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ORIGINAL ARTICLE

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Prevalence and correlates of stress urinary incontinence during pregnancy: a survey at UNICAMP Medical School, São Paulo, Brazil

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Abstract The aim of this study was to evaluate the prevalence of stress urinary incontinence (SUI) in women in the third trimester of pregnancy. In total, 340 patients attending the Antenatal Clinic at the State University of Campinas (UNICAMP) were interviewed. Overall, 170 women (50%) presented SUI. Stress urinary incontinence did not correlate to either body mass index (BMI) or race. There was no correlation between parity and SUI, but when considering distinct types of effort, urine leakage on coughing ($P = 0.0478$) and laughing ($P = 0.0046$) were highly more frequent in multiparous women. One hundred eleven women had had only vaginal deliveries and 68 delivered by cesarean section. There was no difference between the two groups concerning incontinence, but multiparous women (≥4) who delivered exclusively vaginally demonstrated 2.0 times more chances to leak urine when compared to nulliparous women. This fact strongly suggests parity to be more relevant than delivery route as a risk factor to stress urinary incontinence. Nulliparous women presented with a high percentage (45.5%) of the symptom, emphasizing the elevated risk of SUI during first pregnancy.

Keywords Stress urinary incontinence · Pregnancy · Parity · Route of delivery · Body mass index · Race

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Introduction

Several studies have objectively demonstrated pelvic organ prolapse and urinary incontinence (UI) as a result of childbirth [1, 2]. Moreover, pregnancy per se might represent a risk factor to the development of UI to prevalence levels as high as 46.6% [3].

Although the precise etiology of UI in pregnancy is unknown, it is usually hypothesized to be caused by either hormonal or mechanical changes. Hvidman [4], in 2002, demonstrated no substantial increase in UI incidence at the onset of pregnancy, suggesting that increasing hormonal concentration or local tissue changes could predispose to UI later in pregnancy. Thorp [5] found UI prevalence of 15% during the first trimester, increasing during the second and third trimesters to 35 and 40%, respectively. Objective pelvic organ support evaluations using the Pelvic Organ Prolapse Quantification (POPQ) Staging System, suggested that alterations in pelvic support occurred prior to delivery, with significant increase in overall POPQ stages in the second and third trimesters [6, 7].

Urodinamic studies have been performed during pregnancy to assess bladder function and findings are contradictory. Francis [8] found bladder capacity to decrease in late pregnancy while Cutner [9] found no significant differences in bladder capacity at 28 weeks' gestation, at 36 weeks' gestation and postpartum. Functional urethral length as well as maximum urethral pressure increased during pregnancy, attempting to maintain continence [10]. Some evidence that pregnancy UI is associated with an overactive bladder have been demonstrated [11, 12].

Pregnancy seems to be casually involved as a predictor of UI during female adult life. Yet, few studies have addressed pregnancy UI vulnerability. This data should serve as a starting point to prevention programs based on behavioral intervention during pregnancy, with reduction of postpartum UI, rather than treatment strategies. The purpose of this study was to evaluate the

prevalence of UI in the third trimester of pregnancy in a population sample and to inspect its association to parity, delivery route, body mass index (BMI) and race.

Patients and methods

Between June 2003 and October 2003, 340 women at the third trimester of pregnancy attending the Antenatal Clinic of the Department of Obstetrics and Gynecology of the State University of Campinas (UNICAMP), São Paulo, Brazil, were interviewed. All patients gave informed consent to participate and the Ethical Committee of the Institution has approved the study protocol. Each woman completed a structured pretested questionnaire. The questions were asked and recorded by a physiotherapist. Exclusion criteria included multiple pregnancy, urinary tract infection, history of pelvic surgery, current use of parasympathomimetic or sympatholytic drugs, respiratory disease and diabetes mellitus.

