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The impact of first time mother's body mass index or excessive weight gain in pregnancy on genital tract trauma at birth

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Abstract

Objective—To explore the impact of body mass index BMI or pregnancy weight gain on the presence, site and severity of genital tract trauma at childbirth in nulliparous women.

Methods—The present study is a sub-analysis of a prospective cohort of healthy nulliparous women recruited during pregnancy and followed through birth. Weight gain during pregnancy and pre-pregnancy BMI were recorded. At birth, women underwent detailed mapping of genital tract trauma. For analyses, women were dichotomized into obese (BMI ≥ 30) versus non obese (BMI < 30) at baseline as well as into those who gained weight as recommended by the Institute of Medicine (IOM) and those who gained more than the recommended amount to determine the impact of obesity or excessive weight gain on rates of genital tract trauma.

Results—Data from 445 women were available for analysis. Presence and severity of genital tract trauma did not vary between obese and non-obese women ($P = NS$). Likewise women who

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gained more than the IOM recommended weight did not have a higher incidence of perineal lacerations (53% vs 51% with perineal lacerations, $P = .61$). Obese women were more likely to gain in excess of the IOM guidelines during pregnancy (75% vs 50% excessive weight gain, obese vs non-obese women, $P < 0.001$).

Conclusion—A woman's BMI or excessive weight gain in pregnancy did not influence her risk of genital tract trauma at birth.

Keywords

Genital tract trauma; nulliparity; obesity

INTRODUCTION

One-third of the United States adult population is obese which contributes to multiple health problems.¹ Excessive weight gain during pregnancy is thought to contribute to continued obesity later in life.^{2,3} Obesity during pregnancy is associated with increased risk for adverse pregnancy outcomes including pre-eclampsia, eclampsia, gestational diabetes, macrosomia, hemorrhage, and cesarean delivery.^{4,5} The impact of a woman's body mass index (BMI) and/or excessive weight gain during pregnancy on genital tract trauma is less clear. Genital tract trauma at birth is common and associated with short-term blood loss and pain.⁶ Genital tract trauma is more common with a first birth and estimates of childbirth-associated genital tract trauma range from 65-85%.⁷⁻⁹ Maternal obesity is associated with fetal macrosomia which in turn is associated with increased rates of genital tract trauma.^{10,11} Obese nulliparous women then would presumably be at higher risk for genital tract trauma.

The Institute of Medicine (IOM) revised guidelines for weight gain in pregnancy established target weight gain ranges for expecting women. Current IOM guidelines recommend less weight gain in obese women than their normal or underweight counterparts.¹² Obesity and weight gains in pregnancy exceeding IOM recommendations may directly impact a woman's pregnancy and spontaneous birth outcomes.¹³ Our goal was to explore the impact of obesity or excessive weight gain during pregnancy on the presence, site and severity of genital tract trauma at childbirth. Our specific aims were to 1) determine the effect of pre-pregnant BMI on genital tract trauma and 2) determine the effect of excessive maternal weight gain on genital tract trauma using IOM weight gain guidelines.

Few studies have specifically explored the role of BMI and weight gain in pregnancy on genital tract trauma. Of these, one study demonstrated protective effects of obesity on rates of 3rd and 4th degree lacerations while all other studies reported an increased risk of laceration with either obesity or excessive weight gain, or both obesity and excessive weight gain in combination.^{10,11, 14-16} The midwifery group involved in the present study participated in a previous randomized controlled trial called INTACT to determine if intrapartum care measures decreased genital tract trauma. In a sub-analysis of data from the INTACT study which included both multiparous and nulliparous women, obese women with excessive weight gain were more likely to experience genital tract trauma than their normal weight counterparts.¹⁵ The present study is a prospective cohort study titled "Alterations in the Pelvic Floor with Pregnancy, Labor and the Ensuing Years" (APPLE). The primary

objective of APPLE was to describe the prevalence of pelvic floor changes in low risk healthy nulliparous women during pregnancy and postpartum.

