# Specific obstetrical risk factors for urinary versus anal incontinence 4years after first delivery.

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## *Abstract*

Aim: delivery can be complicated by urinary or anal incontinence (UI or AI). We hypothesized that the mechanisms of injury may differ for UI and AI. Hence, obstetrical risk factors may be specific for different types of incontinence.

Design: Data on maternal characteristics were collected at first delivery. Data on incontinence were obtained by a questionnaire completed by 627 women four years after first delivery. UI was defined by "Do you have involuntary loss of urine" and AI by "Do you have involuntary loss of flatus or stool". A multinomial logistic regression analysis was conducted to assess risk factors for UI only, AI only, and UI + AI.

Results: 22% of women reported UI only, 6.5% AI only, and 6.5% both. Risk factors associated with UI only were age (at 1$^{st}$ delivery) ≥ 30 (OR 2.27 [95% CI 1.47-3.49]), pre-existing UI (6.44 [2.19-19.0]) and pregnancy UI (3.64 [2.25-5.91]). Risk factors associated with AI only were length of the second active stage > 20 minutes (2.86 [1.15-7.13]) and third degree perineal tear (20.9 [1.73-252]). Significant predictors of UI+AI were age ≥ 30 (2.65 [1.29-5.46]), no epidural (4.29 [1.65-11.1]), third degree perineal tear (20.0 [1.28-314]), and UI before pregnancy (32.9 [9.00-120]). Cesarean delivery was not significantly associated with UI, AI, or UI+AI, although for all three outcomes, the adjusted odds ratios were substantially less than one.

Conclusion: We found specific associations between obstetrical risk factors and urinary versus anal incontinence four years after first delivery. Our results are consistent with the hypothesis that the underlying mechanisms of injury differ for UI and AI.



**Key-words:** urinary incontinence; anal incontinence; delivery

**Word count:** abstract 261; text 1996.

Facteurs de risque obstétricaux spécifiques de l'incontinence urinaire ou de l'incontinence anale quatre ans après le premier accouchement.


## *Résumé*

Objectif : L'accouchement peut se compliquer par une incontinence urinaire ou anale (IU ou IA). Notre hypothèse est que si les mécanismes lésionnels sont différents pour chaque incontinence, les facteurs de risque obstétricaux devraient être spécifiques à chaque type d'incontinence.

Méthodes : Les données sur la mère ont été recueillies à la première naissance. Les données sur l'incontinence ont été obtenues par un questionnaire rempli par 627 femmes, quatre ans après le premier accouchement. L'IU était définie par « Avez-vous des fuites involontaires d'urine » et l'IA par « Avez-vous des pertes involontaires de gaz ou de selles ». Une régression logistique multinomiale a été conduite afin d'estimer les facteurs de risque pour l'IU isolée, l'IA isolée, et IU+IA.

Résultats : 22% des femmes avaient une IU isolée, 6,5% une IA isolée, et 6,5% les deux à la fois. Les facteurs de risque associés à l'IU isolée étaient un âge (au 1er accouchement) ≥ 30 ans (OR 2,27 [IC 95% 1,47-3,49]), une IU préexistante (6,44 [2,19-19,0]), et une IU de la grossesse (3,64 [2,25-5,91]). Les facteurs de risque associés à l'IA isolée étaient une durée des efforts expulsifs > 20 minutes (2,86 [1,15-7,13]) et un périnée complet (20,0 [1,28-314]). Les facteurs de risques pour IU+IA étaient un âge ≥ 30 ans (2,65 [1,29-5,46]), l'absence de péridurale (4,29 [1,65-11,1]), un périnée complet (20,0 [1,28-314]), et une IU préexistante à la grossesse (32,9 [9,00-120]). L'accouchement par césarienne n'était pas significativement associée à l'IU isolée, à IA isolée, ou IU+IA, bien que pour les trois, les OR ajustés étaient sensiblement inférieur à un.

