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## Title

**Evaluation of a policy of restrictive episiotomy on the incidence of perineal tears among women with spontaneous vaginal delivery: a ten-year retrospective study**

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1 **Abstract**

2 **Evaluation of a policy of restrictive episiotomy on the incidence of perineal tears among**  
3 **women with spontaneous vaginal delivery: a ten-year retrospective study**

4 **Introduction:** Routine episiotomy is no longer recommended to limit obstetrical anal  
5 sphincter injuries (OASIs). We aimed to evaluate the effect of a restrictive policy of  
6 episiotomy on the risk of OASIs during spontaneous vaginal deliveries.

7 **Material and methods:** We performed a retrospective single-center observational study  
8 among women with a term singleton cephalic fetus, with spontaneous vaginal delivery. The  
9 occurrence of episiotomy, intact perineum, first, second, third or fourth-degree (OASIs)  
10 perineal tears were compared before (period A, from 01/01/2006 to 12/31/2008) and after  
11 (period B, from 01/01/2012 to 12/31/2016) implementation of the restrictive policy. Odds of  
12 perineal tear were estimated using multivariable logistic regression models, stratified by  
13 parity.

14 **Results:** From 2006 to 2016, the rate of episiotomy decreased, from 14.9% (n/N=200/1141)  
15 to 4.7% (94/1912). In period B (N=8984) vs A (N=8984), the rates of episiotomy were, 12.9 vs  
16 26.6 % for nulliparas (p<0.01) and 2.3 vs 6.8% for multiparas (p<0.01). Odds of OASIs were  
17 not different in period B vs A, both for nulliparas (0.9 vs 0.8%, AOR=0.88(0.38-2.05)) and  
18 multiparas (0.4 vs 0.2%, AOR=2.28(0.63-8.29)). Odds of second-degree tear were higher in  
19 period B vs A, both for nulliparas (39.8 vs 17.4%, AOR=2.55(2.11-3.08) and multiparas (26.2  
20 vs 12.8%, AOR=2.26(1.95-2.66)); and odds of intact perineum were lower (for nulliparas,  
21 15.8 vs 24.9%, AOR=0.61(0.42-0.90) and for multiparas, 47.1 vs 56.0%, AOR=0.61(0.49-  
22 0.76)). No difference was observed for first-degree tears.

23 **Conclusion:** The progressive implementation of a restrictive policy of episiotomy during  
24 spontaneous vaginal delivery was not associated with an increased risk of OASIs over a ten-  
25 year period.

26 **Key words:** episiotomy, OASIs, perineal tear, spontaneous vaginal delivery

27

28 **Introduction**

29 Among women giving birth vaginally, it is estimated that 35% to 75% will suffer from a  
30 perineal tear.<sup>1-3</sup> These tears of the perineum may have short, medium- or long-term  
31 consequences, the importance of which depends on their severity. Obstetrical anal sphincter  
32 injuries (OASIs) are the most severe and they affect from 0.8 to 5.9% of women with vaginal  
33 delivery.<sup>1-6</sup> OASIs are associated with greater perineal pain, urinary or anal incontinence,  
34 sexual disorder, and may have a major impact in women quality of life.<sup>7-9</sup> The principal risk  
35 factor of OASIS is instrumental vaginal delivery. In case of spontaneous vaginal delivery,  
36 nulliparity, macrosomia, obesity, persistent occiput-posterior position have been  
37 demonstrated to be associated with the occurrence of OASIS.<sup>2-5, 10-12</sup>

38 The benefit of episiotomy to limit the occurrence of severe perineal tears has been  
39 controversial. In the 90's, episiotomy was a frequent obstetric intervention, concerning  
40 nearly half of women giving birth vaginally in high income country.<sup>13, 14</sup> Since then, robust  
41 evidence has shown that a policy of systematic episiotomy was not relevant. Compared to a  
42 selective policy, it was not protective against severe perineal tear or maternal and neonatal  
43 morbidity.<sup>15</sup> Moreover, episiotomy could also be associated with postpartum hemorrhage,  
44 perineal pain and sexual disorder.<sup>16-18</sup> A restrictive practice of episiotomy has therefore  
45 been promoted and its use has decreased in many countries.<sup>1, 19</sup> World Health Organization  
46 considers a 10% episiotomy rate a reasonable target.<sup>20</sup>

47 In France, the practice of systematic episiotomy is also no longer recommended.<sup>21, 22</sup> In  
48 accordance with these recommendations, a sharp reduction in the episiotomy rate was  
49 observed between 1998 and 2016, from 71.3% to 34.9% of deliveries in nulliparas and from  
50 36.2% to 9.8% of deliveries in multiparas <sup>10</sup>.

