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Maternal risk factors of urinary incontinence during pregnancy and postpartum: A prospective cohort study

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ABSTRACT

Introduction: Urinary incontinence (UI) during pregnancy is a common health problem. Vaginal delivery in particular affects the pelvic floor and increases the risk of pelvic floor dysfunctions. This prospective cohort study was conducted to investigate the incidence of UI during pregnancy and three months postpartum and determine the risk factors underlying UI.

Methods: In total, 547 volunteer women were recruited from the maternity clinic of a tertiary hospital. The participants filled out a questionnaire twice, one in the second trimester and the other three months after delivery. A multivariate logistic regression model with forward stepwise selection was used to analyze known risk factors for UI.

Results: The prevalence of UI during pregnancy was 39.5% and three months after childbirth 16.1%. Twenty-two percent of participants had pre-existing UI compared to 41.0% of the 88 women with UI three months postpartum. UI before pregnancy (OR 2.2), during pregnancy (OR 3.8) and primiparity (OR 2.3) were significantly associated with postpartum UI.

Conclusions: Women with UI before or during pregnancy and who are primiparous are at increased risk for postpartum UI. To prevent and reduce the risk factors contributing to UI, pregnant women should be routinely counseled.

Introduction

Urinary incontinence (UI) is a common health problem that affects 44–57% of the middle-aged female population. In women in early adulthood, UI is a less common problem that nevertheless affects 25% of this population segment [1,2]. Aging aside, pregnancy and childbirth are also known risk factors of UI [3]. In nulliparous women, the most common risk factors are obesity, childhood enuresis and high-impact exercise [4]. Every five-unit increase in BMI has been shown to increase the risk of UI 20–70% [5].

Pregnancy and childbirth alter the anatomy and innervation of the pelvic floor [6,7]. The most common lower urinary tract disorders in pregnancy are frequency and nocturia, which occur in 75–77% of pregnant women [8]. Stress UI, with a prevalence of 18–75%, is the most common type of incontinence during pregnancy, and is highest in the third trimester [9]. The International Urogynecological Association (IUGA) and the International Continence Society (ICS) define stress UI as involuntary loss of urine occasioned during effort, such as physical exertion, sneezing or coughing [10].

The factors behind UI in pregnancy are not fully understood, but anatomical changes in the pelvic floor, the weight of the pregnant uterus and hormonal issues have been suggested [11]. Pre-pregnancy obesity [12] and maternal age increase the risk of UI [13]. The prevalence of UI decreases after birth to around 30% three months postpartum [14]. UI at three months postpartum predicts UI five years later [15,16].

Abbreviations: UI, Urinary incontinence; PFMT, pelvic floor muscle training

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Vaginal delivery, especially, increases the risk of pelvic floor dysfunction, possibly by damaging pelvic innervation and causing lacerations to the pelvic musculature [17]. In a large Norwegian cohort study, the incidence of UI was 10% in nulliparous women, 16% in women receiving a cesarean-section, and 21% in women with a vaginal delivery [18]. Instrumental vaginal delivery, especially the use of forceps, further increases the risk [19].

Our prospective study presents a population of gravid women in one maternity clinic in Finland. Our aim was to determine the prevalence of UI during pregnancy and three months postpartum and to analyze the underlying risk factors.

Materials and methods

The present cohort study was conducted in the town of Jyväskylä in the Central Finland Hospital District, Finland. The hospital district serves a population of 270,000. During the recruitment period the number of births was 3704 and 80% of pregnant women partook in the mid-pregnancy sonography that is offered routinely in Finland to all pregnant women. From these visits 891 participants were recruited of whom 697 (78%) answered the survey (Attachment 1: questionnaires). Participation was voluntary and did not affect the sonography, hence reasons for not partaking was not recorded. Inclusion criteria were normal pregnancy with one fetus, and able to speak Finnish adequately. Substance abusers were excluded. The women completed a questionnaire on two occasions: the first in mid-pregnancy (mean (SD) 21.9 (2.0) weeks) and the second three months after childbirth. Of the 697 participants, 547 (78%) completed both questionnaires and were included in the final analysis. The women who answered both questionnaires were higher educated (62.3% vs. 44.7%, $p < 0.001$) and fewer of them regular smokers (1.8% vs. 6.0%, $p = 0.004$) compared to the women who only answered the first survey. All the women signed an informed consent before the study began. The study adhered to the Declaration of Helsinki and was approved by the ethics committee of the Central Finland Health Care District (diary number Dnro4E/2012).

