Is maternal hypotension during pregnancy and/or posterior located placenta associated with increased risk of stillbirth? A case-control study

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January 2007

A thesis submitted for the degree of Doctor of Philosophy of the University of Adelaide, South Australia.
# Table of contents

ABSTRACT ........................................................................................................................................ V

GLOSSARY ........................................................................................................................................ IX

DEDICATION ...................................................................................................................................... XIV

ACKNOWLEDGMENTS ................................................................................................................... XV

PROLOGUE ....................................................................................................................................... 17

CHAPTER 1 - BACKGROUND ........................................................................................................ 24

  INTRODUCTION .......................................................................................................................... 24
  RISK FACTORS FOR POOR PREGNANCY OUTCOME ............................................................... 24
  RISK FACTORS FOR STILLBIRTH .............................................................................................. 34
  CHOICE OF STUDY VARIABLES ............................................................................................... 35
  HYPOTENSION AND PREGNANCY OUTCOME ....................................................................... 35
  PLACENTATION AND PREGNANCY OUTCOME ....................................................................... 40
  THE STUDY QUESTIONS ........................................................................................................... 41
  PURPOSE OF THE STUDY .......................................................................................................... 42

CHAPTER 2 – LITERATURE REVIEW .......................................................................................... 43

  INTRODUCTION .......................................................................................................................... 43
  LITERATURE SEARCH METHOD ............................................................................................... 43
  HYPOTENSION RESEARCH ........................................................................................................ 45
  PLACENTAL POSITION RESEARCH ........................................................................................... 58
  SUMMARY .................................................................................................................................... 62

CHAPTER 3 - STUDY DESIGN .................................................................................................... 63

  INTRODUCTION .......................................................................................................................... 63
  THE EPIDEMIOLOGICAL APPROACH ........................................................................................ 63
  EPIDEMIOLOGY AS THE UNDERPINNING DISCIPLINE .......................................................... 68
  CASE-CONTROL STUDIES ........................................................................................................ 70
  THE STUDY DESIGN .................................................................................................................. 73
  SUMMARY .................................................................................................................................... 99

CHAPTER 4 – ANALYSIS AND RESULTS ............................................................................... 100

  INTRODUCTION .......................................................................................................................... 100
  STATISTICAL ANALYSIS SOFTWARE ...................................................................................... 100
  DATA ENTRY .................................................................................................................................. 100
  DATA ANALYSIS PROCESS ...................................................................................................... 103
  ANSWERING THE STUDY QUESTIONS ...................................................................................... 110
  SUMMARY .................................................................................................................................... 138

CHAPTER 5 – DISCUSSION, RECOMMENDATIONS AND CONCLUSIONS ......................... 139

  INTRODUCTION .......................................................................................................................... 139
  POSTERIOR LOCATED PLACENTA ............................................................................................. 139
  MATERNAL HYPOTENSION IN PREGNANCY ......................................................................... 143
  SECONDARY FINDINGS ............................................................................................................. 149
  GENERAL STRENGTHS AND WEAKNESSES OF THE STUDY ................................................ 165
  GENERALISABILITY OF RESULTS .............................................................................................. 167
  MATERNAL HYPOTENSION: WHAT CAN BE DONE? ............................................................... 169
  POSTERIOR LOCATED PLACENTA: WHAT CAN BE DONE? ..................................................... 175
Figures

Figure 1.1 Web of causation .......................... 25
Figure 1.2 Placental vascular structure ................. 29
Figure 1.3 Perinatal deaths in South Australia 2003 ............. 34
Figure 1.4 CTG showing episode of fetal bradycardia .............. 39
Figure 2.1 & 2.2 Graphs shows similarities between studies .......... 46
Figure 2.3 Relationship between DBP and perinatal mortality risk. ......... 53
Figure 2.4 CTG during sleep ................................ 57
Figure 2.5 CTG fetus with double nuchal cord during maternal sleep ........ 60
Figure 3.1 Case-Control Study Design .............. 71
Figure 3.2 Selection Bias ................................... 83
Figure 3.3 Confounding ........................................ 84
Figure 3.4 Mean Arterial Blood Pressure ready reckoner .......... 92
Figure 4.1 Egret spreadsheet ........................................ 101
Figure 4.2 Infant weight for gestational age at birth .......... 112
Figure 4.3 Antecedent cause of death .................. 114
Figure 4.4 Contributing causative factors noted at autopsy .......... 116
Figure 4.5 Time of death ........................................ 117
Figure 4.6 Liquor colour ........................................ 119
Figure 4.7 Nuchal cord documentation .................. 120
Figure 4.8 Race .................................................. 121
Figure 4.9 Placental Positions ............................... 136
Figure 5.1 "Triple risk" SIDS model ......................... 168

