

This is the peer reviewed version of the following article: Arrue, M., Diez-Itza, I., Ibañez, L., Paredes, J., Murgiondo, A. and Sarasqueta, C. (2011), *Factors involved in the persistence of stress urinary incontinence from pregnancy to 2 years post partum*. **International Journal of Gynecology & Obstetrics**, 115: 256-259, which has been published in final form at <https://doi.org/10.1016/j.ijgo.2011.07.024>. This article may be used for non-commercial purposes in accordance with Wiley Terms and Conditions for Use of Self-Archived Versions. This article may not be enhanced, enriched or otherwise transformed into a derivative work, without express permission from Wiley or by statutory rights under applicable legislation. Copyright notices must not be removed, obscured or modified. The article must be linked to Wiley's version of record on Wiley Online Library and any embedding, framing or otherwise making available the article or pages thereof by third parties from platforms, services and websites other than Wiley Online Library must be prohibited.

Factors involved in the persistence of stress urinary incontinence from pregnancy to two years postpartum

Arrue M¹, Diez-Itza I¹, Ibañez L¹, Paredes J¹, Murgiondo A¹, Sarasqueta C^{2,3}.

(1) Department of Obstetrics and Gynaecology. Donostia Hospital. San Sebastián. Guipúzcoa. Spain.

(2) IIS Biodonostia. Donostia Hospital. San Sebastián. Guipúzcoa. Spain.

(3) CIBERESP. Barcelona. Spain.

Corresponding author

Name and Surname: Miren Arrue Gabilondo

Home address: San Francisco 43B-4, Tolosa, 20400. Guipúzcoa. Spain. Telephone: +34 679636322

Work address: Departamento de Obstetricia y Ginecología. Edificio Materno-Infantil. Hospital Donostia. Paseo Beguiristain, 107–115. 20014 San Sebastián. Guipúzcoa. Spain. Telephone: +34 943 00 70 00. Fax: +34 943 00 74 28.

E-mail: mirenarrue@yahoo.es

Keywords: Stress urinary incontinence; persistence; pregnancy; delivery; risk factors; weight.

Word Count: 1982

Synopsis

The factors involved in the persistence of stress urinary incontinence first occurring during pregnancy and still present two years postpartum are analyzed.

Abstract

Objective: our aim was to identify factors involved in the persistence of stress urinary incontinence (SUI) from pregnancy to two years postpartum. Severity of incontinence and impact of SUI on quality of life were evaluated.

Method: a longitudinal cohort study was undertaken on 458 primigravid women. SUI was diagnosed using the 2002 ICS definitions. Severity was assessed with the Incontinence Severity Index (ISI) and impact on quality of life using the International Consultation on Incontinence Questionnaire (ICIQ-UI SF). The statistical analysis included comparison of means (Student's t-test and analysis of variance) and percentages (Chi square and Fisher's exact tests). Multiple logistic regression analysis was performed using variables that were significant or close to significance in the univariate analysis ($p < 0.2$).

Results: two years postpartum 26 (9.5%) women reported persistent SUI since pregnancy. Incontinence severity was slight or moderate in most cases and the impact on quality of life was low. Higher BMI in pregnant women at term was the only factor associated with persistent SUI from pregnancy to two years postpartum (OR: 1.19; 95%CI: 1.08-1.32).

Conclusion: Higher BMI in pregnant women at term is an independent risk factor for the persistence of SUI from pregnancy to two years postpartum.

Introduction

It is commonly assumed that stress urinary incontinence develops, at least in part, as the result of delivery trauma to the pelvic floor [1]. However, stress incontinence is often already a problem during pregnancy. Specifically, it has been reported that up to 32% of primigravid women develop this symptom during pregnancy [2].

Although the majority of women recover their pre-pregnancy continence status within 8 weeks after delivery [3], a significant percentage of women persist with symptoms in the postpartum period. Prevalence rates of persistent UI vary widely from 5% to 92% [4-7]. It is well documented that antenatal incontinence increases the risk of postpartum incontinence [8-12], which in turn increases the risk of long-term persistent incontinence [7,13]. In spite of this clear association, the mechanism involved remains unknown. The pathophysiology of the development of SUI during pregnancy is also not well understood. It has been hypothesized that it is caused by hormonal and by mechanical changes [14]. The hormonal theory involves relaxin, which is thought to stimulate connective tissue remodelling and may consequently play a role in the modifications that prepare the female pelvis for delivery. Susceptibility to this hormone has been described, the most susceptible women showing clear local tissue changes [15]. The mechanical theory is supported by some authors who report a relationship between the pressure of the enlarged uterus on the bladder and the development of both UI [16] and SUI [17] during pregnancy.