Conclusion : Nous avons trouvé des associations spécifiques entre des facteurs obstétricaux et l'incontinence urinaire ou anale quatre ans après le premier accouchement. Nos résultats sont compatibles avec l'hypothèse que les mécanismes lésionnels diffèrent pour l'IU et l'IA.



Mots-clés: incontinence urinaire ; incontinence anale ; accouchement

## *Introduction*

First childbirth may become complicated by urinary or anal incontinence (UI or AI). The exact pathophysiology of postnatal incontinence is not well understood. Observable lesions such as third degree perineal tears can explain anal incontinence but this occurs in only a minority of deliveries. Other occult injury to the pelvic floor, e.g., pudendal neuropathy or levator ani muscle avulsion could affect urinary or anal continence.[1] The pudendal nerve innervates striated muscles of the pelvic floor, including levator ani, urethral sphincter and anal sphincter. Risk factors for pudendal nerve damage during childbirth are birth weight > 4 kg and a second active stage longer than 30 minutes.[2] The levator ani muscle which is involved in the maintenance of the urinary and anal continence can also be injured at the time of childbirth. Using MRI findings, DeLancey reported injuries of the levator ani in 20% of primiparous women and Dietz found lesions in 36% of women using sonography.[3,4] Risk factors for the lesions of the levator ani during childbirth are advanced maternal age, forceps delivery and the duration of the second stage.[5] The two sphincteric (urinary and anal) complexes are also bound by crossed reflex like the vesico-anal reflex.[6]

Previous literature has not elucidated to what extent postnatal urinary incontinence and postnatal anal incontinence result from the same underlying mechanisms of injury. The analysis of risk factors associated with postnatal incontinence suggests that certain risk factors such as advanced maternal age and parity may be common to both UI and AI.[7,8] Other risk factors may be more specifically associated with one type of incontinence. For example, UI during pregnancy has been found to be a specific risk factor for postnatal UI and instrumental vaginal childbirth for postnatal AI.[9,10]

We hypothesized that pregnancy and delivery-associated traumatic mechanisms at the origin of postnatal incontinence differ at least to some extent for UI and AI. Therefore, specific obstetrical risk factors are likely to be associated with different types of incontinence. The analysis of risk factors related to stress UI was published previously for a portion of the population.[11] To complete this objective we performed a secondary analysis in the whole sample of primiparous to identify both risk factors that may be common to UI and AI, and those that may be specifically associated with different types of postnatal incontinence, four years after a 1$^{st}$ delivery.

## *Materials and Methods*

Our data were initially collected for a study aimed at comparing the risk of incontinence for women delivering in two maternity units.[12] One maternity had a policy of systematic episiotomy and the other a restrictive policy for episiotomy. The study population includes nulliparous women who delivered a live-born singleton at 37-41 weeks in cephalic presentation in 1996. Mothers whose current mailing address was not known (and those deceased) were excluded. Data on maternal characteristics (age, height, weight), pregnancy (gestational age, epidural, second active stage duration, delivery mode, newborns' birthweight) were collected at the time of childbirth. Women were asked to provide information about pelvic floor disorders using a postal questionnaire, which was sent four years after childbirth. In the absence of response to the first mail, a second and if necessary a third mail was sent. The questionnaire collected data about profession and education level of the mother, interventions on the pelvic floor since childbirth, new pregnancies and pelvic floor symptoms. Urinary incontinence was defined by a positive response (Yes) to the question "Do you have involuntary loss of urine?" and anal incontinence was defined by the answer "Yes" to "Do you have involuntary loss of flatus or stool?" The type of UI was defined using a validated questionnaire (Bristol Female Lower Urinary Tract Symptoms questionnaire),[13] severity of UI was measured with Sandvik's score,[14] and AI was assessed using Pescatori's score,[15] as detailed in a previous publication.[12] The complete questionnaire used for the study is available online. The choice of cut-off values for continuous variables (maternal age < 30, BMI < 25 kg/m², gestational age < 40 weeks, active second stage length > 20 minutes, newborn weight < 4000g) was done a priori. We found no evidence of a difference in the risk of urinary incontinence four years after 1st childbirth for women delivering in the two maternity units. However, the risk of anal incontinence was slightly higher for women who delivered in the maternity with a policy of systematic episiotomy.[12] Using data from this enquiry, we first examined risk factors associated with each type of incontinence (UI or AI) using two separate logistic regression models adjusted on maternity. All significant risk factors for UI or AI were then included in a multinomial logit analysis to assess specific risk factors for the following outcomes: UI only, AI only, and UI + AI. Variables for mode of delivery, third degree perineal tear and maternity unit were forced in the model irrespective of their statistical significance in the logistic models. We used estimates of the odds ratios in the multinomial model for each risk factor and outcome in