APPENDIX ONE: HOSPITAL A HREC APPROVAL ........................................ 186
APPENDIX TWO: HOSPITAL B HREC APPROVAL ........................................ 187
APPENDIX THREE: SUPPLEMENTARY BIRTH RECORD (SBR) ...................... 188
APPENDIX FOUR: DATA COLLECTION PROFORMA .................................... 189
APPENDIX FIVE: DATA COLLECTION PROFORMA .................................... 190
APPENDIX SIX: WHITFIELD/ PSANZ COMPARISON .................................. 191
APPENDIX SEVEN: HYPOTENSIVE SYMPTOMS QUESTIONNAIRE ............ 192
REFERENCE LIST .................................................................................. 193
Tables

Table 2.1 Summary of all hypotension and stillbirth studies 46
Table 2.2 Caesarean and perinatal mortality associated with maternal hypotension 48
Table 2.3 Poor perinatal outcomes associated with maternal hypotension 48
Table 3.1 Data collection proforma risk factors and reason for inclusion 93
Table 4.1: Example of initial univariate analysis 104
Table 4.2 Maternal age in years 111
Table 4.3 Gestational age in weeks 112
Table 4.4 Infant weight descriptive statistics by hospital of birth 112
Table 4.5: Colour Of Liquor: 118
Table 4.6: Estimated Blood Loss 120
Table 4.7a: Gravidy 122
Table 4.7b: Parity 122
Table 4.8: History of Spontaneous Loss 122
Table 4.9: Number of Antenatal visits 123
Table 4.10: Tobacco smoking status 123
Table 4.11: Medical Complications 124
Table 4.12: Obstetric Complications 125
Table 4.13: SGA 126
Table 4.14: BMI 126
Table 4.15: Hospital admissions 127
Table 4.16: Lowest Haemoglobin 127
Table 4.17 Blood group 128
Table 4.18 Systolic Blood pressures greater than 130mmHg 129
Table 4.19: Diastolic Blood pressure initial, minimum, average and last 130
Table 4.20: MAP greater than 103mmHg 132
Table 4.21a: Contingency table for overall blood pressure 132
Table 4.21b Hypotension as a predictor of stillbirth. 133
Table 4.22: Essential Hypertension 134
Table 4.23a : PIH Conditional Regression 134
Table 4.23b PIH as a predictor for stillbirth 135
Table 4.24a: Placental position 136
Table 4.24b Posterior Placenta as a predictor of stillbirth 137
Table 4.25 Posterior Placenta and Hypotension as predictors of stillbirth 137
Table 4.26 Odds ratio estimates for stillbirth 138
Abstract

Title
Is maternal hypotension during pregnancy and/or posterior located placenta associated with increased risk of stillbirth?

Design
A retrospective case-controlled study comparing a group of stillbirths with a live born control group matched for maternal age, baby gender, gestational age and year of birth. The purpose of this study was to ascertain whether hypotensive women or women with a posterior located placenta are at increased risk of stillbirth.

Two Australian tertiary referral obstetric hospitals were chosen as participating hospitals for this study. All cases with a discharge diagnosis of stillbirth over a five year period at these hospitals were identified and considered as cases for inclusion in the study. An attempt was made to match each case with two controls. After exclusions there were 124 cases and 243 controls.

Blood pressure (BP) readings throughout pregnancy were extracted from the medical record of each subject, and summary 'exposure' measures were created. These included: diastolic and systolic readings as well as mean arterial pressure taken at the initial (booking BP), minimum, calculated average, and final reading prior to the birth. Placental position, as determined by midtrimester ultrasound, was also collected.

