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THE IMPACT OF DIAGNOSIS-TO-DELIVERY TIME ON NEONATAL OUTCOME AS WELL AS MATERNAL MORBIDITY AND MORTALITY IN PATIENTS WITH ABRUPTIO PLACENTA

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A submissible research article submitted to the Faculty of Health Sciences at the University of the Witwatersrand, Johannesburg, in partial fulfilment of the requirements for the degree of Master of Medicine (MMED), in the field of Obstetrics and Gynaecology

Supervisors:

Prof L Chauke

Dr L Mbodi

Date: 04/08/2025

DECLARATION

I Mvumeleni Vincent Shongwe declare that this research report is my own work. It is being submitted for the degree of Master of Medicine in Obstetrics and Gynaecology at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at this or any other University

Signature:

Date: 01/08/2025

DEDICATION

I dedicate this MMed to my mother and daughter, Sizakele Doris Shongwe and Omuhle Abusisiwe Shongwe

Keywords: Abruptio Placenta, Neonatal Morbidity, Maternal Morbidity, diagnosis-to-delivery time, Neonatal mortality, Maternal mortality

Abstract

Aim: The impact of diagnosis-to-delivery time on Neonatal outcome as well as maternal morbidity and mortality in patients with Abruptio placenta

Methods: This is a cross-sectional study based on review of clinical records of women diagnosed with abruptio placenta from 1st January 2017 to 31st December 2020. Relevant data was extracted from documentations from the clinical records using a specially designed study form. The data obtained were analysed using Stata 15.0® Statistics. Ethics clearance was obtained from the relevant authorities.

Results: The median (IQR) diagnosis to delivery time was 1.2 hrs (72 minutes). The most common cause of prolonged diagnosis to delivery time was that the longest management related time interval was between the diagnosis of abruptio to initiation of anaesthesia of 1.5 hrs and 56 (56.6%) patients were classified as overweight. There were 40 stillbirths and six early neonatal deaths, giving a perinatal mortality rate of 256.6 per 1000 births. There were two maternal deaths. A diagnosis to delivery time of more than 32 minutes was associated with 2.5 likelihood of maternal admission to the obstetric high care or intensive care units and 2.6 likelihood of stillbirth or early neonatal death (p=0.008, 95% CI).

Conclusion: Although the optimal decision to delivery time was not achieved in the current study, corrective strategies to reduce decision to delivery time delays should be undertaken which will result in a significant improvement in optimal DDI rate at CMJAH Hospital.

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LIST OF ABBREVIATIONS

ACOG:	American College of Obstetricians and Gynaecologists
ACE:	A newsletter for Provincial Maternal Death Assessors compiled by the National Confidential Committee into Maternal Deaths (NCCEMD). This newsletter, titled "ACE," serves to inform in maternal deaths assessment related topics. It provides updates on the progress of the confidential enquiry program, shares lessons learned from maternal deaths, and makes recommendations for improving maternal care)
AKI:	Acute Kidney Injury
ANA:	Anti-Nuclear Anti Body
PAH:	Antepartum Haemorrhage
AUC:	Area Under the Curve
BMI:	Body Mass Index
CI:	Confidence Interval
CEO:	Chief Executive Officer
CJMAH:	Charlotte Maxeke Johannesburg Academic Hospital
CHPT:	Chronic Hypertension
DDI:	Diagnosis to Delivery Interval
DM:	Diabetes Mellitus
DRC:	Democratic Republic of Congo
DIC:	Disseminated Intravascular Coagulation
END:	Early Neonatal Death
FGHR:	Foetal Growth Restriction
HIV:	Human Immune Deficiency Virus
HOD:	Head of Department
HREC:	Human Research Ethics Committee
ICU:	Intensive Care Unit
IQR:	Inter-Quartile Range
M&M:	Maternal and mortality
MMR:	Maternal Mortality Rate (Saving Mothers Report)
MBT:	Massive Blood Transfusion

MMED:	Master of Medicine
MOU:	Midwife Obstetric Unit
NICU:	Neonatal Intensive Care Unit
NRFHR:	Non-Reassuring Foetal Heart Rate
OH:	Obstetric Haemorrhage
PA:	Placental Abruption
PET:	Preeclampsia Toxaemia
RPR:	Repaid Plasma Regin Test
PPROM:	Preterm Prelabour Rupture of Membranes
PROM:	Prelabour Rupture of Membranes
RH:	Rhesus Factor
RCOG:	Royal College of Obstetricians and Gynaecologists
SB:	Still Birth
SA:	South Africa
TU:	Transitional Unit
OHCU:	Obstetric high care unit

JOURNAL ARTICLE

The impact of diagnosis-to-delivery time on neonatal outcome as well as maternal morbidity and mortality in patients with abruptio placenta.

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Aim: The impact of diagnosis-to-delivery time on Neonatal outcome as well as maternal morbidity and mortality in patients with Abruptio placenta

Methods:

This is a cross-sectional study based on review of clinical records of women diagnosed with abruptio placenta from 1st January 2017 to 31st December 2020. Relevant data was extracted from documentations from the clinical records using a specially designed study form. The data obtained were analysed using Stata 15.0® Statistics. Ethics clearance was obtained from the relevant authorities.

Results:

The median (IQR) diagnosis to delivery time was 1.2 hrs (72 minutes). The most common cause of prolonged diagnosis to delivery time was that the longest management related time interval was between the diagnosis of abruptio to initiation of anaesthesia of 1.5 hrs and 56 (27.6%) patients were classified as overweight and obese. There were 40 stillbirths and six early neonatal deaths, giving a perinatal mortality rate of 256.6 per 1000 births. There were two maternal deaths. A diagnosis to delivery interval of more than 32 minutes was associated

with 2.5 likelihood of maternal admission to the obstetric high care or intensive care units and 2.6 likelihood of stillbirth or early neonatal death (p=0.008, 95% CI).

Conclusion:

The optimal diagnosis to delivery time of 30 minutes was not achieved owing to several challenges in our setting but adverse maternal and perinatal outcomes were recorded. To improve foeto-maternal outcomes, efforts to reduce the diagnosis to delivery interval should be pursued strongly, using the recommended 30 minutes as a benchmark.

INTRODUCTION

Placental abruption (PA) refers to the abnormal detachment of a normally located placenta occurring after 20 weeks of gestation but before delivery. This condition is associated with adverse maternal, foetal, and neonatal outcomes. The potential complications include preterm delivery, birth asphyxia, stillbirth, antepartum and postpartum haemorrhage, disseminated intravascular coagulation (DIC), emergency hysterectomy, renal failure, and maternal mortality (1). The current 2023 Saving Mothers Report (SMR) for South Africa stated that Obstetric Haemorrhage (OH) is still amongst the top cause of maternal death in the country and was responsible for 146 (16.5%) deaths in 2023. Of these 146 deaths, 31 (21.2%) were cause by PA. Furthermore, of these 31 deaths from PA, 20 (64.5%) and 11 (35.4%) patients had PA with and without hypertension (HPT) respectively (2). The above suggests that PA is responsible for a significant number of maternal deaths in South Africa and strategies to further decrease these deaths are warranted. While PA is associated with adverse outcomes, timely intervention can lead to positive results for both the mother and her baby. The impact of delivery to diagnosis interval (DDI) on neonatal outcome was highlighted in a study that found that a DDI of 20 minutes or less in patients with PA that is complicated by foetal bradycardia was associated with neonatal morbidity and mortality (3). A study by Kayani et al (3) reporting on 33 women with singleton pregnancies over 28 weeks of gestation, admitted with clinically overt placental abruption, where delivery was affected for foetal bradycardia, 11(33.3%) had a poor outcome, eight (24.2%) infants died and three (9.1%) infants who survived developed cerebral palsy. This study did not find any statistically significant relationship between maternal age, parity, gestation, or birthweight and a poor outcome. However, a statistically significant relationship was found between decision to delivery time ($p = 0.02$) and the odds ratio for poor outcome in DDI of 20 compared with 30 minutes on regression analysis was 0.44 (95% CI 0.22-0.86). In this study, only fifty-five percent of infants were delivered within 20 minutes of the decision to deliver.

The reported incidence of placental abruption ranges from 0.6% to 1.2% %. (4,5,6). The incidence of placental abruption in developed countries is about 1% of all deliveries, whereas in developing countries it is around 2-8% (7). However, in the incidence of there is significant geographical variation this condition, it is a major contributor to adverse maternal and perinatal outcomes especially in low- and middle-income countries with a paucity of healthcare (8).

Studies on the classification of placental abruption have categorized the condition into grades or classes based on the severity of the bleeding and the extent of separation of the placenta (9,10,11,12). Abruptions are classified according to severity in the following manner (13).

Grade 0: No clinical symptoms; diagnosed retrospectively,

Grade 1: Mild vaginal bleeding with no foetal distress,

Grade 2: Moderate bleeding with signs of foetal distress

Grade 3: Severe bleeding, maternal shock, and possible foetal death.

