MODE OF DELIVERY AND OUTCOME OF PATIENTS WITH A PREVIOUS SCAR AT CHARLOTTE MAXEKE JOHANNESBURG ACADEMIC HOSPITAL

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Declaration

I, Momanyi Mokaya, declare that this dissertation is my own work. It is being submitted to The University of the Witwatersrand, in partial fulfilment for the degree of Masters of Medicine in Obstetrics and Gynaecology. It has not been submitted for any degree or examination purposes at this institution, or any other university.

Momanyi Mokaya

This 21st day of December 2016

Dedication

This research is dedicated to my grandfather pastor Jackson Mokaya Momanyi, for his inspiration and positive role model he espoused for the entire family. He will be greatly missed. I also dedicate it to my parents Dr. Stanley Mokaya and Mrs. Lora Mokaya for their support and encouragement through my postgraduate training.

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Abstract

The setting of this study was at the Charlotte Maxeke Johannesburg Academic Hospital (CMJAH) a tertiary referral and teaching hospital attached to the University of Witwatersrand situated in Parktown, Johannesburg. The hospital manages all high risk pregnancy including previous caesarean sections. This study evaluated women with one previous scar at CMJAH for their: antenatal choice of delivery method, eventual delivery method and pregnancy outcome. Over the years there has been a significant uptrend of caesarean sections and consequently also an increasing number of women with one previous scar with subsequent pregnancies.

Objectives: 1) To obtain the indication for the mothers' first caesarean section, 2) To determine the mothers' choice of delivery method following their first caesarean section, 3) To determine the actual mode of delivery and factors that influenced it, 4) To establish short term neonatal outcome following delivery, 5) To establish short term maternal outcome following delivery.

Methodology: The study was a prospective cohort study of women with one previous scar who attended the antenatal clinic at the Charlotte Maxeke Johannesburg Academic Hospital (CMJAH). The aim was to compare their antenatal choice of delivery to how they eventually delivered. 100 women were recruited from the antenatal clinic from 1st July 2016 to 30th September 2016. Data was collected via interviewing the mothers and also from hospital records; this was captured on a data sheet. Data was then analysed using STATA software.

Results: One hundred women were followed up to delivery. 63 wanted to deliver via vaginal birth after caesarean section (VBAC) during their antenatal period, 35 wanted a repeat caesarean section and two were still undecided on their preferred mode of delivery. 22 women eventually managed to have VBAC (including 4 assisted deliveries). There were a total of 78 deliveries via caesarean section 46 being emergency caesarean sections and 32 being elective caesarean sections**.** The attempted VBAC success rate was 35% (including assisted deliveries) the remainder receiving emergency caesarean sections. Of the patients who wanted repeat caesarean section, 94.3% delivered by caesarean section. 76% of babies had no adverse short term outcome while 87% of mothers had no short term complications post-delivery. There was statistically no difference between short term complications of mother and foetus in both modes of delivery.

Conclusion: Women who choose caesarean section delivery during their antenatal period are much more likely to deliver via their preferred mode compared to women who choose VBAC as their mode of delivery, statistically significant, P<0.001.The main reasons for conversion of a VBAC to caesarean section observed were foetal distress and poor progress. Overall outcomes of mother and foetus were not statistically significant between vaginal and caesarean section delivery routes, though the most severe maternal complications were observed in emergency caesarean section deliveries.

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ABBREVIATIONS

ANC: Antenatal Clinic

BMI: Body Mass Index

BP: Blood Pressure

CEO: Chief Executive Officer

CMJAH: Charlotte Maxeke Johannesburg Academic Hospital

CPD: Cephalo-Pelvic Disproportion

C/S: Caesarean Section

EDD: Expected Date of Delivery

ERCS: Elective Repeat Caesarean Section

FHR: Foetal heart rate

HIV: Human Immunodeficiency Virus

ICU: Intensive Care Unit

LMP: Last Menstrual Period

L/W: Labour ward

MDG: Millennium Development Goals

MMR: Maternal Mortality Ratio

NICU: Neonatal Intensive Care Unit

NIH: National Institutes for Health

NVD: Normal Vaginal Delivery

RCOG: Royal College of Obstetricians and Gynaecologists

RDS: Respiratory Distress syndrome

SA: South Africa

SSA: Sub-Saharan Africa

TOLAC: Trial of Labour After Caesarean Section

TU: Transitional Unit (Neonatal)

TTN: Transient tachypnea of the newborn

UK: United Kingdom

USA: United States of America

VBAC: Vaginal Birth After Caesarean Section

WHO: World Health Organisation

Definitions

A "booked" patient refers to a patient who attended the antenatal clinic at least once and had booking bloods, history and examination performed by doctor or midwife

Maternal weight and BMI were values obtained on first booking visit

Gestational age at delivery was based on sure dates of last menstrual period or based on an early ultrasound

"Short term" outcome refers to the maternal and foetal condition 24-48 hours after delivery

"Minor complications" refers to complications not prolonging hospital stay and easily corrected within scope of management

"Severe/major complications" refers to complications necessitating further surgical, medical intervention beyond routine care and/or associated with prolonged hospital stay

1. INTRODUCTION

1.1. Introduction

A number of recent international studies reaffirmed earlier World Health Organisation (WHO) recommendations about optimal rates of caesarean section. The best outcomes for women and babies appear to occur with caesarean section rates of 5% to 10%. Rates above 15% seem to do more harm than good.[1] This is due to the generally observed increased rates of maternal and neonatal morbidity associated with caesarean sections.

In the United States of America (USA) the national caesarean section rate was 4.5% in 1965 when first measured.[2] However, it is now much higher at about 32.8% in 2010 and 2011.[3] This means about one in three mothers delivers by a caesarean section in USA.

Most mothers are healthy and are likely to expect a normal vaginal delivery during pregnancy. Caesarean section is major surgery and increases the likelihood of many short and longer term adverse effects for mothers and babies. In the USA there are clear recommendations for more judicious use of this procedure.[4, 5]

Caesarean section births currently constitute about 25% of births in the UK.[6] Every labour and delivery carries some risk to both the mother and baby. Good obstetric care is based on identifying risks, counselling women on the relative risks of various options, and opting to adopt a choice with a favourable risk–benefit profile. Studies have shown that vaginal birth after caesarean section (VBAC) is adequately safe for the majority of women with one previous lower segment incision. This is supported by the Royal College of Obstetricians (RCOG). The advice is that VBAC labours should be undertaken in hospitals with facilities for emergency surgery and advanced neonatal resuscitation, with continuous electronic foetal monitoring and intravenous access.[7]

A consensus meeting in March, 2006 by the National Institutes of Health (NIH) and the WHO concluded that the caesarean section rate was high, and VBAC was seen as an acceptable alternative to elective repeat caesarean section (ERCS). This approach was partially motivated by the reported success rates and safety of VBAC from as early as 1985

from publications at the time.[8] At that time, the statement was applicable to developed countries, as resource-poor developing countries were yet to register significant caesarean section rates requiring planned interventions. However, recent demographic data indicate that the practice of planned VBAC is now prevalent in most maternity units in Africa.[9]

The overall rate of caesarean section in Sub-Saharan Africa (SSA) is still low. However, it is the most commonly performed operation in the region with an upward trend as more women gain access to this lifesaving procedure.[9] As a result, the proportion of women with scarred uteri from caesarean sections is steadily on the rise. Taking into consideration high fertility rates combined with suboptimal contraceptive use in the region, the probability of these women having subsequent pregnancies is high.[9] It is therefore important that clinicians be well prepared to advise and formulate appropriate delivery plans suitable for patients without compromising safety.

A concern is that obstetric haemorrhage and infection account for almost half of the maternal deaths in SSA, and efforts to reduce this have remained elusive.[10] In South Africa, obstetric haemorrhage and sepsis form part of the big 5 causes of maternal deaths.[11]

Data from SSA indicates that more than 15% of emergency caesarean sections performed on scarred uteri will require blood transfusion, and these needs are doubled in the event of uterine rupture.[12] This situation is further worsened by poor antenatal care and suboptimal birth preparedness in resource challenged settings facing the region including South Africa.[13]

The universal adoption of VBAC was fostered by the results of a meta-analysis several years ago by Boulvain *et al,* 1997. They reported a success rate of 69% (95% CI 63–75%) and concluded that VBAC in SSA was as comparable to safe to those in developed countries, despite the difficult clinical conditions and limitations of resources.[14]

A large population based retrospective cohort analysis of primiparous women who gave birth to a live baby via initial caesarean section in Washington (USA) between 1987 and 1996 and had a second delivery during the same time period (1987 to 1996) showed: ruptured uterus occurred at a rate of 1.6/ 1000 in women who had a repeat elective caesarean delivery, 5.2 /1000 among women with spontaneous onset of labour, 7.7/1000 in women whose labour was induced without prostaglandins, and 24.5/1000 among women with prostaglandin-induced labour. The study concluded that in women with one prior caesarean delivery, the risk of

uterine rupture is higher among those whose labour is induced compared to those who had a repeat caesarean delivery prior to labour. Labour induced with a prostaglandin confers the highest risk of uterine rupture.[15]

Based on the RCOG guidelines, for a planned VBAC to be considered safe, strict criteria must be fulfilled. For example it is not recommended in patients with a previous uterine rupture, high vertical uterine incision, and in situations where three or more previous surgeries have been performed. Additional recommendations are the use of continuous electronic foetal heart rate monitoring, and institutional ability to perform emergency caesarean section and provide blood transfusion.[7] Although these are UK guidelines they are also accepted in South Africa and form the basis of management of VBACs in our setting at the CMJAH for women with one previous caesarean section. For women with more than one caesarean section VBAC is not offered.[16]

Challenges faced locally include being unable to continuously monitor women in labour and the lack of information on the previous operations as a result of suboptimal record keeping.[9] This may hinder hospitals from meeting the minimum standards required to offer safely planned VBAC. This is a view shared by midwives and obstetricians in the region for example in East Africa, where despite having a policy to offer VBAC delivery, units still perceive the practice as suboptimal and a major risk to maternal safety.[17, 18] A systematic review by Rossi *et al,* 2008 reported a 73% success rate for VBACs and found the incidence of maternal morbidity to be similar for women choosing either VBAC or ERCS.[19]

A retrospective study done in Kenya, East Africa in by S Z Wanyonyi *et al*, 2009 to determine perinatal outcomes for women with one previous scar included 215 women who met the criteria for VBAC showed that only 44.6% of mothers opted antenatally for VBAC. The success rate for VBAC was 49.4% in that study with the commonest cause for failure being prolonged active phase of labour.[17]

Concerns have been raised in SSA that VBACs that are not adequately supervised carry more risk than repeat elective caesarean section. Furthermore a recent review by De Jong *et al*, 2015 has shown that ERCS is safer than unsuccessful VBAC.[20] Significant maternal complications associated with unsuccessful VBAC include uterine rupture, hysterectomy, venous thromboembolism, haemorrhage, transfusion requirements, visceral injury, and

maternal death. It has been argued that many of these complications can be averted by offering the woman an ERCS.[21]

Neonatal outcomes have also been found to vary according to the mode of delivery, with the proportion of babies born with an arterial of pH less than 7.10 being higher after failed VBAC compared to successful VBAC (22.2% and 3.1% respectively). These findings by Landon *et al,* 2004 who reported more acidotic arterial cord pH for the babies born of mothers with failed trial of labour.[22] Despite these differences in the immediate peripartum period, subsequent neonatal morbidity was comparable regardless of the mode of delivery.

