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Caesarean Section in the Second Delivery to Prevent Anal Incontinence after Asymptomatic Obstetric Anal Sphincter Injury: The EPIC Multicentre Randomised Trial

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1 **Cesarean section in the second delivery to prevent anal incontinence after asymptomatic**
2 **obstetrical anal sphincter injury: the EPIC multicenter randomized trial**

3

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9 **Running head : Cesarean for prevention of anal incontinence**

10

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39 **ABSTRACT :**

40 **Objective:** To determine whether planned cesarean section (CS) for a second delivery protects
41 against anal continence in women with obstetrical anal sphincter lesions.

42 **Design:** Randomized trial.

43 **Setting:** 6 maternity units in the Paris area.

44 **Sample :** Women at high risk of sphincter lesions (first delivery with 3d degree laceration
45 and/or forceps) but no symptomatic anal incontinence.

46 **Methods :** Endoanal ultrasound was performed in the third trimester of the second
47 pregnancy. Women with sphincter lesions were randomized to planned CS or vaginal delivery
48 (VD).

49 **Main outcome measures :** Anal continence at 6 months post-partum. Secondary outcomes
50 were urinary continence, sexual morbidity, maternal and neonatal morbidities and worsening
51 of external sphincter lesions.

52 **Results :** Anal sphincter lesions were detected by ultrasound in 264/434 women enrolled
53 (60.8%) ; 112 were randomized to planned VD and 110 to planned CS. At 6-8 weeks after
54 delivery, there was no significant difference in anal continence between the 2 groups. At 6
55 months after delivery, median Vaizey scores of anal continence were 1 [IQR 0-4] in the CS
56 group and 1 [IQR 0-3] in the VD group ($p = 0.34$). There were no significant differences for
57 urinary continence, sexual functions or for other maternal and neonatal morbidities.

58 **Conclusions :** In women with asymptomatic obstetrical anal sphincter lesions diagnosed by
59 ultrasound, planning a CS had no significant impact on anal continence 6 months after the
60 second delivery. These results do not support advising systematic CS for this indication.

61 **Funding** : French Ministry of Health National Program for Clinical Research Grant

62 **Key words**: obstetrical anal sphincter lesion, cesarean section, anal endosonography, anal
63 incontinence

64 **Tweetable abstract**:

65 C-section for the 2d delivery did not protect against anal continence in women with
66 asymptomatic obstetrical anal sphincter lesions.

67

68 **Introduction**

69 Anal incontinence is a source of distress for patients, with a major impact on sexual health ¹
70 and quality of life ^{2,3}. It is a frequent symptom ⁴, with a prevalence of 14.8% among women
71 in a population-based study in the United States ⁵. Obstetrical anal sphincter injuries (OASIS)
72 are visible third or fourth-degree perineal lacerations, reported in 2 to 12% of vaginal
73 deliveries ^{6,7} associated with anal incontinence in up to 38% ¹ or even 53% ⁸ of cases at long
74 term. Occult anal sphincter lesions, which are not noticed at the time of delivery, can be
75 detected by systematic endoanal ultrasonography in up to 27% of women after their first
76 vaginal delivery ⁹. These undiagnosed anal sphincter lesions may result in anal incontinence in
77 9% of women ^{7,9}. Instrumental delivery is the most important risk factor for anal incontinence,
78 with anal sphincter lesions reported in up to 63% to 82 % of forceps deliveries ⁹ and anal
79 incontinence in 23 % ⁹. Post-delivery anal incontinence decreases over time, but it contributes
80 to anal incontinence in the long term ¹⁰.

81 In case of anal sphincter lesions at the first delivery, cesarean section (CS) is often discussed
82 for subsequent deliveries, with the purpose of protecting anal function, but consensus is
83 lacking. ^{11 12 13, 14}. Current RCOG guidelines state that in women who have suffered OASIS,
84 elective caesarean section may be considered in case of symptoms or endoanal
85 ultrasonographic defects¹⁵. To date there is no high-level evidence from a randomized trial to
86 help make an informed decision ¹⁴. The potential benefit needs to be proven, since CS is a
87 major surgical procedure with risks for the mother and infant ¹⁶, including maternal
88 morbidities and mortality at surgery and during subsequent pregnancies¹⁷. In recent
89 retrospective cohort studies comparing CS versus repeat VD in women with a history of anal
90 sphincter lesions, no significant difference was found in the incidence of anal incontinence ¹⁰.

91 ¹⁸. However, indication bias could not be ruled out in such observational studies. The
92 potential benefit of prophylactic CS on urinary incontinence, quality of life and sexual
93 functions also must be addressed, as they deeply impact quality of life ^{2,19}. Our objective was
94 to evaluate whether anal incontinence could be prevented by planned CS for the second
95 delivery, in women with asymptomatic anal sphincter disruption after the first delivery.

96

97 **Methods**

98 *Study design*

99 The multicenter, prospective, randomized, open EPIC (Etude de Prévention de l'Incontinence
100 par Césarienne) trial compared planned CS to planned VD for the second delivery in women
101 with a history of a traumatic first delivery with anal sphincter lesions on endosonography and
102 no self-reported anal incontinence at baseline.

103 Women were recruited in 6 maternity units in the Paris area (5 academic centers and 1 general
104 hospital), between 01/04/2008 and 29/12/2014, with their written, informed consent for each
105 of the 2 steps of the study. Patients were not formally involved in the development of the
106 research and no core outcome was used. The study was approved by an ethics committee
107 (Comité de Protection des Personnes Ile de France V, Paris, France).

