibiotics among caesarian delivered mothers

Antibiotics	Number of women	Dose in mg	Interval	Duration (days)
Ceftriaxone injection	241	1000	After every 24 hours	2.83±0.52
Metronidazole i.v	217	500	After every 8 hours	1.41±0.70
Amoxicillin capsules	108	500	After every 8 hours	5.01±0.02
Metronidazole tablets	107	400	After every 8 hours	5.02±0.19
Azithromycin tablets	1	500	After every 24 hours	3
Amoxiclav capsule	5	625	After every 12 hours	5
Cephalexin capsules	1	500	After 8 hours	5

Mean are in: Mean ± Standard deviation

5.4.0 Influence of BMI on length of hospital stay and caesarian wound complications

The overall mean ± SD length of hospital stay was 4.12 ± 1.36 days. The minimum and maximum length of hospital stay was two and ten days respectively. There was mild increase of length of hospital stay with increase in BMI. Length of hospital stay by BMI categories were; below normal 4.00 ± 0.58 days (n=2), normal 4.01 ± 0.24 days (n=35), overweight 4.25 ± 0.26 days (n=81) and obese 4.56 ± 0.55 days (n=124). However, the difference observed for hospital stay with regard to BMI is not statistically significant (p = 0.711).

Table 5 shows the influence of BMI on caesarian wound complications. Nine out of eleven caesarian wound complications grouped as dehiscence plus or minus fever were from overweight and obese women. Further analysis of chi-square using Fisher's exact test did not show statistical significant differences between BMI and wound complications among caesarian delivered mothers (p = 0.678).

Table : The influence of BMI on caesarian wound complications

BMI (kg/m^2)	**Caesarian wound outcome**			**P-value**
	Complications n (%)	**No complication n (%)**	**Total n (%)**	
BMI <25kg/m^2 (Below + Normal)	2 (5.41)	35 (94.59)	37 (100)	0.678
BMI > 25kg/m^2 (Overweight + Obese)	9 (4.39)	196 (95.61)	205 (100)	
Total	11	231	242	

5.5.0 Influence of number or type of pre-caesarian antibiotic prophylaxis on length of hospital stay and caesarian wound complications

Comparison of mean length of hospital stay based on the number of pre-operative prophylactic antibiotics showed decrease of the length of hospital stay as the number of antibiotics increased. The minimum and maximum number of antibiotics used for prophylaxis was one and two, respectively. The 95% CI of mean length of hospital stay was 4.88 ± 0.82 days (n = 25) and 4.11 ± 0.16 days (n = 217) for caesarian delivered mothers who received one and two pre-caesarian antibiotics respectively. ANOVA comparison of mean length of hospital stay for the group of women who were using one and two antibiotics showed strong statistical significance differences (p=0. 007). Therefore, women who received two antibiotics stayed for a shorter time compared to those who used one antibiotic.

Four (16%) out of 25 caesarian delivered mothers who received one prophylactic antibiotic contracted wound complications. Seven (3.23%) out of 217 caesarian delivered mothers who

received two prophylactic antibiotics contracted wound complications. Furthermore, the Fisher's exact test has shown statistically significant effects (p = 0.018) when the number of antibiotic prophylaxis is compared with wound complications. Therefore, using two different antibiotics for prophylaxis among caesarian delivered mothers reduce the chance of wound complications.

Table 6 shows the influence of the type of pre-caesarian antibiotics on mean length of hospital stay. The mean length of hospital stay were such that women who used intravenous Metronidazole stayed in the hospital for 5.67 ± 1.28 days (n = 12), Ceftriaxone 4.15 ± 0.90 days (n = 13) and Ceftriaxone plus intravenous Metronidazole 4.11 ± 0.16 days (n = 217). Overall, women using Ceftriaxone plus intravenous Metronidazole had shorter hospital stay then either of the drugs alone.

Table : Types of pre-caesarian prophylactic antibiotics versus mean length of hospital stay among caesarian delivered mothers

Type of antibiotics	Number of caesarian delivered mothers	Length of hospital stay (days)	Categorical p-value	P-value (ANOVA)
Ceftriaxone inject.	13	4.15±0.90	0.051	
I.V Metronidazole	12	5.67±1.28	0.063	0.001
Ceftriaxone inject + I.V Metronidazole	217	4.11±0.16	0.002	

Table 7 shows the influence of the type of pre-caesarian antibiotic prophylaxis on caesarian wound complications. The results are in favor of Ceftriaxone plus intravenous Metronidazole and Ceftriaxone alone. Those who receive intravenous Metronidazole alone are more likely to have caesarian wound complications. Furthermore, comparison of the type of antibiotic prophylaxis versus caesarian wound complications using Pearson chi-square test has shown strong statically significant effects (p = 0.0001).