S. Liu *et al,* 2007 found that in SSA acceptance rates for trial of labour after caesarean section (TOLAC) are low. Another finding is the VBAC success rate was also lower than the commonly quoted figures of 72-76%.[21] However, a recent review of a trial in Senegal and Mali by Kabore *et al,* 2015 on TOLACs found that in low risk women without compounding obstetric complications and with one previous caesarean section, there was no reason not to offer a woman trial VBAC when the delivery is conducted in hospital with appropriate monitoring.[23, 24]

The role of counselling pregnant women in the antenatal period regarding their delivery choices would not be complete without informing them of the relative risks of both repeat caesarean section and VBAC. Once women are made to understand the pros and cons of either method they can better apply that knowledge in making an informed decision based on their individual circumstances.[25] Various factors such a previous successful vaginal delivery, previous successful VBAC, body mass index (BMI), maternal age, indication for previous caesarean section influence success rates of women attempting a VBAC.[26] It is also important to elaborate on the criteria set for accepting VBAC and contraindications to VBAC in the counselling. Internationally recognised indications and contraindications are published in various guidelines (e.g. RCOG).[27] Indications would include for example previous lower segment scar, previous breech delivery, clinically adequate pelvis and proper medical personnel to monitor the labour among others. Examples of contraindications include previous classical uterine incision, previous uterine rupture, or if the patient declines it.[27]

According to available publications it is noted that the South African national average caesarean section rate in state hospitals is about 21%. In private hospitals in South Africa the

figure approaches 80%.[20] Based on our maternal morbidity and mortality statistics at CMJAH the caesarean section rate is approximately 45%-50%.

To date no study has analysed the current trend of VBAC at CMJAH, and specifically the pregnant women's antenatal choice for mode of delivery versus their eventual mode of delivery and the pregnancy outcomes.

1.2. Problem Statement

There are no local studies that have been done to compare maternal antenatal delivery plans and actual birth outcomes of patients with a previous scar. Regional sub-Saharan studies have been done and majority of studies have been western-based multi-centre studies. This study will help evaluate our current practice in relation to global standards.

1.3. Aim

This study aimed to look at the eventual mode of delivery in women with one previous lower uterine segment caesarean section compared to their antenatal choice, looking into factors that prompted or changed the delivery outcomes. It also looked at the short term outcomes of the mother and baby after delivery through either means.

2. LITERATURE REVIEW

2.1. Introduction

As per National Institute of Health (NIH) and WHO consensus VBAC is an acceptable modality to reduce the overall caesarean section rate. Despite these recommendations, Caesarean rates continue to rise globally, with a 26% Caesarean rate in the USA in the last 10 years, [3, 28] 21.3% in England [29] and 19% in Canada.[30] While VBAC rates remain relatively high in the UK at 33% the rates are decreasing significantly in the USA from a high in the 90's 28.3% to 12.7% recently.[3] About 11% of pregnant women in the USA have undergone a previous caesarean section.[31]

Data collected from worldwide sources indicate that overall both in the developing world and developed world caesarean sections rates have been on the upward trend over several years.[32] Looking between 1990 and 2014 the global C/S rate has risen to 18.6% of all births. There still remains a significant gap between the C/S rate of the developed versus developing world. Latin America and the Caribbean region have the highest C/S rate 40.5%, Europe at 25% and Asia at 19.2%. The rise in C/S rate in Africa within that time period has been from 2.9% to 7.4% which remains the lowest rate globally. It is noted that increasing deliveries in the developing world are attended more by medical personnel.[33] This increase in attendance of skilled personnel has invariably led to a greater increase of interventions, including caesarean section where indicated. In South Africa an audit of caesarean sections in private practice found with the leading causes of caesarean section being previous caesarean section, maternal request and prevention of mother to child transmission of HIV.[34] There is increased recognition of an increased risk of placenta praevia and placenta accreta in subsequent pregnancies in women with previous caesarean sections [35] and the risk of hysterectomy may be as high as 1 in 700 for repeat caesarean sections.[36] There is also noted a higher risk of hemorrhage and longer hospital stay.[37]

2.2. Indications of caesarean sections

Caesarean sections are usually done for the benefit of the foetus some of which are presumed. Maternal indications are also important in choosing a caesarean section delivery to reduce morbidity and mortality. However increased C/S rates may also be influenced by better anesthetic and pediatric care. Also the general population is becoming more welcoming to

caesarean section and increasingly it is offered as a way of the clinician avoiding potential litigation.[38] Now days it is also not uncommon for the first caesarean section to be performed on maternal request.[39]

Commonly accepted C/S indications include:

2.2.1 Caesarean section for previous caesarean section

This accounts for almost a third of caesarean section deliveries in the developed world. Previously when the commonest incision for caesarean section was the classical incision there was the concern that there would be scar dehiscence or uterine rupture during labour. Hence a repeat caesarean section was advocated for future deliveries. With the lower segment caesarean section, evidence showed that the risk of uterine rupture was significantly less. Published data shows a scar dehiscence rate of less than 1% in women attempting VBAC.[40, 41] Moreover, Enkin[42] in a series of 8899 patients undergoing TOLAC found a 79.9% vaginal delivery rate and 20.1% for repeat caesarean section. The question remains, with such data, why is the uptake of VBAC not as comparable in different regions. Factors such as maternal preference and doctor bias toward this procedure may be contributory. In South African private hospitals previous caesarean section is a leading reason to offer women a repeat caesarean section.[34] Mostly a VBAC is offered with only one previous lower segment scar including at CMJAH. Some international jurisdictions may offer a VBAC with more than one previous scar with more rigorous monitoring[43] but the practice generally is a repeat caesarean section for two or more scars.[16]

2.2.2 Poor progress or labour dystocia

In developed countries this accounts for about a third of caesarean sections. It should be noted however that this can be a vague diagnosis if the specific cause has not been identified.[38] The common acronym power, passage, passenger may have not been stipulated in many instances and conditions such as poor uterine contractions may be subjected to caesarean section rather than augmentation of labour with continuous monitoring of labour. Proponents of active management of labour describe a strict criteria to diagnose labour coupled with interventions such as early amniotomy, judicious use of oxytocin with adequate monitoring to promote progression of labour and eventual delivery.[44] However if the above fails caesarean section is usually indicated.[34]

2.2.3 Foetal distress

Intrapartum hypoxia occurs in approximately 1% of labours and causes foetal death in 0.5 per 1000 pregnancies. Cerebral palsy rates occur in approximately 1 in 1000 pregnancies. Clinical diagnosis of foetal hypoxia during labour is referred to as foetal distress and the aim is swift delivery optimally within 30 minutes of making a diagnosis.[45] The problem arises with poor diagnosis as current available methods of assessing foetal distress are not accurately predictive for the actual compromised babies. It has been suggested that continuous electronic foetal monitoring has led to a rise in the caesarean section rate for foetal distress without significantly improving perinatal mortality. Meta-analysis of caesarean section versus intermittent auscultation revealed a higher caesarean section rate for continuous monitoring with no reduction in perinatal mortality.[46] But it was noted that there was a reduction in deaths attributed to hypoxia and also less neonatal seizures in the continuous foetal monitoring category.[47]

2.2.4 Antepartum haemorrhage

2.2.4.1 Abruptio placentae

Non-randomized trials have shown a higher perinatal mortality rates for vaginal delivery compared to caesarean section.[48] Retrospective studies have also shown a slight advantage of caesarean section [49] while some studies showed no advantage of caesarean section in outcome. [50]

2.2.4.2 Placenta previa

A diagnosis of Placenta previa usually necessitates a caesarean section delivery.[6, 51]

2.2.4.3Vasa Previa

A vasa previa diagnosis antenatally is also best managed by caesarean section.[6, 51]

2.2.5 Breech Presentation

Recommendations state that for uncomplicated singleton breech pregnancy at 36 weeks' gestation, an external cephalic version should be offered, with the exceptions of women in labour, with a previous scar, foetal abnormality, foetal compromise, ruptured membranes, vaginal bleeding or medical conditions that would complicate the procedure. In women with a singleton breech presentation at term for whom external cephalic version is contraindicated or has been unsuccessful, it is prudent to offer a C/S because it reduces perinatal mortality and neonatal morbidity.[6, 52, 53]

2.2.6 Twin pregnancy

Caesarean section has been promoted as a preferred mode of delivery for twin pregnancy. This is due to the increased risk of morbidity and mortality of the second twin following vaginal delivery.[54] The second twin in a vaginal delivery has four times higher risk of death due to intrapartum anoxia compared to the first twin. The second twin is also has a higher risk of adverse outcomes, for example respiratory distress syndrome, compared to the first twin if delivery is vaginal. This increased risk is removed if delivery is by caesarean section.[55, 56] Elective caesarean section at 37 weeks has thus found favour in many centres.[57]

2.2.7 Preterm delivery

Preterm birth is associated with significant morbidity and mortality for the new-born. There is an inverse proportion of increased risk and decreasing gestational age. There has been debate on effect of morbidity/ mortality depending on mode of delivery. Caesarean section has the theoretical advantage by offering a less traumatic birthing process. The perceived benefit to the new-born needs to be weighed against the facts that preterm caesarean section is usually technically challenging and often requires performing a classical caesarean section with its associated risks such as scar dehiscence in subsequent pregnancies. A systematic review of randomised controlled trails did not show any benefit of caesarean section over vaginal delivery.[58, 59]

2.2.8 Other indications

Caesarean section may also be advocated in maternal conditions to expedite delivery. In pre-eclampsia there is a higher risk of caesarean section especially if the delivery is indicated remote from term. Caesarean section rates of above 80% in gestations < 30 weeks gestation have been described.[60] Vaginal delivery is, however, possible even at preterm gestations.