There are numerous risk factors associated with placental abruption which include maternal age, parity, cocaine use, multiple gestations, preeclampsia, chronic hypertension, oligohydramnios, premature rupture of membranes (PROM), chorioamnionitis, dietary and nutritional deficiencies, male foetus, trauma, thrombophilia, dysfibrinogenemia, intrauterine infections and certain socio-demographics factors are associated with increased risk of PA such as ethnicity (with a higher incidence in Black populations compared to Asian and Caucasian) (14,15). Placental abruption in a previous pregnancy is the most important risk factor for placental abruption in a subsequent pregnancy (16,17).

Placental abruption can have severe consequences for the mother, including haemorrhage: severe bleeding can lead to hypovolemic shock (5, 18), disseminated intravascular coagulation (DIC): a life-threatening clotting disorder (5, 19), organ failure: kidney and liver dysfunction due to blood loss (19,20), and uterine rupture: in extreme cases, the uterus may rupture (21). Foetal and neonatal morbidity and mortality associated with placental abruption are linked to foetal hypoxia: reduced oxygen supply due to placental separation (22), premature birth: increased risk of preterm delivery (17,23), stillbirth: in severe cases, foetal demise may occur (24), low birth weight: due to impaired placental function (25) and admission neonatal outcomes intensive care: many affected newborns require specialized care (26).

Maternal Death: Rare but possible in severe cases significant blood loss leading to shock, blood clotting problems, and potential organ damage. A study on placental abruption and adverse perinatal outcomes found that placental abruption has a significant impact on

stillbirth, preterm delivery and foetal growth restriction (FGR). The risk of stillbirth was profound when the abruption was severe (27).

It is important to note that the diagnosis of PA is primarily made through clinical assessment, as there are currently no robust diagnostic tests available. It is well documented that the specificity of ultrasound examination in detecting retroplacental clots is limited. Specifically, ultrasound examination has a sensitivity of 24%, and the specificity is limited may give a high number of false positives, resulting in a positive predictive value of 88% and a negative predictive value of 53% for the detection of placental abruption. Ultrasound examination may fail to detect PA approximately three-quarters of PA cases (28). However, when a retroplacental clot is identified on ultrasound, there is a high likelihood that PA is present (29).

The recommended interval between diagnosis of a need for emergency caesarean section and delivery in patients with abruptio placentae is generally considered to be less than 30 minutes (30), however this might not be practical in some settings due to various factors, amongst them, limited resources. Preventing prolongation of the DDI for emergency CD remains central to improving perinatal outcomes. The American College of Obstetricians and Gynaecologists (ACOG) committee on professional standards (31) and the National Institute of Clinical Excellence (NICE) guidelines (32) suggest that the DDI during an emergency caesarean section (CS) should not be more than 30 min, and a delay of more than75 min in the presence of maternal or foetal compromise can lead to poor outcome. A study that evaluated a total of 453 emergency CSs found a mean DDI of 36.3 ± 17.2 min 38.1 ± 17.7 min for Category 1 and 2 CS respectively. Only 42.3% of the emergency CS adhered to the recommended 30 min DDI and 57.6% had a DDI of more than 30 min. Reasons of delay included delay in transferring the patient to operation theatre (22.1%), anaesthetics related factors (18.1%), and lack of resources or manpower (16.1%) (33).

Maternal complications occurred in 15 (3.3%) patients with 3 (0.7%) non survivors having a DDI of 91.0 ± 97.0 min as compared to survivors with a DDI of 36.8 ± 15.7 min, $p = 0.001$. There was no significant association between DDI and occurrence of neonatal complications (33). In a more recent study reported that When the DDI exceeds 30 min, it constitutes a third-degree delay and is associated with an increased risk of maternal and perinatal morbidity (34).

Emergency caesarean section is required when delivery can reduce the risk to the life of the mother or foetus (35). When a caesarean section is indicated for foetal compromise, a DDI of 30 min (or less) has been suggested as the ideal time frame within which an obstetric team should achieve delivery to minimise hypoxic ischaemic morbidity on the neonate (36). However, the origin and evidence base for this recommendation are not clear. There is limited evidence, and lack of randomised controlled trial to support that a DDI of 30 min results associated with better mater41,42nal and neonatal outcomes. The majority of the available evidence comes from observational studies (36).

The 30-minute rule is based on expert consensus. Previously, numerous studies have raised concerns about this recommendation (37). Other studies suggested that the short- term foetal morbidity was related not only to the DDI but also to the indication for caesarean section (38,39). These studies also found an increase in short-term adverse outcomes for both mother and foetus in cases of placental abruption where the mode of delivery was a caesarean section. The above observation could be due to either maternal or foetal indications for caesarean sections. Furthermore, Caesarean delivery performed for sustained foetal bradycardia demonstrated that delivery within 25 minutes from the onset of bradycardia was associated with improved long-term neurological outcomes (30,40).

In South Africa, CS are classified based on urgency into three categories: Planned (elective), Extremely Urgent, and Urgent. Emergency CS, which are not planned, are further subdivided into extremely urgent, urgent, and emergency (41,42). The recommended DDI for placental abruption may vary in different settings due to various factors, amongst them availability of resources. In South Africa, for placental abruption, the recommended decision-to-delivery interval (DDI) should ideally be within 30 minutes (43,44).

To date, no research has been conducted in our setting to evaluate the impact of DDI on maternal and neonatal outcomes. This study was conducted to address this. The aim of this study was to assess the impact of diagnosis-to-delivery time on Neonatal Outcome as well as Maternal Morbidity and Mortality in patients with Abruptio placenta

Methods

Study design

This was a retrospective cross-sectional study based on a review of clinical records of pregnant patients diagnosed with abruptio placenta with live foetuses who were managed at the study site during a four-year period (1st January 2017 to 31st December 2020).

Study site

The study was conducted at Charlotte Maxeke Johannesburg Academic Hospital (CMJAH)- a tertiary- quaternary and a teaching hospital in association with the University of the Witwatersrand, Johannesburg, South Africa. The Department used to perform approximately 11 000 deliveries per annum, The number has reduced to approximately 7000 following strengthening of the opening of an additional Midwife Obstetric Unit and strengthening of the nine existing ones, including referring hospitals.

Study population and sample

The study population consisted of pregnant patients with a clinical diagnosis of placental abruption which included women with grade 1 and grade 2 PA upon admission who delivered at the study site during the study period. The study included all pregnant patients with confirmed placental abruption, evidenced by the presence of a retroplacental clot at delivery.

Data collection

The department of Obstetrics and Gynaecology conducts daily audit meetings and hosts a weekly morbidity and mortality meeting where each hospital admission and delivery from the previous day is reviewed, along with discussions of complicated cases, maternal and neonatal near misses including maternal and neonatal deaths. File numbers of patients who presented with AP and managed at this institution during the study period was obtained from the audit and mortality meetings, labour ward admission, theatre, obstetrics high care and ICU registers and used to access patient files from Hospital Patient Records Department.

A specially designed data capture form was utilized to collect patient demographics, as well as medical, surgical, and pregnancy-related information, including diagnoses, management strategies, maternal and neonatal outcomes, and overall pregnancy outcomes.

Data analysis

Categorical variables were summarised using frequencies and percentages. Continuous variables were analysed by computing means (with standard deviations) for normally distributed data and medians (with inter-quartile range [IQR]) for non-normally distributed data. The time duration between events (e.g. delivery and diagnosis of abruptio placenta) was calculated by calculating the time interval in minutes between the events using the equation: Time of Delivery – Date of Diagnosis. To facilitate computation of average times, the time in milliseconds was converted to hours using the formula: Hours = (Time e of delivery – Time of diagnosis)/ (60*60*1000).

Predictors of maternal, foetal and neonatal outcomes: The prevalence of maternal death (1.1%) and neonatal death (3.3%) in the study population was relatively low, limiting the statistical power to examine these outcomes independently. As a result, the analysis focused on alternative clinically relevant adverse outcomes with higher frequencies, specifically: maternal admission to the OHCU and ICU, stillbirths, and neonatal admission to the Neonatal Intensive Care Unit (NICU) or Transitional Unit (TU). These outcomes were each coded as binary variables—where "Yes" indicated the presence of the outcome (coded as 1), and "No" indicated its absence (coded as 0)—to facilitate the use of logistic regression models. Initially, bivariate logistic regression analyses were conducted to assess the unadjusted association between each outcome and selected explanatory variables which mainly included the time intervals between various steps of the referral pathway.

Subsequently, multivariable logistic regression models were fitted, adjusting for key a priori maternal risk factors known to influence perinatal and maternal outcomes. These included advanced maternal age (defined as ≥35 years), HIV status (positive or negative), and booking status (booked or unbooked). These variables were selected based on their clinical relevance and established association with maternal and neonatal morbidity and mortality in the literature.

