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Pelvic Floor Symptom and Quality of Life Changes During First Pregnancy: A Prospective Cohort Study

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Abstract

Introduction—We describe pelvic floor function in nulliparous pregnant women.

Materials/Methods—Nulliparous midwifery patients completed the Incontinence Severity Index (ISI), Pelvic Floor Impact Questionnaire (PFIQ-7), Wexner Fecal Incontinence Scale (W), and answered questions about sexual activity and perineal pain at baseline during the first (T1), second (T2), or third trimester (T3) and repeated in late T3. They also underwent a Pelvic Organ Prolapse Quantification (POPQ) exam at their baseline visit. Data were compared across trimesters.

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ANOVA and logistic regression accounted for repeated measures and was controlled for age and education.

Results—We recruited 627 women. In T1, 124 women gave baseline data and completed questionnaires, 403 in T2, and 96 in early T3 (496 repeated questionnaires in later T3). Besides an increase in genital hiatus and perineal body (all adjusted $p < .05$), physical exam measures did not differ between trimesters. As pregnancy progressed, urinary incontinence (UI) (T1=33, T2=44, T3=69% women with ISI >0, all comparisons $p<.02$) and IIQ-7 scores increased. Fecal incontinence (FI) increased (T1=8, T2=15, T3=16% from T2 to T3, $p=.04$), while CRAIQ-7 scores did not increase. Perineal pain increased (T1=17, T2=18 and T3 = 40%, all adjusted $p <. 001$), and sexual activity decreased as pregnancy progressed (T1= 94, T2 = 90, T3 = 77% sexually active, T1 vs T3 and T2 vs T3, $p <.001$).

Conclusions—During pregnancy, women experience worsening UI, FI and perineal pain. UI symptoms are associated with a negative impact on quality of life. Sexual activity decreases and POPQ stage does not change.

MeSH Terms

Pregnancy; Pelvic Floor Changes; Fecal Incontinence

Introduction

Some women experience pelvic floor changes during pregnancy, such as urinary and anal incontinence, pelvic organ prolapse and sexual activity status, which may have a negative impact on a woman's daily life. Urinary incontinence (UI) commonly occurs during pregnancy, affecting 26-70% of women (1-8). Anal incontinence, while less common, troubles 1.3-16% of women during pregnancy and may be a source of embarrassment (1-3, 9-11). Many women experience a decline in sexual activity and function while pregnant. (12, 13). While various studies have addressed pelvic floor changes during pregnancy, few have focused on primiparous women exclusively, addressed pelvic floor function comprehensively and gathered data across all three trimesters.

It is important to understand pelvic floor changes associated with childbearing and their possible temporal nature. First, obstetric care providers can provide women with anticipatory guidance about pelvic floor changes during pregnancy and give them information about the possible duration and severity of these changes. This may lead to initiation of therapy for their symptoms. Second, given the climbing cesarean section rate worldwide, it is important to determine which pelvic floor changes are associated with pregnancy versus mode of delivery. If pregnancy has an independent detrimental effect on pelvic floor function, then the controversy over the role of delivery mode on pelvic floor changes associated with childbearing becomes more complex. The objective of this analysis was to comprehensively describe pelvic floor changes during pregnancy in a low-risk, nulliparous population of women.

Materials and Methods

This is planned secondary analysis of a longitudinal study titled “Alterations in the Pelvic Floor in Pregnancy, Labor and the Ensuing Years (APPLE)” which followed women through pregnancy, childbirth and the following two years (14). From 2006-2011, nulliparous women cared for by staff nurse midwives at the University of New Mexico (UNM) Health Sciences Center were recruited in Albuquerque, New Mexico. Eligible women were greater than 18 years of age, nulliparous, had a singleton pregnancy, were able to complete questionnaires in English or Spanish, and did not have serious medical problems necessitating physician care. Women were eligible for enrollment until 36 completed weeks of gestation (14). Prior publications from this cohort compared the pelvic floor outcomes of women who did and did not enter the second stage of labor (14), specific sexual function changes during pregnancy (15), the effect of perineal lacerations on pelvic floor function at 6 months postpartum (16), as well as perineal anatomy (17). The investigators have also studied differences in translabial ultrasonographic measurements of the anal sphincter complex (ASC) in those who delivered vaginally versus by cesarean delivery (18), if these measurements relate to postpartum anal and fecal incontinence based on delivery mode (19), and if ASC measurements differ by method: translabially versus endoanally (20). The UNM Institutional Review Board approved this study, and all women gave written informed consent.

