

## Outcome of subsequent pregnancy three years after previous operative delivery in the second stage of labour: cohort study

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### Abstract

**Objective** To evaluate the reproductive outcome and the mode of delivery in subsequent pregnancies after instrumental vaginal delivery in theatre or caesarean section at full dilatation.

**Design** Prospective cohort study.

**Setting** Two urban hospitals with a combined total of 10 000 deliveries a year.

**Participants** A cohort of 393 women with term, singleton, cephalic pregnancies who needed operative delivery in theatre during the second stage of labour from February 1999 to February 2000. Postal questionnaires were received from 283 women (72%) at three years after the initial delivery.

**Main outcome measure** Mode of delivery in the subsequent pregnancy.

**Results** 140 women (49%) achieved a further pregnancy at three years. 91/283 (32%) women wished to avoid a further pregnancy. Women were more likely to aim for vaginal delivery (87% (47/54) *v* 33% (18/54); adjusted odds ratio 15.55 (95% confidence interval 5.25 to 46.04)) and more likely to have a vaginal delivery (78% (42/54) *v* 31% (17/54); 9.50 (3.48 to 25.97)) if they had had a previous instrumental vaginal delivery rather than a caesarean section. There was a high rate of vaginal delivery after caesarean section among women who attempted vaginal delivery 17/18 (94%). In both groups, fear of childbirth was a frequently reported reason for avoiding a further pregnancy (51% after instrumental vaginal delivery, 42% after caesarean section; 1.75 (0.58 to 5.25)).

**Conclusion** Instrumental vaginal delivery offers advantages over caesarean section for future delivery outcomes. The psychological impact of operative delivery requires urgent attention.

### Introduction

Rising rates of caesarean section have been recorded across the developed world.<sup>1</sup> The management of the first time mother with a singleton cephalic pregnancy at term seems to account for much of the increase in rates of caesarean section and, perhaps more importantly, much of the variation between individual obstetricians, delivery units, regions, and countries.<sup>1,2</sup> A consensus group of the American College of Obstetricians and Gynecologists has suggested that to control rates of caesarean section there should be further training in instrumental vaginal delivery.<sup>2</sup> Many obstetricians are concerned, however, about the potential for neonatal trauma and maternal pelvic floor morbidity after instrumental delivery,<sup>3-5</sup> leading to a sharp fall in the number of obstetricians prepared to offer mid-cavity or rotational instrumental vaginal delivery.<sup>6</sup> Delivery by caesarean

section is associated with important potential consequences, including subfertility,<sup>7-9</sup> uterine rupture,<sup>10</sup> and placenta previa.<sup>11</sup> Obstetricians need to consider the overall reproductive outcome for an individual woman and not just the outcome of the index pregnancy in isolation.

High rates of spontaneous vaginal delivery can be achieved after a previous instrumental vaginal delivery; in one study more than 75% of women achieved a spontaneous vaginal delivery, having heavier babies in the second pregnancy and with very low overall rates of birth trauma or asphyxia.<sup>12</sup> Similar rates of vaginal delivery are not seen after a previous caesarean section, largely because fewer women are aiming for vaginal delivery in these circumstances.<sup>1</sup> Evidence is also growing that maternal choice is being limited, with some North American maternity units declining access to vaginal birth after caesarean section.<sup>13</sup> We have previously reported that 4% of women in a UK population needed a trial of instrumental delivery in theatre or a caesarean section at full dilatation, suggesting that difficult operative deliveries in the second stage of labour are at least as common as breech presentation at term.<sup>14</sup> We found an excess of early maternal morbidity and admission to the neonatal intensive care unit after caesarean section and an excess of neonatal trauma after instrumental vaginal delivery. These results suggest the need for a balance between the risks of different types of morbidity when managing delay in the second stage of labour. When we surveyed women one year after their initial delivery, those who had experienced an instrumental vaginal delivery were significantly more likely to report a preference for vaginal delivery in a subsequent pregnancy.<sup>15</sup> We have now surveyed our original cohort of women at three years after the initial operative delivery to evaluate their reproductive outcome and mode of delivery in subsequent pregnancies.

