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ORIGINAL ARTICLE

Single prior caesarean section and risk of anal sphincter injury

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Abstract

Introduction and hypothesis Injury to the anal sphincter at vaginal delivery remains the leading cause of faecal incontinence in women. Previous studies reported an increased incidence of obstetric anal sphincter injury (OASI) in women attempting vaginal birth after caesarean section (VBAC). The aim of the paper was to establish whether women in their second pregnancy, with one previous uterine scar, are at a higher risk of OASI compared with nulliparous women.

Methods All primiparous and secundiparous women with a previous caesarean section who delivered from 2008 to 2017 were analysed in a single-centre retrospective study. The primary endpoint was OASI. Labour characteristics in both groups were compared, and a multiple regression model was created.

Results There were 8573 vaginal deliveries of nulliparous women and 3453 deliveries of women in their second pregnancy with a previous caesarean section, of whom 550 had a successful VBAC. There was no significant difference in the rate of OASI between primiparous women and those who had a successful VBAC: 3.5% (297/8573) versus 3.1% (17/550), $P = 0.730$). Foetal macrosomia (>4 kg) and forceps delivery were risk factors for sphincter injury, while episiotomy and epidural anaesthesia were protective.

Conclusions VBAC does not confer an increased risk of OASI after a first delivery by caesarean section when compared with nulliparous women. The rate of successful VBAC may be contributory and suggests that the risk conferred by VBAC may be unit-specific. Unit and national-level audit is necessary to investigate this risk further.

Keywords Obstetric anal sphincter injury · OASI · VBAC · Caesarean section · Perineal trauma

Introduction

Injury to the anal sphincter at vaginal delivery remains the leading cause of faecal incontinence in women [1, 2]. This debilitating condition severely impacts on women's quality of life (QoL), with the degree of morbidity directly related to the severity of perineal trauma [1, 2]. Caesarean section rates continue to increase [3], and obstetricians are more frequently encountering complications, such as intra-abdominal adhesions, ureteric and vesical injury and abnormal placentation [3, 4]. Trial of labour after one caesarean delivery is safe [5, 6] and offers an alternative to elective repeat caesarean section.

Previous studies have reported an increased incidence of obstetric anal sphincter injury (OASI) in secundiparous women attempting vaginal birth after caesarean section (VBAC) [7–10]. This increased risk is thought to be attributable to the more propulsive uterine contractions in this group, despite an essentially primiparous perineum [7]. Understanding this risk is especially important given the ageing population [11] and the increased prevalence of pelvic floor dysfunction [12].

The aim of the paper was to establish whether women in their second pregnancy, with one previous uterine scar, are at a higher risk of OASI when compared with nulliparous women.

Methods and materials

This was a retrospective analysis of prospectively gathered data, including all nulliparous women who had a vaginal delivery, and secundiparous women with a previous caesarean delivery who attempted VBAC over a 10-year period from 1 January 2008 to 31 December 2017 in our institution. Our unit is a university-affiliated district general hospital in which approximately 3500 women deliver annually. Delivery records

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were extracted from the hospital's computerised maternity record service. These records are completed contemporaneously by the attending midwife and obstetrician (if involved). Data are part of the continuous audit of labour and delivery and, thus, ethical approval was not deemed necessary by our institutional research ethics committee.

Women who attend our unit in their second pregnancy having had a previous caesarean delivery are counselled about VBAC on their first visit to the antenatal clinic. Women are normally encouraged to attempt VBAC after one previous caesarean delivery, but maternal requests for elective repeat caesarean sections are accepted. Those women attempting VBAC receive routine antenatal care and are seen on a weekly basis from 36 weeks of gestation. Spontaneous labour is awaited, and women are allowed to progress beyond their due date. If spontaneous labour does not occur before 40 + 12 weeks of gestation, induction is performed by amniotomy, if suitable, or the patient undergoes an elective repeat caesarean delivery.

In our institution, every woman who has a vaginal delivery has a rectal examination to determine the integrity of the anal sphincter immediately after delivery. This examination is carried out by the attending midwife or obstetrician. Episiotomy is not routinely performed but is at the discretion of the birth attendant, where indicated. All episiotomies carried out in our hospital are mediolateral. Suspected sphincter injuries are examined and diagnosed by an obstetrician who has received specialist training in the diagnosis and repair of OASI. Perineal injuries were classified as either absent (intact perineum, 1st, 2nd, and episiotomy) or present (3a, 3b, 3c, and 4th degree) for the purposes of this study.

