An audit of the indications for peripartum hysterectomies performed at a tertiary institution in Johannesburg, South Africa: a retrospective study

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A research report submitted to the Faculty of Health Sciences, University of the Witwatersrand, Johannesburg, in partial fulfilment of the requirements for the degree of Master of Medicine in Obstetrics and Gynaecology

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DECLARATION

I, Nakedi Rogers Mmabatswa , declare that this research report is my own original work and has not been submitted or published for any degree program or examination in any institution. I am submitting this research report in the submissible format with my protocol in the department of Obstetrics and Gynaecology at the University of theWitwatersrand, Johannesburg. Any literature work done by others and cited in this research report has been given due acknowledgement and listed in the references section.

NAKEDI ROGERS MMABATSWA

Signature 

Date:18 june 2024

DEDICATION

I dedicate this MMed to my late mother Makoena Sinah Mmabatswa for everything I am today, my wife Marcia Mmabatswa and my two daughters Remofilwe and Oabile Mmabatswa

RESEARCH OUTPUTS ARISING FROM THIS PROJECT

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Abstract

Background: Peripartum hysterectomy (PH), the surgical removal of the uterus during or shortly after childbirth, is a critical procedure in maternal healthcare. Definitions of PH vary globally leading to challenges in understanding its occurrence. Our study aimed to provide comprehensive insights into PH in a South African context, investigating indications, demographic characteristics, clinical and histopathological diagnoses, complications, and outcomes.

Methods: A retrospective record review study design was used, focusing on PH cases at a tertiary facility in Johannesburg, SA. The study period was between January 2018 and December 2020. Medical records were systematically examined to identify trends, indications, and outcomes associated with PH. Data collection encompassed demographic characteristics, obstetric history, clinical indications, clinical and histopathological diagnoses, and complications. Data analysis used descriptive statistics, interrater reliability tests and comparative findings with previous SA studies.

Results: The study included 56 peripartum women who underwent PH. Pregnancy-related sepsis emerged as the most common indication, with an 88.8% (16/18) histopathological confirmation rate. Abnormal placentation and uterine rupture were also common indications. Clinical and histopathological diagnoses exhibited a strong level of agreement (70.9%), emphasising the importance of accurate diagnostics. We found an evolving landscape of PH indications in South African clinical setting, with pregnancy related sepsis surpassing historical indications. We found a prevalence of maternal deaths amounting to 21.4% (12/56).

Conclusion: Our study found a shift in the primary historical indications such as uterine atony and uterine rupture in South Africa, with pregnancy-related sepsis emerging as the primary

indication in recent years. Clinical assessment complemented by histopathological findings remains critical for improved obstetric complication management.

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I am extremely fortunate and grateful to have married my wife Marcia Maserufe Mmabatswa, whose understanding and constant encouragement were sustaining factors in completing this research report.

To my daughters Remofilwe and Oabile thank you for giving me unlimited smiles, happiness and pleasure. Your sad faces when I had to lock myself and study pushed me to complete this research report.

List of tables

List of figures

Abbreviations

CMJAH-Charllotte Maxeke Johannesburg Academic Hospital

HIV-Human Immune Virus

ICU-Intensive Care Unit

IQR-inter-Quartile Range

LMIC-Low- and Middle-income countries

NHLS-National Health Laboratory Services

PH- Peripartum Hysterectomy

PPH-Postpartum Haemorrhage PRS-Pregnancy

Related Sepsis

SA-South Africa

TABLE OF CONTENTS

An audit of the indications for peripartum hysterectomies performed at a tertiary institution in Johannesburg, South Africa: Retrospective Study

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Conclusion: Our study found a shift in the primary historical indications such as uterine atony and uterine rupture in South Africa, with pregnancy-related sepsis emerging as the primary

indication in recent years. Clinical assessment complemented by histopathological findings remains critical for improved obstetric complication management.

Keywords: Peripartum Hysterectomy, Pregnancy Related sepsis, Histopathological diagnosis

Synopsis

There is a shift in historical indications of peripartum hysterectomy such as uterine atony and uterine rupture in South Africa, with pregnancy-related sepsis emerging as the primary indication in recent years.

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Introduction

Peripartum hysterectomy (PH), a surgical procedure involving the removal of the uterus either at the time of delivery or within 42 days postpartum, represents a critical intervention in maternal healthcare [1]. While initially designed as a last resort to address obstetric haemorrhage, the indications for PH have evolved to encompass a range of conditions complicating pregnancy [2]. However, the global definition of PH remains diverse, reflecting variations in regional practices. For instance, in developed nations such as the United Kingdom (UK), PH is defined by a 24-hour window from delivery, while in other countries, the focus is the surgical indication of obstetric haemorrhage alone [3-4].

Globally, the incidence of PH remains relatively low (1.1 per 1,000 births), yet its implications for maternal health are profound [5]. In high-resource settings, where obstetric care is robust, the most common indications for PH are complications related to abnormal placentation [6-7]. However, in middle-income countries, the aetiology is more diverse, with instances of uterine rupture emerging as a significant concern [8-10]. In the context of South Africa, studies have identified sepsis, uterine atony, and uterine rupture as the predominant indications for PH [11-12].

PH, given its potential to address life-threatening complications, warrants focused attention within the South African healthcare context. Existing studies conducted in South Africa have not comprehensively compared clinical indications with histological diagnoses in the context of PH [2,11], leaving a critical gap in our understanding of the procedure's underlying pathologies and potential strategies for improvement.

The primary objective of this study was to perform an audit of indications for PH at a tertiary facility. By systematically analysing data of PH cases, our study aimed to identify trends, factors, and common indications associated with this procedure. Additionally, the study sought to compare clinical indications with histological diagnoses.

Methods.

Study Design:

We used a retrospective descriptive record review study design to comprehensively investigate PH cases occurring between January 2018 and December 2020 at Charlotte Maxeke Johannesburg Academic Hospital (CMJAH), a tertiary academic hospital in Johannesburg, South Africa. This design facilitated an in-depth analysis of medical records, allowing for the identification of trends, indications, and outcomes associated with PH within the specified time frame.

