

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

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► **To cite this version:**

Xavier Fritel, Babak Khoshnood, Arnaud Fauconnier. Specific obstetrical risk factors for urinary versus anal incontinence 4years after first delivery.. Progrès en Urologie, Elsevier Masson, 2013, 23 (11), pp.911-6. 10.1016/j.purol.2013.06.009 . inserm-00870500

**HAL Id: inserm-00870500**

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Submitted on 7 Oct 2013

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1 Specific obstetrical risk factors for urinary versus anal incontinence four years after first  
2 delivery.

### 3 **Abstract**

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

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

12 Results: 22% of women reported UI only, 6.5% AI only, and 6.5% both. Risk factors  
13 associated with UI only were age (at 1<sup>st</sup> delivery)  $\geq 30$  (OR 2.27 [95% CI 1.47-3.49]), pre-  
14 existing UI (6.44 [2.19-19.0]) and pregnancy UI (3.64 [2.25-5.91]). Risk factors associated  
15 with AI only were length of the second active stage  $> 20$  minutes (2.86 [1.15-7.13]) and third  
16 degree perineal tear (20.9 [1.73-252]). Significant predictors of UI+AI were age  $\geq 30$  (2.65  
17 [1.29-5.46]), no epidural (4.29 [1.65-11.1]), third degree perineal tear (20.0 [1.28-314]), and  
18 UI before pregnancy (32.9 [9.00-120]). Cesarean delivery was not significantly associated  
19 with UI, AI, or UI+AI, although for all three outcomes, the adjusted odds ratios were  
20 substantially less than one.

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

24

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

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

27

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

### 30 **Résumé**

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

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

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

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

54

55 Mots-clés: incontinence urinaire ; incontinence anale ; accouchement

56

## 57 **Introduction**

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

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

79 We hypothesized that pregnancy and delivery-associated traumatic mechanisms at the origin  
80 of postnatal incontinence differ at least to some extent for UI and AI. Therefore, specific  
81 obstetrical risk factors are likely to be associated with different types of incontinence. The  
82 analysis of risk factors related to stress UI was published previously for a portion of the  
83 population.<sup>11</sup> To complete this objective we performed a secondary analysis in the whole  
84 sample of primiparous to identify both risk factors that may be common to UI and AI, and  
85 those that may be specifically associated with different types of postnatal incontinence, four  
86 years after a 1<sup>st</sup> delivery.

87

## 88 **Materials and Methods**

89 Our data were initially collected for a study aimed at comparing the risk of incontinence for  
90 women delivering in two maternity units.<sup>12</sup> One maternity had a policy of systematic  
91 episiotomy and the other a restrictive policy for episiotomy. The study population includes  
92 nulliparous women who delivered a live-born singleton at 37-41 weeks in cephalic  
93 presentation in 1996. Mothers whose current mailing address was not known (and those  
94 deceased) were excluded. Data on maternal characteristics (age, height, weight), pregnancy  
95 (gestational age, epidural, second active stage duration, delivery mode, newborns'  
96 birthweight) were collected at the time of childbirth. Women were asked to provide  
97 information about pelvic floor disorders using a postal questionnaire, which was sent four  
98 years after childbirth. In the absence of response to the first mail, a second and if necessary a  
99 third mail was sent. The questionnaire collected data about profession and education level of  
100 the mother, interventions on the pelvic floor since childbirth, new pregnancies and pelvic  
101 floor symptoms. Urinary incontinence was defined by a positive response (Yes) to the  
102 question "Do you have involuntary loss of urine?" and anal incontinence was defined by the  
103 answer "Yes" to "Do you have involuntary loss of flatus or stool?" The type of UI was  
104 defined using a validated questionnaire (Bristol Female Lower Urinary Tract Symptoms  
105 questionnaire),<sup>13</sup> severity of UI was measured with Sandvik's score,<sup>14</sup> and AI was assessed  
106 using Pescatori's score,<sup>15</sup> as detailed in a previous publication.<sup>12</sup> The complete questionnaire  
107 used for the study is available online. The choice of cut-off values for continuous variables  
108 (maternal age < 30, BMI < 25 kg/m<sup>2</sup>, gestational age < 40 weeks, active second stage length >  
109 20 minutes, newborn weight < 4000g) was done a priori. We found no evidence of a  
110 difference in the risk of urinary incontinence four years after 1<sup>st</sup> childbirth for women  
111 delivering in the two maternity units. However, the risk of anal incontinence was slightly  
112 higher for women who delivered in the maternity with a policy of systematic episiotomy.<sup>12</sup>  
113 Using data from this enquiry, we first examined risk factors associated with each type of  
114 incontinence (UI or AI) using two separate logistic regression models adjusted on maternity.  
115 All significant risk factors for UI or AI were then included in a multinomial logit analysis to  
116 assess specific risk factors for the following outcomes: UI only, AI only, and UI + AI.  
117 Variables for mode of delivery, third degree perineal tear and maternity unit were forced in  
118 the model irrespective of their statistical significance in the logistic models. We used  
119 estimates of the odds ratios in the multinomial model for each risk factor and outcome in

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

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

125

126 **Results**

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

134 Risk factors for UI (with or without AI) were maternal age  $\geq 30$  at 1<sup>st</sup> delivery (adjusted OR,  
135 2.3 [95% CI 1.5-3.4]), UI before 1<sup>st</sup> pregnancy (10.2 [3.7-28.1]), and UI during 1<sup>st</sup> pregnancy  
136 (3.3 [2.1-5.1]). Risk factors for AI (with or without UI) were UI before 1<sup>st</sup> pregnancy  
137 (adjusted OR 5.2 [95% CI 2.3-11.8]), no epidural (versus yes) during 1<sup>st</sup> delivery (2.4 [1.2-  
138 4.8]), second active stage  $> 20$  min (2.5 [1.2-5.1]), and occurrence of 3<sup>rd</sup> degree perineal tear  
139 during 1<sup>st</sup> delivery (13.3 [2.1-83.0]). Other factors tested and non-significant were: education  
140 level, a BMI greater than 25 kg/m<sup>2</sup>, gestational age at first delivery, a first newborn over  
141 4000g, pelvic floor exercises after first delivery, episiotomy at first delivery, a second  
142 delivery (this concerns 381 women), and an ongoing pregnancy (see online additional tables  
143 S1 and S2).

