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Incidence and risk factors of caesarean section in preterm breech births: a population-based cohort study

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Condensation: Breech presentation is common in preterm infants and is associated with widespread use of cesarean delivery despite the absence of recommendations for mode of delivery.

Abstract

Objectives: To describe the incidence of breech presentation at 22 to 34 weeks' gestation, estimate the incidence of cesarean section delivery by cause of prematurity, and assess the factors associated with caesarean delivery in preterm breech births with preterm labor or preterm premature rupture of membranes.

Study design: EPIPAGE 2 is a French national prospective population-based cohort study of preterm births that occurred in 546 maternity units in 2011. We estimated the overall incidence of breech presentation and the incidence of cesarean delivery by cause of prematurity. Among the 579 singletons with breech presentation born at 22 to 34 weeks in a context of spontaneous preterm labor or membrane rupture, multivariable logistic regression was used to assess the association between individual and institutional characteristics and caesarean delivery.

Results: Among the 3,660 singletons born at 22 to 34 weeks' gestation in the EPIPAGE 2 study, 20.1% (n=911) were breech presentation. Among these births, the rate of cesarean section was 99.6% with vascular pathologies, intrauterine growth retardation or placental abruption as compared with 60.1% with spontaneous preterm labor or membrane rupture. The main indication for caesarean delivery was gestational age associated with breech presentation (61.0%). Delivery mode varied by region of birth. Other characteristics associated with caesarean delivery were hospital status (public teaching, public non-teaching or private), clinical chorioamniotitis, hospital admission after labor onset, and gestational age.

Conclusion: Breech presentation is common in preterm infants and is associated with widespread use of cesarean delivery with significant regional disparities that could reflect the lack of consensus and recommendations on the preferential mode of delivery. Other factors

associated with caesarean delivery are the status of the maternity unit, clinical chorioamniotitis, admission after labor onset and gestational age.

Keywords: EPIPAGE 2, breech presentation, preterm birth, mode of delivery, caesarean section

Introduction

Mode of delivery of preterm fetuses with breech presentation remains controversial (1–5). Obstetricians are often faced with this situation because the prevalence of the breech presentation is elevated with low gestational age: from 3% to 4% at term to 28% at 25 to 28 weeks' gestation (6,7). This issue is crucial in obstetrical management. Indeed, the condition of the child, already exposed to the specific risks of prematurity, can worsen because of the potential complications associated with labor and vaginal delivery (anoxia, obstetric trauma, head entrapment, death) (8–10). In addition, caesarean section, which is technically difficult because of the absent or thicker lower uterine segment, is associated with non-negligible maternal risks both in the short term (2,11–13) and long term (14).

Results of a randomized controlled trial published in 2000 (15), concluded that the risk of neonatal death with term breech presentation was reduced with planned caesarean delivery as compared with planned vaginal delivery. This study included 2,183 women from 121 maternity units and 26 countries. Nevertheless, external validity was limited because of the large variation in local policies and individual skills and by the analysis of neonatal deaths unrelated to delivery route (16–18). These results largely contributed to changes in practices (19), with a greater use of caesarean delivery with breech presentation, at term but also before term, although the study did not provide any specific information concerning preterm breech presentation. Because of this lack of evidence, the National College of French Gynecologists and Obstetricians (CNGOF), in its guidelines of 1998 and 2016, does not recommend one delivery mode over another for preterm breech presentation (20–22).

The objectives of this work were to (1) describe the incidence of breech presentation in deliveries between 22 and 34 weeks' gestation, (2) estimate the incidence of caesarean section

delivery with preterm breech presentation by cause of prematurity and (3) study the individual and institutional factors associated with caesarean delivery in preterm breech fetuses.

Methods

Setting and data collection

This study is based on data from the EPIPAGE2 (Etude épidémiologique sur les petits âges gestationnels) cohort study (23), a prospective, national, population-based cohort study implemented to describe the short- and long-term outcomes of preterm infants in terms of birth circumstances, medical practices and organization of care. Infants were included from March to December 2011 in 546 maternity units, representing 98% of French maternity units. Infants born at 22 to 26 weeks, 27 to 31 weeks, and 32 to 34 weeks were included for 8 months, 6 months and 5 weeks, respectively. Different stages of follow-up are planned up to age 12 years. Individual perinatal data were collected from medical records in both maternity and neonatology units. The data for centers were obtained from a specific questionnaire sent to obstetrics and neonatology departments that included at least one live birth in the cohort (i.e., 413 centers).