Study Population and Setting:

The study's focus was on women who underwent PH at CMJAH, which serves as a prominent referral centre for the central Gauteng Province. The inclusion criteria required participants to have undergone PH at CMJAH when they were at least 24 weeks pregnant or within the first six weeks (42 days) following delivery, capturing both antenatal and postnatal PH cases.

Data Collection:

We undertook a thorough and systematic review of medical records, encompassing all women who underwent PH within the defined timeframe. Medical records were evaluated from various departments including the obstetric department and intensive care unit (ICU). Pathology reports were extracted from the National Health laboratory Service (Department of Anatomical Pathology).

Study variables:

The study incorporated a diverse range of variables to comprehensively explore PH among the study population. Demographic characteristics, obstetric history, delivery and obstetric complications, clinical indications for PH, clinical and histopathological diagnoses, immediate and intermediate complications, and ICU admissions were examined.

Data Management:

To facilitate data collection and management, a structured questionnaire was developed and programmed onto Redcap, a secure web-based application. The data collection sheets used in the study did not display any patient identifiers, ensuring the anonymity of the participants. Following data collection, the complete dataset was exported into Stata version 16.0 (Stata Corp, College Station, TX) software for analysis. All collected data were stored in a password-protected and encrypted data storage device to prevent unauthorised access and maintain data integrity. Access to the data was restricted to the research team.

Data Analysis:

The analysis of demographic characteristics and clinical factors used simple descriptive statistics. Categorical variables were summarised using frequencies and percentages, providing an overview of the distribution and prevalence of different categories. The continuous variables were analysed by calculating means (accompanied by standard deviations for normally distributed data) and medians (along with inter-quartile range [IQR] for non-normally distributed data).

The degree of agreement between clinical indications and histopathological diagnoses of PH was tested through the interrater reliability test by using both the percent agreement and Cohen kappa statistic[17]. A p-value of less than the level of significance of 5% ($\alpha < 0.05$) was

considered to indicate that the Cohen kappa statistic was statistically significant. This statistical measure assessed the level of concordance between the two diagnostic approaches, providing insights on the alignment and accuracy of clinical assessments with subsequent pathological findings.

To contextualise our findings, we conducted a comparative analysis with previous studies.

Ethical Considerations:

The study obtained ethical clearance (M210949) from the University of the Witwatersrand's Human Research Ethics Committee (Medical). Since the study involved a retrospective record review a waiver of consent alongside the ethical clearance to collect anonymised secondary data was obtained. Explicit permissions were obtained from the relevant hospital authorities and the National Health Laboratory Service. Utmost care was taken to protect patient confidentiality and to maintain anonymity during secondary data collection or analysis.

Results

Participant characteristics:

A group of 56 pregnant women who had undergone peripartum hysterectomy PH (total and subtotal hysterectomy) were investigated (Table 1). The median age of the study participants was 32 years (IQR: 25-35). The age distribution ranged from 16 to 41 years, with the majority (76.8%) falling within the age bracket of 18 to 35 years.

The median parity was 3 (IQR: 2-3), with multiparous women accounting for 87.0% (47/56) of cases. Gravidity exhibited a median of 3 (IQR: 2-4), with a majority of the cases (87.0%, 47/56) falling between 2 and 5. Antenatal attendees were a majority, 48/56 (85.7%) and 8/56(14.3%)were unbooked, of which 18/56 (34.0%) tested positive for HIV infection, with a median CD4 count of 450 (IQR: 357-

693) cells/µl. Large portion of the women living with HIV 44.4% (8/18) were virally suppressed at booking. The majority (76.8%, 43/56) of deliveries occurred at the study institution, with a median gestational age of 36 weeks (IQR: 33-38). Gestational age at delivery ranged from as early as 24 weeks to a full-term 42 weeks.

Mode of delivery and caesarean section indications:

The most common mode of delivery was caesarean section, accounting for 78.6% (44/56) of cases (Table 2). Emergency caesarean sections, constituted 93.2% (41/44) of all cases. The primary indication for emergency caesarean sections was a previous caesarean section, representing 35.7% (15/41) of cases, followed by foetal distress 19% (8/41).
(Table 3).

Pregnancy-Related Complications:

Pre-eclampsia emerged as the most frequent pregnancy-related complication, accounting for 26,8% (15/56) of cases followed by gestational diabetes mellitus, preterm premature rupture of membranes, postpartum haemorrhage (PPH), pregnancy related sepsis (PRS), and acute respiratory distress syndrome, each occurring in 9.7% to 12.9% of instances (Figure 1).

Clinical indications and concordance with histological findings

Clinical indications for PH encompassed uterine rupture, abnormal placentation, Postpartum haemorrhage (PPH), and Pregnancy related sepsis (PRS) with prevalence rates of 14.3% (8/56), 25.0% (14/56), 28.6% (16/56), and 32.1% (18/56), respectively (Figure 2). An in-detail analysis of concordance between clinical and histopathological diagnoses showed PRS to be the leading histopathologically confirmed indication (88.8%, 16/18), followed by abnormal placentation (71.4%, 10/14) (Table 4). In contrast, uterine rupture and PPH due to uterine atony displayed comparatively lower confirmation rates. If the determination of the clinical and histopathological diagnoses were made randomly by clinicians and pathologists, we would

expect the two approaches to agree on 21.7% of the patients. However, the interrater reliability test indicated an observed agreement percentage of 70.9%, indicating a strong level of agreement between the two diagnostic approaches (Cohen's kappa=0.629) [17]. The amount of agreement indicates that we can reject the null hypothesis that these determinations were made randomly (p value
<0.0001).