The aim of our study was to identify factors involved in the persistence of stress urinary incontinence from pregnancy to two years postpartum. Our hypothesis was that some of the factors involved in the development of SUI during pregnancy may also be

associated with its persistence after delivery. We also assessed severity of SUI and its impact on quality of life two years after first delivery.

Materials and Methods

This was a longitudinal cohort study including primigravid women who came to Donostia Hospital to give birth from April to October 2007. As our aim was to study only cases of new SUI, women who reported any kind of urinary incontinence before pregnancy were excluded from the study. Other exclusion criteria were: multiple pregnancy, gestational age of less than 37 weeks, diabetes mellitus, previous urogynecological surgery or malformations and neurological disorders. Finally, women who had a subsequent pregnancy during the follow-up period set at two years postpartum were also excluded.

All the women were interviewed and enrolled on the study when they came to our hospital to give birth. At this point, a detailed medical history was taken focused on urinary incontinence based on the definitions of the International Continence Society (ICS) in 2002 [18]. The women also underwent a standardized physical examination including measurement of height and weight. Data concerning the delivery and the newborn were subsequently collected from the clinical charts.

All the women included in the study were telephoned two years after delivery. An interview focusing on urinary incontinence, similar to the first one, was carried out. The women with persistent SUI since pregnancy were asked about the frequency and amount of leakage, in order to determine their score on the Incontinence Severity Index (ISI) formulated by Sandvik et al. [19]. All these women were also asked to complete the validated Spanish version of the International Consultation on Incontinence Questionnaire–Urinary Incontinence Short Form (ICIQ-UI-SF) [20].

We assessed whether the persistence of SUI from pregnancy to two years postpartum was influenced by the following variables: maternal age, gestational age, maternal body mass index (BMI) at term, maternal weight gain during pregnancy, mode

of delivery, second stage of labour, pushing time, augmentation with oxytocin, episiotomy, and administration of epidural anaesthesia, as well as the infant head circumference and weight.

All the patients included in the present study were fully informed about the study and gave their consent before enrolment. The study protocol was approved by the Clinical Research Ethics Committee of Donostia Hospital.

Statistical analysis of the data:

Statistical analysis was performed using the Statistical Package for the Social Sciences (SPSS Version 15.0 for Windows). Means were compared using the Student's t-test or analysis of variance, while percentages were compared using the Chi-square or Fisher's tests. A logistic regression model was used for multivariate analysis. The level for statistical significance was set at $p=0.05$.

Results

During the study period, 479 pregnant women who came to give birth at Donostia Hospital at term were interviewed. Twenty-one (4.4%) complained of UI prior to pregnancy and consequently were excluded. Two years after delivery 381 (83.1%) women attended a follow-up appointment. A comparison between the women who did and did not attend the follow-up appointments is shown in Table 1. There were no significant differences between the groups except for maternal age, the mean age of the women who did not attend the follow-up appointment being significantly lower. Of the women who were interviewed two years after delivery, 109 were or had been pregnant again and so were excluded from further analysis, and the remaining 272 women formed the study group (Figure 1). Their mean age was 31.3 years (SD:3.7), mean BMI at term was 23.4 (SD:3.9) and mean weight gain during pregnancy 12.5 kg (SD:3.9).

A total of 26 (9.5 %) women reported the development of SUI during pregnancy and were still suffering this symptom two years postpartum. The distribution of severity based on the Incontinence Severity Index was: 13 (50.0%) slight, 12 (46.2%) moderate and only 1 (3.8%) very severe. The mean score of ICIQ-UI SF was 7.4 (SD:4.2), the mean score on the question concerning impact on everyday life being 3.3 (SD:3.0).

The analysis to identify the factors involved in the persistence of SUI from pregnancy to two years postpartum indicated that there was an association with higher BMI at term (Table 2). We did not find statistically significant relationships with any of the other variables analysed. Nevertheless, a multiple logistic regression model was

built with variables close to statistical significance in this univariate analysis. Specifically, as well as BMI at term, augmentation with oxytocin and episiotomy were included in this analysis together with mode of delivery and maternal age as potential confounders. This model indicated that higher maternal BMI at term was the only factor independently associated with SUI first occurring during pregnancy and still present two years postpartum (OR: 1.19; 95% CI: 1.08-1.32).