Table : Caesarian wound complications based on type of pre-operative prophylactic antibiotics

Type/name of Pre-caesarian antibiotics	Caesarian wound complication(s)				P-value
	Dehiscence n (%)	Fever+ Dehiscence n (%)	No complication n n (%)	Total n (%)	
Ceftriaxone injection	0(0)	0(0)	13(100)	13(100)	0.0001
Intravenous Metronidazole	3(25)	1(8.33)	8(66.67)	12(100)	
Ceftriaxone injection + Intravenous Metronidazole	4(1.84)	3(1.38)	210(96.77)	217(100)	
Total	7	4	231	242	

P-value was calculated using Pearson chi-square of wound complications frequency distribution basing on type of pre-caesarian antibiotic prophylaxis

5.6.0 Effects of pre- and post-caesarian antibiotic prophylaxis administration time

5.6.1 Effects of pre-caesarian antibiotics prophylaxis administration time on length of hospital stay and wound complications

Table 8 shows the effects of pre-caesarian prophylactic antibiotics administration time on the length of hospital stay. The results show slight increase in mean length of hospital stay as the pre-caesarian prophylactic antibiotics administration time increases. However, the observed difference is not statistically significant ($p = 0.553$).

Table : Effects of pre-caesarian antibiotics administration time on mean length of hospital stay

Pre-caesarian antibiotics administration time (minutes)	Number of Caesarian delivered mothers	Length of Hospital stay (days)	Categorical p-value	Overall p-value (ANOVA)
0-30	37	3.97 ±0.37	0.40	
31-60	49	4.00 ±0.29	0.38	0.553
61-90	23	4.17±0.36	0.57	
>91	133	4.32±0.27	0.17	

Categorizing pre-caesarian antibiotics administration time as indicated in table 9 shows that, early administration time is associated with few caesarian wound complications. One out of 86 women who had pre-caesarian antibiotic prophylaxis administered between 0 and 60 minutes experienced wound complications. Ten out of 156 women who had their pre-caesarian antibiotic prophylaxis administered for >61 minutes experienced wound complications. Comparison of pre-caesarian antibiotic prophylaxis administration time versus wound complications by using Fisher's exact test showed statistically insignificant results ($p = 0.103$).

Table : Effects of pre-caesarian prophylactic antibiotics administration time on caesarian wound complications

Pre-caesarian antibiotics administration time (minutes	Caesarian wound complications			P-value
	Complications n (%)	No complication n (%)	Total n (%)	
0-60	1 (1.16)	85 (98.84)	86 (100)	0.103
>61	10 (6.41)	146 (93.59)	156 (100)	
Total	11	231	242	

5.6.2 Effects of post-caesarian antibiotic administration time on length of hospital stay and caesarian wound complications

Administration of first dose of post-operative antibiotics at 30-60 minutes resulted into reduced days spent in hospital after caesarian section. Further analysis using ANOVA test to compare mean length of hospital stay versus first post-caesarian antibiotic prophylaxis administration time has shown statistical significant effects ($p = 0.01$).

Table 10 shows the effects of post-caesarian antibiotic prophylaxis administration time on wound complications. There was no caesarian wound complication reported from a group of women who received first post-caesarian antibiotic prophylaxis between 0 to 60 minutes. Eleven ceases of wound complications were recorded from the group of caesarian delivered mothers who received first post-caesarian antibiotic prophylaxis >61 minutes. However, comparison of first post-caesarian antibiotic prophylaxis administration time versus wound complications by using Fisher's exact test showed no statistical significant effects ($p = 0.61$).

Table : Effects of post-caesarian first dose prophylactic antibiotics administration time on caesarian wounds complications

First post-caesarian antibiotics administration time (minutes)	Caesarian wound complications			P-value
	Complications n (%)	No complication n (%)	Total n (%)	
0-60	0 (0.00)	25 (100)	25 (100)	0.61
>61	11 (5.07)	206 (94.93)	217 (100)	
Total	11	231	242	

5.7.0 Influence of duration of post-caesarian antibiotics prophylaxis on length of hospital stay

Table 11 shows the effects of duration of time on which caesarian delivered mothers were on Ceftriaxone injections or intravenous Metronidazole. Duration of time caesarian delivered mothers were kept on Ceftriaxone injection has statistical significant effects on mean length of hospital stay ($p = 0.021$). It was also observed that the first and second dose of Ceftriaxone injections were associated with short length of hospital stays. The effects of duration of days caesarian delivered mothers were on intravenous Metronidazole was not statistically significant ($p=0.302$).

Table : Effects of duration of days on post-caesarian Ceftriaxone injection and intravenous Metronidazole to mean length of hospital stays among caesarian delivered mothers

Duration on Ceftriaxone injection (Day (s))	Number of caesarian delivered mothers	Length of hospital stay (days)	Categorical p-value	P-value
1	3	3.33±0.65	0.821	
2	43	3.60±0.23	0.058	
3	190	4.34±0.21	0.019	0.021
4	1	4	NA	
5	4	4	NA	
Duration on intravenous Metronidazole (Day(s))				
1	155	4.32±0.23	0.251	
2	34	3.91±0.25	0.293	0.302
3	27	4.33±0.55	0.372	

NA=Not Applicable

Also, there was no statistically significant effects (p = 0.77) a given type of oral antibiotics prescribed had on mean length of hospital stay. Furthermore, analysis has shown a lack of influence (p = 0.21) of number of post-operative antibiotics administered on the mean length of hospital stay.

