





Do We Know How to Avoid OASIs in Non-Supine Birth Positions? A Retrospective Cohort Analysis

Sabemos como evitar as LOEAs em posições de parto não supinas? Uma análise de coorte retrospectiva

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Abstract

Objective To evaluate the association between the upright and supine maternal positions for birth and the incidence of obstetric anal sphincter injuries (OASIs).

Methods Retrospective cohort study analyzed the data of 1,728 pregnant women who vaginally delivered live single cephalic newborns with a birth weight of 2,500 g. Multiple regression analyses were used to investigate the effect of the supine and upright positions on the incidence of OASIs after adjusting for risk factors and obstetric interventions.

Results In total, 239 (13.8%) births occurred in upright positions, and 1,489 (86.2%) in supine positions. Grade-III lacerations occurred in 43 (2.5%) patients, and grade-IV lacerations occurred in 3 (0.2%) women. Supine positions had a significant protective effect against severe lacerations, odds ratio [95% confidence interval]: 0.47 [0.22–0.99], adjusted for the use of forceps 4.80 [2.15–10.70], nulliparity 2.86 [1.44–5.69], and birth weight 3.30 [1.56–7.00]. Anesthesia ($p < 0.070$), oxytocin augmentation ($p < 0.228$), shoulder dystocia ($p < 0.670$), and episiotomy ($p < 0.559$) were not associated with the incidence of severe lacerations.

Conclusion Upright birth positions were not associated with a lower rate of perineal tears. The interpretation of the findings regarding these positions raised doubts about perineal protection that are still unanswered.

Keywords

- ▶ birth position
- ▶ delivery
- ▶ episiotomy
- ▶ labor
- ▶ perineal trauma
- ▶ risk factors

Resumo

Objetivo Avaliar a associação entre as posições maternas verticais e supinas ao nascimento e a taxa de incidência de lesões obstétricas do esfíncter anal (LOEAs).

Métodos Estudo coorte retrospectivo que analisou os dados de 1.728 gestantes que tiveram parto vaginal cefálico simples com peso ao nascer de 2.500 g. Análises de regressão múltipla foram usadas para investigar o efeito de posições supinas ou verticais sobre a taxa de incidência de LOEAs após o ajuste para fatores de risco e intervenções obstétricas.

Resultados No total, 239 (13,8%) nascimentos ocorreram nas posições verticais, e 1,489 (86,2%), nas posições supinas. Lacerações graves de grau III ocorreram em

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Palavras-chave

- ▶ posição do parto
- ▶ parto
- ▶ episiotomia
- ▶ trabalho de parto
- ▶ trauma perineal
- ▶ fatores de risco

43 (2,5%) pacientes, e de grau IV, em 3 (0,2%) mulheres. As posições supinas tiveram um efeito protetor significativo contra lacerações graves, razão de probabilidades [Intervalo de Confiança de 95%]: 0,47 [0.22–0.99], ajustado para o uso de Fórceps 4.80 [2.15–10.70], nuliparidade 2.86 [1.44–5.69], e peso ao nascer 3.30 [1.56–7.00]. Anestesia ($p < 0.070$), aumento de ocitocina ($p < 0.228$), distocia de ombro ($p < 0.670$), e episiotomia ($p < 0.559$) não estiveram associados à incidência de laceração grave.

Conclusão As posições de parto verticais não estiveram associadas a uma menor taxa de ruptura perineal. A interpretação dos achados referentes a essas posições levantou dúvidas sobre a proteção perineal que ainda aguardam respostas.

Introduction

The best maternal position adopted during the pelvic phase to avoid perineal damage is an issue that is still controversial, depending on a set of multifactorial predictors and specific subgroups of analysis.^{1–3} High rates of obstetric anal sphincter injuries (OASIs) among women giving birth in the lithotomy position were reported in a population-based study¹ in Sweden on term non-instrumental births without episiotomy. However, another population-based research² in Austria, including primiparous term births, did not prove any effect of the birth positions on OASIs. It has been supported that the traditional lithotomy position favors fetal assistance, enabling interventions such as episiotomy and surgical vaginal delivery.⁴ Meanwhile, balancing risks and benefits during the second stage of labor is the current practice, as the occurrence of severe perineal lesions is multifactorial, and no single factor is responsible for the increased incidence of OASIs.⁵

