GYNECOLOGY

Atraumatic normal vaginal delivery: how many women get what they want?

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BACKGROUND: Trauma to the perineum, levator ani complex, and anal sphincter is common during vaginal childbirth, but often clinically underdiagnosed, and many women are unaware of the potential for long-term damage.

OBJECTIVE: In this study we use transperineal ultrasound to identify how many women will achieve a normal vaginal delivery without substantial damage to the levator ani or anal sphincter muscles, and to create a model to predict patient characteristics associated with successful atraumatic normal vaginal delivery.

STUDY DESIGN: This is a retrospective, secondary analysis of data sets gathered in the context of an interventional perinatal imaging study. A total of 660 primiparas, carrying an uncomplicated singleton pregnancy, underwent an antepartum and postpartum interview, vaginal exam (Pelvic Organ Prolapse Quantification), and 4-dimensional translabial ultrasound. Ultrasound data were analyzed for levator trauma and/or overdistention and residual sphincter defects. Postprocessing analysis of ultrasound volumes was performed blinded against clinical data and analyzed against obstetric data retrieved from the local maternity database. Levator avulsion was diagnosed if the muscle insertion at the inferior pubic ramus at the plane of minimal hiatal dimensions and within 5 mm above this plane on tomographic ultrasound imaging was abnormal, ie the muscle was disconnected from the inferior pubic ramus. Hiatal overdistensibility (microtrauma) was diagnosed if there was a peripartum increase in hiatal area on Valsalva by >20% with the resultant area $\geq$25 cm^2. A sphincter defect was diagnosed if a gap of >30 degrees was seen in $\geq$4 of 6 tomographic ultrasound imaging slices bracketing the external anal sphincter. Two models were tested: a first model that defines severe pelvic floor trauma as either obstetric anal sphincter injury or levator avulsion, and a second, more conservative model, that also included microtrauma.

RESULTS: A total of 504/660 women (76%) returned for postpartum follow-up as described previously. In all, 21 patients were excluded due to inadequate data or intercurrent pregnancy, leaving 483 women for analysis. Model 1 defined nontraumatic vaginal delivery as excluding operative delivery, obstetric anal sphincter injuries, and sonographic evidence of levator avulsion or residual sphincter defect. Model 2 also excluded microtrauma. Of 483 women, 112 (23%) had a cesarean delivery, 103 (21%) had an operative vaginal delivery, and 17 (4%) had a third-/fourth-degree tear, leaving 251 women who could be said to have had a normal vaginal delivery. On ultrasound, in model 1, 27 women (6%) had an avulsion and 31 (6%) had a residual defect, leaving 193/483 (40%) who met the criteria for atraumatic normal vaginal delivery. In model 2, an additional 33 women (7%) had microtrauma, leaving only 160/483 (33%) women who met the criteria for atraumatic normal vaginal delivery. On multivariate analysis, younger age and earlier gestation at time of delivery remained highly significant as predictors of atraumatic normal vaginal delivery in both models, with increased hiatal area on Valsalva also significant in model 2 (all $P \leq .035$).

CONCLUSION: The prevalence of significant pelvic floor trauma after vaginal child birth is much higher than generally assumed. Rates of obstetric anal sphincter injury are often underestimated and levator avulsion is not included as a consequence of vaginal birth in most obstetric text books. In this study less than half (33—40%) of primiparous women achieved an atraumatic normal vaginal delivery.

Key words: birth trauma, levator avulsion, obstetric anal sphincter injury, pelvic organ prolapse, ultrasound

Introduction

Trauma to the anal sphincter (obstetric anal sphincter injury [OASI]) is a well-known complication of vaginal childbirth with a quoted incidence of 4—6.6%.[1] The short-term effects of OASI can include pain, infection, dyspareunia, and sexual dysfunction, with the main long-term effect being anal incontinence.[2] Nevertheless, rates of diagnosis at the time of injury are poor, and the injury may be occult.[3,4]

Likewise, pelvic floor trauma due to childbirth can also involve levator ani muscle injury, which has a quoted incidence of 10—36%.[5,6] One form of such trauma is levator avulsion, described as a traumatic separation of the puborectalis muscle from its insertion at the superior pubic ramus, which typically occurs at the time of crowning of the fetal head during vaginal delivery of the first child.[7,8] Even more so than with OASI, recognition of injury at the time of delivery is problematic, although perineal and vaginal tears have recently been shown to be clinical markers of levator avulsion.[9] Levator trauma may also present as irreversible overdistention of the levator ani complex, termed "microtrauma." Microtrauma has been defined as an increase in peripartum hiatal area on Valsalva >20% with a resulting area $\geq$25 cm^2.[10] Both forms of levator injury play an important role in both the development of pelvic organ prolapse[11] and its recurrence.[12,13]

