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New and old predictive factors for breech presentation: our experience in 14'433 singleton pregnancies and a literature review

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Abstract

Objective. Breech presentation represents a common indication for primary cesarean section in women presenting for parturition. This study aims to investigate the presence of new and old risk factors for breech presentation and to provide a literature review.

Methods. In this population-based retrospective cohort study we collected data from 14'433 consecutive singleton deliveries occurred in a 3rd level hospital setting of northeast Italy between January 2001 and July 2009. Related risk factors and trends in breech presentation prevalence were also considered.

Results. Mean maternal age was 31.78 years (±5.17) and mean gestational age at delivery 38.67 weeks (±2.54). Breech presentation prevalence in nullipara and pluripara was respectively 5.36% (415/7743) and 3.53% (236/6689) ($p<0.05$), and was significantly lower among Sub-Saharan-African women 2.62% (14/535) vs 4.51% (651/14432) ($p<0.05$). Also advanced maternal age, early gestational age at delivery, neonatal female gender and low weight at delivery resulted associated with a higher prevalence of breech presentation. By multivariate logistic regression, the breech presentation resulted independently predicted by maternal age, ethnicity, parity, gestational age and neonatal weight MoMs at delivery, and neonatal gender.

Conclusions. Advanced maternal age, early gestational age, low neonatal weight MoMs at delivery and female gender resulted to be risk factors for fetal breech presentation at delivery, while multiparity and Sub-Saharan-African ethnicity resulted to be protective.

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New and old predictive factors for breech presentation: our experience in 14'433 singleton pregnancies and a literature review

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Condensation
Advanced maternal age, early gestational age, low neonatal weight MoMs at delivery and female gender resulted to be risk factors for fetal breech presentation at delivery, while multiparity and Sub-Saharan-African ethnicity resulted to be protective.

Keywords. Breech Presentation, Risk Factors, Humans.

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Introduction

The breech presentation is a quiet common occurrence in the obstetrical practice, accounting for about 3-5% of singleton fetuses at delivery [1–4], even if percentages as high as 8.2% have also been reported [5]. It represents a challenging vaginal delivery condition, for which a large number of obstetrical maneuver have been described during the past years (e.g. Bracht, Thiessen, Müller and Mauriceau-Levret-Veit-Smellie) [6], and a particular clinical skill and expertise are required due to its recognized correlation with some possible complications, such as fetal head incarceration, asphyxia and brachial plexus lesions [7].

The Term Breech Trial demonstrated the planned cesarean section to be associated with a significant reduction in perinatal mortality and short term morbidity, as well as in maternal mortality and morbidity at three months in comparison to planned vaginal birth [8–10]. For this reason and also for fear against related medical litigation, the practice of vaginal breech delivery has progressively decreased in the last decades, being breech presentation nowadays a typical indication for primary cesarean section in women presenting for parturition [6, 11–13], and therefore contributing to the rise of cesarean section rate all over the world [14].

This progressive abandon of the breech vaginal birth rose up the interest on the risk factors associated to breech presentation in order to prevent breech presentation and to consequently reduce the cesarean section rate. Our population-based retrospective cohort study aims to investigate the incidence and predictive factors of breech presentation in our population.

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Materials and methods

Population

In this population-based retrospective cohort study we collected data about the 14'433 consecutive singleton deliveries which took place in the University Clinic of Gynecology and Obstetrics in Udine between 2001 and 2009, considering the risk factors and trends in breech presentation prevalence.

The study has been carried out in accordance with The Code of Ethics of the Declaration of Helsinki.

Outcome measures

Outcome measures were considered the prevalence of the breech presentation at delivery and the possible associated risk factors. In detail, following factors were considered: maternal age, parity, ethnicity, gestational age, neonatal sex and weight at delivery, previous cesarean sections, previous miscarriages or abortions, and schooling.

The trend in breech presentation prevalence was also considered in order to point out any possible variation during the study period. And the neonatal weight MoM, which overcomes the possible influence of gestational age and neonatal sex, was calculated as follows: neonatal weight / 50th centile of neonatal weight at the same gestational age adjusted per neonatal sex.