The present study reports the frequency and the profile of births occurred in upright positions in a teaching maternity. The main objective was to evaluate the association between upright maternal positions for birth and the rate of OASIs, with a comprehensive view, using a multifactorial analysis. Additionally, we compared the rate of OASIs found in the present study with that of our previous report.⁶

Methods

An observational cohort study retrospectively evaluated vaginal births from July 2016 to February 2018 based on eligibility criteria. The Ethics Review Board of our institution approved the study under registry number CAAE-Brazil 10286913.3.0000.5149, with a waiver for written consent.

The primary hypothesis was that the maternal position during birth, be it upright or supine, did not affect the incidence of OASIs. The Maternal and Neonatal Healthcare Information System (Sistema de Informação em Saúde Materna e Neonatal, SISMater) platform, which was developed by Universidade Federal de Minas Gerais, provided the structured database. Physicians and obstetric nurses used the electronic register consistently to collect data in real time. Birth positions have a specific interface, with struc-

tured entries: upright positions (including sitting, kneeling, knee-elbow/all fours, squatting and standing), and supine positions (including recumbent, semi-recumbent, lateral, and lithotomy). The eligibility criteria were cephalic vaginal single births of live newborns with birth weights ≥ 2500 g.

A collaborative team of obstetric specialists, resident physicians, obstetric nurses, and doulas managed the women in labor, but the physicians were directly responsible for the delivery. The staff encouraged the practice of women-centered care to improve the mother's experience during labor and childbirth. The clinical protocol of the university has recommended best practices for delivery and maternal care, including maternal mobility, companion during a hospital stay, non-pharmacological pain relief or epidural analgesia, partograph, and effective communication. Mediolateral episiotomies and operative delivery followed restrictive protocols, indicated only for interrupted progression or suspicion of fetal distress. There was no institutional recommendation for perineal massage or warm compresses during pushing, or data related to antenatal perineal massage. The birth position during the second stage of labor was chosen by the women taking into account the comfort of the position or following the medical recommendation based on the facilities where the birth took place. The birth positions registered by the midwives, grouped as upright or supine, were the predictive variables for severe perineal lacerations. A detailed classification of the positions was approved by consensus among the physicians and the nursing staff. They were proposed according to the report by Soong and Barnes.⁷ The difference between the recumbent and semi-recumbent positions was the inclination of the surgical table. Sitting was the position adopted when the woman gave birth on the stool. The primary outcome, OASIs, was classified as severe grade-III (laceration extending to the anal sphincter) and grade-IV (laceration reaching the rectal mucosa, exposing its lumen) lacerations.⁸ Episiotomy, as an intentional laceration, was considered a grade-II laceration.⁹

We performed a descriptive analysis of the characteristics of the cohort concerning the frequency, variability, and measures of central tendency and the births in upright positions. The univariate analysis evaluated the statistical

association between severe perineum lacerations (dependent variable) and birth positions. The Chi-squared test was used for the independence hypothesis, and the odds ratio (OR) and 95% confidence interval (95%CI) were calculated to estimate the strength of the association. The Mann-Whitney test compared the numerical variables between the groups. Logistic multiple regression analyses were used to investigate the effect of birth positions on OASIs, adjusted for non-modifiable risk factors (maternal age, nulliparity, gestational age, shoulder dystocia, and birth weight) and obstetric interventions (induced labor, delivery with analgesia, oxytocin use in the second stage of labor, episiotomy, and use of forceps). The set of independent variables was obtained using the stepwise-backward method, setting the input value of 0.20 and output *p*-value of 0.10, and biological plausibility. The fit of the models and the calibration, specifically the Hosmer-Lemeshow goodness-of-fit test, and the coefficients of determination (adjusted R^2) were evaluated. The Statistical Package for the Social Sciences (SPSS, IBM Corp., Armonk, NY, US) software, version 22.0, was used for the analyses. The significance level, adjusted for the hypothesis test, was ≤ 0.05 , and the bootstrap CI was set to 95%, calculated over 1,000 samples.

