UNIVERSITY of RWANDA

College of Medicine and Health Sciences

School of Medicine and Pharmacy

Department of Anesthesiology, Critical Care and Emergency.

INDICATIONS AND OUTCOME OF EMERGENT C-SECTIONS UNDER GENERAL ANESTHESIA AT KIGALI UNIVERSITY TEACHING HOSPITAL:

A two years retrospective study

Dissertation submitted in partial fulfilment of the requirements for the award of the Degree of Master of Medicine in Anaesthesiology

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July, 2020.

DECLARATION

I declare that this dissertation is the result of my own work and has not been submitted for any other degree award at the University of Rwanda or any other institution.

NAMES:	SIGNATURE	DATE
SAIDIA Angelique	_____	_____

This dissertation has been submitted for the degree of Master of Medicine in Anesthesiology with my approval as a university supervisor.

Supervisor:	Signature	Date
Dr Françoise NIZEYIMANA	_____	_____

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I would like to express my special to Prof Théogène TWAGIRUMUGABE for his endless support, his time, and his advices made for this study, I will always remember this.

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DEDICATION

To God the Almighty

To my Parents

To my Husband and Daughter

To my sister and friends

To my classmates and other people who contributed to this study.

I dedicate this work.

ABBREVIATIONS

CHUK: Centre Hospitalier Universitaire de Kigali

C-section : Caesarean section

D.H: District Hospital

FRC: Functional residual capacity

G.A: General Anesthesia

HIC: High-income-countries

ICU: Intensive Care Unit

IOL: Induction of labour

IRB: Institutional Review board

IUFD: Intra-uterine-fetal-demise

IV: Intravenous drugs

LMIC: Low- and Middle-Income Countries

NICE: National Institute for Health and Care Excellence

NPA: Non -physician Anesthetics

PPH: Post -partum haemorrhage

SAB: Spinal anesthesia block

SSA: Sub-Sahara Africa

TTN: Transient tachypnoea of the new born

USA: United States of America

VBAC: Vaginal birth after caesarean section

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ABSTRACT

Background

Indications and maternal or neonatal outcomes of c-section under general anesthesia are not well known in Rwanda and at CHUK in particular. The aim of this study was to determine the rates for use of general anesthesia for C-section, maternal and fetal outcomes.

Methods

We conducted a cross-sectional retrospective study on emergency caesarian deliveries under general anesthesia from January 2018 to December 2019 at CHUK. We collected data including demographic characteristics, indications, gestational age and APGAR score, anesthesia, maternal and fetal outcomes as aspiration, airway hyperreactivity for the parturient, NICU admission, asphyxia and death for neonates during the first 24 hours. We analyzed the association of different characteristics, anesthesia process and the outcomes.

Results

We found135 (6.7%) parturients who underwent GA from among a total of 2021 emergency C-sections during the study period. Only 124 had sufficient data in the files. The mean age was 31years. Most indications of C-section were fetal (59.7%) including 56.1% of non-reassuring fetal heart rate. Maternal outcomes included respiratory complications as gastric content aspiration in 1 case (0.8%), 1 difficult intubation (0.8%) and 1 laryngospasm (0.8%). Majority of parturients (96.8 %) were fit to be discharged home within 3 days after C-section whereas 4(3.2%) were admitted to ICU and two of them (1.6%) died of complication related to pre-eclampsia. Gestational age <34 weeks was associated with low (<7) APGAR (p=0.001) and so was the presence of an anesthesiologist among the providers (p=0.034). Of 46 (36.5%) neonates admitted in NICU, 1 (2.2%) died within 24 hours and 7 had birth asphyxia (15.2%).

Conclusion

The rates of emergency C-section at CHUK remains acceptable. Complications related to general anesthesia were also acceptable. Low APGAR score and immediate neonatal death are rather linked to prematurity.

Key words: General anesthesia, Caesarian section, maternal fetal outcome

CHAPTER I: INTRODUCTION

1.1. Background

Cesarean section is an essential maternal healthcare service. It is a principal treatment which main indications like obstructed labor 31%, mal presentation 18%, prior caesarian section 14%, fetal distress 10%, uterine rupture 9%, and ante-partum hemorrhage 8% among them intrapartum Cs accounts for 14% as emergent as 3% versus elective which is 2% (1) . Caesarian section has raised in high- and low-income countries. Its r ate was estimated between 10% to 15% but could not be below 5%. Worldwide caesarian account 19 % of all deliveries, where North America and Caribbean's have 30-40%. Latin America has 6-27%, Europe 25%, Asia 19% and Africa 7.3%(1)(2)(3)(4).

In Africa a study done in Ethiopia from 2016-2017 in one hospital in West Tigray showed that the rate of caesarian section is 13.2%(5) . According to a study done in Kenya the rate of Caesarian section was estimated at 6.3% while in Tanzania this rate was 29.9 -35.5%(6)(7).

Emergency Cesarean section is a life-saving procedure of mother and baby which should ideally be performed within 30 minutes thought it requires anesthesia to be carried out(8)(9).For both anesthesia technique, either spinal or general have complications, some of them are life – threatening or cause permanent disabilities to a patient(9)(7)(1)(10)(11).The risk of anesthesia related mortality for obstetric patients was 1.2 per 1000 women and anesthesia caused 2.8% death of all maternal deaths in which 13,8% died following caesarian section(8). Majority of problems of general anesthesia are; failed intubation, pulmonary aspiration of the gastric contents which is still the main cause of maternal death at 33% and awareness that leads to long standing psychological symptoms (12).

In a study done in Singapore 0.8% patients who delivered by caesarian section under general anesthesia developed airway concerns like bronchospasm and laryngospasm , 0.5% had difficult intubation (13)compared to spinal anesthesia which is known to cause backache, post-dural puncture headache, nerve injury, total spinal anesthesia, infection, and cardiac arrest(14).

General anesthesia increased three times the risk of maternal and twice perinatal death compared to spinal anesthesia where it was also associated with increase in other complications like post-

partum hemorrhage, decreased APGAR score at 1 min and at 5 min after birth versus neuraxial anesthesia(9)(15)(16)(17).

In a national survey done by 2015 in Czech Republic in 49 obstetric centers showed that general anesthesia for emergent obstetric cases were 67% (18)(19). A similar survey conducted in Finland found that general anesthesia was used in 11% while 44% had spinal anesthesia, 37% received combined spinal and epidural and 8% were operated under epidural only(20).In a retrospective study conducted in Nigeria showed that 17,6% were done under general anesthesia (21).

In a study done across Africa revealed that the prevalence of C-section in Rwanda in private clinics was 64.2% while it was 4.6% in public institutions (22). This rate was increased in referral facilities like in Ruhengeri Referral hospital where the rate was 34.9%(5)(16). In a study conducted in 2010 at Muhima, Kigali-Rwanda, caesarian sections performed were classified as emergent (17.4%), urgent (2.2%), semi-urgent (74.1%). Almost 2.2% of C-sections were done under general anesthesia and 7.2% were converted to GA after a failed spinal (23).

The current rate of general anesthesia for emergent c-section in Rwanda and the maternal and fetal outcomes have not been assessed. We conducted this study to determine the indications and outcome for emergent c-sections under general anesthesia at Kigali University Teaching Hospital.

1.2 Problem Statement

Kigali University Teaching Hospital, obstetric department receives many patients who come for deliveries mostly the women who need specialized care referred from District Hospitals. The indications and outcomes of emergency c/s procedures under general anesthesia have not been studied before. This study explored the rate of general anesthesia in emergency C-section and the maternal and fetal outcomes.

1.3 Research Question

What are the main indications and outcome of emergent c-sections under general anesthesia at Kigali university teaching hospital?

1.4 Objectives of the study

1.4.1. Main objective

To determine rate, main indications and outcome of emergent c-sections under general anesthesia at Kigali university teaching hospital.