order to examine the extent to which specific risk factors may be associated with different types of incontinence.

We complied with French laws on data confidentiality, and restrictions on type of data collected (e.g. no religious or racial data). Informed consent was obtained from all study participants.

## *Results*

Among the 1323 primiparous women who met inclusion criteria, postal address was no longer valid for 548 (41%) and one had died, 774 (59%) women received the postal questionnaire and 627 (81 %) completed it. The first delivery was spontaneous vaginal in 368 cases, instrumental in 209 cases (95 by vacuum) and by cesarean section for 50 women. Continence disorders four years after 1st childbirth of the 627 women who responded are summarized in Table 1. The prevalence of UI was 29% (N=181) and that of AI 13% (82), 22% of women (140) reported UI only, 6.5% (41) AI only, and 6.5% (41) both UI and AI.

Risk factors for UI (with or without AI) were maternal age ≥ 30 at 1st delivery (adjusted OR, 2.3 [95% CI 1.5-3.4]), UI before 1st pregnancy (10.2 [3.7-28.1]), and UI during 1st pregnancy (3.3 [2.1-5.1]). Risk factors for AI (with or without UI) were UI before 1st pregnancy (adjusted OR 5.2 [95% CI 2.3-11.8]), no epidural (versus yes) during 1st delivery (2.4 [1.2-4.8]), second active stage > 20 min (2.5 [1.2-5.1]), and occurrence of 3rd degree perineal tear during 1st delivery (13.3 [2.1-83.0]). Other factors tested and non-significant were: education level, a BMI greater than 25 kg/m², gestational age at first delivery, a first newborn over 4000g, pelvic floor exercises after first delivery, episiotomy at first delivery, a second delivery (this concerns 381 women), and an ongoing pregnancy (see online additional tables S1 and S2).

Table 2 presents the results of the multinomial logistic regression analysis to assess specific risk factors associated with UI only, AI only, and UI+AI. Estimates suggested that different risk factors were associated with the three outcomes. Risk factors associated with UI only were maternal age at delivery ≥ 30 (adjusted OR 2.3 [95% CI 1.5-3.5]), pre-existing UI (6.4 [2.2-19.0]) and UI during pregnancy (3.6 [2.2-5.9]), whereas risk factors for AI only were duration of the second active stage > 20 min (2.9 [1.1-7.1]), and 3rd degree perineal tear (20.9 [1.7-252]). Risk factors significantly associated with UI + AI were maternal age > 30 years (2.6 [1.3-5.5]), UI before pregnancy (32.9 [9.0-120]), no epidural (4.3 [1.6-11.1]) and 3rd degree perineal tear (20.0 [1.3-314]).

## *Discussion*

To our knowledge, this is one of the few studies that evaluated specific risk factors associated with UI and AI four years after 1st delivery. One previous study, which looked at specific risk factors for UI and AI, was based on data collected six months after first childbirth.[16] This study found that risk factors were different for postnatal UI (shoulder dystocia and vaginal delivery) vs. postnatal AI (age over 35 years, smoking, duration of the second stage of labor more than an hour and third degree perineal tear).