PH Complications:

Immediate complications post-PH predominantly encompassed haemorrhage 17.9%, (10/56) and bowel injury 19.6%, (11/56) (Table 5). Wound infection emerged as the principal intermediate complication (21.4%, 12/56). Of the participants, 26.8% (15/56) necessitated intensive care unit admission secondary to PH. We found a prevalence of maternal deaths amounting to 21.4% (12/56). The maternal deaths had a mean age of 30.5 years (SD = 7.37). Among these, 75.0% (9/12) were aged between 18-35 years, and 25.0% (3/12) were over 35. Of the 12 maternal deaths, 16.7% (2/12) were HIV positive, 66.7% (8/12) were HIV negative, and 16.7% (2/12) had an unknown HIV status. In terms of gravidity, 75.0% (9/12) were multigravida (2-5), 16.7% (2/12) were primigravida, and 8.3% (1/12) were multigravid (>5). Parity distribution showed that 8.3% (1/12) were nulliparous, 8.3% (1/12) were primiparous, 75.0% (9/12) were multiparous, and 8.3% (1/12) were grand multiparous.

Discussion

Our study provides comprehensive insights into the characteristics, indications, and outcomes of PH based on an analysis of a cohort of 56 pregnant women accessing obstetric care in tertiary hospital in South Africa. To our knowledge, it is the first study in South Africa to compare clinical indications with histopathological reports, highlighting a substantial diagnostic accuracy for PRS and other indications [2,11-12].

The demographic characteristics of the study participants reflect a broad spectrum of ages and ethnicities, emphasising that PH is not confined to a specific demographic [19] . We found a relatively high prevalence of HIV (34.0%) among the women included in our analysis compared to the South African prevalence estimates among female [20]. Potentially HIV patients may seem to have poor health seeking behaviours resulting late clinic presentation for intervention which leads to poor adverse outcomes.

Our findings reveal a notable shift in the landscape of PH indications at CMJAH during the study period, with PRS emerging as the most common indication, confirmed histopathologically in 88.9% of cases. The prevalence of PRS as the leading indication for PH is consistent with recent South African studies[2].

Abnormal placentation, confirmed in 71.4% of clinically diagnosed cases on histopathological examination, emerges as the second most common indication for PH. The diagnostic accuracy for abnormal placentation in our study was considered good. In contrast, histopathological confirmation rates for uterine rupture and PPH due to uterine atony were notably lower, revealing challenges in clinical diagnoses for these conditions [22]. This is an expected finding since there is no highly specific pathological findings associated with uterine rupture and PPH due to uterine atony.

Histopathologically confirmed uterine rupture accounted for 33.3% of PH indications, with a poor concordance between clinical and histopathological diagnoses [23]. This discrepancy suggests the possibility of PH being performed based on incorrect clinical assessments[23] or potentially due to the uterus having been incised after surgery which may affect interpretation histopathological findings. However, the presence of significant pathology in only a limited

number of cases raises questions about the appropriateness of hysterectomy as the primary intervention in these instances. Additionally, it emphasises the importance of providing pathologists with comprehensive clinical information to guide tissue sampling, potentially yielding more meaningful results [24].

The reported maternal mortality rate in our study was 21.4%, aligning with figures from similar settings in South Africa and Nigeria[1] . However, this rate is notably higher than that observed in developed countries[5]. It is essential to acknowledge the challenge of differentiating between deaths directly attributed to hysterectomy and those stemming from underlying pathologies. Although our study lacked exact post-mortem results, we speculate that hemorrhage significantly contributed to the maternal death given that PPH was a leading indication for peripartum hysterectomy among the maternal deaths

The substantial shift in the primary indication for peripartum hysterectomy (PH) observed over different time periods in South Africa carries significant implications for maternal healthcare.

Historically, uterine atony and uterine rupture held their place as the predominant reasons for PH[11] . However, our recent study (2018-2020) and previous research conducted from 20092014 revealed a noteworthy transformation, with PRS emerging as the leading indication for PH [2]. The increasing prominence of sepsis as an indication for PH may be linked to factors such as non-sterile obstetric practices, antibiotic resistance, non-suppressed HIV status and overall healthcare infrastructure.

Despite our efforts to ensure data accuracy and comprehensiveness, the inherent limitations of retrospective data collection cannot be entirely mitigated. Secondly, the study's single-centre design may limit the generalisation of our findings to broader geographic or healthcare contexts within the country. The small sample size of 56 cases may impact the precision of prevalence estimates and limit the ability to detect less common indications or outcomes. Finally the study's inability to differentiate between deaths directly attributed to hysterectomy and those resulting from underlying pathologies is a notable limitation when assessing maternal mortality associated with PH. Despite these limitations, our study provides valuable insights into the changing landscape of PH indications in South Africa and highlights the need for continued research in this critical area of maternal healthcare.

Conclusion

The most common cause of PH was PRS. Our findings also show the importance of histopathological reports not only in confirming clinical diagnoses but influencing a more focused PH management approach[18]. Despite advancements in obstetric care, PH remains a critical procedure associated with maternal mortality and morbidity[13] .

Despite limitations, this research contributes valuable insights for the need of continued exploration of PH in maternal healthcare particularly in underdeveloped settings.

Contributions

RNM contributed substantially to the study conceptualisation and design; data collection and processing; data analysis; and wrote the initial draft of this journal article. SB was responsible for overseeing implementation of the study and provided guidance from study conceptualisation to data analysis; and she also reviewed and contributed to the final writeup. RW contributed to the study conceptualisation, reviewed and assisted with interpretation of histology specimens; and also contributed to the final writeup.

Declaration. The research for this study was done in partial fulfilment of the requirements for Mmabatswa Nakedi Rogers's MMED O&G at the University of the Witwatersrand.

