



A new perspective on VBAC: A retrospective cohort study

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Summary

Background: Previous studies assessing the safety of vaginal birth after caesarean section (VBAC) have compared VBAC to elective repeat caesarean section (ERCS), despite the fact that the risks posed by each are considerably different. Explaining the complications of VBAC in a way that is meaningful to women can be challenging, and thus a comparison to a similar group of women who have also not undergone previous vaginal delivery may be a more relevant comparison.

Research question: When counselling women undergoing planned VBAC, should a comparison of outcomes be made to women undergoing ERCS, or is a comparison to other nulliparous women undergoing vaginal birth a more valid comparison in terms of risk outcomes?

Participants and methods: A retrospective cohort study was undertaken comprising a consecutive cohort of 21,389 women who delivered, stratified by Robson's criteria into Robson groups 1–5. Those in Robson groups 6–10 were not included. Demographic data and maternal/neonatal outcomes were reviewed, with main outcome measures comprising uterine rupture, post-partum haemorrhage (PPH), 3rd/4th degree tears and neonatal morbidity.

Results: There was no increase in PPH, vaginal tears or neonatal complications in the VBAC group when compared to Robson groups 1 and 2 (nulliparous women in spontaneous or induced labour, respectively). Uterine rupture rates were low in all groups, with no correlation identified.

Discussion: The maternal and neonatal morbidity associated with VBAC is comparable to primiparous women undergoing a vaginal birth.

Conclusion: In demonstrating the low relative morbidity in this comparison, these outcomes may aid in counselling women faced with the choice of VBAC versus ERCS.

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Introduction and literature review

There is a growing trend towards caesarean section (CS) in developed countries.^{1,2} In Australia, the CS rate has increased from 18% in 1991, to 21.9% in 1999, and to 28.3% in 2007.^{3,4} The most common indication for a woman

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to have an elective CS is previous CS (56.6%).⁵ However, CS is associated with a higher rate of surgical, infectious, and thromboembolic complications than vaginal birth, as well as subsequent perinatal complications such as placenta praevia and placenta accreta.^{6,7} Despite this, concerns about maternal and neonatal complications have contributed to a decrease in vaginal birth after CS (VBAC) rates. As there are complications with both VBAC and elective repeat CS (ERCS), the management of women who have undergone a single low transverse CS depends largely on patient preference and circumstance, including family, cultural and community attitudes, and the attitudes of health care professionals.^{8–11}

While current literature on the safety of VBAC does not include randomised trials,¹² several large observational studies looking at VBAC have provided information which has been generally reassuring.^{6,7,13–16} In these studies, VBAC has been compared to outcomes following ERCS with the result that the most feared complication of VBAC, that of uterine rupture, seems to be increased in comparison to ERCS.^{11,17,18} Systematic reviews of the incidence of uterine rupture have found that VBAC can increase the incidence of uterine rupture over ERCS by up to 5 per 1000 cases in particular groups of women.^{11,17} Uterine rupture is associated with VBAC, but this is higher when the labour is induced or augmented.¹⁹ With regards to other outcome measures, there is less clear evidence, with inconsistent differences between groups for maternal morbidity, blood transfusion or post-partum haemorrhage (PPH).^{11,20} A recent meta-analysis divided outcomes into women having a successful VBAC or failed TOL, demonstrating that maternal morbidity, uterine rupture and blood transfusion were all more common after failed TOL than either successful VBAC or ERCS. Outcomes in the latter two groups were comparable in this study.⁷ An earlier meta-analysis demonstrated a decreased risk of maternal morbidity in those women who attempted VBAC, including infection and blood transfusion, although no attempt was made to separate this group into “successful” and “failed”.¹⁷ One study has also demonstrated a higher risk of 3rd or 4th degree perineal tears with VBAC and also with nulliparity.²¹ Neonatal outcomes for VBAC are also controversial, with one meta-analysis looking at neonatal morbidity/mortality suggesting that VBAC may be associated with higher fetal and neonatal mortality over ERCS and lower Apgar scores at 5 min of age,²⁰ but more recent studies suggesting otherwise.²²

