PLANNED VAGINAL DELIVERY OR PLANNED CAESAREAN DELIVERY IN WOMEN WITH EXTREME

OBESITY

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Abstract

Objective: To compare the outcomes of planned vaginal versus planned caesarean delivery in a cohort of extremely obese women (BMI 50kg/m^2 or greater).

Design: A national cohort study using the UK Obstetric Surveillance System (UKOSS).

Setting: All hospitals with consultant-led maternity units in the UK.

Participants: 591 extremely obese women delivering in the UK between September 2007 and August 2008.

Methods: Prospective cohort identification through UKOSS routine monthly mailings.

Main Outcome Measures: Anaesthetic, postnatal and neonatal complication rates.

Results: After adjustment, there were no significant differences in anaesthetic, postnatal or neonatal complications between women with planned vaginal delivery and planned caesarean delivery, with the exception of shoulder dystocia (3% vs 0%, p=0.019). There were no significant differences in any outcomes in the subgroup of women who had no identified medical or antenatal complications.

Conclusions: This study does not provide evidence to support a routine policy of caesarean delivery for extremely obese women on the basis of concern about higher rates of delivery complications, but would support a policy of individualised decision on mode of delivery based on a thorough assessment of potential risk factors for poor delivery outcomes.

Introduction

Obesity is a growing global public health problem and a major contributor to the global burden of chronic disease and disability (1). Obesity has significant implications for the provision of maternity care both in relation to increased risks and complications for both mother and baby, and its association with an increased risk of caesarean delivery. A recent systematic review of 11 cohort studies reported that the risk of caesarean delivery was increased by 50% in women with a body mass index (BMI) of 30-35 kg/m^2 and more than double in women with a BMI>35 kg/m^2 compared with women with a normal BMI (20-25 kg/m^2) (2). Factors associated with the higher risk of caesarean delivery in obese women may include medical and pregnancy complications such as diabetes and pre-eclampsia, as well as poor uterine contractility (3) and concerns regarding the challenges of both general and regional anaesthesia in the emergency situation (4, 5). Anecdotally, there appears to be an increasing move to recommend planned caesarean delivery to avoid the perceived risks of emergency caesarean delivery in this group of women. However, earlier studies have highlighted increased morbidity and mortality associated with caesarean delivery in obese women, (6) longer operative times and length of hospital stay with blood loss and postoperative infective morbidity being greater (7, 8). Recent consensus standards on the management of women with obesity in pregnancy make no recommendation concerning caesarean delivery due to lack of evidence to inform advice (9). There is thus an urgent need for evidence to inform the development of clinical policy on the planned mode of delivery in this group of high risk women.

The aim of this study was to investigate, using data from a UK national cohort of pregnant women with a BMI 50kg/m^2 or over (10), the factors associated with mode of birth, and to compare the outcomes in women planned to deliver vaginally with those planned to deliver by caesarean.

Methods

The cohort of extremely obese women was identified through the UK Obstetric Surveillance System (UKOSS) (11) between September 2007 and August 2008 and the methods of identification have been fully described elsewhere (10). The study included pregnant women who, at any point in pregnancy, had a body mass index (BMI) of 50kg/m^2 or greater and had data for mode of birth and urgency of caesarean delivery (Figure 1).Women were divided into two groups based on the planned mode of delivery. Women who laboured or who had an induction of labour were included in the planned vaginal group and women who were delivered by caesarean without labour were included in the planned caesarean group. Characteristics were compared between the two groups using the Chi squared and Fishers exact tests.

A multivariable logistic regression model was used to examine predictive factors for caesarean delivery. We developed a pragmatic model by including factors known from the literature to be associated with caesarean delivery particularly in obese women. The factors included were age, ethnicity, socioeconomic status based on occupation, previous caesarean delivery, diagnosed diabetes including current gestational diabetes, multiple pregnancy and BMI. Continuous variables were tested for departure from linearity by the inclusion of quadratic terms in the model and subsequent likelihood ratio testing on removal. Potential interactions between each variable and every other variable in the model were tested by the addition of interaction terms and subsequent likelihood ratio testing on removal. P<0.05 was considered evidence for significant interaction or departure from linearity. Unadjusted and adjusted odds ratios (OR) and 95% CIs were calculated.