The incidence of pelvic floor dysfunction (UI, bowel function, vulvar pain) before and after pregnancy was assessed using structured self-reported questionnaires. Other clinical variables included pre-existing morbidities, UI before pregnancy, primiparity, and the mode of delivery (spontaneous vaginal, instrumental vaginal or cesarean section). The sociodemographic factors were age, BMI, Body Surface Area (BSA), alcohol use, level of education, smoking, and physical and pelvic floor exercise (Table 1). Activity level was determined with the FIT-Index, which measures the frequency, intensity, and duration of exercise [20]. The participant was considered active in pelvic floor muscle training (PFMT), if she trained at least twice a week. BSA was calculated according to the commonly used Mosteller-BSA formula [21].

Table 2
Clinical factors in relations to continence. Values are expressed as counts with percentages.

Clinical factors	Continent (n = 459) 3 months after delivery	Incontinent (n = 88) 3 months after delivery	P-value
Primipara	186 (41)	41 (47)	0.30
Delivery mode			0.35
Spontaneous vaginal	354 (77)	74 (84)	
Assisted vaginal (i.e. suction cup)	38 (8)	5 (6)	
Cesarean section	67 (15)	9 (10)	
Pre-existing diseases			
Diabetes	21 (5)	3 (3)	0.78
Gestational diabetes	15 (3)	3 (3)	0.99
Hypertension	4 (1)	0 (0)	0.99
GI-disease	8 (2)	3 (3)	0.40
Asthma	45 (10)	5 (6)	0.22
Depression	12 (3)	2 (2)	0.99
Musculoskeletal diseases	14 (3)	1 (1)	0.48
Urinary incontinence			
Before pregnancy	87 (19)	36 (41)	< 0.001
During pregnancy	160 (35)	61 (69)	< 0.001
Stress UI during pregnancy	187 (41)	58 (66)	< 0.001
Bowel function			
Incontinence	8 (2)	1 (1)	0.99
Constipation	220 (48)	44 (50)	0.72
Vulvar pain	82 (18)	16 (18)	0.94
Burning during sexual intercourse	59 (13)	10 (11)	0.70

Statistics

The descriptive statistics are presented as means with SDs or as counts with percentages. Characteristics between groups were compared using *t*-tests (for continuous variables) or Chi-square tests (for categorical variables). Multivariate logistic regression modeling with forward stepwise selection (probability for entry ≤ 0.05, probability for removal ≥ 0.10) was used to investigate factors related to postpartum incontinence. All the variables in Tables 1 and 2 except pre-existing morbidities were included in the multivariate forward stepwise logistic regression model. The normality of variables was evaluated with the Shapiro-Wilk W test. The Stata 15.1, StataCorp LP (College Station, TX, USA) statistical package was used for the analysis.

Results

Participants were divided into two groups according to reported continence 3 months after delivery. The participants were around

Table 1
Sociodemographic factors in relation to continence.

Sociodemographic factors	Continent (n = 459) 3 months after delivery	Incontinent (n = 88) 3 months after delivery	P-value
Age, mean (SD)	30.0 (5.0)	31.0 (5.0)	0.066
BMI, mean (SD)	24.0 (4.3)	25.0 (4.3)	0.050
Height, mean (SD)	166.0 (6.0)	166.0 (6.0)	0.78
Weight, mean (SD)	66.4 (12.5)	69.1 (13.5)	0.067
BSA (Body surface area), mean (SD)	1.74 (0.17)	1.78 (0.18)	0.093
Education years (SD)	15.1 (2.5)	15.0 (2.5)	0.77
Smokes, n (%)	17 (4)	0 (0)	0.089
Alcohol use, n (%)	13 (3)	7 (8)	0.019
2–3 times a month	13	6	
4 or more times a week	0	1	
Physical Exercise (FIT index)[a], mean (SD)	37 (17)	39 (17)	0.40
Pelvic floor exercise, n (%)	156 (34)	24.0 (27.0)	0.22