After consent, women completed validated symptom severity scales and quality of life measures for pelvic floor dysfunction. We aimed to collect questionnaire data at two time points during pregnancy: early in the first or second trimesters and again in the third trimester in order to characterize functional changes throughout pregnancy. Physical exams were performed once during pregnancy at the time of recruitment, which could have occurred in either T1, T2 or T3. All pelvic floor disorders recognized were defined according to the International Urogynecological Association (IUGA)/International Continence Society (ICS) joint report for female pelvic floor dysfunction (21).

Physical exam data included assessment of pelvic floor support by the Pelvic Organ Prolapse Quantification (POPQ) exam (22), assessment of pelvic floor muscle strength using the Brink’s scale (23), and rectal exam using a modified Brinks’ scale. For rectal exam, the examiner’s finger was placed in the rectum and the examiner was asked to rate rectal resting and squeeze tone on a four point scale from “no response” to “strong squeeze/resting tone; full circumference of the finger compressed”.

In addition to physical exam, women completed a variety of validated symptom severity and quality of life measures. To assess urinary incontinence, women completed the Incontinence Severity Index (ISI) (24); presence of urinary incontinence was defined as a score greater than 0 and moderate to severe incontinence as a score greater than or equal to 3 (24). To characterize incontinence type, women completed the Questionnaire for Urinary Diagnosis (QUID) (25) which determines if incontinence symptoms were stress-related, urgency-related or both. Finally, women completed the Incontinence Impact Questionnaire (IIQ-7) which measures the impact of UI on quality of life. For AI, women completed the Wexner fecal incontinence scale (W) (26), as well as the Colo-rectal-anal Impact questionnaire

(CRAIQ-7). Anal incontinence was defined as a score on the Wexner scale greater than 0; fecal incontinence (FI) was defined as a positive response to the involuntary loss of formed or loose stools. To evaluate for prolapse women underwent Pelvic Organ Prolapse Quantification exams. Sexual activity was self-reported. Finally, women were asked to report symptoms of perineal pain by completing the Present Pain Intensity (PPI) scale which was dichotomized into any versus no pain. Demographic data were collected and included age at delivery, height and weight as measured at the first clinic visit, years of education, race/ethnicity as reported by the patient, and tobacco use. All examiners underwent POPQ training with live models prior to the conduct of the study; 17 exams were repeated with a second examiner to determine inter-rater reliability of exams which was found to be high (14).

The parent study was powered to determine the effect of genital tract trauma on postpartum pelvic floor function (14). We aimed to recruit 630 nulliparas from the nurse midwifery clinics. We anticipated being able to recruit the majority of women in the first or early second trimesters and that women would be willing to complete questionnaires twice during their pregnancy. For physical exam data, means across trimesters were compared with analysis of variance and for significant differences were controlled for by age and education with ANCOVA. For POPQ stage comparisons, we used Jonckheere-Terpstra test for ordered categorical data. For functional outcomes, women may have had one or two observations during the study period. To account for paired means, we used mixed linear models with the two visits as the repeated factor (SAS proc mixed). For binary variables, we used generalized linear models using generalized estimating equations to compare across trimesters. (SAS proc genmod) To control for age and education, these variables were entered into the models. Significance was set at $p<.05$, and all analyses were performed on SAS Institute Inc, Version 9.4, Cary North Carolina.

Results

We recruited 627 nulliparous women from the UNM nurse midwifery clinics from 2006-2011. As previously reported, this was a young, educated cohort of women, the majority of whom reported that they were either non-Hispanic White or Hispanic. Few women smoked during pregnancy, and the mean BMI of this cohort was 25.1 ± 5.7 kg/m^2 (Table 1). By design, most women 527/627 (84%) were recruited in either the first or second trimester; of those who were recruited in the first or second trimester, 497/527 (94%) also gave data in the third trimester. Hence, most women (80%) had paired data. Also by design, physical exam data during pregnancy were collected once across the three trimesters. Urinary incontinence increased across the three trimesters, with 69% of women reporting any UI in the third trimester and 24% reporting moderate to severe incontinence. The proportion of women who reported stress or urgency predominant incontinence did not change across trimesters (All P = NS). The impact of UI on quality of life (QoL) increased into the third trimester (Table 2).