In all of the studies in the literature thus far, the two groups used for comparison have been those undergoing

VBAC and those undergoing ERCS. While CS and vaginal birth have accepted differences in their complications, the outcomes of VBAC could be appropriately compared to a ‘like’ group of women. In addition, the comparison between VBAC and ERCS may not be an easily comprehensible notion for pregnant women, with a recent study demonstrating the difficulties for patients in understanding the key factors in the decision-making process.²³ In fact, the recent NIH draft consensus on VBAC outcomes identified substantial problems with the current comparison groups for outcomes.²⁴ The current study offers a different approach of comparing women undergoing VBAC to an equivalent group of women who have also not previously undergone vaginal delivery: namely, nulliparous women following vaginal birth, as well as comparing them to all women presenting with term, singleton, and cephalic presentations. This has been achieved by stratifying women according to the Robson ‘Ten Group Classification System’.²⁵ The Robson criteria have been used effectively as a tool for comparing CS rates among equivalent subpopulations.^{25,26}

The current study comprises a 6 year review of VBAC at a large tertiary centre, formally assessing the primary outcomes of uterine rupture, PPH, 3rd/4th degree tears and neonatal morbidity, defined as admissions to SCN (special care nursery)/NICU (neonatal intensive care unit). The information provided will contribute to the evidence and advice given to women faced with choice of VBAC versus ERCS.

Participants and methods

The study design comprised a retrospective cohort study, with 21,389 consecutive women registered through the Royal Women’s Hospital (Melbourne, Victoria, Australia) all included in the study. The Royal Women’s Hospital is one of Australia’s largest maternity tertiary referral, metropolitan teaching hospitals, with an annual delivery rate of over 5000 deliveries. All women delivered between January 1st 2000 and December 31st 2005 were included in the study and stratified by Robson’s criteria (see Table 1), with the only exclusions comprising those women classified as Robson groups 6–10 (comprising multiple gestation, malpresentation, or prematurity). All research was collected and recorded anonymously, complied wholly with the Declaration of Helsinki, and no ethical committee approval was required as dictated by the national guidelines of the National Health

Table 1 Robson’s Ten Group Classification System.²⁶

Group	Description
1	Nullipara, >37 weeks, single, cephalic presentation, spontaneous labour
2	Nullipara, >37 weeks, single, cephalic presentation, induced labour or caesarean delivery before labour
3	Multipara, NO previous caesarean, >37 weeks, single, cephalic presentation, spontaneous labour
4	Multipara, NO previous caesarean, >37 weeks, single, cephalic presentation, induced labour or caesarean delivery
5	Multipara, previous caesarean, >37 weeks, single, cephalic presentation
6	Nullipara, single breech presentation
7	Multipara, single breech presentation
8	Multiple gestation (with or without previous caesarean)
9	Singleton pregnancy, oblique or transverse lie (excluding breech, with or without previous caesarean)
10	Single cephalic pregnancy, <37 weeks (including previous caesarean)

and Medical Research Council (NHMRC) of Australia for retrospective clinical studies, and as such conformed to the "Statement on Human Experimentation" by the National Health and Medical Research Council of Australia.

Information was collected from individual medical records, with data entered prospectively into an electronic database as part of a larger hospital database. Retrospectively reviewed data included in the current paper comprised demographic data (age and past obstetric history), antepartum and medical complications, labour and obstetric management variables, neonatal outcomes and maternal outcomes. The specific obstetric information collected comprised the method of delivery (namely, normal vaginal birth (NVB), forceps- or vacuum-assisted vaginal birth or CS), and the potential obstetric complications of shoulder dystocia, 3rd and 4th degree tears and PPH. The incidence and outcomes of uterine rupture were also assessed, despite the expected difference between groups given the presence of a uterine scar in the VBAC group. Neonatal complications, such as respiratory compromise, low Apgar scores and the need for newborn intensive care unit admission, were also recorded.

