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Stress urinary incontinence four years after the first delivery: a retrospective cohort survey

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Headline: Stress incontinence 4 years postdelivery

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Abstract

Background: Our aim was to estimate the prevalence of stress urinary incontinence four years after the first delivery and analyze its risk factors.

Methods: A retrospective cohort survey was conducted in a French university hospital. The 669 primiparous women who delivered in our department in 1996 a singleton in vertex position between 37 and 41 weeks of amenorrhea were included. A mailed questionnaire was sent four years after the indexed delivery. The main outcome measure was stress urinary incontinence four years after the first delivery.

Results: 307 women replied, 274 had moved and 88 did not respond. Four years after the first delivery, prevalence of stress urinary incontinence was 29% (89/307). According to multiple logistic regression analysis, the independent risk factors were urine leakage before the first pregnancy (OR 18.7; 95% CI 3.6–96.4), urine leakage during the first pregnancy (OR 2.5; 95% CI 1.3–4.8), duration of first labor ≥ 8 hours (OR 3.1; 95% CI 1.7–5.7), mother's age > 30 years at the first delivery (OR 2.4; 95% CI 1.4–4.2) and cesarean section at the first delivery (OR 0.3; 95% CI 0.1–0.9).

Conclusion: Our results suggest that stress urinary incontinence following pregnancy arises from a multifactorial condition. The main risk factors are: age, previous incontinence (before or during the first pregnancy), prolonged labor and vaginal delivery.

Keys-words

Stress urinary incontinence; pregnancy; delivery; cesarean section.

Abbreviations

BMI: body mass index

CI: confidence interval

n: number

OR: odds ratio

P: probability

SUI: stress urinary incontinence

Introduction

Stress urinary incontinence (SUI) is common in women but its pathophysiology remains poorly elucidated (1, 2). As long as obstetrics has been taught, it has commonly been assumed that vaginal delivery favored pelvic floor disorders (3). Three months after the first delivery, urinary incontinence is two times more frequent in women who delivered vaginally than those who had a cesarean (4). However, long after the first delivery, the impact of the mode of delivery remains uncertain (1, 5).

The aim of this study was to determine the prevalence of SUI four years after the first delivery and analyze its risk factors. Knowing these factors before the first delivery may help to identify women at high risk who may benefit from preventive measures.

Materials and Methods

We used the database of our maternity ward to identify women who gave birth, in 1996, after 37 to 41 weeks of amenorrhea to a living singleton in a vertex position. This birth was considered a first delivery if the women had not previously delivered a fetus of more than 22 weeks. The study population comprised 669 women meeting these inclusion criteria.

Data on the mother (date of birth, height, weight before conception), the pregnancy (term, presentation) and delivery (length of labor, type of delivery, duration of active second stage, birth weight) were collected at the time of the first delivery.

Information on urinary continence was obtained from a questionnaire mailed in September 2000. If no response was received, a second and even third mailing was sent. The questions addressed urinary leakage before and during the first pregnancy, pregnancies since 1996 and urinary symptoms during the preceding four weeks. When a woman answered *yes* to

the entry question (*Do you have involuntary loss of urine?*) she was asked, using a validated questionnaire (6), about the frequency, the amount and the circumstances of leakage, if she wore pads for incontinence and if leakage was a problem for her. The questionnaire used for the study is available from the authors upon request. Informed consent was obtained from each responding woman.

Our outcome of interest was SUI four years after the first delivery (hereafter termed current SUI). A woman was considered to have current SUI if she replied affirmatively to the following question: *Do you have loss of urine during physical exertion, cough or sneeze?* Incontinence was categorized in three levels (slight, moderate or severe) using the severity index developed by Sandvik et al (7), which had been shown to correlate well with the 48-hour pad test.

The following variables were tested as potential risk factors: mother's age at the first delivery, body mass index (BMI), birth weight, duration of labor (from the onset of contractions to delivery), duration of active second stage (from the onset of expulsive efforts to delivery), mode of first delivery, third-degree perineal tear at the first delivery, a second delivery since 1996, urinary leakage before the first pregnancy and urinary leakage during the first pregnancy. Because an episiotomy was systematically performed, this factor was not considered.

Responders were compared to women not reached and non-responders for the different confounding variables collected at the time of their first delivery.

