PREVALENCE, OBSTETRIC CHARACTERISTICS, CLINICAL PRESENTATIONS AND OUTCOMES OF PATIENTS MANAGED FOR UTERINE RUPTURE AT KENYATTA NATIONAL HOSPITAL BETWEEN JANUARY 2016 AND DECEMBER 2020. (A descriptive retrospective cross-sectional study)

Principal Investigator:
Dr. Kiden Annet
H58/33072/2019
Department of obstetrics and Gynaecology

A research dissertation submitted for examination in partial fulfilment of the requirements for an award of the degree of master of Obstetrics and Gynecology, Department of Obstetrics and Gynecology, Faculty of health sciences, University of Nairobi.

2023

Declaration

I, hereby declare that this dissertation entitled: "Prevalence, obstetric characteristics, clinical presentations, and outcomes of patients managed for uterine rupture at Kenyatta National Hospital between January 2016 and December 2020," a retrospective cross-sectional study, is my original work; it has not been presented anywhere for an award. It was done under the guidance of my supervisors. Citations from other sources have been duly acknowledged and referenced.

Signature: **Date:** 8th August 2023

Dr. Kiden Annet

Certificate of Approval

This dissertation has been presented with our full approval as University of Nairobi research supervisors.

Professor Zahida Qureshi

Associate Professor, Department of Obstetrics and Gynaecology, Faculty of Health Sciences University of Nairobi.

Signature: _(signature)_ **Date:** 9th August, 2023
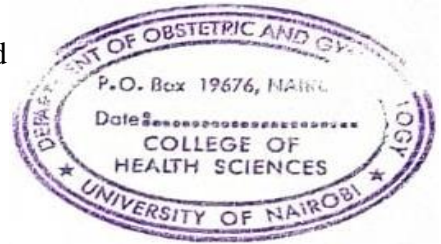
Dr. George Gwako

Lecturer, Department of Obstetrics and Gynecology, Faculty of Health Sciences, University of Nairobi.
Consultant obstetrician and Gynecologist, Kenyatta National Hospital

Signature: _(signature)_ **Date:** 9th August, 2023

Certificate of Authenticity

This is to certify that this dissertation is the original work of Dr. Kiden Annet, MMED Student Registration number (H58/33072/2019), of the Department of Obstetrics and Gynecology, University of Nairobi. The research was carried out in the Department of Obstetrics and Gynecology, College of Health Sciences at the University of Nairobi.

This scholarly work has not been presented anywhere for an award

Signature: _____. **Date:** 9th August,2023

Professor Eunice J. Cheserem, MBChB, MMed (Obs/Gyn), PGDRM, Dip IMHC (Sweden), Fell. Onc/Gynae
Associate Professor, Department of Obstetrics and Gynecology, Faculty of Health Sciences,
Consultant Obstetrician and Gynecologist, Kenyatta National Hospital.
Chair, Department of Obstetrics and Gynecology, University of Nairobi.

Acknowledgment

First, I am indebted to the Lord God Almighty for His ineffable love and grace for offering me the opportunity to do MMED in obstetrics and gynecology with University of Nairobi, a prestigious university with high global reputation due to her educational excellence.

Further, I am exultantly grateful to the visionary leadership of MMH for offering me this golden opportunity to pursue MMED in obstetrics and gynecology with University of Nairobi to become a better asset to the institution in the nearest foreseeable future. Long live CEO, long live MMH fraternity.

My special thanks go to my supervisors, Prof. Zahida Qureshi and Dr. George Gwako for their patience and constructive criticisms for this dissertation to reach its final destination. Equally, I am grateful to all other faculty lectures in the school of health sciences for selflessly sharing their accumulated wealth of knowledge with students which has given me totally a new outlook about medicine in general, obstetrics and gynecology in particular.

I also extend my gratitude to all those who helped me during data collection process Dr. Peninnah Makau and Dr. Ken Mworia. It was through your cooperation that the data for this dissertation were harvested. My cohort members and other colleagues in the UoN-KNH, I do appreciate your cooperation and friendships we made in the course of our studies.

Lastly, I dedicate this piece of scholarly work to my beloved husband, Robert and our children: Charity, Heritage, Joy and Caleb who endured a lot of vexation in the course of my study. You are special people in my life. I love and God bless you all!

UoN- June 2022
Dr. Kiden Annet

List of Abbreviations and Acronyms

AKI	Acute Kidney Injury
ANC	Ante Natal Care
APGAR	Appearance, Pulse, Grimace, Activity, Respiration
CI	Confidence interval
COVID-19	Corona virus Disease of 2019
DIC	Disseminated Intravascular Coagulation
ERCS	Elective Repeat Caesarean section
FSB	Fresh Still Birth
ICU	Intensive Care Unit
KMTC	Kenya Medical Training College
KNH	Kenyatta National Hospital
LSCS	Lower Segment caesarean section
MoH	Ministry of Health
MSB	Macerated Still Birth
MVA	Manual Vacuum Aspiration
NBU	New Born Unit
NICU	Neonatal Intensive Care Unit
NMR	Neonatal Mortality rate
RDS	Respiratory Distress Syndrome
SES	Socioeconomic status
SOPS	Standard Operating Procedures
SPSS	Statistical Package for Social Sciences
PH	Partial Hysterectomy
TAH	Total Abdominal Hysterectomy
TOL	Trial of Labor
TOLAC	Trial of Labor After Caesarean birth
UoN	University of Nairobi
VVF	Vesico-Vaginal Fistula
WHO	World Health Organization

Operational Definitions

Uterine rupture is tearing of the uterine wall during pregnancy or delivery.

Uterine scar dehiscence occurs when a preexisting uterine scar is either disrupted or separated.

Low APGAR score: <7 in 5 minutes

Obstructed Labor: poor or no progress of labor in spite of good uterine contractions.

Short inter-delivery interval: occurs within a period of less than 18 months.

Grand multi-parity is a woman who has delivered five or more babies weighing >500 g.

A massive blood transfusion is the replacement of one blood volume is done within 24 hours or half blood volume is done in a 4 hour period in an adult.

Fetal macrosomia: > 4000g irrespective of gestational age

Early diagnosis of uterine rupture: Time between rupture and delivery before onset of fetal compromise.

Anaemia occurs when the number of RBCs within blood falls below the normal.

Early neonatal mortality: is a death which occurs within the first 28 days of life of a neonate

A hypovolemic shock: refers to a medical or surgical condition in which rapid fluid loss results in multiple organ failure due to inadequate circulating volume and subsequent perfusion.

Maternal mortality refers to deaths due to complications from pregnancy or childbirth.

Induction of labor occurs when the process of labor is stimulated artificially.

Maternal bladder injury refers to a trauma which occurs during vaginal or instrumental delivery.

Fetal acidosis: refers to high levels of toxicity in an unborn baby's blood.

A stillbirth: is a baby who dies after 28 weeks of pregnancy but before or during birth.

List of figures and tables

Table of Contents

Abstract

Introduction: Uterine rupture is one of the leading causes of poor maternal and neonatal outcomes. Globally, the prevalence of uterine rupture is as low as 0.07%. However, in comparison to the global prevalence, there is unacceptably high prevalence of uterine rupture in sub-Saharan Africa, Kenya inclusive (1.3%). There is dearth of recent studies on the prevalence, obstetric characteristics, clinical presentation, and outcomes of patients managed for uterine rupture in Kenya. Thus, this study aimed to determine the prevalence, obstetric characteristics, clinical presentation, and outcomes of patients managed for uterine rupture at Kenyatta National Hospital (KNH), a referral hospital in Nairobi. Information obtained in this study is vital in planning strategies to reduce the adverse outcomes of uterine rupture.

Material and methods: This was a descriptive, retrospective cross-sectional study of patients managed for uterine rupture at KNH between January 1, 2016 and December 31, 2020. A total of 143 patients managed for uterine rupture cases were sampled from 69,190 deliveries during the study period. Relevant information about the prevalence, obstetric characteristics, clinical presentation, and outcomes were extracted from medical records, maternity theatre, statistics and maternal mortality reviews using abstraction form. The information were computerized and analyzed using SPSS 21.0 version.

Results: The prevalence uterine rupture was 0.21 % (1:484 deliveries). The mean age of the participants was 29.2 ($\pm$ 5.2), and median 29.0 (IQR 25.5-33.0) years. The most obstetric and labor characteristics were previous caesarian delivery (69.2%), unsupervised labor (26.6%) and obstructed labor in the unscarred uterus (22.4%). The most common surgical intervention was uterine repair in 125 (87.4%), and 82 (57.3%) patients required blood transfusion. Abdominal pain (91.1%) and abdominal tenderness (62.2%) were the leading clinical presentations. Meanwhile the adverse maternal, stillbirths and neonatal deaths were 7.0%, 69.2% and 6.3% respectively.

Conclusion: There was high prevalence of uterine rupture in the study site. Previous CS delivery, obstructed labor and unsupervised labor, and abdominal pain were the leading obstetric and labor characteristics that predisposed uterus to rupture. Patients' education and improved maternity services may lead to a reduction of adverse maternal and fetal outcomes secondary to uterine rupture.

Chapter 2: Review of Literature

The review of literature was done according to the order of research objectives: prevalence, obstetric characteristics, clinical presentations, outcomes of patients managed for uterine rupture.

2.1 Prevalence of uterine rupture

Hofmer et al in 2005 in a systematic review to determine the prevalence of uterine rupture worldwide found out that the prevalence of uterine rupture in community based studies ranged between 0.016- 0.30% and in facility based studies the range is 0.012- 2.9% (1). Moreover, a study by Gardiel et al in Ireland on review of hospital experience of uterine rupture revealed a low incidence of uterine rupture of 0.023% (19).

Further, in Multi-country survey (2017) to determine the incidence and outcomes of uterine rupture among women with prior C/S delivery, Motomura et al showed that the incidence of uterine rupture was 0.5% in women with at least one previous scar, with 0.2% in high Human Development Index (HDI) countries and 1.0% in low Human Development Index (HDI) (2). Hussein et al in Tanzania 2012, in a retrospective study to determine the incidence, causes, complications and fetal/maternal outcomes of uterine rupture found the incidence of 0.225% (15). Similarly, a Kenyan retrospective study in 1991 by Lema et al found the incidence of uterine rupture to be at 0.23% (17).

However, in Ethiopian retrospective cross-sectional studies, Dawud et al and Geremew et al revealed substantially high prevalence of uterine rupture ranging between 0.9% - 2.44% (4, 8).

2.2 Obstetric characteristics of uterine rupture

Several studies indicated previous uterine scar, multiparity, hyper-stimulation of uterus with uterotonics, maternal age as some of the common obstetric characteristics of uterine rupture.

2.2.1 Previous uterine scar

In 2019, a Nigerian study indicated high percentages of 87.5% of uterine rupture cases due to increased number of repeated C/S (12,13). Similarly, a study by Lema et al in Kenya and Talib et al. in Saudi Arabia found that previous C/S scar contributed 56.8% and 51.3% respectively of all the uterine rupture cases (5). Other studies done in India by Nagajyothi et al and Yemen by Ishraq et al. demonstrated the rates range of 22% - 36.2% of uterine rupture with one and two previous scars (8, 15).

2.2.2 Obstructed labor

Studies have reported labor obstruction as a major obstetric characteristic of uterine uterus in countries with low income countries.

In Yemen, Dhaifalah et al showed that 83% of 37 patients of ruptured uterus was due to obstructed labor (6). Similarly, a retrospective study by Ehigiegbaa et al demonstrated that 38.6% of 51cases of uterine rupture are due to obstructed labor (14). Talib et al, in his retrospective cohort study, noted that obstructed labor contributed 8.8 % (14/160) of the cases of uterine rupture (5).