Data analysis was conducted using Stata 15.0® (Stata Corp, 4905 Lakeway Drive, College Station, Texas 77845 USA). A p-value of < 0.05 was considered statically significant

Ethics consideration

Permission to conduct the study was obtained from the Head of Department (HOD) of Obstetrics and Gynaecology and the Chief Executive Officer (CEO) at the study site. Ethical clearance was obtained from the Human Research Ethics Committee (HREC Medical) of the University of the Witwatersrand (M200940).

Results

Patient profile

There were 27162 deliveries and 203 (0.8%) pregnant patients were diagnosed with abruptio placenta. Of these, 180 (93.6%) patients had live foetuses at presentation to referring healthcare facilities. The mean age of the study population was 29 ± 5.9 years (Range: 18-45). The majority of the women were South African citizens (104, 57.8%), had booked for antenatal care (152, 84.4%), were HIV negative (140, 77.9%), had no significant past medical history or previous pregnancy complications (164, 91.1%), and did not smoke, abuse alcohol or use illicit drugs (156, 86.7%). Additionally, most of the patients were referred from another facility (168, 93.3%) and during after-hours (177. 98.3%). Just over two-thirds (122, 67.8%) had hypertension-related complications during the index pregnancy. Information on body mass index (BMI) was available for only 99 (55.0%) of the patients and 31 (31.3%) were classified as overweight and 25 (25.3%) were obese (class1 (n=17), class 2 (n=5) and class 3 (n=3). The most common presenting symptom was vaginal bleeding (167, 92.8%) and tender uterus (114, 63,3%) respectively. A total of 32(17.8%) foetuses presented with foetal distress (Table 1).

Table 1. Maternal profile of women diagnosed with abruptio placenta

Description (n=180)	N (%) or median (IQR, range)
Maternal age (years) Mean ±SD	28.7 (5.9)
Alcohol, smoking and illicit drug use	
None	156 (86.7)
Alcohol use	11 (6.1)
Current smokers	6 (3.3)
Past smokers	5 (2.9)
Illicit drugs use	2 (1.1)
BMI (n=99)	26.2 (23.1-30.2, 18.1-45)
Under weight	1 (1.1)
Normal weight	42 (42.4)
Overweight	31 (31.3)
Obesity Class 1	17 (17.2)
Obesity Class 2	5 (5.1)
Obesity Class 3	3 (3.0)
Referring facility	
In patient	8 (4.4)
Clinic	20 (11.1)
MOU	28 (15.6)
Self-referred	58 (32.2)
Private doctor	2 (1.1)
Level 1 hospital	16 (8.9)
Level 2 hospital	39 (22.0)
Both level 2/3 hospital*	5 (2.8)
Not recorded	4 (2.2)
Timing of referral	
During working hours	3 (1.7)
After hours	177 (98.3)
Nationality (n=180)	
South African	104 (57.8)
Immigrant	76 (42.3)
Rapid Plasma Reagin status (n=180)	
Negative	174 (96.7)
Positive	2 (1.1)
Unknown	4 (2.2)
human immunodeficiency virus status (n=180)	
Negative	140 (77.8)
Positive	40 (22.2)
Rhesus factor (n=180)	
Negative	173 (96.1)
Positive	7 (3.9)
Booking status	
Booked	152 (84.4)
Unbooked	28 (15.6)
Previous pregnancy complications	
None	164 (91.1)
Previous SB	7 (3.9)
Previous early neonatal death (END)	5 (2.8)
Previous antepartum haemorrhage (PAH)	3 (1.7)
Previous abruptio placenta	1 (0.6)
Comorbidities	
Hypertension	140(77.8)
Asthma	2 (1.1)
Diabetes mellitus	2 (1.1)
None	36 (20.0)
Current pregnancy complications	
Chronic hypertension	10 (5.6)
Pre-eclampsia	74 (41.1)
Eclampsia	9 (5.0)
Prelabour rupture of membranes	11 (6.1)
Prelabour premature rupture of membranes	10 (5.6)
Chorioamnionitis	3 (1.7)
Antiphospholipid syndrome	3 (1.7)
Autoimmune disease (antinuclear antibodies (ANA) positive)	2 (1.1)
None	58 (32.2)

*Patients were referred to a level 2 hospital from a level 1 hospital and subsequently to the study site. In patients: these are patients who were diagnosed with abruptio placenta who were in the ward

Time intervals

The median time from the diagnosis of abruptio placenta with a viable fetus to the delivery interval of the baby via caesarean section was 1.2 hours. The longest duration observed was between the obstetrician's review and the initiation of anaesthesia (Table 2).

Table 2: Diagnosis to delivery intervals (hours) among women diagnosed with abruptio placenta

Description of time interval in hours	median (IQR, range)
Time from diagnosis at referring healthcare institution to calling an ambulance *(n=12)*	0.7 (0.4-1.4, 0-3.1)
Time from calling ambulance to ambulance arriving at a referring healthcare facility *(n=18)*	0.7 (0.07-1.3, 0-1.67)
Ambulance transit time *(n=17)*	0.2 (0.2-0.4, 0.1-8.2)
Time from arrival to review by a nurse at referral (receiving) hospital *(n=17)*	0.5 (0.2-0.9, 0-1.8)
Time from arrival at referral (receiving) hospital and review by a doctor (hrs) *(n=19)*	0.5 (0.3-0.9, 0-2.5)
Time from review by doctor to anaesthetic time *(n=110)*	1.5 (0.8-3.4, 0.1-18.1)
Anaesthetic to surgical starting time *(n=110)*	1.1 (0.9-1.5, 0.3-3.2)
Time from surgical starting time to delivery of the baby *(n=110)*	0.1 (0.05-0.16, 0.01-0.9)
Time from diagnosis to delivery (hrs) (n=167)	1.2 (0.01-3.1, 0-40.8)

Maternal and foetal outcomes

Table 3 is a summary of maternal, foetal and neonatal outcomes. The most common maternal complication was Couvelaire uterus, occurring in 23 (13.1%) of the patients. Twenty-one (11.7%) patients experienced uterine atony. There were two maternal deaths. Both were due to hypovolaemic shock secondary to postpartum haemorrhage. An almost equal number of the patients were admitted to the postnatal ward (87, 48.3%) and the obstetric high care unit (86, 47.8%) the latter group mainly for observation. Only four (4, 2.2%) women required admission to the ICU for hemodynamic and respiratory support. The majority of neonates (137, 76.1%) were delivered preterm, with a median weight of 1960 grams (Range 500-4300 grams). A total of 69 (38.3%) and 19 (10.6%) neonates were admitted to the transitional unit (neonatal high care) and ICU, respectively. There were 32 (17.8%), 23 (12.7%), and six (3.3%) stillbirths, macerated stillbirths and early neonatal deaths respectively (Table 3).

Table 3: Maternal and neonatal outcomes

Description	n (%) or median (IQR, range)
Maternal (N=180)	
Complications	
Acute kidney injury (AKI)	13 (7.8)
Couvelaire uterus	23 (13.1)
Uterine atony	21 (11.7)
Maternal death	2 (1.1)
Management of maternal complications	
Balloon tamponade	5 (2.8)
Uterine compression suture (B-Lynch)	10 (5.6)
Hysterectomy	3 (1.7)
Massive blood transfusion (MBT)*	11 (6.1)
Maternal post operative admission	
Ward	87 (48.3)
Obstetric High Care Unit (OHCU)	86 (47.8)
ICU admission	4 (2.2)
Fetal (N=180)	
Fetal outcomes	
Macerated stillbirths	8 (4.4)
Fresh stillbirths	32 (17.8)
Alive	140 (77.8)
Fetal outcomes	
Preterm deliveries	137 (76.1)
Gestational age at delivery	33 (28-36, 21-42)
Birthweight at delivery	1960 (1280-2570, 500-4300)
APGAR score	
One minute	6 (4-9, 0-9)
Five minutes	9 (7-9, 0-10)
Ten minutes	10 (9-10, 0-10)
Admission post-delivery (n=140)	
Discharged to mother	46 (32.9)
Admitted to Transitional Unit (TU)	69 (49.3)
Admitted to neonatal ICU (NICU)	19 (13.6)
Early Neonatal Death (ENND)	6 (4.3)

*MBT in our unit is considered as transfusion of 4 red blood cells concentrate, 4 fresh frozen plasma and 1unit of mega platelet. Preterm birth, also known as premature birth, refers to the delivery of a baby before 37 weeks of pregnancy.

The following factors were associated with admission to OHCU and ICU (Table 4): non-South African citizenship (p=0.03), pre-eclampsia(p=0.008) and severe pre-eclampsia (p=0.01), delays in achieving full anaesthesia (p=0.02), and maternal age greater than 35 years (0.02) (p=0.02). Furthermore, a delay in delivery by more than 32 minutes was associated with a 2.5 likelihood of maternal admission to the OHCU/ICU (p=0.007, 95% CI). Similarly, a DDI of more than 32 minutes was associated with a 2.6 likelihood of stillbirth or early neonatal death (p=0.008, 95% CI).