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Conflicts of interest. None to declare

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Table 1 Participant demographic and obstetric characteristics

Characteristic	Metrics
Age (Years), n (%)	
Median (IQR)	*32 (25-35)*
<18	1 (1.8%)
18-35	43 (76.8%)
>35	12 (21.4%)

Race, n (%)	
African	53 (94.6%)
Indian	1 (1.8%)
Caucasian	1 (1.8%)
Coloured	1 (1.8%)
Parity, n (%)	
Median (IQR)	*3 (2-3)*
Nulliparous (0)	2 (3.8%)
Primiparous (1)	6 (11.4%)
Multiparous (2-5)	47 (87.0%)
Grand multiparous (>5)	1 (1.9%)
Gravidity, n (%)	
Median (IQR)	*3 (2-4)*
Primigravid (1)	6 (9.3%)
Multigravida (2-5)	47 (87.0%)
Multigravida (>5)	3 (3.7%)
Antenatal care clinic attendance, n (%)	48 (86.8%)

Table 2 Modes of delivery of women who underwent hysterectomy (N=56)

Parameter	Metric
Median (IQR) estimated gestational age at delivery (weeks)	36 (33-38)
Mode of delivery, n (%)	
Normal Vaginal Delivery	8 (14.3)
Assisted Vaginal Delivery	1 (1.8)
Caesarean section	44 (78.6)

Vaginal Birth After Caesarean	2 (3.6)
Not recorded	1 (1.8)

Table 3 Indications of caesarean sections

	N (%)
Type of Caesarean section (n=44)	
Emergency	41(93.2)
Elective	3 (6.8)
Indications of Emergency Caesarean (n=42)	
Foetal Distress	8 (19.0)
Previous caesarean section	15 (35.7)
Cephalic Pelvic Disproportion	2 (4.8)
Breech	2 (4.8)
Antepartum haemorrhage	6 (14.3)
Placenta previa	4 (9.5)
Multiple pregnancy	1 (2.4))
Not recorded	4(9.5)

Table 4 Comparison of histopathological findings and clinical indications.

Description	Clinical Indication N	Histopathological Confirmation n (%)	No histopathological Confirmation n (%)
Postpartum haemorrhage	16 (28.6%)	10 (62.5%)	Normal postpartum uterus 6 (37.5%)
Abnormal placentation	14 (25%)	10 (71.4%)	Normal postpartum uterus 4 (28.6%)

Uterine rupture	8 (14.3%)	3 (37.5%)	PRS 1 (12.5%) Uterine atony 1 (12.5%) Abnormal placentation 1 (12.5%) Not recorded 2 (25.0%)
Pregnancy related sepsis (PRS)	18 (32.1%)	16 (88.8%)	Uterine atony 1 (5.6%) Normal postpartum uterus 1 (5.6%)

; Cohen's kappa :

Table 5: Maternal outcomes and complications associated with PH (N=56)

Complication type	n (%)
Immediate	
Bleeding	10 (17.9)
Bladder injury	3 (5.4)
Ureteric injury	5 (8.9)
Bowel injury	11 (19.6)
Intermediate	
Wound infection	12 (21.4)
Ileus	5 (8.9)
Death	12 (21.4)
Intensive Care Unit admission	15 (26.8)

Table 6 Historical comparison of Indications of peripartum hysterectomy in South Africa

Indication	Year of study

	MH Sebitloane et. al (1993-1998) King Edward hospital(tertiary)	JN Wandabwa, et. Al (Feb 2007- Jan 2009) Nelson Mandela Academic Hospital	LJ Van Vuuren et. al (Feb 2009- Mar 2014) Tygerberg academic hospital	Present study (2018-2020) CMJAH
Uterine atony	31 %	30.6%	15.9%	28.6%
Unclassified Haemorrhage	-	9.7%	4.0%	-
Uterine rupture	32.4%	25.8%	5.2%	14.3%
Pregnancyrelated Sepsis	23.9%	27.4%	39.7%	32.1%
Tears	-	-	9.2%	-
Placenta abnormalities	12.7%	6.5%	18.5%	25.0%
Unknown	-	-	7.5%	-