We considered also the male to female ratio in the whole population and stratified by gestational age categories and neonatal weight (2 categories based on the median value).

Data collection

For the retrospective analysis of singleton deliveries in our Clinic we retrieved data from the clinical files. In case of the literature review we searched in the following sources: Medline, EBESCO, and Google Scholar. Hand-searching of recent conference proceedings was also undertaken. We included in our review all articles written in English and published between 1990 and 2010 about risk factors for breech presentation. Then, three reviewers independently extracted data from included articles onto a standard form. After that, the three reviewers summarized data on a table.

Statistical analysis

The statistical analysis was performed using R (version 2.10.1) and considering statistically significant $p<0.05$. The following statistical tests were used: t-test, chi-square test, Fisher exact test. And also a multivariate logistic regression analysis was performed.

Results

Mean maternal age and gestational age at delivery were respectively 31.78 years (±5.17) and 38.67 weeks (±2.54). If compared with mothers who deliver their baby in vertex presentation, those who delivered their baby in breech presentation resulted significantly older, and gave birth at an earlier gestational age to lower weighted newborns (Table 1). In particular the neonatal weight MoMs were significantly lower in the breech than in the vertex presentation ($p<0.05$), even if the prevalence of SGA was the same in the two groups (Table 1, Figure 1).

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The breech presentation prevalence showed no significant trend over the studied decades in our setting, presenting an overall value of 4.51% (651/14432), but resulted significantly lower ($p<0.05$) in multipara (3.53%, 236/6689) than in nullipara (5.36%, 415/7743), and among Sub-Saharan-African women (2.62%, 14/535) compared to the whole population (4.51%, 651/14432) (Table 2).

Non-significant difference in breech presentation prevalence resulted associated with previous cesarean section, miscarriages/abortions, or schooling.

By the monovariate logistic regression analysis, the prevalence of breech presentation by female fetuses resulted significantly higher than by male ones (OR 1.18, CI.95 1.01-1.38, $p<0.05$) (Table 1), remaining significant also after adjustment for neonatal weight and gestational age at delivery (OR 1.20, CI.95 1.02-1.42) ($p<0.05$).

The male to female ratio in our population was 1.1. In addition, Table 3 shows the male to female ratio stratified for gestational age at delivery and neonatal weight (2 categories based on the median value), pointing out a shift in favor of female gender in the breech presentation if compared with the vertex one, in particular after the 37th gestational week. But the prevalence of female gender is significantly higher in breech than in vertex presentation only in some strata ($p<0.05$) (Table 3).

We found also a significantly higher placental index (weight of the placenta / weight of the fetus) in females 0.19 (±0.05) than in males 0.18 (±0.05) ($p <0.05$), as well as in the breech 0.22 (±0.08) than in the vertex presentation 0.18 (±0.05) ($p<0.05$). Anyway, the placental index did not represent an independent risk factor for the breech presentation by the multivariate logistic regression.

In the final model of the multivariate logistic regression, advanced maternal age, nulliparity, early gestational age and neonatal female gender resulted risk factors for breech presentation, while Sub-Saharan-African ethnicity seemed to be a protective factor (Table 4).

Comment

Incidence and trend in breech presentation's prevalence

The incidence of breech presentation in our collective was found to resemble that of the most published studies, particularly conduced among European as well as Italian women [2–4, 15]. Non-significant trend was found in the prevalence of breech presentation at delivery during the eighth-years of the studied period.

A population-based study in Norway described in a period of 27 years an increasing incidence in breech presentation, possibly justified by the increasing maternal age at delivery and lowering of parity [2]. We do not confirm these data, although also among the Caucasian population in our setting we observed a trend of increasing age at delivery and a lowering natality index. This may be probably due to the increasing prevalence of births from immigrant people in general and in particular from Sub-Saharan-Africa. In fact, this subgroup of women are more likely to become pregnant at a younger age and to have a higher parity, both representing protective factors against breech presentation at term.