Participants

Among the 7,804 infants born at 22 to 34 weeks' gestation included in the EPIPAGE2 study, we included all singletons who were alive at the beginning of labor or during the caesarean section performed before labor, who were in breech presentation. Exclusion criteria were multiple pregnancies, home births, terminations of pregnancy and stillbirths before labor. Because the use of caesarean section delivery is almost systematic in situations of prematurity induced for a maternal indication (e.g., hypertensive pathology) and/or fetal indication (e.g., intrauterine growth retardation [IUGR]), we focused on cases of spontaneous preterm labor

(SPL) and preterm premature rupture of membranes (PPROM), these two case groups being mutually exclusive.

Outcome and other studied factors

The primary outcome was caesarean section delivery, performed before or during labor, as reported in the medical record.

The variables analyzed first focused on maternity unit characteristics: region, type (type I: without neonatal department; types IIa & IIb: with neonatal department; type III: with neonatal intensive care unit) and status of the institution (public teaching, public non-teaching or private). We then studied maternal characteristics (age, nationality, employment, marital status, parity, previous caesarean section) and obstetric characteristics (cause of preterm birth, antenatal steroids, *in utero* transfer, clinical chorioamniotitis, admission after labor onset, gestational age).

SPL was defined as preterm labor with intact membranes and PPROM as membranes ruptured more than 24 hr before delivery. Gestational age was determined from a first trimester ultrasound or the date of the last menstrual period. Antenatal steroids use was a binary variable classified as at least one injection versus no injection of betamethasone or dexamethasone before delivery.

Statistical analysis

We first estimated the incidence of breech presentation by gestational age and that of caesarean section by cause of prematurity. We then described the respective frequencies of vaginal and caesarean deliveries and compared institutional and individual characteristics by mode of delivery. To account for the inclusion scheme of the study and for representative preterm births in France, a weighted coefficient was allocated to each individual (1 for births

between 22 and 26 weeks, 1,346 for births between 27 and 31 weeks, and 7 for births between 32 and 34 weeks). The association between maternal or obstetric characteristics and caesarean section was estimated by univariate and multivariate logistic regression models and quantified by crude odds ratios (ORs) and adjusted ORs (aOR) and their confidence intervals (95% CIs). The variables included in the multivariate model were chosen according to their clinical relevance. Data were missing for 0% to 9.5% of patients for each covariate. A missing data indicator class was added to each relevant categorical variable in the multivariate analysis. The adjustment of the multivariate model to the data was tested by the Hosmer-Lemeshow test; its discriminating power was evaluated by the area under the receiver operating characteristic curve. Data were analyzed by using Stata/SE 13.0 (StataCorp LP, College Station, TX). Statistical significance was set at 2-tailed $p<.05$.

Results

Incidence of breech presentation

Among the 3,660 singletons born at 22 to 34 weeks included in the EPIPAGE 2 study, 911 (weighted percentage 20.1%) were in breech presentation (Figure 1). The overall frequency of breech presentation varied by gestational age at birth: 47.1% to 37.4% at 22 to 26 weeks, 29.5% to 24.2% at 27 to 29 weeks, and 20.5% to 12.5% at 30 to 34 weeks (Figure 2).

Incidence of caesarean section delivery with breech presentation by cause of prematurity

The main causes of premature birth, mutually exclusive, were SPL (41.1%), PPROM (28.1%), vascular or hypertensive pathology (22.1%), IUGR (5.6%) or placental abruption (3.1%). With breech presentation, caesarean delivery was almost systematic with vascular pathologies, IUGR and placental abruption (99.6% of patients). It was performed for 60.1% of

patients (95% CI [54.6-65.7]) with breech presentation and SPL or PPROM with variations by week of gestational age (Figures 1, 2).

Factors associated with caesarean delivery with breech presentation and SPL or PPROM

The births included in this analysis occurred in 170 maternity units. Regional disparities existed: in Rhône-Alpes, Auvergne, Martinique and Limousin districts, more than 80% of births were caesarean deliveries as compared with less than 33% in French Guiana, Picardie, Centre and Haute-Normandie (Figure 3). Nearly one-third of births occurred in other than type III maternity units (Table 2). Before 32 weeks, 4.2%, 7.8% and 6.2% of infants were born in type I, IIa or IIb maternity units, respectively. Most deliveries occurred in a public institution: a public teaching hospital for 49.6% or a public non-teaching hospital for 41.5%. After adjustment, region ($p<.001$) and hospital status ($p=.005$) were significantly associated with caesarean delivery (Tables 1, 2).

Among socio-demographic characteristics, the age of the mother and her nationality were not associated with the mode of delivery. However, single patients or housewives less often had a caesarean section delivery than patients in a couple relation or who were employed, respectively. These associations disappeared after adjusting for confounding factors (Table 2).