51 Our objectives were to describe episiotomy rate over a 10-year period following the French  
52 recommendations on a restrictive policy of episiotomy and to evaluate the effect of the  
53 progressive implementation of a policy of restrictive episiotomy on the risk of severe  
54 perineal tears among women with spontaneous vaginal delivery.

## 55 **Material and methods**

56 We performed a single-center comparative retrospective observational study. The study  
57 took place at a level III, university maternity unit. All women with spontaneous vaginal  
58 delivery and a term singleton cephalic fetus were included over a 10-year period, from 2006  
59 to 2016. Women with medically indicated termination of pregnancy or stillbirth were  
60 excluded.

61 Data were collected retrospectively, from women's medical record completed by the  
62 midwives or obstetricians in charge of the women during pregnancy, labor, delivery and  
63 immediate post-partum period.

64 In French practices, episiotomy is usually medio-lateral. The indication of episiotomy was left  
65 to the practitioner's discretion during pushing in the second stage of labor. In our center,  
66 midwives attend autonomously spontaneous vaginal deliveries. Hands-on perineal  
67 protection and use of lubricating oil during delivery have been usual practices throughout  
68 the study periods. We implemented a policy of restrictive episiotomy during spontaneous  
69 vaginal delivery progressively since 2009. The first incentives to reduce the number of  
70 episiotomies were provided following the annual review of obstetric practices that usually  
71 takes place in January. To encourage the restrictive policy, the indication of episiotomy was  
72 systematically discussed during the daily obstetrical staff, the rates of episiotomy were  
73 regularly reported to the team and peer training in perineal protection was offered to young

74 midwives. Each year, we dedicated a team meeting to the analysis of episiotomy rates and  
75 the team was strongly encouraged to continue the restrictive policy. The first round lasted 2  
76 years, after which the positive results led us to maintain our efforts.

77 Perineal tears were classified according to the four-degree classification described by Sultan  
78 et al.<sup>23</sup> Third and fourth-degree tear, i.e. OASIs (obstetrical anal sphincter injuries), involving  
79 the anal sphincter complex were clinically diagnosed by the midwives and systematically  
80 ascertained by an obstetrician. During the 10-year period, there was no change of the  
81 diagnostic process of severe perineal tear.

82 Annual rates of episiotomy were described over the 10-year period, for the whole  
83 population and stratified by parity (nulliparas, multiparas). To evaluate the effect of  
84 implementing a policy of restrictive episiotomy, we performed comparative analyses  
85 between two time periods. Before (years 2006 to 2008: period A) and after the  
86 implementation of the policy (years 2012 to 2016: period B). Because the evolution of  
87 practices was gradual, we respected a washout period of three years without evaluation.

88 Study population characteristics and perineal status (i.e. intact perineum, without any tears  
89 or episiotomy; first-degree perineal tear; second degree-perineal tear; third or fourth-degree  
90 perineal tear) were compared between the two periods. Univariate analyses were  
91 performed using Chi<sup>2</sup> test, Student t-test or Mann-Whitney test (non-normal distribution),  
92 as appropriate. Independent association between the period and perineal status was  
93 estimated using multivariable logistic regression models. Analyses were stratified according  
94 to parity (nulliparas, multiparas). Associations were adjusted for potential confounding  
95 variables, i.e. associated in literature both to practice of episiotomy and risk of OASIs:  
96 maternal age, country of birth (European, North African, sub-Saharan African, Asian or

97 other), body mass index (BMI), neonatal weight, maternal position at delivery (lithotomy,  
98 adapted lithotomy, i.e. with a foot-rest allowing moderate flexion of the legs, lateral  
99 position, or other as squatting, crawling or standing positions) , persistent occiput-posterior  
100 (OP) position and epidural analgesia. Continuous variables showed no deviation from log-  
101 linearity when compared to fractional polynomials modelling.

