



# PELVIC FLOOR DYSFUNCTION 6 YEARS POST VAGINAL VERSUS CESAREAN DELIVERY

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1 **PELVIC FLOOR DYSFUNCTION 6 YEARS POST VAGINAL VERSUS CESAREAN**  
2 **DELIVERY**

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1 **Running foot**

2 Long term pelvic floor dysfunction after vaginal versus cesarean deliveries

3

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21 **Précis**

22 After 6 years, women who had uncomplicated vaginal deliveries experienced more fecal and  
23 urinary symptoms, while sexual dysfunction was more frequently reported after elective  
24 cesarean delivery.

25

1 **ABSTRACT**

2

3 *OBJECTIVE:*

4 To estimate fecal, urinary and sexual symptoms 6 years after uncomplicated vaginal versus  
5 elective cesarean deliveries.

6

7 *METHODS:*

8 Patients who delivered 6 years (2000-2004) before this study were chosen at random from our  
9 hospital database. Singleton elective cesarean deliveries (eCS, cases) were compared to  
10 uncomplicated vaginal deliveries (uVD, controls). Validated questionnaires grading fecal,  
11 urinary incontinence and sexual dysfunction were completed by the patients.

12

13 *RESULTS:*

14 A total of 309 women with uVD and 208 with eCS returned postal questionnaires in 2008.  
15 Socio-demographic characteristics and fecal incontinence were similar between groups. After  
16 eCS, women reported significantly less urge urinary incontinence (aOR 0.55; 95%CI 0.34-0-  
17 88) and stress incontinence (aOR 0.53; 95%CI 0.35-0-80) than after uVD. However, pain  
18 associated with urination (aOR 1.58; 95%CI 1.01-2.49) and sexual activity (aOR 0.40; 95%CI  
19 0.19-0.84) was significantly more frequent after eCS than uVD.

20

21 *CONCLUSION:*

22 Six years postpartum, uVD is strongly associated with urinary incontinence, while eCS is  
23 associated with sexual and urination pains.

24

25 **Key words** Pelvic floor dysfunction, incontinence, vaginal delivery, cesarean section

26

## 1 INTRODUCTION

2 To many authors, long term pelvic floor dysfunctions are caused by vaginal delivery<sup>1</sup>.  
3 Vaginal delivery is known to cause pelvic floor muscles and nerves traumatism, short- and  
4 long-term damages to pelvic organs, thus inducing urinary, anorectal or sexual dysfunctions.  
5 Elective cesarean section without labor is supposed to protect from pelvic floor dysfunctions,  
6 thus potentially increasing the rate of this procedure<sup>1, 2</sup>. However, there are conflicting  
7 evidences as to whether an elective cesarean section confers or not a protective effect against  
8 these pelvic dysfunctions.

9 Because of pelvic floor dysfunctions' latency, studies concerning a relationship between  
10 childbirth and pelvic floor dysfunctions are difficult to establish<sup>3</sup>.

11 However, some studies<sup>2, 4</sup> suggest that women who sustained a vaginal delivery have a higher  
12 risk to develop pelvic floors dysfunctions than women with cesarean section; whereas others  
13 defend the vaginal delivery and claim that the pregnancy in itself is one of the major risk  
14 factors, at least for stress urinary incontinence<sup>5</sup>. In the literature, there are many studies  
15 analyzing one or two aspects of the pelvic organs. In our study, we aimed to compare three  
16 spheres: urinary, anorectal and sexual functions. We allowed a complete vision of the  
17 problematic and a better overview of the different dysfunctions caused by the vaginal  
18 delivery.

19 To evaluate long-term urinary, anorectal, and sexual function, we analysed outcomes of a  
20 cohort of patients who sustained elective cesarean section (CS) compare to outcomes of a  
21 cohort of uncomplicated vaginal delivery (VD).

22 This study investigated the whole spectrum of pelvic dysfunctions and gave accurate update  
23 of the multiple long-term dysfunctions caused by the different mode of delivery.

24 To evaluate the long-term impact of the mode of delivery, we used validated questionnaires  
25 concerning fecal, urinary and sexual function.