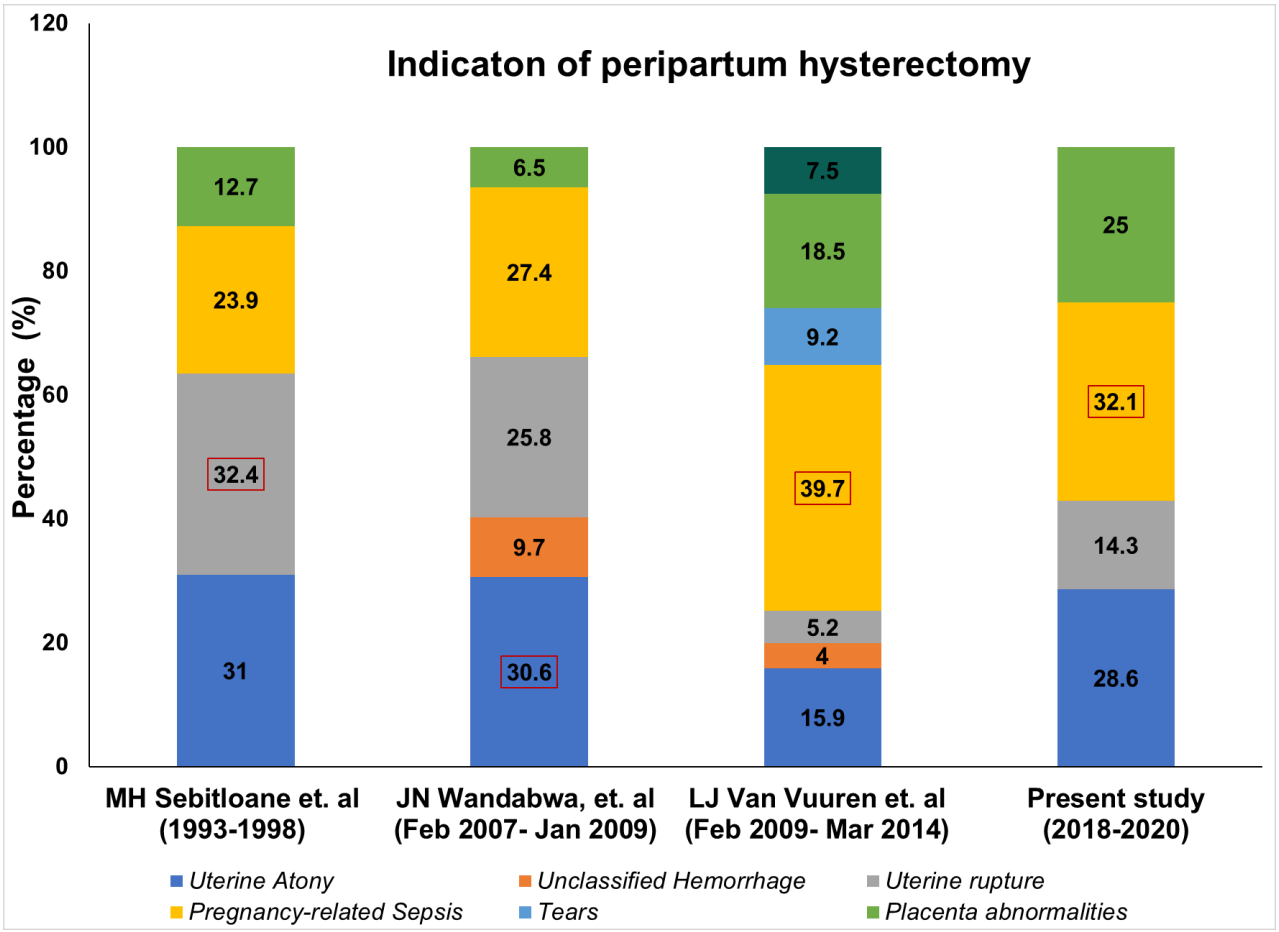

Figure 3 Main indications of peripartum hysterectomy in South Africa over time

APPENDICES Appendix A: Approved Protocol

2.Literature Review

2.1. Introduction.

Peripartum hysterectomy (PH) can be defined as the removal of the corpus uteri alone or with the cervix at the time of a Caesarean Section (CS) or within the puerperium. The removal of the uterus at CS is referred to as caesarean hysterectomy, while the removal after vaginal birth is called PH. The operation may be performed as an emergency or as a planned procedure (1,2).

It is usually performed for severe obstetric complications such as major obstetric haemorrhage (OH) and pregnancy related sepsis (PRS) (3). It represents a major operation in modern obstetric practice, being associated with loss of fertility, which may cause psychologic trauma, and the risk of multi-organ failure and death.

Peripartum Hysterectomy due to Obstetric Haemorrhage.

Globally, (OH) is a leading cause of preventable maternal mortality. (4) In South Africa (S.A) OH, followed by hypertensive disorders, are major direct causes of maternal morbidity and have not decreased significantly over the past few years and is the most preventable of all maternal deaths. (5) In 2014, concern was expressed about the large numbers of deaths from bleeding associated with caesarean delivery (CD), which has also been emphasized by several international research studies. (6,7).

Table 1. The major causal groups of death from OH in SA (8).

Category	Percentage of OH %	Maternal mortality ratio (MMR) per 100,00

Postpartum haemorrhage (PPH) following vaginal delivery	36,4	7,0
Bleeding associated with caesarean delivery (BLDACD)	34.7	6,6
Antepartum haemorrhage (APH)	17.2	3,4
Ruptured uterus	11.2	2,1

Emergency hysterectomy was performed in 25% of all OH deaths (27% of deaths from BLDACD and 17.2% of women dying from PPH after vaginal delivery) (8).

Peripartum Hysterectomy due to Pregnancy related sepsis.

Previous reports including the Saving Mothers Reports consistently use the term "pregnancyrelated sepsis" Deaths from pregnancy related sepsis (PRS) are those caused by infections in the genital tract or in tissues involved in the birth process in viable pregnancies (8). Viability is usually defined as that gestational age where at least 50% of babies born alive will survive until discharge from neonatal services (8).

In an attempt to standardise the definition of deaths associated with maternal sepsis, the world health organization (WHO) defines maternal sepsis as "life-threatening organ dysfunction resulting from infection during pregnancy, childbirth, post-abortion or postpartum" (9).

S.A statistics between 2017 and 2019, indicated that 170 women died as a result of PRS and this is at least 31 deaths less than that in 2014-2016 period and is the lowest amongst all the

previous triennial reports. The number of deaths due to PRS decreased every triennium since 2008-2010 (n=258), 2011-2013 (n=226), 2014-2016 (n=205) and 2017-2019 (n=170). (3) Maternal deaths due to PRS in viable pregnancies in S.A show a slow but steady decline. (8)

The true global burden of maternal sepsis remains to be determined. Accurate case identification has been hindered by shifting definitions and diagnostic failures; even so, the existing statistics are alarming (10).

The mainstay management of maternal sepsis is organ supportive with a significant onus on early recognition and correction of sepsis. Management consists of two key approaches: resuscitation and source control, (which may include PH). (11)

2.2. Prevalence and Incidence

A worldwide systematic review and meta-analysis, showed that prevalence of PH (19802015) differed between poorer (low and lower middle income) and richer (upper middle and high income) settings, with: 2.8 PH performed compared with 0.7 per 1,000 deliveries respectively (12).

High income countries such as the United States have a low PH incidence rate of approximately 0.77- 2.28/1000 deliveries (13). In low- and middle-income countries, PH incidence is high, ranging from 2 to 6 per 1000 deliveries (14).

African countries have recorded higher PH incidence rates Ghana and Nigeria have reported an incidence of 4.34/1000 deliveries and 6.2/1000 deliveries respectively (13,14)

In SA, there is a wide variation in the incidence of PH amongst the different provinces probably because of different study periods. The reported S.A PH incidence rates of 1.2/1000 deliveries (15) and 1.5/1000 deliveries (16) are some of the lowest incidence rates in the African continent.

This could be attributed to the disparity in accessibility and availability of various modern obstetric service like uterine artery embolization, family planning and antenatal care (ANC) facilities.

2.3. Risk Factors Peripartum hysterectomy.

2.3.1 Caesarean section

Several studies have suggested an association of PH with previous delivery by CD (17) The risk of PH increases with the number of previous CD. There is an increased incidence of previous CS in patients with placenta praevia and in patients with adherent placenta (17).

2.3.2. Other Uterine Surgery

There is limited evidence, that other previous uterine surgery, (18) including uterine curettage, (19) predisposes to PH.

