MEDWIN PUBLISHERS
Committed to create value for Researchers

Open Access Journal of Gynecology
ISSN: 2474-9230

Emergency Caesarean Sections: Decision to Delivery Interval and Obstetric outcomes in Nsambya Hospital, Uganda-A Cross Sectional Study

Eleanor Nakintu[1] and Daniel Murokora[2]*

[1]Master of Medicine (Obstetrics and Gynecology), Mother Kevin Postgraduate Medical School, Uganda

[2]Master of Medicine (Obstetrics and Gynecology), Uganda Women's Health Initiative, Uganda

Research Article

Volume 1 Issue 4

Received Date: October 16, 2016

Published Date: November 21, 2016

***Corresponding author:** Daniel Murokora, Master of Medicine (Obstetrics and Gynaecology), Uganda Women's Health Initiative, P.O. Box 32275, Kampala, Uganda, Tel: +256 772 501 700; E-mail: murokora@gmail.com

Abstract

Background: Lack of hospital preparedness to perform an emergency cesarean section (EmCS) contributes to maternal morbidity and mortality. Pregnancy outcomes are affected by the Decision to Delivery interval (DDI) yet this time and its effect had not been known in St. Francis hospital Nsambya especially, whether we achieve the 30 minutes' interval that is globally advocated for.

Objective: This study aimed to determine the average DDI, its variations with the indications for Emergency cesarean sections and how it affects the maternal and fetal outcomes among women delivering in St. Francis hospital Nsambya.

Methods: This was a cross-sectional study implemented between September and December 2015 at St. Francis Hospital Nsambya's postnatal ward. The study population comprised 297 women, consecutively selected, having undergone EmCS. Eligible women were consented and interviewed on either the second or third post-operative day. Their medical records were reviewed and data collected using a structured questionnaire. The DDI was recorded, including time of arrival in theatre and time of anesthesia. Maternal and newborn outcomes were recorded. Double data entry into Epi data software was done, cleaned and exported to stata for analysis. Bivariate and multinomial regression analyses were applied to control for probable confounders.

Results: The average DDI was 92 minutes (SD±44.2) The average time from decision to arrival in theatre was 30minutes and from arrival in theatre to anesthesia was 31 minutes. Only 0.7% of participants had a DDI within 30 minutes. The more urgent the indication, the shorter was the DDI. (P = 0.028). The DDI had no significant effect on the maternal outcome, however prolonged stay in theatre was associated with adverse maternal outcome (P = 0.004). 43.4% of babies had an adverse outcome but this had no association with DDI. One still birth had a DDI above 60 minutes. The day-time CS were associated with longer DDI than night time CS but this was not statistically significant. There was no maternal or fetal adverse outcome in mothers who's DDI was within 30minutes.

Conclusion: The average DDI for EmCS in Nsambya hospital is 91.89 minutes. This DDI did not significantly affect the outcome of the mother and the baby. A DDI of 30 minutes is not an absolute threshold for influencing obstetric outcome. Delays in theatre were associated with significant maternal morbidity.

Introduction

Emergency cesarean section (EmCS) is a lifesaving intervention to both the mother and her unborn baby. When the health facility is not ready to perform an EmCS in the desired time, morbidity and mortality of the mother and the baby will occur. Each day, around 1,500 women die from complications related to pregnancy and childbirth, most of them in sub-Saharan Africa and South Asia [1]. The proportion of mothers who do not survive childbirth in developing countries is 14 times higher than in the developed world as estimated by the United Nations [2] Furthermore, millions of women who survive childbirth suffer from pregnancy related infections and disabilities, often with lifelong consequences [1].

The Maternal Mortality Ratio (MMR) and perinatal mortality rate in Uganda have generally had a slow reduction over the last three decades. The MMR has followed a trend of 505, 435 and 438 per 100,000 live births, as reported by the Uganda Demographic Health Survey (UDHS) for the years 2000/2001, 2006 and 2011 respectively. Similarly the perinatal mortality rate of 43, 36 and 40 for the same years has been reported [3]. Notably, the final report on MDGs in Uganda showed that the target reduction in MMR was not achieved. The WHO also confirmed this by concluding that Uganda made insufficient progress towards meeting the MDG target of 131 maternal deaths per 100,000 live births [4].

Various health system factors contribute to this slow reduction. These include poor infrastructure or non-functional Comprehensive Emergency Obstetric and Newborn Care (CEmONC) units, the lack of essential maternal medical supplies like safe blood and human resource challenges especially the lack of skilled birth attendants. Proper functioning of the health centre therefore is a critical factor in reducing the life-threatening delays and the subsequent prevention of maternal morbidity and death. The lack of readiness by health facilities to perform an EmCS once a decision has been made contributes to severe morbidity and mortality to the mother and baby [1,5]. Poor hospital infrastructure can delay access to treatment in emergency situations. According to Orji in a similar study that involved several maternity centers in Nigeria, he concluded that the major factor causing delay to operation is theatre-related and therefore recommended an obstetric operating theatre within the labor ward [6].

In 2014/2015, the caesarean section rate for Nsambya hospital was 31%, seventy percent of which were emergency deliveries [7]. Some of the main indications for EmCS include a non-reassuring fetal heart, obstructed labor, and delay in second stage, antepartum hemorrhage, severe preeclampsia and eclampsia. Hospital delays have to be reduced to a minimum level through making a guiding protocol on decision to delivery interval for obstetric emergencies. This can be done by first observing the current DDI and associated obstetric outcomes. This study aimed to find out what the average DDI was, its effect on maternal and newborn outcomes in Nsambya hospital.

Overview of Emergency Cesarean Section

An emergency cesarean delivery is performed to immediately improve maternal or fetal outcomes for various indications. It is performed in situations, which are life-threatening to the mother and /or the unborn baby.

Compared with scheduled surgery, an emergency cesarean is associated with increased risks of severe hemorrhage, anesthetic complications from rapid administration of general anesthesia, and accidental injury to the fetus or surrounding abdomino-pelvic organs. The risks of the procedure are as for elective procedures, namely, haemorrhage (sometimes requiring a blood transfusion), thrombo-embolic diseases, infection, and damage to bowel or bladder and also include the risk of fetal laceration. Where the indication for caesarean section is placenta Previa or abruption, consideration must be given to include hysterectomy in the consent process Precautions preoperatively, intra-operatively, and postpartum are paramount to reduce morbidity and mortality [8].

Once a decision has been made to deliver the baby by EmCS, there should be a clear discussion with the woman and her partner regarding the indications for intervention. The reason for performing the CS is documented in the birth records by the person making the decision. It is important to discuss and document any other options if available and appropriate. If to involve an interpreter for the consent process.

A written consent is obtained, apart from situations where there is maternal compromise or fetal indications such as late deceleration where delivery must be as swift as possible. In such cases verbal consent must be obtained. It must be documented clearly in the clinical notes the reasons for it not being appropriate to gain written consent [9].

The decision to perform a CS is usually taken by a doctor. In some controversial cases where the doctor has to weigh the risks against the benefits of operating, the

Copyright© Eleanor Nakintu & Daniel Murokora.

decision is discussed with a senior obstetrician. The discussion is documented in the woman's hospital records. In the event that delay would be life threatening to mother or baby, the attending midwife may inform the Consultant of the need to perform an Emergency Caesarean Section.

There should be clear communication between midwives' other medical staff, anaesthetic team and theatre team. It is also vital that the urgency and the category of the Caesarean section are clearly discussed between obstetric and anaesthetic team as concluded by Popham in his study of anaesthetic complications in emergency caesarean sections [10].

Consideration is usually given to the potential difficulty of surgery and for the senior obstetrician to be present although this should not delay the start of a category 1 section. Obstetric consultants should be present when the indication is placenta praevia. Other examples when it may be appropriate to involve a senior obstetrician are preterm deliveries (under 32 weeks), known previous difficulty at surgery, previous abdominal surgery with known adhesions, and significant risk of bleeding associated with abruption [9].