METHODS

We performed a secondary analysis of data from the APPLE study. Nulliparous women who presented for care with the University of New Mexico (UNM) midwives at ≤ 36 weeks gestation at one of five clinical sites were invited to participate. Women were usually introduced to the APPLE study during the first or second prenatal visit with the midwife. At the subsequent visit the study was discussed again and if women chose to participate, written informed consent was obtained by the CNM. Inclusion criteria for the APPLE study included, nulliparity, pregnancy less than 36 completed weeks, and eligible for midwifery care at the time of admission to the labor and delivery unit.

Women with significant pregnancy complications either in the antepartum period or in the intrapartum period were transferred to physician care and were no longer eligible to participate in our study. Antenatally, women in the study completed questionnaires about pelvic floor function and were examined using the validated Pelvic Organ Prolapse Quantification (POP-Q) pelvic exam for the primary objective of the study. In the intrapartum phase of the study all women were cared for by midwives at the University of New Mexico Hospital. Women consented into the study who delivered by cesarean section remained in the main study of pelvic floor changes but were excluded from this secondary analysis of genital tract trauma. Following birth, midwives performed genital tract examinations and completed detailed descriptions of all trauma, including depth of lacerations and location. The CNMs at the University of New Mexico refer operative vaginal deliveries to physician colleagues, however, examination of genital tract trauma after birth was performed by the CNM in the same manner as for all other women in the study. At this institution it is not customary to cut an episiotomy with vacuum or forceps-assisted deliveries. Women who had an episiotomy at birth were also examined in the same manner as those who birthed without episiotomy.

Intact was defined as complete absence of any tissue separation at any site. For second degree perineal lacerations, the depth of laceration was measured on each side.¹⁷ Physician colleague second observers were asked to review and confirm the severity of lacerations of a 2nd degree or greater. Site of trauma was described as we have previously published and¹⁸ classified as anterior (periurethral or labial), posterior (perineum) or both. (Table 1) Pre-pregnant weight was self-reported and weight gain was measured during prenatal care. Height was measured at the first prenatal visit. Data collected at birth included oxytocin and epidural use, length of active pushing, birth weight and occiput position. All midwives involved in the study participated in regular educational sessions regarding patient consenting, data collection, as well as reviews of pelvic anatomy and training specific to laceration identification and measurement and repair techniques. Our group has previously published an inter-rater reliability in the identification of trauma of 95.5%.¹⁹ This research study was approved by the UNM Health Science Center Institutional Review Board and all women gave written informed consent.

For analyses, we dichotomized women into those who were obese in the antepartum period (BMI ≥ 30 kg/m²) vs all others: normal (BMI 18.5 and ≤ 25 kg/m²), overweight (BMI 25 and < 30 kg/m²) or underweight (BMI < 18.5 kg/m²). In addition, women were categorized into those who gained at or below the recommended amount of weight based on their BMI (IOM recommendation for underweight women is a weight gain of 28-40 pounds, for normal weight women 25-35 pounds, for overweight women 15- 25 pounds and for obese women 11-20 pounds) versus those who gained more than the recommended amount. Descriptive statistics of the study cohort included appropriate means, standard deviations or frequencies (%). Median and interquartile ranges (IQR) were used for skewed data. Satterthwaite t-tests were used for non-skewed continuous variables, Wilcoxon's rank sum test for skewed variables and Fisher's exact test for categorical variables. Significance was set at P value < 0.05 .

RESULTS

From 2006-2011, 627 women consented for participation; 541(86%) delivered with the midwifery group at UNM. Of these, 448/541(83%) gave birth vaginally. Three women ($< 1\%$) did not have weight gain recorded during pregnancy. The number of women for whom data were available for analysis was 445. Of the 448 women who gave birth vaginally, 8 ($< 2\%$) of the women underwent episiotomy and 26 (6%) of the women underwent operative vaginal deliveries. Women participating in the study represented a young, ethnically diverse and well educated group. (Table 2)

In keeping with current obstetrical practices, 60% of women had epidurals and 47% had their labor augmented or induced by oxytocin. The average pre-pregnancy BMI for women participating was 24.6 ± 5.3 (range 14.6 – 45.3 kg/m²). The majority of women, 245(55%), were normal weight prior to pregnancy, 32(7.2 %), were underweight, 100(23%) were overweight and 68(15%) obese. On average, women in this study gained 16.1 ± 6.2 kg during pregnancy. Most women, 242(55%), gained more than the recommended weight for their pre-pregnancy BMI, while only a third, 147 (33%) gained the recommended weight and 55(12%) gained less than the recommended weight.