Predictive modeling of levator trauma and/or OASI has attempted to identify which women are at risk of pelvic floor trauma at the time of birth.[4,6,10,14] The use of ultrasound at the time of investigation has allowed a more accurate assessment of pelvic floor damage.[15] However, despite improved diagnosis of

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AJOG at a Glance

Why was this study conducted?
It is assumed that pregnant women benefit from a normal vaginal delivery, and that normal vaginal delivery is the least traumatic way to give birth. We wanted to study the incidence of severe pelvic floor damage in normal vaginal delivery and try to create a predictive model for atraumatic normal vaginal delivery.

Key findings
Only 33–40% of the women in our study had an atraumatic normal vaginal delivery; younger age, larger hiatal area, and earlier gestation were associated with no trauma.

What does this add to what is known?
To our knowledge, this is the first study to attempt to create a predictive model for atraumatic normal vaginal delivery (as diagnosed on ultrasound).

pelvic floor birth trauma with the inclusion of postpartum imaging, accurate prediction of levator trauma and OASI, especially antenatal prediction, still remains challenging.[6,16,17] Another useful method for decreasing rates of pelvic floor trauma would be to abandon the prediction of levator trauma and OASI in favor of identifying those antenatal characteristics of women who successfully achieve an atraumatic normal vaginal delivery.

The World Health Organization defines normal birth as a low-risk pregnancy leading to a spontaneous, vertex delivery between 37–42 weeks of pregnancy that results in a healthy mother and child,[18] while the in the United Kingdom normal birth is spontaneous in both labor and delivery, but can include interventions such as augmentation of labor, artificial rupture of membranes (but not as part of a medical induction of labor), use of nitrous oxide or opioids, electronic fetal monitoring, or a managed third stage of labor.[19] In contrast, the current New South Wales Health policy, Towards Normal Birth, fails to define "normal birth" altogether, but instead focuses only on increasing the rates of vaginal delivery.[20] For the purposes of this study, we defined an atraumatic normal vaginal delivery as any vaginal delivery that was spontaneous, vertex, and did not result in permanent pelvic floor trauma in the form of levator avulsion, overdistention, or OASI.

Despite differences in the political definition of what constitutes normal birth, there is ample evidence that women themselves perceive normal vaginal delivery as desirable.[21,22] Furthermore, there is evidence that women may be much less risk averse than the clinicians looking after them. Turner et al[23] attempted to quantify the risk of morbidity from vaginal delivery that pregnant women would be prepared to accept before opting for an elective cesarean delivery. They found that while pregnant women (and their midwives) were much more tolerant of interventions such as episiotomy, perineal pain, and operative vaginal delivery (including the use of forceps) than clinicians, their willingness to trial vaginal delivery declined rapidly when faced with the prospect of emergency cesarean delivery or moderate to severe urinary or anal incontinence.[23]