Emergency cesarean section is performed under general or regional anesthesia. The degree of urgency often dictates the mode of anesthesia to be used. Anesthetists are expected to docomplex tasks under pressure of time, yet they have the primary responsibility of ensuring that the procedure they use is the safest for the mother. General anesthesia is the fastest method butit is associated with increased maternal morbidity and mortality [10]. Regional anesthetic techniques have been shown to be increasingly safe providing acceptable response times for the majority of 'urgent' cesarean sections [11].

The 30 Minute Rule/Guideline

Globally, EmCS have been performed but the time interval between decision and delivery of the baby varies across countries. The guidelines established by several consensus panels such as the Royal College of Obstetricians and gynecologists, American College of Obstetricians and gynecologists, as well as Canadian National Consensus Conference recommend that obstetric services should be capable of performing a Cesarean section within a time interval of 30 minutes. The American College of Obstetricians and Gynecologists and American Academy of Pediatrics passed a 30 minute guideline to enable standardization of the time interval even though this was not based on strong scientific evidence [12].

The decision to produce the 30-minute guidance arose from the need to address legal issues associated with medical negligence in the United States. This guideline was not based on perinatal outcomes but rather on a survey in various hospitals across the United States [13].

Numerous observational studies have been done widely to assess the practicability of the 30-minute rule and proved that the standards are not always achievable even in the developed world. According to Tufnell et al. [13-15] many important tasks need to be done between decision to deliver and delivery: which tasks are crucial and may be missed if delivery is rushed. A retrospective study showed sixty-three percent of emergency cesarean sections were begun in less than 30 minutes. A significantly greater number of infants in the group that delivered in less than 30 minutes experienced five minute Apgar scores less than six. There were no significant differences in maternal morbidity associated with emergency cesarean sections [16].

A multi centre study by Bloom measured the DDI and related maternal and neonatal outcomes in a time span of 2 years. The results showed that more than a third of EmCS were performed in more than 30 minutes and adverse neonatal outcomes were not increased [15]. Other studies showed that short DDI have been associated with poorer outcomes of the baby and may also harm the mother [17]. One factor that was cited was the possible over-use of general anesthesia in order to deliver the baby within 30 minutes.

ACOG later agreed that the 30 minute rule is not a requirement but each institution, based on resources and geographic location should have required personnel readily available [12]. Training in teamwork and communication, availability of anesthetists, and operation theatre are the main factors to achieve a quick caesarean delivery [18].

The Obstetric Pearls Committee of the American Society of Health Care Risk Management (ASHRM) does not streamline the DDI to a time limit rather addresses based on the institutional capability providing obstetric care. The ASHRM reads as "emergency cesarean sections should be performed as quickly as possible, in keeping with the capabilities of the institution and therefore paramount to prepare for it" [19]. It does not give any time interval. Currently, there is no general consensus of an acceptable DDI for performance of Emergency

Copyright© Eleanor Nakintu & Daniel Murokora.

cesarean sections and this time is arbitrary [8]. Moreover, delivery must be as rapid and safe as possible.

Indications and Categories of Emergency Cesarean Sections

Caesarean section was included in clinical practice as a lifesaving procedure both for the mother and the baby [20]. The reason for performing an EmCS and the category should be clearly stated on the operation form and documented in the birth record by the person making the decision. Perceived urgency can be critical in motivating a caesarean section and any reason for delay in undertaking the caesarean section should clearly be documented in the birth record [21].

A systematic review of the different classifications of CS concluded that classifications based on degree of urgency (including Lucas classification) were theoretically easy to understand and implement. It could also improve communication between health professionals (nurses, obstetricians, anesthesiologists) thus potentially lead to better maternal and perinatal outcomes [22].

The DDI from Category 1 to 4 should be viewed as a 'continuum of urgency' rather than discrete categories. For example, while the team may aim to deliver a baby in 30 minutes when there is an abnormal fetal heart rate, a failed instrumental delivery may require a shorter DDI. It is also to be remembered that the category of urgency may change after the decision is made, a category II may become a category I or vice versa. Failure to progress in labour when there is no maternal or fetal compromise is a Category III Caesarean section but also remember that significant delay will increase the risk of maternal and fetal morbidity for example bleeding secondary to uterine atony, maternal pyrexia, fetal compromise, and should be performed at the earliest opportunity for the theatre team. It is of vital importance that there continues to be clear communication between the obstetric, midwifery and anaesthetic staff at all times [23]. When EmCS are well classified, this can lead to better communication within the obstetric team and reduce the delays that should have occurred a study in France revealed that the DDI lessened significantly after introduction of colour codes for each category of CS [24].

The commonest indications of emergency CS include; uterine rupture, prolapsed umbilical cord haemorrhage due to placenta Previa, placental abruption, vasa Previa, failed forceps, failed vacuum, failed vaginal birth after cesarean, failed induction, failure to progress, failure to descend, shoulder dystocia, fetal bradycardia (less than 110 BPM for more than 10 minutes), fetal tachycardia.

The Lucas classification according to Urgency

Category I also classified as Emergency cesarean delivery: This is when surgical delivery is performed in situations that are extremely life-threatening for the mother or fetus or both. For example, failed assisted or operative vaginal delivery with fetal distress, cord prolapse, acute placental abruption, placenta Previa with profuse bleeding or any major antepartum haemorrhage, ruptured uterus.

Category II also termed as Urgent cesarean delivery: Is when surgical delivery is performed in situations that are not immediately life threatening but has high maternal and fetal risks, for example, an abnormal fetal heart rate but not acute fetal compromise, failed assisted vaginal delivery without fetal distress, previous two cesarean deliveries in labor and failure to progress in labor with fetal or maternal compromise.

Category III classified as Scheduled cesarean delivery: This is when there is need for early delivery but no maternal or fetal compromise. Examples include: Failure of labor progress with no fetal or maternal compromise, planned CS with ruptured membranes, maternal medical conditions like pre-eclampsia.
Category IV or elective cesarean sections: when surgical delivery is performed at a time convenient to the patient or the obstetric team or both.

Classifications based on indications

Althabe [25] proposed a detailed CS classification along with a guideline containing specific, precise and clear definitions for indications such as dystocia, acute intrapartum fetal distress and several maternal indications. His classification however was more complex and difficult to adhere to in the maternity wards due to its complexity and detail. It is therefore more theoretical than practical. Anderson's classification [22] also used these same terms but did not provide any details or parameters on how to decide that this was indeed the indication for the CS. However, Anderson's classification provided clear hierarchal rules on how to classify a woman with more than one indication for CS. A systematic review of which classification was more practical concluded that the Lucas was easier to be applied in a busy maternity unit [9].

Effect of Decision to Delivery Time Interval

Decision to delivery time interval is the time line between a decision being made and delivery of the baby. It is not synonymous with decision to incision time where the goal of birth of a baby is yet to be achieved [26]. Life-

Copyright© Eleanor Nakintu & Daniel Murokora.

threatening situations may develop rapidly and without warning, often in previously uncomplicated pregnancies. It is because of the unpredictable nature of childbirth that emergency obstetric care (EmOC) has been called the 'keystone in the arch of safe motherhood' Knight defines the third delay as failure to receive an adequate and appropriate care once a mother reaches a health facility [27,28]. It has been suggested that long decision to delivery times arise because a multitude of tasks has to be completed in a coordinated fashion by a relatively large multidisciplinary team before the CS can take place. In 2011 a study by Aiste Cerbinskaite on influence of time on DDI concluded that for category I and II CS, midwifery expertise and staffing levels with the correct form of anesthesia influence the outcome [29]. Typically, critical steps occur between making of the decision and delivery of the baby. A study identified time of admission, time of making the decision, incision on skin, delivery of the baby as some of the main steps that must be time-stamped [30]. This same study identified common adverse perinatal outcomes to include perinatal death; still birth, neonatal septicemia as some of those that could arise from delay in delivery of the baby.

In Uganda, a study by Balikuddembe in 2008, evaluated the impact of decision to intervention time at Mulago hospital identified a wide variation in range of time (7.5hours) as well as adverse maternal and neonatal events. Shortage of human resource factors and theatre space allocation were the major factors contributing to delays in intervention [31].