Chapter 1: Introduction

Uterine rupture is one of the rare and yet preventable catastrophic obstetric emergencies. Its occurrence breach the integrity of uterine wall, thus resulting to adverse maternal and fetal outcomes.

Globally, the prevalence of ruptured uterus stands at 0.07% (1). However, it should be noted that the prevalence of uterine rupture varies considerably from one country to the other depending on their human development index (HDI). Some studies conducted have shown substantially low prevalence of uterine rupture 0.016% - 0.2% in countries with high (HDI) and high prevalence of uterine rupture 0.23% -1.0% in countries with low (HDI) (1)(2).

Most studies conducted in the Africa demonstrated a substantially high prevalence of uterine rupture ranging between 0.22% - 2.44% (3,4). These statistics are similar to those seen in the Middle East countries (5,6). The high rates of uterine rupture in Africa are attributed to poor socio-economic status, cultural practices, limited access to antenatal and intrapartum care – unbooked obstetric emergencies, few comprehensive emergency care facilities and poor obstetric care (4).

Although the characterization of uterine rupture varies from country to country based on their HDI, the most common obstetric characteristics include: trial of labor, obstructed labor, poor socio-economic status, unsupervised labor, multi-gravity, previous caesarean section or uterine surgeries, injudicious use of uterotonics and fetal mal-presentations are common causes in low HDI (5,7,8).

Clinically, uterine rupture presents with cessation of contractions, abdominal pain, abdominal tenderness, non-reassuring fetal status (NRFS) and vaginal bleeding (3,9).

According to several authors, the adverse maternal outcomes of uterine rupture include VVF, anemia, sepsis, wound infection, ICU admission, long hospital stay and maternal mortality (4)(5)(10). Moreover, some studies associated Fresh Stillbirth, Macerated Stillbirth, Asphyxia, low APGAR score, neonatal death with few live births with the undesirable fetal outcomes due to the occurrence of uterine rupture (5)(11)(6).

Therefore, this study was undertaken to determine the prevalence, obstetric characteristics, clinical presentations and outcomes of patients managed for uterine rupture at Kenyatta National Hospital.

2.2.3 Grand multiparity
Grand multiparity has been demonstrated by several studies to predispose rupture of uterus.

Studies conducted in Yemen, Nigeria and Kenya associated grand multiparity with uterine ruptures within the range 58.3- 65% (6,12,13). In other studies by Golan et al, Mokgokong and Marivate and Schrinsky and Benson, 32% of uterine rupture cases without previous scar, had parity of more than 4 (20, 21, 22). In all these studies, grand multiparity has been noted to characterize the gravid uterus to rupture due to strenuous weakening of the myometrium with subsequent pregnancies(10,12–14,16).

In contrast, Gardeil et al showed low rate 0.005% of rupture cases despite having high parity (17). Income inequality between low and middle income countries in Yemen, Nigeria and Kenya may explain their high rates of uterine rupture as compared to Ireland as a high income country.

2.2.4 Maternal age
Some authors linked increased incidence of uterine rupture with maternal age of >35 years.

Shipp et al found that among 3015 patients with 1 CS delivery, the rates of uterine rupture were 1.4% and 0.5% in patients with 1 caesarean section delivery were for patients $\geq$ 30 years and those $\leq$ 30 years respectively (18). Additionally. Safia et al established a threefold increased risk of uterine rupture in patients $\geq$ 35 years of age in comparison to those $\leq$ 25 years (16).

Both Arrowsmith et al and Smith et al attributed increased rates of uterine rupture to advanced maternal age due to myometrial cellular morphological changes as a result of deposition of cholesterol and more connective tissue between the muscle bundles (19,20).

2.2.5 Inter-delivery interval
Several studies linked inter-delivery interval to occurrence of uterine rupture.

Esposito et al demonstrated high rates of uterine rupture among patients with inter-pregnancy interval of less than six months (21). Moreover, Stamilio et al reported 2.7% cases of uterine rupture in women with an inter-delivery interval of <6 months compared with 0.9% cases of women with inter-delivery interval >6 months (22). However, Bujold et al reported an inter-delivery interval of less than or equal to twenty four months contributes to 2.8% of uterine rupture cases compared with 0.9% for those with an inter-delivery interval of >24 months among (23).

2.2.6 Fetal macrosomia
Some studies linked occurrence of uterine rupture to fetal macrosomia. Elkousy et al indicated 2.8% cases of uterine rupture in women with fetuses >4000g compared with 1.2% cases of uterine rupture in women with fetal weight of <4000g (36). Additionally, Jastrow et al demonstrated a direct correlation between fetal weight and uterine rupture (37).

In contrast, Zelop et al reported no significant difference in the rates of uterine rupture in women with fetal weight >4000g and those with fetal weight <4000g (24).

2.2.7 Gestation beyond 40 weeks
Studies have reported that gestational age >40weeks predispose uterus to rupture during TOLAC. Hammoud et al in Canada indicated 2.7% rates of uterine rupture among patients with gestational age ≥ 40 (25). In a British study, Kiran et al found 2.1% (10 of 466) significantly increased rate of uterine rupture in patients of TOLAC greater than 40 completed weeks in comparison with those with gestational ages of less than or equal to 40 weeks at 0.3%(26). In contrast, Coassolo and Zelop et al found no correlation between the rate of uterine rupture among women at gestation age >40 weeks and <40 weeks (27)(24).

2.3 Clinical presentations of uterine rupture

2.3.1 Abdominal pain and tenderness
Several studies have associated a sudden or atypical maternal abdominal pain and tenderness with uterine rupture. A study by Nyengidiki et al in Nigeria indicated that 92.5% of cases of uterine rupture presented with abdominal pain (9). Moreover, other studies further reported abdominal pain as a presenting complain in all patients managed for uterine rupture (16) (6) (47).
However, Bujold & Gauthier noted 5% of abdominal pain as the first of uterine rupture cases (23).

2.3.2 Vaginal bleeding

Bleeding is a common presentation in cases of uterine rupture. It may present vaginal or intra-peritoneal bleed. Adewale et al in 2019 revealed that 50% of the patients had intra-partum vaginal bleeding (12). While Dawud et al in Ethiopia found vaginal bleeding to at 45.6% of cases and Nyengidiki in Nigeria in a retrospective study 30% of patients to have vaginal bleeding respectively(3,12). In studies by Yeou-Lih et al and Zwart et al. found that 24% - 27% of hemorrhages cases as a common sign of uterine rupture (46, 48).

2.3.3 Hypovolemic shock

Several studies linked hypovolemic shock with occurrence of uterine rupture. Report by Rahman et al revealed 34% cases of hypovolemic shock in women who had uterine rupture (29). Further, Golan et al indicated signs and symptoms of hypovolemic shock in 29% cases of uterine rupture (30). Yeou-Lih et al indicated 10% cases of maternal hypovolemic among patients with rupture reviewed retrospectively (31).

2.3.4 Non Reassuring Fetal Status (NRFS)

Several authors have commonly associated fetal bradycardia with uterine rupture (45)(35). Additionally, Leung et al associated prolonged decelerations in 79% cases of uterine rupture (7). Lastly, Wang et al indicated associated abdominal pain and FHR anomalies as the two most symptoms of ruptured uterus (47.6%) (31). A study by Lydon-Rochelle et al. reported fetal distress in 76% of complete uterine rupture patients undergoing VBAC (32) while Yeou-Lih et al. indicated fetal distress as the most common manifestation of gravid uterus with a percentage of 48% (31).

2.4 Maternal and fetal outcomes of patients with uterine rupture

2.4.1. Severe maternal blood loss or anemia

Hussein et al in Tanzania noted 100% cases of uterine rupture required blood transfusion (11). Ehigiegbaa et al indicated 90.9% patients with uterine rupture who had a range of blood loss of 500ml – 5000ml had blood transfusions either intra-operatively or post-operatively (14). Talib et al discovered that out of 160 patients that had uterine rupture, 50.6% needed minimum of two units of blood (5). Studies by Kieser & Baskett, Leung et al and Shipp et al further demonstrated patients with ruptured uteri required blood transfusion (53)(9)(24).

2.4.2. Hypovolemic shock

Several studies implicated hypovolemic shock as one of the unwanted outcomes of uterine rupture. Rahman et al reported hypovolemic shock in 34% women who had uterine rupture (29). Similarly, Golan et al, in their study demonstrated occurrence of hypovolemic shock in 29% women who experienced a uterine rupture (30).

2.4.3. Maternal bladder injury

Some literature reviewed found maternal bladder injury as an undesired outcome of uterine rupture. Jain et al in 2018 in a cross sectional study found that 12% of patients managed for uterine rupture developed VVF as a long term complication (33). Similarly, other studies reported cystotomy and bladder injuries in women who developed uterine rupture (34)(58). Other maternal complications of uterine rupture include bladder injury causing VVF, wound sepsis, long hospital stay, ICU admissions, urinary incontinence, cervical lacerations and anesthesia related complications like aspiration pneumonia (3–5,33,35).

2.4.4. Need for hysterectomy

Several studies reported that patients who had uterine rupture required hysterectomy (22)(56)(9). Additionally, Qazi et al in Pakistan noted 26.6% total abdominal hysterectomy and 50% subtotal hysterectomy in patients with uterine rupture (35).

However, Talib et al in a retrospective cohort study showed total hysterectomy was done 6.3% and subtotal hysterectomy in 3.1% of patients managed for uterine rupture (10).

2.4.5 Maternal death

A study by Mokgokong and Marivate revealed that the maternal mortality rate due to ruptured uterus before diagnosis was 4.5% and after delivery was 10.4% respectively (22).

In contrast, in Los Angeles, a study by Leung et al reported 1% of maternal death due to uterine rupture (7) while Golan et al associated no maternal death with women who had scarred uterine rupture and 15% women who had an unscarred uterus (20).

2.4.6 Fetal hypoxia or anoxia/Asphyxia

Hypoxia or anoxia is one of the undesired fetal outcomes of patients who developed uterine rupture. Menihan indicated 91% neonates born after uterine rupture had bradycardia within 18 to 37 minutes before delivery. No neonatal death or long term neurologic sequel occurred within this period despite fetal acidosis. (8). Moreover, Bujold and Gauthier in their study of 23 cases of

uterine rupture showed that even with rapid intervention in less than 18 minutes, 2 of the neonates developed Ischemic Encephalopathy (HIE) and motor developmental deficit. From their findings, quick interventions did not always avoid severe metabolic acidosis and long term neurological disorder but prevented neonatal death (23). A study by Leung et al, 5% neonates born after uterus rupture developed neonatal asphyxia with significant perinatal morbidity (7).

2.4.7 Fetal acidosis
Some studies associate development of fetal acidosis to either complete extrusion of placenta or fetus into a peritoneum. Leung et al indicated 25% newborns had a pH<7, 39% Apgar scores <7 and 43% cases of newborns with a pH<6.8, 12% had APGAR scores of less than 3 in 5 minutes(8). Moreover, Menihan et al showed that 91% neonates delivered after rupture of the uterus had pH<7 from umbilical cord artery sample, APGAR score <7 in 5 minutes in 45% (10).

2.4.8 Admission to a neonatal intensive care unit
A study by Menihan reported 73% neonates delivered after rupture of the uterus required NICU admission (8). Further, other studies indicted NICU admissions delivered after uterine rupture (53)(51).

2.4.9 Stillbirth and neonatal death
In low income countries, the prevalence of fetal and neonatal death is extremely high in comparison to high income countries. Studies done in Chad and Nigeria reported substantially high rates of stillbirth (16). Schrinsky and Benson further indicated 65% rate of perinatal mortality resulting from uterine rupture (21).

In contrast, Blanchette et al reported 17% neonatal death in women whose uterus ruptured (11). Pallavi's study in India 2019 indicates a relatively low stillbirth rate of 10.1% (10). Further, studies in other high income countries revealed significantly low rate of perinatal deaths (9)(4)(51).