As expected, the majority of this nulliparous cohort sustained some trauma to the external genitalia or vagina, with only 42(9%) delivering completely intact without laceration to the vagina, perineum or external genitalia. Of women who sustained trauma, 171(38%) had minor trauma to the genital tract, defined as any first degree perineal laceration or external genitalia or vagina that did not require suturing. Perineal trauma occurred in 236 women, with 87(19%) 1st degree, 128(28%) 2nd degree, 18(4%) 3rd degree lacerations and 3($< 1\%$) 4th degree lacerations; the remainder of women did not have perineal lacerations 209(47%), although some women had minor lacerations elsewhere. The measured depth of 2nd lacerations was similar in all comparison groups (data not shown). Second observers were present for 69% of 2nd degree lacerations; all but one (2%) agreed with laceration assessment.

Obese women had slightly more years of education, were less likely to use tobacco, were more likely to have their labor augmented or induced with oxytocin and had shorter second

stages than women who were not obese. (all $P < 0.03$) (Table 2) Although obese women in our cohort did not gain on average more absolute weight than their non-obese counterparts, obese women were more likely to gain more than the IOM recommended weight than non-obese women (75% vs 50%, obese versus non-obese women, $P < 0.001$).

Obese women were not more likely to sustain genital tract trauma and the site of the trauma did not vary between obese and non-obese women. (all $P = \text{NS}$) (Table 3) Obese women were not more likely to sustain severe 3rd and 4th degree lacerations (19(5%) versus 2(3%) 3rd and 4th degree lacerations in non-obese versus obese women, respectively, $P = 0.21$).

Women who gained in excess of the IOM recommended weight gain guidelines had higher starting BMIs, significantly heavier babies at birth and were more likely to have their labor augmented or induced with oxytocin. Weight gain in excess of IOM recommendations did not result in an increased presence, site or severity of genital tract trauma. (all $P = \text{NS}$) (Table 3). Women who gained more than the recommended weight were also not more likely to sustain severe perineal lacerations (12 (6%) versus 9 (4%), 3rd and 4th degree lacerations in women who gained the recommended amount versus women who gained more than the recommended amount, respectively, $P = 0.40$).

Data were analyzed using antepartum BMI and BMI at birth. When data were analyzed by BMI at birth, results did not vary (data not shown).

DISCUSSION

We did not find that obesity or excessive weight gain during pregnancy influenced the presence, site or severity of genital tract trauma among healthy nulliparous women. In addition obese women or women who gained more than the IOM recommended amount of weight were not more likely to sustain severe 3rd or 4th degree lacerations. The results of this secondary analysis are divergent from previous studies. These prior studies are limited by either the inclusion of women with high rates of operative delivery and/or episiotomy,^{11,14,16} or included multiparous women who are at a reduced risk of genital tract trauma.¹⁵

Multiple factors may have contributed to our findings (Table 4). The nulliparous women who participated in our study had low rates of operative vaginal deliveries and episiotomies. The low rates of operative interventions among our cohort likely resulted in our low rates of severe 3rd and 4th degree lacerations. While others have reported that severe lacerations may be missed at the time of delivery, our agreement with a second observer was high (98%) and all midwives who participated in the study underwent extensive training in the identification of perineal lacerations, making the likelihood that we have missed more severe lacerations unlikely. Physician colleague second observers were planned for lacerations of 2nd degree or higher and this was achieved 69% of the time. This rate of observation reflects our busy clinical setting where either the physician service needed to prioritize other clinical obligations or the midwifery service was responsible for multiple patients and could not wait for an observer. Because the midwifery service has participated in past trials exploring genital tract trauma they have, in general, incorporated techniques such as gentle

physiologic pushing with delivery of the fetal head and allow passive second stages for women who choose epidural analgesia. These practices may also have led to reduced rates of severe lacerations among women in this present study

Although obese women in the present study gained on average the same amount of weight as their non-obese counterparts, they were more likely to gain greater than the IOM recommended amount. It is possible that the obese women who participated were unaware that they should be gaining less weight than their non-obese counterparts, and were instead focused on absolute weight gain which led to excessive weight gain. Providers may have an opportunity to emphasize that weight gain guideline recommendations vary by BMI at the beginning of pregnancy.