Table 4: Maternal factors associated with maternal admission to OHCU/ICU (N=177)

Description	Normal ward (n=87) n (%) or median (IQR)	OHCU/ICU (n=90) n (%) or median (IQR)	Crude Odds Ratio OR (95% CI)	p value	Adjusted Odds Ratio (95% CI)	p value
Maternal age >35	11 (12.6)	18 (20.7)	1.80 (0.80-4.08)	0.16	-	-
HIV positive	21 (24.7)	19 (21.1)	0.81 (0.40-1.65)	0.57	-	-
Booked	74 (85.1)	75 (86.2)	1.10 (0.47-2.56)	0.83	-	-
Referral centre						
Clinic/MOU	22 (29.3)	25 (29.4)	1		1	
Self/Private	27 (36.0)	29 (34.1)	0.95 (0.43-2.1)	0.89	0.96 (0.43-2.18)	0.93
Level 1/2 hospital	20 (26.7)	25 (29.4)	1.10 (0.48-2.5)	0.82	1.12 (0.47-2.70)	0.80
Tertiary hospital	6 (8.0)	6 (7.1)	0.88 (0.25-3.12)	0.84	0.92 (0.25-3.41)	0.90
Non-SA citizen	4 (50.6)	31 (34.4)	0.51 (0.28-0.94)	**0.03**	0.45 (0.24-0.84)	**0.01**
Previous SB	3 (4.1)	4 (5.2)	1.30 (0.28-6.00)	0.74	1.21 (0.25-5.79)	0.81
Previous HDP	2 (2.6)	6 (7.5)	3.08 (0.60-15.77)	0.18	2.48 (0.45-13.65)	0.30
Previous PAH	1 (1.4)	2 (2.6)	1.90 (0.17-21.35)	0.61	2.22 (0.19-25.85)	0.52
Alcohol use	3 (4.4)	8 (12.3)	3.04 (0.77-12.01)	0.11	3.86 (0.95-15.71)	0.06
Smoking	5 (7.4)	6 (8.8)	1.22 (0.35-4.20)	0.75	1.61 (0.45-5.77)	0.46
BMI (n=99)						
Normal BMI	26 (49.1)	17 (38.6)	1		1	
Overweight	15 (28.3)	14 (31.8)	1.43 (0.55-3.69)	0.46	1.65 (0.60-4.53)	0.32
Obese	12 (22.6)	13 (29.6)	1.66 (0.61-4.48)	0.32	1.52 (0.53-4.40)	0.43
CHPT	3 (3.8)	5 (6.2)	1.67 (0.39-7.31)	0.48	1.60 (0.36-7.09)	0.53
PET	17 (21.8)	33 (41.8)	2.57 (1.28-5.18)	**0.008**	2.43 (1.17-5.4)	**0.02**
SEVERE PET	6 (11.8)	18 (32.7)	3.65 (1.31-10.1)	**0.01**	3.07 (1.04-9.01)	**0.04**
PROM	7 (9.5)	4 (5.2)	0.52 (0.15-1.87)	0.32	0.56 (0.15-2.01)	0.37
PPROM	8 (11.1)	2 (2.6)	0.22 (0.04-1.06)	**0.06**	0.27 (0.05-1.36)	0.10
Time from review at base to calling of ambulance	0.8 (0.6-2.0)	0.7 (0.4-0.8)	0.86 (0.23-3.19)	0.82	0.87 (0.21-3.66)	0.85
Ambulance reaction time	0.1 (0.05-0.1)	1.1 (0.6-1.6)	12.38 (0.76-202.96)	**0.08**	15.48 (0.67-126.72)	**0.07**
Ambulance transit time	0.2 (0.1-8.2)	0.3 (0.2-0.4)	0.58 (0.24-1.37)	0.21	0.49 (0.09-2.58)	0.40
Time from arrival to doctor's review	1.1 (1-1.1)	0.5 (0.3-0.8)	0.05 (0.001-2.02)	0.11	0.09 (0.003-1.99)	0.13
Time from doctor review to start of anaesthesia	1.5 (0.7-2.7)	1.6 (0.9-3.9)	1.03 (0.92-1.15)	0.59	1.08 (0.96-1.21)	0.23
Time to full anaesthesia	1 (0.9-1.2)	1.3 (1.1-1.8)	3.51 (1.58-7.74)	**0.02**	3.50 (1.60-7.85)	**0.002**
Time from cutting to delivery	0.1 (0.05-0.16)	0.1 (0.03-0.16)	0.51 (0.1-2.6)	0.43	0.58 (0.11-2.99)	0.52
Time to diagnosis to delivery						
<32 min	43 (55.1)	29 (34.1)	1	**0.007**	1	**0.07**
>32 min	35 (44.9)	56 (65.9)	2.37 (1.26-4.47)		2.47 (1.27-4.79)	

DISCUSSION

Key Findings

The aim of our study was to assess the impact of diagnosis-to-delivery time on Neonatal outcome as well as maternal morbidity and mortality in patients with Abruptio placenta.

The incidence of PA was 0.8%. The median time from diagnosis to delivery was 1.2hrs (72 minutes), with a IQR range (0.01-3.1, 0-40.8hrs). Furthermore, we have demonstrated that a delay in delivery of more than 32 minutes was associated with a 2.5-fold increase in the likelihood of maternal admission to the Obstetric High Unit or ICU (p=0.007, 95% CI). Similarly, a delay in delivery exceeding 32 minutes was correlated with a 2.6-fold increase in the likelihood of stillbirth or early neonatal death (p=0.008, 95% CI). Maternal and neonatal outcomes were recorded. The proportion of those who smoked and used illicit drugs was too low to assess the influence of smoking and use of illicit drugs on abruptio placentae. Furthermore, lack of association between alcohol consumption and abruption placentae may in part be explained by the variation in amount, type and mode of alcohol used by participants between studies.

The main finding of our study was that the incidence of abruptio placentae was (0.8%) which corresponds with incidence of 0.6-0.8% which has been reported previously (45). This figure also falls within the range of 0.3–2 %, reported by others (46,47,48, 49), but it is lower than what has been reported previously in Uganda and Israel (50,51). The large discrepancy between prevalence rates is probably influenced by various factors including differences in study populations, diagnostic criteria, and the severity of abruption cases included.

The time interval from the decision to delivery of the neonate is known as the decision-to-delivery interval (DDI), and the decision to delivering the baby is based on the severity of the abruption and the well-being of both the mother and the foetus. Several international professional bodies including RCOG (31) and NICE guidelines (32) have advocated a DDI ≤ 30 minutes time frame within which an obstetric team should achieve delivery. Several studies have achieved this target but in a small percentage of their patients (37, 38, 52, 53, 54,55,56). In our study the decision to delivery time was 72 minutes.

The duration of decision to delivery time of 72 minutes observed in our study is probably related the longest time of 1.5 hrs from review by obstetrician doctor to anaesthetic time. Furthermore, in the present study a diagnosis to delivery interval exceeding 32 minutes was associated with a 2.5-fold increased likelihood of maternal admission to high or intensive care and a 2.6-fold increased likelihood of stillbirth or early neonatal death with a of 0.008 and 95% confidence interval. A study from Tanzania reported that adverse maternal and fetal outcome were more in DDI above 75 min with OR 1.2 (0.49 to 2.83) and 1.7 (0.91 to 3.38) times higher respectively than when the DDI was less than or equal to 75 min (57). The delayed decision-to-delivery interval was associated with an increase in perinatal deaths with an odds ratio (OR) of 6.9 (95% CI, 3.166 to 15.040) (58). Another study stated that prolonged DDI > 150 minutes was significantly associated with maternal morbidity ($p = 0.001$), stillbirth ($p = 0.008$) and early neonatal death ($p = 0.049$) (56).

The most common reason for prolonged decision to delivery time in our study was the longest management related time interval was between the diagnosis of abruptio to initiation of anaesthesia of 1.5 hrs. Sayegh et al, in a study conducted in a French maternal hospital, found that DDIs were mainly influenced by the time taken to get the patient into the operating theatre, as the mean decision-to-operating theatre interval accounted for 45.6% of the mean DDI (59).

Repeat CS being more surgically demanding is known to be significantly associated with prolonged operation time and decision to delivery time. A previous history of CS is technically more difficult to perform owing to intra-abdominal adhesions, which must be confronted before delivering the baby and are thus associated with longer operation time and prolonged decision to delivery (60). Whether any of our patients were previous CS was unknown. In one study, the authors stated that the most common cause of prolonged DDI of 297 (175-434) minutes was repeat CS (AOR = 4.923, 95% CI 1.09-22.36; $p = 0.039$) and prolonged decision-to-operating room time (AOR = 8.22, 95% CI 1.87-8.66; $p<0.001$) were significant predictors of prolonged DDI and obese women were twice more likely than nonobese women to have prolonged DDI, but this was not statistically significant (AOR = 2.226, 95% CI 1.75-6.59; $p = 0.149$) (56).