Caesarean section on request has also become a significant reason in performing the first C/S, this is particularly so in private hospitals according to a local audit in south Africa.[34]

2.3. Attitudes towards one previous scar

Studies have shown that generally with higher social economic status, the higher the affinity for caesarean section births. It has been found that women are likely to take risks to their own health/life for the benefit of their unborn baby.[38]

Women of lower socio economic and lower level of education are more averse to caesarean section. A study in Nigeria involving 413 patients revealed that women had good knowledge of caesarean section. Of those only 6.1% were willing to accept C/S as a method of delivery, while 81% would accept a C/S if needed to save their lives and/or that of their babies. Approximately 12.1% of women would decline a C/S under any circumstances. Women's low level of education, past successful vaginal and/ or instrumental deliveries were most likely to be associated with women's non-acceptance of an indicated caesarean section. Further analysis showed that this was mainly due to inaccurate cultural perceptions of labour and caesarean section in the cohort of women.[61] This views have been replicated in similar studies showing many African women viewing caesarean section as an unnatural form of birth, only willing to undergo the procedure in life or death circumstances.[62] Many patients would also not be willing to undergo a caesarean section without prior consultation and consent from their partners.[63] The timing of seeking antenatal care also reflects background attitudes towards health facilities. A study done in Senegal showed an association between late booking due to reluctance to attended health facilities and higher incidence of adverse outcomes. [64]

2.4. Monitoring during labour in patients with one previous caesarean section

Risk of uterine rupture during labour for patients with one previous caesarean section is a concern. In a review of uterine rupture in patients with prior caesarean section, Guise *et al,* 2004[65] reported a rate of symptomatic uterine rupture of 2.7/1000 trials of labour. Monitoring labour is vital in women undergoing a VBAC to detect early signs of rupture. Foetal heart rate (FHR) disturbances were the most common premonitory sign of uterine rupture, occurring in 55–87% cases of uterine rupture. Foetal bradycardia was the most commonly reported FHR disturbance. There has been research on whether intra-uterine pressure monitoring could provide early warning of dehiscence. Studies performed on evaluation of intrauterine pressure monitoring and risk of uterine rupture have not reliably found an association between uterine contractility patterns and uterine rupture. [66, 67] A case control study done in Ethiopia found that certain predictors of failed VBAC included meconium stained liquor, malposition and history of previous stillbirth. Predictors of successful VBAC were previous history of successful VBAC, rupture of membranes at the time of presentation and cervical dilatation of more than three centimetres at time of presentation.[68] The presence

of these factors were influential during monitoring of labour to allow either VBAC or booking for caesarean section.

2.5. Short term neonatal outcome

Assessment of the neonate is vital in any delivery process. Challenges however have been faced in tracking foetal and neonatal mortality. For example neonatal deaths were not specifically stated in millennium development goals (MDG) 4, which sought to reduce under-five child mortality by two thirds. Neonatal mortality was estimated to have decreased by 47% worldwide between 1990 and 2015. [69] Assessing the levels of neonatal and foetal mortality is important for determining the magnitude of burden, evaluating risk factors and identifying priority areas for interventions, programmes and policies.[70, 71]

Studies in the developed world have shown a higher rate of admissions to neonatal intensive care units for pulmonary disorders of neonates born by caesarean section compared to those born vaginally.[72] This finding was reaffirmed in the developing world by a study that included South America, Asia and Africa.[73] Comparing elective and emergency caesarean sections, a higher incidence of neonatal adverse effects was found in the emergency caesarean section group. These included lower Apgar scores, more resuscitation performed and higher admission rates to neonatal intensive care units of the neonates delivered via emergency C/S.[74]

2.6. Short term maternal outcome

This aims at looking into the wellbeing of the mother post-delivery. Typically at CMJAH most mothers are observed for between 24-72 hours after C/S delivery and usually 24 hours or less for uncomplicated vaginal delivery. A recent study did not find significant variations in maternal complications if discharged at 24 or 72 hours post-delivery.[75] Monitoring levels of maternal mortality has been a priority on the global health agenda. MDG 5 aimed to reduce the maternal mortality ratio (MMR) by 75% between 1990 and 2015. Monitoring on the success of this target has relied on modelling estimates.[76] This data suggests that maternal mortality has decreased by 44% during this period.

Assessing maternal outcomes in middle and low resource countries an increased rate of adverse outcome was noted in women who delivered via caesarean section compared to those who had a vaginal delivery.[73] When comparing complication rates of emergency versus elective C/S, a higher rate of maternal adverse outcome has been observed in women delivering via emergency C/S. These include longer hospital stay, higher incidences of wound infection, fever, haemorrhage and urinary tract infection.[77]

3. STUDY METHODOLOGY

3.1. Objectives

1. To obtain the indication for the mothers' first caesarean section
2. To determine the mothers' choice of delivery following their first caesarean section
3. To determine the actual mode of delivery and factors that influenced it
4. To establish short term neonatal outcome following delivery
5. To establish short term maternal outcome following delivery

3.2. Methods

3.2.1. Setting

This study was conducted at CMJAH. It was a prospective study of women who had one previous scar which monitored their delivery outcomes.

CMJAH is a regional/tertiary teaching hospital attached to the University of the Witwatersrand medical school situated in Parktown, Johannesburg. It receives referrals from surrounding clinics (Hillbrow, Alexandria, Jeppe, Malvern, Witkoppen, Joubert Park, Yeoville etc.) and secondary level hospitals mainly Edenvale, South Rand, Rahima Moosa Mother and Child, Far East Rand, Pholosong and Tambo Memorial hospitals. It also receives referrals from other referral hospitals and from other provinces depending on prevailing circumstances.

It serves an urban population with majority being of lower socio economic status, and also an immigrant population from other African countries.

The ante-natal clinic at CMJAH runs from 08h00 – 16h00 Monday to Friday. Previous C/S patients are referred to CMJAH for assessment by the doctor. During these visits a delivery plan is made. Unfortunately the records don't always indicate the patients' choice of delivery hence the prospective nature of this study. Some patients are referred back to their local clinics after initial assessment to come back to CMJAH at 34 weeks gestation as per protocol while some follow up at CMJAH ANC throughout their antenatal period.

Patient selection was based on women who attended the antenatal clinic and subsequently delivered at CMJAH. Women who can have VBAC are:[27]

- Patient agrees to VBAC
- Previous C/S x1 (lower uterine segment)
- Previous C/S was more than 18 months ago
- Pregnancy with a singleton foetus, cephalic presentation and longitudinal lie
- Estimated foetal weight below 3.5 Kilograms
- Have spontaneous labour as induction of labour contraindicated at CMJAH

Any condition that required delivery before spontaneous labour begun was then required to undergo an ERCS.

3.2.2. Study Design

This was a prospective descriptive study.

3.2.3. Study Population

Patients were recruited at the researcher's convenience from the ANC between 1st July 2016 and 30th September 2016. There was no formal sampling technique. Patients were approached at about 28-36 weeks gestation if they met the inclusion criteria. The study was explained to them and if they gave consent to participate, a consent form was signed. After the initial interview patients were given a sticker attached to their antenatal records to remind them or the attending health care provider(s) to contact the researcher upon delivery for follow up.

3.2.4. Inclusion Criteria

Women with one previous lower uterine segment caesarean section scar who delivered at CMJAH and who had been seen at the CMJAH antenatal clinic and had indicated their preferred mode of delivery during the antenatal clinic visits. For the women to attempt VBAC the previously mentioned requirements would apply.

3.2.5. Exclusion Criteria

Women with more than one previous caesarean section.
Unbooked patients (Patients who did not attend antenatal clinic during their pregnancy).
Women under the age of 18 years.
Women with factors that dictate future caesarean sections as the safer mode of delivery such as contracted pelvis, previous myomectomy, previous classical caesarean sections or previous uterine rupture were excluded as they could have adversely affected perinatal outcome.

3.2.6. Data Analysis

Data was collected on a data sheet, Appendix B. The data was analysed using STATA 13.0 statistical software from StataCorp LLC with the aid of a statistician. Frequency tables were generated for most of the variables and summary statistics were presented. Standard deviations, median and ranges were used for descriptive statistics of continuous variables. Tests for associations were done using the Pearson's chi square and Fischer's exact test when at least one cell had an expected value <5. Statistical significance was considered at p-value of <0.05. Means (with standard deviations) and medians (with interquartile ranges) were reported for continuous (numerical) variables. Student's t-test for parametric data and the Mann-Whitney test for non-parametric data were used to determine the difference between the groups. Frequencies were reported as percentages with 95% confidence intervals. Bivariate analysis was used to determine if variables were associated.

3.2.7. Ethical Considerations

The study was approved by the Human Research Ethics Committee of The University of Witwatersrand (Ethics Clearance Certificate: M160201), Appendix C.

Permission to perform the study at the Charlotte Maxeke Johannesburg Academic Hospital was obtained from the CEO of the institution, Appendix D.

Each of the patients signed a consent form (Appendix A) prior to recruitment into the study. Every patient was allocated a study number which appeared on the data sheet (Appendix B). Names were not be used to safeguard confidentiality.

4. RESULTS

A total of 100 patients with one previous scar were recruited and followed up to delivery, having met the inclusion criteria for the study. A total of 111 patients were approached to participate in the study with seven patients declining to participate. Four patients who were lost to follow up were not included in the study.

4.1 Demographic data

Table 4.1 describes the demographics of the participants. The mean age was 30.28 years. It's important to note that 64% of women were para one, meaning that their first delivery was by caesarean section.

