Descriptive study of women with eclampsia requiring intensive care unit admission at Chris Hani Baragwanath Academic Hospital

Dr Nkhangweleni Colbert Makheda

Student number: 1508819

Supervisor: Dr Salome Maswime

Dissertation for MMED in Obstetrics and Gynaecology

The study is submitted in partial fulfilment for the degree of Masters of Medicine in Obstetrics and Gynaecology.

Declaration

I, Dr Nkhangweleni Colbert Makheda declare that this dissertation is my own work and it is being submitted in partial fulfilment for the degree of Master of Medicine in Obstetrics and Gynaecology at the University of Witwatersrand, Johannesburg.

This work has not been submitted before for any degree or examination at this institution or other universities.

Signed: ……

Date: ……

Presentations

1. Makheda NC, Maswime S. Descriptive study of women with eclampsia requiring intensive care unit admission at Chris Hani Baragwanath Academic Hospital. Priorities in Perinatal Care Conference. Oral presentation, and conference paper, Drakensburg, South Africa, 15 March 2018.

2. Makheda NC, Maswime S. Descriptive study of women with eclampsia requiring intensive care unit admission at Chris Hani Baragwanath Academic Hospital. FIGO XXII. RIO world congress of Obstetrics and Gynaecology, 15 October 2018.

Publications

1. Makheda NC, Maswime S. Descriptive study of women with eclampsia requiring intensive care unit admission at Chris Hani Baragwanath Hospital Academic Hospital. Int J Gynae Obstet 2018; FCS034 DOI: 10.1002/ijgo.12582.

Abstract

Background

Eclampsia is a life threatening condition and the most widely recognized complication of hypertensive disorders of pregnancy requiring intensive care admissions. It is also an important cause of maternal and perinatal morbidity and mortality, and accounts for approximately 63000 maternal deaths every year globally.

Objectives

To determine the incidence, outcomes and complications of women with eclampsia admitted to the intensive care unit at Chris Hani Baragwanath Academic Hospital (CHBAH).

Methods

A retrospective cross sectional study of all women with eclampsia admitted to the intensive care unit at CHBAH.

Results

There were 57 women with eclampsia admitted to ICU between January 2011 and December 2016. Eclampsia with ICU admissions was most common between the ages of 16-20 years (n=18, 31.5%) and more prevalent in primigravida. The

incidence rate of ICU admission in women with eclampsia is 44/100 000 births per year. There were three maternal deaths from eclampsia. Maternal and fetal complications that developed in ICU were HELLP syndrome (n=15, 26.3%), acute renal failure (n=11, 19.2%), metabolic acidosis (n=9, 15.8%), pulmonary oedema (n=8, 14%), preterm births (n=31, 52.5%), birth asphyxia (52.5%) and low birth weight (45.8%). The reason for ICU admission was haemodynamic monitoring (100%), ventilation (89%), cardiopulmonary resuscitation (45%), renal support (19%) and inotropes (16%).

Conclusion

Eclampsia is a preventable condition affecting women mostly in low to middle income countries. Eclampsia that requires ICU admission is often associated with life-threatening multi-organ system maternal and fetal complications. Measures to prevent eclampsia need to be strengthened.

Acknowledgements

Appreciation dedicated to my supervisor Dr Salome Maswime for the inspiration, motivation, support and guidance on this research project. Special thanks to Dr Jackie Brown for permission to conduct the research project in intensive care unit. I also give special thanks to Mrs Mathonzi Mapule for the maternity intensive care unit case records and Mr Nkhiphitheni Munyai for analysing the data.

To my lovely wife Petunia Makheda and three children's (Uya, Fulu and Princess), family and friends, I salute you for continuous encouragement and support.

I would like to thank the almighty God for giving me knowledge, power and strength to make it possible to achieve this great work.

List of tables

Table of contents

Chapter 1

Research protocol and extended literature review

Introduction

Eclampsia is one of the most widely recognized complications and obstetric indications requiring intensive care admission. Eclampsia is a complication of hypertensive disorders of pregnancy and contributes to maternal near-miss, maternal mortality and perinatal mortality (1). Globally obstetric admissions requiring intensive care admission contribute 0.1% to 1.5% of all intensive care admissions (2).

Globally eclampsia accounts for 63000 maternal deaths every year. The case fatality rate is 14% in developing countries and 0% to 1.8% in developed countries (3). In Europe eclampsia is uncommon with approximately two to three cases per 10,000 live births reported (4). The United Kingdom reported seven maternal deaths out of 382 eclamptics giving a case fatality rate of 1.8% (5). Maternal mortality is higher in less developed countries like India. Sarkar et al (2013), in West Bengal Midnapur Medical College and Hospital described a case fatality rate of 4.9% with eclampsia representing 45.4% of total maternal deaths (6). Das et al (2015) also described a case fatality rate of 4.9% in Eastern India; with eclampsia representing 43.3% of aggregate maternal deaths (2).Maternal mortality from eclampsia is increasing in sub-Saharan Africa. A five year review in Northern Nigeria demonstrated that eclampsia is still the major cause of maternal mortality with a case fatality rate of 22.3% (7).

In South Africa, according to the Saving Mothers report of 2011-2013, hypertensive diseases of pregnancy was the third commonest cause for deaths with 640 deaths. More than 50% of the hypertension related deaths during pregnancy occur as a

result of eclampsia (8). A study conducted by Poonyane, 2015 in three Johannesburg teaching hospitals indicated that eclampsia was the most common occurring maternal complication. It contributed to 34% of complications in women admitted with severe preeclampsia (9). Soma-Pillay et al (2014), conducted a study in Pretoria Academic Complex on maternal near miss and maternal deaths, there were 26614 deliveries, 117 near misses and 19 maternal deaths. Six deaths were related to complications associated with severe preeclampsia. Two near misses and two maternal deaths were due to eclampsia. The mortality index for eclampsia was 50% (10).

Preeclampsia and Eclampsia may lead to multi-organ dysfunction and failure. Complications from Eclampsia require a multidisciplinary team approach, and may also require admission to the intensive care unit for hemodynamic monitoring; inotropic support; invasive and non-invasive ventilation; and organ support.

Epidemiology and definition

Hypertensive disorders of pregnancy are common and complicate 2-10% of pregnancies (11). Eclampsia complicates 1-2% severe preeclampsia cases and is defined as generalized tonic-clonic seizures in a pregnant or recently delivered woman with preeclampsia, and no other attributed cause (12). Eclampsia can occur during antepartum, intrapartum and post-partum period with a high incidence in developing countries and low incidence in developed countries (11, 12).

The United Kingdom in 1992 reported 383 cases of women with eclampsia giving the incidence of 4.9 per 10000 deliveries (5). The low incidence was attributed to improvement in obstetric care, community health education, administering magnesium sulphate in all women diagnosed with severe preeclampsia (5). A comparative higher incidence of eclampsia was reported in the study done by

Sharara in Qatar in 1991 to 2009, the incidence of eclampsia was 31 per 100 000 deliveries in seventy women admitted with eclampsia out of 224809 deliveries (13).

Eclampsia is ten to thirty times more common in developing countries because of contrasts in quality of antenatal monitoring, delayed transport to tertiary health care facility, unbooked patients and delay in diagnosis and treatment (14). In Nigeria the incidence of eclampsia varies from three to seventeen per 1000 deliveries, Agida et al, in 2010 reported that the incidence of eclampsia was thirteen per 1000 deliveries (14). In South Africa, Mwinyoglee et al, in 1996, reported the incidence of 3.6 per 1000 deliveries of eclampsia women admitted at Garankuwa hospital (15). Moodley et al, in 1980 reported that the incidence of eclampsia was 2.8 per 1000 and also reported that the incidence of eclampsia was six per 1000 deliveries in 1990 (16).

Maternal complications associated Eclampsia

Eclampsia is a life threatening condition that is associated with severe maternal complications (3). Maternal complications include, cerebro-vascular accidents, cerebral oedema, cerebral hemorrhages, pulmonary oedema, aspiration pneumonia, renal failure, disseminated intravascular haemorrhage (DIC), HELLP syndrome, placenta abruption and postpartum haemorrhage (3, 17, 32). Majority of these complications require intensive care admission.