A small percentage of our patients were overweight and obese might have played a role of prolonged decision to delivery time of 72 minutes. Ayele et al (2021) reported that time of

decision and time taken from decision to delivery to delivery of anaesthesia were the predictors of prolonged delivery time interval (53). Spencer and MacLennan conducted a study among hospitals with differing levels of care and found that the delay was due to a lack of staff in Level 1 hospitals, lack of theatres in Level 2 hospitals and anaesthetic complications in Level 3 hospitals (61).

The commonest medical disorder observed in the present study was hypertensive disease, pre-eclampsia was found in 74 patients (41.1%), gestational hypertension in 5 patients (8.3%) and chronic hypertension in 10 (5.6%). Our findings also suggest a significant influence on prolonged DDI for hypertensive diseases. For hypertensive cases, initial attempts to stabilize blood pressure prior to delivery may contribute to this delay. The most common maternal complications (47.6%; n=57) identified included acute kidney injury in 13 (7.8%) patients, Couvelaire uterus was observed in 23(13.1%), uterine atony occurred in 21 (11.7%) of the patients. There were two maternal deaths and the perinatal mortality rate 255.5 per 1000 births. In contrast Udom et al (2023) reported 22.7% (n=71) were hypertensive disease and 29.7% (n=90) had maternal complications which included post-operative anaemia (74; 23.6%), postpartum haemorrhage (PPH) (22; 7.0%), and puerperal/wound sepsis (18; 5.8%). There was one maternal death. The perinatal mortality rate of 66.3 per 1000 births (56).

Previous studies have reported that both maternal cigarette smoking (62,63) and alcohol consumption and use of illicit drugs during pregnancy [64,65,66) are associated with abruptio placentae. In the present study, the proportion of those who smoked and used illicit drugs was too low to assess the influence of smoking and use of illicit drugs on abruptio placentae. Furthermore, lack of association between alcohol consumption and abruption placentae may in part be explained by the variation in amount, type and mode of alcohol used by participants between studies. The decision-to-delivery interval (DDI), particularly when complicated by HIV, can be prolonged due to the time-consuming nature and cautious approach to patients. This delay in delivery, often exceeding the recommended 30 minutes, can negatively impact maternal and fetal outcomes. Although a small number of our patients (n=40; 22.2%) were HIV positive and could be a contributing factor to decision to delivery interval of 72 minutes. More than 50% of patients in the current study were characterised as overweight (n=31) and obese (n=25) (class 1, 2 and 3). Obesity can lead to longer decision-to-delivery time. The findings of Futterman et al. (2022) and Conner et al. (2013) suggested

the challenges of urgent caesarean births in obese patients, manifested in longer decision-to-delivery and skin-to-delivery intervals as BMI class increases.

Although several studies have reported that foetal-maternal outcomes were not significantly negatively affected with a DDI of up to 75 minutes (44, 53,57). They recommended that it would be wise to accept 75 minutes DDI, where the standard DDI of 30 minutes is not feasible owing to several challenges (67,68,69). However, our finding should be interpreted with caution, because even though DDI is a significant predictor of adverse maternal and perinatal outcomes, other factors aside DDI also contribute to these outcomes.

LIMITATIONS

This was a retrospective study which like other studies of this nature, is limited by missing clinical records and a small sample size. Lastly the combining of admissions to ICU and OHCU could have caused some misclassification bias as the two groups, even though they represent more sicker patients they are not homogenous as admission to OHCU could be for magnesium sulphate administration and not necessarily indicating disease severity.

CONCLUSION

Although the optimal DDI target was not achieved in the current study, corrective strategies to reduce DDI delays should be undertaken which will result in a significant improvement in optimal DDI rate at CMJAH Hospital.

AUTHOR CONTRIBUTIONS

L Chauke and MV Shongwe conceptualised the study

MV Shongwe conducted the study and wrote the initial and final draft supervised by L Chauke and L Mbodi

A Chikandiwa assisted with statistical analysis

All authors reviewed and approved the draft and final manuscript

CONFLICT OF INTEREST

All authors declare no conflict of interest

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APPENDICES

Appendix A: Approved Protocol

The impact of diagnosis-to-delivery time on Neonatal outcome as well as maternal morbidity and mortality in patients with Abruptio placenta.

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Abbreviations

ACOG	American College of Obstetrics and Gynaecology
PAHU	Antepartum Haemorrhage of Unknown Cause
CEO	Central Executive Office
CMJAH	Charlotte Maxeke Johannesburg Academic Hospital
DDI	Decision to Delivery Interval
DIC	Disseminated Intravascular Coagulation
DII	Decision-to-Incision Interval
DRI	Decision-to-operating Room Interval
FDP	Fresh Dried Plasma
FHR	Fetal Heart Rate
HREC	Human Resource Ethics Committee
INR	International Normalized Ratio
IUFD	Intrauterine Fetal Demise
NRFHR	None Reassuring Fetal Heart Rate
PA	Placental Abruption
SA	South Africa
UA	Umbilical Artery
WHO	World Health Organization

1. INTRODUCTION AND BACKGROUND

Placental abruption (PA) is referred to as the abnormal detachment of a normal located placenta beyond 20 weeks of gestation occurring prior to the birth baby (1-5). PA is linked with adverse maternal, fetal and neonatal complications (3). The incidence of placental abruption is noted to be 0.49 – 1.8 % (3).

Worldwide PA is an obstetric condition that is deadly for both mother and the fetus (2). The saving mothers report 2011-2013 reported 110 maternal mortalities attributed to PA and further reported that the risk of dying was eight times higher if the PA was treated with caesarean section.

A South African population-based cohort study that utilized the maternal near-miss Approach established that abruptio placenta was the leading cause of obstetric haemorrhage and the

leading cause of massive transfusion of blood. In their study the definition of the massive transfusion was transfusion of five or more units of Packed Red Blood Cells (7)

2.1. RISK FACTORS ASSOCIATED WITH PLACENATL ABRUPTION

There is numerous risk factors associated with PA and only the common once will be discussed in this section. PA is associated with the following risk factors: age of the mother, parity, cocaine usage, multiple gestation, preeclampsia, chronic hypertension, oligohydramnios, premature rupture of membranes (PROM), chorioamnionitis, dietary and nutritional deficiency, male fetus, trauma, thrombophilia, dysfibrinogenemia, and intrauterine infections (8).

2.2. PRESENTATION OF PLACENTAL ABRUPTION

The presentation of PA varies widely. The classically described symptomatology of PA is abdominal pain and vaginal bleeding (4, 8). Some cases of PA can present with fetal death and some are asymptomatic (4, 8). It is quite important to note that PA can be major without any of the mentioned symptomatology and there is a poor correlation between the amount of bleeding and the severity of PA (8).

There are three parameters that determine the severity of the PA: location of PA, whether there is or no vaginal bleeding and the degree of separation (8). However another grading system exist that classifies PA clinically and includes maternal, foetal and neonatal complications (4). The risk of still birth mostly occurs with the PA of more than 50% (8). The contractions associated with PA have a specific characteristics which are high frequency and low amplitude (8). Upon palpation of the patient's abdomen the uterus may be noted to be harder and tender (4, 8)

2.3. DIAGNOSIS OF PLACENTAL ABRUPTION

Placental abruption is the diagnosis that is made clinically (9). The diagnosis should be suspected among patients who present with pain in the abdomen, bleeding through the vagina and in patients presenting with unknown cause of preterm labour without history of trauma (8). There are no sensitive or reliable tests for the diagnosis of PA. However ultrasound can be use though it has a limited sensitivity in the diagnosis of the retroplacental bleeding or clot (9). In one study the sensitivity, specificity, positive and the negative predictive value for the sonar in diagnosing the retroplacental clot were 24, 96, 88 and 53 % retrospectively. In view

of these finding it is Apparent that ultrasound will probably fail to diagnose PA in three-quarter of cases (9). The ultrasound features of PA are largely dependent on: size of retroplacental bleeding, site of bleeding and the time interval between the onset of separation and sonar assessment (8). These features are: retroplacental collection, hematoma that is located in the margin of the placenta, hematoma in the subchorionic region, increased heterogeneous thickness (>5 cm in a perpendicular portion) (8). PA is classified clinically as severe or minor with the severe form characterized by the following adverse maternal outcomes: Disseminated Intravascular Coagulation (DIC), hypovolemic shock, renal failure, transfusion of blood, hysterectomy, or death in the hospital and the adverse fetal outcomes indicative of severe form of PA are: fetal growth restriction (FGR) and intrauterine fetal demise (IUFD) (4). Neonatal mortality associated with the severe form of PA are: Small for Gestational Age (SGA) and preterm delivery (4). PA without features of severity is classified as minor form of PA (4). Compare to the minor form of PA, severe form is associated with the increased maternal morbidity profile (4).