### Methods

The original cohort study was done in two urban hospitals in Bristol. These units have over 10 000 deliveries annually and serve a geographical area with a stable population. Additional patients are occasionally received from a midwifery led unit and from planned home births as all operative deliveries for the area are performed in one of the two hospitals. All women who were fully dilated and had instrumental vaginal delivery in theatre or caesarean section were eligible for recruitment to the study.

Because the definition of "difficult" operative vaginal delivery is subjective and open to operator bias, we included only operative vaginal deliveries that were done in theatre. Operative vaginal deliveries are done in theatre if rotation is required, borderline cephalopelvic disproportion is suspected, or possible recourse to caesarean section is anticipated. Although it is

difficult to validate the decision to transfer a woman to theatre, these criteria reflect actual practice in most teaching units, and the results can be generalised accordingly. Inclusion criteria were women at 37 or more completed weeks with a live, term, singleton, cephalic pregnancy. Study recruitment was from February 1999 to February 2000. Women meeting inclusion criteria were identified from delivery suite records within 24 hours of delivery and approached personally by researchers before hospital discharge.

In the initial research, the researcher completed a detailed dataset using hospital records and interviewed the mother about her labour and delivery and her views on future pregnancies. Full details on the identification and recruitment of women in the cohort and the early maternal and neonatal morbidity experienced until hospital discharge are described elsewhere.<sup>14</sup> Further information on maternal morbidity, infant feeding, and views on future pregnancies was gathered by postal questionnaires sent to each woman at six weeks and one year postpartum.<sup>15 16</sup> A further questionnaire, sent at three years, requested information on subsequent fertility, voluntary subfertility (where the woman wished to avoid a further pregnancy), involuntary subfertility (where the woman had difficulty conceiving or failed to conceive), pregnancies achieved, outcome of pregnancies, and planned and actual mode of delivery. The researchers sought the reasons for voluntary subfertility using focused questions derived from a previously published questionnaire survey.<sup>8</sup> The duration of involuntary subfertility was recorded, and for women who reported difficulty in conceiving, the interval to conception was recorded. Non-respondents were sent reminders, and, if no response was received, they were telephoned. Delivery outcome information was validated against the maternity database record for each individual woman.

The primary outcome of interest was mode of delivery in a subsequent pregnancy. The secondary outcomes were subfertility, early pregnancy loss, and preterm delivery. Each woman in the study gave written consent.

### Statistical analysis

Univariate comparisons were made between the maternal, labour, and postnatal characteristics of the two groups. This was done for both the original cohort and the respondents at three years to determine whether there was any obvious non-respondent bias and to ascertain potential confounding factors. The caesarean section group was considered to be the reference group, and the vaginal delivery group was the comparison group. The two groups were compared for reproductive and delivery outcomes after the initial delivery. If a woman reported more than one pregnancy after the index delivery, the first subsequent pregnancy was considered in the main analyses. Previous analyses suggested that the responses of the women who went on to have a caesarean section after a failed attempt at instrumental delivery were similar to those of the women who had an immediate caesarean section.<sup>15 16</sup> We did not, therefore, perform any subgroup analyses in the caesarean section group.

Univariate analyses were done using logistic regression, followed by multivariate analyses adjusting for potential confounding factors. Significance was defined a priori as  $P < 0.05$ , and factors fitting this criterion and those where there was biologically plausible potential for confounding were included in the model. Results are reported as unadjusted and adjusted odds ratios with 95% confidence intervals. Relative risk ratios are presented in addition to unadjusted odds ratios for the data on subsequent mode of delivery, as odds ratios can be misleading when there is a frequent occurrence of the factor of

interest. The statistical software package SPSS (version 11.0) was used for data analysis.

## Results

Two hundred and eighty three women from the original cohort of 393 (72%) returned the postal questionnaire sent three years after their previous operative delivery. The demographic, obstetric and neonatal characteristics of the respondents were similar to the profile of the original cohort, suggesting that the available study sample at follow up was representative of the original cohort (table 1). We did not have consent to establish the pregnancy outcome of the non-respondents.