1.4.2. Specific objectives

- To determine the rate of emergency c-sections patients under general anesthesia.
- To determine the main indications of emergency Caesarian section under general anesthesia
- To assess the intra operative complications potentially related to general anesthesia among emergency c-section parturient.
- To assess fetal and maternal outcome after emergency c-section under general anesthesia within the first 24 hours postoperatively
- To explore factors associated with low APGAR score among parturients undergoing c-section under general anesthesia

CHAPTER II: LITTERATURE REVIEW

2.1. Introduction

Even though vaginal delivery is the commonest route of delivery and the one that is preferred by the African ladies and their families due to the quick recovery and decreased complications compared to c-section where they think that those women who underwent c-section are very weak and consider C/s as an abnormal way of delivery. We still have some women who have to deliver by caesarian section for different reasons, which may be elective or emergent(24)(25)**.**

Caesarean section is another way of delivering the baby to women if vaginal route is not an option. It implicates making an incision through the pregnant uterus and extracting a baby(25).

Emergency c-section is the commonest surgical procedure performed worldwide in order to rescue the life of the pregnant mother or the fetus which may be in danger(26). In recent years there has been considerable rise in the rate of c-section has been increasing globally in developed and developing countries increasing up to 60% which represent 15% of worldwide deliveries. This increase in c-section is attributed to some factors like advanced maternal age, multiple pregnancy maternal obesity, induction of labor (IOL) and increase of VBAC(27)**.**

Even though the rate of c-section rise around the world in Africa it is counted to be 3.5%.(52) This rate is relatively low to a target proposed by WHO where c-section rate has to be above 10-15% in order to decrease maternal and neonatal mortality.(27) This decreased number of c-section in Africa is due to shortage of specialist in LMIC which has a median 0.7 /100.000 population compared to developed countries where it is 20-40 specialist per 100.000 population(53).

However, c-section is counted among the safest lifesaving procedure but carries out complications that rise with c-section rate which are associated with neonatal and mostly maternal complications related to the procedure itself or to anesthesia.(26)(28).

Although recent new systems and modern technologies are being developed to deliver adequate and safe anesthesia to pregnant women in order to obtain a live infant and mother. Obstetric anesthesia is commonly one of the riskier sub-specialty in the anesthesia practice. Some attribute the challenge physiological changes of the pregnancy for parturient and to conduct safe anesthesia to both mother and the baby(29).

2.2. Indications of Caesarian section

Emergency caesarian section is indicated normally for maternal and fetal interest(25). Other common indications are failure of labor to progress, previous caesarean section, Previous Caesarean section, Pre-eclampsia or eclampsia, Placenta previa or abruption, Fetal compromise, malposition of the fetus e.g. breech or transverse lie, Multiple pregnancy, Cord prolapse, Worsening of pre-existing maternal condition e.g. cardiac, maternal choice(18)(30)**.**

It is very useful to know the indications of caesarian section, it indicates the level of emergency for the delivery of the neonate, therefore determining the category of caesarian section according to NICE guidelines or Royal College of obstetrics and Gynecologists is important because emergency caesarian section is an unspecified term which can't be understood the same way by health care professionals and this guidelines help in patients management and resources according to the category of CS(28)**.**

2.3 Complications of Caesarian section

Caesarian section is the risk for maternal mortality in LMICs with a rate of 7.6 in 1000 women who had caesarian section and a greater number is in sub-Saharan Africa which has 10.9 per 1000 compared to UK which accounts 8 in 100,000 and it represent 100 times risk of maternal mortality in LMICs(28)**.** Health complications after c-section delivery are those commonly known for a delivering mother and her baby and which has intra-operative complications (Infections, organ injury (bladder, intestines, ureter, hysterectomy as a treatment for severe bleeding, e.g. from placenta praevia leading to blood transfusion)(31). Post- operative complications as thromboembolic diseases (embolism, thrombosis, adhesions, persistent pelvic pain etc..) there is risk of complications in the following pregnancies (IUGR, preterm delivery(18). Spontaneous abortion, Ectopic pregnancy, IUFD, Uterine rupture and Infertility risk for placenta previa, increta or accrete there is also associated respiratory complications to the born infant like transient tachypnea of the newborn. (TTN)(31)(32)**.**

2.4 General anesthesia

Maternal mortality has decreased to 44% since the UN involved the millennium development goals from 1990 t0 2015 but the majority of these deaths were commonly occurring in LMICs where maternal mortality is 14 folds greater than in HICs. In all those maternal mortalities, anesthesia represent 2.8% where general anesthesia has 900 times higher risk than regional anesthesia which is 300 times in LMICs compared to United states of America(28).

2.5 Physiology of pregnancy

During pregnancy there are modifications that occur to the airway system where a pregnant women accumulate weight, breasts increase in size, airway mucosa edema and friability due to increased vessel and all of this leading to difficult positioning when the parturient comes for emergency c-section.(28).

What is known on the respiratory system changes is that there is augmentation in minute ventilation up to 50%, there is increased oxygen consumption at 20% and FRC is reduced at 20%(29). All this airway and respiratory modifications that occur during pregnancy lead firstly to quick desaturation in apnea periods because women's respiratory reserve is depleted. Secondary airway edema and friability expose the women to bleeding in the airways and edema of airway mucosa and lastly difficult ventilation and intubation this is why pre-oxygenation with 100% oxygen before induction of G.A is of great importance(9)(28).

In a systematic review done by Sobhy at al found that it contributed to 31% of maternal death. Pregnant women have high risk of pulmonary aspiration of gastric content at where aspiration pneumonitis is estimated at 0.1% compared to the general population when given G.A. because of higher aspiration risk, delayed gastric emptying due to labor time (labor induced nausea and vomiting), decreased tone of lower esophageal sphincter caused by increase in progesterone hormone(29).

Progesterone secreted by the placenta during pregnancy causing weakness of LES, delayed gastrointestinal intestinal transit, more acidic gastric juice. Another risk of gastric aspiration is caused by the pregnant uterus by elevating both intra-abdominal and intra- gastric pressures and lowering the gradient, displacement of the stomach, decrease angulation of the stomach and esophagus(9). When the patient has been given suxamethonium in induction of G.A there is increase gradient and LES above the intra-gastric pressure(33). In order to overcome all those

challenges WHO has developed a protocol of drinking clear fluids on labor (water, juice, etc...) to relieve thirst and prevent ketosis on labor(9). To neutralize the stomach pH and gastric contents with removing solid particles, before induction of general anesthesia, patients will be given a non-particulate anta- acid so that even if aspiration of gastric contents into the lungs happens there will be minimal damage to the lung parenchymal(34).

2.6 General anesthesia

General anesthesia is used mainly for true obstetrical emergency cases ,where there is limited time for regional anesthesia in very urgent cases when the life of the mother and unborn baby is compromised, failed regional anesthesia, contraindications to neuraxial anesthesia and in case of maternal request, general anesthesia will remain will the best choice to anesthetist(29)(35).

General anesthesia is better for faster induction, decreased hypotension for cardiovascular stability, greater ventilation and airways management for emergent caesarian section up to the recovery of patients(34).The best goal of general anesthesia delivery in emergency c-section is to achieve an appropriate level of hypnosis in order to offer good surgical conditions to the surgeon, minimize awareness, maximize good oxygenation and perfusion to the mother and the fetus, avoiding uterine atony to prevent bleeding and minimizing the transfer of anesthetic drugs to the baby(36)**.**

Several studies have agreed on the effectiveness of rapid sequence induction in case of emergent c-section by giving thiopentone (4-5mg/kg lean body weight),succinylcholine (1.5mg/kg) with the use of Sellick's maneuver (Cricoid pressure) which is very important to prevent gastric content aspiration and avoiding to give opioids and benzodiazepines before the baby is delivered to avoid transfer of those agents through the placenta for cardio-pulmonary depression of the neonate(8)(29)**.**Cricoid pressure is a technique used in induction of emergency general anesthesia in case of emergency operation when the assistant of the anesthesia provider apply 10N on the level of the cricoid cartilage toward C6 vertebra body in a perpendicular to the operating table, the pressure is then increased from 20 to 40 N and release it after the conformation of the tracheal intubation by stethoscope and capnography (ETco2) and cuffing of the endotracheal tube(34).