108 Women having a history of a traumatic first delivery were first assessed for eligibility by the
109 obstetrician at clinic visits in the third trimester of their second pregnancy. They were
110 included if they had a first vaginal instrumental delivery with forceps (vacuum extractions
111 were not considered) and/or with a diagnosis of a third-degree perineal tear, had no self-
112 reported anal incontinence at inclusion (on a questionnaire with yes/no answers), were 18

113 years old or over, and signed informed consent. The main exclusion criteria were a history of
114 anal surgery, a fourth-degree perineal tear at the first delivery, self-reported AI, defined as
115 involuntary leakage of gas or stools and any other indication for planned CS for non-
116 proctologic reasons.

117 After inclusion, women had a proctological evaluation including the Vaizey score ²⁰ and anal
118 endosonography with the same expert operator (LA). The Vaizey score was chosen for its
119 sensitivity by considering 24 components of AI, including loss of flatus with or without loss of
120 liquid and solid stool, pad use, stool urgency, medication use and quality of life.
121 Endosonography was performed with a 7-10 MHz rotating rectal probe and a hard sonolucent
122 plastic cone (Bruel and Kjaer, Naemm, Denmark). Three anal canal levels (upper, middle, and
123 lower) were studied and recorded (videorecorder, Sony, Tokyo, Japan). Anal sphincter lesions,
124 were characterized as defined by Law et al. ²¹: a lesion of internal sphincter was identified as
125 a hyperechoic loss of continuity of the normal internal hypoechoic ring. A lesion of the external
126 anal sphincter was identified as a hypoechoic loss of continuity of the normal external
127 hyperechoic ring (figure S1); the angulation defect was quantified and defined as severe if
128 more than 90°.

129 *Trial procedures*

130 Women with all types of external anal sphincter lesions at ultrasound were offered to
131 participate in the randomized trial, and if they consented were assigned (1:1 ratio) to planned
132 CS at 39 weeks' gestation or vaginal delivery. Concealment was obtained with a computer-
133 generated randomization scheme, in various-sized blocks, stratified by center, transmitted in
134 separate sealed and opaque envelopes prepared by the sponsor. Blinding was not feasible,
135 but investigators were unaware of aggregate outcomes during the study, since the analysis

136 was performed only after the follow-up period was completed and the database was frozen.
137 In the vaginal delivery group, the management of the delivery, including episiotomy, forceps
138 or vacuum, was left to the appreciation of the clinician. In case of an emergent indication
139 unrelated to the issue of anal sphincter protection, CS was allowed.

140 *Outcomes*

141 Standard obstetrical and perinatal outcomes were recorded after delivery. Study visits were
142 planned with the proctologist and the obstetrician at 6-8 weeks post-partum and 6 months
143 (up to 24 months). The 6-8 weeks and 6 months follow-up visit included the Vaizey, Wexner,
144 and also the Female Sexual Function Index (FSFI)²², physical and mental Short-Form Survey
145 (SF12) and Measurement of Urinary Handicap (MUH) score ²³. In addition, the 6-months visit
146 included an anal ultrasound examination. The primary outcome was anal incontinence at 6
147 months after delivery (M8), as measured by the Vaizey score ²⁰. Secondary endpoints were
148 anal incontinence (Vaizey score) at 6 to 8 weeks after delivery (W6-8); post-partum transient
149 anal incontinence (at least 1 stool and/or at least 2 gas leakages after delivery, which has
150 disappeared at W6-8), maternal morbidities (hemorrhage, uterine rupture, placenta accreta,
151 hematomas, cervico-vaginal lacerations, hemoperiteum, organ wounds, anesthetic
152 complications, infections, deep vein thrombosis), fetal/neonatal morbidities (respiratory
153 distress, infection, acidosis, trauma, neonatal intensive care), urinary continence measured
154 with the MUH score, quality of life with the 12-Item Short-Form Health Survey (SF12) score ²⁴,
155 women's sexuality with the FSFI and worsening of external sphincter lesions (defined as
156 increase of angulation from baseline of more than 10 degrees) measured 6 months after
157 delivery.

158 *Statistical analysis*

159 Assuming a mean (SD) Vaizey score at M8 of 5 (6) in the control group^{9, 20}, 86 women/group
160 would provide 90% power at a 2-sided α -level of 0.05 to detect a clinically meaningful
161 difference of mean Vaizey score of 3 between groups. The target for enrollment was increased
162 to account for potential loss to follow-up.

163 Baseline characteristics are reported by trial group (CS and VD) as numbers (%) for categorical
164 variables and means (\pm standard deviations, SD) or medians [interquartile range, IQR] for
165 continuous variables, as appropriate.

166 All analyses were performed according to the intention-to-treat (ITT) principle. Missing data
167 were handled using multiple imputations on principal and secondary endpoints except
168 maternal and neonatal outcomes. Variables included in the imputation models were BMI, age,
169 ethnic group, history of constipation, history of diarrhea, use of forceps, perineal tear,
170 ruptured internal sphincter, components of Vaizey score, MUH score, SF12 score at baseline,
171 W6-8 and M8, and FSFI score at M8. Procedures of multiple imputations used assume that the
172 missing data are missing at random (MAR) and were adapted for data sets with arbitrary
173 missing patterns. We used fully conditional specification (FCS) method with linear regression
174 for continuous variables, and with discriminant function for categorical variables. We obtained
175 analyses results by averaging results across 5 imputed datasets using Rubin's rules. The Vaizey
176 score at M8 post-partum was compared between CS and VD groups using a permutation test,
177 as this variable was not normally distributed and showed a floor effect. A post-hoc subgroup
178 analysis of the primary outcome was conducted in the 27 women with Vaizey scores ≥ 5 (a cut-
179 off usually defining anal incontinence²⁵) at the prenatal visit, after testing positive for
180 interaction with trial arm. Secondary outcomes were compared between VD and CS groups
181 using Chi-square or Fisher exact test, Student, Wilcoxon or permutation test as appropriate.