Similarly, any anal incontinence was common across trimesters, but the largest increase was seen between the first and second trimesters. Fecal incontinence was rarer, but it did increase from the first to the second trimester. The impact of AI on QoL was low and did not increase

as pregnancy progressed (Table 3). The number of women who described any perineal pain increased steadily as pregnancy progressed. The number of women who reported being sexually active decreased across trimesters (Table 4). On physical exam, POPQ stage did not vary across trimesters. There was a small increase in measurements of the GH at rest or with strain and the PB with strain. Brinks scores did not change over the course of pregnancy, nor did rectal squeeze scores (Table 5).

Discussion

In this cohort of young, healthy nulliparous women, urinary and anal incontinence increased, perineal pain increased, sexual activity decreased and pelvic support did not change across trimesters. The most profound changes were in urinary incontinence symptoms which resulted in significant changes in quality of life as measured by the IIQ-7 in the third trimester. These findings support that there are important changes in pelvic floor function during the course of pregnancy that occur before delivery and these changes affect even young health nulliparous women.

The first time many women experience urinary incontinence is during pregnancy. We found that UI had a greater change in quality of life than fecal incontinence symptoms. Others have reported that the rates of UI increase as pregnancy progresses. A large, Spanish, prospective cohort study of 1,128 healthy, continent, nulliparous women were given validated questionnaires in each trimester (1). The objective was to describe rates of UI and anal incontinence during pregnancy, and the investigators used many of the same validated questionnaires used in our trial. This study reported an UI incidence of 39.1% (CI 36.3-41.9). Additionally, similar to our findings, the prevalence increased as pregnancy progressed from 8.3% in the first trimester to 31.8% and 34.8% in the second, and third, respectively (1). Another large population-based study included all women delivering live born neonates in a 1 year period from 2002-2003 in Oregon (27). Only primiparous women (n=5,599) who did not report urinary incontinence prior to pregnancy were included. Out of these 5,599 women, 1,054 (19%) had leakage only during pregnancy, which is a lower rate than reported in our population (27). Similar to our findings, Brown et al. (6) investigated UI using a validated questionnaire in 1,507 Australian nulliparas in early and late pregnancy. Symptoms of UI were reported by 17% of women in early pregnancy (mean gestation 15 weeks) and 55.9% in the 3rd trimester (mean gestation 31 weeks) (6). In this trial, all types and severity of UI increased over the course of pregnancy. Women younger than 24 or older than 40, women with a BMI ≥ 30, and women with subclinical urinary symptoms prior to pregnancy were at greater risk of developing new UI in pregnancy (6).

We found that anal incontinence is less common than urinary incontinence during pregnancy, which is supported by other studies. Solans-Domènech et al. (1) reported a prevalence of anal incontinence of 2.3%, 6.8%, and 7.4%, in the first, second and third trimesters, respectively. Risk factors for anal incontinence were age over 35 and excessive weight gain in pregnancy. In a Dutch study of 487 nulliparous women, van Brummen et al. (10) found that 3.9% and 3% of women at 12 and 36 weeks gestation, respectively, reported fecal incontinence. King et al. (11) recruited 129 primiparas in the 3rd trimester to determine prevalence of fecal incontinence and pelvic floor muscle strength. Mean Brink score was 9.1

± SD, and fecal incontinence was reported by 14% of women (11). Our finding that sexual activity decreases as pregnancy progresses has been demonstrated by other trials (12, 13, 28-32).

Although POPQ stage was quantified only once during each woman's pregnancy, the pooled POPQ points and stages did not differ regardless of the trimester in which the measurements were recorded. Others have shown that POPQ stage may increase during pregnancy. In a small prospective observational study of 129 nulliparous pregnant active duty women from Madigan Army Medical Center in Tacoma, WA, patients underwent a POP-Q exam in each trimester of pregnancy (33). The majority of women had stage 1 POP and no patient had more than stage 2. Overall, the leading edge of prolapse ranged from -2.5 to -1.48, measurements which are usually asymptomatic for women (33). Another study of 94 primiparous women by Sze et al. (34) found that 26% had stage II prolapse at 36 weeks gestation (34). In our cohort, we found that few women had stage II prolapse, and the only changes in POPQ measurements occurred in the genital hiatus (both at rest and with strain) and perineal body.

Our findings confirm that pregnancy is closely linked to urinary and anal incontinence, perineal pain and sexual inactivity. In our cohort, significant changes in POPQ measurements did not occur.