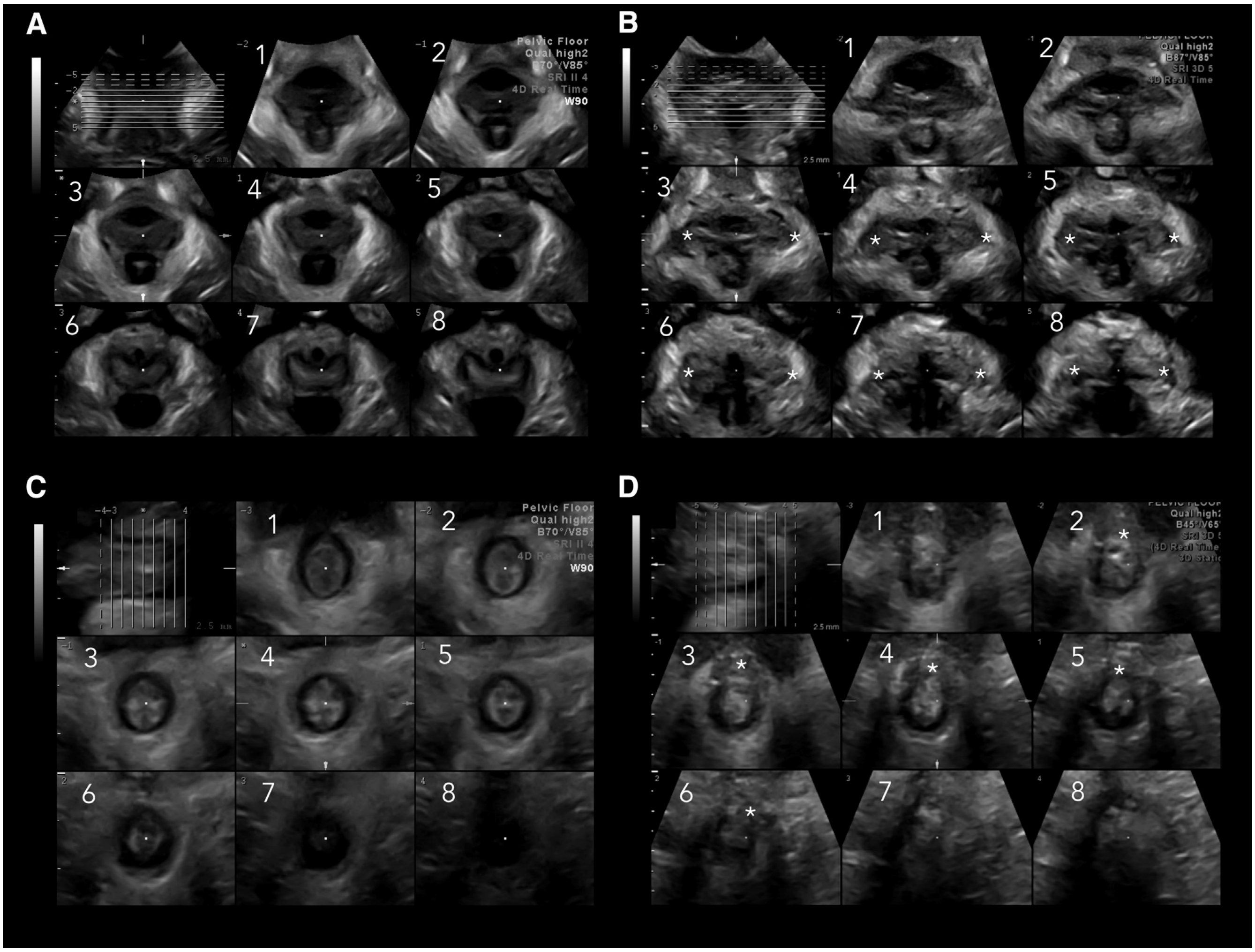
In this study, we attempted to create a predictive model for an atraumatic normal vaginal delivery by examining the characteristics associated with women who successfully gave birth vaginally without intervention and/or major pelvic floor trauma as diagnosed at the time of delivery or on postpartum ultrasound.

Materials and Methods

This is an unplanned retrospective analysis of data sets of primiparous women seen in a randomized controlled trial undertaken in 2 tertiary obstetric units in Sydney, Australia. From July 2007 through March 2014, 660 patients were recruited through the antenatal clinic at participating hospitals and randomized into study arms examining if the use of a pelvic floor trainer could prevent levator ani trauma and/or OASI as diagnosed on transperineal ultrasound. The EpiNo device (Starnberg Medical, Sydney, Australia) is a perineal trainer that purports to stretch the pelvic floor muscles, thereby decreasing the risk of both perineal tears and the need for episiotomy. In all, 335 patients were randomized to use the device (with 269 returning for postpartum assessment) and 325 patients were randomized into the control group (with 235 returning for postpartum follow up). Inclusion criteria were as follows: (1) a nulliparous woman with no previous pregnancies ≥20 weeks' gestation, (2) a planned vaginal delivery, (3) a low-risk singleton pregnancy between 33–38 weeks' gestation, and (4) maternal age ≥18 years. After written consent was obtained, all participants underwent identical antenatal assessments consisting of a standardized interview; a clinical examination, including the Pelvic Organ Prolapse Quantification; and a 4-dimensional translabial ultrasound. Ultrasound imaging was performed in the supine position after bladder emptying using GE Voluson 730 Expert or E8 systems (GE Medical Systems Kretz Ultrasound, Zipf, Austria) with 8- to 4-MHz curved-array volume transducer with an acquisition angle of 85 degrees as previously described.[24] Volumes were acquired at rest, on Valsalva, and at maximum pelvic floor muscle contraction (PFMC) (defined as the contraction leading to the most marked reduction in anteroposterior hiatal diameter), with at least 3 Valsalva volumes acquired for each patient. All patients were invited back for repeat assessment 3–6 months postpartum, which was performed with the patient's abdomen covered to safeguard blinding against delivery mode. Patients were requested not to divulge any information relating to their labor, delivery, or outcome until after the completion of the examination.