Results
This study found that low Diastolic Blood Pressure (DBP) readings (between 60-70mmHg) throughout pregnancy were associated with a statistically significant increased risk of stillbirth. This trend was seen from the initial reading at booking (OR 1.83 95% CI 1.0-3.2, p=0.03) through to the last taken before the birth (OR 1.53 95% CI 0.9-2.5, p=0.09) including the calculated average over the course of the pregnancy (OR 1.61 95% CI 1.0-2.6, p=0.05) and minimum observed during the pregnancy (OR 2.94 95% CI 0.98-
In addition, this study found a minimum diastolic reading of less than 60mmHg carries a significant risk of stillbirth with a crude odds ratio of 3.5 (95% CI 1.18-10.41, p=0.02).

This study did not show a statistically significant association of systolic hypotension with stillbirth. However, after combining both systolic and diastolic blood pressures to calculate the mean arterial blood pressure (MAP) the analysis did suggest that women with a minimum MAP between 73-83mmHg were at increased risk of stillbirth (OR 1.69 CI 1.02-2.81, p=0.04). Furthermore, this study found that three MAP readings of less than 83.3 during the course of the pregnancy carries almost twice the risk of stillbirth (adjusted OR 1.99) even after adjusting for race, gravidity, parity, BMI and SGA (and matching for maternal age, gestational age, gender and year of birth.)

Women who have a posterior located placenta were statistically more likely to suffer a stillbirth than women who had a placenta in any other position (crude OR 1.64) and this estimate was largely unaffected by adjustment for blood pressure and other putative risk factors (adjusted OR 1.67)

**Conclusion**

In conclusion, this is the first study which specifically examined a stillborn population in order to explore whether maternal hypotension and posterior located placenta impact negatively on stillbirth incidence and the results of this study suggest that both maternal hypotension and posterior located placenta are probably independent contributory risk factors for stillbirth. This means that maternity care providers should closely manage and monitor progress of women who are hypotensive during pregnancy or those whose placenta is posterior; and that effective management strategies need to be developed to care for these women.
**Article by the candidate published in a peer refereed journal**


**Presentations at conferences made by the candidate**


*Keynote address 'Like a Fire in your heart' and 2 workshops 'Partners in Grief' and 'Subsequent pregnancy'* at the 4th SANDS New Zealand National Conference (Napier) September 2003

*Invited paper 'SAD cases of stillbirth: the Epidemiology and experience of unexplained stillbirth close to term' and Free Paper 'Unheard voices: Is there an association between maternal hypotension and poor pregnancy outcome? ’* C&N project people Midwifery Expo (Adelaide) September 2004

*Free paper "Hypotension in pregnancy and stillbirth risk"* Birth Issues Research Conference (Noosa) August 2006


**Travel grant awarded.**

Funding was granted in 2003 for travel to New Zealand to present a Keynote address to the SANDS NZ National Conference by The University of Adelaide Research Abroad Scholarship
The University of Adelaide
Candidate's Certification

This work contains no material which has been accepted for the award of any degree or diploma in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text.

I give consent to this copy of my thesis, when deposited in the University Library, being made available in all forms of media, now or hereafter known.

Signed…

Dated…
Accoucher: The person attending the birth who assists the mother to birth her baby.

Anencephaly: A neural tube defect that causes the baby to be born with little or absent cerebrum and flat bones of the skull.

Antepartum: The period before giving birth.

Antepartum haemorrhage (APH): Vaginal bleeding in excess of 15 ml after 20 weeks of pregnancy.

Apgar score: A numerical score indicating the condition of the baby after birth. The infant is given a score out of two for heart rate, respiratory effort, muscle tone, reflex response and colour.

Autopsy (Necropsy): A pathological examination of a deceased person performed to determine the cause of death.

Bicornuate Uterus: A congenital developmental error causing partial or complete duplication of the uterus and two fundal 'horns'.

Body Mass Index (BMI): An index which relates a person's weight to their height to determine if they are lean, normal, overweight or obese. The index is calculated by weight in kilograms (kg) divided by height in metres (m) squared.

Caesarean Section (LSCS): An operation when the baby is delivered via an abdominal operation through the lower segment of the uterus.

Cardiotocograph (CTG): Also known as electronic fetal monitoring. A machine generated printout which depicts fetal heart rate in relation to uterine activity.

Caucasian: An individual of European descent.
Cervical incompetence painless dilatation of the cervix in the second trimester which may result in fetal loss.