Fischer et al (2016), at Hamburg, Germany reported that 40% of patients with posterior reversible encephalopathy syndrome require intensive care monitoring as it complicates to status epilepticus, cerebral ischaemia, intracerebral haemorrhage (18). Singhal et al (2009), at Rohtak, Haryana, India reported that 8% of maternal mortality was due to pulmonary embolism, pulmonary oedema, DIC and HELLP syndrome in women with preeclampsia and eclampsia (19). Pannu et al (2014), at Safdarjung Hospital, India showed that women with eclampsia suffered major complications. 16.8% suffered posterior reversible encephalopathy, 14.5% suffered

pulmonary oedema, 12% suffered acute renal failure, and 9.6% suffered postpartum haemorrhage (20).

Jido conducted a study at Kano, Nigeria in 2012 and reported that 50% of maternal deaths that resulted from eclampsia are because of cerebrovascular accident and a high rate of deaths were attributed to pulmonary oedema and aspiration pneumonia (3). Placental abruption, visual problems, and cerebrovascular accidents were common complications of eclampsia in women admitted in an intensive care unit at Douala General Hospital, Cameroon (21). Makhanya et al (2016), Kwazulu- Natal, South Africa indicated that 50% of maternal deaths that resulted from eclampsia were due to cerebral haemorrhage and oedema. Among the complications of eclampsia, renal dysfunction contributed 29.3%, HELLP syndrome (12.1%), pulmonary oedema (5.2%), postpartum haemorrhage 5.2% and disseminated intravascular coagulation 3.4% (22).

Strategies for prevention of complications of eclampsia are limited. Prevention is based on early detection of gestational hypertension or preeclampsia, close monitoring, the use of antihypertensive to control blood pressure, calcium supplementation for low dietary calcium intake in antenatal care in patients with preeclampsia, timely delivery and use of magnesium sulphate during labour and postpartum in women with severe preeclampsia (22, 23).

In 2002, the Magpie trial: a randomized control trial which recruited 10141 women demonstrated that women allocated magnesium sulphate had 58% lower risk of eclampsia in women with preeclampsia than those allocated placebo, it reduced the risk of maternal death and had no serious adverse effects on the mother and baby (24). More than 50% of deaths attributed to complications of eclampsia are avoidable through provision of timely and effective care, training health care workers in limiting risk of seizures; manage acute hypertensive episodes, urgent referral to tertiary facility and establishing more obstetrics care unit (22, 23).

Prevention of pre-eclampsia and eclampsia

Early prediction of preeclampsia usually allows for early initiation of preventive therapy (25, 26).The following factors have been shown to play a role in the risk of developing preeclampsia and thus eclampsia:

Maternal factors include nulliparity, multiple pregnancies, previous preeclampsia, antiphospholipid syndrome, insulin-dependent diabetes, pre-existing hypertension and family history of preeclampsia. Screening with these factors shows detection rates of 48.3% for early preeclampsia and 41.5% for late preeclampsia (25).Maternal uterine artery Doppler's have also been used to predict women at risk of pre-eclampsia. Abnormal Doppler's are due to poor placentation and inadequate remodelling of the spiral arteries (26).

The use of uterine artery pulsatility index at 11-13 weeks' gestation can determine if women are at risk of developing early-onset preeclampsia and if the multiple median of uterine artery pulsatility index is significantly increased. The detection rates can increase from 48.3% to 73.3% if maternal factors are combined with uterine artery Doppler's during the first trimester. The detection rate can also increase from 48.3% to 90.0% if maternal factors are combined with mean arterial pressure, uterine artery Doppler's, pregnancy associated plasma protein A and placental growth factors using Bayes' theorem based method (25).

PAPP-A (Pregnancy associated plasma protein A) is a glycosylated protein that is produced by the placenta syncytiotrophoblast. The low level of PAPP-A below the 5th percentile is associated with a higher incidence of preeclampsia. The reduced levels reflect impaired placentation (26).

Placental growth factor (PIGF) and vascular endothelial growth factor 1 are used as biomarkers for pre-eclampsia in high income countries. Their levels are reduced in women who will develop preeclampsia (26).

Angiogenic markers like the ratio of soluble fms-like tyrosine kinase 1 (Sflt-1) to placenta growth factor (PIGF) of 38 or lower can be used during the second and third trimesters to predict preeclampsia (27). The ratio below 38 indicates that it's unlikely for these women to develop preeclampsia in one week. Women with elevated ratio of more than 85 suggest early onset preeclampsia while ratio above 110 suggests late onset preeclampsia. Severely elevated ratio of more than 655 for early onset preeclampsia and more than 201 for late onset preeclampsia suggests delivery in 48 hours (28).

The ASPRE trial study was conducted in 2017, on screening for preterm preeclampsia in singleton pregnancies using a combination of maternal factors, uterine artery pulsatility index, mean arterial pressure, maternal serum pregnancy associated plasma protein-A and placental growth factor at 11-14 weeks' gestation to identify women at high risk of early onset preeclampsia. The combined screening detected 76.6% cases of preterm preeclampsia, thus effective in identifying women at risk of preeclampsia. Aspirin given from 16 weeks gestation in a dose of 150mg orally daily has been shown to reduce the incidence of preterm preeclampsia by 62% (29).

Intensive care unit admission

Intensive care units are multidisciplinary. Patients with life threatening illness or injuries get continuous specialized medical restorative and nursing care (30). Senanayake et al, in 2013 demonstrated that the rate of obstetrics intensive care admissions varies from 0.4% to 4.5% at University of the Colombo, Sri Lanka (31).

Most reviews in both developing and developed countries indicated that hypertensive disorders of pregnancy including eclampsia and obstetric haemorrhages are the most well-known indications for obstetric intensive care admissions (2, 21, 22, 30, 31).

In Columbia during the period of 2006 to 2009 there were 51084 deliveries, 217 were admitted to intensive care unit and eclampsia contributed 20.30% of all deliveries (32). In United Kingdom, London during the year 2005, of the 33 patients admitted to intensive care unit, 39.4% were as a result of hypertensive disorders of pregnancy (33).

A study conducted by Priso et al (2015), in Cameroon reported that eclampsia contributed to 72.5% of the total 74 patients admitted to Intensive care unit (21). Muhammed et al (2010), in Nigeria, Aminu Kano Teaching Hospital conducted a seven year review on obstetrics admissions to intensive care unit. The study found that eclampsia contributed 53.3% of all obstetrics women admitted to intensive care unit. There were fifteen patients admitted in intensive care unit over the total of 20560 deliveries (2).

In South Africa, comparable findings of 52.9% of women with eclampsia or preeclampsia were found by Ntuli et al. in a five year retrospective review of obstetrics admission to intensive care unit at Polokwane Tertiary Hospital, Limpopo. Preeclampsia and Eclampsia was the leading causes of obstetrics intensive care admission .There were 138 obstetrics patients out of the total 2073 intensive care admissions (34). Platteau et al (1997), in King Edward VIII Hospital, Durban found that eclampsia contributed to 24% of obstetrics admissions to surgical intensive care unit. Eclampsia was also the most widely recognized diagnosis, representing 66% of all intensive care admissions (35).

Maternal mortality associated with Eclampsia

In Africa, Maternal deaths because of eclampsia are high due to lack of resources, inadequate resuscitation skills, and lack of intensive care facilities required in the management of maternal complications from eclampsia (3, 22). Majoko et al, (2001) in Zimbabwe conducted a study on maternal outcome in eclampsia at Harare Maternity Hospital, and found that eclampsia accounted for the case fatality rate of 26.5%.There were 151 cases of women with eclampsia over 25425 deliveries (36). Majority of maternal deaths resulted from eclampsia were associated with avoidable factors including patient related factors, health worker related factors and health care system related factors. Maternal deaths due to eclampsia are preventable through early identification of preeclampsia and early delivery.

Fetal mortality associated with Eclampsia

Eclampsia is the major cause of perinatal mortality worldwide. Perinatal mortality due to eclampsia was reported to be 5 to 10% in developed countries and up to 40% in developing countries. The majority of perinatal deaths associated with eclampsia are attributed to chronic placental insufficiency, placenta abruption and preterm births (37). In South Africa, Makhanya et al (2016), reported that eclampsia was associated with perinatal deaths, there were five stillbirths and five early neonatal deaths associated with eclampsia. The perinatal deaths were attributed to hypoxic ischaemic encephalopathy, congenital sepsis, asphyxia and hyaline membrane disease (22).