Contingency tables were analysed using the chi-square or Fisher's exact test, as appropriate. Means were compared using Student's *t* test. Trends in anal sphincter injuries over the 10-year period were analysed using chi-squared test for trends in proportions. Two groups were compared: women with and without OASI, and women who had a successful VBAC compared with nulliparous women delivering vaginally in the same time period. A multiple logistic regression analysis model was then produced, with OASI as the dependent categorical variable and coefficients adjusted for mode of delivery, episiotomy, epidural analgesia, birthweight, gestation, maternal age, and length of the second stage of labour. Results are presented as adjusted odds ratios (OR), with associated 95% confidence intervals (CI) and *P* values. R3.4.5 (R Foundation for Statistical Computing, Vienna, Austria) was used for all statistical analyses, and a two-tailed probability value of $P < 0.05$ was considered significant.

Results

From 1 January 2008 to 31 December 2017, there were 8573 vaginal deliveries of nulliparous women and 3453 deliveries of women in their second pregnancy who had a previous caesarean section. In women with a previous uterine scar, approximately half [52.9% (1827/3453)] underwent an elective caesarean delivery, which did not change significantly over the study period ($P = 0.597$). Of remaining women [66.2% (1076/1626)] underwent an emergency caesarean delivery, and 33.8% (550/1626) had a successful VBAC. The institutional caesarean section rate for the study period was 30.4%.

There was no significant difference in the rate of OASI between primiparous women and those who had a successful VBAC: 3.5% (297/8573) versus 3.1% (17 of 550), $P = 0.730$, odds ratio (OR) 0.90, 95% confidence interval (CI) 0.52–1.43. VBAC was not a significant predictor of sphincter injury when multiple regression was performed (*see* Table 1). The rate of OASI in primiparous women rose from 1.8% (20/1112) in 2008 to 4.5% (28/619) in 2017 ($P = 0.009$); Fig. 1. In women who had a successful VBAC, the rate in 2008 was 5.3% (3/57) and 0% (0/39) in 2017, though this did not reach statistical significance ($P = 0.717$). A comparison of baseline labour characteristics between nulliparous and secundiparous women with a previous caesarean section can be seen in Table 2. A comparison of women with an intact sphincter and those with sphincter injuries can be seen in Table 3.

Instrumental delivery

There was no difference in the rate of instrumental delivery between groups [44.5% (3812/8573) versus 48.5% (267/550), $P = 0.069$]. There was an increased rate of instrumental delivery in those with an OASI compared with those with an intact sphincter [53.3% (168/314) versus 44.0% (3911/8809), $P = 0.002$]. Forceps delivery was a strong predictor of OASI in the multiple regression model (OR 4.39, 95% CI 2.96–6.54, $P < 0.001$), while vacuum delivery was non-significant (OR 0.98, 95% CI 0.67–1.42, $P = 0.915$).

Episiotomy

There was no difference in the rate of episiotomy in women with sphincter damage compared with those with an intact sphincter [50.6% (159/314) versus 45.2% (3986/8809), $P = 0.068$)] Similarly, there was no difference between women who had a successful VBAC and nulliparous women [46.7% (257/550) versus 45.4% (3888/8573), $P = 0.559$]. Episiotomy reduced the risk of sphincter injury in the multiple regression model (OR 0.65, 95% CI 0.46–0.92, $P = 0.015$).

Birthweight

Over the study period, 20.7% (65/314) of infants born to mothers with an OASI were macrosomic (birth weight >than 4 kg) compared with 10.3% (903/8809) born to mothers with an intact sphincter ($P < 0.001$). Mothers

Table 1 Multiple logistic regression model comparing mothers with obstetric anal sphincter injury (OASI) and those with an intact sphincter

	Intact sphincter ($n = 8809$)	OASI ($n = 314$)	OR	95% CI	*P* value
Vacuum (%)	30.0 (2640/8809)	18.2 (57/314)	0.98	0.67–1.42	0.915
Forceps (%)	14.4 (1271/8809)	35.4 (111/314)	4.39	2.96–6.54	< 0.001
VBAC (%)	6.1 (533/8809)	5.4 (17/314)	0.94	0.54–1.52	0.810
Episiotomy (%)	45.2 (3986/8809)	50.6 (159/314)	0.65	0.46–0.92	0.015
Epidural (%)	42.2 (3718/8809)	38.9 (122/314)	0.59	0.45–0.76	0.001
Birthweight (g)	3417 ± 490	3639 ± 468	1.00	1.00–1.00	< 0.001
Gestational age (weeks)	39.5 ± 1.7	39.9 ± 1.2	1.04	0.95–1.15	0.429
Maternal age (years)	27.9 ± 5.5	28.2 ± 5.0	1.00	0.98–1.03	0.775
Length of second stage of labour (min)	70 ± 58	78 ± 54	1.00	1.00–1.00	0.244