Stresses UI was defined as complain in involuntary leakage on effort or exertion, or on sneezing or coughing [13]. Patients were asked to answer "yes" or "no" as to whether they experienced SUI before or during pregnancy and to subjectively grade symptoms according to frequency (once a week; many times a week; daily) and intensity (low; moderate; severe). The type of precipitating factor, such as coughing, sneezing, laughing, standing up, lifting or other physical activity was researched.

Measurements of height and weight were converted to BMI (kg/m^2). Mean index≥30 was considered overweight for third trimester pregnancy [14].

The data from the questionnaire were analyzed using the Statistic Package for Social Sciences (SPSS) for Windows. Associations between categoric variables were assessed by frequency test, Fisher's exact test and χ^2 test and, when necessary, prevalence ratio (PR). $P < 0.05$ was considered statistically significant.

Results

Three hundred forty women were interviewed, with a mean age of 26.4 years. Of the subjects, 47.1% referred themselves as white and 52.9% as non-white. Only 3.5% were college educated and 44.1% did not complete elementary school. Overall, 170 patients (50%) reported involuntary loss of urine, while the other 50% had never experienced SUI. Patients were divided into four parity groups: 34.7% nulliparous; 27.1% primiparous; 28.8% multiparous 2–3 and 9.4% multiparous 4 or more. In 50% of the multiparous≥4, the onset of UI was before pregnancy. In the other groups, prevalence before pregnancy was 13.6, 8.7 and 14.3% for nulliparous, primiparous and multiparous 2–3, respectively (Table 1).

The incidence of SUI in each parity group followed a similar pattern. A high percentage (64.0%) of the multiparous (≥4) patients were affected by SUI, but also nulliparous women presented with a high percentage (45.5%) of the symptom, emphasizing the elevated risk of SUI during first pregnancy. Although the difference between parity groups was not statistically significant ($P = 0.2492$), there was a significant difference when the type of effort related to urinary leakage was considered (coughing $P = 0.0478$; laughing $P = 0.0046$) (Table 2). Analysis of the PR (CI 95%), demonstrated that multiparous (≥4) had 2.0 times more change to urine loss on laughing when compared to the nulliparous women (Table 3).

Analysis of the subjective data on the severity of SUI during pregnancy (Table 4) demonstrated no correlation between parity and urinary loss frequency, but there was statistical significant increase ($P = 0.0039$) in daily episodes of SUI in the multiparous group (≥4). The same results were obtained with PR, with 2.1 times more chance to daily episodes of leakage in the multiparous group, when compared to nulliparous group (Table 5).

To evaluate the correlation of route of delivery and SUI symptoms, women who delivered only vaginally and only by cesarean section were selected. The PR analysis demonstrated a chance almost 2.0 times higher of multiparous women (≥4) who delivered exclusively by the vaginal route, to present stress urinary incontinence (SUI) (Table 6), suggesting parity to be more relevant than delivery route as a risk factor to SUI.

The prevalence of incontinence was not significantly related to race. No relationship between BMI and UI was observed in this study (Table 7).

Table 1 Characteristics of the study population ($n = 340$)

	n	%
Race		
White	160	47.1
Mulatto	140	41.2
Black	37	10.9
Others	3	0.8
Parity		
Nulliparous	130	38.2
Primiparous	96	28.2
Multiparous 2–3	89	26.2
Multiparous ≥4	25	7.4
School grade		
Elementary school (incomplete)	150	44.1
Middle school (complete)	97	28.5
Middle school (incomplete)	43	12.7
Elementary school (complete)	29	8.5
College (complete)	12	3.5
College (incomplete)	8	2.4
None	1	0.3

Discussion

It is well known that vaginal delivery can cause trauma to the pelvic floor, either as a consequence of direct injury to the levator ani muscle or to nerve injury. Cesarean section rates, mainly in Brazil, have reached

Table 2 Relationship between parity and different types of effort determining stress urinary incontinence