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Risk factors for breech presentation

Our data points out the following predictive factors for breech presentation: advanced maternal age, nulliparity, early gestational age, low neonatal weight MoM at delivery, neonatal female gender, and women ethnicity other than Sub-Saharan-African.

Table 5 reviews the literature about the risk factors for breech presentation. Nulliparity, low gestational age, preterm delivery and advanced maternal age resulted strongly predictive for breech presentation at delivery [2, 16–18], whereas tobacco smoke during pregnancy, low volume of amniotic fluid at 31-35 weeks, fundal position of the placenta, familial recurrence and previous cesarean section resulted other possible risk factors [19–22].

Early gestational age

As the normal kicking movements of the fetus allow it to assume a vertex position by the time of delivery, the timing of fetal conversion has been investigated in some studies by monitoring the change in fetal position between early and late ultrasound examinations [22, 23]. Witkop found that in early pregnancy (15-22 weeks) more than the half of fetuses presented a non-vertex position, including breech, transverse and variable presentations, while just 10% of them had a non-vertex position at 31-35 weeks. According to this study, a non-vertex fetus in the 35th gestational week still has a 45% probability to convert spontaneously and deliver in the vertex position.

In another recent interesting paper, Fox similarly described the risk of fetal breech presentation longitudinal assessed by ultrasound. At 28-30 weeks, 21.4% of fetuses presented in an abnormal position. By 38 weeks and more, only 5.3% of them persisted as either a breech or a transverse lie [23]. According to this study an abnormal presentation in the early trimester has a 78.8% chance to spontaneous converse to a vertex presentation at term, the chance of converting going to progressively reduce as the gestational age nears to the term [23]. It resulted thus clear that a preterm delivery is more frequently associated with a breech presentation at birth, as resulted in our study and in other studies [2, 18].

Nulliparity

In the study conducted by Witkop, multiparous women had half of the risk of non-vertex presentation as nulliparous women. Smoking during pregnancy, low volume of amniotic fluid at 31-35 weeks, and fundal position of the placenta at late ultrasound examination were also associated with significant increases in the risk of non-vertex position at delivery [22].

It is possible to speculate that more extensible uterine walls, characteristic of multiparous women, make easier the fetal spontaneous cephalic version into the pelvis near the term of pregnancy. On the contrary, a fundal placental position and a reduced amniotic fluid volume may interfere with this spontaneous process. These observations could be of clinic relevance for an hypothetical attempt of fetal external cephalic version in order to decline the rate of primary cesarean section for breech presentation [2, 16, 18, 24, 25].

Furthermore, also a recent randomized controlled study and a meta-analysis confirmed primiparity to be a significant pre-procedural predictor of external cephalic version failure [26, 27].

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Neonatal weight

Another risk factor associated with fetal breech presentation at delivery is the low neonatal weight at birth, which we considered as MoM of the neonatal weight, in this way we corrected the weight for gestational age at delivery and neonatal sex. In Table 1 we show that the neonatal weight MoM is significantly lower in breech presenting fetuses at delivery than in the other group and the prevalence of SGA is almost the same, only slightly higher in the group with fetal breech presentation at delivery than in the other group (p n.s.). Therefore, the low neonatal weigh as a risk factor could not be related to an high prevalence of IUGR that could be the cause of spontaneous or iatrogenic preterm birth letting to high prevalence of breech presentation at delivery, but breech presentation seemed more closely related to neonatal weight itself.

Other studies documented this association between breech presentation and low newborn weight [2, 17, 18]; an American study documented an association between the incidence of breech and smaller size for gestational age at term of pregnancy, especially for fetuses whose birth weight was under the 10th percentile [17]; and a recent work specified that each 500g decrease in birth weight is associated with an approximate 1.3 fold proportional increased risk of breech [18].

It is then possible to speculate that a higher fetal weight, distributed in proportion mainly to the fetal head, could help a spontaneous vertex version trough the gravity force.