5.8.0 Effects of type of caesarian section and of incision on length of hospital stay and wound complications

5.8.1 Effects of type of caesarian section on length of hospital stay and wound complications

There were only two types of caesarian section i.e. emergency and elective. One hundred seventy three (71.49%) out 242 participants delivered by emergency caesarian section and the rest (28.51%) by elective. Elective caesarian had lower mean length of hospital stay at 95% CI of 4.03 ± 0.37days (n = 69) compared to 4.25 ± 0.19 days (n = 173) among emergency caesarian. Despite the observed difference on length of hospital stay between the two groups, results shows no statistical significant basing on independent sample t-test (p = 0.26).

Four (5.08%) out of 69 elective caesarian delivered mothers contracted wound complications. Seven (4.05%) out of 173 emergency caesarian delivered mothers had wound complications. However, the difference observed for frequency distribution of wound complications with regard to type of caesarian section is not statistically significant (p = 0.514) as calculated using Fisher's exact test chi-square .

5.8.1 Effects of type of caesarian incision techniques on length of hospital stay and wound complications

One hundred sixty three (67.36%) out of 242 pregnant women delivered by subumbilical midline incision (SUMI) and (32.6%) by Pfannenstiel incision. The length of hospital stay was slightly higher in the group of mothers delivered by using SUMI incision technique i.e. 4.27 ± 0.20 days (n = 163) compared to 4.01 ± 0.32 days (n = 79) among those delivered using Pfannenstiel technique. However, when mean length of hospital stay for SUMI and Pfannenstiel caesarian techniques were compared using independent sample t-test result was not statistically significant (p = 0.17).

Prevalence of caesarian wound complications was high (5.52%) among women who delivered by SUMI technique compared to (2.53%) of those who delivered using Pfannenstiel technique. However, Fisher's exact test shown that, the type of incision technique had no influence on frequency distribution of caesarian wound complications (p = 0.511).

5.9.0 The Influence of post-caesarian Hb levels on length of hospital stay and wound complications

The overall mean ± (1.96SE) hemoglobin concentration was 10.92±0.19 g/dL (n = 233). The distribution of Hb levels among the 233 caesarian delivered mothers was such that; (53.3%) normal (11-16g/dL), (35.1%) mild anemia (9-10.9g/dL), (6.6%) moderate anemia (7-9g/dL) and (1.2%) severe anemia (<7g/dL). Table 12 shows the effects of post-caesarian hemoglobin (Hb) concentration on mean length of hospital stays. The mean length of hospital stay increase as Hb levels decrease. The observed difference is statistically significant (p = 0.04) based on ANOVA comparison of all post-caesarian Hb's categories mean length of hospital stay.

Table : Effects of post-caesarian Hb concentration on mean length of hospital stay

Hemoglobin category	Number of caesarian delivered mothers	Length of hospital stay (days)	Categorical p-value	P-value (ANOVA)
Normal (11-16g/dL)	129	4.18±0.23	0.025	
Mild anemia (9-10-9g/dL)	85	4.20±0.28	0.048	0.04
Moderate anemia(7-9g/dL)	16	4.88±0.96	0.053	
Severe anemia(<7g/dL)	3	5.67±1.31	0.071	

Two (1.55%) out of 129 caesarian delivered mothers who had normal Hb levels contracted caesarian wound complications. Nine (8.65%) out of 104 caesarian delivered mothers who had mild or severe anemia contracted wound complications. The observed difference is statistically significant based on Fisher's exact test chi-square results p=0.013.Therefore there is potential association between Hemoglobin concentration and caesarian wound complications.

5.10.0 Binary logistic regression

Categorical predictors of caesarian wound complications with p value <0.2 were further subjected into binary logistic regression to calculate the odds ratio. Number of pre-caesarian antibiotics and post-caesarian Hb levels qualified for binary logistic regression. The odd ratio (OR (95% CI)) for caesarian wound complications among those who received one (either intravenous Metronidazole or Ceftriaxone injection alone) pre-caesarian antibiotic prophylaxis versus two (Ceftriaxone injection plus intravenous Metronidazole combination) was 2.50 (0.24, 25.57). Therefore, the risk of contracting wound complications was 2.5 times among the group of caesarian delivered mothers who received one prophylactic antibiotic. The odds ratio (95% CI) for caesarian wound complications between caesarian delivered mothers with normal Hb levels (11.0-16 g/dL) and those who were anemic (Hb< 10.9 g/dL) was 0.006 (0.0001-0.019). Therefore, normal Hb levels had strong protective effects against caesarian wound complications.