Women were less likely to report difficulty conceiving (adjusted odds ratio 0.33 (95% confidence interval 0.12 to 0.98)) and were more likely to have achieved a further pregnancy (2.09 (1.10 to 4.28)) after an instrumental vaginal delivery than after a caesarean section (table 2). The interval between trying for a pregnancy and conception ranged from four to 24 months. A total of 140 women (49%) had achieved a further pregnancy at three year follow up, representing 73% (140/192) of those who had planned or were going to consider a further pregnancy. We found no significant differences for ectopic pregnancy, miscarriage, and preterm birth between the caesarean section group and the vaginal delivery group. No woman reported a termination of pregnancy. Of the 91 women who had not planned to have a further pregnancy, almost half (42/91) stated that they "could not go through childbirth again," with no significant difference in this response between the women in the instrumental vaginal delivery group and those in the caesarean section group (table 3).

Women were more likely to aim for a vaginal delivery if they had had a previous instrumental vaginal delivery than if they had had a previous caesarean section (table 4). This association was reported at one year after the index pregnancy (8.15 (3.07 to 21.67)) and persisted when the women were planning delivery in the subsequent pregnancy (15.55 (5.25 to 46.04)). Women were more likely to have a vaginal delivery if they had had a previous instrumental vaginal delivery (9.50 (3.48 to 25.97)), although there was a high rate of vaginal delivery in women who had had a previous caesarean section but were aiming for a vaginal delivery subsequently (17/18 (94%)). In three of the 42 (7%) women who had had an instrumental vaginal delivery previously and who subsequently delivered vaginally, the subsequent delivery was an instrumental vaginal delivery (all ventouse). In eight of the 17 (47%) women who had had a previous caesarean section and who subsequently delivered vaginally, the subsequent delivery was an instrumental vaginal delivery (seven ventouse, one forceps). Six women had given birth twice since the initial delivery, four after an initial instrumental delivery and two after a caesarean section; all six women delivered vaginally for the second birth.

## Discussion

Women are more likely to achieve a spontaneous vaginal delivery if they have had a previous instrumental vaginal delivery rather than a previous caesarean section. Fear of childbirth is a frequently reported reason for avoiding further pregnancies after either of these operative delivery modes. With the year on year increase in rates of operative delivery it is important to evaluate the impact of obstetric interventions on future reproductive outcome and subsequent mode of delivery.

**Table 1** Maternal and neonatal characteristics in relation to instrumental vaginal delivery and caesarean section. Values are numbers (percentages) unless stated otherwise