2.3.3 Other risk factors

Other risk factors for PH includes advance maternal age, abnormal placentation, and higher parity. (12)

2.4 Indications of PH 2.4.1

PPH

2.4.1.1.PPH definition

WHO defines PPH as “blood loss greater than or equal to 500 ml within 24 hours after birth”, and severe PPH as “blood loss greater than or equal to 1 000 ml within 24 hours (20)

2.4.1.2. Prevention of PPH

Active management of the third stage of labour with 10 IU intramuscular oxytocin reduces the risk of PPH by 60% and should be employed routinely for birth at a facility (21).

2.4.1.3 non-medical interventions for PPH in the labour ward

These interventions, includes the following: manual removal of the placenta, bimanual compression, aortic compression, repair of perineal tears and balloon tamponade. The last can involve purpose-made devices, such as the Ellavi balloon (Sinapi, SA), Rusch catheter (Teleflex Medical, USA) or Bakri balloon (Cook Medical, USA), or 'home-made' devices that use condoms or surgical gloves to make the balloon for tamponade. (22)

2.4.1.4 Medical treatment of PPH

This includes uterotonic drugs (oxytocin, ergometrine, prostaglandin F2 alpha) to contract the uterus, which are given sequentially; followed 10 - 15 minutes later by an oxytocin infusion if there is no response after oxytocin/ergometrine or ergometrine only if no contraindications exist), Tranexamic acid, a fibrinolytic inhibitor, was not previously in the SA PPH protocol, but the WOMAN trial (23) indicated that it reduces PPH mortality compared with placebo when administered in addition to standard therapy. A dedicated WHO guideline (24) specifies the importance of using it early in the PPH algorithmic approach, as its effect is reduced if given after 3 hours of onset of PPH. It is now included in the new SA PPH protocol.

2.4.1.5. Surgical interventions for PPH

If bleeding persists despite all medical and non-medical interventions, surgical intervention is paramount. Early recourse to theatre is needed, especially in cases of haemorrhage secondary to retained placenta, retained products or trauma not amenable to repair in the labour ward, e.g., deep vaginal tears or suspected cervical/ uterine trauma. (25)

Surgical interventions depend on the intraoperative findings. e.g., for an atonic uterus, compression sutures can be placed, a balloon tamponade can be placed insitu- for suspected placental site bleeding followed by stepwise uterine artery systemic devascularisation or to proceed subtotal hysterectomy. Bleeding at the uterine incision site can be managed conservatively by opening the uterine incision to identify bleeding arteries and seize bleeding with haemostatic sutures. (25)

Hysterectomy is a life-saving procedure that must be done when the abovementioned conservative surgical measures fail, or immediately in cases of catastrophic haemorrhage secondary to extensive uterine rupture or placenta increta/ percreta (26).

2.4.2 Abnormal placentation

With the rising CS rate and the rising incidence of placenta praevia and accreta and the more severe forms of increta and percreta, associated with previous CS, recent studies have indicated a change in the trend towards abnormal placentation as the most common indication for emergency and planned PH. In the absence of risk factors, early diagnosis of placental abnormalities is difficult. Unfortunately, the diagnosis of placenta increta and percreta is frequently established only after unsuccessful removal of the placenta at delivery (27).

2.4.3. Uterine rupture

Uterine rupture is associated with maternal and perinatal mortality and morbidity worldwide, particularly in developing countries. The most common cause of uterine rupture is tear of a previous CS scar after a trial of labour in a patient with a previous CS. Rupture of an unscarred uterus is rare. It may occur in obstructed, multiparous labour and in response to inappropriate use of oxytocic agents. Its incidence decreases with improve- ment in obstetric practice (28).

2.4.4. Extension of the lower uterine segment incision.

PH may be necessary in cases of lateral extension of the lower uterine segment incision, when the CS is performed with the foetal head deeply impacted in the pelvis in the second stage of labour. The tear may extend to branches of the uterine arteries. Haemostasis may be challenging and injuries to the ureters are possible. Broad ligament haematoma formation is not an uncommon occurrence (28).

2.4.5. Pregnancy Related Sepsis

A puerperal infection is a more generalised term which incorporates three groups of infections:

. Infections of the genital-urinary systems related to labour, delivery and the puerperium;

. infections related to the birth process but not of the Genito-urinary system e.g., breast abscess, wound sepsis, septic thrombophlebitis, respiratory tract infection, or drip site sepsis.

. incidental infections e.g., influenza and meningitis.

Sepsis is an important aetiology for a PH, particularly in S.A. The high rate of sepsis may be aligned with incidence of HIV infections in the community. Low socio-economic standards, limit access to healthcare which result in, late diagnosis of complications. Sterility issues in the labour ward and CS theatre also contribute to PRS. (29)

2.5 Outcome and Complications of PH

Surgical complications may be aggravated by placental pathology distorting the lower uterine segment. The pelvic anatomy can also be compromised and due to increased blood supply to pelvic organs during pregnancy, haemorrhage poses a greater risk morbidity and mortality. (30)

2.5.1 Intraoperative complications.

It is understandable that PH, often carried out due to unexpected emergencies, would have unavoidable complications. The most frequent, by far, is excessive bleeding, observed in 23% of this series, and reported in almost all referenced publications (31,32).

The next more frequently reported complication affects the bladder and ureters. The 5% of these in this series falls within the range of 2-9% seen in previously reported works (31,32). Less commonly reported occurrences are bowel injuries (31), laceration of large pelvic vessels, or infundibulopelvic ligaments. (32).

2.5.2 Postoperative complications.

The morbidity observed following this operation is very high and varies, from bleeding to wound infection/dehiscence urinary tract infections and ileus (31,32). Many complications may require a re-operation for definitive management, in particular bleeding, infections or fistula repair.

A small number of deaths could be expected among patients given this operation because most of the cases done are indicated for the more severe types of life saving emergencies seen in obstetrics (31,32).

2.6. Reason for study.

PH is a near-miss maternal event that is performed to prevent maternal death and because of the risks and dangers associated with PH, it has become necessary to audit these cases with a view to reducing maternal mortality and morbidity by anticipating and preventing the complications that may arise.