102 Sensitivity analyses were performed to select a population of low-risk women, among : (1)  
103 nulliparas with spontaneous labor, the selected population corresponding thus to Robson  
104 group 1; (2) women without fetal heart rate anomalies during the active second stage of  
105 labor (FHRA), as they are the only indication for episiotomy in the French  
106 Recommendations.<sup>22</sup>

107 Significance was set at 0.05. Statistical analyses were performed with Stata software, version  
108 12.1.

### 109 *Missing data*

110 Complete case analyses were performed because less than 4% of data was missing for each  
111 variable, and less than 1% for the main criteria (episiotomy , N=21 (0.2%) and perineal status,  
112 N=23 (0.2%)). In multivariable models, fewer than 8% of women were excluded from analyses  
113 because of missing data for one of the variables considered.

114 *Ethical approval:* The local Institutional Review Board, CEERB Paris Nord (IRB 00006477) of  
115 HUPNVS, Paris 7 University, AP-HP (N ° 2019-0044), approved the research project. The CNIL  
116 approved data collection for this study (n°2216439 v 0).

### 117 **Results**



118 Over the 10-year period, episiotomy rates decreased gradually, from 14.9% to 4.7% for all  
119 women ( $p<0.001$ ); from 28.4% to 9.8% for nulliparas ( $p<0.001$ ); and from 7.6% to 2.2% for  
120 multiparas ( $p<0.001$ ). (Figure 1).

121 Respectively 3978 and 8984 women were included in period A and period B (Figure 2). Study  
122 population characteristics and obstetric practices changed over time. In period B, there was  
123 significantly more multiparas, from non-European country of birth, with advanced maternal  
124 age and higher BMI (Table 2). For both nulliparas and multiparas, there was also more  
125 induction of labor and epidural analgesia, and women gave birth more frequently in an  
126 adapted lithotomy position (vs classical lithotomy). For nulliparas, the duration of active  
127 second stage of labor was longer in period B. For multiparas, fewer persistent OP position  
128 was observed in period B. Rates of episiotomy were lower in period B, both for nulliparas  
129 (12.9% in period B vs 26.6% in period A,  $P<0.01$ ) and multiparas (2.3 vs 6.8%,  $P<0.01$ ).

130 For nulliparas, period B was not significantly associated with a higher risk of third or fourth-  
131 degree perineal tear (0.8 in period B vs 0.9% in period A; adjusted odds ratio, AOR; 95%  
132 confidence interval, CI 0.88(0.38-2.05) (Table 3). Period B was significantly associated with  
133 more second-degree perineal tear (39.8% vs 17.4% in period A,  $AOR=2.55(2.11-3.08)$ ) and  
134 fewer intact perinea (15.8% vs 24.9%,  $AOR=0.61(0.42-0.90)$ ). No difference was observed  
135 for first-degree perineal tear.

136 The same results were observed for multiparas. In particular, no association was found  
137 between the period and the risk of OASIs (0.4 vs 0.2%, respectively in period B and A;  
138  $AOR=2.28(0.63-8.29)$ ). Period B was also significantly associated with more second-degree  
139 perineal tear (26.2% vs 12.8%,  $AOR=2.26(1.95-2.66)$ ) and fewer intact perinea (47.1% vs  
140 56.0%,  $AOR=0.61(0.59-0.76)$ ).

141 The results of sensitivity analyses were consistent with those of the principal analysis.  
142 Among nulliparas in spontaneous labor (N=2836), no association was found between the  
143 period and the risk of OASIs (0.6 vs 0.9%, respectively in period B and A; AOR=1.36 (0.48-  
144 3.85)). (Table A1) Similar results were observed excluding women with FHRA during active  
145 second stage of labor (Table A2).

## 146 **Discussion**

147

### 148 *Principal findings*

149 After the progressive implementation of a restrictive policy of episiotomy, the rate of  
150 episiotomy during spontaneous delivery globally decreased, from 14.9 to 4.7%. There were  
151 more second-degree perineal tears and fewer intact perinea in the period following the  
152 restrictive policy. The rate of OASIs was less than 1% and no difference was observed  
153 between the periods.