Retrospective reviews and comparisons of women who give birth by cesarean versus vaginally have pointed to an association between delivery mode and pelvic floor dysfunction. Given that others have found that cesarean delivery is not completely protective against the development of pelvic floor disorders and that pregnancy is associated with the development of pelvic floor dysfunction, particularly incontinence, it is evident that mode of delivery is not the whole story (1, 6, 10, 11, 27, 33, 34). Our findings and those of others support that pregnancy itself affects the pelvic floor and can be responsible, at least in part, for the pelvic floor changes that develop throughout a woman's life.

The strengths of this study are that it was conducted prospectively, using validated questionnaires and measurement for all variables, and involved a large number of nulliparous women. Additionally, the findings likely are not confounded by multiple medical comorbidities, as the population was limited to low-risk, healthy nulliparas. Additionally, it has become increasingly important in urogynecologic literature to collect both subjective and objective outcomes, which we accomplished. Likewise, we determined whether or not the pelvic floor dysfunction affected the quality of life of these nulliparous women.

The limitations of this trial include that while a large number of women were included, a smaller number of women gave data in T1 vs T2 and T3. It is difficult to assess whether this infers a selection bias. Additionally, a large percentage of our population was Hispanic, so it is possible that the results are not generalizable to other populations. Although we did train and validate the accuracy of our examiners, at the time of study design, the midwife providers for the patients felt that subjecting women to more than one examination was not warranted, so second exams were not part of the study protocol. Hence, we were unable to perform physical exams more than once during pregnancy, so none of the anatomic

measurements are paired. Nonetheless, none of our patients had prolapse beyond the hymen during pregnancy, the point at which prolapse typically becomes symptomatic.

In conclusion, multiple pelvic floor changes occur during pregnancy, including increased prevalence of urinary and anal incontinence, perineal pain and sexual inactivity. Women can expect few vaginal support anatomic changes during pregnancy. Obstetric providers should talk to their patients regarding the natural history of these pelvic floor changes during pregnancy, so that they can institute therapy, such as pelvic floor exercises.

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Table 1

Demographic data across trimesters

	Overall N=623	Trimester 1 N=124	Trimester 2 N=403	Trimester 3 N=96	P
Age years (mean +/- SD*)	24.2 +/- 5.1	24.9 +/- 5.2	24.3 +/- 5.1	22.7 +/- 4.8	0.006
Education years (mean +/- SD*)	13.9 +/- 3.8	14.6 +/- 6.6	13.8 +/- 2.7	13.2 +/- 2.8	0.02
Race (%)					0.05
Non-Hispanic white	268(44)	52(43)	182(46)	34(36)	
Hispanic	273(44)	60(50)	171(43)	42(44)	
Other: Asian/Pacific Islander, Black, American Indian	72(12)	9(7)	44(11)	19(20)	
Smoked Tobacco (%)	58(9)	8(7)	37(9)	13(14)	0.21
BMI(mean +/- SD*)	25.1 +/- 5.7	25.0 +/- 6.0	25.4 +/- 5.8	24.1 +/- 4.5	0.17

*Standard deviation

Table 2

Urinary incontinence outcomes across trimesters

Urinary incontinence	T*1 N=122	T*2 N=396	T*3 N=589	P values T*1 vs T*2	P values T*1 vs T*3	P values T*2 vs T*3	ANCOVA variables	Adjusted P values T*1 vs T*2	Adjusted P values T*1 vs T*3	Adjusted P values T*2 vs T*3
Any UI# (ISI** > 0) (%)	40(33)	176(44)	407(69)	.02	<.001	<.001	Age	.02	<.001	<.001
							Education	.06	<.001	<.001
Moderate or severe UI# (ISI** ≥ 3) (%)	7 (6)	59 (15)	141(24)	.01	<.001	<.001	Age	.01	<.001	<.001
							Education	.02	<.001	<.001
Among women with any Urinary Incontinence										
	N=40	**N=176**	**N=407**							
ISI** (Mean ± SD$)	1.7 ± 0.9	2.2 ± 1.3	2.3 ± 1.4	.03	.008	.46	Age	.03	.008	.44
							Education	.03	.005	.25
IIQ-7^ (Mean ± SD$)	8.2 ± 17.1	7.1 ± 12.3	13.3 ± 17.1	.68	.06	<.001	Age	.67	.06	.001
							Education	.90	.04	<.001
Stress predominate UI# (QUID## stress > urge) (%)	10(25)	60(34)	135(34)	.25	.26	.82				
Urgency predominate UI # (QUID## urge > stress) (%)	19(48)	81(47)	194(48)	.91	.92	.69				