26

## 1 MATERIALS AND METHODS

2 The case-control study was designed in 2008 using our obstetrical database at the Maternity  
3 Hospital of the Centre Hospitalier Universitaire Vaudois in Lausanne, Switzerland (33'274  
4 patients delivered between 1996 and 2011). The quality of this database of prospectively  
5 collected data has already been described elsewhere (cross-check congruent data in 98.2-  
6 99.8% of the cases)<sup>6</sup>.

7 To estimate a sample size, we used studies that compare urinary incontinence rates after  
8 vaginal (23-25%) versus cesarean deliveries (10-16%)<sup>7, 8</sup>. On the basis of these estimates, a  
9 sample size of 213 patients in each group would have an 80% power to detect a 11%  
10 difference with a significance level of 0.05. Similar sample size was calculated for fecal  
11 incontinence.

12 The literature was insufficient to determine the sample size necessary for the other pelvic  
13 floor functions. Based on a 35% response rate we previously observed<sup>6</sup>, a total of 1217  
14 patients would be necessary.

15 In order to compare the results with our previous work investigating "Pelvic floor dysfunction  
16 6 years post-anal sphincter tear at the time of vaginal delivery"<sup>6</sup> and with other studies in the  
17 field<sup>7, 9, 10</sup>, patients who delivered 6 years before this study were chosen at random from our  
18 hospital database (from 2000 to end 2003). During that period, the number of vaginal  
19 deliveries exceeds the number of cesarean deliveries. For this reason, 800 uncomplicated  
20 vaginal deliveries (vaginal tears of maximal grade 1, uVD, controls) and 500 singleton  
21 elective cesarean deliveries (eCS, cases) were selected (n=1300). These deliveries are referred  
22 to throughout as the 'index deliveries'.

23 Both groups received the same questionnaires by post mail, Non-responders received a  
24 second mail 2-3 months later. A total of 98 patients (7.5%) had no longer address mentioned  
25 during last consultation at our hospital. These women's current home address was traced

1 using phone or internet directories. Sixty-nine (5.3%) women were not located. Help for  
2 translation (n=6) had been proposed to women who were not fluent in French, either by a  
3 nurse or a midwife. The Ethical Committee of the University and the Hospital approved the  
4 study. Responding to the questionnaires was considered informed consent for our study's  
5 participation.

6 Current socio-demographic and physical patients' characteristics were registered using self-  
7 reported questionnaires. Obstetrical history and mode of delivery of subsequent birth (that  
8 might have occurred in other hospitals) were also collected with a self-questionnaire.  
9 Multiparus patients who delivered by both modes of delivery were excluded from the analysis  
10 (n=87). Four validated questionnaires were used: the short forms of the Urogenital Distress  
11 Inventory (UDI-6) and the Incontinence Impact Questionnaire (IIQ-7)<sup>11, 12</sup>; Wexner fecal  
12 incontinence scale<sup>13</sup>; and the Female Sexual Function Index (FSFI)<sup>14, 15</sup>.

13 The validated UDI-6 questionnaire measures the bothersomeness of incontinence symptoms,  
14 with higher scores indicating a greater degree of bothersomeness or a worse quality of life<sup>11</sup>  
15 (Table 2). Severe urinary incontinence was defined as a UDI-6 score  $\geq 3$ . The IIQ-7 measures  
16 the impact of urinary incontinence on activities, roles, and emotional states (Table 3): higher  
17 scores indicating a greater impact/worse quality of life. For both questionnaires, each item is  
18 categorised by the frequency of occurrence or the degree of discomfort (never, slightly,  
19 moderately and much).

20 Fecal incontinence was evaluated using Wexner fecal incontinence scale<sup>13</sup>. The Wexner scale  
21 consists of eight items (Table 4), each item scores between 0 and 4 related to the frequency of  
22 occurrence (0 absent, 1 less than once a month, 2 less than once a week, 3 less than once a  
23 day, 4 daily). A Wexner score of zero means absence of anal incontinence, and a score of 20  
24 means complete incontinence. Severe fecal incontinence was defined as a Wexner score  $\geq 3$ .