The most common hypnotic drugs used for induction of general anesthesia are thiopental, propofol, ketamine and etomidate. Ketamine and etomidate are known for their fast onset and minimal cardiovascular effects which are very nice choice when used to pregnant women with hemodynamic instability(36).

Thiopentone is the among the best drug due to its effects of minimizing maternal hypertension and awareness with a delayed recovery in case of difficult intubation. Propofols used in obstetric anesthesia due to its properties of propofol is another hypnotic used for induction of G.A for caesarean section not usually preferred in obstetric anesthesia because it is associated with mother's hypotension episodes, have a high risk of maternal awareness due to its short duration of amnesia, causing decrease in Apgar scores in the newborns and a prolonged duration for a patient to regain spontaneous ventilation(8)(32)**.**Succinylcholine is the best choice among neuromuscular blockers for its quick onset which is 30-45 seconds and short duration where it is due to last not later than 5 minutes. The advantages of succinylcholine is that it doesn't cross the placenta to reach the neonate due to its capacity of being highly ionized and very poor lipid solubility.it is a safe drug, hydrolyzed by pseudocholinesterase and doesn't reach the neonate(36).Rocuronium or vecuronium are non-depolarizing neuromuscular blocking agents usually used in place of suxamethonium when it is unavailable or contraindicated for some raisons. When used at sufficient doses, it offers good intubating conditions as succinylcholine but has a prolonged duration of action which is a down side of it in case the anesthesia provider can't ventilate or intubate the patient(32)**.**For induction of general anesthesia in emergent caesarian section the most used drugs are thiopental, propofol, ketamine and suxamethonium with the use of Sellick's maneuver (Cricoid pressure) which is very important to prevent gastric content aspiration(29).

2.7 Complications and of general anesthesia

A number of studies high light G.A as a risk factor of life-threatening adverse effects like difficult airway, aspiration and awareness, it is advised to avoid it whenever possible and use other alternatives like neuraxial blocks. General anesthesia for caesarian section is the leading risk factors for MMR for pregnant women undergoing c-section under G.A in LMICs(28).

Airway difficulties are common in pregnant women where it is associated with 4-5 times higher difficulties and quicker hypoxia are the leading cause of maternal mortality(29).

2.8 Pulmonary aspiration of the gastric contents

Aspiration of gastric content is the major complications for general anesthesia among emergency caesarian section with the incidence of 1 in 400–600(29)**.** Studies done in USA showed that gastric aspiration is the first cause for maternal mortality related to anesthesia which represent 33%, failed airway has been associated with increased risk of gastric aspiration in emergency c-section under GA (34)**.**

To prevent gastric aspiration patients are being positioned in head up tilt, given prokinetics as Metoclopramide which is a dopamine antagonist to increase gastric emptying and treat nausea(28). Anti-acids like sodium citrate and sodium bicarbonate 8.4% are being used but are associated with production of gas(37).H2 blockers and PPI such as cimetidine, Ranitidine, famotidine, omeprazole as well as lansoprazole etc.. and the use of Cricoid pressure have been of a big utility in preventing gastric aspiration(29)**.**

2.9 Difficult intubation

The majority of complications related to general anesthesia are difficult or failure to intubate which lead to a scenario of 'cannot intubate, cannot ventilate' which is increased eight to ten times in obstetric patients because of physiological and anatomical changes of pregnancy such as weight gain involving bigger BMI, upper airway edema, breast enlargement associated, comorbidities and in situation like emergency caesarian section where there is limited time for airway assessment of the patient the risk of airway difficulties increases(35)**.** To avoid these problems it is advised to do a quick pre- anesthesia visit and to practice the failed intubation drill guidelines for trainees and staff(32).

2.10 Transfer of hypnotics to the baby

In order to avoid neonatal respiratory depression, induction of general anesthesia is done when the operators have already scrubbed, prepared the abdomen and ready for incision to extract the baby(29).Anesthetic agents used for induction of G.A before the delivery of the baby are thiopental, ketamine, propofol and etomidate except opioids and benzodiazepines which are being given after the neonate is delivered to avoid transfer of these agents to the fetus(29). It is better to be prepared for neonatal resuscitation in case there is delayed extraction after G.A there will be potential cardio respiratory depression and decreased muscle tone of the neonate which means that there will be transfer of Iv anesthetics drugs alongside halogenated which will be excreted by assisted ventilation where neonates recovery pretty well(36).

A systematic review of Cochrane database for anesthesia of cesarean section for two randomized studies revealed that there was no evidence on APGAR score in neonatal outcome for babies born to mothers who were given spinal anesthesia compared to those who were given G.A(38).

For studies done on neonates to analyze the pH of umbilical artery of neonate from mothers who received general anesthesia for caesarian section found that the pH of umbilical artery was the same as the one operated under spinal anesthesia(35).

In an epidemiological review investigating later learning disability for children born when their mothers were being given G.A or neuraxial anesthesia found that there was no difference between them but rather children who were born by c-section had few learning disabilities compared to their fellow born vaginally(36).

2.11 Awareness

The incidence of awareness among obstetric patients operated under GA for emergency c-section is increasing and it is very important to avoid awareness because it causes long standing psychological sequelae(29).In a study done in Spain, the incidence of awareness was 1% for caesarian section done under general anesthesia. A prospective study done by ANZCA group from Australia and New Zealand from 2005-2006 in caesarian section done under general anesthesia for emergent fetal delivery 0.26% were reported to be associated with awareness.

Measures put in place to prevent awareness are putting the patients on halogenated anesthesia as halothane 0.5%,isoflurane 0.6% and sevoflurane 1% associated with nitrous oxide 50% which virtually proven to prevent the risk of awareness(29)(35).

CHAPTER III: METHODOLOGY

3.1. Study design

It was an observational retrospective study using cross-sectional design.

3.2 Study Period

We collected data from January 2018 to December 2019

3.3 Setting

The study was conducted in CHUK in obstetric department which is the most frequented tertiary hospital with an obstetric department that receives and takes care of many parturients referred from different District Hospitals.

3.4 Population

Our study population was all parturient who were present and underwent emergency C-section under general anesthesia during the study period of two years from January 2018 to December 2019.

3.5. Sample size

Our study considered 124 parturients who underwent emergency c-section under general anesthesia during data collection using convenient sampling method for the selection of the study period of 2018-2019.

3.6 Data variables

We collected data on age, indication of c-section, type of anesthesia, maternal complications related to general anesthesia as aspiration, laryngeal trauma, difficult intubation, laryngospasm, delayed recovery, accidental tooth extraction, perioperative bleeding and need of transfusion; fetal complications related to G.A as birth asphyxia, postpartum apnea, low APGAR score and neonatal death during the first 24 hours postpartum. The anesthesia providers and the operator for the C-section were also recorded from the file.

3.7 Data collection

Data were collected by assigned research assistants including trained medical students and NPA who collected data for all women who had emergency caesarian sections under general anesthesia from patients' files using pre-elaborated data collection tool from 2018 and 2019.

3.8 Analysis and statistics

Data were entered into SPSS version 25. We analyzed the rates of the outcome of interest by using frequencies and percentages. Association of categorical variables with the outcome of interest was analyzed by using Chi-square test. The outcome of interest for analytical study was a low APGAR at the first minute defined as an APGAR $\leq$ 7. Variables with a significant association with the outcome ($p< 0.05$) were used in an exploratory logistic regression model to identify potential independent predictors to the outcome.