182 All statistical analyses were performed using SAS V.9.4 (SAS Institute Inc., Cary, North Carolina,
183 USA).

184

185 **Results**

186 A total of 549 women were included, of whom 434 had anal endosonography, which showed
187 that 264 (60.8%) had anal sphincter lesions. Of these, 222 (84.1%) accepted to be randomized,
188 112 were assigned to planned VD and 110 to planned CS (Figure 1, Flowchart). Among the 222
189 randomized women, 20 (9.0%) had third-degree perineal tears during spontaneous VD and
190 202 (91.0%) had forceps at the first delivery including 140 (71.1%) without perineal tears and
191 29 (14.7%) with third-degree perineal lacerations (table 1). There were no significant
192 differences at baseline between the 2 trial arms. The only medical history was neurological
193 disease, diabetes and cholecystectomy in 2 patients (0.9%) each. The principal treatments
194 used during the 2nd pregnancy were iron supplements in 133 (61.0%) and laxatives in 8 (3.7%).
195 Although according to the eligibility criteria, none of the women self-reported any anal
196 incontinence symptom at inclusion, the Vaizey score was calculated during the data analysis
197 as being ≥ 5 in 27 women before the second delivery, corresponding to the definition of
198 symptomatic anal incontinence. Women who did not complete the M8 visit did not differ from
199 those who completed this visit except for age (Table S1).

200 For the second delivery, 17 (15.6%) women in the VD arm had CS for obstetrical indications,
201 whereas 18 (16.5%) women in the CS arm delivered vaginally (Table 2). In the VD arm, 5
202 women had (5.5%) forceps delivery and 1 (1.9%) 3d degree lacerations during spontaneous
203 VD.

204 *Outcomes*

205 Primary and secondary outcomes are reported in Table 3. At W6-8 after delivery, anal
206 incontinence was not statistically different between trial arms, nor was post-partum transient
207 anal incontinence (11.7% in the CS arm vs 25.0% in the VD arm (absolute risk difference [95%
208 CI]: -13.3 [-25.1 to 0.0]).

209 At the M8 endpoint, the median [IQR] Vaizey score for anal incontinence was 1/24 [0-4] in the
210 CS arm vs 1/24 [0-3] in the VD arm ($p=0.34$) (table 3). This primary outcome was actually
211 measured at a median [IQR] time of 8.0 [6.8 – 11.2] months post-partum (call now M8), due
212 to constraints in scheduling and if necessary re-scheduling appointments. When comparing
213 Vaizey scores at inclusion and at the M8 visit, the results did not differ between the CS and VD
214 groups (median (IQR) differences 0.0 [-1.5-2.0] and 0.0 [0.0-1.0], respectively, $p = 0.9825$)
215 (Figure S2). The effect of trial arm on Vaizey score at M8 differed between women with Vaizey
216 score at inclusion <5 and women with Vaizey score at inclusion ≥ 5 (significant interaction,
217 $p=0.008$). Post-hoc subgroup analyses showed that in the subgroup of 27 women with a Vaizey
218 score before delivery ≥ 5 , Vaizey score at M8 were significantly lower in the CS than in the VD
219 arm (median 3 IQR [0-7] vs 6 [3.5-8.5], $p=0.026$).

220 At M8, there was no statistically significant difference between groups for urinary
221 incontinence (MUH score), sexual function (FSFI) and physical and mental quality of life
222 assessed with SF12.

223 Similarly we found no difference between the 2 arms for maternal morbidity. Minor
224 complications occurred in 4 (4.9%) patients in the VD arm and 8 (8.8%) in the CS arm, including
225 3 (3.3%) anesthetic complications (headaches) in the CS arm and none in the VD arm. After
226 delivery, 21 (13.8%) received iron supplements and 8 (5.3) took laxatives. For neonatal

227 outcomes, 5 (6.1%) had at least one complication in the VD arm including 4 transfers to
228 neonatal care units (2 for respiratory distress and 2 for infection) versus none in the CS arm.
229 Among the 222 randomized women, 125 (56.3%) had post-partum endosonography at the M8
230 visit, 61 (54.5%) in the VD arm and 64 (58.2%) in the CS arm. Baseline characteristics of these
231 women did not differ from those without endosonography (Table S1). External sphincter
232 lesions deteriorated more frequently in the VD arm than in the CS arm (11 (22.4%) women vs
233 1 (2.2%), absolute risk difference -20.2 [95% CI: -31.7 to -7.6]), but no additional internal
234 sphincter lesions were observed.

235 **Discussion**

236 **Main Findings :** In this randomized trial of women with asymptomatic anal sphincter lesions
237 from a first delivery, planned cesarean section in the second delivery was not protective
238 against anal incontinence at 8 months post-partum. At 6-8 weeks post-partum, anal
239 incontinence was less frequent in the cesarean section group, but the difference was not
240 statistically significant. In addition, we found no benefit of cesarean section on urinary
241 incontinence, sexual functions or quality of life.