Responders with current SUI were compared to those without for the different variables. Univariate analysis was performed using Student's t-test for quantitative variables and the χ^2 test for qualitative data. Multivariate analysis was performed using stepwise logistic regression. Variables were introduced into the model when $P < 0.25$ according to univariate analysis (8). As the impact of cesarean section was the main question we planned to introduce

it into the logistic regression model independently of univariate analysis results. Urinary leakage before the first pregnancy and urinary leakage during the first pregnancy were considered independent variables. Quantitative variables were dichotomized into qualitative variables. The final model included only variables associated with current SUI at the threshold of $P < 0.05$. The coefficients in the final model were estimated using the maximum likelihood method; the adjusted odds ratios and their confidence intervals (CI) were calculated from the model's coefficients and their standard deviations. All analyses were performed with StatView 5.0 software (SAS Institute Inc., Cary, NC, USA).

Results

From the 669 women included in the study, we received 307 (45.9%) responses to our questionnaire, 273 (40.8%) letters were returned stamped *no longer at this address*, one (0.1%) woman had died and 88 (13.2%) women did not respond despite two "reminder" letters. If we exclude the 274 women who did not receive the questionnaire, the response rate was 77.7% (307/395). We searched for difference concerning potential risk factors among the 307 responders, the 274 women not reached and the 88 non-responders (Table I). Responders were older and less likely to have had a cesarean section at first delivery.

The prevalence of any urinary incontinence was 5% (16/304) before the first pregnancy, 22% (68/303) during the first pregnancy and 32% (99/307) four years later. For the 99 women with urinary incontinence four years after the first delivery, circumstances, frequency, amount, bother and pads associated with leakage are reported in Table II. The degree of urinary incontinence was categorized as slight for 62 women, moderate for 21, severe for 8, and unknown for 8.

Among the 89 (29%) women with current SUI, incontinence had started before the first pregnancy for 14 (16%), during the first pregnancy for 23 (26%), immediately after the first delivery for 20 (23%) and later for 32 (36%). SUI occurred *rarely* for 31 (35%), *sometimes* for 34 (39%), *often* for 19 (22%) and *all of the time* for 5 (6%). Twenty (22%) women wore protective pads because of SUI.

Univariate comparisons between the risk factors present in women with current SUI and those with no SUI are given in Table III. No significant association was found between current SUI and BMI, birth weight, active second stage ≥ 20 min, third-degree tear, second delivery and mode of first delivery. The prevalence of current SUI was 19% (6/31) after cesarean, 30% (49/166) after spontaneous childbirth and 31% (34/110) after forceps delivery ($P = 0.45$; χ^2 test).

The following variables were included in the logistic regression model (Table IV): age at delivery, duration of labor, cesarean section, urinary leakage before the first pregnancy, and urinary leakage during the first pregnancy. The risk of current SUI increased with urinary leakage before the first pregnancy, urinary leakage during the first pregnancy, duration of labor ≥ 8 hours, and mother's age > 30 years. The risk of current SUI was lower with cesarean section at the first delivery.

Discussion

Only 46% of the women included responded to the mailed questionnaire. This low response rate can mostly be explained by the change of address of 41% of the women. It is likely that growth of the nuclear family necessitated a larger home, as previously reported. Indeed, the West Berkshire perineal management trial found that 49% of their subjects had moved during the three years following the delivery (9). Wilson *et al.*, who sent a questionnaire 6 years after delivery had a 53% response rate (10). We assume that moving is not associated with SUI. In our population, the non-responders were slightly younger and had more frequently delivered by cesarean. It is possible that these women did not reply because they experienced fewer urinary disorders. This hypothesis is in agreement with our data. Thus, the real risk associated with age and mode of delivery might be higher than that we observed.

Urinary leakage preceding the first pregnancy was the strongest risk factor among our subjects. Recently, Wilson *et al.* (10) reported a strong association between urinary incontinence before pregnancy and the risk of SUI 6 years after delivery (OR 11.7; 95% CI 8.6–15.9). Pertinently, Alnaif and Drutz (11) observed a urinary incontinence prevalence of 15% in nulliparous Canadian students 15–19 old. This urinary incontinence preceding pregnancy could be a sign of the poor quality of the connective tissue supporting the urethra and the bladder neck.