In terms of obstetrics history, nearly half of the mothers were multiparous; in total, 7.1% had a scarred uterus and 3.3% had had two or more previous caesarean sections. Parity was not associated with caesarean delivery. There was a gradient with an increase in caesarean deliveries by number of previous caesarean sections. This association was not found on multivariate analysis.

Concerning the current pregnancy, the cause of preterm birth, *in utero* transfer and antenatal corticosteroids were not associated with the delivery mode (Table 2). After adjustment, risk of

caesarean delivery was increased with clinical chorioamniotitis (aOR 2.0 [1.1-3.7]) but reduced with admission after labor onset, representing 25.2% of patients, as compared with labor occurring during hospitalization (aOR 0.3 [0.1-0.5]).

Finally, risk of caesarean delivery was strongly associated with gestational age (p<.001), even after adjusting for individual and institutional characteristics (Table 2). No caesarean section was performed at 22 and 23 weeks' gestation (Figure 2). From 24 to 25 weeks, 1 in 5 patients had a caesarean section delivery. From 26 to 34 weeks, the frequency of caesarean delivery varied from 59.8% to 80.0%. Gestational age associated with breech presentation was the main indication for caesarean section, reported in 61.0% of cases. Other non-mutually exclusive indications were maternal pathology (18.6%), abnormal fetal heart rate before or during labor (18.3%), fetal pathology (14.3%) and/or stagnated dilation (1.7%).

Comment

Main findings

Among singletons born at 22 to 34 weeks, 20.1% were breech presentations, with significant variations depending on gestational age. Most of these preterm deliveries were caesarean sections, 99.6% with vascular pathologies, IUGR or placental abruption as compared with 60.1% with SPL or PPROM. Delivery mode appeared to vary by region of birth in France. Childbirth occurred in other than a type III maternity unit for nearly 20% of births before 32 weeks. Other characteristics associated with caesarean deliveries with preterm breech presentation were the status of the maternity unit, clinical chorioamniotitis, admission after labor onset, and gestational age.

Strengths and limitations

The main strength of this study is related to the design of the EPIPAGE2 cohort, a large national, prospective, population-based study. The strong involvement of families (93% participation among all eligible children) and the systematic and standardized collection of precise individual data ensure good representation of patients and medical practices.

However, this analysis has some limitations. Indeed, 596 eligible children (7.1%) were not included in the EPIPAGE 2 cohort because of parental refusal. Among these, 109 singletons (19.6% [15.2-24.9]) were breech presentations, with no significant difference from children included in our analysis (data not shown). The comparison of caesarean delivery rates was not possible between these two groups because the cause of delivery was unknown with refusal of participation. However, non-participation is not likely linked to fetal presentation or mode of delivery, which limits this potential bias.

The missing data for the variables "presentation" and "cause of prematurity" led us to exclude 173 then 75 subjects from the analysis (i.e., 6.8% of the initial sample). Infants whose presentation was unknown were more often delivered by caesarean section (86.5% [79.0-94.0]) and less often because of SPL or PPROM (46.0% [34.4-57.5]) than was our study population. Thus, most of these participants were not eligible for our analysis. Among the 75 infants for whom the cause of prematurity was missing, 66.2% (53.6-78.8) were delivered by caesarean section, so the distribution of delivery route did not differ from that for our analysis population.

A final limitation was the lack of precise data on the type of breech presentation, frank or complete. This clinically relevant information may affect the choice of delivery route, with a complete breech considered to have a poorer obstetric prognosis. However, in the context of preterm births, the type of breech is not as important in the decision as gestational age or the speed of labor.

Interpretation

Our results show a high rate of caesarean section deliveries in preterm breech singletons in France. Several factors can explain this result. First, situations of induced preterm birth (because of vascular pathology, IUGR…), which have increased in frequency in recent years (24), strongly affect the overall incidence of caesarean deliveries. In cases of SPL and PPROM, clinical guidelines do not guide the practitioner's choice (20,22). The lack of consensus in the literature (1–5) and the fear of potential severe complications of labor and delivery can also explain the preponderant use of caesarean delivery. Its use may also be a reflection of the medico-legal considerations in the management of obstetric situations considered at risk (16,25).

Performing a caesarean section is a marker of active antenatal care of the unborn child, as are antenatal steroids or magnesium sulfate for neuroprotection (26). Therefore, gestational age logically plays a preponderant role in this decision (26). Thus, in our study, no caesarean section was performed before the resuscitation threshold considered in France in 2011 (24 weeks). Thereafter, caesarean sections are more easily offered to patients with fetal vital prognosis considered "acceptable" (27), which corresponds to increasingly low gestational age as a result of advances in neonatology.