Discussion

In this longitudinal cohort study including only primigravid women who were continent before pregnancy, we observed that the prevalence of persistent SUI from pregnancy to two years postpartum was 9.5% with the majority assessed as having slight to moderate incontinence, and reporting a low impact on quality of life. Although the mean age of the women who did not attend the follow-up appointment was significantly lower, we do not believe that this interfered with our results, since maternal age does not seem to be a risk factor for urinary incontinence in the postpartum period [21].

The reported prevalence of persistent SUI from pregnancy to after delivery varies widely from 5 to 92% [4-7] probably due to the diversity in study samples (nulliparous and multiparous) and differences in methodological design. Groutz et al. [4] conducted a study in which prevalence of SUI, was assessed based on symptoms reported by the women, in a similar way to our study. They found rates of persistent SUI of 5%, 11%, and 21% for nulliparous, primiparous, and grand multiparous women, respectively. The difference between their rates and those found in our study can be attributed to the shorter follow-up of the cited study, which was limited to the immediate puerperium.

We found that severity of SUI two years postpartum was slight or moderate in the vast majority of our patients. In terms of quality of life, the assessment by the ICIQ-UI SF questionnaire indicated that in most cases SUI had only a mild impact. To date, little has been published concerning the impact of SUI on quality of life postpartum. Dolan et al. [22] conducted a prospective cohort study of primigravid women with this aim and concluded that the King's Health Questionnaire showed a worsening in the

quality of life of incontinent women, but that this worsening could be due to the coexistence of other factors related to the postpartum period.

We analysed factors involved in the persistence of SUI from pregnancy to the postpartum period to try to identify a link between pregnancy and postpartum SUI. The analysis produced the most interesting finding of our study, namely that there was an association between higher maternal BMI at term and SUI first occurring during pregnancy and still present two years postpartum. Data on factors involved in the persistence of SUI from pregnancy to the postpartum period are scarce. Glazener et al. [5] indicated that persistence of pregnancy-related urinary incontinence to postpartum was associated (OR: 1.68) with higher maternal BMI before pregnancy. However, these authors did not make any distinction between the different types of urinary incontinence and the follow-up was limited to three months postpartum. In addition, a recent study performed among Chinese women analyses not the persistence but the prevalence of SUI six months after delivery and indicates an association between being incontinent in the postpartum period and higher maternal weight at term. However, weight was self-reported in the cited study and women who were incontinent before pregnancy were not excluded [23].

The main distinguishing characteristic of our study is that it was designed with the aim of evaluating factors involved in the persistence of SUI from pregnancy to two years after first delivery and, accordingly, women who reported incontinence before pregnancy were not included. Another strength is that only primiparous women with no subsequent pregnancies in the follow-up period were included, in order to avoid the possible effects of further pregnancies and deliveries on the continence mechanism.

The results of this study may be limited due to the symptom-based definition of SUI. Indeed, the study design did not allow us to evaluate other constitutional risk

factors for SUI, such as antenatal bladder neck mobility. King et al. [24] indicated that primiparous women with postpartum SUI have significantly greater antenatal bladder neck mobility than those who are continent after childbirth. Another limitation of our study design was that we were not able to analyse the influence of weight loss in the follow-up period. It has been reported that, among women who were incontinent during pregnancy, the risk of UI six months postpartum decreases with weight loss from the time of delivery [25].

Despite these limitations, we obtained a clear result: persistent SUI was present in as many as 9.5% of primiparous women two years postpartum. In most cases, the women had only slight to moderate incontinence and it had relatively little impact on their quality of life. However, the most notable achievement of the present study is that we have identified higher maternal BMI at term as an independent risk factor for persistent SUI from pregnancy to two years postpartum. We were able to demonstrate this independent association taking into account a large number of constitutional, pregnancy, labour and delivery variables and among women who were continent before pregnancy. This result suggests that higher maternal BMI during pregnancy may play a role in the link between pregnancy and postpartum SUI. Our data also indicate that measures to prevent postpartum stress urinary incontinence should be taken already during pregnancy and special attention should be paid to maternal weight.

The mechanism by which increased BMI favours the presence of SUI during pregnancy and its persistence to two years postpartum remains unknown and future research is needed to investigate these associations. However, pregnant women should already be advised to modify their behaviour during pregnancy, namely to control their weight and thus reduce their risk of postpartum SUI.