Maternal age

In our collective also an advanced maternal age was found to be associated with fetal breech presentation at delivery. In another publication Jolly described a 37% increased risk for women aging > 40, compared to those aging 18-34 [28], and similar results were described by Ezra, who compared women > 40 years with women between 35 and 40 years and in others already cited studies [2, 18, 29].

Ethnicity

As described in the introduction chapter, different populations were found to have slightly near incidence of breech presentation, with some exceptions, like the Netherlands' population [2–5]. Probably, particular ethnic pelvic conformations could be responsible for different prevalence of fetal breech presentation at delivery.

Our results resemble those of other studies, which describe a protective association between breech presentation and an African-American or Sub-Saharan-African ethnicity, with a lower incidence in these populations [16, 18, 30].

Neonatal gender

In our study, also neonatal female gender resulted a significant risk factor for breech presentation at delivery, independently by the other considered factors in the multivariate analysis, including neonatal weight MoMs. The Dawkin's Selfish gene theory hypothesized that after the beginning of determining sex genetically, sexually antagonistic genes may be expressed [31, 32]. In addition, mammalian placenta have a paternal imprinting [33]. Therefore, this result could be related partly to the paternal imprinting of the placenta which in case of female fetus could lead to a higher placental index. This because the paternal imprinting of placenta could limit the growth of a female fetus. As a consequence, to overcome this situation for every volume of fetus there is more volume of placenta in female than in male fetuses, leading to impaired movements

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of the baby. One more hypothesis could be the existence of a different pattern of fetal movements in male and female fetuses.

Other factors

Venditelli found the risk of breech presentation at term in women with previous cesarean deliveries to be twice that of women with previous vaginal deliveries [19, 21], but our data does not confirm these findings.

Other factors not considered in our study were also reviewed (Table 5). Quite interestingly, Nordveit described that men and women who themselves were delivered in breech presentation had more than twice the risk of breech delivery in their own first pregnancies compared with men and women who have been born in cephalic presentations (odds ratios 2.2, 95% confidence interval 1.8 to 2.7, and 2.2, 1.9 to 2.5, for men and women, respectively) [20].

Also tobacco smoke during pregnancy, low volume of amniotic fluid at 31-35 weeks, fundal position of the placenta were found to be associated to breech presentation [22], but in our population it was not possible to analyze these risk factors due to the lack of specific information.

Multiple biological mechanisms may probably contribute to increase the risk of breech presentation, including a combination of a not well understood genetic inheritance with some acquired environmental factors [34].

Conclusions

Old maternal age, nulliparity, early gestational age, low neonatal weight MoMs at delivery and neonatal female gender resulted to be risk factors for fetal breech presentation at delivery, while Sub-Saharan-African ethnicity resulted to be protective.

Conflict of interest

The authors declare that they have no potential conflicts of interest relevant to this article. This study had no financial support.

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Figures Legends

Figure 1 - On the left gestational age at delivery, on the right fetal weight MoMs.