An important step in the reduction of DDI is having the operation room within the labour ward. Hilleman's in a 10-year study had shown that Emergency CS performed in the delivery room results in a shortened DDI without detrimental preoperative maternal or neonatal complications [32]. Some recent studies have also concluded that most of the delays are always during preparation and transfer to the operation room [33]. As we have seen, every facility has a particular area where a time lag defines their DDI which is either in the operating theatre or in patient preparation. This means also that different maternity units have got different DDIs that suit them and gives optimum outcomes for mother and baby.

This study will be undertaken to evaluate the maternal and fetal outcomes in EmCS in respect to their DDI in the local setting. It will be aimed to search for evidence concerning the appropriate standard on the time limit for DDI in ST. Francis Hospital Nsambya. The study will also explore some reasons for delayed DDI (above the average DDI for Nsambya Hospital)

Perinatal outcomes (stillbirth and early newborn death) have been proposed as a facility indicator of CS quality of care [9].

Problem Statement

Timely delivery of the baby by EmCS is lifesaving because it improves maternal and fetal outcomes. A 30 minute interval between the decision and delivery of the baby was suggested by the Royal College of Obstetricians and Gynecologists (RCOG)and quotes that the longer the DDI, the poorer the outcome [34]. In addition to this, ACOG recommends that delivery should be carried out with urgency appropriate to the risk to the baby and the safety of the mother once a decision to operate has been made ACOG [12]. However it has been very difficult to achieve worldwide especially in Resource Limited Settings (RLS) and may contribute to the high maternal mortality due to complications of childbirth some of which may have been averted if an EmCS was done earlier.

In Uganda, a study by Kiwanuka on utilization of health services reported that some of the complications of childbirth could be averted by hastening a required EmCS [35]. Nsambya hospital has a high CS rate of 31%, many of them are emergencies. In addition, the hospital MMR of 350 per 100000 live births (2012/2013) is still unacceptably high. The hospital lacked information on how long it took between the decision to deliver and actual delivery of the baby and if this affected the outcome of the mother and her baby. Further still, the intervening steps are timed but had not been studied and therefore this created a challenge in determining which of the steps may have been delayed thus impacting the design of proper corrective action.

Justification of the Study

Nsambya hospital and Uganda at large has no information on locally adjusted evidence based DDI and its effects on maternal and fetal outcomes to guide the recommendations or protocols for optimal Decision to Delivery time interval and appropriate categorization of emergency cesarean sections according to their clinical definitions and urgency. A cross sectional study by Thomas et al was the first to show that prolonged decision to delivery intervals may result in poor maternal and fetal outcomes [17].

This study was designed to describe the current average time interval between decision and delivery of the baby by EmCS, to document maternal and fetal outcomes as well as propose an optimum, realistic and

Copyright© Eleanor Nakintu & Daniel Murokora.

feasible time frame within which caesarean sections should be conducted after a decision has been made. Data got from this study will help us to better establish attainable DDI standards for EmCS in our settings. It will also help us better estimate the magnitude of delays. The results from the study will inform modification of policy on optimum DDI in Uganda and other similar low resource settings.

Information on CS type and indications is critical information about the quality of procedures performed and provide insights that are masked by institutional CS rates alone.

By adopting the classification described by Lucas [21], this study adds to show a clear understanding of basis for the urgency of delivery once a decision for EmCS is done. Appropriate management should then take place in order to minimize the interval from decision to delivery.

Materials and Methods

Research questions

1. What is the average DDI for EmCS in St. Francishospital Nsambya?
2. What is the effect of major indications of CS on DDI in Nsambya Hospital?
3. What is the effect of DDI on maternal outcome and fetal outcome?

Objectives of the study

General objective

To determine the average DDI and its effect on maternal and fetal outcomes among women undergoing EmCS in Nsambya Hospital.

Specific objectives

1. To determine the average DDI for EmCS in Nsambya hospital.
2. To explore the effect and the common indications for EmCS have on DDI.
3. To assess the effect of DDI on maternal and fetal outcomes.

Study design

This was a cross sectional study among women who underwent EmCS at St. Francis Hospital Nsambya.

Study site and setting: This study was conducted at St Francis Hospital Nsambya, a private not for profit institution with 361 beds. This hospital is a tertiary care referral hospital located in the southern part of Kampala city approximately 3 kilometers from the city centre. It has an annual delivery of 7500 and approximately 1413 cesarean sections [7].

The labor ward has a total bed capacity of 17 including 11 beds for delivery and 6 beds in the admission area where triage of mothers is made. It admits mothers who attended the antenatal clinic in the hospital, as well as those booked in other facilities. It also admits women referred from other health units for further management. It is run by a team of midwives divided in 3 shifts, one intern doctor, two postgraduates in Obstetrics and Gynecology, and an obstetrician during the day. The night team comprises of one intern, 3 post graduates and an obstetrician. Within the labor ward, are two operating theatres each with one operating table. They handle both elective and EmCS plus all other obstetric emergencies.

Expectant mothers were placed on the operating table in sitting position, with a prone posture, her back was exposed and antiseptic used to prepare the site for insertion of the spinal needle. After infiltration of local anaesthesia and once the spinal space was reached, bupivacaine for spinal was administered. The woman would then be assisted to lie in the supine position and a wedge put on her right side to offer left lateral tilt. The surgeon, having scrubbed and dressed, then surgically prepares the abdomen with five to six swabs in iodine solution. The patient is draped with sterile towels. A pfannenstiel surgical incision is made with a scalpel into the skin and followed down to the fascia and to the midline of the anterior rectus. The incision in the rectus is then extended laterally using a pair of scissors. This exposes muscles that are pulled laterally to access the peritoneal cavity. The lower segment of the gravid uterus is identified and a crescentic incision is made to deliver the baby. The time of delivery and APGAR score are then recorded in the first minute.

The decision to perform EmCS is done by doctors during clinical reviews of the laboring women and also at the admission triage area.

Recruitment of women was done in the post cesarean section general and private wards.

Study Participants

This study comprised of all women wonder went EmCS at St Francis hospital Nsambya between 27thSeptember and 15th December 2015 and met the inclusion criteria. A term baby was defined as one delivered after 37

Copyright© Eleanor Nakintu & Daniel Murokora.

completed weeks of gestation. The gestational age was determined mainly from information on her antenatal card for those who had booked and physical exam from the few who had no documents.

Selection criteria

Inclusion criteria: This was restricted to include women who delivered a singleton infant weighing 2,500g and more by EmCS. The mother was supposed to have consented on the second or third post-operative day to accept reviewing her records and getting all the information required for the study.

Exclusion criteria: Women with Pre-eclampsia, eclampsia, Diabetes mellitus, sickle cell disease and other chronic illnesses were excluded due to the possibility of underlying pathology that may have already had an impact on the unborn child and the mother. Multiple gestations were also excluded.

Sampling method and Sample size estimation: Consecutive sampling method was used to recruit women. According to Nsambya Hospital CS records data from July 2014 to June 2015 Nsambya hospital had a total of 6706 deliveries.

Of the 6706 deliveries, 2246 were CS. 1639 were EmCS indicating that 73% accounted for EmCS performed in that period.

Total CS rate is therefore 33.5%
Using Kish Leslie (1965) formula for estimation of sample size in cross sectional studies at 95% confidence interval and taking 5% level of precision

n=Z2pq/E2
Where:
n= sample size
p= proportion of variable of interest taken at 33.5 % since it maximizes the sample size – drawn from Cesarean section rate.
Z2 = 1.962
q= 1-p;
P = 0.335;
Q = 1-0.335 = 0.665
E= level of precision is 0.052.

These parameters give a total of 342 Cesarean sections. Currently, the emergency cesarean sections account for about 73% of all cesarean sections and therefore the estimated sample size for this study was 250women.

However, in order to cater for the mothers who were not be able to participate in the study after CS or due to incomplete documents, a 15 % addition on the estimated sample size was added to make a total of 287 women.

This sample size of 287 was achieved from 27th September to 15th December 2015.