Outcomes were compared between the two groups in a further multivariable model, adjusting for potential confounders identified from the literature (pre-existing: diabetes, asthma, hypertension or endocrine disorder; and/or current: gestational diabetes, pre-eclampsia or a thromboembolic event in

this pregnancy, previous delivery by caesarean section). Neonatal outcomes were additionally adjusted for preterm delivery. A sensitivity analysis was conducted to explore the outcomes in the group of women who had no reported antenatal or medical complications (pre-existing: diabetes, asthma, hypertension or endocrine disorder; and/or current: gestational diabetes, pre-eclampsia or a thromboembolic event in this pregnancy) by repeating the comparison of outcomes excluding women with any of these known complications.

All analyses were carried out using STATA 10 software (StataCorp, College Station, TX).

Results

This analysis included 591 women who met the study inclusion criteria (Figure 1). The median BMI was 55 with a range from 50.0 to 80. Of the 591 women, 174 (29.4%) were in the planned caesarean group and 417 (70.6%) were in the planned vaginal group. Of those who planned a vaginal delivery, 30.5% (n=127) went on to have a caesarean delivery. Characteristics of women according to planned mode of delivery are shown in Table 1. Women in the planned caesarean group were significantly older, of higher parity and more likely to have essential hypertension, previous hypertensive disorders of pregnancy, previous caesarean delivery, a multiple pregnancy or current gestational diabetes. In a logistic regression model, after controlling for age, ethnicity, socio-economic status and the other variables in Table 1, the factors associated with a significantly higher odds of actual caesarean delivery were a previous caesarean delivery and pre-existing diabetes or gestational diabetes and (Table 2). Of the 26 women in the planned vaginal delivery group who had a previous caesarean delivery, only 9 (35%) delivered vaginally. There was a three-fold increase in the risk of caesarean delivery associated with multiple pregnancy; this was not statistically significant but it should be noted that due to small numbers this comparison has limited power to demonstrate statistical significance.

Admission to a neonatal intensive care unit was more likely in the infants born to women undergoing a planned caesarean delivery on univariate analysis. However, after adjustment, there were no significant differences in anaesthetic, postnatal or neonatal complications between women with planned vaginal delivery and planned caesarean delivery (Table 3), with the exception of shoulder dystocia. None of the 13 infants born following shoulder dystocia were reported to have suffered permanent injury. The sensitivity analysis showed that there were no significant differences in any outcomes in the subgroup of women who had no identified medical or antenatal complications (Table 4), although it should be noted that there was a 66% lower risk of major maternal morbidity in the planned vaginal group (not statistically significant).

Discussion

This study did not identify any statistically significant differences in anaesthetic, maternal postnatal or neonatal complications according to planned mode of delivery in a national cohort of extremely obese women in the UK after adjusting for maternal medical and antenatal complications, other than in the occurrence of shoulder dystocia. None of the infants suffered permanent injury. All the other complications examined, with the exception of postnatal wound complications, occurred less frequently in the planned vaginal group than the planned caesarean group, although again the differences were not statistically significant, possibly due to limited study power even in this national cohort study. When we examined the subgroup of women with no identified medical or antenatal complications, we were unable to identify any differences in any of the complications examined.

Other studies addressing this issue are few and have focused particularly on planned mode of delivery in obese women who have undergone a previous caesarean delivery, reporting poorer outcomes amongst those undergoing a trial of labour compared with elective repeat caesarean delivery (12, 13). In contrast, we studied the entire group of extremely obese women and not a selected group, and after adjusting for

potential confounders did not demonstrate any differences in outcomes with the exception of shoulder dystocia without permanent injury. In our analysis of women without any documented medical or antenatal complications there were no significant differences, although it should be noted that even large national studies such as this have limited power to detect differences in rare outcomes. This study does not provide any evidence to support a policy of routine caesarean delivery for extremely obese women on the basis of concern of higher rates of delivery complications, but would support a policy of individualised decision on mode of delivery based on a thorough assessment of potential risk factors for poor delivery outcomes. Such a policy would be supported through guidance such as that available to inform the care of women undergoing birth after previous caesarean birth (14).