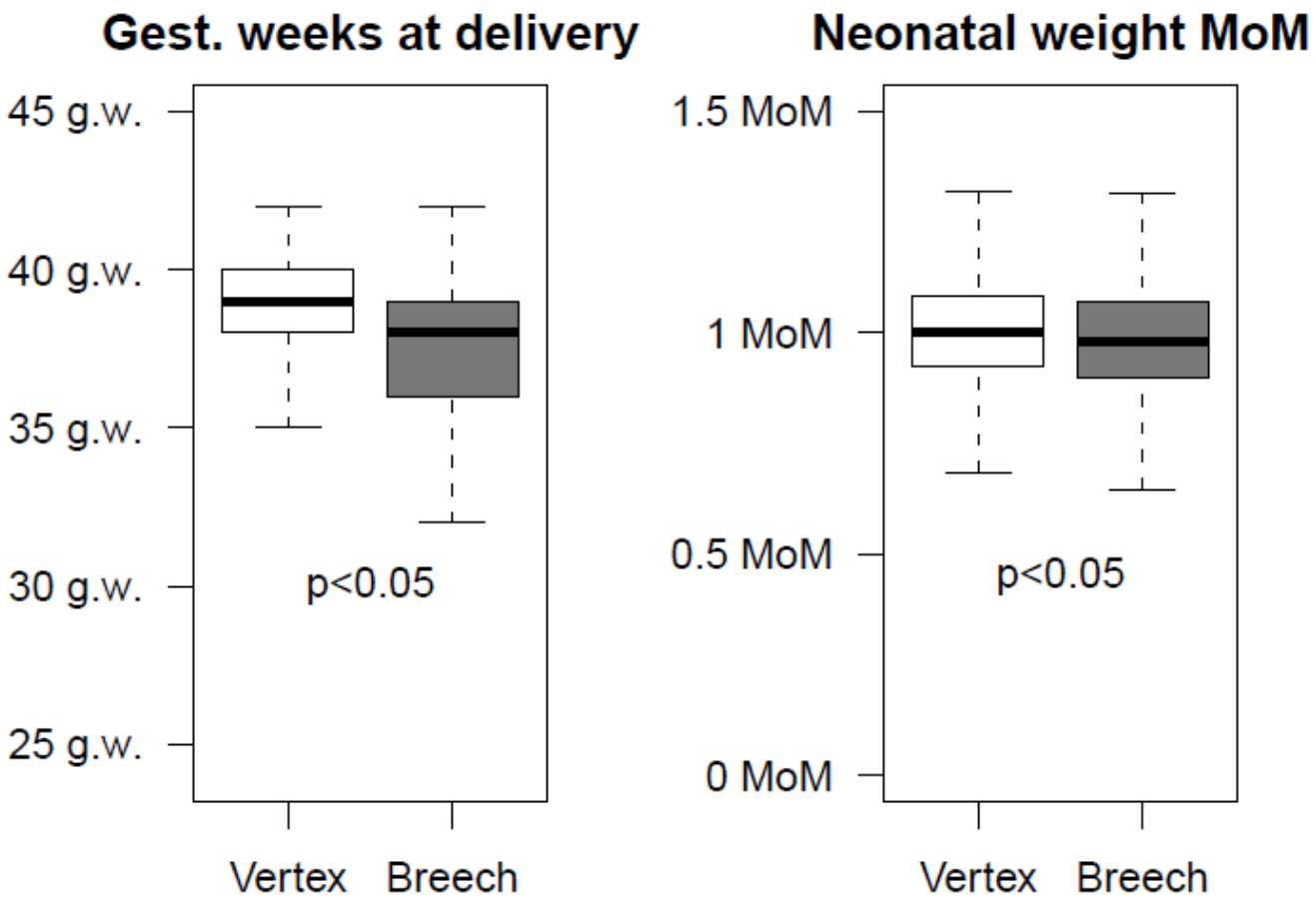

Table 1 – Comparison of the population in vertex and breech presentation. Mean (± standard deviation) and t-test; prevalence and chi-squared test.

	Vertex	Breech	p
Mother's age (years)	31.76 (±5.14)	32.46 (±5.24)	<0.05
Gestational age (weeks)	38.78 (±2.35)	36.08 (±4.32)	<0.05
Neonatal weight (grams)	3273.32 (±606.66)	2704.71 (±928.87)	<0.05

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MoM of neonatal weight	1.00 (±0.14)	0.98 (±0.22)	<0.05
SGA (10th p)	10.38% (1426/13736)	10.91% (71/651)	0.668
Sub-saharian Africa	3.79% (521/13737)	2.15% (14/650)	<0.05
Multiparity	46.83% (6453/13781)	36.25% (236/651)	<0.05
Previous CS	10.49% (1446/13781)	10.29% (67/651)	0.870
Neonate female sex	48.18% (6640/13781)	52.38% (341/651)	<0.05

Table 2 – Prevalence of breech presentation in the whole population and in the sub-groups divided for macro-area of immigration. All the sub-groups are compared to the whole population (first row) and it is reported the p value of chi-squared test.