However, there are other grades of abruption placenta that exist that use both clinical presentation and laboratory parameters such as the one known as Sher and Shetland classification and the classification is as follows: Grade 1: retrospective diagnosis. Grade 2: clinical symptoms and signs indicative of PA are present and the baby alive. Grade 3: the baby has demised. Grade three (3) PA has further two subgrades which are A and B where A: No Coagulopathy. B: Coagulopathy (10).

2.4. ADVERSE MATERNAL OUTCOMES

PA is one amongst the obstetric conditions that is commonly linked to the adverse maternal and fetal outcomes and this is even worse in resource constrain setting (2). DIC, anaemia, PPH, admission in ICU and the quantity of blood transfused are the anticipation of worse maternal outcomes (2). In a resourceful setting particularly with blood products available, maternal death is less common (2). The following are amongst the most serious adverse maternal morbidity outcomes associated with PA: pulmonary edema, heart failure of acute onset, acute myocardial infarction and acute respiratory failure, cardiomyopathy, cardiovascular disorders in the puerperium, coma, and amniotic fluid embolism (4).

The patients with PA can present with haemorrhagic shock either from concealed or revealed PA. Shock is the condition that is characterize by tissue hypoperfusion from hypovolemia

which results in in adequate tissue perfusion. Typically, the in the adult population the mean arterial pressure is less than 70 mm Hg. The clinical signs are cold and clammy skin, urine output less than 0.5ml/kg/hr. and altered mental state. Hyperlactatemia is usually present. Tissue hypoperfusion result in anaerobic metabolism, lactic acid production, lactic acidosis, drop in PH and metabolic acidosis (19). If remains unattended this can result in multiorgan failure and eventually death (3). As noted earlier in patients with severe preeclampsia often they have a normal blood pressure even with severe form of PA. However once blood loss exceed 25%, signs of hypovolemia Appears (3). Therefore, effective replacement of the circulatory blood volume is central to the management of the haemorrhagic shock. Initially crystalloid is used and thereafter further management depends on the haematocrit status (3).

Disseminated intravascular coagulation (DIC) commonly is more related with the severe form PA. Thromboplastic release in abruptio placentae leads to the activation of the coagulation cascade (5). Consequently, this leads to the usage and depletion of the coagulation factors and platelets. DIC stimulate fibrinolysis, eventually resulting in a viscous cycle. The Laboratory and clinical assessments are both used in the diagnosis of the DIC. The clinical picture constitutes bleeding tendency from surgical wound, puncture sites, nose, rectum, gums. The laboratory parameters affected by DIC are international normalized ratio (INR), platelets, fibrinogen, Fibrin Degradation Products (FDP). Laboratory parameters are not sensitive because more than 50% of the coagulation factors should be depleted before the laboratory parameters are deranged (1). Sometimes the retroplacental bleeding is massive and results in the movement of blood out of the myometrial vessels into the myometrium of the uterus resulting in the purplish colour, the so called Couvelaire uterus. There is a strong association between the Couvelaire uterus and postpartum haemorrhage (3).

2.5. ADVERSE FETAL AND NEONATAL OUTCOMES

Evidence shows that PA is linked with adverse maternal, fetal and neonatal morbidity. In as much as two-thirds of patients presentation with PA has fetal and neonatal complications (4). Literature shows that PA is linked with still birth, fetal growth restriction and preterm delivery (1, 5). The risk of the still birth is significant in those with severe form of PA. The incidence of PA is 1%. FGR is noted to be 14.3% amongst the neonates born to mothers diagnose with PA (1, 5). It has been noted that 50 % PA is associated with SB (5). Fetal heart rate abnormalities (particularly fetal bradycardia) in the cases of PA have been associated with adverse fetal and or neonatal outcomes (11). There is improved maternal and infant

prognosis if the diagnosed of PA is made early with quick intervention (12). Our study investigated outcomes in women who had an abruption with a live baby. Late hospital presentation with PA, Asphyxia, low Pagar score low birth weight, prematurity, and a retroplacental clot are related to poor neonatal and fetal outcomes in patients with PA (2).

In a case control study by Kayan *et al.,* in their retrospect view of pregnancies ended with severe PA and fetal bradycardia concluded that in cases of severe PA with fetal bradycardia the decision to delivery interval (DDI) of 20 minutes or less was linked with significant reduction in the adverse neonatal outcomes including morbidity and mortality (13).

In their study 33 patients in singleton pregnancies above the gestation of 28 weeks were selected with clinical diagnosis of PA associated with fetal bradycardia, eleven (11) of the pregnancies had adverse outcomes. Eight (8) of the infants died and the three (3) that survive had cerebral palsy. Fifty-five percent (55%) infants were born within 20 minutes of the decision to deliver and the maternal complications rare (13).

2.6. DECISION TO DELIVERY INTERVAL

There is scanty of literature on the association between diagnosis to delivery interval in patients with PA and adverse maternal, fetal or neonatal outcomes.

A study by Rinat Gabbay- Benz *et al*., found that fetal short term morbidity was related not only to DDI but also to the indication for caesarean section and there was a rise in short term adverse outcome for both mother and the fetus in cases of PA whose mode of birth was the Caesarean Section (CS) (14). However short term neonatal morbidity noted to be associated with the indication for CS not to the DDI (14). Caesarean delivery performed for fetal bradycardia delivered within 25 minutes from the onset of the bradycardia showed an improved long-term neurological outcome (14). Shorter DDI was found to those cases of PA operated for None Reassuring Fetal Heart Rate (NRFHR) and vaginal bleeding (14). The American College Obstetrics and Gynaecology (ACOG), Royal College of Obstetrics and Gynaecology (RCOG), and World Health Organization (WHO) recommended 30 minutes or less of the interval between the decisions to delivery time for an emergency caesarean delivery (15). There is in fact no evidence to support that 30 minutes interval actually improve maternal or neonatal outcomes (15).

Tufnell *et al.,* reported on their findings of auditing the interval from decision to delivery time in urgent CS to ascertain as to whether the current standard of 30 minutes is routinely feasible and whether delay results to complications. They concluded that the 30 minutes interval for the emergency CS was not routinely achievable and reported that failure to achieve this recommendation was not associated with any adverse neonatal outcomes (16).

Wong *et al*., conducted a retrospective study of the DDI and the overall entire duration of surgery for the caesarean delivery in the tertiary general hospital in ascertaining the DDI, total duration of surgery and the factor affecting two components. Their CS urgency was categorized into 4 categories (17). Where category 1 means instant threat the mother or fetus life, category II fetal or maternal compromise with immediate threat to life, category III there is no fetal or maternal compromise however requires early delivery, category 4, non-urgent or an elective delivery that can be a scheduled to suite the women and or stuff (17). Category 1 CS should be performed in no more than 30 minutes of the decision for caesarean section and within 30 to 75 minutes for category 2 (17). They concluded that many of the birth were not more than the recommended delivery time correlating with the urgency of the CS. The influence of the time might be the result of the challenges of time taken to transfer patients to theatre. In their studies the entire duration of time was impacted by the experience of the surgeon, history of preceding CS and individual operating technique and preferences (17).

Retrospective cohort study by Khemworpaong *et al*., noted that the decision-to-incision time interval (DII) in emergency caesarean delivery hardly met the recommendations. They have found that only 3.5% of emergency CS had a DDI 30minutes with a median of 82 minutes. The exception in this study was the finding of a significant shorter time intervals for caesarean delivery performed for non- reassuring fetal Heart Rate (NRFHR) (15).

A study performed in Thailand reported no differences on the fetal and the neonatal complications when looking at the decision-to-operating room interval (DRI), decision-to-incision interval (DII), and DDI (15). However, they have noted that all the interval time were tremendously shorter during after office hours. A study by Furukawa *et al*., on perinatal outcome in abruption placenta revealed differences in perinatal complications among the women who had hypertension, preterm labour or membrane rupture (18). In their study the finding of clinically low risk women who were more likely to experience more severe neonatal outcomes including a high incidence of IFUD, fibrinogen at <150 mg/dl, umbilical artery (UA) pH <7.1, and a low Apgar score came at as a surprise (18).

2.7. JUSTIFICATION OF THE STUDY

From the literature, there is an identified gaps in the knowledge about the impact of decision to delivery time in patients with PA and its impact on women with clinical diagnosis of PA with a live fetus. To the best of our understanding, there has been no previous studies done in our institution or South Africa. It is hoped that the results of this study will assist in designing a pragmatic way of managing patients with PA which could help improve maternal, fetal and neonatal outcomes.