Acknowledgements

This study is part of a research project supported by Health Research Fund (FIS) of the Carlos III Health Institute of the Spanish Ministry of Health (PI070261).

Conflicts of interest: none

References

1. Cutner A, Cardozo LD. The lower urinary tract in pregnancy and the puerperium. *Int Urogynecol J* 1992;3(4):317-23.
2. Viktrup L, Lose G, Rolf M, Barfoed K. The frequency of urinary symptoms during pregnancy and puerperium in the primipara. *Int Urogynecol J Pelvic Floor Dysfunct* 1993;4(1):27-30.
3. Nygaard I. Urinary incontinence: is cesarean delivery protective? *Semin Perinatol* 2006;30(5):267-71.
4. Groutz A, Gordon D, Keidar R, Lessing JB, Wolman I, David MP, et al. Stress urinary incontinence: prevalence among nulliparous compared with primiparous and grand multiparous premenopausal women. *Neurourol Urodyn* 1999;18(5):419-25.
5. Glazener CM, Herbison GP, MacArthur C, Lancashire L, McGee MA, Grant AM, et al. New postnatal urinary incontinence: obstetric and other risk factors in primiparae. *BJOG* 2006;113(2):208-17.
6. MacArthur C, Glazener C, Wilson D, Lancashire R. Persistent urinary incontinence and delivery mode history: a six-year longitudinal study. *BJOG* 2006;113(2):218-24.
7. Viktrup L, Lose G. The risk of stress incontinence 5 years after first delivery. *Am J Obstet Gynecol* 2001;185(1):82-7.
8. Groutz A, Rimon E, Peled S, Gold R, Pauzner D, Lessing JB, et al. Cesarean Section: does it really prevent the development of postpartum stress urinary incontinence? A prospective study of 363 women one year after their first delivery. *Neurourol Urodyn* 2004; 23(1):2-6.
9. Diez-Itza I, Arrue M, Ibáñez L, Paredes J, Murgiondo A, Sarasqueta C. Factors involved in stress urinary incontinence 1 year after first delivery. *Int Urogynecol J* 2010;21(4):439-45.
10. Wesnes SL, Hunskaar S, Bo K, Rortveit G. The effect of urinary incontinence status during pregnancy and delivery mode on incontinence postpartum. A cohort study. *BJOG* 2009;116(5):700-7.

11. Fritel X, Fauconnier A, Levet C, Bénifla JL. Stress urinary incontinence four years after the first delivery: a retrospective cohort study. *Acta Obstet Gynecol Scan* 2004; 83(10):941-5.
12. Van Brummen HJ, Bruinse HW, Van de Pol G, Heintz PM, Van der Vaart CH. The effect of vaginal and cesarean delivery on lower urinary tract symptoms: what makes the difference? *Int Urogynecol J* 2007;18(2):133-9.
13. Viktrup L, Rortveit G, Lose G. Risk of stress urinary incontinence twelve years after the first pregnancy and delivery. *Obstet Gynecol* 2006;108(2):248-54.
14. Hvidman L, Foldspang A, Mommsen S, Bugge Nielsen J. Correlates of urinary incontinence in pregnancy. *Int Urogynecol J Pelvic Floor Dysfunct* 2002;13(5):278-83.
15. Unemori EN, Amento EP. Relaxin modulates synthesis and secretion of procollagenase and collagen by human dermal fibroblasts. *J Biol Chem* 1990;265(18):10681-5.
16. Nel JT, Diedericks A, Joubert G, Arndt K. A prospective clinical and urodynamic study of bladder function during and after pregnancy. *Int Urogynecol J Pelvic Floor Dysfunct* 2000;12(1):21-6.
17. Chaliha C, Bland JM, Monga A, Stanton SL, Sultan AH. Pregnancy and delivery: a urodynamic viewpoint. *BJOG* 2000;107(11):1354-9.
18. Abrams P, Cardozo L, Fall M, Griffiths D, Rosier P, Ulmsten U, et al. The standardisation of terminology of lower urinary tract function: Report from the Standardisation Sub-Committee of the International Continence Society. *Neurourol Urodyn* 2002;21(2):167-78.
19. Sandvik H, Espuña M, Hunskaar S. Validity of the incontinence severity index: comparison with pad-weighing test. *Int Urogynecol J* 2006;17(5):520-4.
20. Avery K, Donovan J, Peters TJ, Shaw C, Gotoh M, et al. ICIQ: a brief and robust measure for evaluating the symptoms and impact of urinary incontinence. *Neurourol Urodynam* 2004;23(4):322-30.
21. Burgio KL, Zyczynski H, Locher JL, Richter HE, Redden DT, Wright KC. Urinary incontinence in the 12-month postpartum period. *Obstet Gynecol* 2003;102(6):1291-8.