VBAC vaginal birth after caesarean section, *OR* odds ratio, *CI* confidence interval

who had a successful VBAC were more likely to have had a baby weighing >4 kg compared with nulliparous women [14.9% (82/550) versus 10.3% (886/8573), $P < 0.001$)] Birthweight was a significant risk factor in the multiple regression model ($P < 0.001$).

Length of second stage of labour

When length of labour was examined, those with an OASI had a significantly longer second stage compared with those with an intact sphincter (78 ± 54 min versus 70 ± 58 min, $P = 0.009$). The mean duration of the second stage was neither significantly different in women who had a successful VBAC compared with nulliparous women (70 ± 58 min versus 68 ± 55 min, $P = 0.477$). nor a significant predictor in the multiple regression model ($P = 0.244$); 20.1% (63/314) of women with sphincter injuries had a prolonged second stage (>2 h), but this was no different to those with an intact sphincter [20.1% (63/314) versus 16.5% (1453/8809), $P = 0.111$)] Similarly, there was no difference in the rate of prolonged second stage between groups [16.5% (1418/8573) versus 17.8% (98/550), $P = 0.471$].

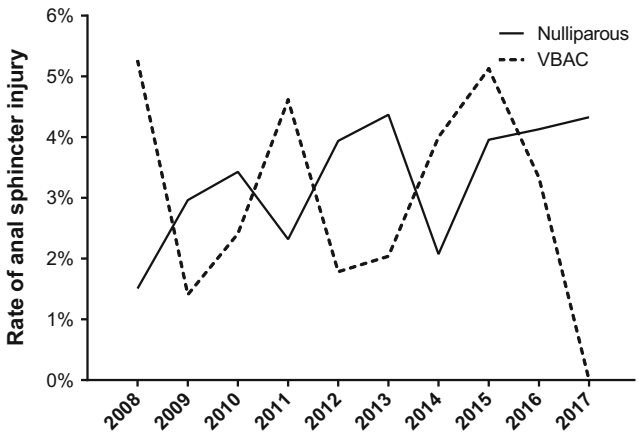

Fig. 1 Trends in obstetric anal sphincter injury (OASI) 2008–2017

Epidural analgesia

One half (278/550) of women who had a successful VBAC opted for epidural analgesia, significantly higher than the 41.5% (3562/8573) of nulliparous women ($P < 0.001$). There was no difference in the uptake of epidural analgesia between those with an OASI and those with an intact sphincter [38.9% (122/314) versus 42.2% (3718/8809), $P = 0.261$]. Epidural analgesia conferred a protective effect on OASI in the multiple regression model (OR 0.59, 95% CI 0.45–0.76, $P < 0.001$).

Gestation and maternal age

Delivery occurred earlier in the VBAC group (39.3 ± 1.9 versus 39.5 ± 1.6 weeks, $P = 0.003$). Those with sphincter injuries delivered later than those without (39.9 ± 1.2 versus 39.5 ± 1.7, $P < 0.001$). Women who had a successful VBAC were significantly older than primiparous women over the same time period (31.2 ± 4.7 versus 27.7 ± 5.5 years, $P < 0.001$). There was no difference in the age of mothers with sphincter injuries compared with those with an intact sphincter (28.1 ± 4.9 versus 27.9 ± 5.5 years, $P = 0.555$). In the multiple regression model, gestation ($P = 0.775$) and maternal age ($P = 0.429$) were not significant predictors of OASI.