### 154 *Strengths and limitations*

155 The retrospective before-after design of our study limits its capacity to establish a causal  
156 pathway between the policy of restrictive episiotomy and the differences observed between  
157 the two periods. Being a single-center study can be considered as a limit, but also as a  
158 strength because we are confident that practices of perineal protection were homogeneous  
159 over each of the study periods. Moreover, the rates of cesarean section and instrumental  
160 delivery in our birth center have not changed much over time (respectively for cesarean and  
161 instrumental delivery, period A versus B : 17.1 vs 17.4% and 15.5 vs 17.0%). Yet, other  
162 obstetric practices have changed over time that may have an impact on our principal finding.  
163 We found less OP positions in period B because the practices evolved favouring to attempt  
164 manual rotation, as early as possible during the first stage of labor and systematically at the

165 beginning of the second stage of labor. This is the practice recommended to reduce  
166 operative delivery.<sup>24, 25</sup> As OP positions are associated with severe perineal tears, we  
167 adjusted on that factor.<sup>26, 27</sup> Maternal position during active second stage of labor also  
168 evolved, favouring adapted-lithotomy position instead of lithotomy position with the legs  
169 resting in the stirrups. Lateral positions were also less frequent. That adapted lithotomy  
170 position is supposed to decrease the degree of flexion of the legs, in order to limit the  
171 stretching of the posterior perineum. Although efficacy of maternal positioning to reduce  
172 perineal tears has never been evaluated, we adjusted on it.<sup>25</sup> Another limitation could be the  
173 under-screening and reporting of OASIs. If the midwives suspect OASIs, they systematically  
174 call the obstetrician for a perineal examination. The contributing factors are sought but the  
175 midwife is never charged. We have no information whereas a rectal examination was  
176 systematically performed for non-superficial tear. However, the frequency of OASIs we  
177 found was the same as the one estimated in a recent French national survey.<sup>1</sup> It is unlikely  
178 that the under-screening was different between the periods and that it biased the results  
179 toward the null.

### 180 *Interpretation*

181 This study adds new evidence regarding the effect of a restrictive policy of episiotomy on  
182 perineal status. There was already evidence that a liberal policy of episiotomy is not  
183 protective against severe perineal tear.<sup>15</sup> Most of the randomised controlled trials (RCT)  
184 were conducted in units performing median episiotomies, and not medio-lateral as in French  
185 practice. To our knowledge, only one pilot RCT compared restrictive versus routine use of  
186 mediolateral episiotomy and found no difference in the risk of third-or fourth degree  
187 perineal tears (OASIs).<sup>28</sup> In French cohort studies evaluating selective policy of medio-lateral  
188 episiotomy, results were consistent with our study. However, neither the study of Chehab et

189 al., nor the one of Koskas et al. stratified the results among operative and non-operative  
190 vaginal delivery.<sup>29, 30</sup> Moreover, our maternity unit seems to have a very low level of  
191 episiotomy rate for women with non-operative vaginal delivery compared to the national  
192 level. It was estimated at 14.1% in 2014 in a population-based study *versus* 6% in our  
193 maternity.<sup>31</sup>

194 We observed that the frequency of intact perineum decreased between the two periods,  
195 contrary to what we expected. In the study of Chehab et al., implementing a restrictive  
196 policy of episiotomy permitted to decrease the rate of episiotomy from 18.8% to 1.3%, all  
197 vaginal delivery included, and to increase the rate of intact perineum from 28.2% to 37.5%.<sup>29</sup>  
198 Both the rates of first and second degree perineal tears increased in their study. This result  
199 may be explained by an evolution in the way of reporting the tears in the medical file by the  
200 midwives in our unit, tending to report more frequently intact perineum instead of first-  
201 degree tear in period A than in period B for tears not requiring any suture. This hypothesis is  
202 supported by the fact that the rate of first-degree tears remained unchanged over time.  
203 Another hypothesis is that the trend may have been related to midwives having less  
204 seniority in period B. Educational strategies dealing with perineal protection, particularly  
205 among younger midwives, and companionship could help decreasing the occurrence of  
206 perineal tears.<sup>6, 32</sup> Other techniques, such as perineal massage or warm compress application  
207 should be further evaluated to limit perineal tear, as evidence is still limited to recommend  
208 them<sup>21, 33 34</sup>.

209 We had no data about medium and long-term outcomes. In the meta-analysis of Jiang et al.  
210 it seemed that restrictive policy was associated with lower immediate postpartum perineal

211 pain, but the evidence was very low.<sup>15</sup> The risks of later perineal pain, urinary or anal  
212 incontinence, dyspareunia and genital prolapse were not different.