3.Justification for the Study

Non-pregnancy related infection, pregnancy related infection and maternal haemorrhage are among the top five leading causes of maternal deaths in SA. These disease profiles may warrant PH as a lifesaving strategy. There is limited research to evaluate the indications and complications of PH in the South African setting: -The only recorded research within the Gauteng Province was undertaken in 1996 at GA Rankuwa Hospital, Pretoria (renamed Dr George Mukhari). Further research will contribute to the establishment of PH protocol.

4. Aims and Objectives

The aim of the study is to audit indications and risk factors, and to compare histological findings to the clinical indication, whilst estimating the incidence and complications associated with PH.

4.1 Objectives

4.1.1. To describe why PH was performed.

4.1.2. To assess the histopathological findings in relation to clinical indication

4.1.3. To assess the microbiology, culture and sensitivity results in relation to clinical indications for PH.

4.1.4. To describe the risk factors contributing to PH

4.1.5. To describe the profile of women who underwent PH at CMJAH

4.1.6. To describe the outcome and complications associated with PH.

5. Methods

5.1 Study design

This will be a retrospective, descriptive, record view of all women who underwent PH between January 2018 and December 2020 at CMJAH.

5.2 Study setting

The study will be conducted at CMJAH because it serves as a referral centre for the greater part of the Gauteng Province.

5.3 Study sampling and size

Records of all women who delivered at CMJAH over the period 2018 to 2020 will be retrieved. This will include evaluation of medical files of patients who underwent PH. Furthermore, the histopathological reports of all such patients will be reviewed once permission has been granted by the Department of Anatomical Pathology at the University of the Witwatersrand/National Health Laboratory Services in addition to study to having been registered on the NHLS academic affairs research management system and data having been received from the corporate data warehouse of the NHLS.

5.4 Data collection

Patients' operative notes and available case files will be obtained from the relevant departments. This includes doctor's notes; nurse's progress report; theatre records; intensive care charts; patients admission record; neonatal intensive care charts, mortuary and histology reports.

Data Will be kept anonymous and names and identifiers will not be displayed or reproduced by collecting data using data collection sheet which will not display the patient's names.

5.5 Inclusion criteria

5.5.1. All women who underwent PH at CMJAH over a period of 2018-2020 and who were at least 24 weeks pregnant or more; or who were within six weeks following delivery will be included in the study.

5.6 Data analysis

The data will be captured onto REDCAP and therefore exported to Microsoft excel spread sheet, for analysis into STATA software.

6. Ethics

Ethical clearance will be sought from the Witwatersrand University Human Research Ethics Committee before collection of data commences. Permission will also be obtained from relevant hospital authorities and NHLS.

7. Funding

A minimal budget of R5000 from the principal investigator will include money for transport and stationery.

8. Problems.

This study may experience limitations as a result of illegible writing in medical record; missing information; or patient records that have been lost. To minimise this limitation all information gathered from various sources will be matched for correctness and accuracy before analysis.

9.Timeline Chat

	May	June	July	August	September	October	November	December	January 2022	February 2022	March 2022	April 2022
Protocol submission	**XX**											
Ethics submission		**xx**	**XX**	**xx**								
Data collection					**xx**	**xx**	**xx**	**xx**				
Data analysis									**xx**	**xx**		
Final writeups and submission											**xx**	**xx**

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Appendix B: Data collection

Data Collection Sheet Date

of birth:

Age:

Race

Black African

Coloured

Indian

White

Other **Parity**

Gravidity.

Antenatal care

Booked -yes

-no

-unknown

HIV status

Positive CD4 date of VL

Negative

Unknown

Delivery at the facility

Yes

No

Unknown

Gestational age at birth

Gestation

Singleton

Multiple

Unknown

Mode of delivery

Normal vertex

Vaginal breech

Assisted vaginal- kiwi vacuum

-forceps

VBAC

Unknown

Caesarean section

Emergency

Indications: fetal distress

Previous c/s times(1,2,3 etc)

Failed VBAC

CPD/poor progress

Breech

APH

Placenta previa

Multiple pregnancy

Failed I. OL

Elective c/s

<u>Maternal obstetric condition</u>

Hypertension/pre-eclampsia/eclampsia

Gestational diabetes

Spontaneous preterm labour

Premature rupture of membrane

Postpartum haemorrhage

Puerperal sepsis

Pneumonia/ARDS

Other

Indication for peripartum hysterectomy

Post normal vaginal hysterectomy- yes

-no

Post caesarean section -yes

-no

Postpartum haemorrhage-trauma

-atony

-tissue (e.g., retained products of conception)

-thrombin (e.g., coagulopathy)

Abnormal placentation

Uterine rupture

Pregnancy related sepsis

Extension of lower segment uterine incision

Other

Histology report

Yes

No

Unknown

Details of report

Microbiology report

Complications

Intraoperative

Bleeding

Bladder injury

Ureteric injury

Bowel injury

Laceration of large pelvic organ vessels other

Postoperative

Wound infection/dehiscence

Urinary tract infection

Ileus

Fistula

Death

ICU admission

Other

Neonatal morbidity

Respiratory distress syndrome

Meconium-stained liquor

Hypoxic-ischemic encephalopathy

Necrotising enterocolitis

Intracranial haemorrhage

Congenital abnormality

Neonatal sepsis

NICU admission

NICU -TU admission

Other

Neonatal outcome.

Apgar score

Birth wight

Alive

Macerated stillbirth

Fresh stillbirth

Morbidity

Appendix C: Permission letters to conduct the study

UNIVERSITY OF THE
WITWATERSRAND,
JOHANNESBURG

Private Bag 3 Wits, 2050
Fax: 027117172119
Tel: 02711 7172076

Reference: Mrs Sandra Benn
E-mail: sandra.benn@wits.ac.za

03 September 2021
Person No: 0700497Y
PAG

Mr NR Mmabatswa
P O Box 598
Senwabarwana
0790
South Africa

Dear Mr Nakedi Mmabatswa

Master of Medicine in Obstetrics and Gynaecology: Approval of Title

We have pleasure in advising that your proposal entitled *An Audit on the indication of peripartum hysterectomy performed at a tertiary institution in Johannesburg, South Africa.* has been approved. Please note that any amendments to this title have to be endorsed by the Faculty's higher degrees committee and formally approved.