Postprocessing of ultrasound volume data was performed on a desktop personal computer using proprietary

FIGURE 1
Avulsion and anal sphincter tear in 29-year-old primigravida 3 months postdelivery



Pelvic floor imaging before and after a traumatic vaginal birth. **A**: Normal pelvic floor on tomographic translabial ultrasound imaging at 36 weeks. **B**: Bilateral avulsion 3 months postpartum. **C**: Normal external and internal anal sphincter at 36 weeks on tomographic translabial ultrasound. **D**: Status after repair of a 3C perineal tear 3 months postpartum. Defects are indicated by '*'.

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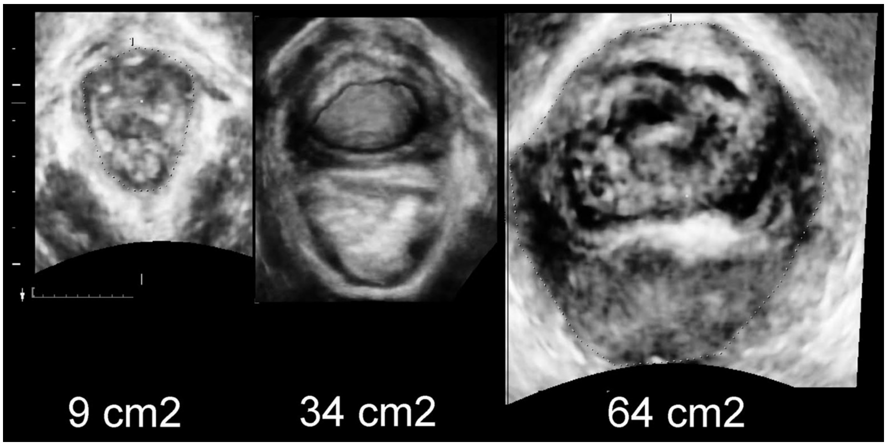
software (4D View 7.0—10.0; GE Medical Systems Kretz Ultrasound, Zipf, Austria) at a minimum of 3 months after data acquisition, blinded to all clinical data. Levator avulsion was assessed on pelvic floor maximum contraction (PFMC), or at rest if the patient failed to perform PFMC, using TUI in the axial plane. The levator ani muscle was imaged from 5 mm below to 12.5 mm above the plane of minimal hiatal dimensions with an interslice interval of 2.5 mm.[25] The plane of minimal hiatal dimensions is identified as the shortest distance between the posterior symphysis pubis and the levator ani plate posterior to the anorectal muscularis in the midsagittal plane.[26] Levator avulsion was diagnosed if the 3 central slices corresponding to the plane of minimal hiatal dimensions, 2.5 mm and 5 mm above this plane of reference (slices 3—5 in Figure 1) showed an abnormal insertion of the muscle at the inferior pubic ramus, ie, the muscle was avulsed from the pubic rami. The validity of this methodology has been demonstrated against symptoms and signs of pelvic organ prolapse.[6]

Hiatal area was measured at the plane of minimal hiatal dimensions identified in the midsagittal plane.[26] Irreversible overdistension of the levator hiatus ("microtrauma") was defined as a postpartum increase in hiatal area on Valsalva >20%, provided this increase resulted in a postpartum hiatal area on Valsalva ≥ 25 cm^2 (Figure 2). We have incorporated ≥ 25 cm^2 in the definition of microtrauma since a hiatal area of <25 cm^2 can probably be regarded as normal.[26]

Evaluation of the external anal sphincter (EAS) was performed using TUI volumes acquired on PFMC. A set of 8 slices was obtained by modifying the interslice interval to incorporate the

FIGURE 2
Microtrauma leading to hiatal ballooning



Different degrees of hiatal enlargement on Valsalva as seen on axial plane pelvic floor ultrasound.
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entire length of the EAS, from the level of the puborectalis muscle to the subcutaneous portion of the sphincter, as described previously.[27] A "significant residual EAS defect" was defined as a gap in the muscle $\geq$30 degrees that appeared in at least 4 out of 6 central slices. This definition has been shown to be linked to symptoms of incontinence and obstructed defecation.[28]