Complications of eclampsia requiring intensive care unit have not been described at Chris Hani Baragwanath Academic Hospital. The main aim is to review the nature of complications associated with eclampsia and the outcomes of eclampsia in women who were admitted in intensive care unit at Chris Hani Baragwanath Academic Hospital.

Objectives

Primary

1. To determine the incidence of women with eclampsia admitted to intensive care unit admission at Chris Hani Baragwanath Academic Hospital.

Secondary

2. To determine the outcomes of women with eclampsia admitted in intensive care unit.
3. To determine complications of eclampsia that necessitated intensive care unit admission.

Methods

Setting

Chris Hani Baragwanath Academic Hospital is a tertiary hospital in South Africa. Chris Hani Baragwanath Academic Hospital is the biggest hospital in Africa and conducts approximately 20 000 deliveries a year.Two regional hospitals refer patients to Chris Hani Baragwanath Academic Hospital (Sebokeng Hospital and Thelle Mogoerane Hospital) and one district hospital (Bheki Mlangeni district hospital), four MOUs (Chiawelo, Lillian Ngoyi, Lenasia South, Stretford).

The maternity section has a maternity admissions ward, first stage ward, and labour ward, high care ward, antenatal and postnatal. The hospital has an intensive care unit with 18 beds in another building which is five blocks away and requires an ambulance to transport the patient from maternity high care to intensive care unit.

Study population

All women with eclampsia admitted to main intensive care unit at Chris Hani Baragwanath Academic Hospital during the period of January 2011 to December 2016.

Study design

Retrospective cross sectional audit of maternal case records of all women admitted to ICU over a five year period. Demographic and clinical details will include age, parity, gravidity, gestational age at presentation and delivery, booking status, previous history of preeclampsia-eclampsia, comorbidities, risk factors, reasons for intensive care admissions, duration of intensive care stay, interventions done, complications, outcomes and omission from the protocol will be described.

Sample size

According to ICU statistics approximately ten women with eclampsia are admitted every year. The estimated sample size over a five year period is 50. A period sample will be used, with no sampling strategy.

Data analysis

The study will employ quantitative techniques. Descriptive data will be analysed using means and standard deviations (for normally distributed continuous data), medians and interquartile ranges (for non-normally distributed continuous data), and proportions with percentages (for categorical data). Precision will be managed by using 95% confidence intervals.

Inclusion criteria

All women with eclampsia admitted to intensive care unit from gestational age of greater than 20 weeks.

Exclusion criteria

Excluded conditions include other causes of seizures e.g. malaria, meningitis, epilepsy, drugs or alcohol withdrawal and furthermore gestational age less than 20 weeks.

Ethics

Ethics approval will be sought from the Wits Human Research Ethics Council. Permission to conduct study at CHBAH will be sought from the Chief Executive Officer.

Timing

February-March 2017	**April – August 2017**	**September-December 2017**	**January 2018**
Permissions	Data collection	Data analysis	Final
		Write-up	

Funding

All costs will be covered by the researcher (stationery and printing).

References

1. Muhammad Z, Muhammad D, Ibrahim S. Obstetric admissions to the intensive care unit: A seven year review at Aminu Kano Teaching Hospital Kano, Nigeria. Borno Med J 2010; 7(1):1-15.
2. Das R, Biswas, Eclampsia: The major cause of maternal mortality in Eastern India. Ethiop J Health Sci 2015; 25(2): 111-115.
3. Jido T. Eclampsia: Maternal and fetal outcome. Afr Health Sci 2012; 12(2): 148-152.
4. Duley L.The global impact of preeclampsia and eclampsia. Semin Perinatol 2009; 33: 130-137.
5. Douglas K, Redman C. Eclampsia in the United Kingdom. BMJ 1994; 309: 1395-1399.
6. Sakar M, Basak S, Mondal K, et al. Maternal mortality associated with eclampsia in an Indian medical college four year retrospective study. J Med Sci. 2013; 4(10):394-3986.
7. Kullima A, Kawuwa M, Audu B. A 5-year review of maternal mortality associated with eclampsia in a tertiary institution in northern Nigeria. Ann Afr Med 2009; 8(2): 81-84.
8. Department of Health. Saving mothers 2011-2013: Sixth report on the Confidential Enquiries into Maternal Deaths in South Africa, Pretoria Department of Health 2015.
9. Poonyane T. Impact of severe preeclampsia on Maternal and Fetal outcomes in Preterm deliveries. http://wiredspace.wits.ac.za/jspui/bitstream/10539/18324/1/Final%Submission.pdf.accessed on 30/11/2016.
10. Soma-Pillay P, Pattinson R, Langa-Mlambo L, et al. Maternal near miss and maternal death in the Pretoria Academic Complex, South Africa: A population-based study. S Afr Med J 2015; 105(7): 578-582.
11. Barbosa I, Silva W, Cerqueira G, et al. Maternal and fetal outcome in women with hypertensive disorders of pregnancy: the impact of prenatal care. Ther Adv Cardiovasc Dis 2015; 9(4): 140-146.

12. Townsend, O'Brien P, Khalil A. Current best practice in management of hypertensive disorders in pregnancy. Intgr Blood Press Control 2016; 9:79-94.
13. Sharara H. A review of Eclampsia in Qatar: A twenty-year study (from January 1991-December 2009).Qatar Med J 2012; 2012(2):7-13.
14. Agida E, Adeka B, Jibril K. Pregnancy outcomes in eclamptics at the University of Abuja Teaching Hospital, Gwagwalada: A 3 year review. Niger J Clin Prac 2010; 13(4):394-398.
15. Mwinyoglee J, Amoko D, Simelela N. Eclampsia at Ga-Rankuwa Hospital. S Afr Med J 1996; 86(12): 1536-1539.
16. Moodley J, Daya P. Eclampsia: A continuing problem in developing countries. Int J Gynaecol Obstet. 1994; 44(1):9-14.
17. Souza P, Guiherme J, Faudes A, et.al, Maternal near miss and maternal death in the World Health Organization's 2005 global survey on maternal and perinatal heath. Bull World Health Organ 2010; 88: 113-119.
18. Fischer M, Schmutzhard E. Posterior reversible encephalopathy syndrome. http://link.springer.com/content/pdf/10.1007%2Fs00415-016-8377-8.pdf.accessed on 15/01/2017.
19. Singhal S, Deepika T, Nanda S, et al. Maternal and perinatal outcome of preeclampsia and eclampsia. J South Asian Feder Obst Gynae. 2009; 1(3): 25-29.
20. Pannu D, Das B, Hazari P, et.al. Maternal and perinatal outcome in eclampsia and factors affecting outcome: a study in North Indian population. Int J Reprod Contracept Obstet Gynecol. 2014; 3(2):347-3511.
21. Priso EB, Njamen T, Tchente C, et.al. Trends in admissions, clinical features and outcome of preeclampsia and eclampsia as seen from the intensive care unit of the Doula General Hospital, Cameroon. Pan Afr Med J 2015; 21: 103.
22. Makhanya V, Moodley J, Govender L. Eclampsia: still a problem in rural Kwazulu-Natal Province, South Africa. S Afr J Obstet Gynaecol. 2016; 22(1):13-16.
23. Sibai B. Diagnosis, Prevention, and Management of Eclampsia. Obstet Gynaecol. 2005; 2005:402-409.
24. Altmad D, Carroli G, Duley L, et al. Do women with preeclampsia, and their babies, benefit from magnesium sulphate? The Magpie Trial: a randomized placebo control trial. Lancet 2002; 359(9321): 1877-1890.