We showed significant regional variations in the frequency of caesarean deliveries for preterm breech presentations with SPL or PPROM. This heterogeneity may reflect regional disparities in the active antenatal care proposed in the context of extreme prematurity. Regional variations may also be related to variations in patient characteristics but also to a different distribution of maternity unit types and status. This contrast can reflect the leadership of the regional university hospital, where practitioners of peripheral maternity clinics have often been trained.

This variability in delivery practices is often reported between countries, maternity units and even obstetricians (25,28–30). In a French survey of management for breech presentations in university hospitals, Michel et al. found mean of 73.8% (range 50.3% to 98.3%) declared rates of caesarean section deliveries (28). The authors reported that obstetric practices were little affected by gestational age and that only 3 of 18 hospitals included gestational age in their decision protocol for delivery route.

Clinical chorioamnionitis was associated with an increase in caesarean deliveries. This finding is consistent in the literature: caesarean delivery allows for shortening the fetal exposure to infection, especially when women are not in labor (31).

Unexpected delivery is common in situations of spontaneous prematurity, with a large number of patients in labor admitted to hospital. Therefore, the breech presentation is often diagnosed shortly before delivery (32). The delivery route must be chosen quickly, unless the imminence of birth leaves no other choice than vaginal delivery. Our results are consistent with findings from a retrospective study of term breeches showing that the probability of a vaginal birth increases with cervical dilation at admission ≥5 cm (33). This finding raises the question of the technical skills required for vaginal delivery in preterm breech presentations, especially in a sudden obstetric context, that is, when vaginal delivery is accepted by the obstetric team only because performing a caesarean section is impossible. This situation, often marked by emergency, requires precise and adapted gestures by all professionals, including younger ones (34).

Conclusion

Breech presentation is frequent for infants born at 22 to 34 weeks' gestation. In this clinical situation, the rate of caesarean deliveries in France is high, with significant regional

disparities that could reflect the lack of consensus and recommendations on the preferential mode of delivery. Other factors associated with caesarean delivery are the status of the maternity unit, clinical chorioamniotitis, admission after labor onset and gestational age. The impact of the delivery mode on neonatal outcomes needs to be addressed.

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Tables and figures

Figure 1: Flow of participants in the study.

Figure 2: Incidence of breech presentation and rate of caesarean section by week of gestational age.

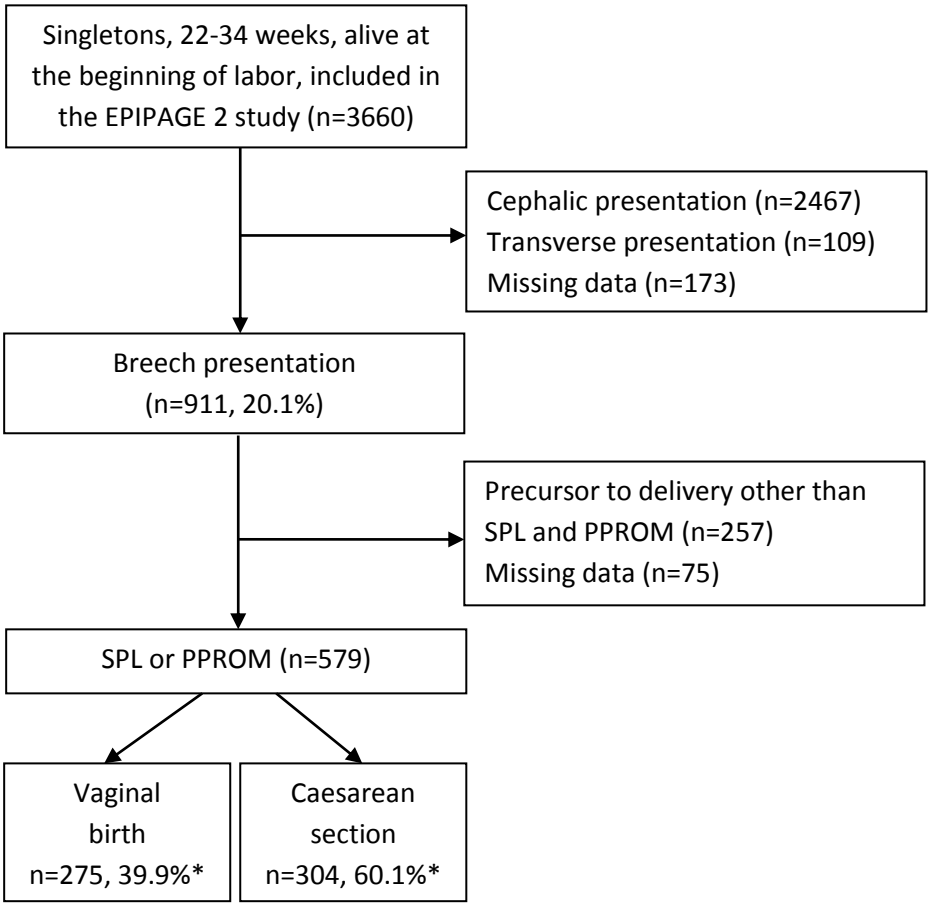
Figure 3: Incidence of breech presentation and mode of delivery by region of birth.*