22. Dolan LM, Walsh D, Hamilton S, Marshall K, Thompson K, Ashe RG. A study of quality of life in primigravidae with urinary incontinence. *Int Urogynecol J* 2004; 15(3):160-4.
23. Yang X, Zhang HX, Yu HY, Gao XL, Yang HX, Dong Y. The prevalence of fecal incontinence and urinary incontinence in primiparous postpartum Chinese women. *Eur J Obstet Gynecol Reprod Biol* 2010;152(2):214-7.
24. King JK, Freeman RM. Is antenatal bladder neck mobility a risk factor for postpartum stress incontinence? *Br J Obstet Gynecol* 1998;105(12):1300-7.
25. Wesnes SL, Hunskaar S, Bo K, Rortveit G. Urinary incontinence and weight change during pregnancy and postpartum: a cohort study. *Am J Epidemiol* 2010;172(9): 1034-44.

Figure 1 Flow chart of the participants in the study

Table 1 Comparison between the women who attended and did not attend the two year follow-up appointment

		Attended (n=381)	Did not attend (n=77)	<i>P</i> <i>value</i>
Maternal age (years)	Mean, SD	31.1 ± 3.6	29.3 ± 4.6	0.000
Gestational age (days)	Mean, SD	278.9 ± 9.7	279.2 ± 8.9	0.80
Maternal BMI	Mean, SD	23.3 ± 3.8	23.1 ± 2.9	0.71
SUI during pregnancy	n (%)	114 (29.9)	26 (33.8)	0.50
Mode of delivery				
Spontaneous vaginal delivery	n (%)	229 (60.1)	49 (63.6)	0.78
Forceps or spatula delivery	n (%)	84 (22)	13 (16.9)	
Vacuum delivery	n (%)	17 (4.5)	4 (5.2)	
Caesarean section	n (%)	51 (13.4)	11 (14.3)	
Augmentation with oxytocin	n (%)	296 (77.7)	59 (76.6)	0.83
Epidural anaesthesia in vaginal deliveries	n (%)	292 (95.4)	85 (94.4)	0.44
Infant birth weight (g)	Mean, SD	3307 ± 447	3317 ± 429	0.6
Pregnant again during follow-up	n (%)	109 (28.6)	21 (27.3)	0.81

BMI: body mass index; SD: standard deviation

Table 2. Results of the univariate analysis to identify variables associated with stress urinary incontinence (SUI) first occurring during pregnancy and still present two years postpartum

Constitutional, pregnancy, labour and delivery variables		Persistence of SUI from pregnancy to postpartum		<i>p</i> value
		No (n=246)	Yes (n=26)	
Maternal age (years)	Mean, SD	31.3 ± 3.6	31.5 ± 4.5	0.79
Gestational age (days)	Mean, SD	278.5 ± 9.6	279.9 ± 10.8	0.47
Maternal BMI	Mean, SD	27.8 ± 3.8	30.9 ± 5.0	0.000
Maternal weight gain in pregnancy (kg)	Mean, SD	12.5 ± 4.7	12.6 ± 4.4	0.93
Mode of delivery				
Spontaneous vaginal delivery	n (%)	147 (59.8)	16 (61.5)	0.90
Instrumental vaginal delivery	n (%)	66 (26.8)	6 (23.1)	
Caesarean section	n (%)	33 (13.4)	4 (15.4)	
2 nd stage of labor ≥ 2 hours	n (%)	68 (27.6)	8 (30.8)	0.73
Active 2 nd stage of labour ≥ 1 hour	n (%)	18 (7.3)	1 (3.8)	0.43*
Use of oxytocin	n (%)	184 (74.8)	23 (88.5)	0.12
Epidural anaesthesia	n (%)	220 (89.4)	24 (92.3)	0.64
Episiotomy	n (%)	175 (71.1)	15 (57.7)	0.15
Infant birth weight (g)	Mean, SD	3303 ± 452	3286 ± 493	0.85
Infant head circumference (cm)	Mean, SD	34.4 ± 1.4	34.3 ± 1.8	0.64

BMI: body mass index; SD: standard deviation

(*) Fisher's exact test