1 The FSFI is a validated instrument for sexual function assessment. This multidimensional  
2 score combines 18 questions shared in 6 subscales (desire, arousal, lubrication, orgasm,  
3 satisfaction and pain). The score ranges from 2 to 36: low scores signifying sexual  
4 impairment or little to absence of sexual activity while high scores represent a high sexual  
5 activity and great satisfaction. Severe sexual dysfunction was defined as FSFI scores  $\leq 25$ .  
6 As we expected that most women would not report any symptoms and to avoid reporting very  
7 skewed distributions, we dichotomized ordinal outcomes of each questionnaire. The effect of  
8 the exposure, demographic data and risk factors were compared between both groups using  
9 the Pearson  $\chi^2$  test (or the Fisher exact test when indicated) for categorical variables. For  
10 continuous variables, medians were compared using the Wilcoxon-Mann-Whitney test.  
11 Relative risks adjusted for all variables of Table 1 were also calculated. Statistical analyses  
12 were performed using STATA 13.0 (Stata Corporation, College Station, USA).

13



## 1 **RESULTS**

2 Among the 1231 (94.7%) women who were localized, 604 (49%) completed the  
3 questionnaires, including 208 CS, 309 VD and 87 patients who delivered by another mode of  
4 delivery after the index pregnancy and were thus excluded from the analysis. Socio-  
5 demographic and obstetrical characteristics at index pregnancy of responders and non-  
6 responders/lost patients were similar (data not shown).

7 Regarding the index delivery, both gestational age at birth (39.6 versus 39.5 weeks,  $p=0.57$ )  
8 and neonatal weight (3263g versus 3234g,  $p=0.51$ ) were similar between VD and CS groups,  
9 respectively. The reasons for elective CS were breech/transverse presentations ( $n=64$ ),  
10 maternal wish ( $n=58$ ), pre-eclampsia ( $n=18$ ), low-lying placenta ( $n=15$ ), genital  
11 herpes/HIV/Hepatitis-C ( $n=9$ ), declined vaginal birth after previous cesarean section ( $n=33$ )  
12 and other ( $n= 11$ ).

13 Table 1 shows women socio-demographic characteristics of both groups at the time the  
14 patients returned back the questionnaires. The mean time between index delivery and the  
15 submission of the questionnaires was 6.7 and 6.3 years for women having had a VD and a CS,  
16 respectively ( $p=0.157$ ). VD and CS did not exhibit any significant differences, except for  
17 marital status and religion. Data presented below are adjusted for all variables presented in  
18 Table 1. All significant univariate analysis remained significant after adjustment in  
19 multivariate analysis.

20 The results of the UDI-6 questionnaire are presented in Table 2. After a CS, women were  
21 significantly less likely to be bothered by urge incontinence (adjusted Relative risk [aRR]  
22 0.55; 95% Confidence Intervals [95%CI] 0.34-0.88) and urine leakage related to physical  
23 activity (aRR 0.53; 95%CI 0.35-0.80) compared to women who had VD. Similar association  
24 can be observed for frequent urination, without to reach statistical significance. In contrast,  
25 women were more likely to complain lower abdominal after CS compared to VD women

1 (aRR 1.58; 95%CI 1.01-2.49). When considering the total UDI-6 score, the mean score was  
2 higher for women with VD compared to those in the CS group, although this difference did  
3 not reach statistical significance ( $p=0.185$ ). The incidence of severe urinary incontinence  
4 (defined as a UDI-6 score $\geq 3$ ) was higher after VD than CS (respectively 43% versus 34.6%  
5 with borderline significance  $p=0.055$ ). Women complaining of at least one symptom (UDI-6  
6 score $\geq 1$ ) were significantly more frequent after VD than CS (76.7% versus 66.4%,  $p=0.01$ ).  
7 The results of the IIQ-7 questionnaire are presented in Table 3. Women who had a CS  
8 reported significantly less frequent urine leakage during physical activities outside home than  
9 women who had VD (aRR 0.43, 95%CI 0.20-0.92). No others significant differences were  
10 observed between both groups in the other items of the IIQ-7 questionnaire or in the IIQ-7  
11 final score.