Legend: * The Poitou-Charentes region did not participate.

Table 1: Association between the region of birth and caesarean section with breech presentation and spontaneous preterm labor (SPL) or preterm premature rupture of membranes (PPROM).

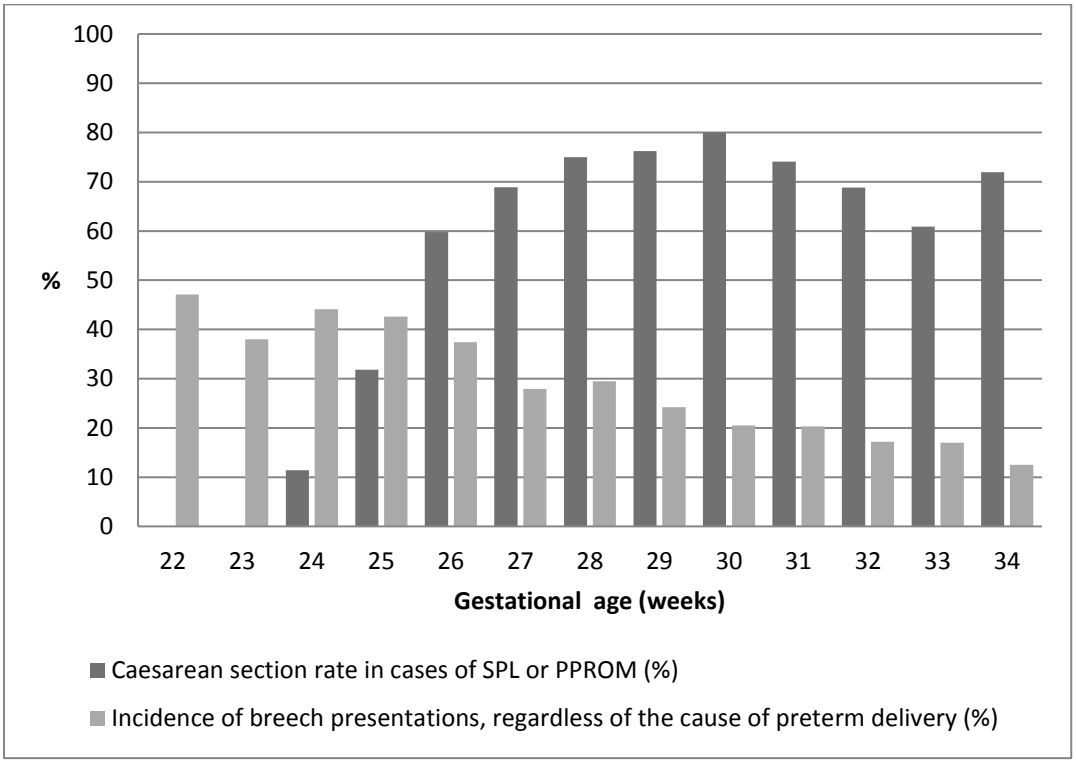
Table 2: Association between institutional and individual characteristics and caesarean section with breech presentation and SPL or PPROM.

Figure 1: Flow of infants in the study.



SPL: spontaneous preterm labor
PPROM: preterm premature rupture of membranes
* Percentages are weighted according to gestational age.

Figure 2: Incidence of breech presentation* and rate of caesarean section by week of gestational age.



* The incidence of breech presentation is assessed among the 3487 singletons, born at 22 to 34 weeks, alive at the beginning of labor with information about fetal presentation.