Following data collection, women were subsequently stratified by the Robson Ten Group Classification System. The Robson criteria enable all CS to be classified into a mutually exclusive patient population category (see Table 1).^{25,26} This classification system classifies CS birth based on individual characteristics of the mother, and not on the indication for CS. These characteristics comprise past obstetric history, the course of the current pregnancy, and length of gestation. The Robson classification is inclusive, in that all women can be classified by the criteria into a single group and are classified into one group only. Outcomes do not affect the stratification, and as such the need for emergency CS or birth weight are only known after classification.

Statistical analysis was undertaken with the aid of a statistician. For comparative statistics, Fisher's exact test and the Chi square test were used. A *p*-value of <0.05 was considered to indicate statistical significance.

Results

Demographics

Age at delivery was reviewed and grouped by Robson classification. Fig. 1 demonstrates the age at delivery by Robson group, demonstrating the breakdown for each age bracket.

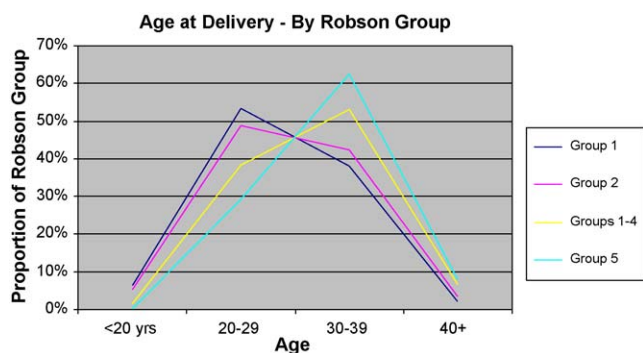


Figure 1 The age at delivery, grouped by Robson classification.

As expected, the age of women in groups 1 and 2 was significantly lower than that of the total of groups 1–4 (comprising nulliparous and multiparous women) and also significantly lower than that of group 5 (consisting of women who have previously given birth by CS, and are thus all multiparous).

Mode of delivery

Most of the women in Robson group 5 (those with previous CS) delivered by CS (79.8%). Notably, group 5 makes no distinction about the number of previous CS, and thus this group includes those with multiple previous CS who would not be routinely offered the option of VBAC. The distribution by Robson classification is presented in Table 2. When group 5 is subdivided to review those with a single previous CS compared to those with multiple previous CS, the data demonstrates that this sub-group has a higher vaginal birth rate, ranging between 35.9 and 40.7% (see Table 3), compared to 20.2% in group 5 overall.

Maternal complications

Post-partum haemorrhage (PPH)

The incidence of PPH was recorded, and further classified by mode of delivery and volume of haemorrhage. There was a significantly increased risk of PPH following NVB for group 5 women when compared to the combined groups 1–4 delivering vaginally (*p* 0.02), but not significantly higher when compared to group 1 or 2 alone (see Table 4). Thus there was no statistically significant increase in PPH with VBAC compared to nulliparous women in either spontaneous or induced labour. For those women who had an instrumental delivery there was no increased risk of PPH for group 5 women when compared to all other comparative groups. For women who underwent CS, group 5 women had a lower rate of PPH, compared to group 1 or 2 women.

Further sub-classification of PPH into low or high volume bleeds was performed (see Table 4). There was found to be significantly more PPH of low volume in group 5 women, compared to the PPH that occurred in the other comparative groups (*p* = 0.01).

3rd/4th degree vaginal tears

In regards to 3rd/4th degree vaginal tears, the absolute number of tears in the study was low. A review of those women who had NVB with or without 3rd/4th degree tears was performed (see Table 4). This demonstrated approximately double the rate of tears in group 5 compared to

Table 2 Distribution of patients by mode of delivery, grouped by Robson classification.

	Group 1	Group 2	Groups 1–4	Group 5
Vaginal births (<i>n</i> (%))	5347 84.0%	2028 65.2%	16,020 83.0%	423 20.2%
Caesarean section (<i>n</i> (%))	1022 16.0%	1084 34.8%	3277 17.0%	1669 79.8%
Total	6369	3112	19,297	2092

Table 3 The total number and rate of vaginal birth (spontaneously or induced) for women that have had a single previous caesarean section and no other pregnancies, at the Royal Women's Hospital (as a percentage of the total number of births).