25. Tan M, Wright D, Syngelaki A, et al. Comparison of diagnostic accuracy of early screening for preeclampsia by NICE guidelines and a method combining maternal factors and biomarkers: results of SPREE. Ultrasound Obstet Gynaecol 2018; 51: 743-750.
26. Park H, Shim S, Cha D. Combined screening for early detection of preeclampsia. Int J Mol Sc 2015; 16: 17952-17974.
27. Zeisler H, Llurba E, Chantraine P, et al. Prediction of the sFlt-1: PIGF ratio in women with suspected preeclampsia. N Engl J Med 2016; 374: 13-22.
28. Matjila M, Anthony J, Vatish M, et al. Consensus statement on potential implementation of the sFlt/PIGF ratio in women with suspected pre-eclampsia. S Afri Obstet Gynaecol 2018; 24(2): 61-65.
29. Rolnik D, Wright D, Poon L, et al. ASPRE trial: performance of screening for preterm preeclampsia. Ultrasound Obstet Gynecol 2017; 50(4): 492-495.
30. Agalu A, oldie M, Ayele Y. Reason for admission and mortalities following admissions in the intensive care unit of specialized hospital, in Ethiopia. Int J Med Sci 2014; 6(9): 195-200.
31. Senanayake H, Dias T, Jayawardena A. Maternal mortality and morbidity: Epidemiology of intensive care admissions in pregnancy. Best Prac Res Clin Obstet Gynaecol. 2013; 27(6): 811-820.
32. Rojas- Suarez J, De Gracia P. Preeclampsia-eclampsia admitted to critical care unit. J Matern Fetal Neonatal Med 2012: 3-4.
33. Selo-Ojeme D, Omosaiye M, Battacharjee P. Risk factors for Obstetrics admissions to intensive care unit in a tertiary hospital: a case control study. Arch Gynaecol Obstet. 2005; 272(3): 207-210.
34. Ntuli T, Ogunbajo G, Nesengani S, et al. Obstetric intensive care admissions at a tertiary hospital in Limpopo province, South Africa. S Afr J Crit Care 2015; 31(1):8-10.
35. Platteau M, Engelhardt T, Moodley J. Obstetric and Gynaecological patients in an intensive care unit: a one year review. Trop Doct 1997; 27: 202-206.
36. Majoko F, Mujaji C. Maternal outcome in eclampsia at Harare Maternity Hospital. Cent Afr J Med 2001; 47(5): 123-128.

37. Ndaboine E, Kihunrwa A, Rumnyika R, et al. Maternal and Perinatal outcome among eclamptic patients admitted to Bugando Medical Centre Mwanza, Tanzania. Afr J Reprod Health 2012; 16(1): 35-41.

Chapter 2 (Submissible format)

Descriptive study of women admitted in intensive care unit at Chris Hani Baragwanath Academic Hospital.

Authors: Dr NC Makheda[1], Dr S Maswime [2]

Abstract

Background

Eclampsia is a life threatening condition and the most widely recognized complication of hypertensive disorders of pregnancy requiring intensive care admission. It is also an important cause of maternal and perinatal morbidity and mortality, and accounted for approximately 63000 maternal deaths every year globally.

Objectives

To determine the incidence, outcomes and complications of women with eclampsia admitted to the intensive care unit at Chris Hani Baragwanath Academic Hospital (CHBAH).

Methods

A retrospective cross sectional study of all women with eclampsia admitted to the intensive care unit at CHBAH.

Results

There were 57 women with eclampsia admitted to ICU between January 2011 and December 2016. Eclampsia with ICU admissions was most common between the ages of 16-20 years (n=18, 31.6%) and more prevalent in primigravida. The incidence rate of ICU admission in women with eclampsia is 44/100 000 birth per year. There were three maternal deaths from eclampsia.

Maternal and fetal complications that developed in ICU were HELLP syndrome (n=15, 26.3%), acute renal failure (n=11, 19.3%), metabolic acidosis (n=9, 15.8%), pulmonary oedema (n=8, 14%), preterm births (n=31, 52.5%), birth asphyxia (52.5%) and low birth weight (45.8%). The reason for ICU admission was haemodynamic monitoring (100%), ventilation (89%), cardiopulmonary resuscitation (45%), renal support (19%) and inotropes (16%).

Conclusion

Eclampsia is a preventable condition affecting women mostly in developing countries. Eclampsia that requires ICU admission is often associated with life-threatening multi-organ system maternal and fetal complications. Measures to prevent eclampsia need to be strengthened.

Background

Eclampsia is a life-threatening condition and is the most widely recognized complication of hypertensive disorders of pregnancy requiring intensive care admission (1). Eclampsia is an important cause of maternal and perinatal morbidity and mortality with a case fatality rate of 14% in low income countries and 0% to 1.8% in high income countries (1, 2, 3, 4). In South Africa, according to the saving mother's report of 2014-16, hypertensive disorders of pregnancy were the third commonest cause for maternal deaths and eclampsia contributed 52.5% of maternal deaths related to hypertension (5).

Complications of eclampsia may require intensive care. Eclampsia is associated with several maternal complications such as maternal death, stroke, posterior reversible encephalopathy syndrome, cerebral haemorrhage, cerebral oedema, aspiration pneumonia, pulmonary oedema, cardiopulmonary arrest, laryngeal oedema, acute respiratory distress syndrome, renal failure, HELLP syndrome, liver rupture, placental abruption and postpartum haemorrhage (4, 6, 7). These complications are life-threatening and may result in prolonged hospital admission, chronic morbidity and mortality.

Eclampsia is a preventable condition. High income countries report a low incidence of eclampsia. The low incidence is attributed to the improvement in obstetrics care, efficient transport systems, community health education, and administration of magnesium sulphate in all women diagnosed with severe preeclampsia (8, 9). In low to middle income countries eclampsia is 10 to 30 times more common. The high incidence in low to middle income countries in contrast with high income countries occurs because of deficiencies in antenatal care, delayed transport to tertiary health care facility, delays in diagnosis of hypertension and initiation of treatment, poor infrastructures and shortage of intensive care units (10, 11).

The aim of this study was to describe the incidence and the nature of complications associated with eclampsia admitted to ICU at CHBAH , and the outcomes of women with eclampsia admitted to intensive care unit.

Methods

A cross-sectional retrospective study was conducted at the Chris Hani Baragwanath Academic Hospital, in Gauteng Province; South Africa. Case records were sought from the intensive care unit for women with eclampsia who were admitted during the period of January 2011 to December 2016. Ethical approval was obtained to conduct this study from the University of Witwatersrand's Human Research Ethics Committee (M170220). The permission to conduct the study at CHBAH was also granted by the Chief Executive Officer and Medical Research and Ethics Committee.

Chris Hani Baragwanath Academic hospital is a tertiary hospital in South Africa and is the biggest Hospital in Africa. It conducts approximately 20 000 deliveries a year. The maternity section has got a high care area with 7 beds where all women with eclampsia are admitted. The hospital has a multi-disciplinary intensive care unit with 18 beds in another building which requires an ambulance to transport the patients from maternity to the intensive care unit.

Information from the patient's case records was collected and tabulated. The demographic and clinical details included age, parity, gravidity, gestational age at presentation, booking status, risk factors, previous history of preeclampsia and eclampsia, comorbidities, reasons for intensive care admissions, duration of intensive care stay, intervention done, complications and outcomes.

There are approximately ten women with eclampsia admitted every year to intensive care unit, which gave us an estimated period sample of approximately 60 cases.

The data was analysed using quantitative research methods. Descriptive data was used for most of the data collected. Data was analysed using Epi-Info version 7.2 and Stata 11 to get the means and standard deviations, medians and interquartile ranges. Results were reported as frequency and percentage.

Results

A total of fifty seven (57) women with eclampsia were admitted to the intensive care unit during the study period. There was a total of 130 061 deliveries during this period. The incidence of ICU admission in women with eclampsia was 44/ 100 000 births per year. Out of 57 cases, three (3) women died and fifty four (54) were discharged alive from ICU to maternity high care. The maternal mortality for eclampsia in ICU was 5.3 per 100 000 births. The demographics are indicated in table 1.