The definition and accuracy of reporting of shoulder dystocia is an important factor in interpreting the incidence of shoulder dystocia. In practice, some clinicians only report a birth as involving shoulder dystocia if they had to employ specific manoeuvres to deliver the baby's anterior shoulder. Others will record shoulder dystocia if there is any delay in the emergence of the shoulder following delivery of the head. It is possible in this cohort that the existence of the women's extreme obesity ensured a high index of concern in the minds of the clinicians for shoulder dystocia and any difficulties delivering the baby was defined as shoulder dystocia. Nevertheless, 2.2% of babies were born following shoulder dystocia. This is higher than many other reported rates although studies report a wide variation in incidence. Unselected population studies in North America and the UK found a 0.6% incidence (15-17).

Shoulder dystocia is known to increase with fetal macrosomia. For example, an incidence of 14.3% has been reported in babies with a birthweight of 4500-4750g, and 21.1% for those 4750-5000g in a population based study in California (18). In this cohort, nearly 10% of babies weighed 4500g or more at birth; over 60% of these were in the planned vaginal delivery group suggesting that more accurate assessment of fetal weight may be beneficial. Unfortunately, estimating fetal weight is particularly

challenging in women with a high BMI as conventional methods, such as ultrasound scanning in late pregnancy, are likely to be difficult, inaccurate and in some cases, not possible at all. Abdominal palpation and fundal height measurement are also not likely to be helpful in predicting the size of the baby. Other measures such an MRI scanning are also limited by the size of the machine and the cost and availability.

One of the main concerns about caesarean delivery for women with extreme obesity has been the risk of anaesthetic complications in the emergency situation. A recent study of difficult and failed intubation in obstetric anaesthesia found that women whose tracheas proved difficult to intubate had a weight range of 50 to 140 kg (median 80 kg) while those in whom intubation was straightforward ranged from 50 to 73 kg (median 57 kg) (19). In their logistic regression analysis however, a weight of 100 kg or more was not an independent predictor of a difficult intubation. This may have been due to the small sample size in the difficult intubation group (36 of 1095 patients) and the sole use of weight, rather than BMI. A study of failed intubation for obstetric anaesthesia is currently being conducted to investigate the role of BMI in failed intubation further (20). Anaesthetic complications were rare in our cohort, and there were no differences between the planned vaginal and planned caesarean groups.

Randomised controlled trials in the context of uncommon pregnancy conditions such as extreme obesity are challenging and national cohort studies such as this provide high quality evidence in the absence of randomised controlled trials, as they are free from most of the biases of centre-based observational studies. Nevertheless, the study design does have limitations. We identified clear differences between the groups planned to deliver vaginally and those planned to have a caesarean delivery reflecting the clinical decision-making which underlies the choice of mode of delivery and we therefore adjusted for these in our analysis. It is likely, however, that there are other differences between the two groups which we have not identified and therefore have not been able to adjust for. UKOSS was also the only

source of data used in the absence of any other available source; however, previous studies using this

system have suggested a high rate of case ascertainment (21-23). The study was conducted in a well

developed health system and as such, the results cannot be generalised to less developed health

systems. It is likely that the health care for this group of women in countries such as the USA, Australia

and much of Europe will be similar and therefore the results are likely to be generalisable to these

settings.

DISCLOSURE OF INTERESTS

We do not have any interests to declare in relation to this study.

CONTRIBUTION TO AUTHORSHIP

CH undertook this particular analysis and wrote the first draft of the paper. JJK assisted with the design of the study and supervised the data collection and analysis and contributed to writing the paper, PB had the original idea for the surveillance system, provided advice at every stage of the study and contributed to the writing and editing of the paper. PS assisted with data coding, conducted validation of the data and contributed to writing the paper. MK is the lead investigator on UKOSS and is responsible for the overall design and conduct of the study as well as leading this analysis and working on subsequent drafts of the paper. All authors provided comment and approved the final version of the paper and the submission. MK will act as study guarantor.

DETAILS OF ETHICS APPROVAL

The UKOSS general methodology (04/MRE02/45) and this study (06/MRE02/77) were approved by the London Research Ethics Committee.