Year	2000/01	2001/02	2002/03	2003/04	2004/05
Rate (number/% of total)	1667 35.9%	1985 28.2%	2137 33.8%	2997 38.9%	3256 40.7%

Table 4 Maternal complications stratified according to the Robson classification. The number and rate of post-partum haemorrhage (PPH), rate of low (<1000 mL) or high (≥1000 mL) volume PPH, and rate of 3rd/4th degree vaginal tears are compared between groups. Statistical significance has been calculated for comparison to group 5.

	Group 1	Group 2	Groups 1–4	Group 5
PPH rate for normal vaginal delivery <i>n</i> /% (<i>p</i> value)	470/13.1% (<i>p</i> = 0.16)	166/14.8% (<i>p</i> = 0.65)	1460/11.4% (<i>p</i> = 0.02)	49/16.0%
PPH rate for instrumental delivery <i>n</i> /% (<i>p</i> value)	537/30.5% (<i>p</i> = 1.0)	297/32.7% (<i>p</i> = 0.60)	920/29.0% (<i>p</i> = 0.84)	35/30.2%
PPH rate for caesarean section <i>n</i> /% (<i>p</i> value)	375/36.7% (<i>p</i> < 0.001)	428/39.5% (<i>p</i> < 0.001)	1208/36.9% (<i>p</i> < 0.001)	425/25.5%
Volume PPH = 500–999 mL <i>n</i> /% (<i>p</i> value)	1101/79.7% (<i>p</i> < 0.001)	707/79.3% (<i>p</i> = 0.001)	2796/77.9% (<i>p</i> < 0.001)	441/86.6%
Volume PPH ≥1000 mL <i>n</i> /% (<i>p</i> value)	281/20.3% (<i>p</i> < 0.001)	184/20.7% (<i>p</i> = 0.001)	792/22.1% (<i>p</i> < 0.001)	68/13.4%
3rd/4th degree tears for normal vaginal delivery <i>n</i> /% (<i>p</i> value)	101/2.8% (<i>p</i> = 1.0)	24/2.1% (<i>p</i> = 0.66)	170/1.3% (<i>p</i> = 0.07)	8/2.6%
3rd/4th degree tears for instrumental delivery <i>n</i> /% (<i>p</i> value)	90/5.1% (<i>p</i> = 0.66)	55/6.1% (<i>p</i> = 1.0)	156/4.9% (<i>p</i> = 0.52)	7/6.0%

groups 1–4 collectively (1.3% vs 2.6%, *p* = 0.07), which did not reach statistical significance. Rates in groups 1 and 2 and group 5 were comparable, suggesting again that there was no additional risk with VBAC compared to nulliparous women generally. A review of those women who had instrumental delivery with or without 3rd/4th degree tears was also performed. There was found to be no difference in tears following instrumental delivery between any of the comparative groups.

Obstetric complications

Shoulder dystocia

The incidence of shoulder dystocia was reviewed. Comparing those women who had NVB with or without shoulder dystocia (see Table 5), there was found to be no difference in risk of shoulder dystocia between the groups following NVB. A

review of those women who had instrumental delivery with or without shoulder dystocia was also performed, revealing a significantly greater risk of shoulder dystocia with instrumental delivery in group 5 when compared to group 1 (*p* = 0.03) and to groups 1–4 collectively (*p* < 0.001).

Neonatal complications

Admission to SCN/NICU

The need for SCN/NICU admission was reviewed by mode of delivery, with there found to be no difference in the need for SCN/NICU admissions for groups 1 or 2 compared to group 5 for NVB or instrumental delivery (see Table 6). The exception to this was in group 5 women undergoing CS, for whom there was a significantly decreased risk of SCN/NICU admission when compared to group 2 (*p* = 0.01), and when compared to groups 1–4 collectively (*p* = 0.01).

Table 5 Obstetric complications, with the number and rate of shoulder dystocia stratified according to the Robson classification and compared between groups. Statistical significance has been calculated for comparison to group 5.