Cholestasis of pregnancy Pregnancy related reduction of gallbladder function resulting in excessive bile acids in the blood stream and skin. The most common symptom is itchiness. This condition is responsible for sudden fetal demise.

Chorioamnionitis inflammation of the chorion and amnion (membranes).

Cordocentesis an antenatal diagnostic procedure during which a fetal blood sample is taken from the umbilical cord.

Diastolic Blood Pressure (DBP) the lower blood pressure reading produced during ventricular diastole.

Essential Hypertension Hypertension existing prior to the onset of the pregnancy.

Funisitis: infection of the umbilical cord.

Gestation: Duration of the pregnancy taken from the first day of the last normal menstrual period (usually measured in completed weeks).

Gestational diabetes mellitus: Diabetes which arises during the pregnancy and resolves after the pregnancy ends.

Gestational Hypertension: hypertension arising in pregnancy after 20 weeks gestation without any other feature of multi-system disorder (pre-eclampsia) and which resolves within 3 months postpartum.¹

Grandmultigravida a woman who has been pregnant more than four times.

Gravidy: The number of times a woman has been pregnant.

Group B Streptococcus (GBS) a common bacteria found in the intestinal and genital tracts. It is the main causative agent of maternal infections of the genito-urinary tract and the neonate.
**HELLP Syndrome** An advanced and often serious form of PE characterised by hypertension as well as hemolysis, elevated liver enzymes, and low platelets.

**Hypoxic** insufficient oxygen levels.

**Incompetent Cervix** see cervical incompetence.

**Intrapartum** the time when the woman is labouring and giving birth

**Intrauterine Growth Restriction (IUGR)** The infant’s birth weight is below the 10th centile for that which would be expected for the gestational age.

**Korotkoff Sound** Named after the physician who first described them there are five Korotkoff sounds associated with the taking of blood pressure.

**Lupus/Antiphospholipid syndrome** A disorder of the immune system associated with excessive blood clotting.

**Mean Arterial Blood Pressure (MAP)** a term which describes a notional average blood pressure in an individual. It is typically calculated by using the following formula $(SBP+2*DBP/3)$.

**Meconium stained liquor (MSL)** fetal faeces present in the liquor which stains it green.

**Multigravida** a woman who has been pregnant more than once.

**Nuchal Cord:** Umbilical cord around the neck of the baby.

**Nulliparous** a woman who has never given birth.

**Orthostatic dysregulation:** a 20mmHg drop in MAP and increase in pulse rate by 20 beats per minute occurring after exercise.

**Orthostatic hypotension:** a blood pressure drop of 10-20mmHg when a person changes position from lying to standing.
**Parity**: The number of times a woman has given birth at greater than 20 weeks gestation (the baby need not have been live born).

**Perinatal death**: a term which encompasses death around birth including stillbirth and neonatal death.

**Placental Abruption** the placenta partially or completely abruits or 'tears away' from the uterine wall.

**Placental Perfusion**: the passage of blood and nutrients through the placenta.

**Placenta praevia**: the placenta reaches or covers the internal cervical os.

**Placentation**: the way in which the placenta is formed and attached to the uterus.

**Post-prandial hypotension** a drop in blood pressure following eating.

**Pre-eclampsia (PE)** hypertension arising after 20 weeks gestation with one or more of: proteinuria, renal insufficiency, liver disease, neurological problems, haematological disturbances, fetal growth restriction. The hypertension returns to pre-pregnancy levels within 3 months postpartum.¹

**Pregnancy Induced Hypertension (PIH)** see gestational hypertension.

**Preterm (Premature)** an infant born prior to the 37th completed week of gestation.

**Primiparous** A woman who has given birth for the first time.

**Pulse Pressure (PP)** the difference between the systolic and diastolic blood pressure.

**Septate uterus** the body of the uterus is partially or completely divided by a septum.

**Small for Gestational Age (SGA)** a term synonymous with intrauterine growth restriction as above.
Stillbirth: "birth of a fetus at or after 20 weeks gestation and/or with a birthweight of 400 gm or more, with no signs of life at birth"\(^2\) (p.40).

Supine hypotensive syndrome occurs when the pregnant woman lies supine and the gravid uterus occludes the inferior vena cava causing her to feel faint.

