

Placental position and late stillbirth: a case-control study

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Aims and objectives. The aim of this study was to determine whether there is a relationship between placental position and stillbirth with the objective of establishing if placental position impacted on stillbirth risk.

Background. Whilst there has been extensive research on low placental implantation because of the importance of detecting placenta praevia, little research has been undertaken on other aspects of placental position and possible impact on pregnancy outcome.

Design. A matched case-control study of stillbirth and placental position was conducted using case-notes from two tertiary obstetric referral centres.

Methods. Notes were retrospectively examined and Placental position as documented in the case-notes at the routine mid-trimester (20 week) ultrasound was identified. Placental position for a total of 124 pregnancies culminating in stillbirth was compared with placental position in 243 (matched) pregnancies resulting in a live born baby.

Results. Women who had a posterior located placenta were statistically more likely to suffer a stillbirth than women who had a placenta in any other position OR 1.64 (95% CI 1.02–2.65 $p = 0.04$).

Conclusion. Posterior located placenta may be a contributory risk factor for stillbirth. Further research is warranted.

Implications for practice. Nurses and midwives should be aware of this potential risk factor to monitor foetal well-being closely.

Key words: midwifery, nurses, nursing, placenta, pregnancy, stillbirth

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Introduction

Whilst there has been extensive research on low placental implantation because of the importance of detecting placenta praevia, only a few studies have been undertaken on other aspects of placental position and possible impact on pregnancy outcome. Such studies have reported that placental position can have an effect on progress during labour (Davydov *et al.* 1987, Collins *et al.* 1991, Lurie *et al.* 2003, Altay *et al.* 2007) and might have implications for poor pregnancy outcomes, including preterm birth (Hadley *et al.*

1990) and small for gestational age (SGA) (Kalanithi *et al.* 2007).

Collins *et al.* (1991) studied 162 successive deliveries in a New Orleans hospital and noticed a relationship between placental location and foetal distress, increased caesarean section rates, incidence of meconium stained liquor as well as a four-fold increase in foetal heart rate decelerations in a group of term pregnancies where the placenta was located on the posterior uterine wall.

Two studies have reported the negative impact of a placenta located in the fundus. A Hungarian group (Kalanithi

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et al. 2007) investigated 2396 women examining the location of the placenta and the clinical course of labour. They described the location of the placenta as either fundal, uterine body or lower uterine segment. One of the factors they studied was the possible influence of placental location on the Apgar score. They found that there were no cases of a low Apgar score less than four in the lower uterine segment group. Whereas the higher the placenta was sited in the uterus the greater the incidence of an Apgar less than four occurring i.e. 0.6 percent in the uterine body group and 2.4 percent in the fundal group. Hadley *et al.* (1990) reported from a case-control trial conducted in the USA which examined predisposing factors for preterm labour. They found that women with a placenta located in the fundus carried a statistically significant increased risk of premature rupture of the membranes. They presumed that, if the placenta was located in the fundus, then this placed the weakest point of the membranes over the cervical os and predisposed women to premature rupture of the membranes with all the consequential negative sequelae.

The fundal placental position is also thought to influence placental separation time. A Turkish study (Degani *et al.* 1998) found in a prospective study of 200 births that placental separation time was faster in the fundal group. However, a more recent Israeli study (Lurie *et al.* 2003) evaluated the association between placental location and length of the third stage of labour. In a retrospective case-note audit they examined 200 consecutive singleton pregnancies for length of an actively managed third stage. They found a significant correlation between fundal placental position and longer third stage of labour.

Two studies have investigated whether placental position may influence maternal placental supply, in turn affecting foetal well being. A North American study (Kofinas *et al.* 1989) examined the association between placental location and uterine artery blood flow in normotensive and hypertensive pregnancies. They concluded that a lateral placental position may predispose the woman to pre-eclampsia due to the 'effect on uterine artery resistance' (p. 1536). An older study (Chapman *et al.* 1979) found an association between 'low-lying' placenta at the <24 week scan and babies who were SGA. They surmised that 'perhaps implantation in the lower part of the uterus provides inadequate conditions for normal placental growth and perfusion' (p. 848). These studies suggest that some implantation sites may not provide adequate supply of nutrients and oxygen to the developing foetus. This literature indicates that placental position may have a negative impact on a range of pregnancy outcomes.

In this paper, we present a case-control study comparing women whose pregnancy resulted in a stillbirth with women

whose baby was live-born. The purpose of the study was to investigate previously unexplored risk factors for stillbirth and alert nurses and midwives providing antenatal care concerning this potential new risk factor. We have previously reported findings from this study examining the link between maternal hypotension and stillbirth (Warland *et al.* 2008). In this paper, we present the findings from a case-control study comparing placental position in pregnancy resulted in a stillbirth with pregnancies where the baby was live-born.