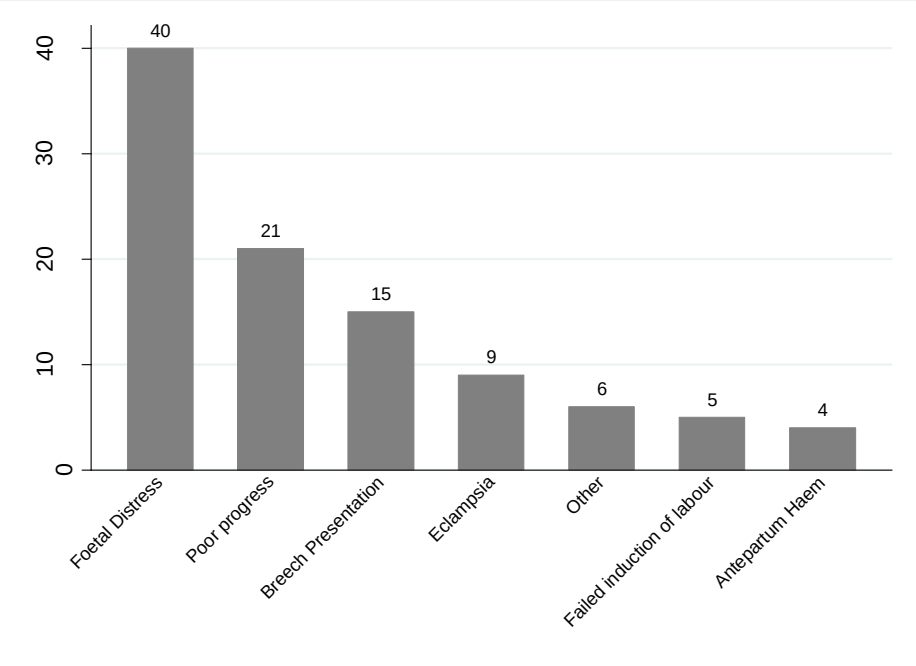

Figure 4.1 Indication for first caesarean section, N=100

4.2 Indication for first caesarean section

Figure 4.1 illustrates the indications of the first caesarean section. 40% (40) of patients had their first indication as foetal distress, while 21% (21) the indication for first caesarean section was poor progress. 15% (15) had breech or malpresentation and 9% (9) had severe pre-eclampsia/eclampsia.

Table 4.1 Demographic characteristics of the women who participated in the study

Demographic characteristics of participants (categorical) N=100		
Characteristic	**Number**	**Percentage**
Race		
Black	97	97
Colored	2	2
Indian	1	1
Nationality		
South African	62	62
Other	38	38
Parity		
1	64	64
2	27	27
3	8	8
5	1	1
Gravidity		
2	58	58
3	27	27
4	10	10
5	3	3
6	2	2
RH		
Negative	5	5
Positive	95	95
RPR		
Negative	94	94
Positive	5	5
Unknown	1	1
BMI		
Underweight <18.5 Kg/m^2	0	0
Normal 18.5 – 24.9 Kg/m^2	21	21
Overweight >25 Kg/m^2	38	38
Obese >30 Kg/m^2	41	41
HIV		
Negative	74	74
Positive	26	26

Demographic characteristics of participants (continuous) N=100		
Characteristic	**Mean (SD)**	**Range**
Age (years)	30.28 (4.95)	20-43
Height (centimeters)	159.77 (6.12)	144-178
Weight (kilograms)	74.95 (15.43)	43-130
Gestational age at booking (weeks)	19.27 (6.52)	4-34
Gestational age at delivery (weeks)	38.56 (1.85)	28-42
Birth weight (grams)	3064 (518.17)	1070-4190
CD4 count (of HIV + patients, n=26)	528.05 (248.82)	107-941

4.3 Antenatal Choice of Delivery

Sixty three percent (63) of women preferred to attempt a VBAC. 35% (35) wanted a repeat caesarean section and 2% (two) were undecided on their preferred mode of delivery as shown on figure 4.2.

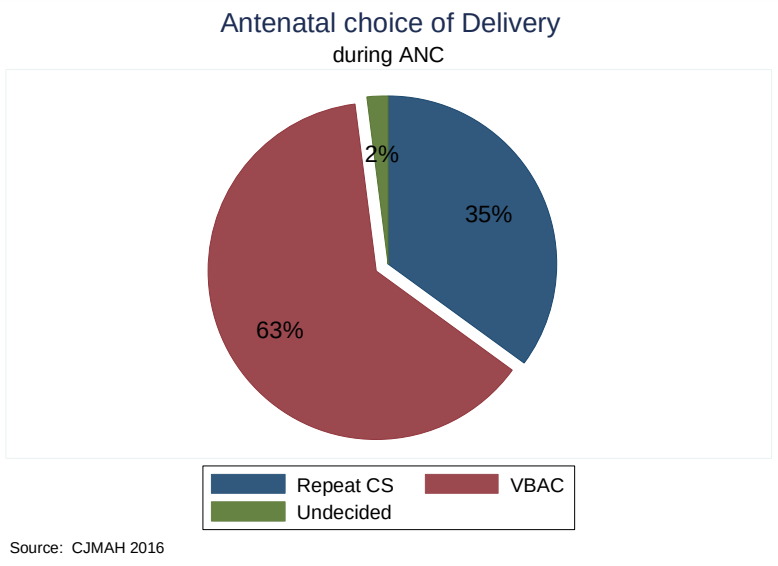

Figure 4.2 Antenatal choice of delivery, N=100

4.4 Actual mode of delivery

As illustrated in figure 4.3, 78 (78 %) women delivered via caesarean section of which 46 (46 %) were emergency caesarean sections and 32 (32 %) were elective caesarean sections (figure 4.4). 22 (22 %) women delivered vaginally comprising 18 (18 %) unassisted vaginal delivery and four (4 %) assisted vaginal delivery, either by vacuum or forceps (figure 4.4).

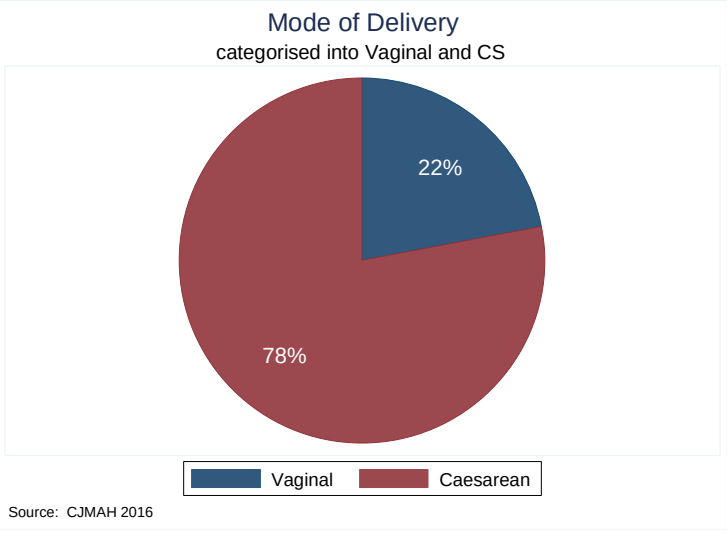

Figure 4.3 Mode of delivery according to vaginal or caesarean section, N=100

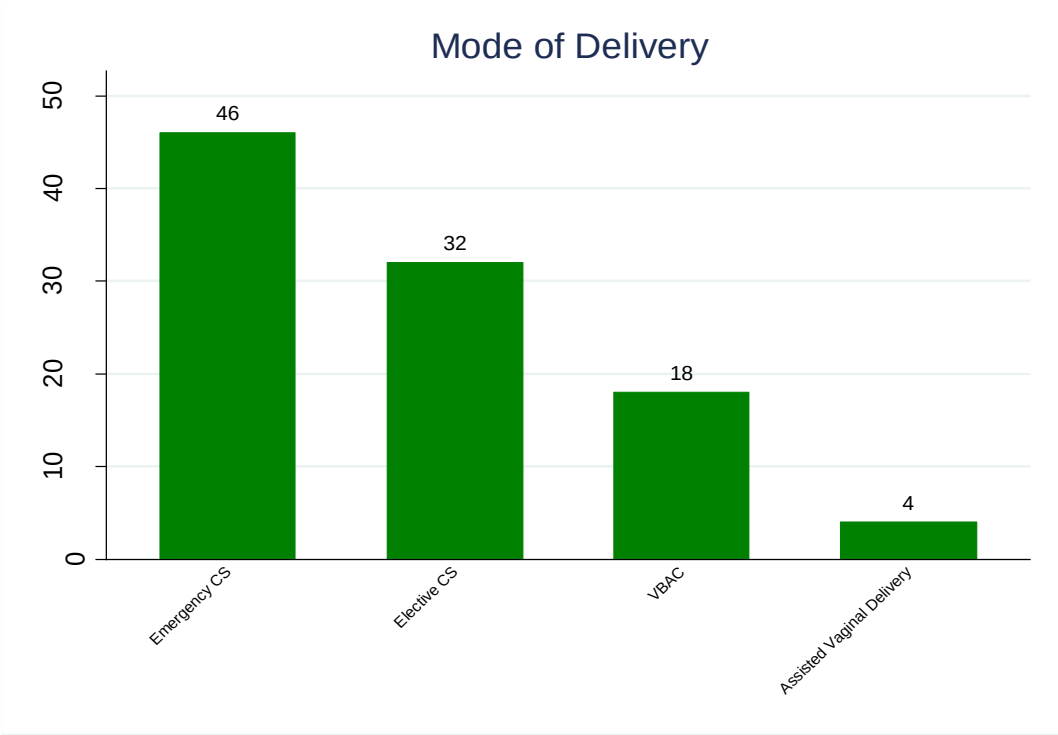

Figure 4.4 Actual mode of delivery, N=100

4.5 Comparison of eventual versus antenatal choice of delivery

As shown in table 4.2 of the 63 women who wanted a VBAC antenatally, only 20 (31.8%) managed to deliver successfully via VBAC, including three assisted deliveries. However six patients who choose VBAC in the antenatal period received elective caesarean sections due to breech presentation (one), high blood pressure (one), persistent abdominal pain (one), change of delivery choice (one) and postdates (two). This means 57 patients attempted VBAC with a successes rate of 35% (20/57). Forty three (68.2%) patients who chose VBAC delivered via caesarean section, this comprised of 37 patients (58.7%) who had emergency C/S and the 6 (9.5%) patients who had elective C/S as reported above.

Of the 35 women who had chosen a repeat caesarean section 33 (94.3%) eventually delivered via caesarean section comprising 26 (74.3%) elective caesarean sections and seven (20%) emergency caesarean sections. Two (6%) patients in this group delivered vaginally.

The two women who were undecided antenatally on their preferred mode of delivery both delivered by emergency caesarean section, (table 4.2). According to the data there is a strong correlation between choosing C/S delivery and delivering via C/S, (P< 0.001).