We found that different risk factors were associated with UI only (i.e., without AI), AI only, and UI + AI four years after 1st delivery. Risk factors for UI only were maternal age at 1st delivery ≥ 30, pre-existing UI and pregnancy UI. Risk factors associated with AI only were length of the second active stage > 20 min and 3rd degree perineal tear. Risk factors associated with UI + AI were age ≥ 30, no epidural, 3rd degree perineal tear, and UI before pregnancy.

The relatively long period of follow-up in our study (four years after 1st delivery) is an important advantage as the prevalence of postpartum UI tends to decrease spontaneously in the 1st postpartum year.[17] Nevertheless, our study has certain limitations. The sample size of the study was based on the number of subjects needed to have sufficient power for showing a difference in the outcomes between the two maternities that had different policies for episiotomy in our initial study.[12] The study was not specifically designed to have sufficient power to explore the specific effects associated with different risk factors. Indeed, the confidence intervals for the estimates of the effects for several risk factors were wide and lack of sufficient power may explain the absence of statistically significant results for some of the risk factors in the present study. In particular, the lack of statistical significance for the associations between mode of delivery and outcomes (different types of incontinence) is likely to be due to insufficient power. It is worth noting that the point estimates (odds ratios) suggested a lower, albeit not statistically significant, risk for all three outcomes (UI only, AI only and UI+AI) for women who delivered following a cesarean section. For reasons of statistical power we also renounced conduct an analysis based on the type of instrument used for delivery (forceps or vacuum).

Our findings of specific associations between obstetric risk factors and prevalence of UI only, AI only and UI+AI may be due to differences in the underlying mechanisms of injury for different types of incontinence. The two main mechanisms proposed to explain postnatal AI are sphincter injury and pudendal neuropathy. In our study, the specific risk factors for AI

(third degree perineal tear and prolonged second active stage) are compatible with these mechanisms. Prolonged active second stage is associated with pudendal nerve damage.[2] Even following repair, 3rd degree perineal tear is associated with anal incontinence years after delivery.[18]

Concerning postnatal stress urinary incontinence, the mechanisms of injury are still largely unknown.[17] Vaginal birth is likely to increase the mobility of the urethra or to be accompanied by lesions of the levator ani.[3,4] However, urethra mobility returns to prenatal values a few months after delivery.[19] Wijma *et al.* found no relation between urethra mobility and postnatal UI.[20] Dietz and Lanzarone found no link between levator ani avulsion and postnatal stress UI.[4] DeLancey *et al.* reported that only 16% of postnatal stress UI could be explained by urethra mobility, whereas urethra closing pressure could account for 25% of postnatal de novo stress UI.[21] The relation between urethra closure pressure and pregnancy remains unclear. Iosif *et al*. found closure pressure to increase during pregnancy and to decrease after delivery, while Le Coutour *et al.* reported opposite findings.[22,23] In our study, the finding of an association between maternal age and UI could be explained by a lower urethra closure pressure as the latter is known to decrease with increasing maternal age.[24] We are not aware of any studies that have examined the link between pregnancy UI and urethra closure pressure or urethral mobility.[17]

In conclusion, our results suggest that urinary incontinence and anal incontinence four years after 1st delivery do not share the same set of risk factors. These results are consistent with the hypothesis that the underlying mechanisms of postnatal incontinence differ for urinary versus anal incontinence. This implies in turn that different strategies may be needed for prevention of urinary and anal incontinence.

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## *Table 1*

Continence complaints 4 years after 1st childbirth. Where percentages do not add to 100%, there were some missing data (from 0 to 3.3%).