Obstetric and delivery data were collected from the hospital databases and patient records. The parent study was approved by the Sydney West and Sydney South Area Health Service Human Research Ethics Committees (SWAHS HREC 07-022 and SSAHS HREC X09-0384) on April 30, 2007, and was registered with the Australian New Zealand Clinical Trial Registry (ANZCTR ACTRN12609000592246). The parent study was a randomized controlled perinatal intervention trial. The intervention arm of this trial included in the analysis, ie, use of the Epi-No birth trainer, was shown to have no effect on any of the tested outcome measures.[29] Power calculations were not undertaken as this is a secondary analysis of a trial for which sample size had been determined independently.

Subsequent analysis focused on the association between known potential antenatal risk factors and the prospect of a nontraumatic vaginal birth, defined as follows: vaginal birth without vacuum or forceps, without obstetric anal sphincter tear, without demonstration of residual anal sphincter defect or levator avulsion on imaging at 3–6 months postpartum (model 1); all of the above plus absence of irreversible overdistension of the levator ani (model 2).

Modeling was undertaken using logistic regression, with multiple risk factors for traumatic birth utilized (Tables 1 and 2). Statistical analysis was performed using software (SPSS, Version 24; IBM Corp, Armonk, NY). Analyses were repeated for the more conservative definition (including microtrauma). The

TABLE 1
Antepartum predictors of nontraumatic normal vaginal delivery for model 1 (excluding operative delivery, obstetric anal sphincter injury, and sonographic evidence of levator avulsion or residual sphincter defect) n = 483

Predictors	Nontraumatic NVD n = 193	Traumatic NVD n = 290	Univariate OR (95% CI) *P* value	Multivariate OR (95% CI) *P* value
Age, y	29.7 (SD ± 5.1)	31.7 (SD ± 5.0)	0.93 (0.89–0.96) <.001	0.93 (0.90–0.97) <.001
Ethnicity Caucasian	151 (78.6%)	231 (79.9%)	0.92 (0.59–1.45) .73	n/a
Prepregnancy body mass index	23.5 (SD ± 5.0)	24.1 (SD ± 4.8)	0.97 (0.94–1.01) .18	n/a
Family history of cesarean	64 (63.4%)	37 (36.6%)	0.83 (0.53–1.31) .43	n/a
Hiatal area on Valsalva	21.4 (SD ± 7.3)	20.3 (SD ± 7.4)	1.02 (0.99–1.05) .12	n/a
Bladder neck descent	17.6 (SD ± 10.7)	18.2 (SD ± 9.7)	0.99 (0.98–1.01) .51	n/a
Gestation at delivery, wk	39.8 (SD ± 1.2)	40.2 (SD ± 1.2)	0.76 (0.65–0.88) <.001	0.78 (0.67–0.90) .001

CI, confidence interval; *NVD*, normal vaginal delivery; *OR*, odds ratio.
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TABLE 2
Antepartum predictors of nontraumatic normal vaginal delivery for model 2 (excluding operative delivery, obstetric anal sphincter injury, and sonographic evidence of levator avulsion, residual sphincter defect, or irreversible levator overdistention) n = 483

Predictors	Nontraumatic NVD n = 160	Traumatic NVD n = 323	Univariate OR (95% CI) *P* value	Multivariate OR (95% CI) *P* value
Age, y	29.3 (SD ± 5.1)	31.6 (SD ± 5.0)	0.91 (0.88–0.95) <.001	0.92 (0.89–0.96) <.001
Ethnicity Caucasian	124 (78.0%)	258 (80.1%)	0.88 (0.55–1.40) .59	n/a
Prepregnancy body mass index	23.3 (SD ± 4.8)	24.2 (SD ± 4.9)	0.96 (0.93–1.01) .086	n/a
Family history of cesarean	35 (21.9%)	66 (20.5%)	1.09 (0.68–1.72) .73	n/a
Hiatal area on Valsalva	19.4 (SD ± 5.9)	21.4 (SD ± 7.9)	0.96 (0.93–0.99) <.005	1.028 (1.002–1.055) .035
Bladder neck descent	17.4 (SD ± 10.8)	18.3 (SD ± 9.7)	0.99 (0.97–1.01) .36	n/a
Gestation at delivery, wk	39.7 (SD ± 1.2)	40.2 (SD ± 1.2)	0.73 (0.62–0.85) <.001	0.77 (0.66–0.90) .001

CI, confidence interval; *NVD*, normal vaginal delivery; *OR*, odds ratio.