Table 1. Demographics characteristics of women with eclampsia admitted to CHBAH intensive care unit

	Results	Number(n=57)	Percentage	Mean and SD
Maternal age (years)	<16	1	1.8	
	16-20	18	31.6	
	21-25	10	17.5	
	26-30	14	24.6	25.7±6.9
	31-35	7	12.3	
	36-40	6	10.5	
	>41	1	1.8	
Parity	0	30	52.6	
	1	13	22.8	
	2	8	14	0.9±1.1
	3	5	8.8	
	4	1	1.8	

	Results	Number(n=57)	Percentage	Mean and SD
Gravidity	1	26	45.6	
	2	14	24.6	
	3	10	17.5	
	4	5	8.8	2±1.2
	5	1	1.8	
	6	1	1.8	
Antenatal attended	Unbooked	38	66.7	
	Booked	19	33.3	
Previous History of eclampsia/preeclampsia		2	3.5	
Antenatal prophylaxis	Calcium	1	1.8	
	Aspirin	4	7.0	
	Enoxaparin Sodium (clexane)	1	1.8	

The age distribution of pregnant women ranged from 15 to 43 years. The mean age was 25.7±6.9 years. The highest number of admissions observed was in women between the ages of 16-20 years (n=18, 31.6%), followed by 26-30 years (n=14, 24.6%). Eclampsia was more prevalent in primigravidas (n=30, 52.6%) and the incidence decreased with increasing parity. Most women with eclampsia had not attended antenatal clinic prior to admission (n=38, 66.7%). The remaining 33.3 % attended antenatal care. None of the women had a previous history of eclampsia however 3.5% had previous history of preeclampsia. Furthermore, the results indicate that four patients (7%) received aspirin and one patient (1.8%) received calcium and enoxaparin sodium (clexane) as antenatal prophylaxis to prevent

preeclampsia. The clinical data and labour related factors for eclampsia within the age groups are shown in table 2.

Table 2. Clinical data at presentation and labour related factors of women with eclampsia admitted at CHBAH intensive care unit

Items	Conditions/ symptoms	Number (n=57)	Percentage (%)
Current obstetrics history	Chronic hypertension	4	7
	Gestational hypertension	4	7
	Pre-eclampsia	18	31.6
	Chronic hypertension with superimposed	1	1.8
	APLS	0	0
	SLE	0	0
Signs and symptoms of imminent eclampsia	Blurred vision	8	14.0
	Vomiting	8	14.0
	Epigastric pain	6	10.5
	Headache	5	8.8
	Nausea	4	7.0
	Hypereflexia	3	5.3
	Clonus	1	1.8
Seizure in relation to labour	Antepartum	41	72
	Intrapartum	9	15.8
	Postpartum	7	12.2
	Status epilepticus.	2	3.5
Mode delivery	Normal vaginal delivery	4	7
	Caesarean section	53	93
Indication for delivery	Eclampsia	43	75.4
	Fetal distress	10	17.5
	HELLP syndrome	1	1.8
Gestational age at	Preterm	35	61.4

delivery	Term	22	38.6

There were 31.6% (n=18) women with preeclampsia on admission. Gestational hypertension and chronic hypertension was seven percent respectively. Eighty four percent (84.2%, n=48) of women did not have impending symptoms of eclampsia. In women who had symptoms and signs of imminent eclampsia, blurred vision (14%, n=8) and vomiting (14%, n=8) were most common, followed by epigastric pain (10.5%, n=6), headache (8.8% n=5), nausea (7%, n=4), hypereflexia (5.3%, n=3) and clonus (1.8%, n=1).

A detailed review on the timing of seizures showed that most seizures occurred during the antepartum period (72%, n=41) compared to 15.8% (n=9) that occurred intrapartum and 12.2% (n=7) postpartum. Status epilepticus was present during the postpartum period in 3.5% of women admitted with eclampsia.

The mode of delivery was caesarean section in 93% of the cases and seven percent were normal vertex delivery, seven percent of the women had induction of labour. Eclampsia was the most common indication for delivery (76%) followed by fetal distress (18%), with antepartum haemorrhage and haemolysis, elevated liver enzymes and low platelets (HELLP) syndrome contributing 1.8% respectively. The mean gestational age at delivery was 33.3 and most babies (64.9%) were delivered at gestational age of less than 37 weeks. All women with eclampsia were admitted to ICU during the postpartum period.

Metabolic acidosis was the most common significant findings on blood gas results during ICU admission accounted 75.4% (n=43). The mean pH was 7.32±0.1, mean lactate 1.8±1.7, mean HCO3 17.9±3.9, mean PCO2 37.1±19.9 and PO2 157.6±76.2. The average length of ICU stay was 3.9±3.3 days and 31.5% stayed for duration of 3 days. The most common blood results findings, imaging and duration of intensive care unit stay are indicated in table 3.

Table 3. Bloods results, imaging and duration of stay of women with eclampsia admitted in CHBAH intensive care unit

Items	Investigations	Number (n=57)	Percentage (%)	Mean and SD
Blood results	Hb<11g/dl	19	33.3	10.6±2.6
	Platelets<150×10^9/l	33	57.9	129.6±72
	Urea > 5	29	50.9	6.5±6.6
	Creatinine > 85µmol/l	35	61.4	121.0±130.6
	AST>40	29	50.9	151.5±212.9
	ALT>40	18	31.6	73.1±103.7
	LDH>600	0	0	0
	INR>1.04	23	40.3	1.0±0.17
	PTT>39.4	2	3.5	34.4±13.2
Blood gases	Metabolic acidosis	43	75.4	
	Metabolic alkalosis	1	1.8	
	Respiratory acidosis	2	3.5	
	Respiratory alkalosis	1	1.8	
	Mixed respiratory and metabolic acidosis	3	5.3	
	Normal blood gas	7	12.3	
Imaging	PRES on CT brain	7	12.3	
	Intracerebral haemorrhage on CT brain	2	3.5	
Duration of ICU stay in days	1	7	12.2	
	2	15	26.3	
	3	18	31.6	
	4	4	7.0	3.9±3.3

	5	4	7.0	
	6	1	1.8	
	7	2	3.5	
	8	1	1.8	
	9	1	1.8	
	10	1	1.8	
	15	1	1.8	
	16	2	3.5	

Eclampsia in ICU was associated with the following multi-organ dysfunctions. HELLP syndrome developed in 26.3% of which 21.5% occurred with renal dysfunctions and 5.3% occurred without renal dysfunctions.

Renal failure developed in 19.3% (n=11) of cases, 15.8% (n=9) developed metabolic acidosis, 14% (n=8) developed pulmonary oedema, 12.3% (n=7) developed posterior reversible encephalopathy syndrome(PRES), 8.8% (n=5) developed placental abruption, postpartum haemorrhage, aspiration pneumonia and obstructed airway (swollen tongue), 5.3% (n=3) developed cardiac arrest, 3.5% (n=2) developed intracerebral haemorrhage, prolong unconscious greater than 12 hours, uncontrolled seizures and ventilation pneumonia), 1.8%(n=1) developed cerebrovascular accident, acute respiratory distress syndrome, laryngeal oedema, respiratory arrest and air embolism. The complications are indicated in table 4.

Items	**Maternal outcome**	**Number(n=57)**	**Percentage (%)**
Maternal deaths	Maternal deaths	3	5.3
Haematological system	HELLP syndrome	15	26.3
	Disseminated intravascular coagulopathy	1	1.8
Respiratory system	Pulmonary oedema	8	14

	Aspiration pneumonia	5	8.8
	Obstructed airway due to swollen tongue	5	8.8
	Acute respiratory distress syndrome	1	1.8
	Laryngeal oedema	1	1.8
	Ventilation Pneumonia	1	1.8
	Air embolism	1	1.8
	Pneumothorax	1	1.8
Cardiovascular system	Cardiovascular arrest	1	1.8
Central nervous system	Posterior reversible encephalopathy syndrome	7	12.3
	Intracerebral haemorrhage	2	3.5
	Prolong unconsciousness>12 hours	2	3.5
	Uncontrolled seizures	1	1.8
	Cerebrovascular accident	1	1.8
Renal system	Acute renal failure	11	19.3
	Renal dysfunction with HELLP syndrome	12	21.1
Metabolic system	Metabolic acidosis	9	15.8
	Magnesium sulphate toxicity	1	1.8
Gastrointestinal system	Liver rupture	1	1.8
Placental	Placental abruption	5	8.8
	Postpartum haemorrhage	5	8.8

Three maternal deaths occurred during the study period in intensive care unit. The first maternal death was a 26 year old woman who had an uneventful pregnancy and died of intra-cerebral haemorrhage after the onset of eclampsia. The second woman who died was 20 years old and had not attended antenatal clinic, she died of acute renal failure. The third woman who died was 28 years also with no evidence of ever attending antenatal clinic. She died of abruptio placenta, renal failure and HELLP syndrome.

The reason for ICU admission was haemodynamic monitoring (n=57,100%), ventilation (n=51, 89.4%), cardiopulmonary resuscitation in 45.6% (n=26) as shown in table 5. Massive blood transfusion was received in 15.8% of cases as the required intervention method done in ICU followed by inotropic support (15.8%), dialysis (5.2%) and tracheostomy (1.8%) respectively. During the postpartum period, 84.2% received magnesium sulphate prophylaxis prior to development of seizures in patient with severe preeclampsia.