Table : Number of pre-caesarian antibiotic prophylaxis and post-caesarian Hb levels versus caesarian wound complications; binary logistic regression

Predictor Variable	**Dependent variable**		**OR (95%CI)**
	Caesarian wound complication	No complications	
Number of pre-caesarian antibiotics			
1	4	21	2.50 (0.24, 25.57)
2	7	210	
Hb levels			
Normal (11-16g/dL)	2	127	0.006 (0.0001-0.019)
Anemic (<10.9g/dL)	9	95	

5.11.0 Multivariate analysis

Numerical variables with p<0.2 were further subjected to multivariate analysis to **control** confounding factors. Number and type of pre-caesarian antibiotic prophylaxis, administration time of post-caesarian prophylactic antibiotics, duration on post-caesarian Ceftriaxone injection and post-caesarian Hb levels were the independent variables potential for MANOVA. The dependent variables were length of hospital stays and number of caesarian wound care. Number of pre-caesarian antibiotic prophylaxis has shown no influence on the length of hospital stay (p = 0.08). Type of pre-caesarian prophylactic antibiotics had significant effects on mean length of hospital stay (p = 0.014). Post-caesarian antibiotic prophylaxis administration time had strong

statistical effects (p = 0.024). Duration on post-caesarian Ceftriaxone had no influence on length of hospital stay (p = 0.42). Post-caesarian Hb levels had significant effects on length of hospital stay (p = 0.038). Therefore, type of pre-caesarian antibiotic prophylaxis, administration time of post-caesarian first dose of prophylactic antibiotic and post-caesarian Hb levels are the important predictors of length of hospital stay among the caesarian delivered mothers.

CHAPTER 6

6.0 DISCUSSION

The overall caesarian wound complications cases observed in this study were 11 (4.55%) out of 242 participants. This low prevalence of wound complications might be attributed by adherence to caesarian section infection prevention measures including use of prophylactic antibiotics (Smail and Gillian, 2010). The observed rate of caesarian wound complications was similar to 4.5% which was reported in a randomized controlled clinical trial involving 175 study arm of caesarian delivered mothers who received antibiotic prophylaxis (Sullivan et al, 2007). Similar findings (7.53%) of the prevalence of caesarian wound complications were reported by Smaill and Gillian (2010). Furthermore, the current prevalence is lower than 9.1% of complications reported by Jido and Garba (2012) after conducting a study on surgical site infections following caesarian section in Kano, Nigeria.

In this study, the overall length of hospital stay was 4.19±0.17 days. Discharge depended on caesarian wound prognosis. Basing on Fink, this length of time is sufficient enough to diagnose number of complications arising from caesarian and initiate prompt treatment which tend to reduce rate of readmission after caesarian (Fink, 2011). Such length of hospital stay has an added advantage in our setup since majority of wound dehiscence and fever occurred within this interval and enabled rational management to be instituted to the 11 cases of the observed wound complications. The mean length of hospital stay in this study is also similar to the four days which was reported by Attia and Shakila (2010) after they studied 65 caesarian delivery mothers at maternal and child clinic in Islamabad, Pakistan. It is also similar to mean length of hospital stay of 96 hours reported by Fink (2011) in a contemporary review as a legally accepted length of hospital stay in USA for caesarian delivered mothers.

In this study BMI has been found to insignificantly influence the length of hospital stay, although the distribution of mean length of hospital stays increased as BMI increased. These results are contrary to those published by Schneid and colleagues (2005) who studied risk factors towards caesarian wound complications and prolongation of hospital stay. In that study, obesity was a strong independent predictor of caesarian prognosis. Several explanations might exist for this contradiction. Our study was a prospective follow-up study while the study design for Schneid et al was a retrospective study. Therefore observation versus recorded information used in the two studies may explain this difference with regard to information biasness. In addition, the sample

size of 242 caesarian in our study is relatively small compared to 19,416 caesarian delivered mothers who were studied by Schneid and colleagues (2005). With such large sample size, Schneid and colleagues were able to get sufficient numbers for each category of BMI for comparison purposes.

A combination of Ceftriaxone and Metronidazole was the predominant prophylactic antibiotics used in this study. Mean interval from pre-operative to the first post-caesarian administration time was eight hours. Both antibiotics have fair pharmacokinetic profile. For instance, Ceftriaxone has long half-life of 5.8-8.7 hours, a fair penetration of body tissues as well as a 24 hours serum concentration exceeding bactericidal concentration for common bacteria (Nau et al, 2010; Bhattacharjee et al, 2013). Such interval of the first two doses (pre- and first post-caesarian dose) observed in our study is equivalent to administration of 2g of Ceftriaxone in divided doses at an interval of eight hours apart. Vanessa and Andrew (2012) have also emphasized the use of combination of highly penetrating, long acting and broad spectrum prophylactic antibiotics at fair dose increment for obese caesarian delivery mothers.