### 213 **Conclusion**

214 The progressive implementation of a restrictive policy of episiotomy for women with  
215 spontaneous vaginal delivery was not associated with an increased risk of obstetrical anal  
216 sphincter injuries over a ten-year period. Initial and continuous training on perineal  
217 protection, specifically among young midwives, should be reinforced to increase the chance  
218 of intact perineum.

219

220

221

222 **Supporting information:** Additional tables A1 and A2

223 Table A1: Multivariable association between the period and perineal status: sensitivity  
224 analysis among nulliparas with spontaneous labor.

225 Table A2: Multivariable association between the period and perineal status: sensitivity  
226 analysis excluding women with fetal heart rate abnormalities during active second stage of  
227 labor, stratified by parity.

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230 commercial, or not-for-profit sectors

231 **Contribution to authorship:** All authors have made substantial contributions to the  
232 manuscript and approved the final manuscript as submitted. LM, PB and GM conceived the  
233 study and contributed to the acquisition of data. PB, LM, GM and JS contributed to its  
234 design, conducted the analyses, performed the study, drafted the original manuscript,  
235 reviewed and revised the manuscript.

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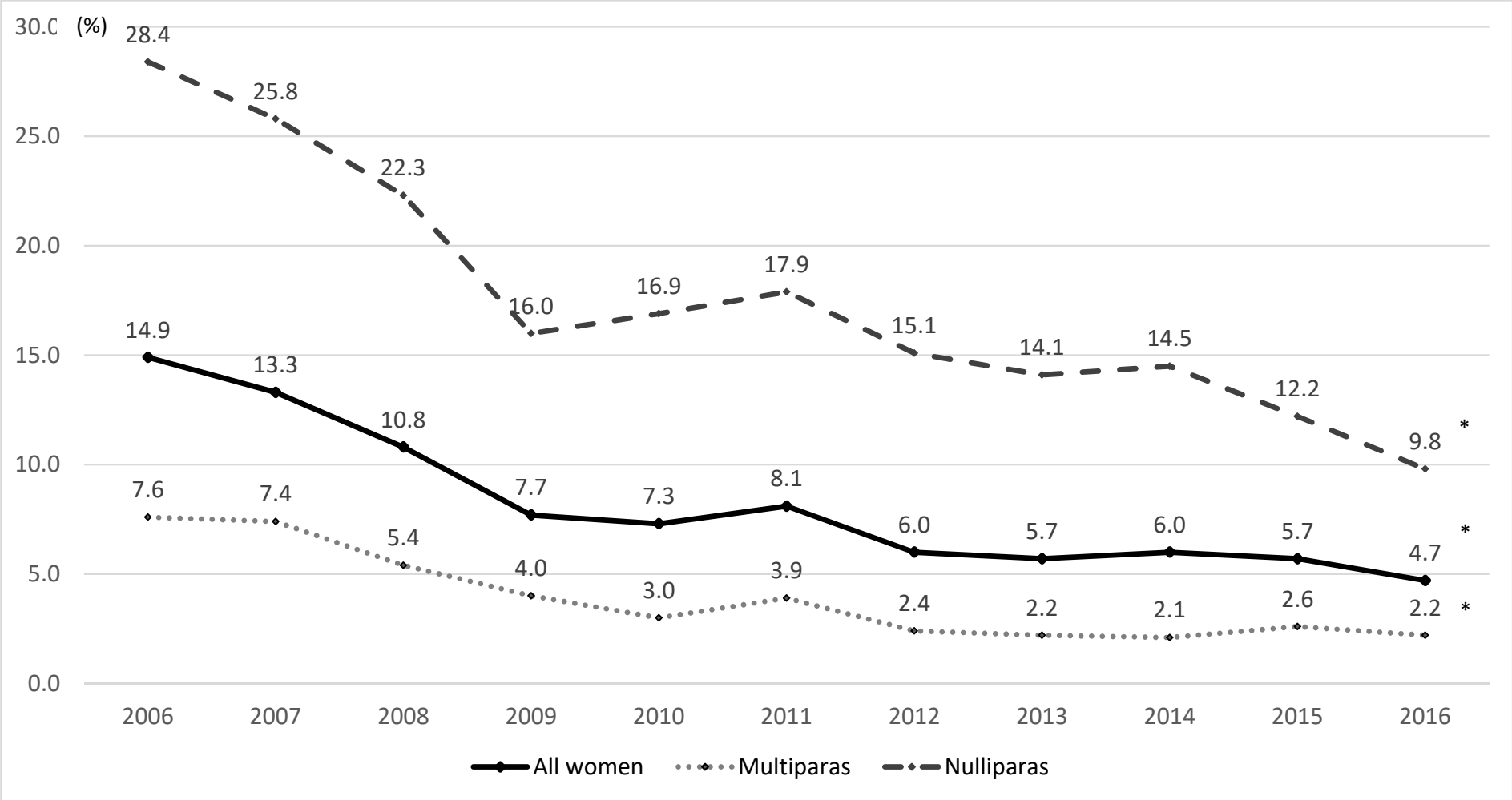
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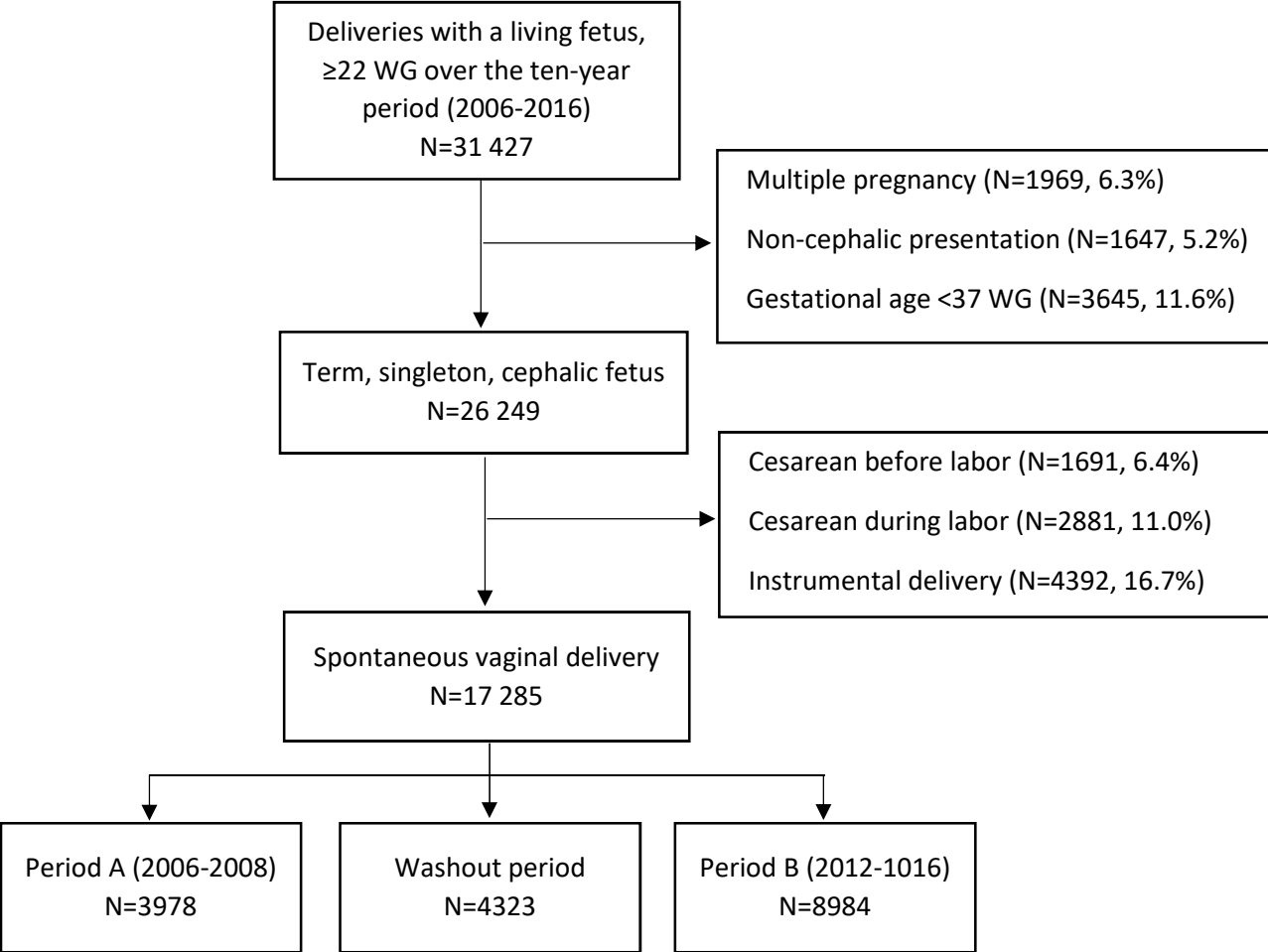
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**Figure 1: Episiotomy rate over a 10-year period among women with spontaneous vaginal delivery (%)**