Troubles de la continence 4 ans après le premier accouchement. Quand la somme des pourcentages est inférieure à 100% c'est le signe de quelques données manquantes (de 0 à 3,3%).

| Continence troubles 4 years after 1st childbirth | | |
|---|---|---|
| | N = 627 | n (%) |
| Urinary Incontinence (UI) | no | 438 (71) |
| | yes | 181 (29) |
| Severity of UI | no UI | 438 (71) |
| (Sandvik score) | slight | 110 (18) |
| | Moderate | 42 (7) |
| | Severe | 16 (3) |
| Type of UI | stress | 55 (30) |
| (% among women with UI) | urgency | 12 (7) |
| | mixed | 109 (60) |
| UI bothersome | *Not a problem* | 24 (13) |
| (% among women with UI) | *A bit of a problem* | 107 (59) |
| | *Quite a problem* | 27 (15) |
| | *A serious problem* | 17 (9) |
| Anal Incontinence (AI) | no | 525 (84) |
| | yes | 82 (13) |
| Type of AI | Flatus only | 64 (78) |
| (% among women with AI) | Stool | 18 (22) |
| AI bothersome | *Not a problem* | 1 (1) |
| (% among women with AI) | *A bit of a problem* | 36 (44) |
| | *Quite a problem* | 13 (16) |
| | *A serious problem* | 30 (37) |

## *Table 2*

Risk factors for urinary incontinence (UI) only, anal incontinence (AI) only, and UI+AI. Multinomial logistic regression adjusted on maternity. Other factors tested and non-significant were: education level, a BMI greater than 25 kg/m², gestational age at first delivery, a first newborn over 4000g, pelvic floor exercises after first delivery, episiotomy at first delivery, a second delivery, and an ongoing pregnancy. Case numbers may not add up because of some missing data for given risk factors (from 0 to 4.6%).

Facteurs de risque d'incontinence urinaire (IU) isolée, d'incontinence anale (IA) isolée, et d'IU+IA. Régression logistique multinomiale ajusté sur la maternité. Les autres facteurs testés et non-significatifs sont les suivants : le niveau scolaire, un BMI supérieur à 25 kg/m², l'âge gestationnel au premier accouchement, un premier enfant de plus de 4000g, une rééducation périnéale après le premier accouchement, un nouvel accouchement, et une grossesse en cours. Le nombre de sujet peut être inférieur à ce qui est attendu en raison de données manquantes pour certains facteurs de risque (de 0 à 4,6%).

| Variable | | (N) | UI only adjusted OR (CI 95%) | AI only adjusted OR (CI 95%) | IU+IA adjusted OR (CI 95%) |
|---|---|---|---|---|---|
| Age at 1st childbirth | < 30 years | (415) | **1** | 1 | **1** |
| | ≥ 30 years | (212) | **2.27 (1.47-3.49)** | 1.34 (0.65-2.73) | **2.65 (1.29-5.46)** |
| UI before pregnancy | no | (565) | **1** | 1 | **1** |
| | yes | (33) | **6.44 (2.19-19.0)** | 2.02 (0.21-18.9) | **32.9 (9.00-120)** |
| UI during pregnancy | no | (468) | **1** | 1 | 1 |
| | yes | (133) | **3.64 (2.25-5.91)** | 1.57 (0.64-3.90) | 1.87 (0.77-4.55) |
| Epidural | no | (101) | 0.96 (0.51-1.78) | 1.52 (0.59-3.92) | **4.29 (1.65-11.1)** |
| | yes | (526) | 1 | 1 | **1** |
| Second active stage | ≤ 20 minutes | (561) | 1 | **1** | 1 |
| | > 20 minutes | (59) | 1.26 (0,62-2,57) | **2.86 (1.15-7.13)** | 2.29 (0.73-7.15) |
| Mode of delivery | spontaneous | (368) | 1 | 1 | 1 |
| | instrumental | (209) | 1.16 (0.74-1.81) | 1.11 (0.54-2.31) | 0.96 (0.43-2.11) |
| | cesarean | (50) | 0.54 (0.22-1.31) | 0.61 (0.14-2.79) | 0.28 (0.05-1.70) |
| Third degree perineal tear | no | (621) | 1 | **1** | **1** |
| | yes | (6) | 3.67 (0.22-61.3) | **20.9 (1.73-252)** | **20.0 (1.28-314)** |