* Trimester;

** Incontinence Severity Index;

Urinary Incontinence;

$ Standard Deviation;

Questionnaire for Urinary Incontinence Diagnosis;

^ Incontinence Impact Questionnaire-7

Table 3

Anal incontinence outcomes across trimesters

Anal Incontinence	T*1 N=120	T*2 N=394	T*3 N=583	P values T*1 vs T*2	P values T*1 vs T*3	P values T*2 vs T*3	ANCOVA variables	Adjusted P values T*1 vs T*2	Adjusted P values T*1 vs T*3	Adjusted P values T*2 vs T*3
Any Anal Incontinence (W[X] > 0) (%)	63(53)	240(61)	388(67)	.10	.002	.05	Age Education	.08 .11	.001 .002	.05 .04
Fecal Incontinence (%)	10(8)	61 (15)	91 (16)	.05	.03	.95	Age Education	.05 .05	.04 .04	.98 .93
Among women with any Anal Incontinence										
	N=63	**N=240**	**N=388**							
Wexner (Mean ± SD[$])	1.98 ± 1.29	2.15 ± 1.52	2.26 ± 1.64	.47	.20	.39				
CRAIQ-7 (Mean ± SD[$])	2.15 ± 11.13	2.64 ± 9.60	2.69 ± 8.74	.71	.67	.95				

*Trimester;

**Incontinence Severity Index;

$Standard Deviation;

XWexner

Table 4

Perineal pain and sexual function outcomes across trimesters

Sexual Activity	T*1 N=123	T*2 N=395	T*3 N=561	P values T*1 vs T*2	P values T*1 vs T*3	P values T*2 vs T*3	ANCOVA variables	Adjusted P values T*1 vs T*2	Adjusted P values T*1 vs T*3	Adjusted P values T*2 vs T*3
Sexually active (%)	116(94)	357(90)	435(78)	.18	<.001	<.001	Age	.18	<.001	<.001
							Education	.21	<.001	<.001
Pain	**N=121**	**N=398**	**N=580**							
Any perineal pain (%)	21(17)	70(18)	232 (40)	.95	<.001	<.001	Age	.94	<.001	<.001
							Education	.73	<.001	<.001

*Trimester

Table 5

Physical exam findings across trimesters*

	Trimester 1 N=123	Trimester 2 N=402	Trimester 3 N=93	P**	Adjusted P for age***	Adjusted P for education***
POPQ Stage				.97 (JT)		
0	59(49)	229(57)	43(46)			
1	55(45)	153 (38)	48 (51)			
2	7(6)	17(4)	3(3)			
POPQ points (means ± SD ^)						
Aa	-2.5 ± 0.6	-2.7 ± 0.5	-2.6 ± 0.5	0.06		
Ba	-2.5 ± 0.6	-2.6 ± 0.5	-2.6 ± 0.5	0.06		
C	-6.0 ± 1.4	-5.9 ± 1.4	-5.9 ± 1.3	0.82		
Ap	-2.8 ± 0.5	-2.8 ± 0.5	-2.8 ± 0.4	0.67		
Bp	-2.8 ± 0.5	-2.8 ± 0.4	-2.8 ± 0.4	0.41		
D	-7.5 ± 1.6	-7.4 ± 1.8	-7.7 ± 1.4	0.35		
GH_rest	2.4 ± 0.8	2.4 ± 0.8	2.7 ± 0.8	<0.001	<.001	0.003
GH_strain	2.7 ± 0.8	2.6 ± 0.8	3.0 ± 0.8	0.005	0.009	0.03
PB	3.5 ± 0.9	3.7 ± 0.8	3.9 ± 0.8	0.003	0.002	0.005
TVL	7.8 ± 1.2	7.8 ± 1.2	8.1 ± 1.3	0.10		
Brinks score(means +/- SD ^)	9.6 ± 2.2	9.8 ± 2.3	9.4 ± 2.4	0.22		
Rectal Squeeze score(means +/- SD ^)	6.3 ±1.3	6.6 ± 1.3	6.6 ± 1.3	0.21		

^ Standard Deviation

* All women underwent only a single pelvic exam during pregnancy

** Anova for unadjusted

*** ANCOVA for adjusted