\*P for trend < 0.001

**Figure 2: Flowchart of study population**



**Table 1: Characteristics of study population before (period A) and after (period B) implementation of a restrictive policy of episiotomy**

Characteristics of study population	Period A N=3978	Period B N=8984	<i>P</i> *
<b>Country of birth</b>			<0.01
Europe	1653 (42.2)	3275 (36.9)	
North Africa	1408 (36.0)	3678 (41.4)	
Sub-saharan Africa	594 (15.2)	1353 (15.2)	
Asia	130 (3.3)	249 (2.8)	
Other	129 (3.3)	327 (3.7)	
<b>Maternal age, y</b>	30.4 (5.4)	31.1 (5.2)	<0.01
<b>BMI, kg/m<sup>2</sup></b>	23 [21-27]	24 [21-27]	0.01
<b>Weight gain during pregnancy, kg</b>	12 [8-15]	12 [7-15]	1.0
Nulliparity	1316 (33.1)	2787 (31.0)	0.02
<b>History of C-section</b>			0.21
No	3799 (95.6)	8520 (94.9)	
Yes, with history of vaginal delivery	93 (2.3)	255 (2.8)	
Yes, without history of vaginal delivery	84 (2.1)	207 (2.3)	
<b>Gestational age, WG</b>	39.7 (1.1)	39.7 (1.1)	0.28
<b>Neonatal weight, g</b>	3352 (462)	3361 (435)	0.29
<b>Midwife's seniority, y<sup>a</sup></b>			<0.01
< 1	80 (11.6)	765 (10.5)	
[1-3[	298 (43.1)	2516 (34.5)	
[3-5[	131 (18.9)	2026 (27.8)	
≥5	183 (26.5)	1993 (27.3)	

Data are expressed as n(%) or mean(sd) or med(Q1-Q3). \*Chi<sup>2</sup>, Student t-test or Mann-Whitney test,

<sup>a</sup> 22.7% of data were missing in period A and 5.7% in period B.

**Table 2: Comparison of labor and delivery characteristics before (period A) and after (period B) implementation of a selective policy of episiotomy**

Labor and delivery characteristics	Nulliparas			Multiparas		
	Period A <sup>a</sup> N=1316	Period B <sup>a</sup> N=2787	P*	Period A <sup>a</sup> N=2262	Period B <sup>a</sup> N=6197	P*
Induction of labor	337 (25.8)	922 (33.1)	<0.01	538 (20.3)	1807 (29.2)	<0.01
Peridural analgesia	1162 (88.3)	2576 (92.4)	<0.01	1913 (71.9)	4991 (80.5)	<0.01
Augmentation of labor	864 (65.6)	1389 (49.8)	<0.01	1144 (43.0)	1726 (27.9)	<0.01
Total duration of labor, h	7 [5-9]	8 [6-10]	<0.01	5 [3-6]	5 [3-6]	0.03
Duration of active second stage of labor, min	20 [13-30]	21 [13-33]	<0.01	10 [5-15]	9 [5-15]	1.0
Persistent OP position at delivery	11 (0.8)	17 (0.6)	0.4	48 (1.8)	64 (1.0)	<0.01
FHRA during active second stage of labor	208 (15.8)	679 (24.4)	<0.01	309 (11.6)	1052 (17.0)	<0.01
Meconium-stained AF	319 (24.7)	727 (26.2)	0.29	561 (21.4)	1379 (22.5)	0.26
Maternal position at delivery			<0.01			<0.01
Lithotomy position	505 (43.4)	249 (8.9)		980 (40.8)	515 (8.4)	
Adapted lithotomy position**	557 (47.8)	2378 (85.4)		1012 (42.1)	4518 (74.4)	
Lateral position	44 (3.8)	49 (1.8)		185 (7.7)	218 (3.5)	
Other***	59 (5.1)	109 (3.9)		228 (9.5)	902 (14.7)	
Episiotomy	337 (26.6)	360 (12.9)	<0.01	181 (6.8)	142 (2.3)	<0.01