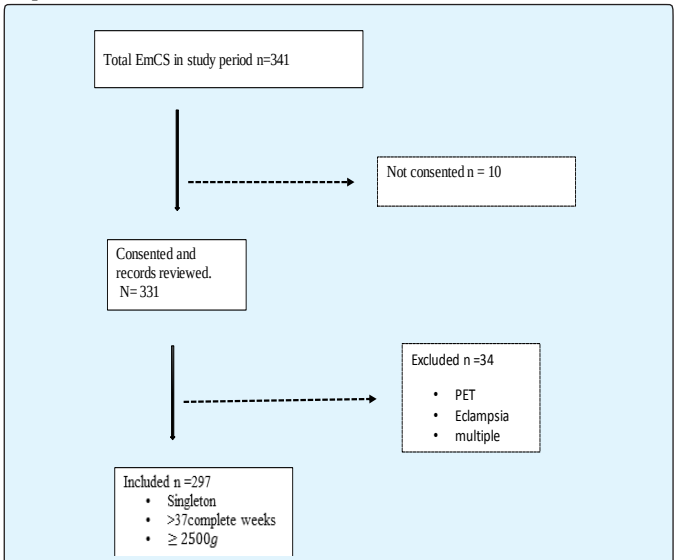

Figure 1: Study Algorithm.

Patient recruitment

The principal investigator (PI) and one research assistant visited the post cesarean section ward every morning during the study period with a list from theatre. Each prospective participant was approached individually and informed about the study. The mother was then requested to join the study. Thereafter an informed written consent to participate in the study was sought. If the mother was unable to give written consent, her immediate caretaker in most cases who was either the spouse or her mother or sister was asked if the patient's records could be reviewed and later the mother was interviewed on recovery. If the mother declined to participate, the next potential participant on the theatre records was approached. Willing participants were then consented and interviewed for individual characteristics by the researcher or her assistant using a structured pre-tested questionnaire.

The date and time of decision for emergency cesarean delivery was retrieved from the patients' files and recorded in the questionnaire. Subsequently, the time of being received in the operating theatre, administration of anesthetic agent, and delivery of the baby were recorded in the questionnaire by the researcher or her assistant. The indication for the EmCS and participants condition at time of decision making was also retrieved.

Copyright© Eleanor Nakintu & Daniel Murokora.

Study variables

The predictor variables: Predictor Variables that were used included maternal age, education level, parity and gestational age.

The outcome variables: The outcome variables included second laparotomy and hysterectomy, post-partum haemorrhage while still in theatre or on the ward that did not require laparotomy or hysterectomy. Maternal development of fever, admission in the High Dependence Unit, catheterization for more than 24 hours including being discharged to go home with a urinary catheter, maternal death. The fetal outcomes included a 5 minute Apgar score below 7, still births, any reason for admission to the special care baby unit or in the neonatal ICU. An early neonatal death which was restricted to 3 days for this study and unstable condition of the baby at mother's discharge was also recorded.

Data management

Data collection: The study used an interviewer-administered questionnaire to capture information. Demographic characteristics, antenatal care and labor course was collected. The demographic characteristics included age of mother in years, her parity, religion, education level, marital status and occupation.

Information on the time of decision-making, time of arrival in theatre, time of anesthesia and time of delivery of the baby was extracted from the mother's records.
Information on whether the mother was a referral, a patient in the labor ward or previously an elective case was also collected from the file.

The indications for emergency caesarean section were sub-divided into three categories based on Lucas classification of cesarean sections.

Indications in category 1 for this study included, cordprolapse, uterine rupture, impending rupture or any suspected scar dehiscence, delay in second stage and failed instrumental delivery. Indications in category II were mal presentation in labor, Non Reassuring fetal status and indications in category III included failed induction of labor and delayin progress of labor. There was no indication in category 4.

Non-reassuring fetal heart andor status was diagnosed by presence of abnormal fetal heart rate pattern, determined by intermittent auscultation, and fresh meconium in the liquor.

The decision-to-delivery interval, defined as the duration from the time the decision was made to the time the baby was delivered by caesarean section (in minutes) was retrieved from the file and recorded for each mother.

Fetal outcomes were recorded as, Apgar scores at one and five minutes, babies who required admission in the special care baby unit or Neonatal Intensive Care Unit (NICU) and deaths.

Maternal morbidity was evaluated with proxy events, mostly severe conditions, rather than the clinical diagnosis itself because of problems in standardizing definitions. Specifically, the following were identified; need for blood transfusion, PPH that did not require blood transfusion, second laparotomy that did not require hysterectomy, hysterectomy, maternal admission to an intensive care unit, need for bladder catheterization for more than 24 hours or maternal death.

Data entry and cleaning: Data were double entered into data entry program Epidata version 3.1 software. Data were then cleaned and stored in a password – protected computer database.

Data analysis: The database was then checked again by the investigator for completeness before being transferred to stata software version 13 for analysis. In preparation for analysis codes were given to several variables. The DDI in minutes was initially given codes from 1-4 in order of less than 30, 30-60, 61-120 and above 120. For further analysis, only 2 codes were given for above 60 and less than or equal to 60 minutes. Using assigned codes, results were analyzed with help of a statistician and presented in figures and tables. Frequency distribution tables with accompanying percentages were used to obtain an insight into Socio-demographic and obstetric characteristics of study participants. Logistic regression was used to measure the strength of associations between the DDI and outcomes of the operation. Statistical significance was defined as a p-value of less than 0.05.

Univariate analysis: Frequency tables were used to describe demographic and reproductive characteristics of participants. Similar tables explained number of mothers under each indication for cesarean section which was later categorized according to urgency. Frequency tables were also used to describe the number of mothers and babies with recorded adverse outcomes.

Binary and Multinomial logistic regression: In order to determine the association between the effects of

Copyright© Eleanor Nakintu & Daniel Murokora.

indications on the DDI, a model formula for logistic regression for nominal outcomes was used. In this model, all the 3 categories of EmCS were compared to the DDI in multinomial logistic regression. A DDI below 60 minutes was coded as 1 and above 60 minutes coded as 0. The same model was used to measure strength of associations between maternal and fetal outcomes against DDI in binary logistic regression. A good outcome was coded as 1 and adverse outcome coded as 0. The same model was used to determine the association between decision to arrival in theatre and from arrival in theatre to anesthesia time intervals versus maternal and fetal outcome. For both these intervals, 1 was a code given for an interval below 30 minutes and 0 was a code given above 30 minutes. Bivariate analysis was used to determine the association between time of the day the decision was done and the DDI.

Log odds (Y) =β0+ β1X1

Where Y=outcome variable (coded 1=Yes, 0=No)

β0 and β1◊ parameters

X1◊ value of the predictor variable

Quality Control: For purposes of ensuring internal and external validity of the study, the following precautions were taken,

- Midwives had refresher training on Apgar score by the principle investigator under guidance of a pediatrician.
- Functional clocks were availed at different triage points and were synchronized at the beginning of the study and thereafter, on a weekly basis.
- The questionnaire was translated into Luganda (common locally spoken dialect) and back translated to ensure consistency.
- The questionnaire was pre-tested before commencement of the study.
- The data collection assistant was trained on how to ask questions and in filling of the questionnaire during its pretesting.
- The principle investigator ensured that all patients admitted during the study period had proper documentation of all events that occurred during labor to avoid loss of information in case of follow up
- The questionnaires were administered on the second or third post op day when the mother was presumably out of danger and pain free.

Ethical considerations

Approval: Approval for the study was obtained from;

- Department of Obstetrics and Gynecology of St. Francis hospital Nsambya
- Ethics and Research Committee, The Institutional Review board of St Francis Hospital Nsambya

Consent of participants: Each participant reviewed the consent form together with the principle investigator or research assistant and signed or declined tosign after a thorough explanation of its content. Participants below the age of 18 were interviewed, assent was got and thereafter consent was sought from their guardians. Participation in the study was voluntary.

Risk and Benefit: There were no benefits offered to participants. Patient's who declined to participate in the study received the standard care without any discrimination. Participants were informed that the results of this research would be used to improve the standards of care at the unit.

Confidentiality: Names and other participant identifier information were omitted from the questionnaires and instead a study number unique to each questionnaire was allocated for purposes of identification during data collection, analysis and presentation to ensure confidentiality of information. Files containing personal information of participants were on controlled access where the hard copies were within locked locations and softcopies were password protected.