Like Viktrup (1) and Wilson *et al.* (10) (OR 3.0; 95% CI 1.7–5.4 and OR 4.1; 95% IC 3.0–5.5, respectively), we found urinary leakage during pregnancy to be a significant risk factor for SUI four years after the first delivery. Foldspang *et al.* (12) conducted a general population study (4,345 women, 20–59 years old) and also identified an association between urinary leakage during pregnancy and SUI at the time of the inquiry (OR 3.4; 95% CI 2.6–4.6). In addition, King and Freeman (13) showed that bladder-neck mobility measured during

the first pregnancy was a risk factor for postpartum SUI. It is possible that pregnancy induces an alteration of the urethra and bladder neck support, as Landon *et al.* (2) found fascia tensile strength during pregnancy to be reduced. It is known that collagen metabolism is modified in individuals with SUI (14). Joint laxity increases during pregnancy, but it is not known if it subsequently returns to prepregnancy levels (15). Kristansson *et al.* (16) found a higher level of serum relaxin (a hormone that affects collagen metabolism) to be associated with SUI during pregnancy.

Urinary leakage before or during the first pregnancy seems to be an early risk factor. However this result has to be interpreted cautiously because, like the other studies, we collected this information retrospectively (1, 10, 12, 17). The relationship that we observed between urinary leakage before or during the first pregnancy and current SUI might be partially explained by a recall bias (18).

Use of forceps and the duration of the active second stage were not associated with current SUI in our study. However, use of forceps is a controversial risk factor, with some authors finding a link with postpartum urinary incontinence (19, 20), and others not (4, 12, 21). Because of the disparity of obstetrical practices, it is possible that forceps and prolonged expulsive efforts are poor markers of the difficulty of the delivery.

Mother's age at first delivery was a significant risk factor, according to our analysis. Because the questionnaire was mailed at the same date for each women (age at questionnaire = age at first delivery + 4 years), it is not possible to conclude whether it is the age at the first delivery or at the time of the questionnaire that is important. Foldspang *et al.* (12) found the risk of urinary incontinence to be increased for a second delivery after 40 years. Persson *et al.* (22) observed an increased risk of later urinary incontinence surgery with increasing maternal age at the first delivery. It would be interesting to determine whether the effect of pregnancy on pelvic connective tissue and urethra support is the same at all ages.

In our cohort, a second delivery was not associated with an increased risk of current SUI. A preponderant effect of the first pregnancy on pelvic floor disorders is likely (22, 23). Højberg *et al.* (24) reported urinary incontinence prevalences of 4% for nulliparous, 14% for primiparous and 16% for multiparous women.

Postpartum urinary incontinence is less common after a cesarean (4, 17, 19, 25–27). But the long-term protective effect of a cesarean is less certain. For the 278 women questioned by Viktrup (1) five years after their first delivery, the relationship between cesarean and SUI was not significant. MacLennan *et al.* included 1,546 women over 15 years old (5). Compared to nulliparity, pelvic floor dysfunction was significantly associated with cesarean section (OR 2.5), spontaneous vaginal delivery (OR 3.4) and instrumental delivery (OR 4.3), but the difference between cesarean and spontaneous delivery was not significant. Wilson *et al.* (10) questioned 4,242 women six years after delivery, and found no difference for urinary incontinence rates between cesarean and vaginal deliveries for primiparas (33 versus 38%, respectively), but a significant difference did exist for second (33 versus 46%) and third deliveries (26 versus 49%). Rortveit *et al.* (28) compared 669 women who delivered by cesarean section to 11,299 who delivered vaginally (1 to 4 times). SUI was significantly associated with vaginal deliveries (OR 2.4). Evaluation using ultrasound showed that, after the first delivery, bladder-neck mobility was increased after vaginal delivery and unchanged after cesarean (13, 25, 29). According to our multivariate analysis, a cesarean was significantly associated with a lower risk of SUI long after the first delivery. But it is not known whether increasing the number of cesareans could lower the long-term prevalence of SUI. It is possible that women requiring cesareans have more inflexible connective tissue, because the less elastic tissue, the more difficult cervix dilatation is, thereby necessitating surgical intervention. Pertinently, Rortveit *et al.* questioned 27,900 women of all ages and found that parity was no longer associated with SUI after 65 years (23).