Data are expressed as n(%) or mean(sd) or med(Q1-Q3). \*Chi2, Student t-test or Mann-Whitney test

\*\*with foot-rest \*\*\*squatting, crawling or standing; WG, weeks of gestation ; OP, occipito-posterior; FHRA, fetal heart rate abnormalities; AF, amniotic fluid.

**Table 3: Multivariable association between the period and perineal status, stratified by parity**

Perineal status	Nulliparas			Multiparas		
	Period A N=1316 (Reference)	Period B N=2787	AOR*(95% CI)	Period A N=2662 (Reference)	Period B N=6197	AOR*(95% CI)
<b>Intact perineum</b>	326 (24.9)	440 (15.8)	0.61 (0.42-0.90)	1166 (56.0)	2918 (47.1)	0.61 (0.49-0.76)
<b>First degree perineal tear</b>	448 (34.2)	925 (33.2)	1.11 (0.94-1.31)	661 (25.0)	1518 (24.5)	1.05 (0.92-1.19)
<b>Second degree perineal tear</b>	228 (17.4)	1110 (39.8)	2.55 (2.11-3.08)	339 (12.8)	1623 (26.2)	2.26 (1.95-2.66)
<b>Third- or fourth-degree perineal tear</b>	10 (0.8)	25 (0.9)	0.88 (0.38-2.05)	5 (0.2)	24 (0.4)	2.28 (0.63-8.29)

Data are expressed as n(%); AOR, adjusted odds ratio; CI, confidence interval; \*all models adjusted for maternal age, country of birth, body mass index, induction of labor, neonatal weight, persistent OP position, maternal position at delivery and epidural analgesia.

**Table A1: Multivariable association between the period and perineal status: sensitivity analysis among nulliparas with spontaneous labor**

<b>Perineal status</b>	<b>Period A (Reference) N=971</b>	<b>Period B N=1865</b>	<b>AOR*(95% CI)</b>
<b>Intact perineum</b>	224 (23.1)	285 (15.3)	0.52 (0.41-0.66)
<b>First degree perineal tear</b>	341 (35.1)	627 (33.6)	1.05 (0.86-1.27)
<b>Second degree perineal tear</b>	179 (18.4)	745 (40.0)	2.49 (2.00-3.10)
<b>Third- or fourth-degree perineal tear</b>	6 (0.6)	17 (0.9)	1.36 (0.48-3.85)

Data are expressed as n(%); AOR, adjusted odds ratio; CI, confidence interval; \*all models adjusted for maternal age, country of birth, body mass index, neonatal weight, maternal position at delivery and epidural analgesia.

**Table A2: Multivariable association between the period and perineal status: sensitivity analysis excluding women with fetal heart rate abnormalities during active second stage of labor, stratified by parity.**

Perineal status	Nulliparas			Multiparas		
	Period A N=1108 (Reference)	Period B N=2108	AOR*(95% CI)	Period A <sup>a</sup> N=2353 (Reference)	Period B <sup>a</sup> N=5145	AOR*(95% CI)
Intact perineum	279 (25.3)	327 (15.5)	0.50 (0.41-0.62)	1305 (55.8)	2441 (47.5)	0.67 (0.60-0.75)
First degree perineal tear	383 (34.8)	720 (34.2)	1.06 (0.89-1.28)	594 (25.4)	1294 (25.2)	1.03 (0.91-1.18)
Second degree perineal tear	195 (17.7)	842 (39.9)	2.60 (2.12-3.18)	305 (13.0)	1325 (26.8)	2.19 (1.88-2.56)
Third- or fourth-degree perineal tear	6 (0.5)	20 (1.0)	1.86 (0.67-5.2)	4 (0.2)	17 (0.3)	2.00 (0.45-8.81)

Data are expressed as n(%) ; AOR, adjusted odds ratio ; CI, confidence interval; <sup>a</sup>all models adjusted for maternal age, country of birth, body mass index, neonatal weight, induction of labor, maternal position at delivery and epidural analgesia.