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Table 1: Demographic characteristics, pregnancy events and complications by planned mode of birth

	Planned vaginal delivery N=417 (%*)	Planned caesarean delivery N=174 (%*)	P value
Parity			
• Primiparous	162 (38.9)	40 (23.1)	
• Multiparous	255 (61.1)	54 (76.9)	<0.001
Age			
• <35 years	322 (77.2)	112 (64.4)	
• ≥35 years	95 (22.8)	62 (35.6)	0.001
Ethnicity			
• White	366 (88.6)	147 (87.0)	
• Black and other minority groups	47 (11.4)	22 (13.0)	0.579
Socioeconomic group			
• Managerial/professional	288 (83.2)	112 (80.0)	
• Other	58 (16.8)	28 (20.0)	0.397
BMI			
• 50-54	278 (66.7)	108 (62.1)	
• 55-59	90 (21.6)	40 (23.0)	
• 60-64	35 (8.4)	15 (8.6)	
• ≥65	14 (3.4)	11 (6.3)	0.423
Previous medical conditions			
• Hypertension	19 (4.6)	19 (11.1)	0.004
• Asthma	51 (12.2)	21 (12.1)	0.956
• Endocrine disorders	13 (3.1)	9 (5.1)	0.229
• Diabetes	17 (4.1)	12 (6.9)	0.148
• Mental health problems	41 (9.8)	19 (10.9)	0.690
• Polycystic ovarian syndrome	22 (5.3)	4 (2.3)	0.108
Previous obstetric conditions			
• Gestational diabetes (GDM)	14 (3.4)	8 (4.6)	0.468
• Pre-eclampsia or Pregnancy induced hypertension (PE/PIH)	39 (9.4)	26 (14.9)	0.048
Composite antenatal medical risk factor	139 (33.3)	86 (49.4)	<0.001
Current obstetric conditions			
• Previous CS	26 (6.2)	74 (42.5)	<0.001
• Multiple pregnancy	6 (1.4)	11 (6.3)	0.001
• PE/PIH	88 (21.1)	47 (27.0)	0.119
• GDM	37 (8.9)	32 (18.4)	0.001
• Thrombotic event	3 (0.7)	0 (0)	0.265

*Percentages of those with data

**Composite antenatal medical risk factor: one or more of the following: pre-existing diabetes, asthma, hypertension or endocrine disorder; and/or current gestational diabetes, pre-eclampsia or a thromboembolic event in this pregnancy

Table 2: **Factors associated with actual delivery by caesarean in extremely obese women, irrespective of planned mode of delivery**

	Vaginal delivery		CS		Unadjusted	Adjusted*
	N=290	%	N=301	%	OR (95% CI)	OR (95% CI)
Age						
<25 years	59	20.3	38	12.6	1.0	1.0
25-34 years	170	58.7	167	55.5	1.52 (0.96-2.41)	1.20 (0.68-2.13)
≥35 years	61	21.0	96	31.9	2.44 (1.45-4.10)	1.50 (0.78-2.86)
Ethnic group						
White	253	87.9	260	88.4	1.0	1.0
All other groups	35	12.1	34	11.6	0.95 (0.57-1.56)	0.86 (0.46-1.60)
SES status						
Non-managerial	199	85.0	201	79.8	1.0	1.0
Managerial	35	15.0	51	20.2	1.44 (0.90-2.31)	1.65 (0.99-2.76)
Previous CS						
No	281	96.9	210	69.8	1.0	1.0
Yes	9	3.1	91	30.2	13.5 (6.67-27.46)	16.7 (7.06-39.7)
Past or current diabetes (including GDM in this pregnancy)						
No	258	89.0	240	79.	1.0	1.0
Yes	32	11.0	61	20.3	2.05 (1.29-3.25)	2.08 (1.20-3.59)
BMI						
<60	256	88.3	260	86.4	1.0	1.0
>60	34	11.7	41	13.6	1.19 (0.73-1.93)	1.14 (0.63-2.06)
Multiple pregnancy						
No	286	98.6	288	95.7	1.0	1.0
Yes	4	1.4	13	4.3	3.23 (1.04-10.02)	3.42 (0.85-13.79)

*Adjusted for all other factors in the model.

