

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

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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-

8.8, $p=0.05$). 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

Warland J and McCutcheon H *Is there an association between maternal hypotension and poor pregnancy outcome?: a review of the literature.* Australian Journal of Midwifery Vol 15 No 4 December 2002 p22 - 26

Presentations at conferences made by the candidate

Free paper 'Challenging conventional belief: Is hypotension benign in pregnancy?' International Society of Perinatal Obstetricians Meeting (Adelaide) Nov 2002. Abstract for this paper was published in the *ANZ Journal of Obstetrics and Gynaecology* Vol 43 No 2 April 2003 pp 175-187 abstract number 13.

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

Free paper "Better outcomes for women and babies: exploring risk factors for stillbirth" ACMI conference Sydney November 2006

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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...

Glossary

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 delivery 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 infants 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 abrupts 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

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