242 **Strengths/Limitations:** To our knowledge, it is the first randomized controlled trial addressing
243 this issue. Also, anal incontinence was assessed with the standardized, validated and widely
244 used Vaizey score, and sphincter lesions were defined by endosonography. External validity
245 was supported by the diversity of trial settings, including teaching hospitals and general
246 hospitals in diverse populations ranging from poor to affluent, with no center effect.

247 This trial also has limits. Our study was necessarily unblinded, and the main outcomes were
248 patient-reported, thus we cannot exclude reporting bias. However, all investigators were

249 unaware of aggregate outcomes during the study. Also, crossovers were observed (cesareans
250 in the vaginal delivery group and vice versa), but the trial was analysed according to the intent
251 to treat, as recommended, and thus compares the strategy of planned cesarean versus
252 planned vaginal delivery. We observed a Vaisey score at M8 of only 1 in the VD group (as well
253 as the CS group), whereas a score of 5 in VD group was used for sample size calculation
254 because 5 points on the Vaisey score is recognized as reflecting clinically significant anal
255 incontinence ²⁵, which would justify an indication for CS. This decreased the power to
256 demonstrate a difference between the two trial arms, however the point estimates are
257 identical in both arms of the trial, which is in favor of an absence of difference rather than lack
258 of power. Moreover, this does not weaken the main finding because it means that a second
259 vaginal delivery was not a significant risk factor for developing clinically significant anal
260 incontinence. The main endpoint planned at M6 after delivery was actually measured at a
261 median of 8 months after delivery, but this longer follow-up may strengthen rather than
262 weaken the evaluation. Lastly, one fifth of the randomized women did not complete the 6
263 months post-partum follow-up, which could lead to attrition bias; however their
264 characteristics did not differ between the two study groups, and the analysis was performed
265 according to the intent-to-treat principle, with multiple imputations performed for handling
266 missing data.

267 **Interpretation in light of other studies :** Our findings are consistent with recent observational
268 studies, including longer follow-up ^{18, 26}. In an observational cohort study, CS for women with
269 anal sphincter disruption at the first delivery was associated with no benefit on anal
270 incontinence 5 years after the second delivery ¹⁸. However, most women sustaining obstetric
271 injuries develop anal incontinence later, after their 50s. Nygaard et al ²⁷ found that anal
272 sphincter disruption following an index delivery was a risk factor for flatus incontinence 30

273 years later. Some large population-based cohort studies failed to show any difference in the
274 incidence of flatus incontinence in women above 50, according to whether they delivered
275 vaginally or by CS¹⁹, but a recent population-based study from Sweden found that the risk of
276 anal incontinence was lower after CS than after VD²⁸. AI also was higher among women who
277 delivered by CS compared with nulliparas and higher among nulliparas compared with men.
278 In another study, an association was found between ultrasound diagnosis of anal sphincter
279 lesions and long-term fecal incontinence after a first delivery²⁹. Because anal incontinence is
280 multifactorial, including neurological and gastro-intestinal as well as mechanical causes, this
281 symptom can occur without sphincter lesions and vice versa. Anal sphincter lesions are
282 observed by ultrasound in less than half of women with postpartum anal incontinence⁹. In an
283 unselected primiparous population, anal sphincter disruption was detected by ultrasound
284 screening after delivery in 27% of women, most of whom had no symptoms³⁰. Thus, although
285 CS can be protective from anal sphincter lesions^{8,9}, ultrasound evidence is one of many factors
286 associated with anal continence. Besides, it has been shown that the severity of the anal
287 sphincter lesion is an important risk factor for subsequent anal incontinence, particularly the
288 depth of the disruption of both the external and internal sphincters³¹. In our trial, we did not
289 observe a protective effect of CS in the subgroup with severe anal sphincter ruptures (defined
290 as >90°)(data not shown). In another study, only 4th-degree tears were associated with an
291 increased risk of anal incontinence at 10 months postpartum³², but this was an exclusion
292 criterion in our trial.

293 One important difference between our trial and most retrospective studies was the inclusion
294 of women whose first delivery was by forceps, even in the absence of a diagnosis of a third-
295 degree perineal laceration. We found 60% of with anal sphincter defects at ultrasound in this

296 group. It thus remains to be shown whether our findings can be replicated in different
297 populations including only OASIs which are diagnosed at delivery.

298 Some observational studies have shown that a subsequent vaginal delivery following an
299 obstetrical anal sphincter injury may result in additional or recurrent lesions³³, which may be
300 apparent or occult, however without any significant change in the continence score according
301 to the mode of delivery. In our trial, the incidence of repeated clinically apparent OASIS was
302 low, since only one woman had a repeated 3rd degree tear.

303 Endosonographic aggravation of external sphincter lesions occurred significantly more often
304 in the VD group than the CS group. These findings may indicate that CS avoids some occult
305 sphincter disruptions, but on the other hand they signify that ultrasound evidence of anal
306 sphincter lesions is not predictive of symptoms of anal incontinence.

307 **Conclusion**

308 Our findings are not in favor of recommending CS for subsequent deliveries in women with
309 asymptomatic ultrasound anal sphincter lesions resulting from a first delivery. This should be
310 useful for clinicians and women to avoid numerous unnecessary cesarean sections¹³.
311 However, we cannot exclude a protective effect of prophylactic CS for women with
312 symptomatic anal sphincter lesions. We did find a significant benefit of CS among women with
313 mild clinical AI detected before the second delivery at the proctological visit. Since it is a post-
314 hoc subgroup analysis, it must be interpreted with caution.