[a] FIT index (Frequency Intensity Time) Index of Kasari (range, 1–100).

age thirty, which is the typical childbearing age in Central Finland. Mean education was 15 years. Alcohol use was more common during pregnancy in the incontinent group than continent group (8% vs. 3%; p = 0.02). Alcohol consumption was assessed with alcohol units/week, and most women in the alcohol consumption group drank alcohol once a month. More severe alcohol use (2–4 times a month) was rare. BMI showed a similar trend, with borderline significance; women in the continent group had lower BMI than women in the incontinent group (24.0 vs. 25.0 kg/m^2, p = 0.05). After childbirth, 43% and by mid-pregnancy 34% of the women performed regular pelvic floor muscle training. No significant difference was observed between the groups in physical activity or PFMT (Table 1). Only 45 participants answered that PFMT was clinically determined during the post-partum visit to the maternity clinic.

Three months after childbirth, UI was reported by 16% (n = 88) of the women. Urinary incontinence prior to pregnancy was reported by 123 participants, 41% of whom also reported incontinence three months after delivery. Among the women who were continent three months postpartum, 19% reported UI before pregnancy (p < 0.001). UI during pregnancy was also significantly higher in this group (69% vs., 35%; p < 0.001). Only SUI during pregnancy was recorded and was also significantly higher in the women who were incontinent three months postpartum (66% vs. 41%; p < 0.001).

Twenty-five percent of the participants had an underlying clinical condition, the most common of which was asthma (n = 50). Diabetes, comprising pre-existing and gestational diabetes, was the second most common condition (n = 42). No significant difference was observed between the incontinent and continent groups in underlying clinical conditions (Table 2).

The 227 (41.3%) primiparous women were distributed evenly between the continent and the incontinent groups (41% vs. 47%, respectively). Mode of delivery was spontaneous vaginal in 428 (78.2%) cases, instrumental vaginal in 43 (7.9%) cases and cesarean section in 76 (13.9%) cases. The type of cesarean, whether elective or emergency, was not recorded. No significant difference in UI three months postpartum was noted between the modes of delivery groups.

The prevalence of UI during mid-pregnancy was 39.5% (n = 216). When all the variables in Tables 1 and 2 except pre-existing morbidities were included in the multivariate forward stepwise logistic regression analysis, UI before pregnancy (p = 0.010; OR = 2.15; 95% CI 1.20–3.87), UI during pregnancy (p < 0.001; OR 3.80; 95% CI 2.16–6.63) and primiparity (p = 0.003; OR 2.29; 95% CI 1.34–3.92) were statistically significantly associated with postpartum incontinence.

Discussion

In this prospective cohort study, the prevalence of UI during mid-pregnancy was twofold higher than before pregnancy or postpartum. Almost every fifth woman reported UI three months after birth. This is most likely related to hormonal and physical changes to the pelvic floor during pregnancy and vaginal delivery [11]. UI before and during pregnancy was significantly associated with UI three months after childbirth. SUI was also more common in the women with UI three months postpartum. In the large Norwegian cohort study, the prevalence of UI prior to pregnancy was 26% and during late pregnancy 58% [30]. In this study, the prevalence was evaluated before pregnancy, during mid-pregnancy and at three months postpartum; hence the prevalence during pregnancy is slightly lower, as UI gradually tends to worsen as pregnancy progresses and the weight of the uterus increases [11].

The timing of the first questionnaire and thus the recruitment of the women was scheduled in during the routine visit to the maternity clinic for the structural ultrasound in mid-pregnancy. We consider our information important in showing that UI is already rather general in mid-pregnancy even though weight gain is not yet that large. Thus, for clinical purposes it is important to find those women with UI as early as possible to initiate the treatment and guidance. However, the prevalence of UI may increase in the third trimester of the pregnancy and thus the results should be viewed with caution.