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variables in both models were tested to see whether Epi-no use modified the associations shown in Tables 1 and 2; no compelling statistical evidence for a confounding effect was found. Any obstetric factors tested to be significant, ie, $P = .05$, on univariate analysis were included in a multivariable logistic regression model to control for confounding variables. A value of $P < .05$ was considered statistically significant.

Results

A total of 504/660 women (76%) returned for a follow-up. Two patients were excluded due to concurrent pregnancy, 2 due to inadequate data on postpartum hiatal areas (microtrauma), 3 due to inadequate data on perineal tears, and 14 due to inadequate imaging of the EAS, thus leaving 483 women for analysis; 229 (47%) and 254 (53%) were in the control and intervention arms, respectively. In regard to those women who chose not to follow up, they were younger than those who did attend follow-up, but otherwise there were no statistically significant differences between the 2 populations (Table 3).

TABLE 3
Demographics of attenders vs nonattenders at follow-up

	Nonattenders n = 156	Attenders n = 504	*P* value
Mean age, y (SD)	29.5 (±5.4)	30.8 (±5.2)	.007
Mean body mass index (SD)	23.6 (±4.4)	23.9 (±4.9)	.47
Mean gestation at delivery, wk (SD)	40.1 (±1.2)	40.0 (±1.2)	.86
Delivery mode[a]			
LSCS			.45
Prelabor	9	26	
First stage	23	66	
Second stage	5	23	
NVD	52	281	
VE/FD	27/6	70/37	
Length of second stage, min[b]	60 (±59)	69 (±70)	.19
OASIS, n	6/146	25/496	.64
Mean birthweight of baby, g (SD)	3461 (±439)	3445 (±412)	.19
Epidural use[a]	62/147	220/499	.68
Syntocinon use[a]	60/146	238/494	.13
Episiotomy[a]	31/144	104/501	.84

FD, forceps delivery; *LSCS*, lower segment cesarean section; *NVD*, normal vaginal delivery; *OASIS*, obstetric anal sphincter injuries; *SD*, standard deviation; *VE*, vacuum extraction.

[a] Obstetric information not available for all patients—total number for inclusion in denominator; [b] Wilcoxon test for length of second stage also nonsignificant ($P = .40$).

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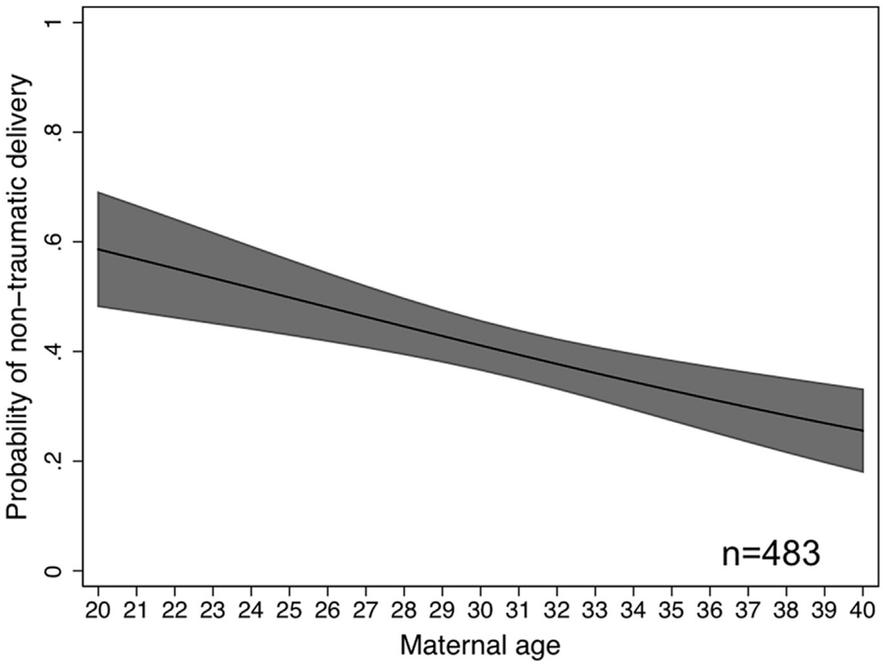
FIGURE 3
Older age at time of first vaginal birth decreases likelihood of atraumatic normal vaginal delivery (n = 483)



Black line indicates predicted probability of atraumatic vaginal delivery for given maternal age (in years) at average gestational age of 40.0 weeks. Gray shaded area illustrates 95% confidence interval.