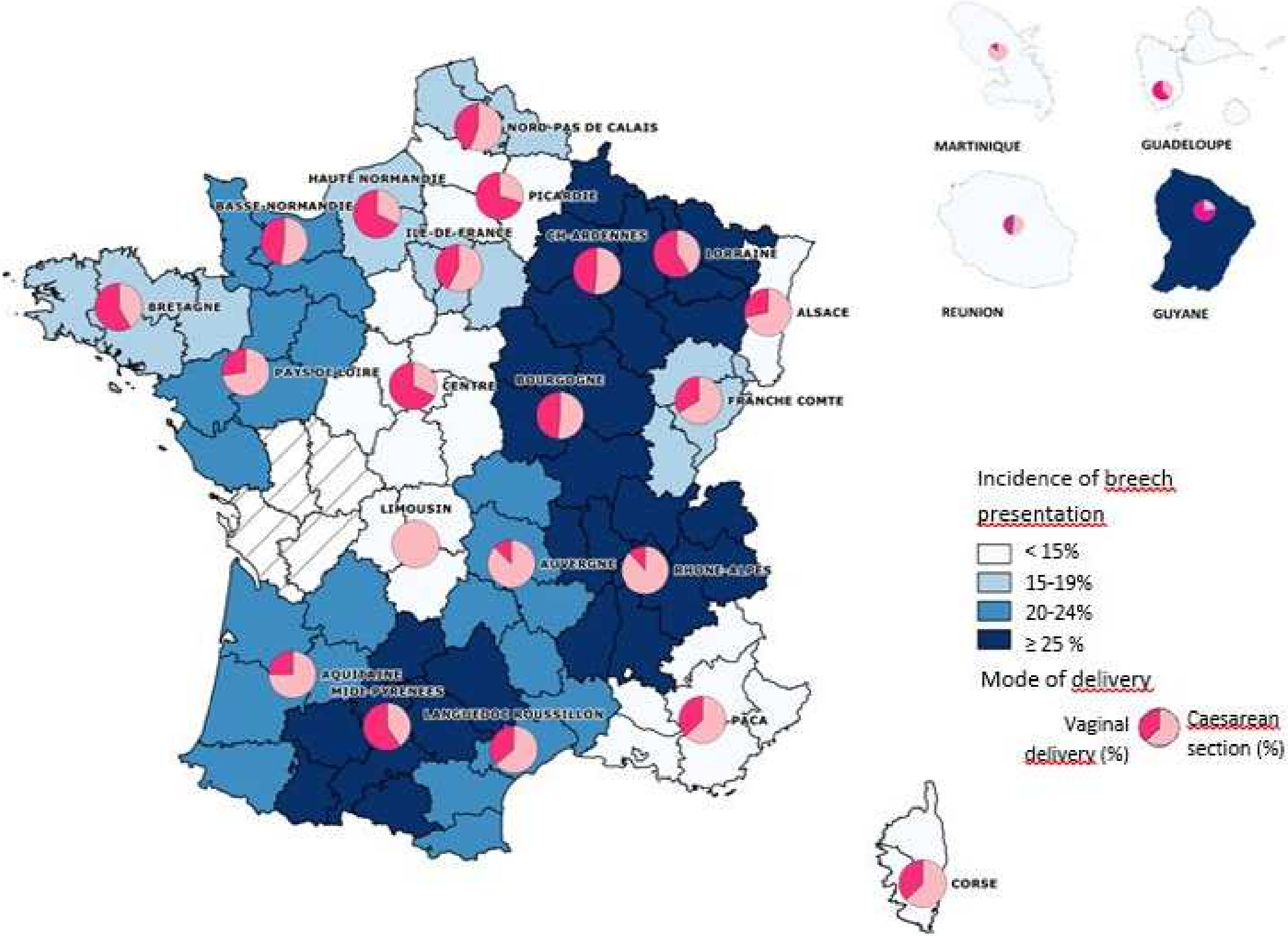

NORD-PAS DE CALAIS
HAUTE NORMANDIE
PICARDIE
BASSE-NORMANDIE
ILE-DE-FRANCE
CH-ARDENNES
LORRAINE
BRETAGNE
ALSACE
PAYS-DE-LOIRE
CENTRE
BOURGOGNE
FRANCHE COMTE
LIMOUSIN
AUVERGNE
RHONE-ALPES
AQUITAINE
MIDI-PYRENEES
LANGUEDOC ROUSSILLON
PACA
CORSE
MARTINIQUE
GUADELOUPE
REUNION
GUYANE
Incidence of breech presentation
< 15%
15-19%
20-24%
≥ 25 %
Mode of delivery
Vaginal delivery (%)
Caesarean section (%)

Table 1: Association between the region of birth and caesarean section with breech presentation and spontaneous preterm labor (SPL) or preterm premature rupture of membranes (PPROM).