Yours sincerely

Mrs Sandra Benn
Faculty Registrar
Faculty of Health Sciences

GAUTENG PROVINCE
HEALTH
REPUBLIC OF SOUTH AFRICA

CHARLOTTE MAXEKE JOHANNESBURG ACADEMIC HOSPITAL (CMJAH)
OFFICE OF THE SENIOR CLINICAL MANAGER

Enquiries: *Ms. TT Mahlangu*
Email: Thandi.Mahlangu4@gauteng.gov.za
Tel: *011 488 3365*
Ref: *1/7/2*
Date: 28/01/2022

GP_202107_040

To: Dr N. Mmabatswa

RE: FINAL APPROVAL OF STUDY

TITLE: AN AUDIT ON THE INDICATION OF PERIPARTUM HYSTERECTOMY PERFORMED AT A TERTIARY INSTITUTION IN JOHANNESBURG, SOUTH AFRICA

Permission is granted for you to conduct the above-mentioned study as described in your request provided:

1. Charlotte Maxeke Johannesburg Academic Hospital will not in any way incur or inherit costs as a result of the said study.
2. Your study shall not disrupt services at the study sites.
3. Strict confidentiality shall always be observed.
4. Informed consent shall be solicited from patients participating in your study.

Please liaise with the HOD and Unit Manager or Sister in charge to agree on the dates and time that would suit all parties.

Kindly forward this office with the results of your study on completion of the research.

Supported/~~Not Supported~~
Signed by:Jayshina Punwasi
Signed at:2022-01-31 13:43:07 +02:00
Reason:Witnessing Jayshina Punwasi

Dr J. Punwasi
Clinical Director

Approved/~~Not Approved~~
Signed by:Gladys Magugudi Bogoshi
Signed at:2022-01-31 19:33:36 +02:00
Reason:Witnessing Gladys Magugudi Bo

Ms. G Bogoshi
Chief Executive Officer

NATIONAL HEALTH LABORATORY SERVICE
UNIVERSITY OF THE WITWATERSRAND – JOHANNESBURG

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

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Dr Y Perner MBBCh (Witwatersrand) FCPath (SA); MMed (Witwatersrand)

Human Research Ethics Committee (Medical)
University of the Witwatersrand
Johannesburg
20000

July 28, 2021

Re: Consent for access to NHLS database

This letter serves to confirm that the Department of Anatomical Pathology at the University of the Witwatersrand and NHLS is happy to assist Dr Mmabatswa with his study entitled "An audit on the indication of peripartum hysterectomy performed at a tertiary institution in Johannesburg, South Africa".

Publication of such work is encouraged and in the event that the information used comprises the diagnosis only then joint authorship from a member of staff in the Department of Anatomical Pathology would not be expected. However, should additional information be extracted from the report for purposes of further interpretation such as morphological details and immunohistochemical profiles, it would be expected that this would be done in conjunction with a member of staff in the Department of Anatomical Pathology and that joint authorship would follow in resulting publications. Dr Mmabatswa will be in contact with the Department of Anatomical Pathology in respect of this. Dr Mmabatswa will ensure that he registers on the NHLS AARMS system and Dr Wadee from the Department of Anatomical Pathology will be his collaborator and co-supervisor.

Assuring you of the Department of Anatomical Pathology's co-operation in this and future research projects.

With best wishes.

Yours sincerely,

Dr Yvonne Perner
Head: Department of Anatomical Pathology

Appendix D: Ethics certificate

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

R49 Dr NR Mmabatswa

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)
CLEARANCE CERTIFICATE NO. M210949

NAME: (Principal Investigator)	Dr NR Mmabatswa
DEPARTMENT:	School of Clinical Medicine Department of Obstetrics and Gynaecology Medical School University
PROJECT TITLE:	*An audit on the indication of peripartum hysterectomy performed at tertiary hospital in Johannesburg, South Africa*
DATE CONSIDERED:	2021/10/01
DECISION:	Approved unconditionally
CONDITIONS:	
NOTE:	If contact information regarding student study participants is required, please contact the Registrar's office - <Nicoleen.Potgieter@wits.ac.za>
SUPERVISOR:	Drs S Bhoora and R Wadee
APPROVED BY:	Dr CB Penny, Chairperson, HREC (Medical)
DATE OF APPROVAL:	2022/01/17

This Clearance Certificate is valid for 5 years from the date of approval. An extension may be applied for.

DECLARATION OF INVESTIGATORS

To be completed in duplicate and **ONE COPY** returned to the Research Office secretariat 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 therefore reports and re-certification will be due in the month of **September** each year. Unreported changes to the study may invalidate the clearance given by the HREC (Medical).

Signature of Principal Investigator

Date 20/01/2022

Appendix E: Guidelines for International Journal of Obstetrics and Gynaecology

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.

- **Synopsis**
    - Brief synopsis of up to 25 words describing the key findings of the study.
- **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.

Appendix F: Turnitin in report

audit indication of PH-4.docx

ORIGINALITY REPORT

13%	12%	8%	3%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	www.ncbi.nlm.nih.gov Internet Source	2%
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4	www.ijrcog.org Internet Source	1%
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Appendix G: Plagiarism Declaration

University of the Witwatersrand, Johannesburg

School of Clinical Medicine

Senate Plagiarism Policy

Declaration by Students

I, Nakedi Rogers Mmabatswa student number: 0700497y, am a student for MMED (Obstetrics and Gynaecology).

In the year 2024, I hereby declare the following:

I am aware that plagiarism (the use of someone else's work without their permission and/or without acknowledging the original source) is totally wrong.

I confirm that all the work submitted for assessment for the above course is my own unaided work except where I have explicitly indicated otherwise.

I have followed the required conventions referencing the thoughts and ideas of others. I understand that the University of the Witwatersrand may take disciplinary action against me if there is a belief that this is not my own unaided work or that I have failed to acknowledge the source of the ideas or words in my writing.

Signature: 

Date: 18 June 2024