	Nulliparous		Primiparous		Multiparous 2–3		Multiparous≥4		Valor- *P*
	n	%	*n*	%	*n*	%	*n*	%	
SUI	59	45.5	46	47.9	49	55.1	16	64.0	0.2492
Coughing	41	69.5	34	73.9	39	79.6	16	100.0	0.0478*
Sneezing	47	79.9	37	80.4	41	83.7	16	100.0	0.2388*
Laughing	22	37.3	11	23.9	17	34.7	12	75.0	0.0046*
Lifting	16	27.1	14	30.4	15	30.6	7	43.8	0.6502

Chi-square test
* Fisher's exact test

Table 3 Prevalence ratio (CI 95%) of different types of effort determining stress urinary incontinence

	Nulliparous PR (CI 95%)	Primiparous PR (CI 95%)		Multiparous 2–3 PR (CI 95%)		Multiparous≥4 PR (CI 95%)	
Coughing	1.0	1.06	(0.84–1.35)	1.15	(0.92–1.43)	1.44	(1.22–1.70)
Sneezing	1.0	1.01	(0.83–1.22)	1.05	(0.88–1.26)	1.26	(1.10–1.43)
Laughing	1.0	0.64	(0.35–1.18)	0.93	(0.56–1.54)	2.01	(1.30–3.11)
Lifting	1.0	1.12	(0.61–2.05)	0.62	(1.13–2.04)	1.61	(0.80–2.23)

Table 4 Relationship between frequency and intensity of stress urinary incontinence and parity

	Nulliparous		Primiparous		Multiparous 2–3		Multiparous ≥ 4		*P*
	n	%	*n*	%	*n*	%	*n*	%	
Frequency									0.0039*
Once a week	18	30.5	14	30.4	9	18.4	1	6.7	
Many times a week	28	47.5	10	21.7	16	32.7	4	26.7	
Daily	13	22.0	22	47.8	24	49.0	10	66.7	
Intensity									0.2187*
Low	45	76.3	34	73.9	33	67.3	10	66.7	
Moderate	12	20.3	6	13.0	14	28.6	3	20.0	
Severe	2	3.4	6	13.0	2	4.1	2	13.3	

* Fisher's exact test

Table 5 Prevalence ratio (CI 95%) of the intensity and frequency of stress urinary incontinence

	Nulliparous PR (CI 95%)	Primiparous PR (CI 95%)		Multiparous 2–3 PR (CI 95%)		Multiparous≥4 PR (CI 95%)	
Frequency							
Once a week	1.0						
Many times a week		0.68	(0.40–1.16)	1.05	(0.72–1.53)	1.31	(0.80–2.16)
Daily		1.46	(0.89–2.38)	1.73	(1.09–2.76)	2.17	(1.38–3.41)
Intensity							
Low	1.0						
Moderate		0.71	(0.29–1.74)	1.41	(0.73–2.76)	1.10	(0.36–3.33)
Severe		3.53	(0.75–16.51)	1.34	(0.20–9.07)	3.92	(0.61–25.03)

epidemic proportions, although a survey in 2004 has demonstrated a drop from 32.4% in 1995, to 26.4% [15]. Thurman [16], in a recent survey about preference for obstetric delivery, found that only 13.3% of the women interviewed would prefer cesarean section. The only significant demographic factor was race, with 21.7% of non-whites choosing *c*-section.

While much have been written about childbirth as a predisposing risk factor to pelvic floor damage and UI, very important and well conducted studies in the literature have pointed to the impact of pregnancy itself. The prevalence of SUI in nulliparous women reported in our study (45.5%) is in agreement with data from the literature. Wijma [17] found a prevalence of UI in nullipa-

Table 6 Prevalence ratio (CI 95%) of route of delivery related to stress urinary incontinence

	SUI				
	Yes		RP (CI 95%)		Total
	n	%	*n*		
Vaginal delivery only					
1	27	47.4	1.00		57
2	22	62.9	1.33	(0.91–1.93)	35
3	7	63.6	1.34	(0.80–2.27)	11
4	7	87.5	1.85	(1.26–2.70)	8
Cesarean section only					
1	20	48.8	1.00		41
2	6	33.3	0.70	(0.35–1.43)	18
3	3	37.5	0.79	(0.31–2.02)	8
4	0	0.0	NM		1

NM not measurable

rous women of 20%, with an increasing report of the symptom from 16% at 12–16 weeks to 35% at 36–38 weeks. Marshall [3] reported that 46.6% of 7771 postpartum women referred onset of UI during pregnancy and Caliha [18] in a prospective study of 549 nulliparas, found a prevalence rate of UI of 43.7%.