Results

General characteristics of participants who enrolled in the study

In total 297 mothers were eligible for the study. The study period was from 27th September to 15th December 2015.

Characteristic	Frequency -1297	Percentage (%)
Age(Years)		
15 - 24	77	25
25 - 29	117	39.4
30 - 34	69	23.2
35 - and above	34	11.4
Marital status		
Single/married	38	12.8
Married/cohabiting	259	87.2
Religion		
Christian (Catholic, Protestant)	244	82.2
Muslim	46	11.5
Others (Buddhists	7	2.4

Copyright© Eleanor Nakintu & Daniel Murokora.

etc.)		
Education		
None/primary	47	15.8
Secondary	93	31.3
Tertiary	157	52.9
Occupation		
Salaried or wage	106	35.7
Business woman	91	30.6
Housewife	100	**33.7**
Referral Status		
Referred	42	**14**
Not referred	255	85.8

Table 1: Socio-Demographic Characteristics of the Study Participants.

Table 1 above shows that the majority of women in the study population were aged between 15 and 34 years (88.6%) and were married. 84.2% had some level of formal education. One out of every 3 women was unemployed.14.1% of the women were referrals from other facilities. The main reasons for referral included obstructed labor, previous scars contracting and poor progress which were clear indications for EmCS.

variable	N=297	Percentage (%)
Parity	148	49.8
1	140	47.1
5-Feb	9	
>6		3
Gestation age		
37	1	0.3
38-42	286	96.3
>42	2	0.7
History of CS		
Yes	96	32.3
No	201	67.7
Booking status		
Booked	292	98.3
Not booked	5	1.7
Screened for HIV		
Yes	285	96
No	12	4

Table 2: Reproductive History of the Study Participants.

Table2 above describes the obstetric characteristics of the study population. Almost half of the respondents were prim parous 49.8% the highest parity being 8.The gestational ages were all above 37 completed weeks with the majority between 38 and 42 weeks.

Repeat CS accounted for 32.3% of all EmCS during this study period with indications such as, failed trial of vaginal delivery or active labor prior to time of scheduled operation. Majority had booked in for antenatal. 4% were HIV sero positive

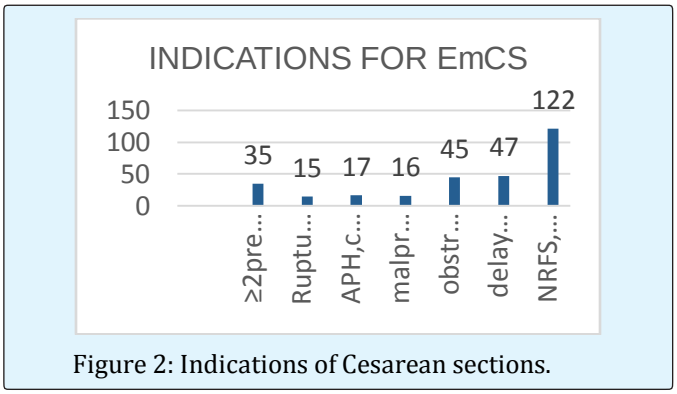

Figure 2: Indications of Cesarean sections.

Figure 3 show that the main documented reason for EmCS was due to a non reassuring fetal status and presence of meconium stained liquor.

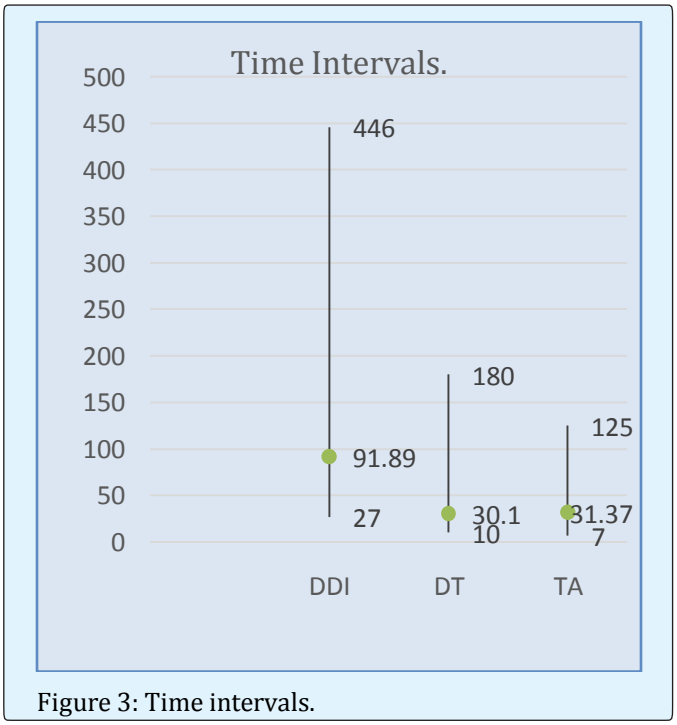

Figure 3: Time intervals.

From Figure 4 above, the average DDI of EmCS in St. Francis hospital was 91.89 minutes (SD±44.2) with a minimum of 27 minutes and maximum 446 minutes. The average time from decision to arrival in theatre (DT) was

Copyright© Eleanor Nakintu & Daniel Murokora.

30.1 minutes (SD±19.2). The average time from arrival in theatre (TA) to anesthesia was 31 minutes (SD±22.1).

Variables	<30	30-60	61-120	>120
>2 previous CS in labor	0	6	22	7
Ruptured/impending rupture	0	3	9	3
APH,	1	3	10	3
Malpresentation	0	2	8	6
Obstructed labor	0	13	23	9
Delayed 2astage, failed vacuum	0	12	24	11
NRFS, MSL	1	30	68	23
Total n (%)	**2(0.7%)**	**69(23.2%)**	**164(55.2%)**	**62(20.9%)**

Table 3: Indications for EmCS versusDDI in minutes.

Table 3 above shows that less than 1% was able to achieve a DDI within 30 minutes and more than 75% had a DDI above one hour. Malpresentation included breech presentation with contraindication to trial of vaginal delivery.

Variables	<300 N(%)	30-60 N(%)	61-120 N(%)	>120 N(%)
Category 1	1(1.3)	26(34.2)	38(50.0)	11 (14.5)
Category 2	0(0.0)	22(20.0)	58(53.2)	29 (26.6)
Category 3	1(0.9)	21(18.8)	68(60.7)	22 (19.6)

Table 4: Categories according to Lucas classification Versus DDI.

Table 4 above shows that 25.6% of the EmCS were category one. 36.7% fell into category two and 37.7% in category 3.From the table, 35.5 % of the mothers whose indications for EmCS fell into category one had a DDI within one hour compared to 20.2% in category 2 and 18.8% in category 3. However, generallymajority was operated after one hour.

DDI	OR	Std.ET,	P-	95% CI
>60				
560				
CAT	########	0.119417	0.028	(0.482-0.959)
Const	########	0.101151	0	(0.304-0.713)

Table 5: Multinomial Logistic regression of categories versus DDI.

Table 5 above shows that a mother in category 1 is 0.67 times more likely to get a CS in less than 60 minutes as compared to a mother in category 2 and a mother in category 2 is also 0.67 times more likely to have a CS in less than 60 minutes as compared to a mother in category 3. This relationship is statistically significant.

Variables	<30min	31-60min	61-120min	>120min
Maternal outcome	0	2	2	1
Hysterectomy	0	2	2	1
Laparotomy	0	1	1	0
Admission to **HDU**	0	0	3	1
Fever	0	2	4	1
PPH	0	3	14	4
Catheterization >24hours	0	4	7	6
Fetal outcome				
Fresh Still birth	0	0	1	0
1 min APGAR score <7	1	23	44	20
5 min APGAR score <7	0	10	20	10
Neonatal hospitalization	1	24	43	20

Table 6: Maternal and fetal out comes versus DDI in minute.

Table 6 above shows that the overall maternal morbidity was 13.46% with PPH that did not require second laparotomy or hysterectomy being the most common complication. Significantly all women operated within 30 minutes had no complication. 75% of these

Copyright© Eleanor Nakintu & Daniel Murokora.

women with adverse outcomes had a DDI above one hour. There was no maternal death during the study period.