	Original cohort			Cohort at three years after delivery		
	Vaginal delivery (n=184)	Caesarean section (n=209)	Odds ratio (95% confidence interval)	Vaginal delivery (n=133)	Caesarean section (n=150)	Odds ratio (95% confidence interval)
Nulliparous	144 (78)	165 (79)	0.96 (0.59 to 1.56)	103 (77.4)	114 (76.0)	1.08 (0.62 to 1.88)
Maternal age >35 years	25 (14)	19 (9)	1.57 (0.84 to 2.96)	17 (12.8)	16 (10.7)	1.23 (0.59 to 2.54)
Non-white	13 (7)	10 (5)	1.51 (0.65 to 3.54)	6 (4.5)	10 (6.7)	0.66 (0.23 to 1.87)
Social class I and II	84 (46)	90 (43)	1.11 (0.75 to 1.66)	64 (48.1)	64 (42.7)	1.25 (0.78 to 1.99)
Body mass index >30	13 (7)	31 (15)	0.44 (0.22 to 0.86)*	11 (8.3)	23 (15.3)	0.50 (0.23 to 1.06)
Previous caesarean section	11 (6)	15 (7)	0.82 (0.37 to 1.84)	8 (6.0)	12 (8.0)	0.74 (0.29 to 1.86)
Previous difficult delivery†	9 (5)	12 (6)	0.84 (0.35 to 2.05)	7 (5.3)	10 (6.7)	0.78 (0.29 to 2.10)
Pre-eclampsia‡	7 (4)	19 (9)	0.40 (0.16 to 0.96)*	4 (3.4)	15 (10.0)	0.28 (0.09 to 0.86)*
Intrauterine growth retardation§	11 (6)	8 (4)	1.58 (0.62 to 4.02)	10 (7.5)	6 (4.0)	1.95 (0.69 to 5.52)
Diabetes mellitus	1 (1)	5 (2)	0.22 (0.03 to 1.93)	1 (0.8)	2 (1.3)	0.56 (0.05 to 6.25)
Induction of labour	52 (28)	78 (37)	0.66 (0.43 to 1.01)	44 (33.1)	60 (40.0)	0.74 (0.46 to 1.21)
Augmentation of labour	106 (58)	108 (52)	1.27 (0.85 to 1.89)	77 (57.9)	75 (50.0)	1.38 (0.86 to 2.20)
Male	111 (60)	117 (56)	1.20 (0.80 to 1.79)	80 (60.2)	95 (63.3)	0.87 (0.54 to 1.41)
Neonatal trauma	40 (22)	19 (9)	2.78 (1.54 to 5.00)*	31 (23.3)	16 (10.7)	2.55 (1.32 to 4.91)*
Admission to neonatal intensive care unit	10 (5)	24 (11)	0.44 (0.21 to 0.95)*	9 (6.8)	14 (9.3)	0.71 (0.30 to 1.69)
Estimated blood loss >1000 ml	6 (3)	20 (10)	0.32 (0.13 to 0.81)*	3 (2.3)	16 (10.7)	0.19 (0.06 to 0.68)*
Prolonged hospital stay (>5 days)	10 (5)	33 (16)	0.31 (0.15 to 0.64)*	9 (6.8)	24 (16.0)	0.38 (0.17 to 0.85)*

\*P &lt; 0.05.

†Shoulder dystocia, rotational instrumental delivery, third degree tear, or postpartum haemorrhage.

‡Blood pressure &gt;140/90 mm Hg on at least two occasions and proteinuria &gt;0.3 g in 24 hours.

§Intrauterine growth restriction—abdominal circumference &lt;10th centile for gestation on scan.

**Table 2** Fertility and pregnancy outcome at three years in relation to mode of delivery at index pregnancy. Values are numbers (percentages) unless stated otherwise

	Index pregnancy		Odds ratio (95% confidence interval)	
	Instrumental vaginal delivery (n=133)	Caesarean section (n=150)	Unadjusted	Adjusted*
<b>Planned further pregnancy</b>	92 (69)	100 (67)	1.12 (0.68 to 1.85)	1.24 (0.68 to 2.24)
Had difficulty conceiving	5/92 (5)	19/100 (19)	0.25 (0.09 to 0.69)†	0.33 (0.12 to 0.98)†
Had involuntary infertility for >1 year	2/92 (2)	3/100 (3)	0.72 (0.12 to 4.40)	0.70 (0.11 to 4.33)
<b>Achieved a planned further pregnancy at 3 years (%)‡</b>	73/92 (79)	67/100 (67)	1.89 (0.98 to 3.64)	2.09 (1.10 to 4.28)†
Ectopic pregnancy	4/73 (5)	0	-	-
Miscarriage	13/73 (18)	11/67 (16)	1.10 (0.46 to 2.66)	0.85 (0.21 to 3.45)
Preterm delivery (<37 weeks)	1/73 (1)	2/67 (3)	0.45 (0.04 to 5.10)	0.55 (0.04 to 7.74)
Term delivery (≥37 weeks)	54/73 (74)	54/67 (81)	0.68 (0.31 to 1.52)	0.71 (0.32 to 1.61)

\*Adjusted for parity to maternal age, social class, previous neonatal trauma, and previous prolonged hospital stay.

†P &lt; 0.05.

‡Includes one woman who was pregnant at the time of the survey where outcome was not yet known.