As observed in this study, the use of a combination of Ceftriaxone injection and intravenous Metronidazole was predominant. Caesarian delivered mothers who received the combination therapy had shorter length of hospital stays than those who were administered either of the drugs alone. The findings are supported by the study conducted by Nwankwo and Shuaibu (2013) on 206 bacteriology cultures from post-caesarian wound infections and antibiotics sensitivity results reported favorable results for a combination of Ceftriaxone and Metronidazole. Similarly, a randomized controlled clinical trial which involved 953 caesarian delivered mothers on antibiotic prophylaxis recommended Ceftriaxone as a superior antibiotic in this group of women (Bhattacharjee et al, 2013).

The distribution of type and number of pre-or post-caesarian antibiotic prophylaxis observed in this study was far different from common type of antibiotics used in the United Kingdom (Wloch et al, 2012). In Wloch et al, (2012) review paper, 9 out of 14 hospitals mostly used Amoxclav as the first choice, while 4 hospital out of 14 predominately used Cefuroxime (2^{nd} generation cephalosporin) and one hospital preferred Cefradine (1^{rst} generation cephalosporin). Other several review works have also failed to generate reliable information regarding a standardized antibiotic prophylaxis for caesarian section delivered mothers (Vanessa and Andrew, 2012;

Smail and Gillian, 2010). Unless proved necessary, the increased use of the third generation Cephalosporins like Ceftriaxone instead of the first generation for prophylaxis is likely to result to resistant bacteria species (Mark et al, 2015).

In this study, duration on post-caesarian antibiotic prophylaxis had no influence on the length of hospital stay. The observed practice of administering pre-caesarian 1g Ceftriaxone injection with or without 500mg intravenous Metronidazole followed by second dose (first post-caesarian) after about 8 ± 2 hours is adequate to prevent anticipated complications and shorten length of hospital stay. Moreover, extension of prophylaxis with oral antibiotics as a common practice had no influence on mean length of hospital stay in this study. A randomized controlled trial to assess the beneficial effects of multiple versus single antibiotics prophylactic doses was conducted in Bugando hospital, Mwanza Tanzania (Fadhil et al, 2013). In that study, Gentamycin (3mg/kg) combined with 500mg intravenous Metronidazole were administered as multiple doses and single doses pre-operatively. The length of hospital stay was the same for the two groups, indicating unnecessary use of multiple doses for prophylactic purposes in caesarian delivered mothers.

In this study, pre- and first post-caesarian doses administration time modes were within the recommended interval as per US and EU guidelines for surgical prophylactic antibiotics (Dellinger, 2007). The US guideline recommends administration within 120 minutes pre/post incision while EU recommends 30 minutes pre/post incision. Pre-caesarian administration time had no statistical significant influence on mean length of hospital stay. On the other hand, post-caesarian administration time had strong influence on mean length of hospital stay. In addition, administration time had no influence on wound complications. With regard to caesarian wound complications the results of this study are similar to those reported by Thigpen and colleagues (2005). In the later study, assessment of the caesarian wound outcome based on timing of prophylactic antibiotics prophylaxis did not find an association between prophylactic administration times with caesarian wound complications. However, a randomized control study conducted by Sullivan et al, (2007) reported significant reductions in overall caesarian wound complications for women who received prophylactic antibiotics at 15-60 minutes. In that study, the authors did not generalize specific time but rather emphasized approximation of time based on pharmacokinetics of Cefazolin which was used in that study.

Although the results were not statistically significant, the mean length of hospital stay and wound complications were much lower in Pfannensteil incision compared to SUMI group. This observation is supported by the fact that Pfannensteil incision results into lower blood loss during operation, few wound complications, shorter length of hospital stay and cosmetically amenable to caesarian delivered mothers (Wylie et al, 2010). Also unlike SUMI, post-operative pains as well as prevalence of wound dehiscence and hematoma are lower when Pfannensteil is applied to obese parturient (Alexander and Liston, 2006). A study conducted by Mark et al, (2010) reported a significant association between the mean length of hospital stay and wound complications. In that study, 194 massively obese parturient were studied and reported lower wound complications as well as significantly lower mean length of hospital stays for women who had delivered by Pfannenstiel compared to subumbilical midline incision. Retrospective study design, small sample size, predominance of high risk morbidly obese (BMI $\geq$50kg/m^2) parturient and failure to document the prophylactic antibiotics used are some of the drawbacks to Mark et al (2010) study. Moreover, a prospective study conducted by Wylie et al, (2010) and a review article published by Alexander & Liston, (2006) also reported statistically significant results in favor of Pfannensteil.

In this study, level of hemoglobin (Hb) concentration had an influence to the mean length of hospital stay as well as caesarian wound complications. Wound healing process involves hemostasis, inflammation, proliferation and remodeling. For the four phases to take place at required sequence, specific time and duration blood oxygen partial pressure should be maintained at higher level (Guo and DiPietro, 2010). The aforementioned reasons explain why anemic participants where burdened with caesarian wound complications and prolonged hospital stays. These findings are in agreement with those from a retrospective study by Schneid et al, (2005) in data extracted from 19,416 caesarian delivered mothers indicated that, Hb concentration is a strong independent factor affecting wound complications and mean length of hospital stay.