Reasons for hysterectomy included ruptured uterus that could not be repaired and failure to achieve hemostas is with other techniques.43.4% of newborns had an adverse outcome (excluded 1 minute Apgar score). There was one fresh still birth during the study period whose DDI was above one hour.

Apgar score of less than 7 at 5 minutes was recorded in 13.4% of newborns and 29% were admitted either in the NICU or special care baby unit.

Variable	DDI >60 n (%)	DDI< 60 n	OR (95%CI)	P-Value
Maternal outcome				
Adverse	30(13.3)	10(14.1)		
Good	196(86.7)	61(85.9)	0.9(0.432-2.019)	0.86
Fetal outcome				
Adverse	61(27.0)	25(35.2)		
Good	165(73.0)	46(64.8)	0.7(0.385-1.201)	0.18

Y=flo+ /31K (1= Good 0 = adverse)

Table 7: Binary logistic regression analysis of outcomes versus DDI.

Table 7 above shows that adverse maternal outcomes were more in mothers with a DDI above one hour but this association was not statistically significant. It also reveals that the majority of newborns with adverse outcomes were delivered after one hour of decision making. The association however is not statistically significant.

Other factors associated with the DDI and obstetric outcome

variable	OR	P-	95% CI
From Decision to arrival in theatre			
Maternal			
outcomes			
>30min	1.257576	0.545	(0.599016 2.640155)
<30min			
Fetal outcomes			
>30 min	1.016718	0.952	(0.5926017 1.744368)
<30 min			
From Arrival in theatre to anesthesia			
Maternal outcome			
>30min	0.371717	**0.004**	(0.1879331 0.7352279)
<30min			
Fetal outcome			
>30 min	0.792588	0.372	(0.4760164 1.319694)
<30 min			

Y=/30+ /31X) (1= <30, 0 = > 30)

Table 8: Binary Logistic regression of intervening time frames versus outcomes.

Table 8 above describes the relationship between intervening time intervals and outcomes. 68% of women arrived in theatre within 30 minutes of the decision making. As shown in the table, the association between this time and the odds of having an adverse maternal or fetal outcome was not statistically significant.

From arrival in theatre to achieving anesthesia, 49% of women waited for less than 30minutes and as the table shows, a mother was 37% more likely to have an adverse outcome if she spent more than 30 minutes in theatre before anesthesia. Delay in administration of anesthetic agent was therefore significantly associated with prolongation of the DDI.

Spinal anesthesia was the preferred mode of anesthesia for EmCS.

Time of the day	>60n (%)	<=60 n(%)	OR (95% CI)	P-Value
Night (1900-0659Hrs)	90(39.8)	36(50.7)		
Day (0700-1859Hrs)	136(60.2)	35(49.3)	0.64(0.376-1100)	0.11

Table 9: Bivariate analysis of DDI versus time of the day.

Copyright© Eleanor Nakintu & Daniel Murokora.

The table shows that the majority of CS were done during the day and that women whose decisions were made during the day had a longer DDI than those delivered at night but this association was not statistically significant.

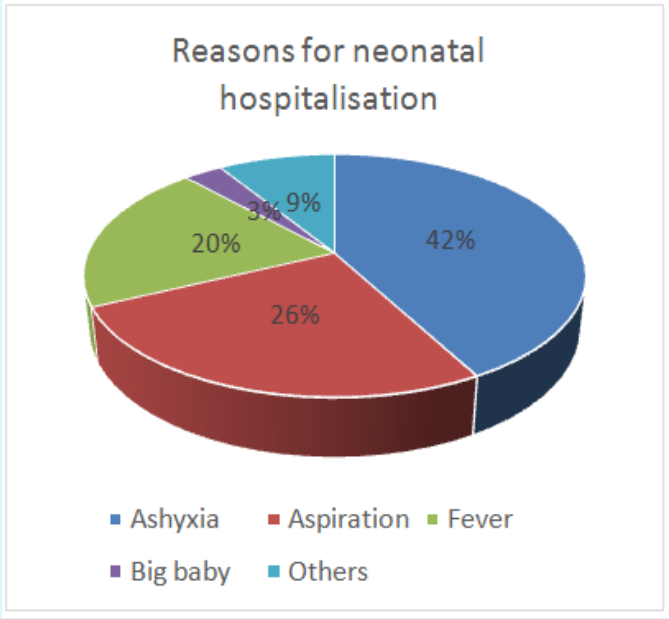

Figure 4: Reasons for neonatal hospitalization.

Figure 5 is a pie chart showing that the main reasons for admission to either the NICU or special care baby unit were birth asphyxia of different grades and meconium aspiration. Other reasons for admission included potential sepsis and born in meconium stained liquor who were admitted mainly for observation.

Discussion

The study found out that the average DDI of EmCS in Nsambya hospital is 92minutes. Only 0.7% of the women achieved a DDI within 30 minutes and 75% were delivered after one hour of decision making. The association between the DDI and occurrence of maternal and fetal complications was not statistically significant. The more urgent CS (category 1) returned a significantly shorter response time. The average time from arrival in theatre to anesthesia was 31 minutes and this was significant in causing maternal complications.

The women in this study were generally young, 62.6% between 25-34 years, which is the optimum age for child bearing. Majority of these women had a good level of formal education (84.2%) and only 1/3 were unemployed; and this probably eliminated the delay to consent for the CS. Referred women generally presented in a poorer condition with prolonged labor, prolonged rupture of membranes and having had many vaginal examinations exposing both the mother and baby to infections.

The most common indications for EmCS were, Non Reassuring Fetal Status (NRFS), dystocia in second stage including failed instrumental deliveries and obstructed labor. Other important indications were malpresentation in active stages of labor and previous CS related indications. A NRFS was over diagnosed on the basis of intermittent auscultation with pinnard or hand held Doppler of an abnormal fetal heart rate sound and presence of meconium stained liquor in early stages of active labor. Evidence in derangement of fetal blood gases was not followed up after admission to the NICU.

An average DDI of 92 minutes for this study is far less than the mean Decision to operation time in Mulago hospital which was 465 minutes [31] and may reflect a better clinical practice in St Francis hospital Nsambya. The study in Mulago hospital was repeated in 2014 with a DDI of 488 minutes [36]. This DDI of 92 minutes is also significantly less than that reported in several other similar studies in Africa. Studies conducted by Onah et al in Nigeria [37] reported a mean DDI of 687 minutes. One of the largest studies which looked at 1000 EmCS in resource limited settings concluded that it was not feasible to achieve a DDI within 30 minutes, however, this study was retrospective and did not conclude with an optimum DDI for RLS [38]. A similar study in and Indian tertiary hospital in a RLS revealed a DDI of 42.5 minutes which is less than that of Nsambya hospital [39].

The DDI of 3 teaching hospitals in Khartoum Egypt was 46 minutes and 48% were done in less than 30 minutes which was comparable to international standards [40].

Only 0.7% women in Nsambya hospital were delivered within 30 minutes and this is in contrast to an audit at a United Kingdom maternity unit of 721 women where 66%(478) were delivered within 30 minutes [14]. ACOG revised their 30-minute dictum by saying that a safe DDI should be determined by each hospital according to their resources. This is in keeping with an audit done In Australia's different maternity centers that had varied DDI from 42 to 70minutes and concluded that DDI reaction times are much influenced by individual facilities and staff availability as long as this does not compromise maternal and fetal outcomes [41].

Copyright© Eleanor Nakintu & Daniel Murokora.

The Lucas classification that was used to categorize these EmCS according to urgency is theoretically easy to understand and implement but it lacks precise definitions of particular indications, unlike the Althabe and Anderson classifications which categorize according to urgency and also clearly define classes where a woman has more than one indication to EmCS [25]. In the obstetric department of Nsambya hospital, cesarean sections have a broad classification of either elective CS or EmCS. We generally consider EmCS as a whole with no further classification. Despite this, the study discovered that the obstetric team was able to recognize the most urgent cesarean sections and attend to them faster than the less urgent; that is to say, the indications in category I were less likely to be delayed than those in category II and III (P = 0.028 CI 0.482 – 0.959). For example, a mother who had APH due to placenta Previa accessed theatre faster and delivered more promptly than a mother with poor progress of labor as seen on her partograph. Those in category 3 were more likely to have a DDI of over 90 minutes. Mothers that had 2 or more previous cesarean sections in active labor but no signs of scar compromise were taken into category III and were more likely to be delayed than those with failed vaginal birth after cesarean section.