Most of the anatomic and physiologic changes in the pelvic floor that occur during pregnancy are not completely understood. O'Boyle [6, 7] has objectively demonstrated POPQ measurements to be significantly higher both comparing nulliparous to non-pregnant women or comparing third to first trimester of pregnancy. Wijma [17] could not find relation between urethro-vesical junction (UVJ) mobility and incontinence, but the resting angle was significantly widened during pregnancy and on coughing or Valsalva manoeuvre there was a significant increase in the displacement coefficient. According to the authors, this would indicate a decreasing effect of contraction of the pelvic floor muscles during pregnancy. Constitutional susceptibility to SUI by a pre-existing collagen deficiency, exacerbated by increased collagen remodeling during pregnancy has also been suggested [19]. Yet, Nel [12] found abnormal neurological symptoms and signs in 41% of the patients during pregnancy and suggests that some subgroups of women are perhaps more prone to nerve damage and altered muscle function on childbirth.

Table 7 Relationship and Prevalence Ratio between BMI race and stress urinary incontinence

	SUI				
	n	%	PR (CI 95%)		*P*
BMI					
≥30	107	62.9	1.15		
≥30	63	37.1	1.0	(0.93–1.43)	0.2073
Race					
Non-white	85	50.0	1.0		
White	85	50.0	1.13	(0.91–1.39)	0.2772

Chi-square analysis

In our study, parity (multiparous women≥4) was significantly associated to increase risk of urinary leakage on coughing or laughing, but no differences were found when we compared the prevalence of urinary symptoms according to the delivery route. MacLennan [20] in a cross sectional survey of 3010 interviews, demonstrated that cesarean section is not associated with a significant reduction in UI when compared to spontaneous vaginal delivery. According to Iosif [21], UI begins during the first pregnancy rather than during subsequent pregnancies indicating that pregnancy itself and hereditary factors predispose to SUI more readily than vaginal trauma. In a previous study conducted at the State UNICAMP in 2001 [22], the authors have demonstrated that the prevalence of UI among climacteric women where 3.5 times higher among those who had had only cesarean section them among those who had never given birth.

Hydman [4] found that BMI≥30 correlated to the prevalence of UI in either nulliparous or multiparous women. In our study, we could note demonstrate any association between BMI and UI. The same results were obtained by Chiarelli [23], who found pregnancy UI to be associated with previous mode of delivery but not with age or BMI.

Scanty literature has been devoted to the understanding of race association to prolapse and UI. Van Dongen [24] in 1981 found a prevalence of genital prolapse among white South Africans 80 times greater then in blacks White women were not more likely to report SUI than non-white women ($P = 0.2772$) in our study. Brazilian is a multiracial rather than a biracial society. The mulatto furnishes this ambiguity, and they tend to see themselves as completely separate from the black community. In our study group, 160 (47.1%) women referred themselves as white and 180 (52.9%) as non-white. Among 340 women enrolled in the study, only 37 (10.9%), referred themselves as black. The Afro-Brazilians represents 44% of the Brazilian population [25], and further studies shall bring new acknowledgement on possible racial differences in the pathogenesis of UI.

Our study demonstrated a very high prevalence of UI during pregnancy, mainly in nulliparous women. This fact emphasizes the elevated risk of SUI during first pregnancy. Also, our results strongly suggest parity to be more relevant than delivery route as a risk factor to SUI. Further research will focus on the follow-up of these pregnant women 6 and 12 months after delivery and future proposals for behavioral strategies during pregnancy, to lower UI prevalence in our population.

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