Methods

Population

Two large Australian tertiary referral obstetric hospitals participated in this study. These hospitals deliver a combined total of between 8–10,000 women per annum. Both hospitals provide a comprehensive range of maternity care, encompassing 'low' and 'high' risk pregnancy and birthing services.

Details of ethics approval

Ethics approval was applied for and granted by each hospital's institutional Human Research Ethics Committee (HREC).

Case selection

All women with a discharge diagnosis of stillbirth (from whatever attributed cause) over five years ranging from 1 April 1997–31 March 2002 at the two participating hospitals were identified and considered as cases for inclusion in the study. This time period yielded 646 potential cases. Stillborn babies born before 27 weeks were then excluded from the study, 413 cases were excluded; most of these were around 20 weeks gestation making matching to a live born infant unachievable. Furthermore, women were excluded from the study if there had been no ultrasound performed ($n = 3$), or the ultrasound report was missing from the case notes ($n = 24$). Other exclusion criteria included multiple pregnancy ($n = 20$) and poor antenatal attendee ($n = 53$). The final number of cases from both the participating hospitals after all exclusions totalled 133.

Control selection

The control group for this study consisted of women who gave birth to a live born baby at the same hospital as the cases. The next available control who met the matching criteria was selected from perinatal databases maintained at the hospitals.

Matching criteria for this study included maternal age, infant gender, gestational age and year of birth. Year of birth matching was achieved to gain comparable ultrasound technology between the case and control pregnancies.

An attempt was made to match two controls with every one case but for five cases only one matched control could be identified and on nine occasions no control could be selected. Cases with no controls were discarded but those with one matched control were included in the analysis. This resulted in the total number of cases 124, controls 243 and an entire sample of 367 women.

Data collection

We retrospectively reviewed the clinical records of the 367 subjects and recorded the placental position noted at the second trimester routine 'morphology' scan.

Defining placental position

A strategy for classification of placental position was adopted which was in keeping with another study which explored placental 'migration' throughout pregnancy (Magann *et al.* 1998) i.e. the main reported position was the one collected. Therefore, if the placenta was reported as 'posterior-fundal' then it was considered to be neither posterior nor fundal and was classified as 'other' whereas if the report stated e.g. 'posterior placenta with a fundal lobe' then most of the placentation was posterior and was thus classified as 'posterior' for the purposes of this study.

Analysis

The analysis for this study involved comparing 'exposures' (to placental position) in stillborn cases with the corresponding exposure in matched controls. All variables were examined using conditional logistic regression in a statistical software package Egret for Windows version 2.0.31 (Cytel software corporation© 1999; Cytel Software Corp., Cambridge, MA, USA). This software was chosen for the facility to handle variable numbers of matched controls per case.

The results are expressed in terms of odds ratios (OR), 95% confidence intervals (CI) and probability values (p), corresponding to the likelihood of the observed differences arising by chance; $p < 0.05$ was considered statistically significant.

Results

When examining the placental variable results (Table 1), a trend (OR 1.48 95% CI 0.9–2.4, $p = 0.12$) towards posterior

Table 1 Estimated odds ratio of stillbirth by placental position

Placental position	Case/Controls ($n = 124/243$)	Odds ratio
Other	18/54	0.68 (0.37–1.26)
Posterior	53/79	1.48 (0.9–2.4)
Anterior	53/110	1 (ref)

Table 2 Estimated odds ratio of stillbirth in women with a posterior placenta by covariate factors

	Case/Controls ($n = 124/243$)	Unadjusted odds ratio	Adjusted odds ratio
Posterior placenta			
N	68/104	1 (ref)	1.67 (1.01–2.77)
Y		1.64 (1.02–2.65)	
Non-Caucasian			
N	26/41	1 (ref)	1.65 (0.90–3.02)
Y		1.28 (0.73–2.26)	
MultiGravid			
N	73/160	1 (ref)	0.86 (0.44–1.68)
Y		0.73 (0.47–1.16)	
Multipara			
N	22/44	1 (ref)	0.82 (0.41–1.63)
Y		0.68 (0.43–1.08)	
Small for gestational age			
N	41/44	1 (ref)	2.86 (1.66–4.93)
Y		2.72 (1.62–4.56)	

located placenta occurring more frequently in stillbirth was found. Posterior placenta was then reduced to a binary outcome measure (present or absent) for which the OR was 1.64 (95% CI 1.02–2.65, $p = 0.04$) and then fitted into a conditional regression model with other common risk factors for stillbirth (non-Caucasian, multigravid, multiparous and SGA; Table 2). The ORs remain largely unchanged (Crude OR 1.64 – Adjusted OR 1.67) suggesting that posterior location of the placenta independently contributes to a slight increase in risk of stillbirth.