In this study participants were selected using convenient sampling method posing a risk of selection bias. Also, the study was conducted in the National Hospital and many participants were from Dar es Salaam metropolitan area. Therefore, these results cannot be generalized to rural areas. Fair sample size, consistent data collection and stratification for some selected

variables like BMI, type of caesarian section incision as well as Hb levels were applied to minimize confounding factors. Moreover, the use of multivariate analysis eliminated confounding factors that may have influenced the findings.

CHAPTER 7

7.0 CONCLUSION AND RECOMMENDATIONS

7.1 CONCLUSION

Mean length of hospital stay as well as caesarian wound complications are significantly influenced by type of antibiotics prophylaxis, administration time of second (first dose post-caesarian) dose of antibiotic prophylaxis and hemoglobin levels. The combinations of Ceftriaxone injection and intravenous Metronidazole results into the lowest mean length of hospital stay and pronounced reduction of caesarian wound complications compared to either of the drugs administered alone. Administration of second (first dose post-caesarian) dose antibiotic prophylaxis within 120 minutes provide favorable results with regard to length of hospital stays. Normal hemoglobin concentration augments caesarian wound healing among recipients of prophylactic antibiotics resulting into shortened length of hospital stay and reduced wound complications.

Pre-caesarian antibiotics administration time, duration on post-caesarian antibiotic prophylaxis, BMI, type of caesarian section or incision appear not to influence length of hospital stay as well as prevalence of caesarian wound complications.

7.2 RECOMMENDATIONS

From the study findings it is recommended that; Ceftriaxone injection with intravenous Metronidazole should continue to be used as prophylactic antibiotics of choice for empirical use. Since extended duration of antibiotic prophylaxis had no added advantage, it is recommended that one day course of Ceftriaxone injection 2g (two dived doses) with or without intravenous Metronidazole 1000mg (two divided doses) should be used for prophylaxis. To augment effects of prophylactic antibiotics, early management of anemia should continue to be part of regular care among caesarian delivered mothers. For establishment of strong evidence further research designed with fairly large sample size or as a randomized controlled clinical trial should be conducted to compare prophylactic antibiotics effectiveness based on type, dose and duration among diverse groups of caesarian delivered mothers.

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9.0 APPENDIX I: CONSENT FORM

9.1 CONSENT FORM (ENGLISH VERSION)

INFORMED CONSENT FORM

ID NO | | | |

Consent to participate in the study entitled:

PRE-& POST-OPERATIVE ANTIBIOTICS PROPHYLAXIS: CAESARIAN SECTION WOUND AND FACTORS AFFECTING DURATION OF TIME TO DISCHARGE

Background: Caesarian section delivery rate keep on increasing in different part globally. Antibiotics prophylaxes have reduced the rate of caesarian section surgical site infection and other complications tremendously. Despite such advancement, duration of time spent in hospital varies and is said to be long among the caesarian delivery mothers. Therefore understanding the factors which influence the variation of time spent in hospital after caesarian section is of paramount importance.

What participation involves:

1. We will not give any additional drug
2. Your file will be review
3. You will be attended to provide some information via interview at some points during the time you are admitted in the hospital until you're discharged.

Confidentiality:

Only number will be used for participant identification purpose. All information obtained from you will be handled in confidential manner and access will only be to the study investigators.

Risk expected:

Other than minor pain expected during measurement of blood glucose level using glucometer at fingertip no anticipated harm or danger which will arise by participating in this study. In case of harm directly associated with participation in the study, contact: +255688445680/+255758890196, Mr. Hamu Joseph Mlyuka, Mpharm Clinical and Hospital pharmacy at Muhimbili University of Health and Allied Sciences, P.O.Box 65013 School of Pharmacy. You can also contact the supervisor of this research Professor Appolinary Kamuhabwa from Muhimbili University of Health and Allied Sciences (Mobile phone:+255 755 576 985).

Your rights:

You are free to agree or refuse to participate in this study.

Benefits:

By participating in this study you're fostering scientific knowledge which may be useful during periodical revision of health policy and practice.

Whom to contact:

If you have questions about this study, you should contact the Director of Research and Publications Muhimbili University of Health and Allied Sciences, Professor **Said Aboud**, P.O.Box 65001, Dar es Salaam. Phone number: 2150302-6

I…….confirm that, I have read and understood the contents of this form. My questions have been answered. I agree to participate in this study.

Signature of the participant……Date……..