Table 3: Anaesthetic, postnatal and neonatal complications by planned mode of birth

	Vaginal N=417 (%)	Caesarean N=174 (%)	Unadjusted OR (95% CI)	Adjusted OR (95% CI)[**]
Caesarean delivery	127 (30.5)	174 (100)	NA	NA
Anaesthetic				
• Failure or problems with regional anaesthesia	35 (8.4)	18 (10.3)	0.79 (0.44-1.44)	0.72 (0.37-1.39)
• General anaesthetic for delivery	22 (5.3)	15 (8.6)	0.59 (0.30-1.17)	0.55 (0.26-1.16)
Maternal postnatal				
• Post operative wound infection or other wound complication†	33 (26.2)	38 (22.4)	1.23 (0.72-2.11)	1.20 (0.68-2.13)
• ICU admission	9 (2.2)	6 (3.5)	0.61 (0.22-1.75)	0.62 (0.19-2.07)
• Major maternal morbidity*	18 (4.3)	11 (6.3)	0.67 (0.31-1.45)	0.53 (0.23-1.24)
Neonatal				
• Birthweight 4500g or greater	35 (8.4)	22 (12.7)	0.63 (0.36-1.11)	0.60 (0.32-1.12)
• Shoulder dystocia	13 (3.1)	0 (0)	∞ (1.44-∞)	NC
• Neonatal Intensive care unit admission	34 (8.3)	27 (15.5)	0.49 (0.29-0.84)	0.67 (0.34-1.30)
• Neonatal death	2 (0.5)	1 (0.6)	0.85 (0.08-9.4)	1.08 (0.09-13.2)

†Denominator is women who had a caesarean delivery.
*Composite score including one or more of the following: intraoperative or postpartum haemorrhage, thromboembolic event, septicaemia, septic shock and/or admission to an intensive care unit.
[**]Adjusted for the presence of one or more of the following: pre-existing diabetes, asthma, hypertension or endocrine disorder; and/or gestational diabetes, pre-eclampsia or a thromboembolic event in this pregnancy, previous delivery by caesarean section. Neonatal outcomes additionally adjusted for preterm delivery (gestation less than 37 completed weeks at birth)
NA Not applicable, NC Not calculable due to zero cells

Table 4: Sensitivity analysis to examine anaesthetic, postnatal and neonatal complications by planned mode of birth excluding women with known antenatal complications*

	Vaginal N=288 (%)	Abdominal N=88 (%)	Unadjusted OR (95% CI)	Adjusted OR (95% CI) **
Caesarean delivery				
	76 (27.3)	88 (100)	NA	NA
Anaesthetic				
• Failure or problems with regional anaesthesia	19 (6.8)	8 (9.1)	0.73 (0.31-1.74)	0.67 (0.25-1.78)
• General anaesthetic for delivery	13 (4.7)	6 (6.8)	0.67 (0.25-1.82)	0.62 (0.20-1.92)
Maternal postnatal				
• Post operative wound infection or other wound complication†	19 (25.0)	15 (17.7)	1.56 (0.73-3.33)	1.43 (0.64-3.22)
• ICU admission	5 (1.8)	3 (3.5)	0.51 (0.12-2.19)	0.29 (0.07-1.25)
• Major maternal morbidity*	10 (3.6)	5 (5.7)	0.62 (0.21-1.86)	0.34 (0.11-1.04)
Neonatal				
• Birthweight 4500g or greater	21 (7.6)	11 (12.6)	0.45 (0.26-1.22)	0.19 (0.32-1.05)
• Shoulder dystocia	5 (1.8)	0 (0)	∞ (0.40-∞)	NC
• Neonatal Intensive care unit admission	18 (6.5)	7 (8.0)	0.81 (0.33-2.00)	0.79 (0.28-2.25)
• Neonatal death	2 (0.5)	0 (0)	∞ (0.16-∞)	NC

†Denominator is women who had a caesarean delivery.

*Composite score including one or more of the following: intraoperative or postpartum haemorrhage, thromboembolic event, septicaemia, septic shock and/or admission to an intensive care unit.

**Adjusted for previous delivery by caesarean section. Neonatal outcomes additionally adjusted for preterm delivery (gestation less than 37 completed weeks at birth)

***The presence of one or more of the following: pre-existing diabetes, asthma, hypertension or endocrine disorder; and/or gestational diabetes, pre-eclampsia or a thromboembolic event in this pregnancy.

NA Not applicable, NC Not calculable due to zero cells