	Vaginal birth (n=275)	Caesarean section (n=304)	Bivariate analysis	Multivariate analysis
	n (%)*	n (%)*	OR* (95%CI)	aOR** (95%CI)
Region of birth				
Alsace	7 (28.7)	10 (71.3)	1.8 (0.5-6.4)	2.1 (0.5-8.3)
Aquitaine	6 (25.0)	16 (75.0)	2.2 (0.5-9.4)	2.3 (0.7-8.4)
Auvergne	2 (12.7)	6 (87.3)	5.1 (0.8-31.7)	2.9 (0.4-22.3)
Basse Normandie	9 (47.6)	5 (52.4)	0.8 (0.2-3.7)	0.4 (0.1-1.7)
Bourgogne	8 (48.3)	8 (51.7)	0.8 (0.2-3.4)	1.0 (0.2-3.8)
Bretagne	14 (58.4)	9 (41.6)	0.5 (0.2-1.4)	0.6 (0.2-2.2)
Centre	7 (68.3)	5 (31.7)	0.3 (0.1-1.6)	2.5 (0.5-13.4)
Champagne-Ardenne	5 (48.0)	6 (52.0)	0.8 (0.1-4.5)	0.4 (0.1-2.1)
Franche-Comté	3 (33.8)	6 (66.2)	1.5 (0.2-10.0)	5.6 (0.7-44.8)
Guadeloupe	5 (61.5)	3 (38.5)	0.5 (0.1-2.1)	1.2 (0.1-10.8)
Guyane	5 (77.5)	4 (22.5)	0.2 (0.1-1.1)	0.3 (0.1-2.1)
Haute Normandie	10 (67.5)	7 (32.5)	0.4 (0.1-1.2)	0.7 (0.2-2.7)
Ile de France	71 (42.6)	67 (57.4)	1	1
Languedoc Roussillon	7 (36.0)	22 (64.0)	1.3 (0.4-4.5)	**11.5 (3.2-41.8)**
Limousin	0 (0.0)	2 (100.0)	-	-
Lorraine	13 (59.5)	5 (40.5)	0.5 (0.1-2.2)	0.6 (0.2-2.4)
Martinique	1 (12.9)	5 (87.1)	5.0 (0.5-45.2)	23.7 (0.6-949.5)
Midi-Pyrénées	13 (59.5)	12 (40.5)	0.5 (0.2-1.6)	0.7 (0.2-2.3)
Nord Pas de Calais	26 (43.7)	16 (56.3)	1.0 (0.4-2.4)	0.5 (0.2-1.4)
Provence Alpes Côte d'Azur	21 (37.5)	21 (62.5)	1.2 (0.5-3.0)	2.4 (0.9-6.6)
Pays de Loire	15 (27.3)	19 (72.7)	2.0 (0.8-5.0)	**3.2 (1.1-9.5)**
Picardie	5 (70.3)	2 (29.7)	0.3 (0.1-1.7)	0.3 (0.1-2.2)
Réunion	8 (48.2)	3 (51.8)	0.8 (0.1-4.5)	1.5 (0.3-8.1)
Rhône-Alpes	14 (11.3)	45 (88.7)	5.8 (2.6-13.2)	**6.7 (2.3-19.1)**

* Percentages and odds ratios (ORs) are weighted according to gestational age.

** aOR: OR adjusted for region, type and status of maternity unit, age, nationality, employment, marital status, parity, scarred uterus, cause of preterm birth, antenatal steroids use, *in utero* transfer, clinical chorioamniotitis, admission after labor onset, gestational age

95% CI, 95% confidence interval

Table 2: Association between institutional and individual characteristics and caesarean section with breech presentation and SPL or PPROM.