2.5. Conceptual framework

Obstetric characteristics		Maternal Outcomes

Obstetric characteristics

Socio - demographic characteristics

Age, SES, education level, marital status Gravidity, ANC visits, inter-delivery interval, previous CS deliveries, previous UR, previous MVA/DC, myomectomy, current gestation pregnancy, fetal macrosomia

Labor characteristics

Labor induction, augmentation, and obstruction; use of partograph; TOLAC; referral status

Clinical presentations

Abdominal pain, vaginal bleeding, shock, NRFS, distorted uterine contour, uterine contraction, cessation of labor, palpable defects on uterus, coma, sepsis

Management

Time of diagnosis, referral system Available skilled surgical team Available skilled midwives/obs/gyn team, Available BT service Available ICU admissions ANC attendance

Maternal Outcomes

Shock, anemia, bladder injury, BT, sepsis, wound infection, uterine repair, Tubal ligation, TAH, PTH, ICU admission, scar dehiscence, maternal death

Fetal outcomes

Fetal hypoxia, Acidosis, abnormal CTG trace, NICU admission

Live birth, low A/S, FSH, MSB, stillbirth, neonatal death

Figure 1.2: Conceptual framework

2.5.1 Narrative / theoretical framework

Uterine rupture is a seldom event and often catastrophic complication with a high incidence of maternal and fetal morbidity and mortality. It can either occur in women with a native, unscarred uterus or a uterus with a surgical scar from previous surgery.

Uterine rupture occurs when a full-thickness disruption of the uterine wall that involves the overlying uterine serosa in present. Its occurrence is associated with severe bleeding, fetal distress, protrusion of the fetus and placenta into the abdominal cavity and need for hysterectomy. On the other hand, uterine scar dehiscence involves the disruption and separation of a preexisting uterine scar. Although, its occurrence is more common than uterine rupture, it rarely results in major maternal and fetal complications.

Although a uterine scar is a well-known obstetric characteristic for uterine rupture mostly arising from caesarean delivery, the majority of events involving the disruption of uterine scars result in uterine scar dehiscence rather than uterine rupture. Other characteristics seen in uterine rupture include over stimulation of uterus in augmentation of labor using oxytocin and other uterotonics, myomectomy, ANC attendance, fetal gestational diabetes with macrosomia, polyhydramnios, multiple gestation pregnancy, and uterine anomalies such as fibroids, gestational age, labour obstruction, use of partograph and TOLAC.

Clinically, uterine rupture presents as vaginal bleeding, uterine contraction cessation, abdominal pain and non-reassuring fetal status (bradycardia/tachycardia).

The maternal outcomes include shock, DIC, sepsis, wound infection, Anemia, VVF, Aspiration pneumonia, maternal mortality. The fetal outcomes live birth, low APGAR score, NICU/NBU admission, still birth (FSB or MSB) and neonatal death.

Hence, this study was undertaken to determine the prevalence, common obstetric characteristics, clinical presentations, and outcomes of patients managed for uterine rupture at KNH in order to institutionalize early interventional measures which are helpful in minimizing poor maternal and fetal outcomes.

2.6. Justification

Given unfavorable outcomes of ruptured uterus, it is hoped that the study findings and recommendations will be incorporated in the standard operating procedures (SOPs) by the hospital management in formulating protocols for prevention and management of uterine rupture in attempts to close the gaps during management of these patients.

Theories opined that increase in cesarean deliveries increases the incidence of uterine rupture. Thus, it is believed that the findings of this study will be used by clinicians to provide evidence based counselling to patients at risk of uterine rupture concerning their pregnancy outcomes and help to develop individualized delivery plans.

Although uterine rupture easily complicates in low income countries like Kenya, there seem to be less studies done to determine the prevalence, obstetric characteristics, clinical presentations and outcomes of patients managed for uterine rupture. Thus, the findings/recommendations of this study may spur some researchers to do further studies about uterine rupture, thus adding to the general body of knowledge.

2.7 Study question

What are the prevalence, obstetric characteristics, clinical presentations and outcomes of patients managed for uterine rupture at KNH between January 2016 and December 2020?

2.7.1 Broad objective

To determine the prevalence, obstetric characteristics, clinical presentations, and outcomes of patients managed for uterine rupture at KNH between January 2016 and December 2020.

2.7.2 Specific objectives

Among patients managed for uterine rupture at KNH between January 2016 and December 2020.

1. Determine the prevalence

2. Identify the obstetric characteristics

3. Describe the clinical presentations

4. Evaluate the maternal, fetal and immediate neonatal outcomes

Chapter 3: Methodology

3.1 Study design

This was a descriptive retrospective cross-sectional study that sought to determine the prevalence, obstetric characteristics, clinical presentations, and outcomes of patients managed for uterine rupture at Kenyatta National Hospital between 2016 and 2020.

3.2 Study location and site

This study was done at Kenyatta National Hospital (KNH) which is located along Hospital Road in Nairobi. Our choice of the site was based on the fact that KNH being a tertiary referral hospital, it was likely to receive patients suspected with ruptured uterus from all the counties in the country. Despite being a referral hospital, it also serves as a primary health facility to its surrounding areas. As the largest Kenyan referral hospital, KNH has a capacity of 1800 beds. Moreover, it also serves as a research and training hospital for medical students from UoN and KMTC. The hospital has a wealth of clinical personnel with varied specialties and expertise that meets the management needs of patients of ruptured uterus making KNH an ideal site for my study.

KNH has laboratory services with a fully functional Blood Transfusion Unit that runs day and night, meeting the needs of patients. In addition, the main theatre, trauma theatre and the private theatre can be used where necessary. Within KNH, this study was conducted in the maternity unit by reviewing records of patients who delivered during the study period. Maternity unit has one labor ward, three Antenatal/postnatal wards: GFA, GFB and 1A which serve both high and low risk pregnancies. In the labor ward, delivery by C/S accounts for 60% of the total monthly deliveries of approximately 1000; this is possible due to the availability of two functional maternity theatres which run concurrently at all times. Moreover, patients in need of ICU care can benefit from services in the maternity ICU located in GFB or the main hospital ICU.

New Born Unit (NBU) has a 50 bed capacity where neonates with birth asphyxia, RDS, neonatal sepsis and low birth weight are admitted. NBU admits approximately 250 neonates per month.

3. 3 Study Population

Study population included all patients managed for uterine rupture at KNH labor ward between 2016 and 2020. These patients included those who ruptured while at the facility, those referred from other facilities, and the self-referred or those admitted directly from home.

3.4 Criteria of inclusion and exclusion

3.4.1 Inclusion criteria
- All patients managed for uterine rupture at KNH between 2016 and 2020.
- All patients of uterine rupture from 24/40 and above.
- All patients referred to KNH from other facilities with or without confirmed diagnosis of uterine rupture.

3.4.2 Exclusion criteria
- All patient files with incomplete data.
- All patients with placenta accreta spectrum of disorders.
- All patients with traumatic etiology for uterine rupture

3.5 Determination of sample size and formula

Fisher's formula will be used to determine the sample size (Daniel, 1999):

$$n = \frac{Z^2 x P(1-P)}{d^2}$$

Where,

n = desired sample size

Z = value from standard normal distribution corresponding to desired confidence level (Z=1.96 for 95% CI).

P = expected population proportion based on previous studies (92.5%)

d = desired precision (5%)

$$n_0 = \frac{1.96^2 x\ 0.925(1-0.925)}{0.05^2}$$

n = 107 +11(10%) = **118**

Nyenyidiki et al (2011) Nigeria; looking at 40 mothers with uterine rupture in a total of 10337 deliveries found 92.5% of cases of uterine rupture who presented with abdominal pain (between 2003-2007).

Table 1: Shows sample size calculation per research object

Objective	Variable	Proportion	Sample size	Reference
1.Obstetric characteristics	Obstructed labor	83%	239	Ishraq et al (2006) Yemen
2.Clinical presentation	Abdominal pain	92.5%	118	Nyenyidiki et al (2011) Nigeria
3.Maternal outcome	Anemia	80.3	267	Dawud et al (2018) Ethiopia
4. Fetal outcome	Still birth	83.3	235	Folorunsho et al (2019) Nigeria

3.6 Data Sources

The IP.Nos of patients managed for uterine rupture were identified from the Labor ward, theatre and admission registers. Then the IP. Nos were submitted to the records department for retrieval of the patients' files after securing approval from both the Ethical Research Committee (ERC) and the health records. The files were checked for eligibility for the study.

3.7 Sampling procedure

All the in-patient numbers (IP.Nos) of patients managed for uterine rupture were collected from admission registers, maternity theatre, labor ward and antenatal wards were cross checked with those from the statistics department.

Files of the patients who met the inclusion criteria were sequentially selected from the department of records to achieve the desired sample size for uterine rupture. All cases were analyzed and sample of 143 was achieved.

3.8 Study variables
Table 2: Shows the study variables

Objectives	Independent variables (exposure)	Dependent variables (outcome)
1.Socio-demographic and obstetric characteristics	Maternal age, SES, marital status, education level, parity, ANC attendance, gestational age, number of previous c/s or uterine surgery, labor induction, labor augmentation, labor duration, use of partograph, TOLAC	Uterine rupture
2.Clinical presentations		Abdominal pain, haemorrhage, shock, bradycardia, palpable fetal parts, palpable defect on the uterus, cessation of uterine contractions
3.Maternal outcomes		ICU admission, Uterine repair Hysterectomy, Blood transfusion Early diagnosis, Referral systems Availability of skilled surgical team Health education at ANC and at discharge, Skilled maternity staff Admission for ERCS, Prolonged inter delivery interval
		Shock, DIC, Sepsis, Wound infection, Anemia, VVF, Aspiration pneumonia, Maternal mortality
4.Fetal Outcomes		Live birth, low A/S, NICU/NBU admission, neonatal death, Still birth- FSB or MSB

3.9.0 Data collection

3.9.1 Instrument for data collection

The files of all the patients who were managed for uterine rupture at KNH during the study period were reviewed to abstract data on the prevalence, obstetric characteristics, clinical presentations, and management interventions, maternal and fetal outcomes.

3.9.2. Data collection procedures

Using structured abstraction form, information on obstetric characteristics, clinical presentations, management interventions, and the maternal and fetal outcomes were extracted.

The principal investigator trained the research assistants on the study protocols and procedures a week before they began to abstract data from the patients' medical records.

The abstractors were medical students with substantial medical knowledge and skill which are extremely essential to ensure fastidious searching of the accurate clinical information from the patients' records. Further, the research assistants were provided with face masks and sanitizer after their training on the MoH's recommendations and guidelines on prevention of COVID-19 infection. This include social distancing, wearing mask, hand washing and use of sanitizer.

3.10 Quality control of data

Content and construct validity of the abstraction tool was pretested by the principal investigator by piloting 10% of the total sample size (12) at KNH to ensure adequate representation of items, and the terminologies and data formats of the abstraction form were consistent with those found in the patients' medical records. Amendments were made before a validated version was produced by identifying and removing any ambiguous information incorporated during the drafting process.

Reliability was tested by calculating the degree of match between a set of coded information abstracted by the two abstractors to get a measure of intra-rater reliability. Reliability of the abstraction form was determined by comparing data collected by the two abstractors using standard statistical packages for each item reviewed and provided a list of those items that disagree. Hence,

reliability was improved by better training of the research assistants on how to abstract information from patients' files and fill them accurately on the abstraction form, and/or adjusting the design of the abstraction form to achieve agreement rate of an acceptable level of 95%.

3.11 Ethical approval

Ethical approval was sought and obtained from the KNH-UoN Ethics and Research Committee (ERC reference number: P839/10/2021) on 15th March 2022. Administrative approval was sought and obtained from the In-charges of labor ward and records department at the site. Patients' consent was not necessary due to the secondary nature of the collected data. Data were coded to uphold the ethical principle of privacy and anonymity of the patients. Extracted data were stored in a password personal computer for confidentiality and only used to answer the research objectives.