12 Regarding fecal incontinence (Table 4), all the items investigated through the Wexner  
13 questionnaire were similar between both modes of delivery, except for alteration of sexual life  
14 which was significantly more present after CS than VD (aRR 1.72; 95%CI 1.13-2.63). This  
15 result was confirmed through investigation of sexual life using the Female Sexual Function  
16 Index (FSFI, Table 5). Four questions (no.2, 17, 18, 19) of the FSFI were significantly worse  
17 after CS than VD, and 3 other questions showed similar borderline significant trend (no.8, 10,  
18 16). Indeed, women who sustained elective CS reported significantly more difficulties in two  
19 questions relating to lubrication (no.8 and 10) and to satisfaction (no.16) than women of the  
20 VD group. Surprisingly, all items investigating pain during/following sexual intercourse were  
21 significantly worse after CS than VD. The subscore for pain was also significantly worse after  
22 CS than VD ( $p=0.002$ ). None of the other sub-scores for excitation, lubrication, orgasm or  
23 satisfaction showed significant differences when comparing both groups. The incidence of  
24 severe sexual dysfunction (defined as a FSFI score $\leq 25$ ) was higher after CS than VD  
25 (respectively 36.2% versus 26.4%,  $p=0.018$ ).

26

## 1 **DISCUSSION**

2 Over the past years, the rate of cesarean section has increased, despite limited information on  
3 potential consequences on women's health. Our study of women who sustained a CS was  
4 designed to evaluate their current symptoms compared to a group of women who had a VD.  
5 We demonstrated that women who sustained VD have an increased risk of developing urinary  
6 symptoms 6 years after the index delivery, such as stress incontinence and urge incontinence.  
7 Similar associations were found by others, although some of them used urinary incontinence  
8 scoring questionnaire that were not validated<sup>8, 16-18</sup>. One study with a long-term follow-up  
9 (more than 18 years) showed poor association between VD and urinary incontinence<sup>19</sup>, but  
10 this study involved a small sample size. Women who were most bothered by their symptoms  
11 were probably more likely to return the questionnaire than women without symptoms.

12 Our data suggest that women who sustained VD have no increased risk of anal incontinence  
13 and thus no alteration of their quality of life to declare. This confirms results published by  
14 Liebling *et al.*<sup>20</sup>.

15 Concerning the sexual function, women who sustained CS reported more frequently sexual  
16 dysfunction than women after VD (similar results in the Wexner and FSFI questionnaires),  
17 mainly in questions related to pain. These results might be explained by three hypotheses: 1)  
18 scar tissues after CS are painful; 2) sexual sensation, and thus pain, are decreased after VD  
19 due to elongation of pudental nerves; and 3) vaginism is more likely to persist after CS than  
20 after VD.

21 The strengths of our study were the use of validated and detailed questionnaires exploring all  
22 three pelvic floor functions. Moreover, socio-demographic and physical characteristics of the  
23 patients were similar between both groups. Some limitations of the present investigation must  
24 be considered. First, women with incontinence or sexual dysfunction may be more  
25 predisposed to participate in studies and therefore their symptoms might be overestimated.

1 Second, the symptoms were self-reported. Third, this study lacks information on whether  
2 incontinence or sexual dysfunction were present or not before or/and during pregnancy or  
3 started after delivery. Fourth, the overall response rate of 49% may appear low in comparison  
4 to other studies<sup>20-23</sup>. However, to avoid a selection bias, we decided not to reach women by  
5 phone before sending the questionnaires, neither asked them to participate at our study in the  
6 direct postpartum period. Similar or lower response rates (27-39%) were obtained by others  
7 authors who mailed a brief questionnaire concerning pelvic floor symptoms in an unselected  
8 group of women after vaginal birth<sup>3, 9, 18</sup>. Finally, we wished to determine the effect of the  
9 actual method of delivery rather than the effect of the approach to delivery. Our results were  
10 thus not analyzed according to intention to treat.

11 In conclusion, we demonstrated that VD is more likely to induce urinary incontinence than  
12 CS. In contrast, CS is more likely to induce sexual dysfunction through more painful  
13 intercourse than VD. This study highlights pros and cons for each type of delivery, thus  
14 providing to the clinicians a decision toll to better inform pregnant women about delivery's  
15 long-term consequences.