Discussion

This study found that women who have a successful VBAC in their second pregnancy are not at a higher risk of OASI than nulliparous women. This finding is contrary to previous research, which suggests that women attempting VBAC are at an increased risk of sphincter injury [7–10]. While there is no ideal success rate for women who attempt VBAC, both the American College of Obstetricians and Gynecologists (ACOG) and Royal College of Obstetricians and Gynaecologists (RCOG) suggest 60–70% should be achievable [5, 6]. In our population, approximately half underwent

Table 2 Comparison of characteristics of nulliparous with secundiparous women with a previous caesarean section 2008–2017

	Nulliparous ($n = 8573$)	VBAC ($n = 550$)	P value
Instrumental[a]	44.5 (3812/8573)	48.4 (261/550)	0.053
Forceps	15.3 (1308/8573)	13.0 (70/550)	0.214
Maternal age	27.7 ± 5.5	31.2 ± 4.7	< 0.001
Birthweight (g)	3423 ± 487	3444 ± 550	0.339
Gestational age (weeks)	39.5 ± 1.6	39.3 ± 1.9	0.003
Length of second stage of labour (min)	70 ± 58	68 ± 55	< 0.001
Episiotomy	45.4 (3888/8573)	46.8 (252/550)	0.478
Epidural	41.5 (3562/8573)	49.5 (267/550)	< 0.001

Categorical data presented as % (n/total). Continuous data presented as mean ± standard deviation

VBAC vaginal birth after caesarean

[a] Vacuum, forceps, or sequential instruments

an elective pre-labor caesarean section. Of the remainder, two thirds were delivered by emergency caesarean section. While some of these emergency deliveries were in women in whom vaginal delivery was not possible–either for maternal or foetal safety–it suggests our successful VBAC rate may be <60–70% of that recommended internationally. This may explain the difference between our findings and those in a different Irish unit [7], as we may be resorting to caesarean delivery earlier. Thus, direct comparison between units, nationally and internationally, is warranted.

Studies in the United States have shown an increased risk of OASI in women attempting VBAC [9, 10], though this may be compounded by a higher incidence of sphincter injury overall and the more common use of midline episiotomy in North America [13]. Midline episiotomy is known to increase the incidence of OASI [1, 9, 10, 14]. The angle of episiotomy is important in reducing the risk of OASI, with one study reporting a decrease in relative risk of 50% with every 6° from the midline [13]. Some studies in the United States report an incidence of OASI up to five times higher than in our cohort [9, 10]. This increased risk is maintained despite a lower rate of forceps delivery than in our cohort, which is a well-established risk factor for OASI [9, 10, 15–17]. The rate of instrumental delivery–either forceps or vacuum–was high in both primiparous and VBAC groups in our study. Previous research has reported a higher incidence of instrumental delivery in VBACs [7], which may contribute to the difference between our results and those in the literature.

The difference between our results and that of Scandinavian research is more difficult to explain, as their studies reported an increased risk following VBAC in the setting of a low overall OASI rate [8, 15]. It is possible that the use of lateral episiotomy, a practice almost exclusive to Finland, may extend further protection to the perineum, as an increased angle of episiotomy reduces the risk of sphincter damage [13]. However, this would not explain results from Norway [15], where most episiotomies are mediolateral. In addition, the rate of instrumental delivery in those studies was lower than in our analysis, suggesting the patient population itself has a role to play in OASI. Different ethnicities are at varying risk of severe perineal trauma [15, 16, 18], perhaps due to racial variance in perineal body length [18].

We have seen an upwards trend in OASI in nulliparous mothers, similar to reports from England [16] and Scandinavia [19]. This is likely due, in part, to increased awareness and, thus, detection of OASI, rather than an increase in actual injuries. Recent guidance from the RCOG [20] raised awareness of OASI [21]. The absence of

Table 3 Comparison of characteristics of women with a sphincter injury after delivery with those with an intact sphincter, 2008–2017

	Intact ($n = 8809$)	OASI ($n = 314$)	P value
Instrumental[a]	44.4 (3911/8809)	48.4 (168/314)	< 0.001
Forceps	14.4 (1271/8809)	35.4 (111/314)	< 0.001
Maternal age	27.9 ± 5.5	28.1 ± 4.9	0.555
Birthweight (g)	3630 ± 468	3417 ± 490	< 0.001
Gestational age (weeks)	39.5 ± 1.7	39.5 ± 1.7	< 0.001
Length of second stage of labour (min)	70 ± 58	78 ± 54	0.009
Episiotomy	45.2 (3986/8809)	50.6 (159/314)	0.068
Epidural	42.2 (3718/8809)	38.9 (122/314)	< 0.001

Categorical data presented as % (n/total); continuous data presented as mean ± standard deviation

[a] Vacuum, forceps, or sequential instruments

significant change in our VBAC cohort likely reflects the smaller numbers analysed when compared with the number of nulliparous women.