3.12 Data management and analysis methods

The collected data were statistical analyzed using Statistical Package for the Social Sciences (SPSS) version 21 (IBM corp). The results were presented using tables, frequencies, percentages, and charts. Continuous variables were presented as measures of central tendencies.

Table 3: Shows data management and analysis plan

Objective	Analysis plan
Obstetric characteristics	Summarized and presented as percentages. Factors such as previous uterine scars, booking status, obstructed labor
Clinical presentations	Summarized and presented as percentages: symptoms and signs such as abdominal pain, per vaginal bleeding, shock, non-reassuring fetal status
Maternal outcomes	Total no. of a morbidity/total no. of all morbidities $\times$ 100 : morbidities such as: TAH, PH, blood transfusion, ICU admission DIC, Sepsis, Wound infection, Anemia, VVF, Aspiration pneumonia, Maternal mortality
Fetal outcomes	Total no. of a morbidity/total no. of all morbidities $\times$ 100. Morbidities such as: Live birth, low A/S, NICU/NBU admission, neonatal death, Still birth- FSB or MSB

3.13 Study results dissemination plan

The plans to disseminate the research results will include presentation to the department and my colleagues, peer-reviewed publication, online distribution through our hospital website, and social media platforms. Data will also be disseminated to KNH fraternity and platforms.

3.14 Study strengths and limitations

Study strengths

- Large sample size
- Most recent study in our region looking at the prevalence, clinical presentations, and maternal and fetal, neonatal outcomes.

Study limitations

- Retrospective nature of study; incomplete data. Mitigated by sampling more patient files.
- Record keeping was a challenge thus, time consumed in getting some mortality files.

Chapter 4. Presentation of results

Flowchart for recruitment of patients managed for uterine rupture at KNH in 2016-2020
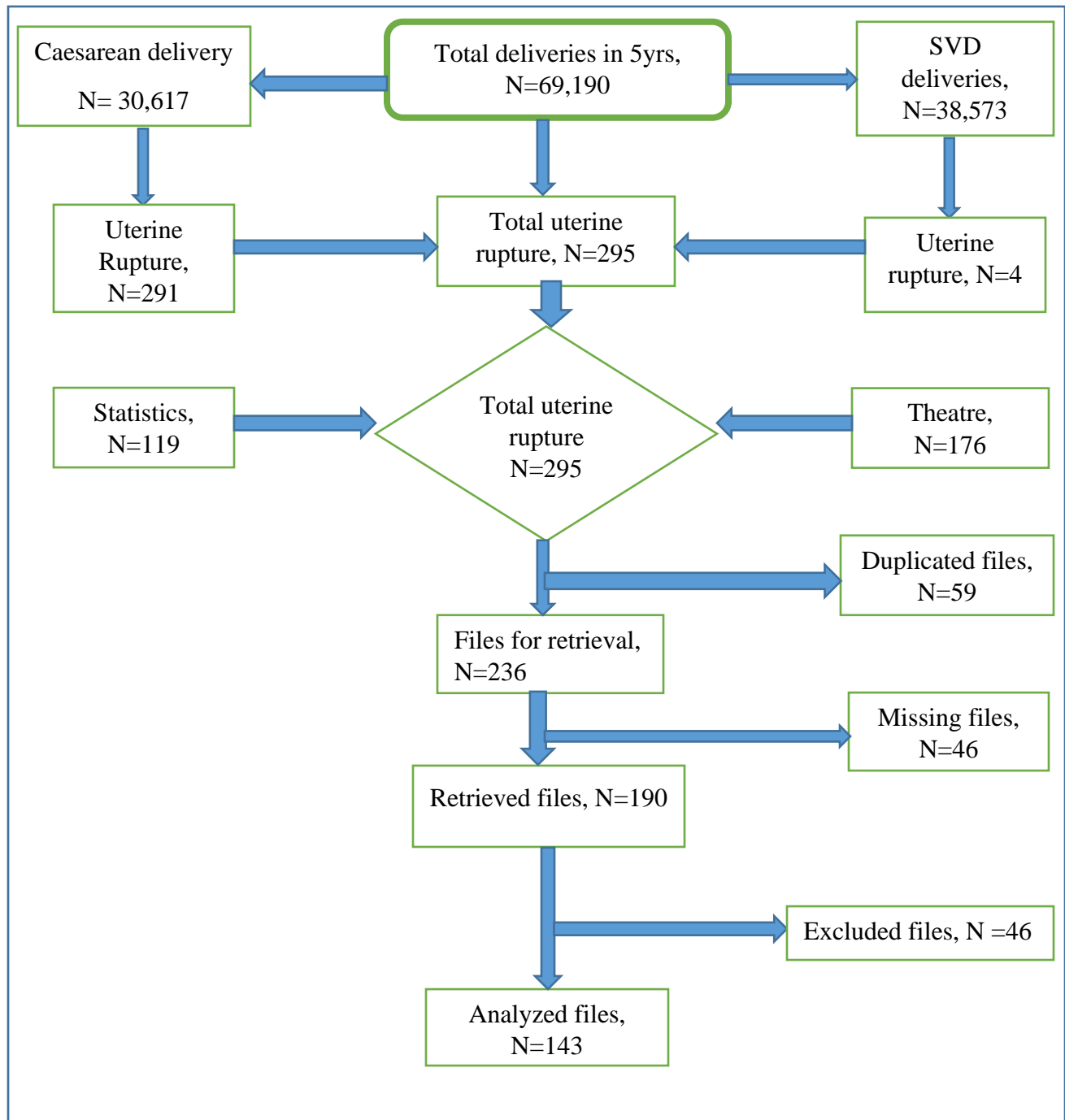
Figure 2.4: Study flowchart

4.1. Prevalence of uterine rupture from 2016-2020 at KNH

From January 1, 2016 to December 31, 2020, there were a total of 69,190 deliveries of which 143 patients had ruptured uterii giving a ratio of 1:484 deliveries.

Table 4: Prevalence of uterine rupture from 2016-2020

Year	Total deliveries	Uterine rupture cases	Prevalence
2016	16489	25	0.15
2017	15938	38	0.24
2018	10114	14	0.14
2019	13814	28	0.20
2020	12835	38	0.30
Total	**69190**	**143**	**0.21**

The table above shows the prevalence was 0.21 (95% CI, 0.04% - 1.16%).
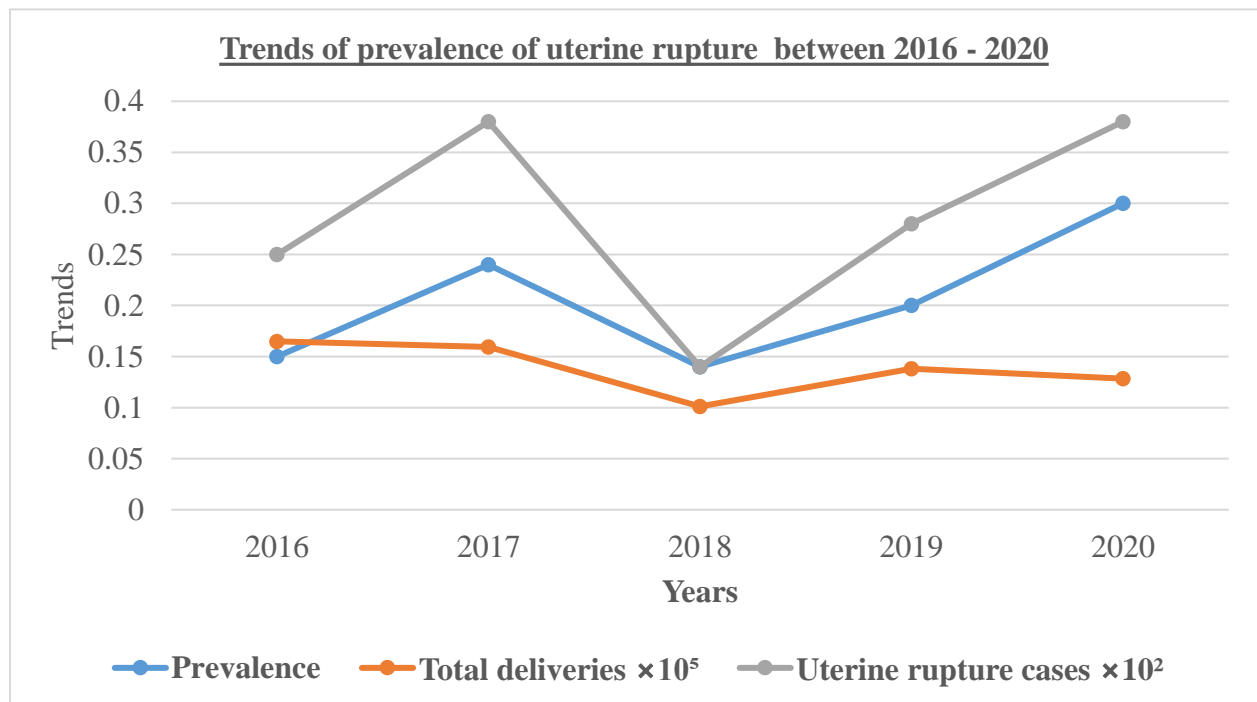
Figure 3.4: Trends in prevalence of uterine rupture

4.2. Obstetric and labor characteristics

Table 5: Shows socio-demographic characteristics of patients managed for uterine rupture

Variables		**Frequency**	**Percent (%)**
Age	<18	1	0.7
	18 – 25	34	23.8
	26 – 35	91	63.6
	36 – 45	17	11.9
Marital status	Married	124	86.7
	Single	19	13.3
Education status	None	0	00
	Primary	61	42.7
	Secondary	60	42.0
	Tertiary	22	15.4
Social economic status	Self-employed	56	39.2
	Formal employment	7	4.9
	Unemployed	80	55.9

The table above shows the mean age was 29.2 (SD 5.2) years, the median age was 29.0 (IQR 25.5 – 33.0) years. Eighty six (86.7%) patients were married, forty two (42%) had primary and secondary education, and 55.9% were unemployed.

Table 6: Obstetric & labor characteristics

a) Obstetric characteristics	Range	Frequency	Percent (%)
Gravidity	1	3	2.1
	2-4	125	87.4
	5+	14	9.8
ANC visits	None	17	11.9
	1 – 3	75	52.4
	4	31	21.7
	>4	20	14.0
Gestation of current pregnancy	24 – 36+6	60	42.0
	37-41+2	68	47.5
	> 41+3	15	10.5
Previous CS deliveries (N=99)	1	65	65.6
	2	27	27.3
	3	6	6.1
	4	1	1.0
Previous MVA/D&C	Yes	5	3.5
Previous uterine ruptures	Yes	3	2.1
Inter-pregnancy interval (N=139)	<2 years	12	8.6
	≥2 years	127	91.4
b) Labor characteristics			
Induction of labor		15	10.5
Augmentation of labor		10	7.0
Obstructed labor		32	22.4
TOLAC (N=65), 1 previous scar	TOLAC, ruptured at KNH	35	53.8
	Referrals from other facilities	17	26.2
	From home to KNH	13	20.0
Partograph use (N=56)	Yes	18	32.1
	No	38	67.9
Reason for referral (N=61)	Previous scar	19	31.1
	Obstructed labor	5	8.2
	APH	8	13.1
	Uterine rupture	11	18.0
	Poor labor progress	4	6.6
	Malpresentation	2	3.3
	NRFS	2	3.3
	Others	10	16.4

The table above shows up to 87.4% patients were multiparous with 9.8% being grand multiparous. At least 88.1% were booked and 11.9% were unbooked. 42.0% ruptured preterm, 47.5% at term and 10.5 ruptured post term. Up to 69.2% patients had history of CS delivery with those that had 1 previous delivery contributing 65 (45.5%), 35 (53.8%) had TOLAC at KNH; 17 (26.2%) had TOLAC were referrals from other facilities; and 13 (20.0%) were admitted directly from home. 61 (42.7%) cases were referred from other facilities with history of previous scar contributing 19 (31.1%), already ruptured uterus 11(18.0%), APH 8 (13.1%) and 5 (8.2%) as the most common reasons for referral. Other important labor characteristics for uterine rupture includes induction of labor and augmentation of labor at 15 (10.5%), 10 (7.0%), respectively. There was no case with history of myomectomy. 56 eligible patients for monitoring of labor, partograph was 18 (32.2%) of patients used partograph, while 38 (67%) were not monitored with partograph.