Primiparous women were at a greater risk for postpartum incontinence. This is most likely due to labor-induced damage to the pelvic muscles and nerves, which is worse during the first pregnancy and delivery [11,17]. Hvidman et al.found that UI prior to pregnancy explained 34% of UI during the first pregnancy and up to 83% of UI in the second pregnancy [22].

Research on the mode of delivery has shown that cesarean delivery protects against UI, especially before menopause [23]. Vaginal delivery changes the anatomy of the pelvic floor and renders the woman more prone to UI [17]. Instrumental-assisted vaginal delivery further increases this risk owing to further damage to the pelvic floor caused by lacerations and mechanical stress [19]. In this study, the cesarean section rate was only 14% and no significant differences in postpartum UI were observed between delivery modes.

In the Finnish population, gestational diabetes is diagnosed in approximately 15% of pregnant women [25]. However, only 7.7% of the women in our study group had any form of diabetes. Moreover, mean BMI before pregnancy was below 25, and thus below the Finnish population mean of 25.2. Obesity in the Finnish population is estimated to be 16.3% (Finnish Institute for Health and Welfare 2018). The women included in the study were incidentally also more highly educated than those who only answered the first survey and were therefore excluded. Hence, the participants were healthier and leaner than the general population. Since obesity is a known risk factor for UI in women in general [5,12], the prevalence of UI in our study may be underestimated.

Our participants increased their pelvic floor muscle training (PFMT) after labor. Although in this study PFMT did not show any differences between the UI groups, PFMT has been shown to be effective in preventing pelvic floor dysfunction during and after pregnancy [26]. In their systematic review, Davenport et al. noted that PFMT combined with aerobic exercise reduced the risk of prenatal and postnatal UI up to 50% [27]. In turn, exercise was not therapeutic in women who developed UI during pregnancy, although they experienced a reduction in symptom severity [27]. However, the role of PFMT in treating UI remains unclear [29]. Therefore, counselling women on PFMT could be a potential tool for preventing UI. As shown in the prospective cohort study by Tennfjord et al. [28], PFMT can safely be commenced within six weeks after delivery.

About 73% (n = 547) of the participants were included in the study. The sample was big enough to evaluate the incidence of UI and several underlying risk factors, and the findings are consistent with those of previous studies. However, a larger study population could reveal additional significant factors, especially with regard to underlying comorbidities, since the prevalence of these was relatively small. A large German and Danish study analyzed 4 500 non-pregnant women and found that chronic pulmonary disease and having at least one underlying co-morbidity were significant risk factors for UI [26].

The strength of this study is a large population of pregnant women. Moreover, the prospective study setting adds to the reliability of the results. The fact that our study lacked objective validated questionnaires can be considered a limitation. However, the questionnaires, using patient-friendly terminology and synthesizing, were carefully designed to cover all the necessary information relevant to both research and the development of clinical work. The questionnaires are partly based on international questionnaires (e.g. Wexner incontinence score) and clinical risk factors for UI presented in the literature. The questionnaires were tailored to measure relevant factors of pregnant and postpartum patients. This allowed us to use specific data to show UI in these patients.

Another limitation is that our study lacked objective assessment of urinary incontinence such as the positive cough stress test, voiding diaries, or pad tests [31–33]. These tests might have yielded more accurate information on the prevalence of UI. Patient-reported outcome measures (PROMs) have, however, come to play an increasingly important role in clinical research in complementing objective outcomes or serving as primary outcomes when objective measures are unavailable [34].

Conclusions

In the present study, four out of ten women developed UI during pregnancy, and every sixth women reported UI three months after childbirth. UI prior to and during pregnancy and primiparity are significant risk factors for postpartum incontinence. Since UI is such a common morbidity, prevention methods, such as increasing counseling to prevent and reduce the risk factors contributing to UI, merit consideration.

Conflict of interest

Nothing to declare.

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Appendix A. Supplementary material

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.eurox.2021.100138.

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