144 Table 2 presents the results of the multinomial logistic regression analysis to assess specific  
145 risk factors associated with UI only, AI only, and UI+AI. Estimates suggested that different  
146 risk factors were associated with the three outcomes. Risk factors associated with UI only  
147 were maternal age at delivery  $\geq 30$  (adjusted OR 2.3 [95% CI 1.5-3.5]), pre-existing UI (6.4  
148 [2.2-19.0]) and UI during pregnancy (3.6 [2.2-5.9]), whereas risk factors for AI only were  
149 duration of the second active stage  $> 20$  min (2.9 [1.1-7.1]), and 3<sup>rd</sup> degree perineal tear (20.9  
150 [1.7-252]). Risk factors significantly associated with UI + AI were maternal age  $> 30$  years  
151 (2.6 [1.3-5.5]), UI before pregnancy (32.9 [9.0-120]), no epidural (4.3 [1.6-11.1]) and 3<sup>rd</sup>  
152 degree perineal tear (20.0 [1.3-314]).

153

154 **Discussion**

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

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

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

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



186 (third degree perineal tear and prolonged second active stage) are compatible with these  
187 mechanisms. Prolonged active second stage is associated with pudendal nerve damage.<sup>2</sup> Even  
188 following repair, 3<sup>rd</sup> degree perineal tear is associated with anal incontinence years after  
189 delivery.<sup>18</sup>

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

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

209

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**Table 1**

Continence complaints 4 years after 1<sup>st</sup> 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 1 <sup>st</sup> childbirth |                           |          |
|--|---------------------------|----------|
|  | N = 627                   | n (%)    |
| Urinary Incontinence (UI)                                    | no                        | 438 (71) |
|  | yes                       | 181 (29) |
| Severity of UI<br>(Sandvik score)                            | no UI                     | 438 (71) |
|  | slight                    | 110 (18) |
|  | Moderate                  | 42 (7)   |
|  | Severe                    | 16 (3)   |
| Type of UI<br>(% among women with UI)                        | stress                    | 55 (30)  |
|  | urgency                   | 12 (7)   |
|  | mixed                     | 109 (60) |
| UI bothersome<br>(% among women with UI)                     | <i>Not a problem</i>      | 24 (13)  |
|  | <i>A bit of a problem</i> | 107 (59) |
|  | <i>Quite a problem</i>    | 27 (15)  |
|  | <i>A serious problem</i>  | 17 (9)   |
| Anal Incontinence (AI)                                       | no                        | 525 (84) |
|  | yes                       | 82 (13)  |
| Type of AI<br>(% among women with AI)                        | Flatus only               | 64 (78)  |
|  | Stool                     | 18 (22)  |
| AI bothersome<br>(% among women with AI)                     | <i>Not a problem</i>      | 1 (1)    |
|  | <i>A bit of a problem</i> | 36 (44)  |
|  | <i>Quite a problem</i>    | 13 (16)  |
|  | <i>A serious problem</i>  | 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/m<sup>2</sup>, 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/m<sup>2</sup>, 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                          |              | UI only<br>adjusted OR<br>(N) (CI 95%) | AI only<br>adjusted OR<br>(CI 95%) | IU+IA<br>adjusted OR<br>(CI 95%) |
|-----------------------------------|--------------|--|------------------------------------|----------------------------------|
| Age at 1 <sup>st</sup> childbirth | < 30 years   | (415) <b>1</b>                         | 1                                  | <b>1</b>                         |
|                                   | ≥ 30 years   | (212) <b>2.27 (1.47-3.49)</b>          | 1.34 (0.65-2.73)                   | <b>2.65 (1.29-5.46)</b>          |
| UI before pregnancy               | no           | (565) <b>1</b>                         | 1                                  | <b>1</b>                         |
|                                   | yes          | (33) <b>6.44 (2.19-19.0)</b>           | 2.02 (0.21-18.9)                   | <b>32.9 (9.00-120)</b>           |
| UI during pregnancy               | no           | (468) <b>1</b>                         | 1                                  | 1                                |
|                                   | yes          | (133) <b>3.64 (2.25-5.91)</b>          | 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)                   | <b>4.29 (1.65-11.1)</b>          |
|                                   | yes          | (526) <b>1</b>                         | 1                                  | <b>1</b>                         |
| Second active stage               | ≤ 20 minutes | (561) <b>1</b>                         | <b>1</b>                           | 1                                |
|                                   | > 20 minutes | (59) 1.26 (0.62-2.57)                  | <b>2.86 (1.15-7.13)</b>            | 2.29 (0.73-7.15)                 |
| Mode of delivery                  | spontaneous  | (368) <b>1</b>                         | 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) <b>1</b>                         | <b>1</b>                           | <b>1</b>                         |
|                                   | yes          | (6) 3.67 (0.22-61.3)                   | <b>20.9 (1.73-252)</b>             | <b>20.0 (1.28-314)</b>           |