4.3. Clinical presentation of patients managed for uterine rupture at KNH in 2016-2020
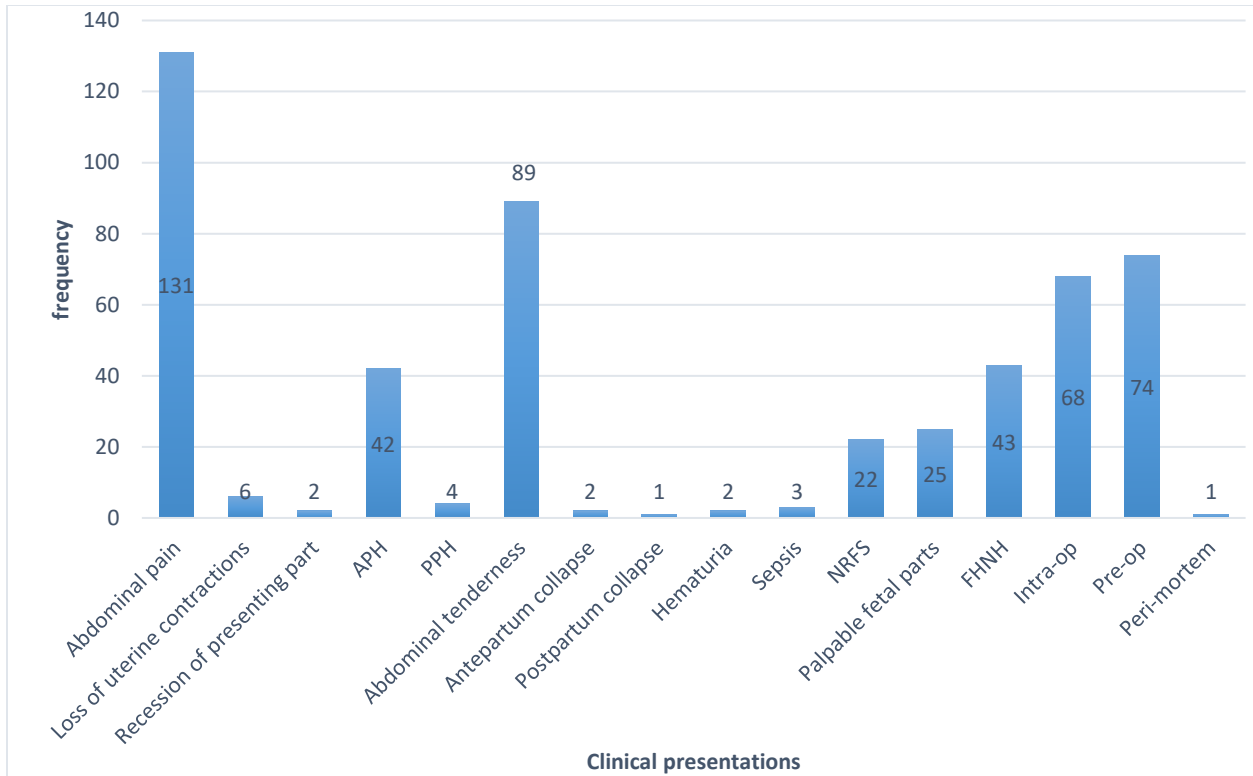
Figure 4.4: Frequency of clinical presentations

In the above bar graph abdominal pain is the most common clinical presentation 91.6%, followed by abdominal tender (62.2%). Meanwhile, loss of fetal heart tone, APH, palpable fetal parts and NRFS at 30.1%, 29.4%, 17.5% and 15.4% respectively. In most patients (51.7%), the definitive diagnosis was made pre-operatively, while 47.6% of the patients were intra-operative diagnosed. Symptoms and signs of uterine rupture overlap with each other.

Table 7: Shows patients with uterine rupture with intra-operative confirmation

Intra-operative	Variable	Frequency (N=68)	Percent (%)
Duration of labor	No labor	18	26.4
	<24	45	66.1
	24-48	5	7.3
Diagnosis	1 previous in labor	30	44.1
	2 previous in labor	14	20.5
	3 &4 previous	3	4.4
	NRFS	5	7.4

	Obstructed labor	7	10.2
	Previous rupture	1	1.3
	Malpresentation	3	4.4
	Peritonitis	1	1.3
	PPH	4	5.8
Partograph use	Non eligible	36	53
	Eligible:	32	
	Used	9	13.2
	Not used	23	33.8
Admission mode	Referral	22	32.3
	KNH	4	5.8
	Home	42	62.0

The table above shows most patients with labor duration of less than 24 hours 45 (66.1%) and those with diagnosis of 1 previous scar in labor contributing 30 (44.1%). 23 (33.8%) were not monitored with partograph. 42 (62.0%) were directly admitted from home.

4.4. Maternal outcomes of patients managed for uterine rupture at KNH in 2016 - 2020

Table 8: Show maternal outcomes of patients managed for uterine rupture

a) Maternal outcomes	Frequency	Percent (%)
Uterine repair only	125	87.4
Uterine repair with BTL	2	1.4
Total hysterectomy	5	3.5
Partial hysterectomy	10	7.0
Peri-mortem	1	0.7
Shock	29	20.3
DIC	5	3.5
ICU admission	8	5.6
Anemia	76	53.1
Blood transfusion	82	57.3

• Transfusion ≤ 3	60	42.0
• Massive transfusion ≥4	22	15.4
Bladder injury	7	4.9
Sepsis	19	13.3
SSI	13	9.1
AKI	4	2.8
Maternal death	10	7.0
Blood loss		
• ≤1500	80	55.9
• ≥1500	63	44.1
Hospital stay (days)		
• ≤6	94	65.7
• 6-10	32	22.4
• ≥10	17	11.9

The table above indicates 87.4% patients had urteine repair, 10.5% had hysterectomy, 76 (53.1%) had anemia and those that had massive transfusion were 22 (15.4%). Those that had hypovolemic shock were 29 (20.3%). 19 (13.3%) had sepsis, 13 (9.1%) with SSI, bladder injury was seen in 7 (4.9%) patients. 4 (2.8%) had AKI and ICU admissions. Maternal mortality of 10 (7.0%).

4.5 Fetal outcomes of patients managed for uterine rupture at KNH in 2016 – 2020

Table 9: Shows fetal outcomes of patients managed for uterine rupture

b) Fetal outcomes		
Live birth	45	31.5
Still Births	98	68.9
• FSB	72	50.3
• MSB	28	18.6
BWT		

• ≤1000	7	4.9
• 1000-1499	10	7.0
• 1500-2499	17	11.9
• 2500-3999	97	67.8
• ≥4000	12	8.4
NICU/NBU admission	17	11.9
Neonatal death	9	6.3
Low APGAR <7 in 5 Min	12	8.4
APGAR>7	33	23.1

The table above shows still birth in 98 (68.0%), live birth in 45 (31.5%). NICU/NBU admission of 17 (11.9%) and neonatal death of 9 (6.3%).

Chapter 5. Discussion and analysis of the results

5.1. Prevalence

In our retrospective descriptive cross-sectional study, 143 cases of uterine rupture were recorded out of 69,190 of the total deliveries during the study period. Thus, giving us the prevalence of 0.21%. Similarly, Lema et al in a retrospective descriptive cross-sectional study indicated a prevalence of 0.23% among patients managed for uterine rupture cases at our study site from (1984-1988) (17). The prevalence of uterine rupture both at the global and high income countries ranges between (0.016 – 0.2%) (1). The high prevalence of uterine rupture in our study could be attributed to the poor socio-economic status, cultural practices, limited access to antenatal and intrapartum care – unbooked obstetric emergencies, few comprehensive emergency care facilities and poor obstetric care, of patients managed for uterine rupture since Kenya is among the low income countries in sub-Saharan African (2, 5). Moreover, the high prevalence of uterine rupture observed in our study could be due the prolonged industrial action by the health workers in 2017 and the COVID-19 pandemic in 2020.

In this study, 17 (11.9%) were unbooked and 126 (88.1%) were booked. These findings are the true opposite of those found by Islam et al in Pakistan where they found 88.5% unbooked and 11.5% were booked hence high prevalence of 0.63% (57). This differences would be due to quality

of antenatal services offered where patients' education on the risk factors and pregnancy complications is lacking in the low level health facilities.

Although 84.7% of patients in this study attained both primary and secondary education, only 44.1% were employed and the majority of 55.9% were unemployed. Our findings were in agreement with a study by Nyengidiki et al who found 52.5 % of their cases were not employed (3). This could be due to similarity in geographical setting with respect to socio-economic status of patients and the impact of employment on poor health care. A study by Adewale et al who found that 31.3% of their study participants had no formal education (16). Low level of education and poor socio-economic status could explain the discrepancy of prevalence uterine rupture in these studies in different study locations.

5.2. Obstetric characteristics

Age: In this study, the mean age of patients with uterine rupture was 29.3 (SD 5.2). The highest prevalence occurring between 26-35 years, accounting for 63.6%. Our finding agrees with a Chadian study by Gabkika et al who found that most of the uterine rupture cases occurred between 25-34 years, thus accounting for 69.5% (5). Moreover, other studies established a threefold increased risk of uterine rupture in patients above 35 years of age in comparison to those less than 25 years (23, 16). Advanced maternal age is associated with increased risk of uterine rupture due to myometrial cellular morphological changes as a result of deposition of cholesterol and more connective tissue between the muscle bundles (19,20).

Previous CS deliveries. In this study, 99 (69.2%) of the patients had previous C/S delivery with 65 (45.5%) who had 1 previous scar. Similarly, a study by Ehigieba et al found 68.2% of uterine rupture cases had previous uterine surgery (18) possibly due to similar settings in the low income countries. Further, in a retrospective descriptive cross-sectional study, Islam et al found 46.2% of the rupture cases had history of 1 previous caesarean delivery (57). The high rates of previous CS deliveries could be due to inadequate patient education, poor labor monitoring, TOLAC and later referrals of patients in these studies (58, 59).

Obstructed labor. The finding of this study indicated 32 (22.4%) of uterine rupture cases had obstructed labor. In Tanzania, a study by Husein et al found 38% of the patients ruptured due to

obstructed labor (14). However, Pallavis et al and Talib et al found low rate rates of rupture attributed to obstructed labor of 6.0% - 8.8% respectively (7,12).

Low incomes, poorly supervised labor secondary to high patient-doctor ratio and late referrals may offer explanation to the high rates of obstructed labor in the East Africa region compared to low rates obstructed labor seen in high and middle income countries with highly resourced medical facilities. Thus, obstructed labor is one of the common obstetric characteristics of uterine rupture particularly in the low income countries (2).

Parity. Most cases of uterine rupture in this study occurred in multiparous women with parity of 2-4, that is 126 (88.1%) and grand multiparity contributed 14 (9.9%). Gabkika et al demonstrated 138 (69.0%) of multiparous women with similar parity (5). However the findings differed with those by Adewale et al that showed that grand multiparity of ≥5 contributed 58.3% of the rupture cases unlike our finding of 14 (9.8%) in the grand multiparity group. Such discrepancies would be accounted for by individualized factors among the study populations, sample size and study design.