**Table 3** Reasons given for voluntary infertility in relation to mode of delivery at index pregnancy. Values are numbers (percentages) unless stated otherwise

Reason given*	Index pregnancy		Odds ratio (95% confidence interval)	
	Instrumental vaginal delivery (n=41)	Caesarean section (n=50)	Unadjusted	Adjusted†
Planned one child only	3 (7)	4 (8)	0.91 (0.19 to 4.31)	0.75 (0.06 to 8.83)
Family complete	19 (46)	22 (44)	1.10 (0.48 to 2.52)	1.66 (0.54 to 5.12)
Could not go through childbirth again	21 (51)	21 (42)	1.45 (0.63 to 3.33)	1.75 (0.58 to 5.25)
Relationship problems	12 (29)	8 (16)	2.17 (0.79 to 5.98)	2.66 (0.89 to 7.94)
Other	8 (20)	15 (30)	0.57 (0.21 to 1.51)	0.51 (0.18 to 1.51)

\*More than one reason could be given.

†Adjusted for parity, maternal age, social class, previous neonatal trauma, and previous prolonged hospital stay.

### Aiming for and achieving vaginal delivery

The increasing use of caesarean section rather than instrumental vaginal delivery for the management of poor progress in the second stage of labour will have far reaching consequences.<sup>6</sup> Most women who have had a caesarean section are now being delivered by caesarean section in subsequent pregnancies, with knock-on effects for the overall rate of caesarean section.<sup>1</sup>

Our previous work suggested that women make a decision about future mode of delivery at an early stage after caesarean

section, usually before hospital discharge.<sup>15</sup> Fear of a further emergency caesarean section in labour and of the risk of uterine rupture<sup>10</sup> and perinatal death<sup>17</sup> make it unlikely that this trend will be easily reversed.

The emphasis will need to be on achieving a vaginal delivery in the first pregnancy. Women who have had an instrumental vaginal delivery should be reassured by the very high rate of spontaneous vaginal delivery that can be achieved in a subsequent pregnancy. The importance of this cohort is that it



**Table 4** Mode of delivery for subsequent pregnancy in relation to mode of delivery at index pregnancy in women who achieved term pregnancy. Values are numbers (percentages) unless stated otherwise

Delivery for subsequent delivery	Index pregnancy		Odds ratio (95% confidence interval)		Relative risk ratio (95% confidence interval)†
	Instrumental vaginal delivery (n=54)	Caesarean section (n=54)	Unadjusted	Adjusted	
Preferred vaginal delivery at 1 year after index delivery <sup>15</sup>	39 (72)	16 (30)	6.18 (2.68 to 14.2)†	8.15 (3.07 to 21.67)†	2.44 (1.57 to 3.80)†
Planned vaginal delivery prior to subsequent delivery	47 (87)	18 (33)	13.4 (5.07 to 35.6)†	15.55 (5.25 to 46.04)†	2.61 (1.77 to 3.86)†
Achieved vaginal delivery for subsequent delivery	42 (78)	17 (31)	7.62 (3.22 to 10.0)†	9.50 (3.48 to 25.97)†	2.47 (1.63 to 3.75)†

\*Adjusted for parity, maternal age, social class, previous neonatal trauma, and previous prolonged hospital stay.  
†P<0.05.

establishes a high success rate among women with the most complex instrumental deliveries and confirms what has been reported for instrumental deliveries as a whole.<sup>12</sup> High rates of vaginal delivery can be achieved after caesarean section in women choosing this option, although instrumental vaginal delivery is more common. Further research is needed to establish the appropriate selection criteria for a trial of labour among women with a previous caesarean section at full dilatation.

### Difficulty conceiving

Operative deliveries are known to have long term consequences for fertility. Primiparous women who deliver by caesarean section have been shown to have fewer children and more difficulty conceiving than controls.<sup>7 18</sup> An increased risk of voluntary and involuntary infertility after a first caesarean section (and to some extent after instrumental vaginal delivery) has also been reported.<sup>8</sup> A recent population based cohort study among women who planned a further pregnancy reported an increased risk of taking more than one year to conceive if the woman had had a previous caesarean section.<sup>9</sup> A further study reports equal rates of subsequent childbearing for primigravidae who had had instrumental delivery for mid-cavity arrest and primigravidae who had had spontaneous vaginal deliveries.<sup>12</sup>

Our data suggest that this apparent association between operative delivery and subsequent subfertility may be a particular problem after delivery by caesarean section. Complex instrumental vaginal delivery may also be a factor, however, reflected in a higher than average rate of ectopic pregnancy. The duration of delay in conception reported by the women in our study may seem relatively short by clinical criteria (usually defined as less than one year), but the reported difficulty in conceiving reflects the perception of the mother rather than that of the clinician. Long term follow up of cohorts such as this are needed to confirm these associations, to establish whether they are causal, and to explore potential aetiological factors.