Name of the participant:……

9.2 CONSENT FORM (KISWAHILI VERSION)

FOMU YA MAELEZO KUHUSU UTAFITI:

NAMBA YA UTAMBULISHO: ☐☐☐

Fomu ya utafiti wenye kichwa cha habari:

DAWA YA KINGA JAMII YA VIUA VIJASUMU KABLA NA BAADA: KIDONDA CHA OPARESHENI YA KUJIFUNGUA MTOTO NA MAMBO YANAYO ATHIRI MUDA WA KUKAA WODINI MPAKA KURUHUSIWA

Utangulizi: Miaka ya karibuni imeshuhudia ongezeko la idadi ya wanawake wanaojifungua mtoto/watoto kwa njia ya upasuaji/oparesheni katika maeneo mengi duniani. Kinga ya magonjwa yatokanayo na vijasumu (bacteria/bakteria) kwa kutumia dawa jamii ya viuavijasumu (antibiotics) zimesaidia kupunguza kwa kiasi kikubwa athari zitokanazo na kidonda cha upasuaji. Pamoja na maendeleo haya, akina mama wajifunguao kwa upasuaji hutumia muda tofauti tofauti na mrefu kukaa hospitalini mpaka kuruhusiwa. Hivyo basi, kufahamu mambo yanayo chochea utofauti wa muda wautumiao hospitalini akina mama waliojifungua kwa upasuaji ili hali wamepewa dawa za viuavijasumu ni jambo la muhimu.

Ushirikiuna mambo yapi:

1. Hautaongezewa dawa yoyote.
2. Faili lako litachunguzwa kupata baadhi ya taarifa.
3. Utatembelewa baadhi ya nyakati uwapo hospitalini ili kushiriki mazungumzo ya uombaji wa taarifa ya maendeleo. Kikomo cha kutembelewa ni baada ya kuruhusiwa kutoka hospitalini.

Usiri:

Utambulisho wako utakuwa kwa namba kuongeza usiri. Pia maelezo yeyote yatakayo chukuliwa yatawekwa siri na kutunzwa na mtafititi.

Matarajio ya hatari:

Zaidi ya maumivu kiasi kidogo unapo pima kiasi cha sukari kwenye mwili kupitia damu kiasi kidogo kwenye kingo ya kidole hakuna madhara yanayo tarajiwa kutokana na ushiriki katika utafiti huu. Ikiwa utapata madhara ya moja kwa moja kuhusishwa na utafiti huu usisite kuwasiliana na bwana Hamu Joseph Mlyuka, P.O.BOX 65013 Shule ya Famasia, Chuo Kikuu cha Afyana na Sayansi Shirikishi Muhimbili. Simu ya kiganjani: +255688445680 au +255758890196. Pia waweza wasiliana na msimamizi wa utafiti huu mhadhiri Profesa Appolinary Kamuhabwa kutoka Chuo Kikuu cha Afyana na Sayansi Shirikishi Muhimbili, Dar es Salaam (Simu ya kiganjani: +255 755 576 985).

Haki yako:

Una haki na uhuru wa kuamua kushiriki au kuto kushiriki katika utafiti huu.

Faida:

Kwa kushiriki katika utafiti huu unasaidia kuongeza uelewa wa kisayansi juu ya mambo ya afya. Uelewa huo waweza saidia katika kuongeza ufanisi nyakati za marekebisho ya sera na utendaji wa mambo yahusuyo afya.

Nani wa kuwasiliana naye:

Ikiwa una swali lolote juu ya utafiti huu, wasiliana na Mkurugenzi wa Tafiti chuo cha Afya na Sayansi shirikishi Muhimbili, Profesa **Said Aboud**, P.O.Box 65001 Dar es Salaam. Simu ya mezani: 2150302-6

Mimi……nathibitisha kuwa nimesoma maelezo yote katika fomu hii na kuyaelewa. Maswali yangu yame jibiwa. Naafiki kushiriki katika utafiti huu.

Sahihi ya mshiriki……..Tarehe…….

Jina kamili la mshiriki:…….

10.0 APPENDIX II CASE REPORT FORM

PRE-& POST-OPERATIVE ANTIBIOTICS PROPHYLAXIS: CAESARIAN SECTION WOUND AND FACTORS AFFECTING DURATION OF TIME TO DISCHARGE

PARTICIPANT'S ID No. ☐☐☐

INSTRUCTION:

- This case report form should be filled by authorized personnel only
- It comprise four sections:
  - Social Demographic information
  - Medical history
  - Medication history
  - Laboratory results
- Every part should be filled accordingly
  - Mark of √ should be applied where it is acceptable
  - Put **NA** for 'Not Applicable'
  - Put **NIL** where data are missing
  - Date should be filled in uniform format i.e. day/month/year
  - Draw oblique line across the space which is completely not filled
  - Units for different parameters should be filled accordingly
  - Complete filled form should be signed by authorized personnel only(here in being the investigator)

INCLUSION CRITERIA	**YES**	**NO**
Received antibiotics prophylaxis pre- or post-operative		
EXCLUSION CRITERIA		
Critically ill patients		
History of diabetic mellitus		
Under regular conventional antibiotics treatment prior to caesarian section		

NB: For participant to be eligible; INLCUSION criteria should be **YES** and all EXCLUSION criteria should be **NO**