315 Because of taboos surrounding anal incontinence, it is difficult to reveal without meticulous
316 questioning. In our trial, 27 women self-reported no anal incontinence at inclusion, but had a
317 Vaizey score ≥ 5 measured by a proctologist. Comparatively to endosonography, clinical-based

318 diagnosis of IA is less expensive, more accessible and seems more predictive of functional
319 outcome, as has been previously suggested in retrospective studies ^{18, 26}. Thus, our findings
320 do not support performing anal endosonography for women with an overt OASI or forceps
321 instrumentation for their first delivery in order to decide on the mode of delivery.

322 Further studies are needed to determine whether CS may be useful in the long term, among
323 women with mildly symptomatic anal lesions, and if so whether women with third- or fourth-
324 degree perineal tears and/or forceps at their first delivery can benefit from a proctological
325 examination in order to make a decision regarding their subsequent deliveries.⁹

326

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333 contribution to inclusions.

334

335 **All the authors report no conflict of interest.**

336

337 **Contribution to authorship**

338 LA, FT and ABM contributed to the design of this study. LA, ALT, CCC, OP included most of the
339 patients. CR and FT conducted the analyses and LA, LM, ABM, ALT, CCC, OP, CR and FT
340 contributed to the interpretation of data. LA, LM and FT drafted the manuscript and all the
341 authors critically revised the manuscript and approved the version to published.

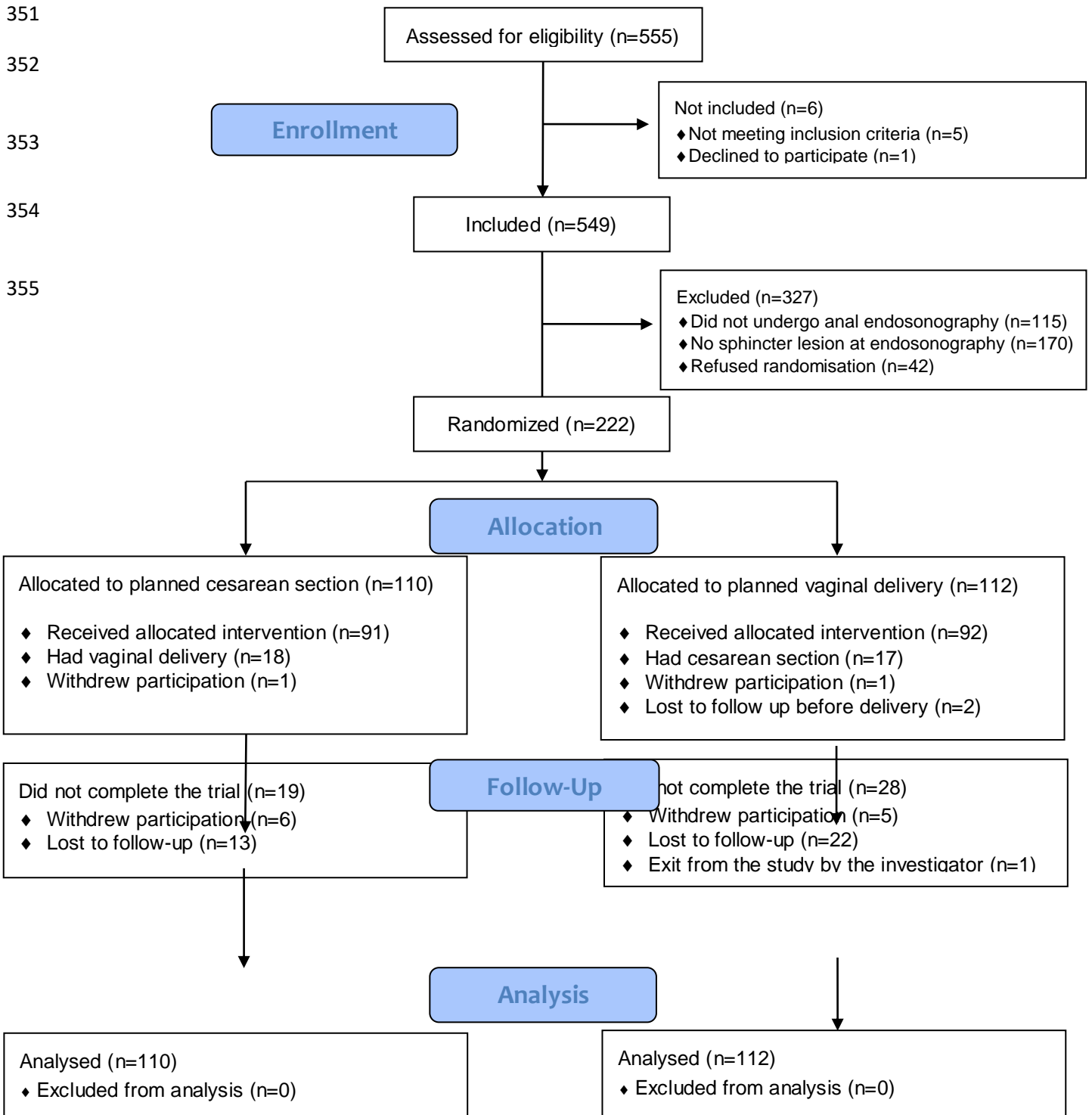
342

343 **Trial Registration** : EPIC trial. ClinicalTrials.gov number, NCT00632567

344 This study (N° ID-RCB 2006-A00518-43) was approved by the Comité de Protection des Personnes
345 (Ethical Human Subjects Protection Review) Paris-Ile-de-France V of Saint Antoine Hospital PARIS 12
346 on the 02 October 2007 (n°07709) and French Health Authority on 22 October 2007 (Ref: DGS2007-
347 0188).