3. AIMS OF THE STUDY

The Primary aim of the study is to determine the impact of diagnosis-to-delivery time on Neonatal outcome as well as maternal morbidity and mortality in patients with Abruptio placenta at Charlotte Maxeke Johannesburg Academic Hospital (CMJAH).

4. STUDY OBJECTIVES

1. To determine diagnosis to delivery time among women diagnosed with abruptio placenta
2. To describe maternal profile of pregnant women diagnosed and managed for abruption placenta.
3. To describe the common risk factors for Abruption placenta among the study population.
4. To describe adverse maternal, fetal and neonatal outcomes associated with placental abruption
5. To determine the waiting time interval where adverse maternal, fetal and neonatal outcome were observed.

5. RESEARCH METHODOLOGY

5.1 Study design

This will be a quantitative retrospective cross-sectional descriptive study encompassing record review over the period of four years with no follow up.

5.2 Study Setting

The study will be performed at the Department of Obstetrics and Gynecology at CMJAH. CMJAH is a tertiary/teaching Hospital of the University of Witwatersrand. The Obstetric unit is a referral center for level 2 hospitals, Midwife Obstetric Unit (MOU) and private institutions; hence the majority of patients are high risk and complicated cases.

5.3 Study Population

Study population will constitute women who had a clinical diagnosis of placental abruption on admission and delivered at the CMJAH between 01 January 2017 and 01 January 2020.

5.2.1. Inclusion criteria:

- Only patients with confirmed placental abruption (with a live fetus) based on the presence of the retroplacental clot(s) or histological evidence of placental abruption.

5.2.2. Exclusion criteria:

- Women with suspected diagnosis of placenta abruption on admission but the presence of a retroplacental clots was not confirmed at delivery
- Women with no histological evidence of placental abruption
- All patients with incomplete records will be excluded as well as all deliveries that occurred outside the study period

5.4 DATA COLLECTION AND ANALYSIS

Data will be collected retrospectively from the admission records in admission ward (162), labour ward (166) and Antenatal admission ward (194). Delivery and surgery records will be retrieved from theatre notes and labour ward notes. Neonatal outcome (immediate and intermediate) records will be collected from Transitional intensive care unit (TICU) and Neonatal intensive care unit (NICU). All histological report if not available from records will be retrieved from the online national health laboratory service (NHLS) Laboratory Tracking system.

Data will be collected through a questionnaire (Appendix A) and transferred into the Red CPA system. No patients will be interviewed.

Data that will be retrieved from medical records, include; baseline characteristics, obstetric data, antenatal and intrapartum characteristics, mode of birth, and neonatal complications.

The diagnosis-to-delivery will be recorded and reviewed including place where diagnosis was made, decision to delivery time, theatre arrival time and delivery time. The diagnosis-to-delivery time will be classified according to whether PA occurs during working hours or after hours. Diagnosis to delivery time will be categorized into < than 30 minutes, between 30 minutes and 1 hour, between 1 hour and 2 hours and more than 2 hours.

9. ETHICS

Ethical Approval will be obtained from the Human Research Ethics Committee (HREC) of the University of Witwatersrand before the study commences. Permission to access patient's record will be sorted with the Office of the chief executive officer (CEO) of CHMJAH and the Clinical head of department (HOD) of Obstetrics and Gynaecology. Permission to access histological report and other results will be requested from the Anatomical Pathology Department of the University of Witwatersrand. The study will be registered with the National Research Health Database (NRHD).

10. FUNDING

All costs of the research including travel to data collection site, print and stationary, will be the responsibility of the researcher. There will be no sponsorship or funding from external sources.

11. TIMELINES

2020	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Development of protocol	✓	✓	✓	✓						

Submission					✓	✓				
Correction							✓			
Ethics Application								✓		
collection of data									✓	
analysis of data										✓
Write up										✓

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APPENDIX B: Data Collection Tool

Site at which PA was diagnosed

Midwife Obstetric Unit (MOU)_____

Clinic_____

Level 1 hospital_____

Level 2 hospital_____

Level 3 hospital_____

Evidence RPC/PA_____

Clinical Evidence of RPC/PA_____

Hist. Dx PA/RPC_____

Presentation and risk factors_____

Fetus alive_____

Fetus demised_____

Fetus demised before arrive to CMJAH_____

Fetus demised in transit_____

Fetus demised at CMJAH_____

Hx abruptio placenta_____

Trauma_____

PAHU_____

PVB_____

No_____

Yes_____

Clots_____

Abd. Pain_____

Hard abdomen_____

Excessive Contraction_____

Blood pressure at dx_____

Pulse_____

Proteinuria_____

UPCR_____

Abdominal distension_____

SFH_____

HOF_____

In labour on admission_____

In labour at dx:_____

Maternal profile and adverse outcomes

Maternal age_____

Race_____

BMI_____

MUAC_____

Weight_____

Prev. PA_____

Smoking_____

Number of cigarettes_____

OH use_____

Drugs_____

Socioeconomic

High_____

Average_____

Low_____

Parity_____

Gravidity_____

Twins_____

Tx lies_____

Bx_____

Oblique lie_____

RPR_____

Non-reactive_____

Reactive_____

Titre_____

Tx_____

Rh_____

Negative_____

Positive_____

A/B_____

Titre_____

Maternal comorbidity

RVD_____

Reactive_____

Tx_____

Anaemia_____

Asthma_____

Renal dx_____

PPROM_____

PROM_____

Chorioamnionitis_____

Oligohydramnios_____

Polyhydramnios_____

PAHU_____

IOL_____

Misoprostol_____

Prostaglandin_____

Bulb_____

Oxytocin_____

Other_____

Prev. PA_____

Previous T1M/C_____

Prev. T2 M/C_____

Prev. preterm delivery_____

Prev. SB_____

PALS screen_____

ANA_____

SLE screen_____

Cardiac (lesion)_____

HPT_____

GHPT_____

CHPT_____

SIPET_____

PET_____

LOPET_____

EOPET_____

PET (+ SF)_____

Eclampsia_____

Number of seizures_____

Use of mgso4_____

DM_____

T1_____

T2_____

Overt_____

GDM_____

Epilepsy_____

Other_____

Delivery

Gest. Age_____

Fetus alive_____

Fetus demised_____

CS_____

Indications for CS_____

Midline incision_____

Lower midline_____

Upper midline_____

Pfannenstiel incision_____

Joe Coel incision_____

Prev. CS_____

Pre. CS x1_____

Prev. CS x2_____

Prev. CS 3_____

Prev. CS x4_____

Adhesions_____

Classical incision_____

EBL_____

PPH_____

Difficult operation_____

Atonic uterus_____

B-lynch_____

Uterine artery ligation_____

Internal artery ligation_____

Type of anaesthesia_____

Spinal_____

General _____

Failed spinal_____

Shock_____

Hypotension (Systolic BP <90)_____

MPA_____

Use of vasopressors_____

Massive transfusion (4:4:1)_____

Evidence RPC/PA_____

Number of RBC transfused_____

Number of platelets transfused_____

Number cryoprecipitate transfuse_____

Single layer uterine closure_____

Double layer of uterine closure_____

Closure of visceral peritoneum_____

Closure of the parietal peritoneum_____

Skin closure_____

S/C_____

Interrupted_____

Staples_____

Vaginal delivery

Gest. Age_____

Evidence of RPC/PA_____

Induced_____

Misoprostol_____

Prostaglandin_____

Bulb catheter_____

Other_____

Spontaneous_____

Assisted vaginal delivery

Forceps_____

Kiwi_____

Vacuum_____

EBL_____

PPH_____

Cyclokapron_____

Barkri_____

Uterine Atonic_____

Perineal Tears_____

1st _____

2nd _____

3rd _____

3A _____

3B _____

3C _____

4th _____

Unclassified _____

Hypotension _____

Shock _____

Blood transfusion _____

Vasopressors _____

Adverse maternal outcomes

PPH _____

Couvelaire uterus _____

Hysterectomy _____

HCA admission _____

ICU admission _____

AKI _____

Ur _____

Cr _____

HELLP syndrome

Plat

Haptoglobin

ALT

AST

Peripheral smear

Ventilation

Blood and blood products transfusion

DIC

Preoperative shock

Hypotension (BP <90)

MPA (<65)

Use of adrenalin

Use of other vasopressors

Intraoperative shock

Hypotension (BP <90)

MPA (<65)

Use of adrenalin_____

Use of other vasopressors_____

Cyclokapron_____

Other drugs_____

Demise_____

Time maternal death dx_____

Fetal profile and adverse outcome

Fetal weight_____

Preterm fetus_____

Fetal demise_____

Fetus demised on transit_____

Fetus demised at the base_____

Fetus demised at CMJAH_____

FGR_____

SGA_____

Fetal congenital abnormalities_____

Adverse neonatal outcomes

Preterm neonate_____

Term neonate_____

Weight_____

PAgar score_____

1min_____

5min_____

10min_____

Resuscitation performed_____

FSB_____

MSB_____

END_____

LNND_____

TU admission_____

NICU_____

Ventilation_____

Neonatal abnormalities_____

Study times

Induction of GA to intubation time_____

Office hrs_____

Normal office hrs_____

Time of diagnosis_____

Time of dx fetus death_____

Time the base called CMJAH for transfer_____

Time the ambulance arrived at the base_____

Time the patient/ambulance arrived to CMJAH_____

Time pt attended by sister_____

Time pt attended by doc._____

Time patient booked for C/S_____

Time porters were called to fetch patient_____

Time patient fetched to OT_____

Time pt arrived to OT_____

Time pt on theatre table_____

Time for induction of anaesthesia_____

Time of completion of GA_____

Time of induction of spinal_____

Time of completion of spinal_____

Time the surgery was started_____

Time the senior was called surgery_____

Time the senior arrived to theatre_____

Time the consultant was called_____

Time consultant arrived to OT_____

Time the baby was delivered_____

Time the surgery was completed_____

Time labour started_____

Time baby delivered_____

APPENDIX C: International Journal of Obstetrics and Gynaecology (IJOG) Author Guidelines

5.1. Clinical articles

For information on clinical trials, please also see section **5.1.1. Clinical trials** below.