3.9 Ethical approval

Ethical approval was obtained from the University of Rwanda, College of Medicine and Health Institutional Review Board (CMHS-IRB) No304/CMHS IRB/2019 and University Teaching Hospital of Kigali EC/CHUK/0138/2019.To ensure patient confidentiality, we used Id numbers, no names appeared on our collecting sheets. We kept the data safely to be seen by researchers only.

CHAPTER IV: RESULTS

4.1The rate of emergency C/s performed under general anesthesia.

In the study period of 2 years, there have been 5190 deliveries in the department of GO/CHUK. An important proportion of patients in this study were between 31-45 years group (52.4%). The mean age was of 31years (+/-6.5 years). During this period the total number of C-sections done in obstetric department were 2964(68.1%) with 2021 (57.1%) as emergency c-sections and 943(42.7%) as elective. Of the emergent C-sections, 1886 (93.4%) were operated under Spinal Anesthesia whereas 135 (6.6%) were done under G.A. (Fig.1)

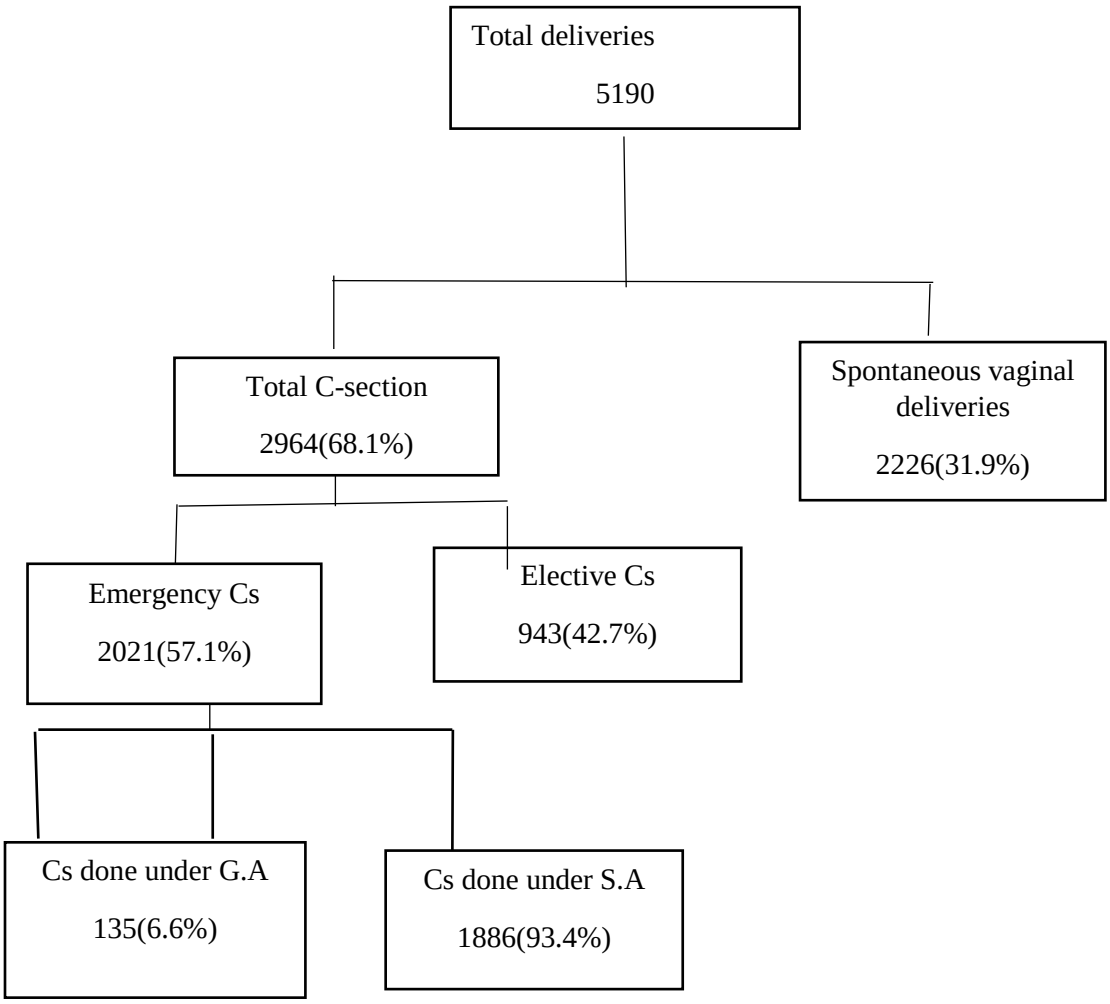

Figure 1. ***Demonstrating the total number of deliveries, C-section and the types of anesthesia given***

4.2. Indications of emergency Caesarian section under general anesthesia

Of the 135 who underwent emergency C-section under G.A, could find sufficient data from files for only 124 patients. Indications for emergency Caesarian section under general anesthesia were mainly related to fetal causes with 74 cases (59.7%) including non-Reassuring Fetal Heart Rate found in 64 cases (51.6%), 5 cases of cord prolapse(4%), 2 severe oligohydramnios (1.6%), 2 twin pregnancies (1.6%) and 1 malpresentation (face, 0.8%). Maternal-related indications were found in 50 cases (40.3%) including 10 patients with severe pre-eclampsia and/or eclampsia(8%), 16 cases of absolute contraindications to SAB (13%), 6 cases with placenta previa (4.8%), 7 with abruptio placentae (5.6%), 8 parturient in active labor phase with previous uterine scar (6.4%) and 3 cases of failure of labor (2.4%). (Fig2)