Forceps use was associated with a four-fold increased risk of OASI in our cohort. Similarly, one third of women with sphincter injuries were delivered by forceps, compared with 14% with an intact sphincter. This result is similar to other research in the literature, both in Europe [15–17] and the USA [9, 10]. While instrument choice has been attributed to the risk of OASI, operator experience is also a contributing factor. A previous report examining instrument preferences of obstetricians showed a lower rate of OASI amongst those who used forceps exclusively, compared with those with an either/or preference [22]. This suggests that experience using forceps may mitigate some risk to the perineum. This is of particular concern in the United States, as residents are becoming less confident with the use of forceps at the completion of their residency [23, 24]. We had no data on the experience of the operator performing each delivery, though most operative vaginal deliveries in Ireland are performed by registrars or specialist registrars (postgraduate years 3–8). Future research should include operator experience as a variable in their analyses.

Women who had a successful VBAC were significantly older than nulliparous women (mean age 31.2 vs 27.7 years), which is not surprising given this was their second pregnancy. In addition, maternal age was not significant in the regression model, which is similar to previous research [25].

Foetal macrosomia–when defined as a birthweight >4 kg has been associated with a two fold increased risk of OASI [9, 10]. Women with sphincter injuries were more likely to deliver a macrosomic infant. While there was no difference in mean birthweight, women who had a successful VBAC were more likely to deliver a macrosomic infant, compared with nulliparous women. Increased birthweight in a second pregnancy is supported by epidemiological data [26] and anatomical changes to placental implantation [27].

Episiotomy was protective in the multiple regression model, a finding in keeping with research in primiparous women in England [16]. Evidence is limited on the benefit of routine episiotomy for spontaneous vaginal deliveries, with liberal use being shown to be no more beneficial than restrictive use in a UK trial [28].

The effect of epidural analgesia on the incidence of OASI is not clear. It may reduce involuntary pushing, and so rapid delivery of the fetal head and shoulders. While it was found to be protective in our cohort, research in the literature is split, with some reporting a benefit [29] and others finding no effect [16, 17].

A prolonged second stage of labour has been associated with OASI [8, 10], though some studies report no effect [30]. In our cohort, there was no significant difference in the proportion of prolonged second stage between those with an intact sphincter and those with sphincter injuries, or between nulliparous women and those attempting VBAC. Similarly, length of the second stage of labour was not found to be an independent risk factor.

There are some limitations worthy of discussion in our analysis. As this was a retrospective database analysis, there is the risk of incorrect or incomplete coding. However, the information in our database is regularly audited and is used for submitting our statistics to the National Perinatal Epidemiological Centre. While this was a retrospective analysis, data was collected contemporaneously by the midwife and/or obstetrician and, thus, should eliminate recall bias. The rate of successful VBAC in our cohort is significantly lower than previously reported. It is possible that women who achieved a VBAC were more likely to have had a straightforward progression of labour, and so, we may have a selection bias for improved perineal outcomes, limiting the ability of our study to directly refute previous findings. We have no data on why the first section was performed in our VBAC cohort. A woman with a prior emergency caesarean section at 10 cm may behave differently during labour and delivery to one whose original caesarean delivery was for a breech presentation. This should be incorporated into future research. Unfortunately, we have no data on the type of perineal support performed, either during delivery of the head or shoulders. Finally, we have no data on the reason why women elected to have pre-labour elective caesarean section. This may have been due to suspected macrosomia, or a previous failed instrumental delivery, and so may have pre-disposed our VBAC cohort to easier deliveries.

We consider our results to be robust, as we have a precisely defined group of parturients in our study. Only women who were nulliparous or who had one previous caesarean delivery were included. Other studies included women with previous vaginal deliveries in their analyses, which may confound their results. While we have not shown a difference in women attempting VBAC, our data on other risk factors for OASI is broadly in line with international research. While single-centre studies may limit generalisability of results, we can be reassured by the homogeneity of the management of our women. Full data on all variables were available for all patients.

Conclusion

VBAC does not appear to confer an increased risk of obstetric OASI, when compared with nulliparous women, in our population. This is in contrast to both national and international research, though there are considerable differences in management between studies. Our lower rate of successful VBAC may contribute to this difference and suggests that the risk conferred by VBAC may be unit-specific. Unit and national-level audit is necessary if we are to include this as part of our patient counselling prior to VBAC.

Compliance with ethical standards

Conflicts of interest None.

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