	Group 1	Group 2	Groups 1–4	Group 5
Shoulder dystocia for normal vaginal delivery <i>n</i> /% (<i>p</i> value)	30/0.8% (<i>p</i> = 0.34)	13/1.2% (<i>p</i> = 0.77)	209/1.6% (<i>p</i> = 0.82)	4/1.3%
Shoulder dystocia for instrumental delivery <i>n</i> /% (<i>p</i> value)	51/2.9% (<i>p</i> = 0.03)	38/4.2% (<i>p</i> = 0.23)	113/3.6% (<i>p</i> < 0.001)	8/6.9%

Table 6 Neonatal complications, with the number and rate of special care nursery (SCN)/neonatal intensive care unit (NICU) admissions stratified according to the Robson classification and compared between groups. Statistical significance has been calculated for comparison to group 5.

	Group 1	Group 2	Groups 1–4	Group 5
Admission to SCN/NICU for normal vaginal delivery <i>n</i> /% (<i>p</i> value)	125/3.5% (<i>p</i> = 0.52)	73/6.5% (<i>p</i> = 0.18)	541/4.2% (<i>p</i> = 0.89)	13/4.2%
Admission to SCN/NICU for instrumental delivery <i>n</i> /% (<i>p</i> value)	127/7.2% (<i>p</i> = 0.58)	90/9.9% (<i>p</i> = 0.74)	246/7.8% (<i>p</i> = 0.72)	10/8.6%
Admission to SCN/NICU for caesarean section <i>n</i> /% (<i>p</i> value)	105/10.3% (<i>p</i> = 0.46)	135/12.5% (<i>p</i> = 0.01)	394/12.0% (<i>p</i> = 0.01)	156/9.3%

Uterine rupture

During the study period there were five uterine ruptures/uterine dehiscences in our cohort (0.02% of cases overall). This relatively low number was insufficient to achieve statistical significance during analysis due to insufficient power (see Table 7). However, the following observations can be made. Four of the five cases of uterine rupture occurred in group 5 women. Of these five cases, the four that occurred in group 5 women did not require a hysterectomy or have other complications. Three of these were in spontaneous labour and one was induced. However, the rupture that occurred in a non-group 5 woman (group 4) ultimately required a hysterectomy. There were no adverse fetal outcomes for any of the group 5 uterine ruptures.

Discussion

The current study has utilised the Robson classification to compare outcomes of VBAC with other groups of women. The Robson classification for CS was first devised in 2001, and has since been shown to be both easily implemented and clinically reliable.^{25,26} Furthermore, a 2007 study by McCarthy

et al. demonstrated that this classification system can be successfully applied to the Australian population of women.³

Previous studies have demonstrated significant outcome differences for women undergoing VBAC when compared to those undergoing ERCS. However, between these two types of delivery, differences are to be expected. The current study compares women of group 5 (women with prior CS), to groups 1 and 2 (nulliparous women without previous vaginal birth), a group known to have higher intervention and complication rates. Although a small percentage of group 5 women may have undergone prior vaginal birth, the majority will have not. Consequently, this analysis evaluates the safety of VBAC between two similar cohorts of women, both of whom have not undergone previous vaginal birth. This comparison has not been previously explored in the literature.

An improved comparison such as this is warranted given the findings of several recent studies, each highlighting the difficulties of women making the decision between VBAC and ERCS.^{23,27} Turner et al. (2008) demonstrated that patients did not share the same appreciation of the complications of each mode of delivery as their clinicians, while Farnworth et al. (2008) demonstrated that women face significant difficulties in this decision process. The current study provides a poten-

Table 7 All cases of uterine rupture over the study period, stratified by Robson criteria.