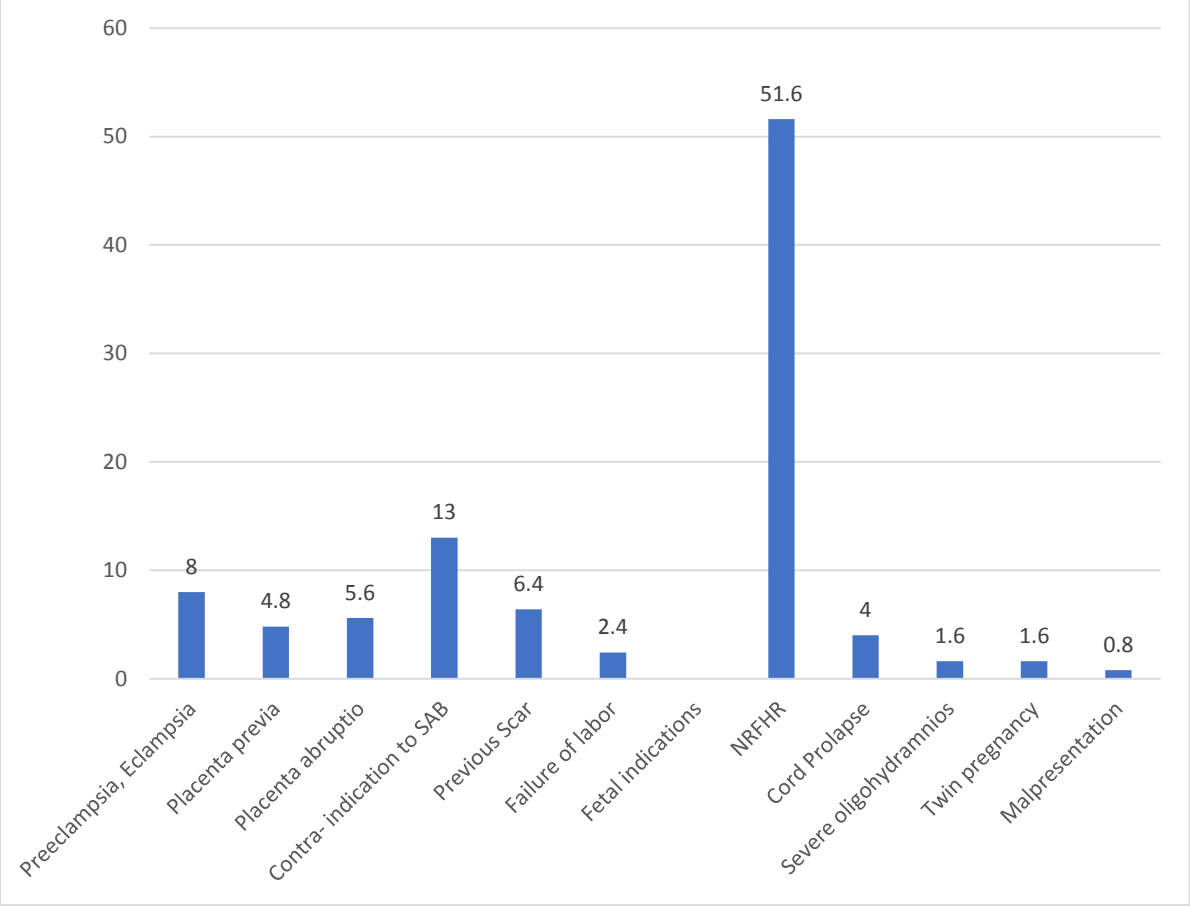

Figure 2*: Indications of emergency Caesarian section under general anesthesia*

4.3. Intraoperative complications

4.3.1. Intraoperative complications related to general anesthesia

Among the 124 of parturient, one (0.8%) had gastric content aspiration, one (0.8%) have had difficult intubation and one (0.8%) one had laryngospasm the recovery. They were all managed with resolution and no further complication was reported. (Fig.3)

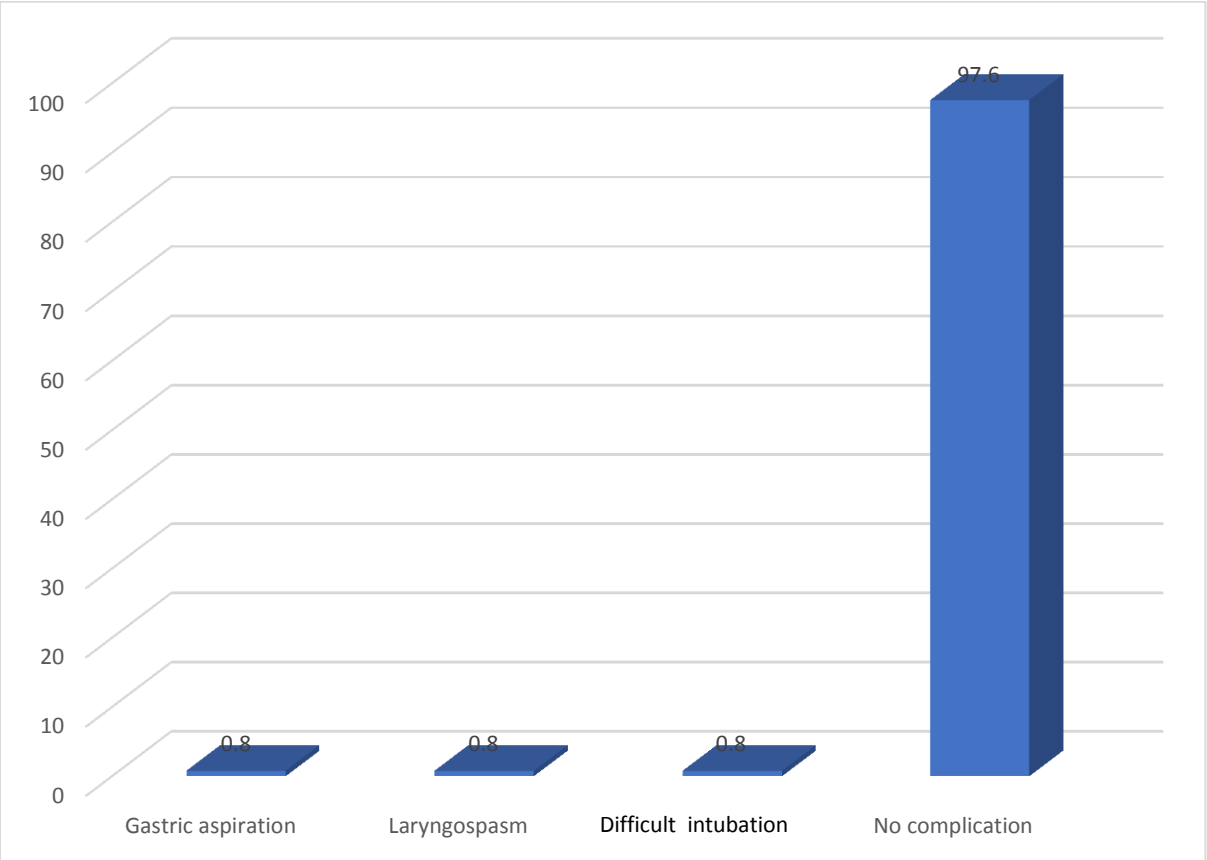

Figure 3*: Anesthesia intraoperative complications related to general anesthesia among emergency c-section parturient.*

4.3.2 Obstetric intraoperative complications in emergency C-section under General Anesthesia

In the study group, 19 (15.3%) had PPH during the intervention and required transfusion of blood components. Of them, 3 underwent hysterectomy for hemostasis.

Also, there has been 2 cases with urinary bladder injury successfully repaired. (Fig. 4)

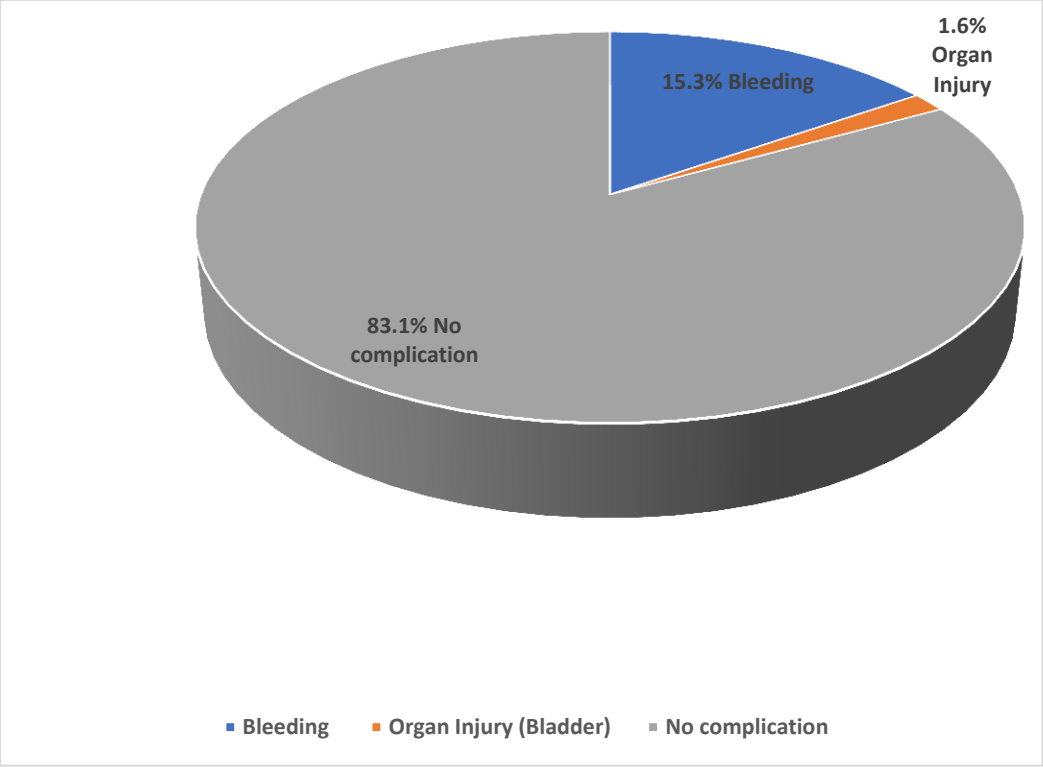

Figure 4*: Obstetric intraoperative complications in emergency C-section under General Anesthesia*

4.4. Fetal and maternal outcome after emergency c-section under general anesthesia

We found of total 126 babies born from our 124 parturients included in this study. Of them, 65(51.5%) were discharged within 3 days after delivery with their mothers whereas46 (36.5%) were admitted to NICU. Four (3.2%) neonates died immediately after birth. The majority of neonates (32; 69.6%) were admitted to NICU due prematurity and its complications, seven

(15,2%) had birth asphyxia, six (13%) had infection risk whereas 1(2.2%) was admitted for low birth weight.