Maternal outcomes were good in majority of the women (86.54%). Among the rest with adverse outcome, 75 % had a DDI above 60 minutes. All women delivered within 30 minutes had good outcomes. These differences may not have been statistically significant but clinically, they pointed to a possibility of developing an adverse outcome beyond a DDI of one hour in our setting. A decision to operation time of 7.5 hours in Mulago hospital was associated with a significant morbidity of 41.3% compared to a DDI of 90minutes in Nsambya hospital which revealed 13.3% maternal morbidity. Bloom did a multi centre study on Decision to Incision time and concluded that there was no association between adverse maternal outcome and DDI. Even though he concluded that way, over 65% of women had a DDI within 30 minutes and they had no adverse outcome. This further emphasizes the point that the shorter the DDI the better the outcome [15].

The complications that developed after the decision for EmCS was made but before assessing were not clearly captured from the mother's hospital records. However, the need for catheterization for more than 24 hours probably meant presence of bladder edema or injury due to obstructed labor and uterine rupture that led to hysterectomy.

The main maternal complication recorded in this study was the presence of post-partum haemorrhage. Overall, 53%of these mothers, some were resuscitated either in theatre or on the wards. Only 2 of them had repeat laparotomy to help achieve hemostasis either by hysterectomy or other means. This relates to the final report on MDG achievements in Uganda that in 2013/2014, the main cause of death occurring in health facilities were postpartum haemorrhage(26%) [4].

In this study, overall, 43.4% of the babies had an adverse outcome and 61% of these were delivered after one hour of decision-making Perinatal outcomes (stillbirth and early newborn death) have been proposed as a facility indicator of CS quality of care [9]. Neonatal hospitalization which was considered as one of the variables for an adverse outcome is in itself a non-specific measure of morbidity unlike still birth and low 5 minute Apgar score. The most valid immediate measures of fetal hypoxia are 5 minute Apgar score and acid basebalance. Five minute Apgar scores below 7 are a marker for metabolic acidosis, but are less clear for long-term outcome. Absence of neonatal support personnel for EmCS in our hospital could have contributed to the many admissions in the special baby care unit. Though the correlation between DDI and these fetal outcomes wasn't statistically significant. In univariate analysis, Longer DDI was associated with poorer fetal outcomes. After adjusting for other clinical factors, however the DDI of less than 60 minutes did not improve or worsen the outcome of both mother and baby. In this study, a binomial analysis of fetal outcomes was used where all fetal outcomes were coded either good or adverse and then compared to the DDI, however, a similar study that looked at each adverse fetal outcome independently in relation to its DDI had statistically significant comparisons. Dunphy and his colleagues looked at 9387 EmCS and found that a low Apgar score, were significantly associated with a DDI above 35 minutes with p <0.001 [42]. In Germany, a similar study which had 109 participants and all were delivered within 30 minutes showed no fetal adverse outcomes even when 50% of study participants had a gestation age below 37, majority having been smokers and PET mothers inclusive [32]. All these mothers received perioperative prophylactic antibiotics which is not routine in our setting. This can explain why the only still-birth during this study period had a DDI of 113 minutes. 29% of all babies were hospitalized and reasons for admission were asphyxia (42%) aspiration of meconium (26%) fever (20%). Other indications included potential for sepsis and having been born in meconium stained liquor. Asphyxia as a reason for neonatal admission was determined by the midwives who

Copyright© Eleanor Nakintu & Daniel Murokora.

received the babies and this was used to define any baby who was not able to breathe spontaneously but after resuscitation. The standard criteria for defining asphyxia were not measurable for example metabolic acidosis, evidence of encephalopathy and evidence of end organ damage.

Not many studies have been done to critically analyze the time from decision making to arrival in theatre. A number of tasks have to be performed before the expectant mother is taken to the operating room. After the mother has been informed, consent has to be got and signed. Intravenous access has to be established and blood samples taken to the laboratory. The operating room has to be informed including the anesthetist [14]. It is mandatory to prepare for acute and unpredicted obstetric situations both before and after the operation. Regular check on presence of utilities like urinary catheters and drugs like oxytocin and misoprostol should be done.

The research by Balikuddembe et al reported that the determinants of DDI were multifactorial with lack of theatre space followed by personnel factors being the commonest causes of delays [31]. In a similar study done by Onah et al in Nigeria revealed that anesthetic delay was the major cause of delay in performing EmCS [37]. Similarly, Onwudiegwu [5] in his study, concluded that non availability of anesthetic coverage and lack of readiness of the operation theatre were the main causes of a prolonged DDI. This study did not explore the cause of delay in theatre but revealed that the likelihood of having an adverse maternal outcome increased if the mother spent 30 minutes or more in theatre. P = 0.004 CI 0.187 – 0.735 With the Sustainable Development Goals in mind, this finding does not favor the target of reducing the global maternal mortality ratio to less than 70 per 100,000 live births by 2030 [2].

Majority of CS were done during the day (57.6%) and the DDI was longer during the day than at night but after adjusting for other factors, the correlation was not significant statistically. A multicenter study carried out in Norway looked at 24 maternity units and concluded that EmCS performed at night had a significantly shorter DDI [43-47].

Conclusion

1. The average DDI was 92 minutes 0.7% of women in this study were delivered within the recommended 30 minutes.
2. Category I cesarean sections returned a significantly shorter response time compared to categories II and III.
3. The DDI in our setting did not significantly affect the maternal and fetal outcomes.
4. Prolonged stay in theatre before anesthesia significantly contributed to maternal morbidity.
5. The DDI was not significantly affected by the time of the day.

Recommendations

A short interval from decision to delivery is important if optimal maternal and fetal condition is to be achieved.

1. A 60 minutes DDI is achievable in St Francis hospital Nsambya and we suggest it becomes the maximum cut off DDI to get good obstetric and newborn outcomes.
2. The time interval between arrival in theatre and actual delivery of the baby should be reduced since it prolongs the DDI and results in poor maternal outcome.
3. Further studies should be done to explore the cause of delay in the operating theatre.
4. More vigilance in documentation, especially the number of patient records that have missing time frames and Apgar scores.
5. We urgently need a written guideline on estimation of urgency, application of a proper classification of EmCS to lessen our DDI.

Study limitations

- There was inability to document outcomes of mothers who had normal or instrumental delivery in theatre as they waited for operation.
- Lack of clear-cut definitions of indications in each category may have led to some errors in interpretation and comparability.
- Inability to capture the exact causes of delay in theatre.
- Seniority of the surgeon was not captured which may have had an impact on the DDI.
- Consecutive sampling method was used in this study making it prone to selection bias due to the non-random nature of this method.

References

1. UNICEF (2008) The state of the world's children 2009: maternal and newborn health, Unicef.

Copyright© Eleanor Nakintu & Daniel Murokora.

2. UN (2016) Sustainable development goals. 17 goals to transform the world.

3. Uganda (2011) Uganda Demographic Health Survey. Uganga: Government of Uganda.

4. UNDP (2015) Final Millennium Development Goals Report for Uganda 2015: Results, Reflections and the Way Forward.

5. Onwudiegwu U, Makinde O, Ezechi O, Adeyemi A (1999) Decision-caesarean delivery interval in a Nigerian university hospital: implications for maternal morbidity and mortality. Journal of Obstetrics and Gynaecology 19(1): 30-33.

6. Orji E, Ojofeitimi E, Esimai A, Adejuyigbe E, Adeyemi A, Owolabi O (2006) Assessment of delays in receiving delivery care at a tertiary healthcare delivery centre in Nigeria. Journal of Obstetrics & Gynecology 26(7): 643-644.