Magnesium sulphate was received in 96.5% of cases to control and prevent further seizures and further 26.3% (n=15) received haloperidol, 19.3% (n=11) clonazepam and phenytoin while 5.2% received propofol to control further seizures. Labetalol was received in 22.8% of women with eclampsia to control severe high blood pressures.Main anti-hypertensive drugs of choice used during and after ICU admission were nifedipine slow release (43.8%, n=25), amlodipine (40.3%, n=23), methyldopa (12.2%, n=7), perindopril and carvedilol (3.5%, n=2). The number of women with eclampsia who needed two anti-hypertensive agents were (19.3%, n=11), three anti-hypertensive agents were (n=10, 17.5%) and four anti-hypertensive agents were (n=2, 3.5%) to control their blood pressures. Prophylactic enoxaparin sodium (clexane) was given in 75.4% during ICU discharge to prevent venous thromboembolism.

Table 5. The reason and interventions performed in women with eclampsia at CHBAH intensive care unit

Item	Interventions	n=57	Percentage
Reason for admission	Haemodynamic monitoring	57	100

Item	Interventions	n=57	Percentage
	Ventilation	51	89.5
	Cardiopulmonary resuscitation	26	45.6
Interventions in ICU	Massive blood transfusion	9	15.8
	Inotropic support	9	15.8
	Dialysis	3	5.3
	Tracheostomy	1	1.8
	Hysterectomy	0	0
Medications used for Seizures	Magnesium sulphate		
	Prior to seizures	48	84.2
	Control of seizures	55	96.5
	Haloperidol (Serenace)	15	26.3
	Clonazepam	11	19.3
	Phenytoin	11	19.3
	Propofol	3	5.3
Anti-hypertensive	Nifedipine slow release (Adalat XL)	26	45.6
	Labetalol	13	22.8
	Alpha Methyldopa	11	19.3
	Hydrochlorothiazide	4	7
	Atenolol	4	7
	Carvedilol	2	3.5
	Perindropril (Coversyl)	2	3.5
	Doxazosin	1	1.8
Postnatal prophylaxis	Enoxaparin sodium (Clexane)	43	75.4
	Aspirin	1	1.8

There were 59 babies including two sets of twins who were born to women admitted to ICU with eclampsia. The fetal morbidity and mortality that occurred during the study period indicated that 52.5% (n=31) of babies had preterm deliveries. The low birth weight accounted for (45.8%, n=27)) 25.4% (n=15) were admitted to neonatal

intensive care unit. There were 11.9% (n=7) stillbirths, 5.1% (n=3) intrauterine fetal deaths and early neonatal deaths, 1.7% (n=1) with intrauterine growth restriction. However 52.5% (n=31) had one minute Apgar scores of less than five while 40.7% (n=24) had five minute Apgar scores of less than seven. The perinatal outcomes are indicated in table 6.

Table 6. Perinatal outcome of women with eclampsia admitted at CHBAH ICU

Fetal outcome	**Number=59 (two sets of twins included).**	**Percentage (%)**
Preterm births	31	52.5
Low Apgar scores	31	52.5
One minute Apgar less than five	31	52.5
Five minutes agars less than five	24	40.7
Low birth weight	27	45.8
Neonatal intensive care unit	15	25.4
Stillbirths	7	11.9
Intrauterine fetal deaths	3	5.3
Early neonatal deaths	3	5.3
Intrauterine growth restriction	1	1.7

Discussion

Eclampsia is a preventable obstetric emergency. If detected and treated timeously severe morbidity and mortality from Eclampsia can be prevented. (12,13). The results indicated that 66.7% of women with eclampsia did not have prenatal care and only 33.3% attended antenatal clinic. Lack of prenatal care was identified as critical factor leading to poor maternal outcome (14). Two out of the three maternal deaths that reported in this study occurred in women who had not attended antenatal clinic.

This was similar to the study conducted by Imarengiaye et al, 2015 in Nigeria on intensive care management and outcome of women with hypertensive diseases of

pregnancy which stated that not attending antenatal care, primigravidity and caesarean section were leading factors associated with ICU admission (15).
The study confirmed that eclampsia is common in primigravida's (n=30, 52.6%) and in women between the ages of 16-30 years (n=42, 73.7%). Similar studies by Imarengiaye et al, 2015 reported 56% of primigravida and Desaleg et al, 2015 reported 47.5% of primigravida (15, 16). The incidence from eclampsia decreases with higher parity. This clearly indicates that eclampsia is a disease commonly found in young primipara's even in the African context.

Eclampsia which requires intensive care unit admission is associated with maternal morbidity in both the mother and the baby. The majority of women with eclampsia admitted in ICU required haemodynamic monitoring and ventilation. HELLP syndrome, acute renal failure, pulmonary oedema, metabolic acidosis and PRES were very common complications identified in ICU. The high numbers of complications associated with eclampsia requiring organ support were unexpected. Similar results were reported by Desalegn et al, 2015 in Ethiopia (16). The study reported high maternal complication rates associated with preeclampsia-eclampsia. HELLP syndrome, acute renal failure, and pulmonary oedema were the leading complications which was similar to the findings of this study.

Our study reported the intensive care unit mortality rate of 5.3 per 100 000 births which is lower in contrary to the study conducted by Jamil et al, 2013 in Pakistan that reported maternal mortality of 15.5% despite low intensive care complication rates (HELLP syndrome developed in 3.4%, acute renal failure (2.6%) and also abruptio placenta 3.4%) (17). The differences might be that eclampsia complications were better managed in our intensive care unit compared to Ayub teaching hospital.
This means that more efforts need to be put into preventing and managing acute complications of eclampsia and as this may result in a high burden and cost to the family or caregivers of the mother infant pair.

France J et al (2012), in Tanzania reported that prodromal symptoms of imminent eclampsia occurred in 90% of women with eclampsia. This is within the normal ranges of 41% to 91% reported in the literature (18). However, this study reported that 84.2% of women in South Africa with a severe form of eclampsia did not have

signs and symptoms of imminent eclampsia. It may be that women in this population present differently from women in other populations.

Few African studies have described the progression of pre-eclampsia to eclampsia. According to South African saving mother's report of 2014-2016, hypertensive diseases in pregnancy are the direct leading cause of maternal death in South Africa despite interventions to reduce the number of maternal deaths (5). It may be that the progression of preeclampsia to eclampsia is not well understood in the African population. The majority of women with severe preeclampsia in this study received magnesium sulphate to prevent eclampsia.

The strength of the study is that it provides a detailed description of risk factors and outcomes in women with a severe form of eclampsia in an African population that could be used to better understand the disease and the management thereof.
In certain countries all women with eclampsia are admitted to ICU, but in the South African context eclampsia is so common that only women with eclampsia and additional life-threatening complications are admitted to ICU. This study indirectly describes near-misses from eclampsia, though not all near-misses in our setting are able to get an ICU bed.

The limitations of the study, the retrospective nature of this study means that the following cannot be answered; the percentage of women with eclampsia who needed ICU and also the percentage of women who needed ICU but could not be admitted due to shortage of beds.

Recommendations are that health care workers and obstetric staff must be trained and educated on the strategies for prevention of eclampsia. Prevention needs to be strengthened through patient education and early antenatal care bookings. Obstetricians need to be equipped not only to prevent eclampsia but to manage life-threatening complications from eclampsia.

Conclusion

Eclampsia is a preventable condition affecting women mostly in low to middle income countries. We found that women who are admitted to ICU for Eclampsia had eclampsia associated maternal life-threatening multi-organ dysfunction and poor perinatal outcomes. Measures to prevent eclampsia need to be strengthened.