348

350 **Figure 1 : Enrollment, Randomization, and Follow-up of the Study Participants**



356 **Table 1. Baseline characteristics of women randomized.***

	Total (N=222)	Vaginal delivery group (N=112)	Cesarean section group (N=110)
Age (years), mean ± SD	32.7 ± 4.5	32.8 ± 4.6	32.7 ± 4.5
Body Mass Index (kg/m) ² , mean ± SD	26.6 ± 4.4	26.2 ± 4.2	27.1 ± 4.6
Geographical origin, N (%)			
Europe	134 (61.2)	64 (58.2)	70 (64.2)
North Africa	50 (22.8)	26 (23.6)	24 (22.0)
Sub-Saharan Africa	16 (7.3)	11 (10.0)	5 (4.6)
Other	19 (8.7)	9 (8.2)	10 (9.1)
Missing data	3 (1.4)	2 (1.8)	1 (0.9)
First delivery, N (%)			
Spontaneous with 3d degree perineal laceration	20 (9.0)	11 (9.8)	9 (8.2)
Episiotomy	6 (35.3)	4 (44.4)	2 (25.0)
Missing data	3 (15.0)	2 (18.2)	1 (11.1)
Forceps	202 (91.0)	101 (91.8)	101 (92.7)
no perineal laceration	140 (71.1)	71 (71.7)	69 (70.4)
1 st degree perineal laceration	20 (10.2)	12 (12.1)	8 (8.2)
2 nd degree perineal laceration	8 (4.1)	1 (1.0)	7 (7.1)
3 rd degree perineal laceration	29 (14.7)	15 (15.2)	14 (14.3)
Missing data	5 (2.5)	2 (2.0)	3 (3.0)
Episiotomy	180 (90.5)	88 (88.0)	92 (92.9)
Missing data	3 (1.5)	1 (1.0)	2 (2.0)
Birthweight (g), mean ± SD	3388 ± 444	3444 ± 444	3332 ± 438
Care and outcome after first delivery, N (%)			
Pelvic Floor Physical Therapy performed	143 (66.5)	75 (69.4)	68 (63.6)
Anal incontinence before 2 months post-partum	27 (12.4)	10 (9.2)	17 (15.7)
Urinary incontinence ² after first delivery	72 (33.3)	40 (36.7)	32 (29.9)
Continenence and health scores during 2 nd pregnancy and before 2 nd delivery			
- Vaizey score, median [IQR]	1.0 [0.0-2.0]	0.0 [0.0-2.0]	1.0 [0.0-3.0]
- Vaizey score ≥5, no. (%)	27 (12.3)	12 (10.9)	15 (13.8)
- Measurement of Urinary Handicap (MUH) score, median [IQR]	4.0 [1.0-8.0]	5.0 [1.0-8.0]	4.0 [1.0-8.0]
- Physical Short-Form Health Survey (SF12) score, mean ± SD	42.0 ± 8.6	41.7 ± 8.4	42.3 ± 8.7
- Mental SF12 score, mean ± SD	48.8 ± 9.1	48.9 ± 9.1	48.7 ± 9.2

357 *no significant differences (p<0.05) between the trial arms

358 **Table 2. Description of the second deliveries.***

	Total (N=222)	Vaginal delivery group (N=112)	Cesarean section group (N=110)
Lost to follow-up	4	3	1
Birthweight (g), mean ± SD	3357 ± 443	3438 ± 443	3234 ± 417
Actual mode of delivery	110 (50.5)		
- Vaginal, no. (%)	108 (49.5)	92 (84.4)	18 (16.5)
- Cesarean, no. (%)		17 (15.6)	91 (83.5)
In case of vaginal delivery			
- Vacuum, no. (%)	4 (3.7)	3 (3.3)	1 (5.6)
- Forceps, no. (%)	5 (4.6)	5 (5.5)	0 (0.0)
- Anterior presentation, no. (%)	100 (96.2)	84 (95.5)	16 (100.0)
- <i>Missing data</i>	6 (5.5)	4 (4.5)	2 (11.1)
- Posterior presentation, no. (%)	2 (1.9)	2 (2.3)	0 (0.0)
- Episiotomy, no. (%)	34 (31.2)	28 (30.4)	6 (35.3)
- Perineal laceration, no. (%)	57 (52.3)	52 (56.5)	5 (29.4)
- 1 st degree	47 (82.5)	42 (80.8)	5 (100.0)
- 2 nd degree	9 (15.8)	9 (17.3)	0 (0.0)
- 3d degree	1 (1.8)	1 (1.9)	0 (0.0)
- Shoulder dystocia, no. (%)	2 (2.5)	2 (2.8)	0 (0.0)
- Duration of labor (hours), median [IQR]	4.0 [3.0 - 5.0]	4.0 [3.0 - 5.0]	3.0 [1.5 - 4.5]
- Active pushing (min), median [IQR]	11.0 [5.0 - 15.0]	12.0 [5.0 - 16.0]	9.5 [7.0 - 10.0]

360 Data are mean ± SD or median [inter-quartile range] or n (%)

361 *There was no significant differences between the trial arms (p<0.05), except for the occurrence of
 362 perineal laceration among women who delivered vaginally (absolute difference risk [CI 95%]: -27.1 [-
 363 49.7 to -1.4]).