Uterine rupture is uncommon among primigravidas. Our study found 3 (2.1%) which was consistent with a study by Dawud et al in Ethiopia 3.3% (6), however disagreed with findings of other studies which recorded higher percentages 9.5%, 8.6% and 6.3% (5, 14,16) respectively. Obstructed labor and poor monitoring of labor among the primigravidas are the likely causes.

Inter-pregnancy interval (IPI) of less than 2 years has been associated with increased risk of uterine rupture in the scarred uterus. However, in this study, 127 (88.8%) of the patients who ruptured had an inter-pregnancy interval of >2 years. This would have been due to other causes of uterine rupture in these patients rather than the adequate healing period.

Injudicious use of oxytocin and misoprostol. Hyperstimulation of uterus with uterotonics can predispose uterus to rupture. In this study, 26 (18.2%) were induced with PGE or augmented with oxytocin. Islam et al and Hussein et al had similar results of 21.2% and 16% respectively (57,14). A study by Gabkika et al indicated that injudicious use of oxytocin and misoprostol contributed 55% (5). Dosage of misoprostol beyond limits per gestation. Unsupervised labor and late referrals and no proper documentation of uterotonics dosages.

Fetal macrosomia. Some studies linked occurrence of uterine rupture to fetal macrosomia. Elkousy et al indicated 3.6% cases of uterine rupture in women with fetuses >4000g compared

with 1.2% cases of uterine rupture in women with fetal weight of <4000g (36). In this study, fetal macrosomia was seen in 12 (8.4%) of the cases. This high rate of uterine rupture may have been due to confounding factors such as gestational age >41weeks and injudicious use of oxytocin/misoprostol during induction of labor.

5.3. Clinical presentations

Abdominal pain/tenderness. In this study, the most common clinical presentation is abdominal pain which was in 131 (91.6%) of the patients. This is similar to the findings of a Nigerian study done by Nyengidiki et al which found that 92.5% cases of uterine rupture had presented with abdominal pain (3). Moreover, other studies further reported abdominal pain as a presenting complain in all patients managed for uterine rupture (16) (6) (47).

However, Bujold & Gauthier noted 5% of abdominal pain as the first of uterine rupture cases (23). This large discrepancy would largely be due to masking of uterine rupture symptoms with those associated with labor pain. Therefore, this requires high index of suspicion when managing the patients in labor especially those with known risk factors for uterine rupture.

Abdominal tenderness is caused by the irritation of the visceral peritoneum by presence of haemoperitoneum in uterine rupture. Our study demonstrated 89 (62.2%) of uterine rupture cases had abdominal tenderness. Silent uterine rupture could explain the discrepancy of our finding with high rate of 81.2% of uterine rupture cases in an Ethiopian study by Dawud et al (6).

Vaginal bleeding /APH. This study found that 29.4% of patients managed for uterine rupture had vaginal bleeding. This is similar to Nyengidiki et al retrospective study which indicated that 30% of uterine rupture patients had vaginal bleeding respectively (3,12). Further , a study by Zwart et al. found that 27% of uterine rupture cases presented with antepartum hemorrhage as a sign (28). However, this finding is lower than that of Adewale et al and Dawud et al which revealed that 50% and 45.6% respectively of patients had intra-partum vaginal bleeding (12).

Most cases of uterine rupture bleed intra-abdominally rather than per vaginal bleed depending on the site of rupture and impaction of the fetal head on the cervical os.

Hypovolemic shock. The findings in this study indicated 20.3% cases of uterine rupture had hypovolemic shock. Although the rate of hypovolemic shock in our study is twice as higher than that of Yeou-Lih et al (10%), it is almost as twice as lower than that of Golan et al (29%) and Rahman et al (34%) (20, 28). The higher rates in our study possibly could be due to cases of unscarred uterine rupture which usually complicates with massive hemorrhage leading to hypovolemic shock as compared with scarred uterus which tend to rupture along the old uterine scar with less hemorrhage. The lower rates in our study could be due to high vigilance in APH management.

None Reassuring Fetal Status (NRFS). In this study, 15.4% of uterine rupture cases were associated with fetal bradycardia. This percentage is very low in comparison to other studies done by Lydon-Rochelle et al, Leung et al, and Rodriguez et al who associated fetal bradycardia in up to 79% cases of uterine rupture (31, 9, 49). Moreover, Yeou-Lih et al., indicated fetal distress as the most common manifestation of gravid uterine rupture with a percentage of 48% (31).

The continuous use of electronic devices to routinely monitor fetal heart rates could account for the higher rates of fetal bradycardia and fetal distress seen in studies done in high income countries than in our own study.

5.4. Outcomes of patients managed for uterine rupture

5.4.1. Maternal outcomes of patients managed for uterine rupture
Blood loss and anemia. The findings of this study showed that 53.1% of patients managed for uterine rupture were anemic, thus needing blood transfusion. Similarly, study done by Talib et al indicated that 160 (50.6%) cases of uterine rupture needed minimum of two units of blood (7). Further, studies by Dawud et al in Ethiopia, Ehigiebaa in Benin and Hussein in Tanzania demonstrated that 80.3%, 90.9% and 100% respectively cases of uterine rupture with had blood loss between 500ml – 5000ml required blood transfusion either intra-operatively or post-operatively (18, 5). Studies by Kieser & Baskett, Leung et al and Shipp et al further demonstrated patients with ruptured uteri required blood transfusion (53)(9)(24). So blood transfusion is a life-saving remedy given to patients with haemorrhage during rupture of uterus.

Maternal Hypovolemic shock. In this study, 29 (20.3%) cases of uterine rupture developed hypovolemic shock and 60 (42.0%) were transfused 1-3 units of blood and 22 (15.4%) had massive transfusion. Other studies by Golan et al and Rahman et al reported hypovolemic shock in 29% and 34% of women who had uterine rupture (29). Further, Folorunsho et al found that 50% cases of uterine rupture had hypovolemic shock and 56.3% of the patients were transfused.

Maternal death. The maternal mortality in this study was found to be 10 (7.0%). This is similarly close to that of Gabkika et al where they found 9.5% maternal mortality.

Contrariwise, other studies demonstrated relatively low maternal mortalities rates (1% - 4%) (9, 17, 6, 12, 56). Variations in study settings, levels of incomes, referral system, and distance from the hospital, patient's health status at the time of referral, diagnosis and management procedures could be some of the reasons for high maternal mortalities in our study.

Other complications. In this study, other maternal complications of uterine rupture include sepsis 19 (13.3%), SSI 13 (9.1%), ICU admissions 8 (5.6%), bladder injury 7 (4.9%), DIC 4 (2.8%) and AKI 4 (2.8%). Similarly, other studies linked VVF, wound sepsis, long hospital stay, ICU admissions, urinary incontinence, cervical lacerations and anesthesia related complications like aspiration pneumonia to uterine rupture (3–5,33,35).

Repairs. The findings of this study revealed that 127 (88.8%) of uterine rupture cases were done uterine repair only. This is comparable to the findings (of descriptive analytical retrospective) done by Gabkika et al where 85.5% of the cases undergoing uterine repair. Further, in a retrospective observational study, Pallavi et al demonstrated that 75.2% cases of uterine rupture had uterine repair. This would be due to the fact that most of the patients have previous CS deliveries which tend to rupture along the old scar and are easily to repair. This study showed that 107 (74.8%) had lower uterine segment rupture which is associated with less bleeding hence preservation of fertility in these patients.

Hysterectomy. Several studies revealed that where hysterectomy is warranted, most surgeons preferred partial hysterectomy to total hysterectomy (6,10,12,36). These findings are in agreement with our study where 10 (7.0%) cases of uterine rupture underwent partial hysterectomy. However, Ahmed in Ethiopia in 2018, found higher number of TAH than STH at 61.5% and 10%

respectively. This would be due to the timely involvement of highly skilled health personnel and multidisciplinary team in the management of patients with uterine rupture cases at KNH.

Further, in this study, 5 (3.5%) cases of uterine rupture were done total hysterectomy. Similarly, in a retrospective study in 1991, Lema et al indicated that 3.2% cases of uterine rupture managed at KNH had TAH. Further, a study by Ehigieba et al revealed low percent of 7.8% of uterine rupture cases who had total hysterectomy. However, a study by Islam in Pakistan in 2018 which revealed 100% cases of uterine rupture had PTH. Possibly, this could be due to institutional policy and/or surgeon preference or expertise.

5.4.2. Fetal outcomes for patients managed for uterine rupture

Live births. In this study, there were 45 (31.5%) live births, which were similar to those of a study by Lema et al done KNH with live birth of 35.7% (17). This similarity could be due to same study design and study site. However, other studies show higher rate of live births ranging from 66.6%-90.6% (7, 16). High income countries register high rate of live births as opposed to low income countries due to early diagnosis and timely intervention high income country.

APGAR score. Our study has found out that 12 (8.4%) neonates delivered after rupture of the uterus had APGAR score <7 in five minutes. This is comparable to a study by Gabkika et al who found 11.5 % infants of uterine rupture cases with APGAR score of <7 in 5 minutes This implies poor/adverse fetal outcomes in low incomes countries.

NICU/NBU admissions. The findings of this study demonstrated that 17 (11.9%) neonates delivered after uterine rupture required NICU admissions. This contrast with the findings of Menihan et al who found 73.0% of the neonates requiring NICU admission. This difference would be due to hospital policy differences.

Stillbirth and neonatal death. The findings of this study revealed 69.2% rate of fetal and neonatal mortality resulting from uterine rupture. Similarly, a study by Schrinsky and Benson further indicated 65% rate of perinatal mortality resulting from uterine rupture (21). Moreover, studies done in other low income African countries demonstrated substantially high rates of stillbirth ranging from 83.3%- 98.3% (5, 14, 16).

In contrast, studies done in high income countries revealed significantly low rates of fetal and neonatal mortality in women with ruptured uterine range of 11.1%-17.0% (11, 4,). This

discrepancy would result from minimizing the time between rupture and initiation of conservative and definitive surgical treatment.

Chapter 6: Conclusion and Recommendations

6.1. Conclusion

- Previous CS delivery mainly with 1 previous scar is the most common obstetric characteristic in patients of uterine rupture. Most patients commonly presented with abdominal pain which could easily be confused with normal labor.

- The most common surgical intervention was repair of uterus. This is commendable as it is fertility sparing. Presence of blood transfusion services in the hospital is lifesaving as the majority of the patients in this study were transfused

- High mortality, fetal and neonatal mortality are seen in our setting.

- The high prevalence of uterine rupture in this study was associated with adverse maternal and fetal outcomes. Thus, compromising with the attainment of Sustainable Development Goal 3 which seeks to ensure healthy lives and promote well-being for all at all ages.

6.2. Recommendations

- Women considering vaginal birth after caesarean delivery should be counselled during ante natal care visits and managed by skilled health personnel in facilities with provision for emergency surgical interventions.

- As a policy, it is advisable for all previous CS patients should be managed in level 4-6 center.

- Vigilant surveillance for uterine rupture in women with risk factors during labor and monitoring of labor in all pregnant women using the partograph to reduce on maternal , fetal and neonatal morbidity and mortality.

- Increase staff in labor units and enhance training and support supervision on uterotonics use during labor for better management of patients and improvement of pregnancy outcomes.

References

1. Hofmeyr GJ, Say L, Gülmezoglu AM. WHO systematic review of maternal mortality and morbidity: The prevalence of uterine rupture. BJOG: An International Journal of Obstetrics and Gynaecology. 2005.