Table 4.2 Antenatal vs Actual mode of delivery

Demonstrates patients with one previous C/S are more likely to deliver via C/S irrespective of their antenatal choice of delivery. p-value <0.001, statistically significant

	Actual mode of delivery					
	Vaginal Delivery		Caesarean section delivery		Total	P-value
	VBAC	Assisted Vaginal Delivery	Elective CS	Emergency CS		
Antenatal choice of delivery	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)	<0.001
Repeat CS	1 (2.9)	1 (2.9)	26 (74.3)	7 (20)	35 (100)	
VBAC	17 (27)	3 (4.8)	6 (9.5)	37 (58.7)	63(100)	
Undecided	0 (0)	0 (0)	0 (0)	2 (100)	2 (100)	
Total	18 (18)	4 (4)	32 (32)	46 (46)	100 (100)	

4.6 Factors influencing mode of delivery

Table 4.3 lists factors that influenced mode of delivery. There is a statistical significance between mode of delivery and antenatal complications observed ($p < 0.001$). Of the 20 women who delivered successfully via VBAC none of them experienced any of the antenatal/intrapartum complications listed.

Of the 37 women that wanted VBAC and subsequently delivered by emergency caesarean section, 14 (37.8%) had as their indication for C/S poor progress followed by 10 (27%) foetal distress and 5 (13.5%) severe preeclampsia. This illustrates an association between developing a complication and having a caesarean section delivery.

Of the 14 women who were diagnosed with foetal distress 13 delivered via caesarean section and one via assisted vaginal delivery. (Table 4.3)

Of the women who experienced poor progress in labor, all delivered via emergency caesarean section. (Table 4.3)

Table 4.3 Comparison of mode of delivery to antenatal complications

Demonstrates that successful delivery via VBAC was not associated with any antenatal complications, P<0.001 statistically significant

	Mode of delivery					
	VBAC	**Assisted Vaginal Delivery**	**Elective CS**	**Emergency CS**	**Total**	**P-value**
Antenatal / intrapartum complications	No (%)	No (%)	No (%)	No (%)	No (%)	
Nil	18 (100)	1 (25)	22 (68.8)	0 (0)	41 (41)	<0.001
Foetal distress	0 (0)	1 (25)	0 (0)	13 (28.3)	14 (14)	
Poor progress	0 (0)	0 (0)	0 (0)	14 (30.4)	14 (14)	
Antepartum hemorrhage	0 (0)	0 (0)	0 (0)	2 (4.3)	2 (2)	
Mal-presentation	0 (0)	0 (0)	2 (6.3)	1 (2.2)	3 (3)	
Preterm membrane rupture	0 (0)	0 (0)	0 (0)	2 (4.3)	2 (2)	
Gestational hypertension	0 (0)	0 (0)	0 (0)	1 (2.2)	1 (1)	
Pre-eclampsia/ eclampsia	0 (0)	0 (0)	1 (3.1)	5 (10.9)	6 (6)	
Other	0 (0)	2 (0)	7 (21.9)	8 (17.4)	17 (17)	

Two women who presented with antepartum hemorrhage delivered via caesarean section, demonstrating 100% caesarean section rate. (Table 4.3)

Of the three women presenting with mal-presentation two (66%) delivered via elective caesarean section and one (33%) via emergency caesarean section. (Table 4.3)

Emergency caesarean section was also performed on all women presenting with preterm rupture of membranes and 83.3% (5/6) of women presenting with preeclampsia, the remaining one delivered by elective caesarean section.

Caesarean section delivery was performed on 15 patients presenting with other complications. These complications comprised of sickle cell crisis (one), postdates (eight), persistent abdominal pain (one), onset of labour before scheduled date C/S date (four) and

chronic hypertension (one). Assisted vaginal delivery was performed in two cases with delayed second stage of labour.

Comparison of parity and antenatal choice of delivery showed that 65% (42/64) of para one mothers chose to deliver via VBAC in the antenatal period while 58% of mothers greater than para one chose to delivery via VBAC. There was a higher percentage of para one mothers choosing VBAC over C/S though this difference was not statistically significant, (P=0.738). (Table 4.4)

Table 4.4 Comparison of parity to antenatal choice of delivery

Relationship between parity and delivery choice not statistically significant, P=0.738

Parity	**Antenatal choice of delivery**			
	Elective C/S No. (%)	**VBAC No. (%)**	**Undecided No. (%)**	**P-value**
1	21 (60)	42 (66.7)	1 (50)	0.738
>1	14 (40)	21 (33.3)	1 (50)	
Total	35 (100)	63 (100)	2 (100)	

Table 4.5 Comparison of gestational age at booking to antenatal choice of delivery

Relationship between time of booking to antenatal delivery choice not statistically significant, P=0.350

Gestational age at booking	**Antenatal Choice of delivery**				
	Elective C/S No. (%)	VBAC No. (%)	Undecided No. (%)	Total	P-value
<13 weeks	12 (34.3)	14 (22.2)	0 (0)	26	0.350
13-27	19 (54.3)	41 (65.0)	1 (50)	61	
> 27	4 (11.4)	8 (12.7)	1 (50)	13	
Total	35 (100)	63 (100)	2 (100)	100	

Comparison of gestational age at booking to antenatal choice of delivery did not show a statistical significance between time of booking and choice of delivery, (P=0.350). (Table 4.5)

Table 4.6 Comparison of mode of delivery to parity, gestational age at booking, BMI and maternal age

	Mode of delivery					
Characteristics	**VBAC**	**Assisted Vaginal Delivery**	**Elective CS**	**Emergency CS**	**Total**	**P-value**
Gestational age at booking	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)	
13 and below	3 (16.7)	2 (50)	11 (34.4)	10 (21.7)	26 (26)	0.333
13-27	14 (77.8)	2 (50)	15 (46.9)	30 (65.2)	61 (61)	
Above 27	1 (5.6)	0 (0)	6 (18.8)	6 (13)	13 (13)	
Parity						
1	12 (66.7)	2 (50)	19 (59.4)	31 (67.4)	64 (64)	0.82
>1	6 (33.3)	2 (50)	13 (40.6)	15 (32.6)	36 (36)	
BMI						
Normal	4(22.2)	5(15.6)	12(26.1)	0(0)	21(21)	0.704
Overweight	6(33.3)	14(43.8)	17(37.0)	1(25.0)	38(38)	
Obese	8(44.4)	13(40.6)	17(37.0)	3(75.0)	41(41)	
AGE						
<25	4(22.2)	2(6.3)	9(19.6)	0(0)	15(15)	0.379
25-34	10(55.6)	26(81.2)	27(58.7)	3(75.0)	66(66)	
>35	4(22.2)	4(12.5)	10(21.7)	1(25.0)	19(19)	

A pattern between gestational age of booking and mode of delivery was also noted. Though not statistically significant (P=0.333). Those women who booked after 27 weeks had a 92% (12/13) caesarean section delivery rate compared to 8% (1/13) vaginal delivery rate. (Table 4.6)

There is no statistical significance noted between mode of delivery and maternal BMI, maternal age or parity of the mother. Of note 79% of mothers were overweight or obese while 21% had a normal BMI. There were no underweight women. (Table 4.6)

Comparing maternal age 19% of mothers were above 35 years of age. Majority 66% were between 25 and 34 years and 15% were below 25 years. (Table 4.6)

Comparing parity majority (64%) of mothers were para one at time of booking while only 36% were para two or greater. (Table 4.6)

Table 4.7 Comparison of antenatal choice of delivery to reason for first caesarean section

Relationship between first C/S to antenatal delivery choice not statistically significant, P=0.337

	Antenatal choice of delivery			
	Elective C/S	VBAC	Undecided	P-value
Reason for first C/S	No. (%)	No. (%)	No. (%)	0.337
Foetal distress	10 (28.6)	30 (47.6)	0 (0)	
Breech Presentation	4 (11.4)	10 (15.9)	1 (50)	
Poor progress	9 (25.7)	11 (17.5)	1 (50)	
Antepartum hemorrhage	3 (8.6)	1 (1.6)	0 (0)	
Failed induction	3 (8.6)	2 (3.2)	0 (0)	
Pre-eclampsia/ eclampsia	5 (14.3)	4 (6.4)	0 (0)	
Other	1 (2.9)	5 (7.9)	0 (0)	
Total	35 (100)	63 (100)	2 (100)	

Comparing the women's antenatal choice of delivery to the indication for their first caesarean section it is noted that 30 (47%) of the women who chose to attempt VBAC had foetal distress as the indication of their first C/S. This was followed by 11 (17%) who had their first C/S for poor progress and 10 (15.9%) who had their first C/S for breech presentation. Only two (3.2%) wanted a VBAC after having their first C/S for failed indication of labour and one (1.6%) who chose VBAC after having the first caesarean section for antepartum hemorrhage. However these variations are not statistically significant. P-value = 0.337. (Table 4.7)

For those who chose elective caesarean section as their preferred mode of delivery 10 (28.6%) had their indication for first C/S as foetal distress, followed by nine (25.7%) as poor progress, five (14.3%) for severe pre-eclampsia/ eclampsia and four (11.4%) for breech presentation. These variations were not statistically significant P-value 0.337. (Table. 4.7)

The two women who were undecided on their mode of delivery had their first caesarean sections for breech presentation and poor progress respectively. (Table 4.7)

Table 4.8 Comparison of mode of delivery to reason for first caesarean section

Statistically significant association between subsequent mode of delivery and reason for first C/S, P=0.013

	Mode of delivery					
	VBAC	**Assisted Vaginal Delivery**	**Elective CS**	**Emergency CS**	**Total**	**P-value**
Indication for first C/S	No (%)	No (%)	No (%)	No (%)	No (%)	
Foetal distress	12 (66.7)	1 (25)	7 (21.9)	20 (43.5)	40 (40)	0.013
Breech presentation	2 (11.1)	0 (0)	6 (18.8)	7 (15.2)	15 (15)	
Poor progress	4 (22.2)	0 (0)	9 (28.1)	8 (17.4)	21 (21)	
Antepartum hemorrhage	0 (0)	0 (0)	2 (6.3)	2 (4.3)	4 (4)	
Failed induction of labor	0 (0)	0 (0)	3 (9.4)	2 (4.3)	5 (5)	
Pre-eclampsia/eclampsia	0 (0)	1 (25)	5 (15.6)	3 (6.5)	9 (9)	
Other	0 (0)	2 (50)	0 (0)	4 (8.7)	6 (6)	

Table 4.8 compares the mothers mode of delivery to the indication of their first C/S. There is a statistical significance between their current mode of delivery and the indication of their first caesarean section p=0.013. 50% (20/40) of the women who had foetal distress as their first indication for caesarean section subsequently had a repeat caesarean section for foetal distress However 32.5% (13/40) managed to deliver vaginally (12 VBAC with 1 assisted vaginal delivery).