Only 1(2.1%) neonate died of prematurity and intraventricular hemorrhage during the first 24hours after birth. Six neonates did not survive the complications of prematurity but died after the period of 24 hours. One neonate died (2.1%) of birth asphyxia.

Of 124 parturient, 120 (96.8 %) were discharged from obstetric department, four patients (3.2%) were admitted to ICU for hemodynamic instability and respiratory support where two of them (1.6%) died of pre-eclampsia complications in ICU (Intracerebral and Subcapsular hemorrhage) . (fig5)

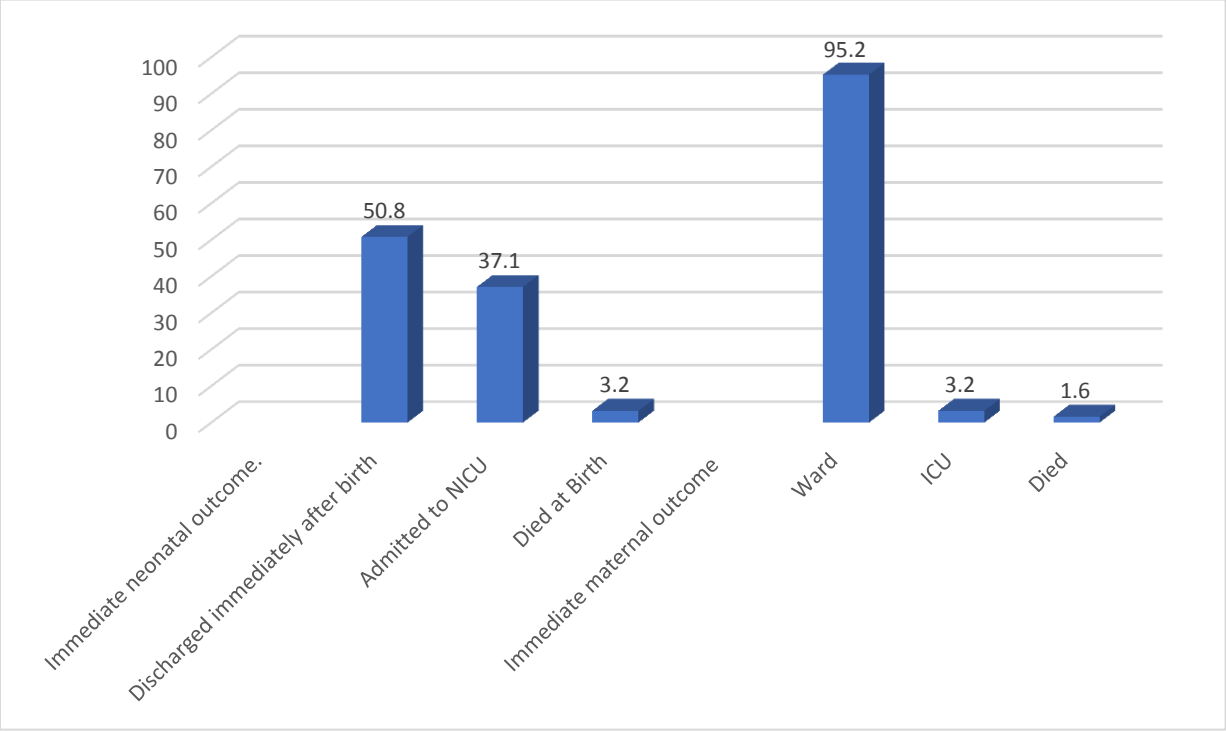

Figure 5. ***Neonatal and maternal outcome after birth***

4.5. Predicting factors of Low APGAR after General Anesthesia

Parturient who were younger than 35 years had 1.2 odds (0.5-2.6) to give birth to neonates with low Apgar (<7 score) compared to older mothers but with no significant difference (p=0.701).

Neonates younger than 34 weeks of gestation had 5.5 odds (1.9-15.8) have a low Apgar score at the first minute compared with term neonates (OR:5.5; 95% CI: 1.8-14.7; p=0.002). Parturient with placenta previa had 1.5 times odds of delivering babies with low Apgar at the first minute compared with parturient without that placenta malposition but no statistically significant difference was found (p=0.593).

Neonates with intrauterine non reassuring fetal heart rate had 1.5 odds to have low APGAR score at the first minute compared with other neonates but the difference was not statistically significant (p=0.242). Parturient with comorbidities tended to do not have neonates with low APGAR score at the first minute compared with parturient without any reported comorbidity but the difference was not statistically significant (p=0.069).

In an exploratory logistic regression model including prematurity, non-reassuring fetal heart rate and maternal comorbidity, prematurity with less than 34 weeks of gestational age stood as an independent predictor of low APGAR score at the first minute (OR 95CI= 5.5 [1.9-15.8]; p-0.002). (Table1)

Table 1. Different predictors of Apgar score at the first minute.

Predictors	APGAR SCORE		COR (95% CI)	p value	AOR (95% CI)	p value
	≤7	>7				
Age of the mother						
≤35 years	37 (42.0%)	51 (58.0%)	1.2 (0.5-2.6)	0.701		
>35 years	13 (38.2%)	21 (61.8%)				
Gestational age						
<34weeks	30 (85.7%)	5 (14.3%)	5.2 (1.8-14.7)	0.001	5.5 (1.9-15.8)	0.002
>34 weeks	47 (53.4%)	41 (46.6%)				
Placenta praevia						
Yes	4 (50.0%)	4 (50.0%)	1.5 (0.35-6.2)	0.593		
No	46 (40.4%)	68 (59.6%)				
Pre-eclampsia						
Yes	5 (35.7%)	9 (64.3%)	0.7 (0.2-2.5)	0.67		
No	45 (41.7%)	63 (58.3%)				
NRFHR (Non-Reassuring Fetal Heart Rate)						
Yes	29 (46.0%)	34 (54.0%)	1.5 (0.7-3.2)	0.242	1.4 (0.6-3.0)	0.432
No	21 (35.6%)	38 (64.4%)				
Any comorbidity						
Yes	1 (10.0%)	9 (90.0%)	0.14 (0.01-1.1)	0.069	0.4 (0.09-1.6)	0.199
No	49 (43.8%)	63 (56.3%)				
Extraction time						
<5minute	31 (37.8%)	51 (62.2%)				
≥5 minutes	13 (41.9%)	18 (58.1%)	1.2 90.5-2.7)	0.688		
Parity						
≤G3	47 (62.7%)	28 (37.3%)	1.0 (0.4-2.1)	0.985		
>G3	30 (62.5%)	18 (37.5%)				
Previous scar						
Yes	5 (62.5%)	3 (37.5%)				
No	72 (62.6%)	43 (37.4%)	1.0 (0.2-4.4)	0.995		

- COR: Crude Odds Ratio AOR: Adjusted Odds Ratio

- **CHAPTER V: DISCUSSION**

General anesthesia is one the anesthesia technique used during caesarean sections. The indications for G.A in emergency Cs may vary according to the level of urgency and presence of life threating conditions for the mother or the fetus. Thy may also include the refusal of regional anesthesia, failed regional technique, presence of coagulation disorders, infection at the site of spinal/epidural needle insertion, maternal hypovolemia, septic shock, increased intracranial pressure, spinal abnormalities, severe valvular heart stenotic disease among others(34)(39)(40)**.**
C /S is among the safest lifesaving procedure but carries complications that may arise and are associated with neonatal and mostly maternal complications related to the procedure itself or to anesthesia (26)(28)(38)**.**