A previous study at the University of New Mexico with the CNM group reported that obese women who gained more than forty pounds experienced more perineal trauma than obese women who gained less than forty pounds; in this study those who gained more weight were more likely to have macrosomic babies, which was also strongly correlated with increased rates of genital tract trauma.¹⁵ In the present study, although obese women were more likely to gain greater than the recommended amount of weight, they did not suffer from increased rates of genital tract trauma. Nulliparous women in the present study were generally younger and weighed less than the mixed population of multiparous and nulliparous women who participated in the prior study and this may account for the different outcomes. Although women in our study who gained more than the IOM recommended weight gave birth to heavier babies, the differences in newborn weights were minor and did not result in increased genital tract trauma.

Obese women had higher rates of Pitocin use and shorter second stages than non obese women. The increased use of Pitocin in obese women may be related to uterine contractility problems encountered more frequently in obese women due to disruption of myometrial cell function.²⁰ The second stages may have been shorter due to the Pitocin use.

Strengths of our study include a large sample of nulliparous women who were followed throughout pregnancy and birth. In addition, the low rates of operative interventions allow for the description of the natural history of genital tract trauma among healthy primiparas. Weaknesses include that pre-pregnancy weight was self-reported and could lead to potential inaccurate measure of weight gain over the course of the pregnancy. However, when we analyzed our results by BMI at birth, our findings did not change. In addition, our sample size may have been too small to see differences in genital tract trauma between groups. The original study was not powered to compare rates of weight gain and obesity in this cohort, although we did choose to study a group of nulliparous women who are known to be at greater risk for genital tract trauma than a population of women which includes both nulliparas and multiparas. In addition, when we performed a post hoc power analyses our sample sizes were adequate to detect a difference in trauma rates of 18% points (obese versus all others) or 13% (those gained the recommended amount versus those that did not) with 80% power and an alpha error of 0.05. We were unable to see differences in trauma rates less than this.

In conclusion, obesity or excessive weight gain during pregnancy did not increase the presence, site or severity of genital tract trauma at birth among healthy primiparous women. Otherwise healthy, primiparous obese women who achieve vaginal birth can be reassured that their likelihood of genital tract trauma compared to their normal weight counterparts is not increased.

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Quick Points

- Obesity is a common health problem in the United States.
- Obesity in pregnancy is associated with multiple negative consequences, including genital tract trauma in some studies.
- In this cohort of 445 healthy primiparous women, obesity or excessive weight gain did not increase the presence, site or severity of genital tract trauma at birth.
- While women should be encouraged to gain in accordance with the Institute of Medicine guidelines, otherwise healthy obese nulliparous women or nulliparous women who gain in excess of IOM guidelines can be encouraged that their risk for genital tract trauma is not increased.

Table 1
Classification of Genital Tract Trauma

Type of Trauma	Definition
<i>Anterior trauma</i>	
Labial	Any disruption of labial tissue
Urethral	Any tissue disruption within 0.5 cm of urethra
Clitoral	Any tissue disruption of clitoris/clitoral hood
<i>Posterior trauma</i>	
First degree laceration	Tear of perineal skin or vaginal mucosa
Second degree laceration	Tear of perineal skin and muscle
Third degree laceration	Tear of perineal skin, muscles and anal sphincter
Fourth degree laceration	Tear of perineal skin, muscles, anal sphincter and anal mucosa
<i>Vaginal trauma</i>	Any tissue disruption in vagina