		Total (n=579)	Vaginal birth (n=275)	Caesarean section (n=304)	Bivariate analysis	Multivariate analysis
		n (%)*	n (%)*	n (%)*	OR* (95%CI)	aOR** (95%CI)
Maternity unit characteristics						
Unit type	I	27 (4.9)	19 (6.0)	8 (4.1)	0.7 (0.2-2.1)	0.6 (0.1-2.3)
	IIa	54 (11.9)	33 (13.2)	21 (11.1)	0.9 (0.4-1.9)	0.8 (0.3-2.4)
	IIb	53 (15.6)	29 (12.5)	24 (17.7)	1.4 (0.7-3.1)	0.9 (0.3-2.3)
	III	445 (67.6)	194 (68.3)	251 (67.1)	1	1
Hospital status	Public teaching	315 (49.6)	146 (53.8)	169 (46.8)	1	**1**
	Public non-teaching	213 (41.5)	100 (39.4)	113 (42.9)	1.2 (0.8-2.0)	**3.3 (1.7-6.2)**
	Private	32 (8.9)	16 (6.8)	16 (10.3)	1.8 (0.6-4.8)	**2.3 (0.6-8.8)**
Maternal characteristics						
Age (years)	< 20	27 (2.9)	18 (4.6)	9 (1.7)	0.4 (0.2-0.9)	0.8 (0.2-2.5)
	20–34	440 (76.5)	215 (78.2)	225 (75.4)	1	1
	≥ 35	111 (20.6)	41 (17.2)	70 (22.9)	1.4 (0.7-2.6)	1.3 (0.7-2.4)
Nationality	French	446 (85.1)	206 (82.0)	240 (87.1)	1	1
	Other	85 (14.9)	46 (18.0)	39 (12.9)	0.7 (0.3-1.3)	1.0 (0.5-2.0)
Marital status	Marital life	482 (91.5)	223 (86.1)	259 (95.0)	1	1
	Single	61 (8.5)	34 (13.9)	27 (5.0)	0.3 (0.2-0.6)	0.8 (0.4-1.8)
Employment	Employed	333 (65.3)	139 (57.0)	194 (70.5)	1	1
	Unemployed	61 (9.7)	31 (9.8)	30 (9.7)	0.8 (0.4-1.7)	1.1 (0.5-2.5)
	Housewife	143 (25.0)	79 (33.2)	64 (19.8)	0.5 (0.3-0.8)	0.8 (0.4-1.5)
Obstetric characteristics						
Parity	0	298 (51.2)	154 (53.5)	144 (49.7)	1	1
	1	156 (26.0)	71 (26.0)	85 (25.9)	1.1 (0.6-1.9)	0.7 (0.4-1.3)
	2 or more	124 (22.8)	49 (20.5)	75 (24.4)	1.3 (0.7-2.4)	0.8 (0.4-1.7)
Scarred uterus	No	486 (89.6)	245 (93.4)	241 (86.9)	1	1
	1 previous scar	46 (7.1)	15 (5.4)	31 (8.3)	1.6 (0.7-3.9)	1.9 (0.8-4.8)
	≥ 2 previous scars	19 (3.3)	5 (1.2)	14 (4.8)	4.3 (1.3-13.8)	2.3 (0.5-11.4)
Cause of preterm birth	SPL	341 (59.1)	184 (62.0)	157 (57.2)	1	1
	PPROM	238 (40.9)	91 (38.0)	147 (42.8)	1.2 (0.8-2.0)	1.2 (0.7-2.0)
Clinical chorioamnionitis	No	387 (82.4)	188 (83.0)	199 (81.9)	1	**1**
	Yes	139 (17.6)	59 (17.0)	80 (18.1)	1.1 (0.7-1.8)	**2.0 (1.1-3.7)**
In utero transfer	No	326 (59.8)	186 (65.7)	140 (56.0)	1	1
	Yes	247 (40.2)	84 (34.3)	163 (44.0)	1.5 (0.9-2.5)	1.6 (0.9-2.7)
Antenatal steroids use	No	182 (33.0)	128 (39.7)	54 (28.5)	1	1
	Yes	384 (67.0)	139 (60.3)	245 (71.5)	1.7 (1.0-2.8)	1.5 (0.8-2.7)
Admission after labor onset	No	417 (74.8)	169 (63.2)	248 (82.7)	1	**1**
	Yes	148 (25.2)	102 (36.8)	46 (17.3)	0.4 (0.2-0.6)	**0.3 (0.1-0.5)**
Gestational age (weeks)	22-25	187 (17.2)	159 (36.7)	28 (4.3)	0.1 (0.0-0.2)	**0.1 (0.0-0.2)**
	26-27	127 (13.1)	47 (11.9)	80 (13.8)	0.8 (0.4-1.5)	**0.8 (0.4-1.7)**
	28-29	86 (10.6)	21 (6.5)	65 (13.4)	1.5 (0.7-3.0)	**1.7 (0.7-4.1)**
	30-31	108 (13.4)	25 (7.8)	83 (17.1)	1.6 (0.8-3.1)	**1.8 (0.8-4.2)**
	32-34	71 (45.7)	23 (37.1)	48 (51.4)	1	**1**

Hosmer-Lemeshow statistic= 0.08, area under the receiver operating characteristic curve (AUC)=0.88

SPL: spontaneous preterm labor, PPROM: preterm premature rupture of membranes

* Percentages and ORs are weighted according to gestational age.

** aOR: OR adjusted for region, type and status of maternity unit, age, nationality, employment, marital status, parity, scarred uterus, cause of preterm birth, antenatal steroids use, *in utero* transfer, clinical chorioamniotitis, admission after labor onset, gestational age