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The mean maternal age in our cohort was 31 years (range 19—45 years) and the average antepartum body mass index was 23.9 kg/m^2 (range 14.5—47.2 kg/m^2). The mean time to follow up was 4.5 months (range 2.3—22.4 months). The mean gestational age at first presentation was 36.0 weeks (range 32.9—37.4 weeks), and the average gestation at delivery was 40.0 weeks (range 35.7—42.3 weeks).

In all, 382 (79%) were Caucasian. An epidural was used in 213 (44%) women and Syntocinon in 235 (49%). The length of second stage was recorded at a median of 60 minutes (interquartile range 0—472 minutes), and the mean birthweight was 3447 g (range 2222—4996 g). Of those delivered vaginally, 98 (20%) had an episiotomy, and 23 (5%) had a documented third- or fourth-degree perineal tear.

Of 483 women, 112 women (23%) had a cesarean delivery (25 prelabor and 87 emergency), leaving 371 patients who achieved a vaginal delivery (77%). Of those 371 women, 34 women (7%) had a forceps delivery and a further 69 (14%) had a vacuum extraction, leaving 268 women. Of the 268, 17 women (4%) were diagnosed with a third- or fourth-degree tear at the time of delivery. This left 251 women remaining. On ultrasound postprocessing of stored volume imaging data, there was no evidence of antenatal levator avulsion, overdistention, or anal sphincter damage, and no levator or anal sphincter trauma was diagnosed in women delivered by cesarean delivery.

In model 1, 27 women experienced an avulsion and 31 women demonstrated a residual sphincter defect on ultrasound, leaving 193/483 women (40%) who could be said to have had an atraumatic normal vaginal delivery. In model 2, as in model 1, 58 women experienced levator avulsion or sphincter defect on ultrasound, with a further 33 women diagnosed with irreversible overdistension. Thus, only 160/483 women (33%) could be said to have had an atraumatic normal vaginal delivery.

Univariate analysis of predictors for levator ani and anal sphincter trauma for model 1 showed decreasing age and gestation at time of delivery as antenatal predictors of nontraumatic vaginal birth. A sensitivity analysis of model 2 (microtrauma included) showed similar results, with the addition of a decreased hiatal area on Valsalva as an antenatal predictor of atraumatic normal vaginal delivery.

On multivariate analysis younger age and earlier gestation at time of delivery remained highly significant as predictors of nontraumatic vaginal delivery in both models, with *increased* hiatal area on Valsalva becoming a predictor for model 2 after accounting for confounders apparent in the univariate analysis (all $P \leq .035$).

Comment

In this study of >400 women, we have shown that younger age, earlier gestation at the time of delivery, and an increased hiatal area on Valsalva determined antepartum are all predictors for an atraumatic normal vaginal delivery.

It is not surprising that a younger age at the time of first delivery is protective, given that the inverse is true (Figure 3). Advanced maternal age at the time of first delivery has been shown to carry an increased risk of pelvic floor trauma in the form of levator ani avulsion, microtrauma, and OASI.[30] One explanation may be that age-related change to the biomechanical properties of connective tissue in the pelvic floor leads to a decrease in the compliance of the tissue. Thus, the muscles of the levator ani complex and anal sphincters are more susceptible to tears and trauma.

Furthermore, higher antenatal distensibility of supportive tissues, as evidenced by a larger hiatal area on Valsalva, may be associated with a decreased risk of levator avulsion, although individuals will vary in their vulnerability as regards trauma.[31] Tissues that are more likely to stretch, rather than rupture or avulse, may protect women from levator avulsion and, at the same time increase the likelihood of progression to spontaneous vaginal delivery of the infant. Interestingly, on univariate analysis decreased hiatal area was positively associated with an increase in trauma; that is, negatively associated with atraumatic delivery. On multivariate analysis this effect disappeared. In fact, on multivariate analysis there is a weak positive association between hiatal area and trauma. This paradoxical effect is likely due to the inclusion of microtrauma. A lack of relaxation of the pelvic floor on Valsalva, ie, simultaneous coactivation of the levator ani at the time of maximal push, may confound the measurement of the true hiatus. In essence, somebody who completely relaxes the pelvic floor muscle on Valsalva looks more distensible than someone who does not; if the muscle is avulsed, however, then coactivation is not possible. For this reason, model 1 may be more realistic.