2. Motomura K, Ganchimeg T, Nagata C, Ota E, Vogel JP, Betran AP, et al. Incidence and outcomes of uterine rupture among women with prior caesarean section: WHO Multicountry Survey on Maternal and Newborn Health. Sci Rep [Internet]. 2017;7(March):1–9. Available from: http://dx.doi.org/10.1038/srep44093

3 Nyengidiki T, Allagoa D. Rupture of the gravid uterus in a tertiary health facility in the Niger delta region of Nigeria: A 5-year review. Niger Med J. 2011;52(4):230.

4.   Tinelli A. Uterine rupture: up to date. J Interdiscip Res Appl to Med. 2017;09(1):61–74.

5.   Astatikie G, Limenih MA, Kebede M. Maternal and fetal outcomes of uterine rupture and factors associated with maternal death secondary to uterine rupture. BMC Pregnancy Childbirth. 2017;17(1):1–9.

6.   Ahmed DM, Mengistu TS, Endalamaw AG. Incidence and factors associated with outcomes of uterine rupture among women delivered at Felegehiwot referral hospital, Bahir Dar, Ethiopia: Cross sectional study. BMC Pregnancy Childbirth. 2018;18(1):1–12.

7.   Talib A Al, Haseeb Y, Chohan M, Qahtani N Al. A Study of 160 cases of uterine rupture. Obstet Gynecol Int J. 2019;10(6).

8.   Dhaifalah I, Santavy J, Fingerova H. Uterine rupture during pregnancy and delivery among women attending the Al-Tthawra Hospital in Sana'a City Yemen Republic. Biomed Pap Med Fac Univ Palacky Olomouc Czech Repub. 2006;150(2):279–83.

9.   Leung AS, Leung EK, Paul RH. Uterine rupture after previous cesarean delivery: maternal and   consequences. Am J Obstet Gynecol. 1993 Oct. 169(4):945-50.

10.   Menihan CA. Uterine rupture in women attempting a vaginal birth following prior cesarean birth.   J Perinatol. 1998 Nov-Dec;18(6 Pt 1):440-3. PMID: 9848757.

11.   Blanchette H, Blanchette M, McCabe J, Vincent S. Is vaginal birth after cesarean safe? Experience at a community hospital. American Journal of Obstetrics and Gynecology. 2001 Jun;184(7):1478-84; discussion 1484-7. DOI: 10.1067/mob.2001.114852.

12.   Kalewad P, Bava A, Nandanwar Y. Pregnancy outcome in cases of rupture uterus: a clinical study. Int J Reprod Contraception, Obstet Gynecol. 2016;5(9):3098–102.

13.   Guise JM, McDonagh MS, Osterweil P, Nygren P, Chan BKS, Helfand M. Systematic review of the incidence and consequences of uterine rupture in women with previous caesarean section. Br Med J. 2004;329(7456):19–23.

14.   Kidanto HL, Mwampagatwa I, Van roosmalen J. Uterine rupture: A retrospective analysis of causes, complications and management outcomes at Muhimbili National Hospital in Dar es Salaam, Tanzania. Tanzan J Health Res. 2012;14(3):1–8.

15.   Nagajyothi S, Sheela SR, Anudeep P, Meela R. Uterine rupture- A 10 years review in

tertiary hospital. Indian J Obstet Gynecol Res. 2018;5(3):409–12.

16.   Adewale FB, Adeniran AS, Ijaiya MA. Clinical profile of patients with uterine rupture at a tertiary facility in North Central Nigeria. 2019;13(1):1–5.

17.   Lema VM, Ojwang SB, Wanjala SH. Rupture of the gravid uterus: a review. East Afr Med
J.   1991 Jun;68(6):430-41. PMID: 1752222.

18.   Ehigiegbaa A, Adeyemo I. Uterine Rupture in Labour: A Continuing Obstetric Challenge in Developing Countries - The Benin Experience. J Med Biomed Res. 2009;5(1):44–50.

19.   Gardeil F, Daly S, Turner MJ. Uterine rupture in pregnancy reviewed. Eur J Obstet Gynecol Reprod Biol. 1994;56(2):107–10.

20.   Golan A, Sandbank O, Rubin A. Rupture of the pregnant uterus. Obstet Gynecol. 1980 Nov;56(5):549-54. PMID: 7432723.

21.   Schrinsky DC, Benson RC. Rupture of the pregnant uterus: a review. Obstet Gynecol Surv. 1978   Apr;33(4):217-32.   doi: 10.1097/00006254-197804000-00001.   PMID: 347349.

22.   Mokgokong ET, Marivate M. Treatment of the ruptured uterus. South African Med J. 1976;50(41):1621–4.

23.   Bibi S, Gul K, Gul Z GP. Management of Patients with Uterine Rupture. J Surg Pakistan. 2014;19(3):117–20.

24.   Shipp TD, Zelop C, Repke JT, Cohen A, Caughey AB, Lieberman E. The association of maternal age and symptomatic uterine rupture during a trial of labor after prior cesarean delivery. Vol. 99, Obstetrics and Gynecology. 2002. p. 585–8.

25.   Arrowsmith S, Robinson H, Noble K, Wray S. What do we know about what happens to myometrial function as women age ? J Muscle Res Cell Motil (2012) 33:209–217 DOI 10.1007/s10974-012-9300-2.

26.   Smith GC, Cordeaux Y, White IR, Pasupathy D, Missfelder-Lobos H, Pell JP, Charnock-Jones DS, Fleming M. The effect of delaying childbirth on primary cesarean section rates. PLoS Med. 2008 Jul 1;5(7):e144. doi: 10.1371/journal.pmed.0050144. PMID: 18597550; PMCID: PMC2443199.

27. Lin C, Raynor BD. Risk of uterine rupture in labor induction of patients with prior cesarean section: an inner city hospital experience. Am J Obstet Gynecol. 2004 May;190(5):1476-8. doi: 10.1016/j.ajog.2004.02.035. PMID: 15167874.

28. RAHMAN J, AL-SIBAI MH, RAHMAN MS. Rupture of the Uterus in Labor. Vol. 41, Obstetrical & Gynecological Survey. 1986. p. 160–1.

29. Plauché WC, Von Almen W, Muller R. Catastrophic uterine rupture. Obstetrics and Gynecology. 1984 Dec;64(6):792-797.

30. Taylor DR, Doughty AS, Kaufman H, Yang L, Iannucci TA. Uterine rupture with the use of PGE2 vaginal inserts for labor induction in women with previous cesarean sections. Vol. 47, Journal of Reproductive Medicine for the Obstetrician and Gynecologist. 2002. p. 549–54.

31. Lydon-Rochelle M, Holt VL, Easterling TR, Martin DP. Risk of uterine rupture during labor among women with a prior cesarean delivery. N Engl J Med. 2001 Jul 5;345(1):3-8. doi: 10.1056/NEJM200107053450101. PMID: 11439945.

32. Esposito MA, Menihan CA, Malee MP. Association of interpregnancy interval with uterine scar failure in labor: a case-control study. Am J Obstet Gynecol. 2000 Nov;183(5):1180-3. doi: 10.1067/mob.2000.109046. PMID: 11084563.

33. Stamilio, David M. MD, MSCE[1]; DeFranco, Emily DO[1]; Paré, Emmanuelle MD[2]; Odibo, Anthony O. MD, MSCE[1]; Peipert, Jeffrey F. MD, PhD[1]; Allsworth, Jenifer E. PhD[1]; Stevens, Erika MA[1]; Macones, George A. MD, MSCE[1] Short Interpregnancy Interval, Obstetrics & Gynecology: November 2007 - Volume 110 - Issue 5 - p 1075-1082 doi: 10.1097/01.AOG.0000286759.49895.46

34. Bujold E, Gauthier RJ. Risk of uterine rupture associated with an interdelivery interval between 18 and 24 months. Obstet Gynecol. 2010 May;115(5):1003-1006. doi: 10.1097/AOG.0b013e3181d992fb. PMID: 20410775.

35. Bujold E, Mehta SH, Bujold C, Gauthier RJ. Interdelivery interval and uterine rupture. Am J Obstet Gynecol. 2002 Nov;187(5):1199-202. doi: 10.1067/mob.2002.127138. PMID: 12439503.

36. Elkousy MA, Sammel M, Stevens E, Peipert JF, Macones G. The effect of birth weight on vaginal birth after cesarean delivery success rates. Am J Obstet Gynecol. 2003 Mar;188(3):824-30. doi: 10.1067/mob.2003.186. PMID: 12634665.

37. Jastrow N, Roberge S, Gauthier RJ, Laroche L, Duperron L, Brassard N, Bujold E. Effect of birth weight on adverse obstetric outcomes in vaginal birth after cesarean delivery. Obstet Gynecol. 2010

Feb;115(2 Pt 1):338-343. doi: 10.1097/AOG.0b013e3181c915da. PMID: 20093908.

38. Zelop CM, Shipp TD, Cohen A, Repke JT, Lieberman E. Trial of labor after 40 weeks' gestation in women with prior cesarean. Obstet Gynecol. 2001 Mar;97(3):391-3. doi: 10.1016/s0029-7844(00)01175-3. PMID: 11239643.

39. Hammoud A, Hendler I, Gauthier RJ, Berman S, Sansregret A, Bujold E. The effect of gestational age on trial of labor after Cesarean section. J Matern Fetal Neonatal Med. 2004 Mar.15(3):202-6.

40. Kiran TS, Chui YK, Bethel J, Bhal PS. Is gestational age an independent variable affecting uterine scar rupture rates? Eur J Obstet Gynecol Reprod Biol. 2006 May 1;126(1):68-71. doi: 10.1016/j.ejogrb.2005.07.021. Epub 2005 Oct 10. PMID: 16221523.

41. Coassolo KM, Stamilio DM, Paré E, Peipert JF, Stevens E, Nelson DB, Macones GA. Safety and efficacy of vaginal birth after cesarean attempts at or beyond 40 weeks of gestation. Obstet Gynecol. 2005 Oct;106(4):700-6. doi: 10.1097/01.AOG.0000179389.82986.50. PMID: 16199624.

42. Singh A, Shrivastava C. Uterine Rupture: Still a Harsh Reality! J Obstet Gynecol India [Internet]. 2015;65(3):158–61. Available from: http://dx.doi.org/10.1007/s13224-014-0551-2

43. Phocas Biraboneye S, Ogutu O, van Roosmalen J, Wanjala S, Lubano K, Kinuthia J. Trial of labour or elective repeat caesarean delivery: Are women making an informed decision at Kenyatta national hospital? BMC Pregnancy Childbirth. 2017;17(1):1–8.

44. Ogwang S, Karyabakabo Z, Rutebemberwa E. Assessment of partogram use during labour in Rujumbura Health Sub District, Rukungiri District, Uganda. Afr Health Sci. 2009;9 Suppl 1(1):27–34.

45. Yucel O, Ozdemir I, Yucel N, Somunkiran A. Emergency peripartum hysterectomy: a 9-year review. Arch Gynecol Obstet. 2006 May;274(2):84-7. doi: 10.1007/s00404-006-0124-4. Epub 2006 Feb 7. PMID: 16463166.

46. Wang YL, Su TH, Lee RKK. Obstetric Uterine Rupture: A 20-Year Clinical Analysis. Taiwan J Obstet Gynecol. 2004;43(3):136–9.

47. England TN. WITH A PRIOR CESAREAN DELIVERY. 2001;345(1):3–8.

48. Zwart JJ, Richters JM, Ory F, de Vries JI, Bloemenkamp KW, van Roosmalen J. Uterine rupture in The Netherlands: a nationwide population-based cohort study. BJOG. 2009

Jul;116(8):1069-78; discussion 1078-80. doi: 10.1111/j.1471-0528.2009.02136.x. PMID: 19515148.

49. Jain R, Shewte MK. Ruptured uterus outcome among the pregnant women admitted in a tertiary care centre. Int J Reprod Contraception, Obstet Gynecol. 2018;7(5):1718–22.