References

1. Muhammad Z, Muhammad D, Ibrahim S. Obstetric admissions to the intensive care unit: A seven year review at Aminu Kano Teaching Hospital Kano, Nigeria. Borno Med J 2010; 7(1):1-15.
2. Jido T. Eclampsia: Maternal and fetal outcome. Afr Health Sci 2012; 12(2): 148-152.
3. Duley L. The global impact of preeclampsia and eclampsia. Semin Perinatol 2009; 33: 130-137
4. Vigil-De Garcia P. Maternal death due to eclampsia and HELLP syndrome. Int J Gynaecol Obstet 2009; 104(2): 90-94.
5. Department of Health. Saving mothers 2014-2016: Seventh triennial report on confidential enquiries into maternal deaths in South Africa. The National Committee on Confidential Enquiries into Maternal Deaths in South Africa, Pretoria Department of Health 2018.
6. Priso E, Njamen T, Tchente C, et.al. Trends in admissions, clinical features and outcome of preeclampsia and eclampsia as seen from the intensive care unit of the Doula General Hospital, Cameroon. Pan Afr Med J 2015; 21: 103.
7. Ghulmiyyah L, Sibai B. Maternal mortality from preeclampsia/eclampsia. Seminars Perinatol 2012; 36(1): 56-59.
8. Douglas K, Redman C. Eclampsia in the United Kingdom. BMJ 1994; 309: 1395-1399.
9. Sharara H. A review of Eclampsia in Qatar: A twenty-year study (from January 1991-December 2009).Qatar Med J 2012; 2012(2):7-13.
10. Agida E, Adeka B, Jibril K. Pregnancy outcomes in eclamptics at the University of Abuja Teaching Hospital, Gwagwalada: A 3 year review. Niger J Clin Prac 2010; 13(4):394-398.
11. Makhanya V, Moodley J, Govender L. Eclampsia: still a problem in rural Kwazulu-Natal Province, South Africa. S Afr J Obstet Gynaecol. 2016; 22 (1):13-16.
12. Kannar A, Patel M, Prajapati, et al. A retrospective study of 100 cases of Eclampsia: perinatal outcomes. In J Reprod Contracept Obstet Gynecol 2016; 5(11): 3898-3901.

13. Pannu P, Das B, Hazari P, et al. Maternal and perinatal outcome in eclampsia and factors affecting the outcome: a study in North Indian population. Int J Reprod Contracept Obstet Gynecol 2014; 3(2): 347-351.

14. Kullima A, Kawuwa M, Audu B. A 5-year review of maternal mortality associated with eclampsia in a tertiary institution in Northern Nigeria. Ann Afr Med 2009; 8(2): 81-84.

15. Imarengiaye C, Isesele T. Intensive care management and outcome of women with hypertensive diseases of pregnancy. Niger Med J 2015; 56(5): 333-337Jamil M, Abbasi M, Zaman H. Outcome of eclampsia in patients admitted to ICU at a tertiary care teaching hospital. Khyber Med Univ J 2013; 5(4): 203-206.

16. Desalegn N, Haile M. Causes of admission and outcomes among preeclampsia and eclampsia mothers admitted to Jimma University Specialized Hospital intensive care unit.Clin Med Sci 2015; 4(5):154-159.

17. Jamil M, Abbasi M, Zaman H. Outcome of eclampsia in patients admitted to ICU at a tertiary care teaching hospital. Khyber Med Univ J 2013; 5(4): 203-206.

18. France J, Muganyizi P. Characteristics of symptoms of imminent eclampsia: A case referent study from tertiary hospital in Tanzania. Open J Obstet Gynecol 2012; 2: 311-317.

Annexure 1: Ethics approval certificate

R14/49 Dr Nkhangweleni Colbert Makheda

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)

CLEARANCE CERTIFICATE NO. M170220

NAME: (Principal Investigator)	Dr Nkhangweleni Colbert Makheda
DEPARTMENT:	Obstetrics and Gynaecology Chris Hani Baragwanath Academic Hospital Intensive Care Unit
PROJECT TITLE:	Eclamptics Requiring Intensive Care Admission at Chris Hani Baragwanath Hospital
DATE CONSIDERED:	24/02/2017
DECISION:	Approved unconditionally
CONDITIONS:	
SUPERVISOR:	Dr Salome Maswime
APPROVED BY:	Prof P Cleaton-Jones, Chairperson, HREC (Medical)
DATE OF APPROVAL:	30/06/2017

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

DECLARATION OF INVESTIGATORS

To be completed in duplicate and **ONE COPY** returned to the Research Office Secretary in Room 301, Third floor, Faculty of Health Sciences, Phillip Tobias Building, 29 Princess of Wales Terrace, Parktown, 2193, University of the Witwatersrand. 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 resubmit the application to the Committee. **I agree to submit a yearly progress report**. The date for annual re-certification will be one year after the date of convened meeting where the study was initially reviewed. In this case, the study was initially reviewed in February and will therefore be due in the month of February each year. Unreported changes to the application may invalidate the clearance given by the HREC (Medical).

Principal Investigator Signature

30/06/2017
Date

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES

Annexure 2: CEO approval letter

GAUTENG PROVINCE
HEALTH
REPUBLIC OF SOUTH AFRICA

MEDICAL ADVISORY COMMITTEE
CHRIS HANI BARAGWANATH ACADEMIC HOSPITAL

PERMISSION TO CONDUCT RESEARCH

Date: 17 Feb 2017

TITLE OF PROJECT: Eclamptics requiring intensive care admission at Chris Hani Baragwanath Academic Hospital

UNIVERSITY: Witwatersrand

Principal Investigator: NC Makheda

Department: Obstetrics and Gynaecology

Supervisor (If relevant): S Maswime

Permission Head Department (where research conducted): Yes (research coordinator)

Date of start of proposed study: Feb 2017
Date of completion of data collection: Dec 2018

The Medical Advisory Committee recommends that the said research be conducted at Chris Hani Baragwanath Hospital. The CEO /management of Chris Hani Baragwanath Hospital is accordingly informed and the study is subject to:-

- Permission having been granted by the Human Research Ethics Committee of the University of the Witwatersrand.
- the Hospital will not incur extra costs as a result of the research being conducted on its patients within the hospital
- the MAC will be informed of any serious adverse events as soon as they occur
- permission is granted for the duration of the Ethics Committee approval.

.....
Recommended
(On behalf of the MAC)
Date: 17 February 2017

.....
Approved/Not Approved
Hospital Management
Date: 21/02/17

Annexure 3: Plagiarism certificate

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

FACULTY OF HEALTH SCIENCES

PLAGIARISM DECLARATION TO BE SIGNED BY ALL HIGHER DEGREE STUDENTS

SENATE PLAGIARISM POLICY: APPENDIX ONE

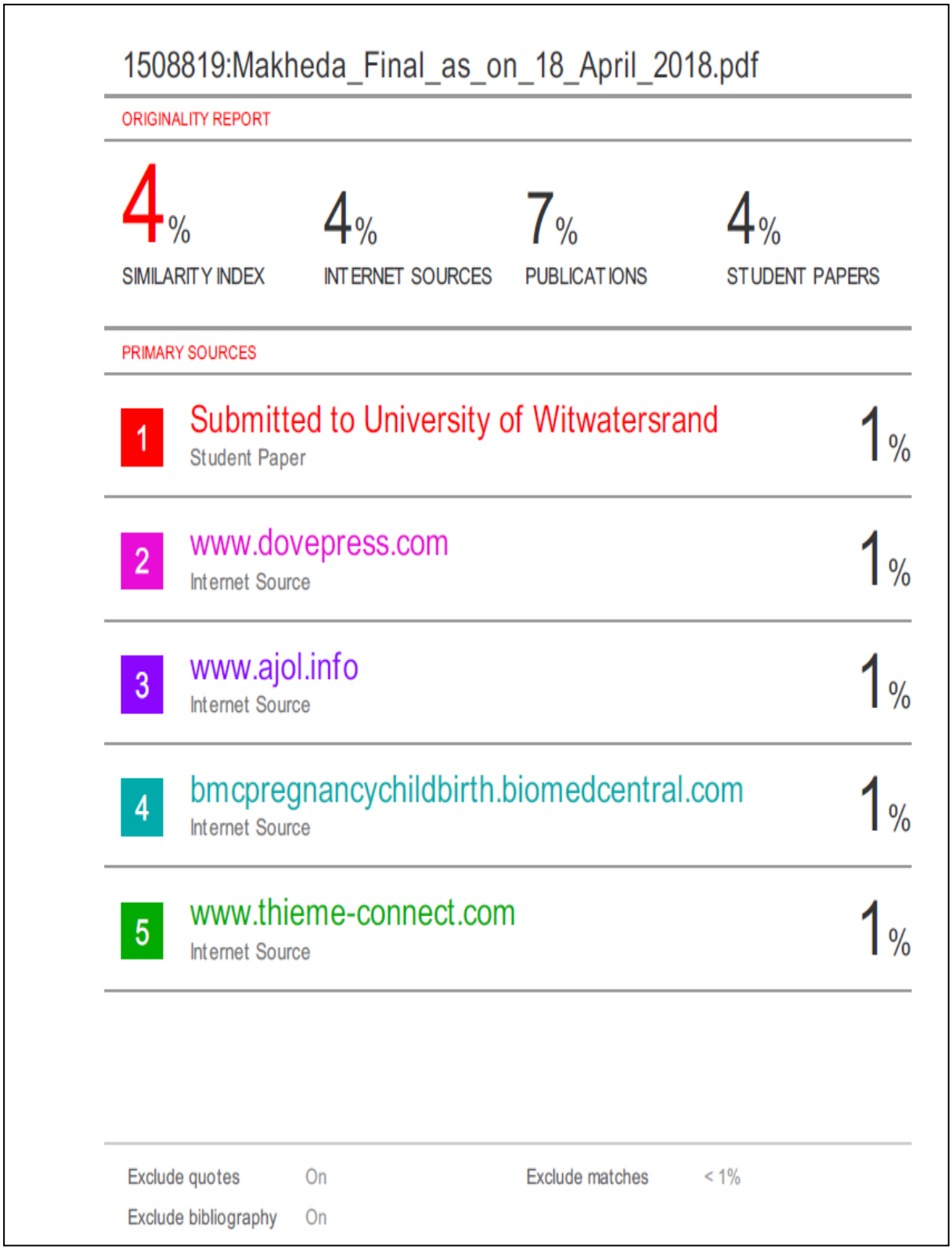
I MAICHEDA N C (Student number: 1508819) am a student registered for the degree of MASTERS DEGREE IN Obstetrics + Gynaecology in the academic year 2015