Maternal complications during general anesthesia for c-sections are linked to airway management with increased probability of difficult intubation, intra-operative bleeding, pulmonary aspiration of gastric content. These are the main leading causes of maternal mortality related to general anesthesia which has been reported 16.2 more times than when spinal anesthesia blocks are used(11)(38)**.**
It is also associated with decreased neonatal APGAR scores at first and fifth minute and increased risk for birth asphyxia which lead to long-term neurological disabilities or neonatal death (39)(43)**.**

For all those reasons**,** spinal anesthesia is considered as the gold standard mainly given the lower rates of maternal mortality and maternal-fetal complications(8)(9).
In our study, we have found that GA was performed for 6.6% of emergent c-sections at CHUK. This was relatively a small proportion compared with the rates in other SSA countries like Nigeria where the rates of GA for C-section reached 17.6% and even as much as 50% in some centers in Nigeria as well according to reports from a study done in Antigua and Barbuda(41). The rate of GA was also lower compared the one found in a study done in a tertiary hospital care of Peshawar, Pakistan where this rate was 21.7% (30).

However, the rate we have found is higher compared with the one prevailing in developed countries like in Belgium where general anesthesia was used in 1.9% of all c-section in

2018(44). These differences between countries and our study site may be attributed to the lack of follow up of pregnancies by qualified personnel and late presentation of parturients to the health facilities in low resources settings than in high resource countries like Belgium.

In this study we have found that indications of c-section were related to fetal causes in 59.7%of cases, of which non-reassuring fetal heart rate accounted for 51.6% of cases, cord prolapse for 4% and severe oligohydramnios for 1.6%. Maternal indications to emergency c-section (40.3%) with anesthesia related indications as with failed spinal in 10% of cases, bleeding disorders in 3.2%, pre-eclampsia and eclampsia in 8% and placenta previa or placenta abruptio in 10.4%. Previous uterine scars accounted for 6.4% of indications for C-section under GA. All these fall in line with findings in a 9 years retrospective study done by Cools E et al. where 50% of emergency C/s were done due to maternal fetal compromise, 22% due to failure of neuraxial anesthesia , 25% because of coagulation abnormalities, 7% related to the spinal deformities and 1% was driven by the maternal request of G.A(44)**.** In our study, maternal indications rate is relatively higher compared with findings in a study done by Begum Tet al. where it was 1.4% for absolute maternal indications for C/S. Majority of indications were primarily repeat C/S (24%), fetal distress (21%), prolonged labor (16%), oligohydramnios (14%) and post-maturity (13%) (37).The difference with our findings may reside in the definition of the outcome used between the two studies. Moreover, in the settings where the two studies were conducted, there was a use of epidural for labor analgesia, indicating a high probability of conversion to epidural anesthesia for C/S.

We found maternal complications from GA in 2.4% cases mainly respiratory complications as difficult intubation, aspiration of gastric content and laryngospasm. This rate is relatively low compared with findings in a study done in Australia and New Zealand that showed the rate of difficult intubation in 1 out of 30(3.3%), while aspiration of gastric content accounted for 0.1% and maternal hypoxemia for 2%.The latter is due to bronchospasm and laryngospasm in only 0.3%(13). Our findings also diverge from those in studies done in India and in Belgium where they did not respectively find any anesthesia related complications intraoperatively(44)(37)**.** A study conducted at CHUK and Muhima DH, Rwanda by Gakumba et al. in 2013found that Mallampati class can suddenly change at any time during labour and these changes may predispose parturient to the difficult airway(45)**.** Most parturients admitted to CHUK are in

active labor phase and this may increase the likelihood of increased Mallampati class, difficult airway and aspiration risks.

In our study, we have found that perioperative transfusion rate was 15.3%. Although relatively high, it remains lower compared with what has been found in a study done in Nigeria where this rate was 20.8 %(46)while in a study conducted by Eran et al in Tel Aviv, Israel this rate was as low as 1.5% (47). This huge difference may be linked to issues of late consultation and presentation of pregnant women to health facilities in low resources settings and lack of sufficient time to treat anemia during pregnancy, multiple pregnancies and resulting uterine atony, high rates of placental insertion among others.

For neonatal outcome, we deplored one neonatal death during the first 24 hours resulting from neonatal asphyxia and prematurity contrary to the study done in Cameroun, neonatal mortality during the first 24hours of life was 35% of all neonates delivered by c-section. (48). This could be linked to the Rwanda national strategies to reduce under 5 years child deaths in line with the fourth MDG is one possibility(49). Our results are low compared to a study across Africa where neonatal death is 18% for neonates born before 35 weeks of gestation (52). This difference may be explained by the bigger number of sample size collected across the region.

Factors that influence a low APGAR in emergency c-section was gestational age below 34 weeks. This concurs with findings in a study done in Ethiopia where pre-term labor was among the factors associated with low APGAR generally attributed to surfactant's deficiency in this category of neonates(50)**.**

The level of experience for the operating surgeon did not influence the APGAR. This is similar to what has been found in a the study done in Cameroun at 3 referral hospitals which also revealed that no significant difference or maternal and fetal outcomes when the c-section is performed by residents or qualified obstetricians(43)**.**Also, Benzouina et al.in Morocco have had the same findings of lack of correlation APGAR scores and the experience of the surgeon(51). This may be explained by the fact that c-section is a commonly performed procedures and residents may acquire sufficient skills quite quickly in low resource settings especially in SSA compared to developed countries(43).Other limitations for this study are the small sample size, which did not enable us to identify predictors to the outcome of interest including this on

anesthesia providers. We could not find records of 2017 for instance to run a 5 or more years retrospective study. Therefore, a multicenter study is more than needed to enlighten the community on these pending issues.

CHAPTER VI: CONCLUSION AND RECOMMENDATION

5.1 Conclusion

The rate of general anesthesia for emergency C-section at CHUK was low in 2018-2019.Similarly, general anesthesia-related complications are also acceptable compared to other v low resource settings in LMICs and expectedly related to the airway management. Impact on the APGAR could not be explored given the design of this study but a low APGAR score was mainly associated with prematurity. Neonatal deaths within 24 hours after birth seemed also to be linked to the prematurity and so were reasons for admission in NICU.

5.2 Recommendation

1.Further research should be done to explore the same variables related to emergency c-section done under general anesthesia may be by comparing outcomes of general anesthesia vs Spinal anesthesia at tertiary level and District Hospitals.

2.Protocol and guidelines should be used as categorization tool of emergency c-sections in order to differentiate the level of urgency among mothers.

3. Encourage patients with pregnancy at high risk for early consultation to avoid subsequent problems for the mother and the fetus.