Observational studies in epidemiology (cohort, case-control, and cross-sectional studies) should follow the STROBE statement and checklist.

Clinical Articles should discuss original research, and must include the following elements:

- **Title**

The title of the manuscript should include the subtitle 'Randomized controlled trial' or 'Clinical trial'.

- **Authors**
  - Primary research studies carried out in **low-/middle-income countries** must have at least one local co-author.
- **Author affiliations**
  - Please list department, institution, city, country only.
- **Corresponding author info**
  - Only one corresponding author should be listed. The corresponding author listed in the manuscript file must match the corresponding author listed in Editorial Manager.
  - Full postal address and email address should be listed.
- **Structured abstract**
  - Headings: Objective; Methods; Results; and Conclusion.
  - Guideline word count: Up to 250 words.
- **Keywords**
  - Guideline: Up to 8 keywords. At least 3 keywords must be included.
- **Main text**
  - Guideline word count: Up to 2500 words
  - Continuous line numbering used throughout
  - Citations: in-text references listed using Arabic numerals in square brackets (e.g. [1,2]), OR using superscript reference indicators (e.g. [1,2]). Do not use parentheses (curved brackets).
  - No footnotes
  - Main headings:
    - *Introduction*

    - Present the background to the study briefly, supported by a limited number of references. State the rationale for the study, and include the study objectives and hypothesis at the end of this section.
- *Materials and methods*
    - State the type of study at the beginning of this section (e.g., retrospective cohort study).
    - Describe concisely the study setting, dates (day, month and year), participants, methods and procedures, and statistical methods. Where Appropriate, state the program used for statistical analysis (including model and version number), and the cut-off for statistical significance. This section should include sufficient detail to allow others to replicate the study.
    - For studies of patients, patient records, or volunteers, include a statement of **prospective** local Ethics Committee Approval (including full name of Committee).
    - For studies with human participants, include a statement about informed consent. If consent was not needed/obtained, include an explanation. Authors must provide copies of the Appropriate documentation if requested.
- *Results*
    - Include the outcome of the study and statistical significance, if appropriate.
    - Tables and figures should be cited here in order, to illustrate the outcomes and supplement the text.
- *Discussion*
    - Discuss the relevance of the results. Compare with previously published studies; discuss strengths and limitations of the study; address any proposals for future research where relevant.
- *Conclusions*
    - Discussion and Conclusions sections may be formatted as one section as preferred.
    - Briefly state the key findings of the study, and major implications for clinical practice/research where relevant.
- **Author contributions:** List each author's role in the design, planning, conduct, data analysis, and manuscript writing. Ensure that all authors meet the **ICMJE criteria for authorship** (anyone who does not fulfil all four criteria should be moved to an Acknowledgments section).

- **Funding:** All sources of funding received for the research, authorship, and/or publication of the article must be listed here. This should match any funding sources listed in Editorial Manager. If no funding was received for the research, state 'None'.
- **Conflict of interest:** List any relationships that may be deemed COIs, or state 'The authors have no conflicts of interest'.
- **References:** See **6.3. References** for reference style. Guideline: up to 25 references.
- **Figures and tables:** See Figures and Tables sections below for further information.

(https://obgyn.onlinelibrary.wiley.com/hub/journal/18793479/about/author-guidelines)

APPENDIX D: ETHICS CLEARANCE CERTIFICATE

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

f
R14/49 Dr MV Shongwe

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)
CLEARANCE CERTIFICATE NO. M200940

NAME: (Principal Investigator)	Dr MV Shongwe
DEPARTMENT:	School of Clinical Medicine Department of Obstetrics and Gynaecology Medical School University
PROJECT TITLE:	The impact of diagnosis-to-delivery time on neonatal outcomes as well as maternal morbidity in patients with abruptio placenta
DATE CONSIDERED:	2020/10/02
DECISION:	Approved unconditionally
CONDITIONS:	
SUPERVISOR:	Professor L Chauke and Dr L Mbodi
APPROVED BY:	Dr CB Penny, Chairperson, HREC (Medical)
DATE OF APPROVAL:	2020/11/05

This clearance certificate is valid for 5 years from the 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 the 3rd Floor, Phillip Tobias Building, Parktown, University of the Witwatersrand, Johannesburg.
I/we fully understand the conditions under which I am/we are authorized 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 submit details to the Committee. **I agree to submit a yearly progress report**. When a funder requires annual re-certification, the application date will be one year after the date when the study was initially reviewed. In this case, the study was initially reviewed in **September** and will therefore reports and re-certification will be due early in the month of **September** each year. Unreported changes to the application may invalidate the clearance given by the HREC (Medical).

APPENDIX E: LETTER OF PAPROVAL FROM THE CEO

GAUTENG PROVINCE
HEALTH
REPUBLIC OF SOUTH AFRICA

CHARLOTTE MAXEKE JOHANNESBURG ACADEMIC HOSPITAL (CMJAH)
Office of the Clinical Director

Enquiries: Ms. TT Mahlangu
Tel: (011) 488-3365
Email: Thandi.Mahlangu4@gauteng.gov

Physical Address: Room 262A,17 Jubilee, Parktown 2193 Postal Address: Private Bag x39, Johannesburg 2000

23 July 2020

Dear Dr Mvumeleni Vincent Shongwe

STUDY TITTLE: The impact of diagnosis-to-delivery time on Neonatal outcome as well as maternal morbidity and mortality in patients with Abruptio placenta

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 office to grant you the final approval to conduct the study.

Supported/Not Supported

Dr PN Africa
Acting Clinical Director
Date: 23/07/2020

Approved/Not Approved

Ms. G Bogoshi
Chief Executive Officer
Date: 27.07.2020

APPENIDX F: LETTER FROM THE HOD O&G TO CONDUCT RESEARCH

GAUTENG PROVINCE

REPUBLIC OF SOUTH AFRICA

CHARLOTTE MAXEKE JOHANNESBURG ACADEMIC HOSPITAL

Office of the Head of Department: Obstetrics and Gynaecology
Enquiries: Prof. L. Chauke

Tel: 011 488-3179
Fax:011 643-2522

20 July 2020

Ms G. Bogoshi
CEO
Charlotte Maxeke Johannesburg Academic Hospital
Parktown
Johannesburg

Dear CEO

Re: Request to conduct research titled:

Permission to obtain: The impact of diagnosis-to-delivery time on Neonatal outcome as well as maternal morbidity and mortality in patients with Abruptio placenta: : -
Dr Mvumeleni Vincent Shongwe.

The above matter refers. I have looked at the protocol and **satisfied to recommend** that he be granted permission to conduct the study as proposed. The candidate has also satisfied the requirements of the Wits Human Research Committee.

Thank you

Prof. H. L. Chauke
Chief Specialist and Clinical Head
Department of Obstetrics and Gynaecology
Charlotte Maxeke Johannesburg Hospital and the University of the Witwatersrand

APPENDIX G: Turnitin plagiarism report

ORIGINALITY REPORT

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SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

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APPENDIX H: Plagiarism Declaration

University of the Witwatersrand, Johannesburg

School of Clinical Medicine

SENATE PLAGIARISM POLICY

Declaration by Students

I Mvumeleni Vincent Shongwe (Student number:) am a student registered for MMed of Obstetrics and Gynaecology in the year: 2025. I hereby declare the following:

I am further confirming that all the work submitted for assessment for the above-mentioned course is my own work.

I have followed the required referencing format which is in accordance with the format stipulated by the University of the Witwatersrand.

I am aware that plagiarism is unacceptable and that the University of the Witwatersrand may take disciplinary action against me if it suspected that this is not my own unassisted work or that I have failed to Appreciate the source of the ideas or words used in this work.

Signature: Date: 04/08/2025