	Prevalence of breech	p
All population	**4.51% (651/14432)**	
Sub-saharian Africa	2.62% (14/535)	<0.05
Asia	4.48% (9/201)	0.982
East Europe	4.08% (41/1006)	0.519
Italy	4.68% (563/12036)	0.518
Arabian countries	3.06% (11/360)	0.187
South America	3.05% (5/164)	0.369
Other origins	6.00% (7/110)	0.352

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Table 3 – Male to female ratio in vertex and breech presentation stratified by gestational age categories and neonatal weight. The p value refers to one-sided chi-square test.

	Weight (g)	Vertex (M/F ratio)	Breech (M/F ratio)	Prevalence of female fetuses in breech vs vertex	p
<34 weeks	<1370	0.98 (123/126)	1.10 (46/42)	↓	0.679
	≥1370	1.44 (173/120)	1.30 (26/20)	↑	0.373
34-37 weeks	<2600	0.89 (160/180)	1.04 (24/23)	↓	0.697
	≥2600	1.43 (220/154)	0.38 (6/16)	↑	<0.05
37-39 weeks	<3140	0.85 (669/791)	0.60 (44/73)	↑	<0.05
	≥3140	1.44 (891/617)	1.39 (53/38)	↑	0.437
>39 weeks	<3450	0.76 (2024/2664)	0.69 (64/93)	↑	0.274
	≥3450	1.44 (2849/1972)	1.23 (43/35)	↑	0.240

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Table 4 – Final model of multivariate logistic regression with breech presentation at delivery as dependent variable.

	OR (CI95%)	p
Mother's age	1.03 (1.02 - 1.05)	<0.05
Gestational weeks	0.80 (0.79 - 0.82)	<0.05
Sub-saharian Africa	0.46 (0.26 - 0.82)	<0.05
Multiparity	0.62 (0.52 - 0.74)	<0.05
MoM of neonatal weight	0.48 (0.3 - 0.76)	<0.05
Neonate female sex	1.25 (1.06 - 1.47)	<0.05

Table 5 – Risk factors for breech presentation review of the litterature.

Author (year)	Location	Number	Type of study (breech diagnosis)	Risk factors	Protective factors
Ezra et al. (1995)	Canada	35140	Retrospective (delivery)	Older maternal age	
Rayl et al (1996)	USA	11771	Population-based case-control study (delivery)	Early gestational age, low neonatal weight, nulliparity	Multiparity, black race
Albrechtsen et al. (1998)	Norway	1592064	Population based cohort study (delivery)	Early gestational age, nulliparity, older maternal age	Multiparity
Roberts et al. (1999)	Australia	559078	Retrospective (delivery)	Low neonatal weight	

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Jolly M. et al. (2000)	UK	385120	Retrospective (delivery)	Older maternal age	
Fawole et al. (2001)	Nigeria	9966	Retrospective (delivery)	Early gestational age, low neonatal weight, nulliparity	Multiparity
Fox et al. (2006)	Australia	1010	Retrospective (ultrasound/delivery)	Early gestational age	
Venditelli et al. (2008)	France	84688	Prospective (delivery)	Previous Cesarean section	Previous vaginal delivery
Witkop et al. (2008)	USA	7045	Prospective (ultrasound examination)	Early gestational age, nulliaprity, tobacco smoke, decreased volume of amniotic fluid, fundal placenta position	
Nordveit et al. (2008)	Norway	2200000	Retrospective (delivery)	Men and women who themselves were delivered in breech presentation have higher to have babies in breech presentation	
Kale A et al. (2009)	Turkey	61	Prospective (delivery)		Multiparity
Getahun at al. (2009)	USA	540953	Retrospective (delivery)		African-american and Hispanic ethnicity
Kalogiannidis et al. (2010)	Greece	2008	Retrospective (delivery)	Previous Cesarean section	

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