Case	Robson group	Background	Mode of delivery	Hysterectomy	PPH	Blood transfusion	NICU	Fetal outcome
1	4	42/40 induced labour. vaginal delivery. PPH requiring laparotomy. Found at operation – ruptured uterus. Haemodynamic instability, with cardiac arrest. Hysterectomy and bilateral internal iliac artery ligation	Vaginal delivery	Yes	>4000 mL	Yes	No	Alive and well
2	5	Spontaneous labour. Found at operation – lower uterine segment dehiscence 3 cm	Emergency caesarean section	No	500 mL	No	No	Alive and well
3	5	Trial of scar. Obstructed labour. Found at operation – lower uterine segment dehiscence	Emergency caesarean section	No	1200 mL	No	No	Alive and well
4	5	Trial of scar. Found at operation – lower uterine segment dehiscence 2 cm.	Emergency caesarean section	No	No	No	No	Alive and well
5	5	Found at operation – lower uterine segment dehiscence 2 cm.	Elective repeat caesarean section	No	1000 mL	Yes	No	Alive and well

tially improved concept for women to comprehend and for clinicians to present to their patients. In the current study, there was no increase in overall complications between the comparison groups, with these findings suggesting that the safety of VBAC is similar to that of vaginal birth in other high-risk groups (nulliparous women). The only significant finding was of an increased risk of shoulder dystocia with instrumental delivery in group 5 women.

In terms of the specific comparative outcomes assessed, the PPH rate for women in group 5 undergoing CS was significantly lower than for any of the other groups. In addition, these were more likely to be of low volume (<1000 ml), when compared to other groups. Previous studies have suggested that high volume PPH is less likely in group 5 women undergoing VBAC, as repeat CS is associated with more bleeding,²⁸ with our study confirming these findings. Uterine rupture is frequently discussed as the greatest perceived complication of VBAC, with uterine rupture referring to a full-thickness separation of the uterine wall and overlying serosa and is thus more prone to catastrophic bleeding and fetal compromise, while uterine scar dehiscence refers to breakdown of a preexisting scar and no disruption of the overlying uterine serosa, which may result in less bleeding and may maintain an intrauterine fetus.^{29,30} Uterine rupture/dehiscence have been shown in previous studies to be more frequent following VBAC compared with ERCS, with increases ranging from 0.2 to 0.9%.^{11,20,31} Although the majority of uterine ruptures occurred in group 5 women undergoing VBAC, the overall number of ruptures in our study was low (0.02% of cases overall), and not significantly different between groups. In fact, despite hysterectomy being a rare outcome following uterine rupture in our study, the case that did require hysterectomy occurred in a non-group 5 woman. Several systematic reviews and meta-analyses have suggested that the risk of hysterectomy is the same or lower in women who attempt VBAC than in women who opt for ERCS.^{11,20} In these studies, comprising almost 100,000 women, women undergoing VBAC had a lower rate of hysterectomy. Of particular note, was that any increase in the incidence of uterine rupture in group 5 women was counteracted by the low maternal and fetal morbidity associated with those ruptures. In fact, these 'ruptures' were all noted to be lower segment dehiscences, rather than the true rupture that occurred in a group 4 woman.

There were no significant differences in fetal outcomes between comparison groups in the current study. Previous studies assessing fetal outcomes, including Apgar scores, admission to NICU, and perinatal mortality, have been reported as similar following VBAC compared to ERCS.^{32,33} These results need to be considered in the context of the Robson classification, for which stratification occurs prior to outcomes, without controlling for several key outcome variables; specifically, birth weight has not been controlled for when discussing shoulder dystocia and CS has not been controlled for according to elective or emergency status, which is of importance in the analysis of PPH. An additional limitation of the current study design is the retrospective nature of analysis, although data was prospectively entered, and follow-up study will be undertaken prospectively.

The results of the current study have implications for decision-making and counselling of women during pregnancies after previous CS. On the basis of these results, women

considering the options of VBAC or ERCS can be advised that VBAC has no higher rate of PPH, 3rd/4th degree tears or admission to SCN/NICU than women having their first baby. Women having an ERCS were more likely to have PPH, however these were more commonly volumes <1000 ml. The absolute risk of scar dehiscence/uterine rupture was very small for all groups and in this study fetal outcomes for patients undergoing VBAC, even in the presence of scar dehiscence, appeared to be similar.

Conclusion

This study provides important additional information to the debate over the safety of VBAC. There was no evidence of an increase in complications with VBAC compared to vaginal birth in nulliparous women. In demonstrating the low relative morbidity in this comparison, the outcomes of the current study may be utilised to aid the counselling of women faced with the choice of VBAC versus ERCS.

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