1. SOCIO-DEMOGRAPHIC INFORMATION

Age
Date of birth ……/…../…… Age ☐ years
Body mass index (BMI)
Body weight ☐ kg Body height ☐ meters Calculated BMI……kg/m^2 Category: Below Normal (<18.5kg/m^2) ☐ Normal (18.5-25kg/m^2) ☐ Overweight (25-30 kg/m^2) ☐ Obese >30 kg/m^2 ☐ Weight gain during pregnancy (Weight at full term-weight before) document if available…….. BMI before pregnancy(document if available)…….kg/m^2
Marital status
Married ☐ Single ☐ Divorced ☐ Widowed ☐
Occupation status
Unemployed ☐ Employed ☐ If YES writes the type of employment e.g. Mkulima/Mfanyabiashara/Ameajiliwa/Amejiajili …… Housewife ☐
Alcohol consumption
YES ☐ NO ☐ From…….to…….. Approximate amount…… (glass/day) or …….. (beer/day) Others(Explain)……
Cigarette smoking
YES ☐ NO ☐ From…….to……. Approximate amounts……..(packs/day) Others (Explain)……

2. MEDICAL HISTORY

2.1 General medical history

S/N	Medical condition e.g. Preeclamsia, Malaria e.t.c	From	To	Duration (month)	Status	
					Recovered	**Not recovered**
1						
2						

2.2 Obstetrics history

GRAVIDA	PARA	LIVING
Previous caesarian section scar (e.g. 1 or 2 e.t.c)……		

2.3 FOR CURRENT CAESARIAN SECTION SURGERY

Gestation age ☐ weeks
Date of caesarian section……/……/……
Type of caesarian section Elective ☐ Emergency ☐ Others (explain below) …… Reason for caesarian section…… ……..
Pre-operative skin antiseptic agent used (e.g. Povidone or chlorhexidine)**.....** …….
Type of incision (e.g. Subumbilical Midline *Incision (SUMI) incision or Lower segment caesarian section(LSCS) etc)* ……

Lower transverse incision ☐ Vertical incision ☐

Size of the incision (length only)……..cm

Material used to close the CS incision (e.g. surgical suture or staple)……

Type/name of surgical suture (e.g. catgut or polyfilament etc)……

Surgical incision closure techniques (e.g.1. Uterus closed in layers. 2.Abdomen closed in layers)……

Maternal and Birth outcome after immediately after CS

1. Maternal outcome (e.g. Fair or Good)……
2. Birth outcome (e.g. live or stillbirth)……..

Caesarian section wound care

DATE e.g. 18/03/2016	CS WOUND CARE e.g. dressing and material used such as gauze,bandage, honey or flagyl or povidone	PROGRESS e.g. wound site clean & dry

Caesarian section wound related complication(s)

Complication	Date	Management	Outcome	Date
Fever				
Dehiscence				
Septicemia				

Other(s):…….....
.....
.....
.....

Overall outcome…….

Discharge date……../……./……..

Obstetrician's/clinician recommendation on discharge summary……

……
Overall time spent in hospital basing on caesarian wound related health care…….

KEY: CS=caesarian section

3. MEDICATION HISTORY

a. PAST MEDICATION HISTORY e.g. before/during antenatal care or referral transfer (if documented)

Generic/brand name	Dose and Frequency	Reason for indication	From	To

b. PRE-OPERATIVE MIDICATION ADMINISTERED

Date	Generic/brand name	Dose & frequency	Reason for medication	Time of administration	Time(hour) to C/S surgery	Time difference (TC/S-TDA)	Time(hour) of completion of C/S

3.3 POST-OPERATIVE MEDICATION ADMINISTERED

Date	Generic/brand name	Dose & frequency	Reason for medication	Time(hour) of administration	Time difference (TPODA-TCC/S)

NB: Medication with multiple doses must be entered once e.g. 20/03/2016;Ceftriaxone 1g OD 3/7 you don't need to repeat entering Ceftriaxone on 21^{rst} up to 22nd since it is obvious that 3 days are covered from 20-22/03/2016. But in case Ceftriaxone will be prescribed again on 23rd March, 2016 then it must be entered again as a new entity. Same drug with different formulation should be entered as separate entity.

KEY: TC/S=Time to attend operation theatre for C/S; TDA=Time of pre-operative drug administration; TPODA=Time of post-operative drug administration; TCC/S=Time of completion of C/S

4.0 LABORATORY RESULTS

4.1 Pre-operative lab results

DATE	**TEST**	**NORMAL**	**RESULTS**	**INTERPRETATION**
…../…./…..	Hb level			
	Urea level			
	Glucose level			
	Bilirubin			
Others (Mention below) …….				

4.2 Post-operative

DATE	TEST	NORMAL	RESULTS	INTERPRETATION
…../…./…..	Hb level			
	Urea level			
	Glucose level			
	Bilirubin			
Others (Mention below) ……				