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ANNEXES

Annex 1. Data Collection

1. Age group

Age in years:

2. Referral Hospitals

1. Muhima

2. Kacyiru

3. Kibagabaga

4. Rutongo

5.Remera Rukoma

6. Private clinic

7.Home

8.Others

3. Reason of transfert

1.Eclampsia

2. Pre-eclampsia

3.Repeated C/s delivery

4.Abnormal placentation

5. Third trimester bleeding

6.PPROM

7.PROM

8.0thers

9.None

4. Past medical History

1. HTN

2. HIV

3. Diabetes mellitus

4. Others

5. None

6. Valvular heart diseases

5. **Gynecological History**

1. Pre-eclampsia

2. UTI

3. Previous uterine scar

4. Bleeding on pregnancy

5. Others

6. None

6. Medication History

1. Dexamethasone

2. Nifedipine

3. MgSO4

4.ARV

5.Daonil Others

6. Glucophage

7. None

8. Others

7.Parity

1. G1

2. G2

3. G3

4. >G3

8. Gestational Age

1. < 34 weeks

2. 34-37 weeks

3. >37 weeks

9. ASA

1.1E

2.2E

3.3E

4.4E

5.5E

10. Indications of Caesarian section

1. Previous C/s

2. Pre-eclampsia, Eclampsia

3. Abnormal placentation (Placenta previa, placenta accreta)

4. Placenta abruptio

6. Failure of labor

7. Malpresentation

8. Maternal request

9. Uterine rupture

10.Others

11. Fetal status

1.NRFHR

2. Cord prolapse

3. Malpresentation

4. Twin pregnancy

6. Severe oligohydramnios

7. Others

12.Technique of anesthesia used

1.RSI

2.Normal induction

3. Sedation

4. Not documented

13. Anesthesia indications of General Anesthesia

1. Failed spinal

2. Disc prolapse

3. Bleeding disorders

4. Spinal malformation

5. Cardiac disease

14. Complications related to Anesthesia

1. Difficult intubation

2. Allergy

3. Aspiration

4. Dysphonia

5. Cardiac Arrest

6. Others

7. None

8. Laryngospasm

15.Mother's post op outcome

1. Ward

2. ICU

3. Died

16. Intraoperative obstetrical complications

1. Bleeding

a. Estimated Blood loss(……..)

b. Transfused PRBC……. Plt…….. FFP……..Cryo……

2. Organ injuries

3. Others

17. Timing related to C/S decision

When is the decision to operate made?…….

17. Time to induction

1. < 15minutes

2. 15-30 minutes

3. 30-60minutes

4. 1-2hours

5. 2-3hours

6.>3hours

7.Not documented

18.Time to extraction

1.<15minutes

2.15-30 minutes

3. 31-60minutes

4. Not documented

19.Duration of Surgery

1. <1hour

2. 1-2hours

3. >2hours

4. Not documented

20. Duration of Anesthesia

1. 1hour

2. 1-2hours

3. 2-3hours

4. >3hours

21. Anesthesia Provider

1. NPA

2. Resident

3. Anesthesiologist

4.ND

22. Operator

1. Resident

2. Gynecologist

23. APGAR score at 1st Minute

1. 0-4
2. 5-7
3. 8-10
4. ND

24. APGAR score at 5th minute

1. 0-4
2. 5-7
3. 8-10
4. ND

25. APGAR score at 10th minute

1. 0-4
2. 5-7
3. 8-10
4. ND

26. Neonatal Intervention after birth

1. Resuscitated

2. Intubation

3. Naloxone

4. No intervention

5. Not documented

27. Birth weight after birth

1. < 1Kg

2. 1-1,5Kg

3. 1.5-2.5 Kg

4. 2.5-4.5 Kg

5. >4.5Kg

6. Not documented

28. Neonatal hospital stay

1. 24hrs

1.<48hrs

2. 3-5days

3. 5-14days

4. 15-21days

5. 22-30days

6. 31-90 days

7. DIED

8. Cause of death

29. Neonatal outcome at Birth

1.Discharged immediately with the mother

2. Admitted to PICU or NICU

3. Died at Birth

4.IUFD

5. Not documented

30. Neonatal Outcome after hospital stay

1. Discharged

2. Died

2. Not documented

30. Was the child admitted to NICU or PICU?

A) What was the cause of admission?

a) Low birth weight
b) Respiratory distress(meconium aspiration)
c) Infectious risk(fever during labor)
d) Prematurity
e) Birth asphyxia
f) Congenital anomalies
g) IUGR
h) others

Annex. 2. IRB approval

UNIVERSITY of RWANDA

COLLEGE OF MEDICINE AND HEALTH SCIENCES

DIRECTORATE OF RESEARCH & INNOVATION

CMHS INSTITUTIONAL REVIEW BOARD (IRB)

Kigali, 25th /06/2019

Dr SAIDIA Angelique
School of Medicine and Pharmacy, CMHS, UR

Approval Notice: No 304/CMHS IRB/2019

Your Project Title ***"Frequency Of Use For General Anesthesia In Emergency Caesarian Section At CHUK"*** has been evaluated by CMHS Institutional Review Board.

		Involved in the decision		
		Yes	No (Reason)	
Name of Members	**Institute**		**Absent**	**Withdrawn from the proceeding**
Prof Kato J. Njunwa	UR-CMHS	X		
Prof Jean Bosco Gahutu	UR-CMHS	X		
Dr Brenda Asiimwe-Kateera	UR-CMHS	X		
Prof Ntaganira Joseph	UR-CMHS	X		
Dr Tumusiime K. David	UR-CMHS	X		
Dr Kayonga N. Egide	UR-CMHS	X		
Mr Kanyoni Maurice	UR-CMHS		X	
Prof Munyanshongore Cyprien	UR-CMHS	X		
Mrs Ruzindana Landrine	Kicukiro district		X	
Dr Gishoma Darius	UR-CMHS	X		
Dr Donatilla Mukamana	UR-CMHS	X		
Prof Kyamanywa Patrick	UR-CMHS		X	
Prof Condo Umutesi Jeannine	UR-CMHS		X	
Dr Nyirazinyoye Laetitia	UR-CMHS	X		
Dr Nkeramihigo Emmanuel	UR-CMHS		X	
Sr Maliboli Marie Josee	CHUK	X		
Dr Mudenge Charles	Centre Psycho-Social	X		

After reviewing your protocol during the IRB meeting of where quorum was met and revisions made on the advice of the CMHS IRB submitted on 25th June 2019, **Approval has been granted to your study.**
Please note that approval of the protocol and consent form is valid for **12 months**.

You are responsible for fulfilling the following requirements:

1. Changes, amendments, and addenda to the protocol or consent form must be submitted to the committee for review and approval, prior to activation of the changes.
2. Only approved consent forms are to be used in the enrolment of participants.
3. All consent forms signed by subjects should be retained on file. The IRB June conduct audits of all study records, and consent documentation June be part of such audits.
4. A continuing review application must be submitted to the IRB in a timely fashion and before expiry of this approval
5. Failure to submit a continuing review application will result in termination of the study
6. Notify the IRB committee once the study is finished

Sincerely,

Date of Approval: The 25th June 2019

Expiration date: The 25th June 2020

Professor GAHUTU Jean Bosco
Chairperson Institutional Review Board,
College of Medicine and Health Sciences, UR

Cc:

- Principal College of Medicine and Health Sciences, UR
- University Director of Research and Postgraduate Studies, UR

Annex 3. CHUK approval

CENTRE HOSPITALIER UNIVERSITAIRE
UNIVERSITY TEACHING HOSPITAL

Quality Health Care
Training & Research

Ethics Committee / Comitéd'éthique

August 23rd , 2019 **Ref.: EC/CHUK/0138/2019**

Review Approval Notice

Dear Saidia Angelique

Your research project: ***"Frequency of use for general anesthesia and outcome in emergency caesarian section at CHUK"***
During the meeting of the Ethics Committee of University Teaching Hospital of Kigali (CHUK) that was held on 23rd August, 2019 to evaluate your request for application of ethical approval for the above mentioned research project, we are pleased to inform you that the Ethics Committee/CHUK has approved your research project.

You are required to present the results of your study to CHUK Ethics Committee before publication.

PS: Please note that the present approval is valid for 12 months.

Yours sincerely,

ETHICS COMMITTEE CHUK

Dr.RUSINGIZA KAMANZI Emmanuel
The Chairperson, Ethics Committee,
University Teaching Hospital of Kigali
<<University teaching hospital of Kigali Ethics committee operates according to standard operating procedures (Sops) which are updated on an annual basis and in compliance with GCP and/ Ethics guidelines and regulations>>

B.P. :655 Kigali- RWANDA www.chk.rw Tel. Fax : 00 (250) 576638 E-mail :chuk.hospital@chukigali.rw