Women complaining of urine leakage before or during their first pregnancy are at higher risk of developing SUI later. For these women, it seems legitimate to propose antenatal pelvic floor exercises, which have been shown to prevent postpartum incontinence (30). However, it is premature to propose prophylactic cesareans to prevent SUI before a randomized trial determines their potential protective effect. Our findings suggest that SUI results from a multifactorial condition in which pregnancy and labor seem to have their own impacts. Our findings need to be confirmed by a prospective study in which women will be examined and questioned early during their pregnancy, or even better before conceiving.

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Table I. Analysis of the differences among responders, women not reached and non-responders concerning potential risk factors for SUI. Values are means [standard deviation] for quantitative data assessed with analysis of variance and percentages (*n*) for qualitative data assessed with χ^2 test.

Risk factor	Responders (*n* = 307)	Not reached (*n* = 274)	Non-responders (*n* = 88)	*P*
Age at delivery, yr	29.3 [4.4]	28.2 [4.4]	28.9 [4.7]	0.01
BMI, kg/m²	21.3 [2.9]	21.1 [2.9]	21.3 [3.2]	0.62
Birth weight, g	3240 [384]	3253 [400]	3241 [430]	0.92
Labor, h	6.2 [2.3]	6.5 [2.5]	6.6 [2.3]	0.21
Active 2nd stage, min	11.1 [7.5]	10.6 [7.9]	10.9 [7.9]	0.69
Cesarean section	10.1 (31)	17.5 (48)	17.0 (15)	0.03
Forceps	36.2 (111)	31.3 (86)	44.3 (39)	0.08
Third-degree tear	1.3 (4)	1.1 (3)	1.1 (1)	0.97

Table II. Characteristics of urinary incontinence four years after the first delivery based on 99 incontinent women responding to the questionnaire.

Urinary incontinence	% (*n*)
Circumstances of leakage	
stress	89.9 (89)
urge	64.6 (64)
other circumstances	22.2 (22)
Frequency of leakage	
less than once a month	41.4 (41)
1 to 3 times per month	29.3 (29)
1 to 3 times per week	11.1 (11)
every day	10.1 (10)
unknown	8.1 (8)
Amount of leakage	
drops	69.7 (69)
small amount	23.2 (23)
more	3.0 (3)
unknown	4.0 (4)
Bothered by incontinence	
not at all	17.2 (17)
a little	54.5 (54)
moderately	15.2 (15)
a lot	10.1 (10)
unknown	3.0 (3)
Use of pads for incontinence	
none	74.7 (74)
1 to 6 per week	16.2 (16)
1 or more per day	4.0 (4)
unknown	5.1 (5)

Table III. Risk factors for stress urinary incontinence (SUI) four years after the first delivery. Univariate analysis using the χ^2 test. Values are percentages (*n*).

Risk factor	SUI		*P*
	Yes (*n* = 89)	No (*n* = 218)	
Age at delivery > 30 yr.	53.9 (48)	36.7 (80)	0.005
BMI > 27 kg/m²	2.2 (2)	4.6 (10)	0.34
Birth weight ≥ 4000 g	2.2 (2)	1.4 (3)	0.58
Labor ≥ 8 h	41.6 (37)	21.1 (46)	0.0002
Active 2nd stage ≥ 20 min	16.9 (15)	19.3 (42)	0.62
Cesarean section	6.7 (6)	11.5 (25)	0.21
Forceps	38.2 (34)	35.3 (77)	0.63
Third degree tear	2.2 (2)	0.9 (2)	0.35
Leakage before pregnancy	16.1 (14/87)*	0.9 (2/217)*	<0.0001
Leakage during pregnancy	40.2 (35/87)*	15.3 (33/216)*	<0.0001
Second delivery	69.6 (53)	61.0 (133)	0.81

* Missing values correspond to questions not completed.

Table IV. Risk factors for stress urinary incontinence four years after the first delivery. Adjusted odds ratios estimated by logistic regression analysis.

Risk factor	Odds ratio	95% CI	*P*
Leakage before the 1st pregnancy	18.7	3.6–96.4	0.0005
Leakage during the 1st pregnancy	2.5	1.3–4.8	0.005
Age at the 1st delivery > 30 yr	2.4	1.4–4.2	0.002
Labor ≥ 8 h	3.1	1.7–5.7	0.0002
Cesarean at the 1st delivery	0.3	0.1–0.9	0.04