364

365 **Table 3 : Outcomes following the second delivery in women with anal sphincter lesions**
 366 **randomized to cesarean vs. vaginal delivery**

Endpoint	Vaginal delivery arm (N=112)	Cesarean section arm (N=110)	Median or mean difference or Absolute Risk Difference (95% CI)	P Value
Primary endpoint				
Vaizey score at M8, median [IQR]	1.0 [0.0-3.0]	1.0 [0.0-4.0]	0.0 (0.0 to 2.0)	0.34
Secondary endpoints				
Vaizey score at W6-8, median [IQR]	0.0 [0.0-3.0]	0.0 [0.0-3.0]	0.0 (-2.0 to 1.0)	0.62
Post-partum transient anal incontinence at W6-8, no. (%)	18 (25.0)	9 (11.7)	-13.3 (-25.1 to 0.0)	0.32
MUH score at M8, median [IQR]	0.0 [0.0-4.0]	1.0 [0.0-4.0]	1.0 (-1.0 to 2.0)	0.72
FSFI score at M8, median [IQR]	28.1 [23.5-31.2]	27.1 [22.1-31.4]	-1.0 (-4.0 to 1.9)	0.61
Physical SF12 score at M8, mean ± SD	52.1 (6.7)	51.7 (7.0)	-0.4 (-2.5 to 1.6)	0.62
Mental SF12 score at M8, mean ± SD	46.2 (9.2)	46.6 (9.5)	0.4 (-2.3 to 3.2)	0.39
Maternal morbidities, no. (%)	4 (4.9)	8 (8.8)	3.9 (-2.7 to 11.2)	0.31
Neonatal morbidities, no. (%)	5 (6.1)	0 (0.0)	-6.1 (-11.7 to -1.3)	0.023
Worsening of external sphincter lesions at ultrasound, no. (%)	11 (22.4)	1 (2.2)	-20.2 (-31.7 to -7.6)	0.003

367 All the analyses were conducted in the intent-to-treat population except maternal and neonatal
 368 morbidities (completers), and are superiority analyses. For secondary endpoints, the confidence
 369 intervals have not been adjusted and inferences drawn from the intervals may not be reproducible.

370

371 **References**

372

- 373 1. Mous M, Muller SA, de Leeuw JW. Long-term effects of anal sphincter rupture during vaginal
374 delivery: faecal incontinence and sexual complaints. *BJOG : an international journal of obstetrics and*
375 *gynaecology*. 2008 Jan;115(2):234-8.
- 376 2. Otero M, Boulvain M, Bianchi-Demicheli F, Floris LA, Sangalli MR, Weil A, et al. Women's
377 health 18 years after rupture of the anal sphincter during childbirth: II. Urinary incontinence, sexual
378 function, and physical and mental health. *Am J Obstet Gynecol*. 2006 May;194(5):1260-5.
- 379 3. Desseauve D, Proust S, Carlier-Guerin C, Rutten C, Pierre F, Fritel X. Evaluation of long-term
380 pelvic floor symptoms after an obstetric anal sphincter injury (OASI) at least one year after delivery: A
381 retrospective cohort study of 159 cases. *Gynecol Obstet Fertil*. 2016 Jul-Aug;44(7-8):385-90.
- 382 4. Sharma A, Yuan L, Marshall RJ, Merrie AE, Bissett IP. Systematic review of the prevalence of
383 faecal incontinence. *Br J Surg*. 2016 Nov;103(12):1589-97.
- 384 5. Menees SB, Almario CV, Spiegel BMR, Chey WD. Prevalence of and Factors Associated With
385 Fecal Incontinence: Results From a Population-Based Survey. *Gastroenterology*. 2018
386 May;154(6):1672-81 e3.
- 387 6. Gurol-Urganci I, Cromwell DA, Edozien LC, Mahmood TA, Adams EJ, Richmond DH, et al.
388 Third- and fourth-degree perineal tears among primiparous women in England between 2000 and
389 2012: time trends and risk factors. *BJOG : an international journal of obstetrics and gynaecology*.
390 2013 Nov;120(12):1516-25.
- 391 7. Oberwalder M, Connor J, Wexner SD. Meta-analysis to determine the incidence of obstetric
392 anal sphincter damage. *Br J Surg*. 2003 Nov;90(11):1333-7.
- 393 8. Samarasekera DN, Bekhit MT, Wright Y, Lowndes RH, Stanley KP, Preston JP, et al. Long-term
394 anal continence and quality of life following postpartum anal sphincter injury. *Colorectal Dis*. 2008
395 Oct;10(8):793-9.
- 396 9. Abramowitz L, Sobhani I, Ganansia R, Vuagnat A, Benifla JL, Darai E, et al. Are sphincter
397 defects the cause of anal incontinence after vaginal delivery? Results of a prospective study. *Dis*
398 *Colon Rectum*. 2000 May;43(5):590-6; discussion 6-8.
- 399 10. Jango H, Langhoff-Roos J, Rosthoj S, Saske A. Long-term anal incontinence after obstetric anal
400 sphincter injury-does grade of tear matter? *Am J Obstet Gynecol*. 2018 Feb;218(2):232 e1- e10.
- 401 11. McKenna DS, Ester JB, Fischer JR. Elective cesarean delivery for women with a previous anal
402 sphincter rupture. *Am J Obstet Gynecol*. 2003 Nov;189(5):1251-6.
- 403 12. Farrar D, Tuffnell DJ, Ramage C. Interventions for women in subsequent pregnancies
404 following obstetric anal sphincter injury to reduce the risk of recurrent injury and associated harms.
405 *The Cochrane database of systematic reviews*. 2014 Nov 6(11):CD010374.
- 406 13. Long E, Jha S. Factors that influence patient preference for mode of delivery following an
407 obstetric anal sphincter injury. *Eur J Obstet Gynecol Reprod Biol*. 2018 Feb;221:28-33.
- 408 14. Waldman R. ACOG Practice Bulletin No. 198: Prevention and Management of Obstetric
409 Lacerations at Vaginal Delivery. *Obstet Gynecol*. 2019 Jan;133(1):185.
- 410 15. RCOG RCoOaG. Management of third and fourth degree perineal tears. RCOG Press.
411 2015;Green top guideline 29.
- 412 16. Lumbiganon P, Laopaiboon M, Gulmezoglu AM, Souza JP, Taneepanichskul S, Ruyan P, et al.
413 Method of delivery and pregnancy outcomes in Asia: the WHO global survey on maternal and
414 perinatal health 2007-08. *Lancet*. 2010 Feb 6;375(9713):490-9.
- 415 17. Ducarme G, Pizzoferrato AC, de Tayrac R, Schantz C, Thubert T, Le Ray C, et al. Perineal
416 prevention and protection in obstetrics: CNGOF clinical practice guidelines. *J Gynecol Obstet Hum*
417 *Reprod*. 2019 Sep;48(7):455-60.
- 418 18. Jango H, Langhoff-Roos J, Rosthoj S, Sakse A. Mode of delivery after obstetric anal sphincter
419 injury and the risk of long-term anal incontinence. *Am J Obstet Gynecol*. 2016 Jun;214(6):733 e1-
420 e13.