Additionally, our study also showed that earlier gestation at the time of delivery predicted a successful atraumatic vaginal delivery. Earlier gestation at the time of delivery is likely related to spontaneous labor leading to an increased likelihood of spontaneous vaginal delivery without serious complication.[32] Additionally, there is some suggestion that earlier delivery is going to result in a smaller infant, as there is a known association with gestations >41 weeks and macrosomia.[33] Regardless, the actual difference in terms of gestation between those women who delivered vaginally without complication and those who did not is small (39.7 ± 1.2 vs 40.2 ± 1.2 weeks), and may not be of much clinical significance in planning for delivery.

Lastly, in this study, we used a relatively lax definition of "normal vaginal delivery," ie, we did not exclude those women who had interventions judged to be outside of the definition by other groups.[18,19] In our model, a women attempting a vaginal delivery could expect to have a spontaneous atraumatic vaginal delivery 33–40% of the time. If those women who had any significant interventions at the time of delivery (ie, Syntocinon augmentation, epidural block, and episiotomy) were to be excluded, then the number of successful deliveries drops dramatically to only 11–12% of the initial 483 who would have been candidates for atraumatic normal vaginal delivery. This is a much smaller proportion of women than might be expected, and indicates that true normal vaginal delivery without intervention or permanent damage to the pelvic floor is much less common than previously assumed.

To our knowledge, this is the first study to date attempting to identify antepartum predictors of atraumatic normal vaginal delivery. Previous studies have identified several possible risk factors for antenatal prediction of levator avulsion/overdistention and OASI, however, findings have been inconsistent across studies, and the clinical usefulness of these parameters is limited.[6,14,34] Our study has shown that a younger age, earlier gestation, and greater hiatal distensibility on Valsalva support the assumption that a vaginal delivery will be successful and not lead to permanent pelvic floor damage. The ultrasound methodology used in the study is inexpensive and safe, and has been shown to be both highly reproducible and acceptable to patients.[35] Lastly, ultrasound imaging provides an objective method for diagnosing occult trauma that may have gone previously undetected or ignored.[36]

However, we must acknowledge several shortcomings of our study. First, the follow-up rate for our study was only 76%. It should also be mentioned that our study participants were largely Caucasian and younger than the Australian average for primiparae, hence the results may not be applicable to populations with different demographics. Additionally, the 24% of women who did not follow up with our unit were also younger than those who did, and although the difference was not large, it was significant. This could have impacted our findings, especially since increasing age has been linked to both a decrease in spontaneous vaginal delivery and an increase in levator trauma.

Another issue of concern is that the data sets used in this study were collected as part of a prospective interventional study examining the effect of antepartum use of a birth device on pelvic floor trauma. While use of this device could have potentially confounded the results, this seems unlikely as the intervention was shown to have no effect on rates of vaginal delivery or on the incidence of levator trauma or OASI.[29]

Finally, disparities in local obstetric practice may have affected outcomes. Patients were recruited from 2 tertiary units in Sydney, Australia, with somewhat disparate obstetric management. Use of forceps, which is a known risk factor for levator avulsion and OASI, is considerably less common in our unit than at many other tertiary units.[37] The number of women diagnosed with pelvic floor trauma after vaginal delivery may be higher in a unit with a high rate of complex vaginal deliveries.[38]

In conclusion, younger maternal age, earlier gestation at time of delivery, and a larger hiatal area on Valsalva were associated with atraumatic normal vaginal delivery. Use of predictive models for atraumatic normal vaginal delivery may be useful when counseling women regarding mode of delivery. Recent discussion on the prospect of consent for vaginal delivery underlines the importance of discussing the risks and benefits with women undertaking a trial of vaginal delivery, including the likelihood of success.[39] Ensuring that women have a realistic expectation of what vaginal delivery may entail, both in terms of risks to their pelvic floor as well as the potential benefits to themselves and their baby, will help women to decide what mode of delivery is best for them. Certainly, there is ample evidence that women are happy to tolerate higher levels of risk that previously anticipated, but not if the outcome is emergent operative delivery or severe pelvic floor trauma. Avoidance of permanent somatic and psychological trauma may involve careful counseling of the risks of pelvic floor trauma.[40] However, identifying those women most likely to succeed with atraumatic normal vaginal delivery and enjoy a postnatal recovery free from serious pelvic floor dysfunction will go a long way to supporting normal vaginal birth—an outcome that is likely to satisfy obstetricians, midwives, and the women they support. ■

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