Discussion

The finding that posterior located placenta may be associated with increased risk of stillbirth is new and not readily explained. Whilst there have been a small number of studies that have examined placental position as it relates to some aspect of pregnancy outcome there has not been a published study which has examined placental position and stillbirth.

The reasons why a posterior located placenta carries an increased risk of stillbirth are unclear. We put forward three possible hypotheses: the structure of the posterior uterine wall is somehow at fault, there may be associated intrauterine

factors with a posterior located placenta, or the pregnant woman's sleeping position is the problem.

A placenta located on the posterior uterine wall may be somehow less efficient due to the anatomy of that wall. Blood supply to the uterus is not uniform (Kalanithi *et al.* 2007) and the posterior wall of the pregnant uterus is longer (Andersen *et al.* 1983) and somewhat thicker (Degani *et al.* 1998). Each of these factors may affect maternal supply especially as the uterus expands to accommodate the pregnancy. At odds with this possible explanation is one study (Andersen *et al.* 1983) that examined the perfusion of posterior wall placentae using an isotopic technique and found no differences between the placenta flow index between the anterior wall placentas and those located on the posterior wall. Andersen *et al.* (1983) offered no information in their paper as to why they had undertaken a study investigating placental flow in posterior placentae, however, their findings might imply that the problem with a posterior located placenta may not be due to reduced or inadequate maternal blood supply.

A posterior located placenta may be associated with increased risk of stillbirth because of other causative risk factors for stillbirths which are also linked with posterior placentae e.g. nuchal cord. Cord around the neck is known to be associated with posterior placenta (Collins *et al.* 1991) and perhaps, although this is controversial, with poor perinatal outcome (Sherer & Manning 1999). It may be that babies with both nuchal cord and posterior located placenta are at increased risk. This link could not be supported in this current study due to the lack of documentation of nuchal cord in the case-notes.

Another possible reason which might explain why posterior located placenta is associated with increased risk of stillbirth, is maternal position. If a woman with a posterior placenta sleeps in a supine position it is possible that the weight of the gravid uterus overlying the placenta might compromise placental perfusion. Whilst research has shown that pregnant women tend not to sleep on their backs because they naturally adopted a sleeping position which minimises the likelihood of aortocaval compression (Mills & Chaffe 1994) this may not be the case for all women. Further research is also required in this area.

Finally, it is worth mentioning that current placental assessment is largely confined to reporting the attachment position. As more is known about the impact of placental insufficiency on pregnancy outcome and because obstetric ultrasound has become more technically sophisticated, there has been a call for placental assessment to include such detail as placental thickness (Elchalal *et al.* 2000), texture and cord insertion (Hasegawa *et al.* 2006, Whittle *et al.* 2006), because each of these factors is known to have a relation with

complicated perinatal outcomes. Such information may provide insights into the reason why it appears that the posterior located placenta is associated with a slight increase in risk of stillbirth.

Limitations of the findings

The retrospective nature of this study is a limitation chiefly because of 'observer variation' meaning that there were several sonographers who performed the ultrasound which reported the position of the placenta. Each of these had their own reporting style and some may have been more experienced than others. However, we consider that sonographers were no more or less likely to report one position over another especially as the outcome of stillbirth was not known at the time of the ultrasound. Therefore, the documented position was considered to be adequate for the purposes of this exploratory study. Nevertheless, a larger prospective study where the placental positions are determined by one experienced sonographer would be useful to confirm the results of this study. Such a study would be able to examine other data such as cord insertion and placental histopathology. These are not routinely documented at either hospital after a livebirth and thus could not form part of this retrospective case-control study.

Strengths

In spite of the above limitations this study also has a major strength because case-control studies are widely recognised as producing high level evidence on relatively rare events.

Conclusion and implications for practice

Results from this study suggest that posterior placental position maybe more prevalent in stillbirth than when the baby is live born. Reasons for this are unclear and further research is necessary. It is important for nurses and midwives to be aware of this research to monitor foetal well-being closely in pregnancies where the placenta is posterior. It is also important to confirm the finding that posterior located placenta increases the risk of stillbirth through a larger study prior to making substantive changes to antenatal care.

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Disclosure of interests

All authors declare there is no conflict of interest associated with this study.

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Contributions

Study design: JW, HMC, PB; data collection and analysis: JW, HMC, PB and manuscript preparation: JW, HMC, PB.

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