- 421 19. Fritel X, Ringa V, Varnoux N, Zins M, Breart G. Mode of delivery and fecal incontinence at
422 midlife: a study of 2,640 women in the Gazel cohort. *Obstet Gynecol.* 2007 Jul;110(1):31-8.
- 423 20. Vaizey CJ, Carapeti E, Cahill JA, Kamm MA. Prospective comparison of faecal incontinence
424 grading systems. *Gut.* 1999 Jan;44(1):77-80.
- 425 21. Law PJ, Bartram CI. Anal endosonography: technique and normal anatomy. *Gastrointest*
426 *Radiol.* 1989 Fall;14(4):349-53.
- 427 22. Rosen R, Brown C, Heiman J, Leiblum S, Meston C, Shabsigh R, et al. The Female Sexual
428 Function Index (FSFI): a multidimensional self-report instrument for the assessment of female sexual
429 function. *J Sex Marital Ther.* 2000 Apr-Jun;26(2):191-208.
- 430 23. Marquis P, Amarenco G, Sapede C, Josserand F, McCarthy C, Zerbib M, et al. [Elaboration and
431 validation of a specific quality of life questionnaire for urination urgency in women]. *Prog Urol.* 1997
432 Feb;7(1):56-63.
- 433 24. Ware J, Jr., Kosinski M, Keller SD. A 12-Item Short-Form Health Survey: construction of scales
434 and preliminary tests of reliability and validity. *Med Care.* 1996 Mar;34(3):220-33.
- 435 25. Perry S, Shaw C, McGrother C, Matthews RJ, Assassa RP, Dallosso H, et al. Prevalence of
436 faecal incontinence in adults aged 40 years or more living in the community. *Gut.* 2002
437 Apr;50(4):480-4.
- 438 26. Fradet-Menard C, Deparis J, Gachon B, Sichitiu J, Pierre F, Fritel X, et al. Obstetrical anal
439 sphincter injuries and symptoms after subsequent deliveries: A 60 patient study. *Eur J Obstet*
440 *Gynecol Reprod Biol.* 2018 Jul;226:40-6.
- 441 27. Nygaard IE, Rao SS, Dawson JD. Anal incontinence after anal sphincter disruption: a 30-year
442 retrospective cohort study. *Obstet Gynecol.* 1997 Jun;89(6):896-901.
- 443 28. Larsson C, Hedberg CL, Lundgren E, Soderstrom L, TunOn K, Nordin P. Anal incontinence after
444 caesarean and vaginal delivery in Sweden: a national population-based study. *Lancet.* 2019 Mar
445 23;393(10177):1233-9.
- 446 29. Guzman Rojas RA, Salvesen KA, Volloyhaug I. Anal sphincter defects and fecal incontinence
447 15-24 years after first delivery: a cross-sectional study. *Ultrasound Obstet Gynecol.* 2018
448 May;51(5):677-83.
- 449 30. Faltin DL, Boulvain M, Irion O, Bretones S, Stan C, Weil A. Diagnosis of anal sphincter tears by
450 postpartum endosonography to predict fecal incontinence. *Obstet Gynecol.* 2000 May;95(5):643-7.
- 451 31. Roos AM, Thakar R, Sultan AH. Outcome of primary repair of obstetric anal sphincter injuries
452 (OASIS): does the grade of tear matter? *Ultrasound Obstet Gynecol.* 2010 Sep;36(3):368-74.
- 453 32. Laine K, Skjeldestad FE, Sanda B, Horne H, Spydslaug A, Staff AC. Prevalence and risk factors
454 for anal incontinence after obstetric anal sphincter rupture. *Acta Obstet Gynecol Scand.* 2011
455 Apr;90(4):319-24.
- 456 33. Fitzpatrick M, Cassidy M, Barassaud ML, Hehir MP, Hanly AM, O'Connell PR, et al. Does anal
457 sphincter injury preclude subsequent vaginal delivery? *Eur J Obstet Gynecol Reprod Biol.* 2016
458 Mar;198:30-4.

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