50. Loue V, Dia J, Effoh D, Adjoby R, Konan J, Gbary E, et al. Management and prognosis of uterine rupture during labor in an under-medicalized country: about 513 cases collected at the Cocody University Hospital Center (Abidjan-Cote dIvoire). Int J Reprod Contraception, Obstet Gynecol. 2015;4(5):1277–82.

51. Landon MB, Spong CY, Thom E, Hauth JC, Bloom SL, Varner MW, Moawad AH, Caritis SN, Harper M, Wapner RJ, Sorokin Y, Miodovnik M, Carpenter M, Peaceman AM, O'sullivan MJ, Sibai BM, Langer O, Thorp JM, Ramin SM, Mercer BM, Gabbe SG; National Institute of Child Health and Human Development Maternal-Fetal Medicine Units Network. Risk of uterine rupture with a trial of labor in women with multiple and single prior cesarean delivery. Obstet Gynecol. 2006 Jul;108(1):12-20. doi: 10.1097/01.AOG.0000224694.32531.f3. PMID: 16816050.

52. Kieser KE, Baskett TF. A 10-year population-based study of uterine rupture. Obstetrics and Gynecology. 2002 Oct;100(4):749-753. DOI: 10.1016/s0029-7844(02)02161-0.

53. Qazi Q, Akhtar Z, Khan K, Khan AH. Woman health; uterus rupture, its complications and management in teaching hospital bannu, pakistan. Maedica (Buchar) [Internet]. 2012;7(1):49–53. Available from: http://www.ncbi.nlm.nih.gov/pubmed/23118819%0Ahttp://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=PMC3484796

54. Hibbard JU, Ismail MA, Wang Y, Te C, Karrison T, Ismail MA. Failed vaginal birth after a cesarean section: how risky is it? I. Maternal morbidity. Am J Obstet Gynecol. 2001 Jun;184(7):1365-71; discussion 1371-3. doi: 10.1067/mob.2001.115044. PMID: 11408854.

55. Islam A, Shah AA, Jadoon H, Fawad A, Javed M, Abbasi AUN. A Two-Year Analysis Of Uterine Rupture In Pregnancy. J Ayub Med Coll Abbottabad. 2018;30 1)(4):S639–41.

Appendices

Appendix 1: Study Timeline

Research Project	March 2021	April-July 2021	August 2021	Sept-Feb 2021	March-April 2022	May 2022	June-July 2022
Concept note presentation	■						
Proposal development		■					
Proposal marking by 2 internal examiners			■				

Task							
Powerpoint presentation to department				▓			
Submission of proposal to Ethics				▓			
Data collection					▓		
Data analysis					▓		
Results presentation to department						▓	
Manuscript writing							▓
Submission of manuscript to peer reviewed journal							▓

Appendix 2: Research Budget

		Units	Unit costs	Total
Proposal development	Photocopying	2	500	1000
	Printing charges	200	10	2000
	Binding charges	3	300	900

Data collection	Photocopying	1000	3	3000
	Stationary i.e. pens,	30	10	300
	Printing	300	10	3000
	Internet		15000	15000
	Research assistance levy	2	20000	40000
Data analysis	Statistician's fees	1	40000	40000
Thesis write up	Stationary	80	10	800
Miscellaneous	Transport, communication and logistics		10000	10000
TOTAL				106,000

Appendix 3: Sample of Data Extraction Tool

Section A: Common obstetric characteristics
(a) Demographic characteristics

1. Date of admission ---------------------------- Data of discharge-----------------------
2. Age [ ] years

3. Marital status

a.   Single   [ ]
b.   Married [ ]
c.   Divorced [ ]

4.   Level of education.

a.   None [ ]
b.   Primary [ ]
c.   Secondary [ ]
d.   Tertiary [ ]

5.   Socio-economic status:

a.   Unemployed [ ]
b.   Self-employed [ ]
c.   Formal employment [ ]

        Para ------ + --------, Gravida ---------
         ANC Visits:

a.   None [ ]
b.   1 [ ]
c.   2 [ ]
d.   3 [ ]
e.   4 [ ]
f.   >4 [ ]

(b) Obstetric characteristics

8.   History of caesarean section deliveries: Yes [ ]   No   [ ].
         If yes: number of previous caesarean section deliveries. Indicate ---------------

9.   History of myomectomy. Yes [ ] No [ ]

10.   History of Manual Vacuum Aspiration (MVA/Dilation /Curettage (D/C). Yes [ ] No [ ]

11.   Gestation age in weeks of current pregnancy [ ]

12.   History of previous uterine rupture: Yes [ ] No [ ]   Indicate number--------- When ------

13. Induction of labor:

    a.   Yes [ ]   No [ ]

    b.   If Yes, which method of induction of labor?

     i.Misoprostol (PGE) [ ] dosage --------------- Route-------------

     ii.Oxytocin   [ ] Dosage ---------------

     iii.Mechanical [ ]

     iv.Others----------------------------

14.   Augmentation of labor:

    a.   Yes [ ] No [ ]

    b.   If Yes, indicate method-------------

     i.What was the dose? -----------------

     ii.What was the duration of labor? -----------------

     iii. indicate any signs of obstructed labor ----------------------------------

14.   Trial of labor after caesarean delivery (TOLAC) : Yes [ ] No [ ]

16.   Inter pregnancy interval in months

    a.   6 [ ]

    b.   12 [ ]

    c.   18 [ ]

    d.   24 [ ]

    e.   30 [ ]

    f.   36 [ ]

17.   Use of partograph:

   Yes [ ]   No [ ]

18. Was the patient referred in?

a.   Yes [ ]   No [ ]

b.   If yes, what was the level of the referring center? Reason for referral------------------------

2 [ ]

3 [ ]

4 [ ]

5 [ ]

Section B: Clinical presentations

a) Signs and Symptoms [ ]

i) Abdominal pain [ ]

ii) Cessation of uterine contractions [ ] / recession of presenting part [ ]

iii) Peripartum bleeding [ ]

iv) Postpartum bleeding [ ]

v) Uterine tenderness [ ]

vi) Peripartum collapse [ ]

vii) Postpartum collapse [ ]

viii) Hematuria [ ]

ix) Sepsis [ ]

x) Nonreassuring fetal status (NRFS); Bradycardia [ ] / Tachycardia [ ]

xi) Easily palpable parts [ ] / uterine defect [ ]

b) Site of rupture

i) Anterior transverse lower segment [ ]

ii) Extension to the broad ligament [ ]

iii) Left anterior lateral [ ]

iv) Anterior vertical [ ]

v) Right anterior lateral [ ]

vi) Posterior [ ]

vii) Fundal [ ]

viii) Extension to the vagina [ ]

Section C: Management procedures
19. Surgical interventions:

a.   Uterine repair only   [ ]

b.   Uterine repair with BTL   [ ]

c.   Total hysterectomy   [ ]

d.   Partial hysterectomy   [ ]

20. Surgeon

a.   Medical officer [ ]

b.   Registrar [ ]

c.   Consultant obstetrician [ ]

d.   Multidisciplinary team [ ]

e.   Medical officer intern [ ]

Section D: Maternal outcomes

22.   Maternal morbidities

a.   Shock: Yes [ ]   No [ ]

b.   Disseminated intravascular coagulation (DIC):   Yes [ ]   No [ ]

c.   Intensive care unit (ICU) admission: Yes [ ] No [ ] Duration of admission; ------- Days

d.   Estimated blood loss (EBL) intra-operative ------------- ml

e.   Wound infection: Yes [ ] No [ ]

f.   Anemia: Yes [ ]   No [ ]   Hb level at discharge ------------------

g.   Units of blood transfused ----------------------------

h.   Bladder Injury: Yes [ ] No [ ]

i.   Sepsis: Yes [ ]   No [ ]   White blood count (WBC) > 15------------------

j.   Surgical site infection Yes [ ] No [ ]

k.   Acute Kidney Injury (AKI): Na   --------- K ----------- Urea--------- Creatinine-----------

l.   Duration of hospital stay: -----------------------Days

m.   Other co-morbidities: Yes [ ] No [ ], specify----------------------

23.   Maternal mortality: Yes [ ] No   [ ]

Section E: Fetal outcomes

24.   Perinatal outcomes

a.   Live birth [ ], APGAR Score ----------/1 minute, -----------/5 minutes, -----------/10 minutes

b.   Fresh still birth (FSB)   [ ]   Macerated still birth (MSB) [ ]

c.   Sex: Male [ ]   Female [   ]

d.   Birth weight ---------------------

e.   Neonatal intensive care unit(NICU)/New born unit (NBU) admission: Yes [ ]   No [   ]

25.   Neonatal outcomes

a.   Early neonatal death: Yes [ ]   No [ ] If yes, time of death post-delivery-----------/ hours

Appendix 4: Approval letter from KNH-UoN ERC

UNIVERSITY OF NAIROBI
FACULTY OF HEALTH SCIENCES
P O BOX 19676 Code 00202
Telegrams: varsity
Tel:(254-020) 2726300 Ext 44355

KNH-UON ERC
Email: uonknh_erc@uonbi.ac.ke
Website: http://www.erc.uonbi.ac.ke
Facebook: https://www.facebook.com/uonknh.erc
Twitter: @UONKNH_ERC https://twitter.com/UONKNH_ERC

KENYATTA NATIONAL HOSPITAL
P O BOX 20723 Code 00202
Tel: 726300-9
Fax: 725272
Telegrams: MEDSUP, Nairobi

Ref: KNH-ERC/A/95

15th March, 2022

Dr. Annet Kiden
Reg. No. H58/33072/2019
Dept. of Obstetrics and Gynecology
Faculty of Health Science
University of Nairobi

Dear Dr. Kiden,

RESEARCH PROPOSAL: PREDISPOSING FACTORS, CLINICAL PRESENTATIONS, MANAGEMENT AND OUTCOMES OF UTERINE RUPTURE FOR PATIENTS MANAGED AT KENYATTA NATIONAL HOSPITAL BETWEEN JANUARY 2016 AND DECEMBER 202   (P839/10/2021)

This is to inform you that KNH-UoN ERC has reviewed and approved your above research proposal. Your application approval number is **P839/10/2021**. The approval period is 15th March 2022 – 14th March 2023.

This approval is subject to compliance with the following requirements;

i.   Only approved documents including (informed consents, study instruments, MTA) will be used.
ii.   All changes including (amendments, deviations, and violations) are submitted for review and approval by KNH-UoN ERC.
iii. Death and life threatening problems and serious adverse events or unexpected adverse events whether related or unrelated to the study must be reported to KNH-UoN ERC 72 hours of notification.
iv.   Any changes, anticipated or otherwise that may increase the risks or affected safety or welfare of study participants and others or affect the integrity of the research must be reported to KNH-UoN ERC within 72 hours.
v.   Clearance for export of biological specimens must be obtained from relevant institutions.
vi.   Submission of a request for renewal of approval at least 60 days prior to expiry of the approval period. Attach a comprehensive progress report to support the renewal.
vii. Submission of an executive summary report within 90 days upon completion of the study to KNH-UoN ERC.

Protect to discover

Prior to commencing your study, you will be expected to obtain a research license from National Commission for Science, Technology and Innovation (NACOSTI) https://research-portal.nacosti.go.ke and also obtain other clearances needed.

Yours sincerely,

DR. BEATRICE K.M. AMUGUNE
SECRETARY, KNH-UoN ERC

c.c.   The Dean, Faculty of Health Sciences, UoN
        The Senior Director, CS, KNH
        The Chairperson, KNH- UoN ERC
        The Assistant Director, Health Information, KNH
        The Chair, Dept. of Obstetrics and Gynecology, UoN
        Supervisors: Prof. Zahida Qureshi, Dept. of Obstetrics and Gynecology, UoN
              Dr. George Gwako, Dept. of Obstetrics and Gynecology, UoN

Protect to discover