There was a 36% (4/11) success rate for women attempting VBAC after having their first caesarean section for poor progress.

All women who had antepartum hemorrhage as the indication of their primary caesarean section subsequently delivered via a caesarean section. (Table 4.8)

There were no successful VBACs for women whose indication for first caesarean section was failed induction of labour. (Table 4.8)

Of the nine women who had severe preeclampsia/ eclampsia as the indication of their first caesarean section five (55.6%) delivered via elective caesarean section; three (33.3%)

delivered via emergency caesarean section and one (11.1%) delivered via assisted vaginal delivery. (Table 4.8)

The six other causes of first caesarean section shown on table 4.8 included twin pregnancy (three) intrauterine growth restriction (one) cord prolapse (one) cord around the neck (one). Of those four delivered via emergency caesarean section and two by assisted vaginal delivery.

4.7 Short term neonatal outcome

Figure 4.5 summaries short term neonatal outcomes observed. 76 neonates did not have any documented complication, with 24 neonatal complications.

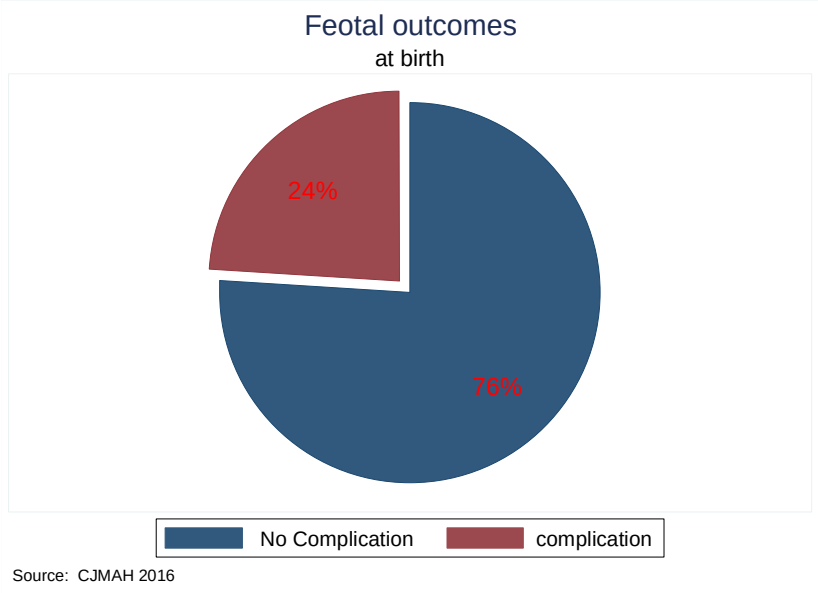

Figure 4.5 Foetal outcome, N =100

Table 4.9 Short-term neonatal outcome following delivery

No statistically significant difference in outcomes between different modes of delivery

Mode of delivery						
	VBAC	Assisted Vaginal Delivery	Elective CS	Emergency CS	Total	P-value
	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)	
Foetal outcome						0.061
No complication	16 (88.9)	1 (25)	24 (75)	35 (76.1)	76 (76)	
Complication (Admission to TU)	2 (11.1)	3 (75)	8 (25)	11 (23.9)	24 (24)	
Apgar score						
7	0 (0)	0 (0)	0 (0)	1 (2.2)	1 (1)	0.439
8	4 (22.2)	2 (50)	5 (15.6)	4 (8.7)	15 (15)	
9	6 (33.3)	2 (50)	10 (31.3)	17 (37)	35 (35)	
10	8 (44.4)	0 (0)	17 (53.1)	24 (52.2)	49 (49)	
Birthweight						
Less than 2500	2 (11.1)	0 (0)	3 (9.4)	7 (15.2)	12 (12)	0.911
2500 and above	16 (88.9)	4 (100)	29 (90.6)	39 (84.8)	88 (88)	

There was no statistical significance between mode of delivery and neonatal complication rates (p=0.061), (Table 4.9). The overall VBAC neonatal complication rate was 22% (5/22) of deliveries. This comprised of unassisted VBAC complication rate of 11.1% (2/18) and assisted vaginal delivery of 75% (3/4). Overall the caesarean section neonatal complication rate was 24.3% with emergency C/S complication rate of 23.9% (11/46 deliveries) and elective C/S complication rate of 25% (8/32 deliveries). Of the complications observed, all fell under the category of admission to transitional unit (TU), (table 4.9). Indications for admission to TU were mild respiratory distress syndrome (RDS)/ transient tachypnea of the newborn (TTN) in 22 cases (eight from elective C/S, eleven from emergency C/S, two from unassisted vaginal delivery and one from assisted vaginal delivery). In seven cases there was a secondary indication for admission to TU for meconium stained liquor (five from emergency C/S, one from elective C/S and one from unassisted VBAC). Two babies had

caput arising from vacuum delivery requiring observation in TU. There were no neonatal ICU admissions or foetal deaths recorded in the period observed.

Ninety nine (99%) five minute Apgar scores were eight and above with only one neonate having an Apgar score of seven. Forty nine (49%) of neonates had an Apgar score of ten at five minutes after birth. (Table 4.9)

In regards to birth weight, a low birth weight of 12% (12 /100) was observed, (figure 4.6). Of the low birth weight neonates, 10 (88.3%) delivered via caesarean section and 2 (11.7%) by VBAC. However this was not a statistically significant finding, (P=0.911). (Table 4.9)

Lowest birth weight was 1070 grams and largest was 4190 grams. The mean birth weight was 3064 grams. (Table 4.1)

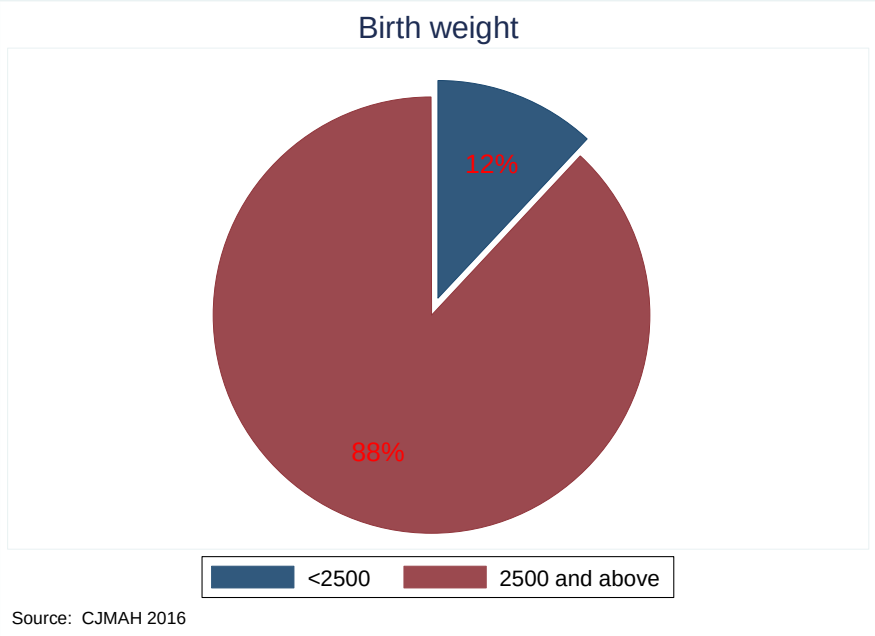

Figure 4.6 Low birth weight comparisons, N=100

4.8 Short term maternal outcome

Figure 4.7 illustrates the summary of short term maternal outcome. 87 women (87%) had no short term complications with 13 mothers developing complications.

Figure 4.8 illustrates the spread of the complications according to mode of delivery. Seven women had complications from emergency C/S, two from elective C/S, two from VBAC and two from assisted vaginal delivery.

Of the 13 (13%) women with complications four (4%) had multiple complications which arose from emergency caesarean sections. Nine women (9%) had single complications comprising of three from emergency C/S, two from elective C/S, two from VBAC and two from assisted vaginal delivery. In total there were 17 complication events recorded among the 13 women. (Table 4.10)

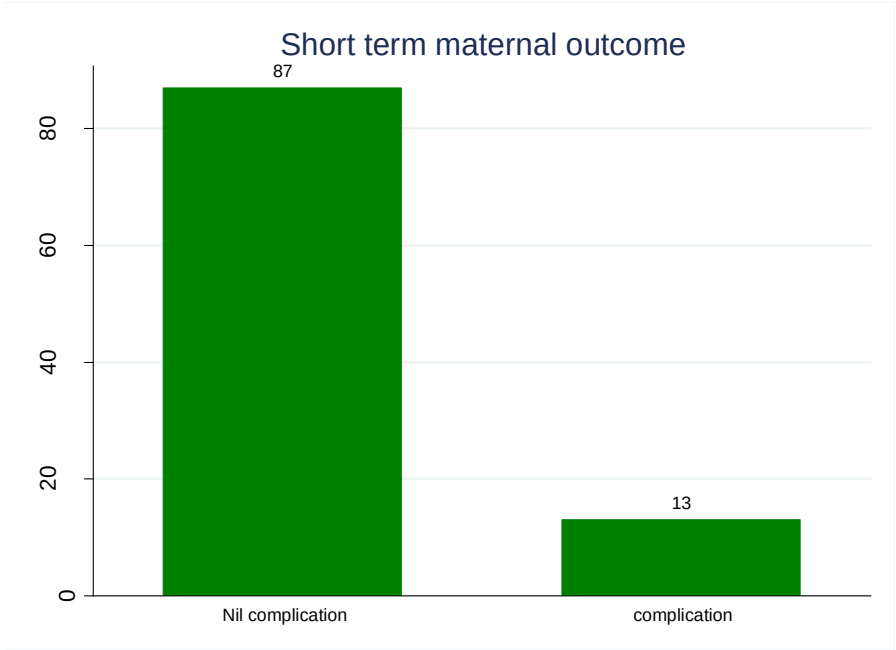

Figure 4.7 short-term maternal outcomes following delivery, N=100

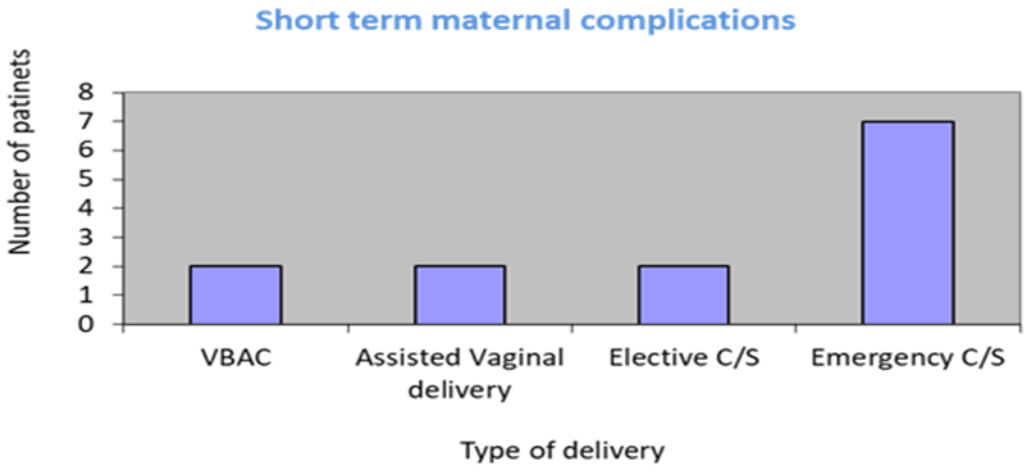

Figure 4.8 Number of patients affected by complications, N=13

Total vaginal delivery complications were 18% (4/22). Total caesarean section delivery complications were 11.5% (9/78). There was no statistical significance between the two complication rates, (P =0.413). Sixty nine % (9/13) of all complications observed were from caesarean section delivery and 31% (4/13) from vaginal delivery.