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 wrong.
- I confirm that the work submitted for assessment for the above degree is my own unaided work except where I have explicitly indicated otherwise.
- I have followed the required conventions in 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.
- I have included as an appendix a report from "Turnitin" (or other approved plagiarism detection) software indicating the level of plagiarism in my research document.

Signature: _____ Date: 2017/02/01

Annexure 4: Turnitin Submission



1508819:Makheda_Final_as_on_18_April_2018.pdf

ORIGINALITY REPORT

4%	4%	7%	4%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	Submitted to University of Witwatersrand Student Paper	1%
2	www.dovepress.com Internet Source	1%
3	www.ajol.info Internet Source	1%
4	bmcpregnancychildbirth.biomedcentral.com Internet Source	1%
5	www.thieme-connect.com Internet Source	1%

Exclude quotes	On	Exclude matches	< 1%
Exclude bibliography	On		

Annexure 5: Data collection sheet

DATA COLLECTION TOOL

Variable	Total Number (n)	Proportion (%)
Age		
Parity		
Gravidity		

Booking status

Booking status	Total number (n)	Proportion (%)	Gestational age by (Early ultrasound /Late ultrasound / Dates / palpation)	Total number (n)	Proportion (%)	Number of antenatal visits	Total number (n)	Proportion (%)	Blood pressure at all Antenatal visits	Total number (n)	Proportion (%)
									Date/BP		
Booked			Booking	/40							
Un-booked			diagnosis	/40							
Unknown			delivery	/40							

Booking bloods

Variable		Total number (n)	Proportion (%)
Hb			
RPR			
RH			
HIV	- Negative/Positive/Unknown		
	- CD4/VL		
BMI	- Weight in kg		
	- Height in cm		

Previous obstetrics history

Variable	Total number (n)	Proportion (%)
Previous history of eclampsia in last pregnancy		
Previous history of preeclampsia		
Previous history of antepartum and postpartum haemorrhage		
Previous history of normal vertex delivery		
Previous history of chronic hypertension		
Previous history of antiphospholipid syndrome		
Previous Caesarian section		

Current obstetrics history

Variable	Total number (n)	Proportion (%)
Chronic hypertension		
Chronic hypertension with superimposed preeclampsia		
Gestational hypertension		
Preeclampsia		
Antiphospholipid syndrome		
Systemic Lupus Erythematous		
HELLP Syndrome		

Comorbidities

Variable	Total number (n)	Proportion (%)
Pre-gestational Diabetes		
Thromboembolism		
Cardiac disease		
Tuberculosis		
Gestational Diabetes		
Epilepsy		
Cerebrovascular accident		
Asthma		
Renal failure		
Thyroid disease		
Thrombophilia		
Liver disease		
Other (describe)		

Seizures

Variable	Total number (n)	Proportion (%)
Details about first seizure		
Number of seizure		
Duration of seizure		
Timing of seizure in relation to labour		
– Antepartum		
– Intrapartum		
– Postpartum		
Number of subsequent seizure		
Status epilepticus		

Signs and Symptoms of imminent eclampsia

Variable	Total number (n)	Proportion (%)
headache		
Blurred vision		
Epigastric pain		
vomiting		
Nausea		
hyperreflexia		
Clonus		

Family history of Hypertension

Social history

Variable	Total number (n)	Proportion (%)
Alcohol		
Smoking		

Antenatal prophylactic measures and gestational age given

Variable	Total number (n)	Proportion (%)
Calcium		
Clexane for Antiphospholipid syndrome		
Aspirin		
Magnesium Sulphate		

Admission to Hospital

Variable	Total number (n)	Proportion (%)
Gestational age		
Diagnosis		
Level of consciousness		
Glasgow coma scale(EMV)		
Reflexes		
Tone		
Focal neurological signs		
Blood pressures		
Urinary Protein -dipstick		
-PCR		
-24 hour		

Laboratory results on Admission

Variable	Total number (n)	Proportion (%)
Hb		
Platelets		
Urea		
Creatinine		
AST		
ALT		
LDH		
INR/PTT		
Arterial Blood Gas		
– PH		
– HCO3		
– PCO2		
– PO2		
– Lactate		
– BE		
– Glucose		

Imaging

Variable	Total number (n)	Proportion (%)
Sonar and Doppler's		
CXR		
CT scan		
EEG		

Dose and Medications given

Variable	**Total number (n)**	**Proportion (%)**
Methyldopa		
Nifedipine		
Labetalol		
Hydralazine		
Amlodipine		
MgSO4		
Clonazepam		
Phenytoin		

Delivery

Variable	Proportion
Gestational age	
Indications for delivery	
Mode of delivery	
– Normal vertex delivery	
– Assistant delivery	
– Caesarian section	
– induction of labour	

Admission to ICU

Variable	**Total number (n)**	**Proportion (%)**
Reason for admission		
Length of ICU stay		
Date of discharge		
Timing of ICU admission in relation to labour		
– Antepartum		
– Intrapartum		
– Postpartum		

Interventions done in ICU

Variable	Total number (n)	Proportion (%)
Hemodynamic monitoring		
Intubation and ventilation		
Use of continuous vasoactive agents		
Cardiopulmonary resuscitation		
Massive blood transfusions		
Hysterectomy		

Maternal Outcome

Variable	Total number (n)	Proportion (%)
Maternal death		
Cerebrovascular accident		
Transient Ischaemic attack		
Intracerebral haemorrhage		
Posterior reversible encephalopathy syndrome(PRES)		
Cerebral oedema		
Cortical blindness		
Retinal detachment		
Prolong unconsciousness greater than 12hours		
Uncontrolled seizures(continue seizures despite adequate treatment)		
Aspiration pneumonia		
Laryngeal oedema		
Pulmonary oedema		
Acute respiratory distress syndrome		
Cardiovascular arrest		
Cardiac failure		
Rupture liver capsule		
Renal failure		
HELLP Syndrome		
Disseminated Intravascular Coagulation		
Placenta Abruption		

Fetal outcome

Variable	Total Number (n)	Proportion
Preterm birth		
Intrauterine growth restriction		
Intrauterine fetal death		
Low birth weight		
Apgar's score in 1 minute and 5 minutes		
Admission to Neonatal intensive care unit		
Stillbirths		
Neonatal death		

Avoidable factors

Patient related factors	
Workers related factors	
Health System related factors	

Study number

File link

Study case	GT number
1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	
etc.	