Table 2
Maternal and labor characteristics dichotomized by BMI or weight gain

	BMI < 30 N= 377	BMI > 30 N = 68	P	IOM recommended weight gain N= 202	> IOM recommended weight gain N=243	P
Age, mean (SD), y	24 (4.9)	23.5 (4.2)	.34	23.9 (4.9)	23.9 (4.8)	.98
Education, mean (SD), y	14.0 (2.7)	13.2 (2.2)	.01	14.0 (2.8)	13.7 (2.5)	.23
Pre-pregnancy BMI, mean (SD), kg/m ² ,	22.9 (3.3)	34.5 (3.5)	<.001	23.4 (5.0)	25.7 (5.4)	<.001
Weight gain in pregnancy, mean (SD), lbs	36.1 (13.1)	32.5 (16.4)	.09	25.3 (8.1)	44.1 (11.3)	<.001
Newborn birth weight, g; mean (SD)	3213 (430)	3213 (391)	.99	3162 (433)	3255 (411)	.02
Race, n (%)			.27			.61
Non-Hispanic White	161 (44)	26 (38)		85 (42)	107 (44)	
Hispanic	161 (42)	38 (55)		90 (45)	109 (45)	
Native American	23 (6)	3 (4)		11 (5)	15 (6)	
Asian/Pf	10 (2)	0 (0)		7 (3)	3 (1)	
Black	17 (4)	1 (1)		9 (4)	9 (4)	
Tobacco Use, n (%)	21 (5)	9 (13)	.032	11 (2)	19 (4)	.35
Epidural n(%)	220 (58)	47(70)	0.07	115 (26)	152 (34)	.24
Oxytocin n(%)	170 (45)	41(62)	.015	84 (19)	127 (28)	.02
Occiput posterior n(%)	11(3)	1(1)	.70	10 (5) 10(5)	2(1)	.008
Operative vaginal delivery n(%) ^a	22 (6)	4(6)	>.99	14(7)	12(5)	.42
Episiotomy n(%)	8 (2)	0 (0)	0.61	4 (1)	4 (1)	>.99
Length of active second stage, min; mean (SD)	74.5 (65.6)	59.5 (51.4)	0.03	70.2 (64.2)	73.9 (63.6)	.56

IOM = Institute of Medicine

^a Includes both forceps and vacuum deliveries

Table 3
Presence, Severity and Site of Genital Tract Trauma among Primiparous Women

	BMI < 30 N= 377	BMI > 30 N = 68	P	IOM recommended weight gain N= 202	> IOM recommended weight gain N=243	P
Presence of Genital Tract trauma						
Intact, n (%)	32 (8)	10 (15)	0.12	21 (10)	21 (9)	0.62
Perineal trauma, n (%)			0.64			0.69
None	176 (47)	33 (49)		96 (48)	113 (47)	
1 st degree	74 (20)	13 (19)		41 (20)	46 (19)	
2 nd degree	108 (29)	20 (29)		53 (26)	75 (31)	
3 rd degree	17 (5)	1 (1)		10 (5)	8 (3)	
4 th degree	2 (1)	1 (1)		2(1)	1 (0)	
Depth of 2 nd Degree Trauma						
Left laceration depth, mm; mean (SD) ^a	2.5 (1.3)	1.8 (1.6)	0.14	2.3 (1.4)	2.5 (1.2)	0.46
Right laceration depth, mm; mean (SD) ^b	2.5 (1.3)	2.0 (1.7)	0.22	2.4 (1.5)	2.6 (1.3)	0.53
Site of Trauma						
Posterior trauma, n (%)	201 (53)	35 (51)	0.7	106 (52)	130 (53)	0.85
Anterior trauma, n (%)	173 (46)	34 (50)	0.59	97 (48)	110 (54)	0.57
Both anterior and posterior trauma, n (%)	97 (26%)	20 (29%)	0.55	51 (25)	66 (27)	0.67

* institute of Medicine

^a N = 128

^b N = 128

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Table 4

Potential Clinical Factors Contributing to Lower Rates of Genital Tract Trauma in Nulliparous Women in this study

•	Low operative delivery rates
•	Judicious use of episiotomy
•	Utilization of passive descent
•	Gentle, physiologic pushing