The complications ranged from extensive episiotomy (three) to sepsis requiring hysterectomy in one patient and bladder/ bowel injury at time of caesarean section in another patient that needed urology and surgical intervention. One patient was admitted to high care post caesarean section for BP control and continuation of magnesium sulphate to prevent eclamptic seizures. (Table 4.10)

There were two cases of postpartum hemorrhage, both requiring blood transfusion. Two women received blood transfusion post caesarean section due to low hemoglobin levels.
53.8% (7/13) complications were on patients who delivered via emergency caesarean section. The remaining six complications comprised of two complications each for women who delivered via VBAC (15.4%), assisted vaginal delivery (15.4%) and elective caesarean section (15.4%). (Table 4.10)

Table 4.10 Short term maternal post-delivery complications

	Mode of delivery				
	VBAC	**Assisted Vaginal Delivery**	**Elective C/S**	**Emergency C/S**	**Total**
Complications	No.	No.	No.	No.	No.
Post-partum haemorrhage	0	0	0	2	2
Blood transfusion	0	0	1	3	4
Infection/ Sepsis	0	0	1	3	4
Hysterectomy	0	0	0	1	1
Bladder/ bowel injury	0	0	0	1	1
Admission to high care	0	0	0	1	1
Third degree perineal tear	0	1	0	0	1
Episiotomy	2	1	0	0	3
Total	2	2	2	11	17

Emergency caesarean sections had a complication rate of 15% (7/46). Elective caesarean section was 6.25% (2/32). Complication rate for VBAC was 18.2% (4/22). This comprised of complications from unassisted VBAC deliveries of 11.1% (2/18 women) both being relatively minor complications (episiotomies) and from assisted vaginal delivery of 50% (2/4 women). The assisted vaginal delivery complications comprised of an episiotomy and a 3rd degree perineal tear.

5. DISCUSSION

One hundred women were followed up to delivery. In obtaining the reason for their first caesarean section it was observed that 40 women (40%) had their first caesarean section for foetal distress which was the majority indication. The second most common indication for their first C/S was poor progress in 21 (21%) women. This was followed by breech presentation (15, 15%) and pre-eclampsia/eclampsia (9, 9%) as third and fourth reasons respectively. These indications are common occurrences and will be commonly encountered in obstetric units offering antenatal care. Knowledge of the indication of the first C/S is important in counselling the mother in her next pregnancy and making a delivery plan. The study did not include women who had permanent indications for a repeat C/S as it would preclude their choice of VBAC.

In determining mothers' choice of delivery following the first C/S it was observed that 63 women wanted to deliver via VBAC during their antenatal period, 35 wanted a repeat caesarean section and two were still undecided on their preferred mode of delivery.

In determining the actual mode of delivery it was noted that 78 (78%) of women delivered by caesarean section and 22 (22%) of women delivered vaginally.

From the above it indicates in this setting most women would prefer to try and deliver via VBAC rather than by repeat elective caesarean section. However this data shows that the rate of successful VBACs is low at 35% of attempts (including assisted deliveries). This is in contrast to other quoted studies which demonstrate success rates of approximately 70%.[17, 42] As noted 68.3% of women who wanted to deliver via VBAC received a caesarean section, with emergency caesarean sections comprising 58% of cases. Many patients undergoing trial of labour after caesarean section often get diagnosed as poor progress or foetal distress and have an emergency caesarean section. These reasons appear to be similar with findings in other African settings.[68] Poor progress was mostly likely diagnosed if the mother presented early in labour.[68] Induction and augmentation of labour is contraindicated in the CMJAH protocol for patients with one previous C/S, resulting in recommendation for caesarean section when a patient is diagnosed as poor progress of labour.[16]

This is in contrast to guidelines in the developed world such as USA, Canada and UK that allow for augmentation and induction of labour in patients with one previous caesarean

section.[78] The lack of augmentation in patients diagnosed with poor progress of labour may be partially responsible for a lower success rate of VBAC at CMJAH compared to those quoted in developed countries.[78] However it is also noted that there have been documented higher success rates even in an African setting.[79] It is also not clear from that data whether augmentation of labour was conducted in that setting or not. From the data from CMJAH it is demonstrated that to deliver successfully via VBAC the antenatal period and labor process would have had to be without an adverse incident. This study shows 36% (4/11) of women who had prior poor progress of labour as the indication of their first C/S and subsequently wanted a VBAC successfully managed to deliver vaginally. Other studies on VBAC after caesarean section have shown a success rate of 70% (if VBAC baby smaller than previous C/S) and 45% (if VBAC baby bigger than previous C/S) even when the indication for first C/S was CPD.[80] The reasons for a lower success rate can partially be explained by lack of augmentation of labour in patients attempting VBAC.

There was no statistically significant association between the reason for first caesarean section and subsequent antenatal delivery choice, but there was a statistical significance between the reason for first caesarean section and eventual mode of delivery. This may demonstrate that the indication for first caesarean section does not significantly influence how the mothers choose to deliver in the next pregnancy but there may be an association between the following mode of delivery and the indication for the first caesarean section. Also noted was a higher percentage of women wanting VBAC if their first delivery was by C/S compared to women who had previously delivered vaginally in addition to their previous C/S. This might be due to their desire to want to experience a vaginal delivery thought it was not a statistical significant finding. (Table 4.7)

A pattern between gestational age of booking and mode of delivery was also noted. Though not statistically significant (P=0.333). Those women who booked after 27 weeks had a 92% C/S delivery rate compared to a 75% C/S delivery rate of women who booked before 27 weeks. (Table 4.6) Even though 61% (8/13) of them chose to deliver via VBAC in the antenatal period and 30% (4/13) choosing to deliver via elective caesarean section, (P-value 0.350). (Table 4.5) Though these findings were not statistically significant, previous studies have found an association between late booking and higher incidence of adverse outcome.[81] This may be partially explained as having less opportunity to intervene timeously on any abnormalities due to late presentation therefore limiting management options.

Six women who initially wanted to deliver via VBAC were later offered elective caesarean section for medical reasons such as pre-eclampsia (one), mal-presentation (one), post-dates (two), persistent abdominal pain (one) and one who later changed her mind and decided on caesarean section.

Of the patients who wanted repeat caesarean section, 94.3% delivered by caesarean section comprising 73% elective caesarean section and 20% emergency caesarean section. There is therefore a high correlation between choice of delivery and mode of delivery for patients choosing a repeat caesarean section, ($P < 0.001$).

Maternal BMI did not seem to have influenced mode of delivery in this study. (P-value 0.704). 79% (79) of women were overweight or obese, with obese patients accounting for 41% (41) of total patients studied. 81% (18/22) of VBAC deliveries had BMI categorized as overweight and obese.(Table 4.6). However other reported studies do find a decrease in successful VBAC with higher BMI.[82, 83] It must also be noted that BMI values in this study were obtained from values recorded at the booking visit when a woman was already pregnant with no reference to the pre-pregnancy values. That may have altered the BMI to a higher category.

In determining short term neonatal outcomes following delivery 76 (76%) of neonates had no adverse events. Of the 26 (26%) neonates who had adverse event none was immediately life threatening. There were no neonatal deaths recorded in the period of observation. This may be a pointer that sufficient intervention may have prevented further adverse outcome. However there may be a possibility that there may have been over intervention in situations whereby none was required. The lack of foetal scalp blood sampling for lactate/ pH at CMJAH to diagnose foetal acidemia results in reliance on the cardiotocograph to make diagnosis of foetal distress, especially in the presence of clinical findings such as meconium stained liquor. This is in contrast to ACOG/RCOG guidelines where a suspicious trace is further investigated by blood sampling to determine foetal wellbeing. Lack of this investigation likely resulted in a broader application of the diagnosis of foetal distress in the CMJAH setting and hence delivery by caesarean section resulting in a reduction of successful VBAC rate.

Of the 24 neonates that were admitted to TU, five were from vaginal delivery and 19 from caesarean sections. The commonest indication for admission to TU for observation was noted as mild RDS/TTN. This condition is commonly experienced in neonates delivered via

caesarean section.[72] The pathophysiology of TTN could arise from a delayed absorption of fluid from the foetal lung to the pulmonary lymphatics. This could lead to increased airway resistance and reduced lung compliance. The causative factor is thought to be lower levels of catecholamines released during a caesarean section compared to vaginal delivery. Catecholamines are thought to be responsible for optimal function of the epithelium sodium channel that absorb excess lungs fluid. An additional explanation why TTN was found to be higher in caesarean deliveries could be due to a generally earlier delivery date compared to VBAC with corresponding lower lung maturity levels. The US and UK have advocated for elective C/S be performed at 39 weeks, and if done prior to that steroids be administered for foetal lung maturity[84]. At CMJAH an elective C/S can be booked from 38 weeks and steroids are only routinely administered when delivery is at 34 weeks and below. In light of new evidence it may be prudent to also adopt C/S after 39 weeks and administer steroids if delivery required earlier. Early delivery at 38 weeks through C/S may have contributed to higher incidence of TTN. Meconium stained liquor (MSL) was commonly observed in the emergency caesarean sections performed for failed VBAC and that in addition to a non-reassuring trace could have contributed to making the diagnosis of foetal distress. Furthermore presence of meconium stained liquor could have played a role in contributing to RDS observed in foetuses admitted to TU as MSL and RDS.