7. NSAMBYA June 2014/July 2015. Annual report.

8. Steven GG, Jennifer RN, Henry LG, Eric RMJ, Mark B L (2012) Obstetrics: normal and problem pregnancies. Elsevier Health Sciences.

9. Soltanifar S, Russell R (2012) The National Institute for Health and Clinical Excellence (NICE) guidelines for caesarean section, 2011 update: implications for the anaesthetist. International journal of obstetric anesthesia 21(3): 264-272.

10. Lim Y, Shah MK, Tan HM (2005) Evaluation of surgical and anaesthesia response times for crash caesarean sections-An audit of a Singapore hospital. Annals-Academy of Medicine Singapore 34(10): 606-610.

11. Popham P, Buettner A, Mendola M (2007) Anaesthesia for emergency caesarean section, 2000-2004, at the Royal Women's Hospital, Melbourne. Anaesthesia and intensive care 35(1): 74-79.

12. ACOG (2007) Guidelines revamped as resource manual for women's health care.

13. Nasrallah FK, Harirah HM, Vadhera R, Jain V, Franklin LT, et al. (2004) The 30-minute decision-to-incision interval for emergency cesarean delivery: fact or fiction? American journal of perinatology 21(2): 63-68.

14. Tuffnell DJ, Wilkinson K, Beresford N (2011) Interval between decision and delivery by caesarean section-are current standards achievable? Observational case series. BMJ 322(7298): 1330-1333.

15. Bloom SL, Leveno KJ, Spong CY, Gilbert S, Hauth JC, et al. (2006) Decision-to-incision times and maternal and infant outcomes. Obstet Gynecol 108(1): 6-11.

16. Schauberger Cw, Rooney Bl, Beguin Ea, Schaper Am, Spindler J (1994) Evaluating the thirty minute interval in emergency cesarean sections. Journal of the American College of Surgeons 179(2): 151-155.

17. Thomas J, Paranjothy S, James D (2004) National cross sectional survey to determine whether the decision to delivery interval is critical in emergency caesarean section. Bmj 328: 665.

18. Helmy WH, Jolaoso AS, Ifaturoti OO, Afify SA, Jones MH (2002) The decision-to-delivery interval for emergency caes are an section: is 30 minutes a realistic target? BJOG: An International Journal of Obstetrics & Gynaecology 109(5): 505-508.

19. Veltman L, Grelyak A, Kradel E (2000) Risk Management Pearls for Obstetrics 2000. Chicago (IL): American Society of Healthcare Risk Management.

20. Luz Gibbons, José MB, Jeremy AL, Ana PB, Mario Merialdi, et al. (2010) The global numbers and costs of additionally needed and unnecessary caesarean sections performed per year: overuse as a barrier to universal coverage. World health report 30: 1-31.

21. Lucas D, Yentis S, Kinsella S, Holdcroft A, May AE, et al. (2000) Urgency of caesarean section: a new classification. J R Soc Med 93(7): 346-350.

22. Torloni MR, Betran AP, Souza JP, Widmer M, Allen T, et al. (2011) Classifications for cesarean section: a systematic review. PloS one 6(1): e14566.

23. Kwek K, Yeap ML, Tan KH, Tee JC, Yeo GS (2005) Crash caesarean section-decision-to-delivery interval. Acta Obstet Gynecol Scand 84(9): 914-915.

24. Huissoud C, Du Mesnildot P, Sayegh I, Dupuis O, Clément HJ, et al. (2009) [Color-codes implementation shortens the decision-to-delivery interval of emergency C-sections]. J Gynecol Obstet Biol Reprod (Paris) 38(1): 51-59.

25. Althabe F, Sosa C, Belizán JM, Gibbons L, Jacquerioz F, et al. (2006) Cesarean Section Rates and Maternal and

Copyright© Eleanor Nakintu & Daniel Murokora.

Neonatal Mortality in Low, Medium, and High-Income Countries: An Ecological Study. Birth 33(4): 270-277.

26. Naseem Rashid Sn (2007) Understanding the decision-delivery interval in cesarean Births. International e-journal of science, medicine and education 1: 61-68.

27. Knight HE, Self A, Kennedy SH (2013) Why are women dying when they reach hospital on time? A systematic review of the 'third delay'. PLoS One 8(5): e63846.

28. Thaddeus S, Maine D (1994) Too far to walk: maternal mortality in context. Soc Sci Med e 38(8): 1091-1110.

29. Aiste C, Sarah M, Jennifer McD, Andrew DL (2011) Emergency caesarean section: influences on the decision-to-delivery interval. J Pregnancy 2011(2011): 640379.

30. Landry E, Pett C, Fiorentino R, Ruminjo J, Mattison C (2014) Assessing the quality of record keeping for cesarean deliveries: results from a multicenter retrospective record review in five low-income countries. BMC pregnancy and childbirth 14: 139.

31. Balikuddembe MS, Byamugisha JK, Sekikubo M (2011) Impact of Decision-Operation Interval on Pregnancy Outcomes among Mothers Who Undergo Emergency Caesarean Section at Mulago Hospital. Journal of US-China Medical Science 8(9): 571.

32. Hillemanns P, Hasbargen U, Strauss A, Schulze A, Genzel-Boroviczeny O, et al. (2003) Maternal and neonatal morbidity of emergency caesarean sections with a decision-to-delivery interval under 30 minutes: evidence from 10 years. Arch Gynecol Obstet 268(3): 136-141.

33. Mak SL, Chow KM (2015) Maternal and fetal outcomes in extremely urgent Caesarean delivery in relation to the decision-to-delivery interval. J Gynaecol Obstet Midwifery 15(1): 16-22.

34. Whittle, Martin J (1999) Towards safer childbirth Minimum standards for the organisation of labour wards. RCOG Press, London.

35. Kiwanuka SN, Ekirapa EK, Peterson S, Okui O, Rahman MH, et al. (2008) Access to and utilisation of health services for the poor in Uganda: a systematic review of available evidence. Trans R Soc Trop Med Hyg 102(11): 1067-1074.

36. EILU (2014) Decision to Delivery interval.

37. Onah H, Ibeziako N, Umezulike AC, Effetie ER, Ogbuokiri CM (2005) Decision–delivery interval and perinatal outcome in emergency caesarean sections. Journal of obstetrics and gynaecology 25(4): 342-346.

38. Livermore LJ, Cochrane RM (2006) Decision to delivery interval: a retrospective study of 1,000 emergency caesarean sections. J Obstet Gynaecol 26(4): 307-310.

39. Singh R, Deo S, Pradeep Y (2012) The decision-to-delivery interval in emergency Caesarean sections and its correlation with perinatal outcome: evidence from 204 deliveries in a developing country. Tropical doctor 42(2): 67-69.

40. Yousif AR (2015) Decision-to-delivery interval in non-elective caesarean section: is it optimal in our hospitals. UOFK.

41. Spencer MK, Maclennan AH (2001) How long does it take to deliver a baby by emergency Caesarean section? Aust N Z J Obstet Gynaecol 41(1): 7-11.

42. Dunphy BC, Robinson JN, Shell OM, Nicholls JSD, Gillmer MDG (1991) Caesarean section for fetal distress, the interval from decision to delivery, and the relative risk of poor neonatal condition. Journal of Obstetrics and Gynaecology 11(4): 241-244.

43. Kolås T, Hofoss D, Oian P (2006) Predictions for the decision-to-delivery interval for emergency cesarean sections in Norway. Acta Obstet Gynecol Scand 85(5): 561-566.

44. HABIB HA (2010) Emergency caesarean section turnaround time and its effect on maternal and newborn health outcomes at University of Nairobi teaching hospitals. University of Nairobi.

45. Hofmeyr JG, Novikova N, Mathai M, Shah A (2009) Techniques for cesarean section. American journal of obstetrics and gynecology 201(5): 431-444.

46. Mackenzie IZ, Cooke I (2002) What is a reasonable time from decision-to-delivery by caesarean section? Evidence from 415 deliveries. BJOG 109(5): 498-504.

47. Ronsmans C, Graham WJ, Group LMSSS (2006) Maternal mortality: who, when, where, and why. The Lancet 368(9542): 1189-1200.

Copyright© Eleanor Nakintu & Daniel Murokora.