Systolic Blood Pressure (SBP) the higher blood pressure reading produced during ventricular systole.

Thrombophilia a range of diseases both inherited and acquired associated with blood clotting. The most common inherited thrombophilia affecting pregnancy outcome is Factor V Leiden.

Trisomy three copies of a chromosome rather than the usual two. Common trisomies are 18 and 21.

Umbilical artery doppler velocimetry measuring the speed at which blood travels through the umbilical arteries.

Unexplained stillbirth Birth of an infant who shows no signs of life (as in stillbirth definition above) whose death was unexpected by history, and after an autopsy of the baby together with gross and histologic examination of the umbilical cord, placenta and membranes no antecedent cause of death was demonstrated.

Unicornuate Uterus A congenital developmental error causing an abnormally thin uterus.

Velamentous umbilical cord insertion cord inserted into the membranes causing the fetal blood vessels to run between the membranes and the placenta.
Dedication

To a beautiful daughter
Emma Louise Warland
Stillborn 22/4/93

and

To a wonderful father and friend
William 'Brian' Kelley
19/4/28 - 26/10/94

To mourn too long
For those we love
Is self indulgent-
But to honour their memory
With a promise
To live a little better
For having known them,
Gives purpose to their life-
And some reason
For their death...

Nanushka
Acknowledgments

There are many people who assisted me in some way through my Ph.D. candidature. I could not have finished this research without the help of the following people:

I'd like to thank Professor Helen McCutcheon for her absolutely amazing skill and experience as my principal supervisor. I am especially grateful for her constant help, support, advice, shoulder to cry on and collegial friendship throughout this Ph.D. In particular I'd like to thank her for continuing to be my supervisor in spite of her university change at the very end of my candidature.

My co-supervisor Associate Professor Peter Baghurst gave me his invaluable help throughout my candidature. I am especially grateful for his assistance at all stages of the ethics proposal and approval. He also spent many hours with me sharing his encyclopaedic knowledge and advice throughout data analysis. He was an especially patient and excellent teacher and I consider myself extremely fortunate to have been able to have had such an expert epidemiologist assisting me.

Dr Jason Collins, a man I have not met face to face but who encouraged me to take on this project and whose interesting 'theory' provided the spark for me to do this research.

Hans Sandstrom for his written translation of some of the key German text. I particularly appreciated the time he took to understand the midwifery terms within the text and his attention to translating with precision.

Dr Eric and Lotte Hoopman for opening their home to me. Lotte spent hours translating and reading German papers to me. Eric's medical knowledge was invaluable in giving us understanding of what Lotte was reading.

Staff at Royal Women's Hospital (RWH) Melbourne, especially Arthur Hui the secretariat of the institutional ethics committee who remained patient and helpful through my many phone calls and emails over the course of one year. Professor James King and Liz Chatham for their encouragement and good advice throughout the ethics approval
process. Helen Robertson who collected data at the RWH and Jenny Ryan for finding Helen and agreeing to give her time away from her clinical area to collect the data.

Professor Jeffery Robinson for his interest, support and help in making the data collection at RWH possible.

Academics and staff at the University of Adelaide. I would like to especially thank those in the Department of Clinical Nursing. The biannual research schools this department runs, as well as the support this department offers to its candidates is excellent especially the collegial support from fellow PhD students. Many of these encouraged me, laughed and cried with me through the difficult "ethics" period of this Ph.D. and for this I'd particularly like to thank Mary Kelly, Amanda Rischbieth, and Victoria Williamson. I would also like to thank Professor Alison Tierney, Dr. David Evans and Dr. Judy Magarey for their ongoing interest and support as well as Kate Cadman who gave many wonderful presentations to ‘PhD school’ and spent time with me at the end of her own Ph.D. helping me define and then secure the 'frame' for this thesis.

Dr Tina Jones for reading and re-reading drafts of this thesis and offering very valuable insight from a non-midwife's point of view.

My work place colleagues at Calvary North Adelaide Hospital especially my night duty buddies for their keen interest which resulted in many interesting middle of the night discussions.

All of my Family, especially my wonderful husband Mike who was incredibly supportive. He should be especially thanked for enduring everything that happens, and doesn't happen in a family where one parent is a Ph.D. candidate. I am also grateful that our beautiful precious children continue to tolerate their “crazy” mother.