In establishing short term maternal outcome 87 (87%) of mothers had no short term complications post-delivery with 13 (13%) recording an adverse event.

From the data, the safest mode of delivery for the mother was elective caesarean section with a 6.3% (2/32) complication rate, the two complications observed were blood transfusion and infection. The complication rate for emergency caesarean section was 15.2% (7/46) and 18% (4/22) for vaginal delivery. The major complications were observed in emergency caesarean section deliveries and some of the women suffering multiple complications. These findings can be compared to a multi-centre study in Asia involving nine countries demonstrating higher complications in emergency caesarean sections.[37] Those findings observed the lowest complication rate among VBAC which differ with CMJAH VBAC findings somewhat due on the higher incidence of complications encountered in women who delivered via assisted vaginal delivery, though these complications were minor (episiotomies). An explanation of this variance may be due to the different perception of the use of episiotomies. In some centres an episiotomy would not be considered a complication as it used routinely in

obstetrics practice.[85] Therefore there may be variations in its documentation as a complication.

6. LIMITATIONS

One limitation to this study was its limited sample size.

Also any long term maternal and neonatal complications that may have developed later were out of the scope of this study which may have further assisted in assessing the patients overall health and wellbeing.

The demographics captured were mainly from the catchment area of CMJAH which may not be completely representative of the entire South African population.

7. CONCLUSION

Women who choose caesarean section as a method of delivery in their antenatal period are much more likely to deliver by caesarean section compared to women who choose VBAC as their preferred mode of delivery delivering by VBAC (P <0.001). The main reasons for conversion of a VBAC to C/S observed were foetal distress and poor progress. Though most women desire to attempt a VBAC the success rate is lower than international reference ranges and this may be partly due to hospital protocol. Elective caesarean section seems to offer the lowest complication rate for mothers, while emergency caesarean section was associated with all the major complications noted. There was no statistically significant difference in neonatal complications from the different delivery methods (P=0.061). There was statistically no significant difference in overall maternal complication rates between vaginal and caesarean section delivery (P=0.413) although highest and most significant complications were noted in emergency caesarean section.

8. RECOMMENDATIONS FOR FUTURE SIMILAR STUDIES

There is a need to evaluate further if increasing the level of monitoring of women undergoing VBAC will alter the success rate. Patient/ midwife ratios may have a role in the success of VBAC and may need to be investigated further. This may be a contributory factor in CMJAH.

Data from this study for instance the success rate of VBAC and factors that may necessitate change of delivery plan could be incorporated in the counselling of women in the antenatal period.

The role of rupture of membranes in HIV positive patients to help progress labour may need to be re-evaluated in view of current circumstances where antiretroviral treatment is universally applied. Especially in situations where maternal viral loads are at lower than detectable limits.

To evaluate if foetal blood sampling is plausible in assessment of foetal acidosis for laboring women at CMJAH. Concern previously was due to mother to child transmission of HIV hence it was not practiced locally. In the scenario of virally suppressed patients does the benefit justify the risks?

Further studies may have to be performed to determine healthcare provider perceptions at CMJAH for tolerance of a woman attempting VBAC if the index caesarean section was classified as CPD.

Also the perception of VBAC by healthcare staff may need to be evaluated especially in the light of the litigious environment currently being faced.

There would also be benefit to further evaluate the long term outcome of VBAC versus caesarean section.

A larger sample of the population in future studies from multiple hospitals to capture the demographics of the general population may be beneficial.

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Appendices

Appendix A: Patient Information and Consent Form

Dear patient, my name is Dr. Momanyi Mokaya, a doctor in this hospital (Charlotte Maxeke Johannesburg Academic Hospital).

I am trying to find out about your current pregnancy, which method you have chosen to deliver in this pregnancy, your previous obstetric history and your eventual delivery outcome of this pregnancy.

By taking part in this study you will be helping us to assess the delivery outcomes in women with one previous caesarean section like yourself and asses any factors that promote or alter your delivery plan to the eventual delivery. This may assist us identify any shortcomings in our overall management and therefore focus on improving our standard of care.

You will not be directly benefitting from this study, but what we find out about you may help others.

To take part in this study with you will need to grant me permission to ask you some questions and have access to your medical records, and if need be the baby's information. I will collect your responses from our interview in a standardized data sheet I have prepared. Your personal identifiers will be concealed and only I will be able to access it. All the information given to me will be secured.

If you decline to take part in the study your management will not be affected in any way. If you initially accept to take part and then change your mind and withdraw from this study there will be no negative consequences to you.

I shall be interested in what is documented in your file and what you have to say in our interviews. If you decide to participate in this study the standard of care you will receive will be the same as other the patients and you will not be given anything in return e.g. money for your participation.

You can contact me at any time in connection with the study. My name is Dr. Momanyi Mokaya and my cell number is: 0603206908 (MTN).

Should you be willing to participate in this study kindly sign that you have understood all that has been explained to you.

Patient name: _____

Patient signature: _____Date: 201__/__/___

Appendix B: Data Sheet

DATA SHEET

1. Patient Demographics

Age	Years				
Race	B (1)	C (2)	I (3)	W (4)	O (5)
Height	__M				
Weight (of booking visit)	__kg				
BMI (of booking visit)	__kg/M2				
Nationality	SA (1)		Non SA (2)		

2. Current Obstetric History

Parity	
Gravidity	
Gestational age at booking	__/40
Gestational age at delivery	__/40
Booking Parameters	
HB	g/dl
RH	+ (1)/ - (0) unknown (2)
RPR	+ (1)/ - (0) unknown (2)
HIV	+ (1)/ - (0) unknown (2)
On ARTs	Y (1) N (0) unknown (2)
CD4 count	___ cells/ uL
Viral load	___ copies/ ml

3. Previous Obstetric History

Year	Gest weeks	Delivery	Sex	Weight	*(see below)	Complications
* L = Live, Mis = Miscarriage, IUD = Intrauterine death, END = Early neonatal death LND = late neonatal death, ID = Infant death						

4. Reason for first c/s

Foetal distress	1
Breech Presentation/ malpresentation	2
Poor progress	3
Elective	4
Antepartum haemorrhage	5
Failed induction of labour	6
Pre-eclampsia/eclampsia	7
Unknown	8
Other	9

5. Antenatal choice of Delivery

Repeat caesarean section	1
Vaginal birth after caesarean (VBAC)	2
Unknown	3

6. Why did you decide on this mode of delivery?

Do not want to go in labour	1
Advice from friends/family	2
Advice from doctor/ healthcare provider	3
Own research	4
Other	5

7. Antenatal/intrapartum complications

Nil	1
Foetal distress	2
Poor progress	3
Antepartum haemorrhage	4
Mal-presentation	5
Preterm pre-labour rupture of membranes	6
Gestational hypertension	7
Pre-eclampisia/ eclampsia	8
IUGR	9
Uterine rupture	10
Other	11

8. Mode of delivery

Vaginal Birth after caesarean (VBAC)	1
Elective Caesarean section	2
Emergency Caesarean section	3
Assisted vaginal delivery	4
Gestational age at delivery	

9. Foetal Outcome

Birth weight	___g
Apgar score	___at 5 min
No complications	1
Admission to TU	2
Admission to NICU	3
Foetal death	4
Other	5

10. Post delivery complications/ Maternal outcome

Nil complications	1
PPH	2
Uterine Rupture	3
Abruptio placenta	4
Infection/ sepsis	5
Admission to ICU	6
Hysterectomy	7
Blood transfusion	8
Maternal death	9
Other	10

Appendix C: Ethics Clearance Certificate

R14/49 Dr M Mokaya

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)
CLEARANCE CERTIFICATE NO. M160201

NAME: (Principal Investigator)	Dr M Mokaya
DEPARTMENT:	School of Clinical Medicine Obstetrics and Gynaecology Department Charlotte Maxeke Johannesburg Academic Hospital
PROJECT TITLE:	Mode of delivery and outcomes of patients with a previous scar at Charlotte Maxege Johannesburg Academic Hospital
DATE CONSIDERED:	26/02/2016
DECISION:	Approved unconditionally
CONDITIONS:	Protocol title change noted 02/10/2017
SUPERVISOR:	Dr Robert Nyaoke
APPROVED BY:	Professor PE Cleaton-Jones, Chairperson, HREC (Medical)
DATE OF APPROVAL:	06/06/2016

This clearance certificate is valid for 5 years from date of approval. Extension may be applied for.

DECLARATION OF INVESTIGATORS

To be completed in duplicate and **ONE COPY** returned to the Research Office Secretary on 3rd floor, Phillip V Tobias Building, Parktown, University of the Witwatersrand, Johannesburg.
I/We fully understand the conditions under which I am/we are authorised to carry out the above-mentioned research and I/we undertake to ensure compliance with these conditions. Should any departure be contemplated from the research protocol as approved, I/we undertake to resubmit to the Committee. **I agree to submit a yearly progress report**. The date for annual re-certification will be one year after the date of convened meeting where the study was initially reviewed. in this case, the study was initially reviewed in **February** and will therefore be due in the month of **February** each year. Unreported changes to the application may invalidate the clearance given by the HREC (Medical).

Principal Investigator Signature — Date 01/07/2016

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES

Appendix D: Permission from Charlotte Maxeke Johannesburg Academic Hospital

GAUTENG PROVINCE
HEALTH
REPUBLIC OF SOUTH AFRICA

CHARLOTTE MAXEKE JOHANNESBURG ACADEMIC HOSPITAL

Enquiries:
Mr. J. Maepa
Office of the Clinical Director
Tell: (011) 488-3365
Email:johannes.maepa@gauteng.gov.za
08 February 2016

Dear Dr MomanyiMokaya

STUDY TITLE: Assessment of mode of delivery outcomes versus antenatal choice in patients with a previous scar at CMJAH.

Permission to conduct the above mentioned study is provisionally approved. Your study can only commence once Ethics approval is obtained. Please forward a copy of your ethics clearance certificate as soon as the study is approved by the Ethics committee for the CEO's to give you the final approval to conduct the study.

Supported / not supported

Dr. M. Mofokeng
Clinical Director
DATE: 8/02/2016

Approved / not approved

Ms. G. Bogoshi
Chief Executive Officer
Date: 9.2.2016