### Avoiding pregnancy

Childbirth can have a detrimental effect on a mother's emotional wellbeing. Some 25%-33% of women report traumatic symptoms associated with childbirth,<sup>19-21</sup> which may be sufficient to deter women from having further pregnancies. In our cohort, many of the women who chose not to have more children stated that they could not go through childbirth again, which confirms the findings of others.<sup>8</sup> Our finding was also confirmed by the views expressed by women from the cohort who were interviewed for a qualitative study, many of whom described the traumatic nature of their experience and the negative effect this had for future potential pregnancies.<sup>22</sup>

Is it possible to help with the psychological stress incurred? Current strategies for reducing emotional morbidity, such as "debriefing," have produced disappointing results.<sup>23-25</sup> A ran-

domised controlled trial of a midwife led debriefing session during the postpartum hospital stay that aimed to reduce maternal depression among women who had had an operative delivery was ineffective in reducing maternal morbidity at six months postpartum.<sup>24</sup> Similarly, additional home visits by community postnatal support workers conferred no health benefit over traditional community midwifery for women, regardless of the type of delivery.<sup>23</sup> Further work is needed to understand the experience of operative delivery and the reasons behind fear of childbirth and to devise an optimal approach to postnatal review that allows women to plan their ideal family size.

### Strengths and weaknesses

This was a prospective cohort study with 100% recruitment of eligible women within a defined geographical area. Complete recruitment should eliminate selection bias, and our results are likely to be generalisable to other similar urban populations, although we had a low background rate of non-white women.

We achieved a high rate of follow up at three years, and respondents were closely similar to the original cohort for important demographic and clinical factors. Therefore, the potential bias from loss of follow up is reduced. Recall bias is unlikely to be an issue, given that we surveyed these women at six weeks, one year, and three years and that they were very aware of planning their pregnancies and their preferred mode of delivery. Any potential for misreporting is likely to apply equally to each comparison group. Longer term follow up is needed to examine fully the issue of subfertility and determine which women fail to conceive.

Qualitative approaches are better at determining the rationale behind women's preferences for future mode of delivery and reasons for avoiding further pregnancies. The results of this study provide a quantitative estimate of what we previously established from in-depth interviews with women from the cohort.<sup>22</sup> A randomised controlled trial tackling this research question would have been better as all potential confounding factors might not have been identified or accounted for with a cohort design. However, such a trial in this clinical context poses considerable difficulties in relation to ethical and feasibility issues.

### Conclusions

Operative delivery in the second stage of labour has important implications for future delivery outcomes. Instrumental vaginal delivery increases the woman's chance of achieving a subsequent spontaneous vaginal delivery. Although morbidity issues need to be considered with instrumental vaginal delivery, we must continue to offer choice when difficulties are encountered in the second stage of labour. Further work is urgently needed to tackle the psychological morbidity experienced by women in these circumstances.

### What is already known on this topic

An increasing proportion of women who want a spontaneous vaginal delivery have an operative delivery—instrumental vaginal delivery or caesarean section—in the second stage of labour

Few studies have examined the consequences of such operative delivery for future pregnancies

### What this study adds

Women are far more likely to have a subsequent spontaneous vaginal delivery after an instrumental delivery than after a caesarean section

Fear of childbirth is often reported, after all types of operative delivery, as a reason for avoiding future pregnancies

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**Contributors:** All authors designed the study, contributed to the analysis, and interpreted the data. RB designed the questionnaires and collected the data. DJM wrote the report, with help from the other authors, and will act as guarantor for the paper.

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