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**TABLE 1:**

Socio-demographic and physical characteristics of patients at the time of the questionnaire.

Data are shown as percent of the total of each group, except for age and weight. SD: Standard Deviation.

<b>Characteristics</b>	<b>Uncomplicated vaginal delivery</b> (n=309) %	<b>Elective cesarean delivery</b> (n=208) %	<b>p value</b>
<b>Age</b> [year $\pm$ SD]	36,6 $\pm$ 5,3	37,3 $\pm$ 5,4	0,196
$\geq$ 40 yo	29,5	35,7	0,135
<b>Ethnicity</b>			
Swiss	60,9	59,7	0,784
Non-swiss	39,1	40,3	
<b>Parity</b>			
Multiparous	16,3	18,5	0,515
<b>Weight</b> [kg + SD]	64 $\pm$ 12	66 $\pm$ 15	0,1
<b>Smoker</b>			
Yes	12,7	15,6	0,343
<b>University degree</b>			
Yes	10,1	9	0,763
<b>Marital status</b>			
Unmarried	14	23,2	0,007
Married	86	76,8	
<b>Religion</b>			
Christian	82,1	74,4	0,035
<b>Health insurance</b>			
Non-private	98,1	97,2	0,56
Private	2	2,8	

**TABLE 2:**

Urinary distress inventory (UDI-6). Relative Risks (RR) were adjusted for all socio-demographic and physical variables of table 1. VD: uncomplicated vaginal deliveries. CS: elective cesarean sections. 95%CI: 95% Confidence Intervals.

<b>Moderate to great symptoms</b>	<b>VD (n=309) %</b>	<b>CS (n=208) %</b>	<b>p value</b>	<b>Adjusted RR</b>	<b>95% CI</b>
Frequent urination	38,1	30,5	0.074	0,67	0,43-1,02
Urine leakage related to urgency	32,9	22,1	<b>0,008</b>	0,55	0,34-0,88
Urine leakage related to physical activity	50,5	36,1	<b>0,001</b>	0,53	0,35-0,80
Small amounts of urine leakage (drops)	32,1	32,1	0,986	1,03	0,66-1,61
Difficulty emptying bladder	14,1	14,0	1,000	0,93	0,52-1,67
Lower abdominal or genital pain	21,0	29,7	<b>0,025</b>	1,58	1,01-2,49
<b>Mean UDI-6 score :</b>	2,7	2,4	0,185		



**TABLE 3:**

Incontinence impact questionnaire (IIQ-7). Relative Risks (RR) were adjusted for all socio-demographic and physical variables of table 1. VD: uncomplicated vaginal deliveries. CS: elective cesarean sections. 95%CI: 95% Confidence Intervals.

<b>Urine leakage during:</b>	<b>VD</b> (n=309) %	<b>CS</b> (n=208) %	<b>p value</b>	<b>Adjusted RR</b>	<b>95% CI</b>
Physical activities at home	0,7	1	1	0,28	0,02-4,07
Physical activities outside home	13,4	6,5	<b>0,017</b>	0,43	0,20-0,92
Entertainment activities (cinema,...)	2,7	2,5	1	0,66	0,17-2,58
Travel longer than 30 minutes	3,4	3	1	0,57	0,17-1,97
Social activities	2,0	2,5	0,762	0,60	0,13-2,8
Feeling anxious or depressive	13,8	16	0,498	1,10	0,62-1,96
Feeling frustrated	12,1	15,6	0,27	1,18	0,65-2,15
<b>Mean IIQ-7 score:</b>	0,69	0,67	0,902		

**TABLE 4:**

Wexner anal incontinence score. Relative Risks (RR) were adjusted for all socio-demographic and physical variables of table 1. VD: uncomplicated vaginal deliveries. CS: elective cesarean sections. 95%CI: 95% Confidence Intervals.

<b>Symptoms</b>	<b>VD (n=309) %</b>	<b>CS (n=208) %</b>	<b>p value</b>	<b>Adjusted RR</b>	<b>95% CI</b>
Incontinence for gas	39,6	38,6	0,812	0,95	0,63-1,42
Incontinence for liquid stool	10,0	11,4	0,664	1,10	0,57-2,08
Incontinence for solid stool	2,9	1,9	0,58	0,58	0,12-2,70
Alteration of lifestyle	5,5	7,1	0,45	1,04	0,43-2,54
Alteration of sexual life	1,4	4,6	<b>0,044</b>	1,72	1,13-2,63
Need to wear a pad	6,2	6,8	0,855	0,97	0,43-2,15
Taking constipating medicine	0,3	0,5	1	3,23	0,16-66,1
Inability to defer defecation for 15 min	9,8	13,5	0,202	1,66	0,88-3,12
<b>Mean Wexner score:</b>	1,2	1,4	0,46		

**TABLE 5 :**

Female sexual function index (FSFI).

no.	FSFI questionnaire	vaginal birth 309 %	Cesarean 208 %	p value	Adjusted RR	95% CI
1	Sexual desire half of the time or less	22,41	25,98	0,36	1,19	0,74 - 1,89
2	Low level of sexual desire	18,79	26,44	<b>0,041</b>	1,54	0,96 - 2,50
	<b>score "DESIRE" (1-6)</b>	<b>3,84</b>	<b>3,7</b>	<b>0,178</b>		
3	Excitation during sexual activity half of the time or less	10,3	13,46	0,324	1,27	0,68 - 2,33
4	Low level of excitation during sexual activity	9,97	12,98	0,318	1,06	0,56 - 2,04
5	Low confidence about becoming sexually excited during sexual activity	10,7	13,59	0,331	1,10	0,59 - 2,04
6	Satisfied with excitation during sexual activity less than half the time	9,03	12,56	0,238	1,23	0,65 - 2,38
	<b>score "EXCITATION" (0-6)</b>	<b>4,48</b>	<b>4,35</b>	<b>0,236</b>		
7	Lubrication during sexual activity less than half of the time	13	14,9	0,54	0,93	0,53 - 1,64
8	Difficulty becoming lubricated during sexual activity	18,43	24,76	0,088	1,30	0,80 - 2,08
9	Maintain lubrication until completion of sexual activity less than half of the time	12,75	14,49	0,573	1,03	0,57 - 1,85
10	Difficulty maintaining lubrication until completion of sexual activity	15,15	21,78	0,058	1,35	0,80 - 2,27
	<b>score "LUBRIFICATION" (0-6)</b>	<b>4,83</b>	<b>4,7</b>	<b>0,274</b>		
11	Reach orgasm less than half of the time	14,72	14,56	0,962	0,99	0,56 - 1,75
12	Reaching orgasm difficult	17,73	20,87	0,376	1,08	0,65 - 1,79
13	Moderately dissatisfied with ability to reach orgasm	15,67	18,05	0,48	1,19	0,68 - 2,04
	<b>score "ORGASM" (0-6)</b>	<b>4,7</b>	<b>4,63</b>	<b>0,582</b>		
14	Moderately satisfied with the amount of emotional closeness during sexual activ	16,05	18,05	0,557	1,14	0,67 - 1,92
15	Moderately dissatisfied about the sexual relationship	11,15	16,1	0,107	1,43	0,79 - 2,56
16	Moderately dissatisfied about overall sexual life	12,75	19,02	0,055	1,43	0,83 - 2,50
	<b>score "SATISFACTION" (0-6)</b>	<b>4,39</b>	<b>4,26</b>	<b>0,283</b>		
17	Pain during vaginal penetration about half the time or more	8,36	18,36	<b>0,001</b>	2,04	1,10 - 3,85
18	Pain following vaginal penetration more than half of the time	13,29	20,98	<b>0,027</b>	1,79	1,04 - 3,03
19	High level of pain during or following vaginal penetration	5,7	13,73	<b>0,002</b>	2,50	1,19 - 5,26
	<b>score "PAIN" (0-6)</b>	<b>5,14</b>	<b>4,78</b>	<b>0,002</b>		
	<b>SCORE TOTAL (2-36)</b>	<b>27,18</b>	<b>26,23</b>	<b>0,094</b>		