Results

During the period evaluated, 3,473 women gave birth to 3,529 newborns. The rate of cesarean sections was of 37.5% ($n=1,304$). Out of 2,169 vaginal deliveries, 1,754 were of live newborns with a birth weight ≥ 2500 g. After an analysis of database consistency, 26 (1.2%) of the vaginal births were excluded due to incomplete registration. The overall group

selected for the present analysis consisted of 1,728 women, as presented in ►Fig. 1.

The positions adopted for delivery in the second phase were supine and upright for 1,489 (86.2%) and 239 women (13.8%) respectively. Based on the characteristics of the birth, 707 out of 1,728 (40.9%) had high-risk pregnancies, and 95 out of 1,727 (5.5%) had major malformations. Around 1/3 (506 out of 1,728; 29.3%) of the women delivered after induced labor. Concerning labor management, the doulas participated in 387 out of 1,728 (22.4%) births, ambulation was frequent in 1,280 out of 1,728 (74.1%) patients, and the episiotomy rate was of 18.3% (317 out of 1,728; ►Table 1). The women who preferred upright positions were also observed to adhere to other newly-introduced practices of labor management, such as ambulation ($p=0.011$), non-pharmacological analgesia ($p=0.019$), bath to relieve labor pain ($p=0.015$), and birth ball ($p=0.001$). The episiotomy rate was significantly lower in the subgroup that preferred supine positions ($p < 0.001$). The immediate outcome after the delivery was classified as good in both subgroups.

Perineal lacerations occurred in 1,402 (81.1%; 95%CI: 79.3–83.0%) births, and they were classified as follows: grade I (624 [36.1%]; 95%CI: 33.7–38.4), grade II (732 [42.4%]; 95%CI: 39.9–44.7), grade III (43 [2.5%]; 95%CI: 1.7–3.2), and grade IV (3 [0.2%]; 95%CI: 0.0–0.4). The occurrence of OASIs was of 2.7% in this cohort (95%CI: 2.0–3.5%). Grade-IV lacerations occurred in the lithotomy ($n=1$), semi-recumbent ($n=1$), and sitting ($n=1$) positions. The semi-recumbent position was the most frequent position, which was adopted in 917 out of 1,728 (53.1%) births. No significant association was found between any specific birth position and the occurrence of OASIs

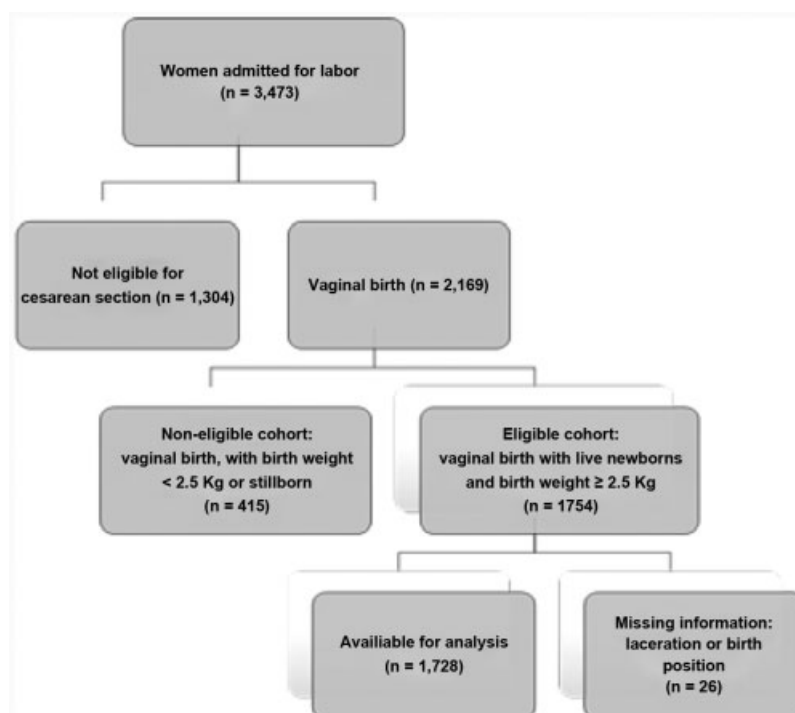


Fig. 1 Flowchart of patient allocation according to the selection criteria.

Table 1 Clinical and obstetrical characteristics of the births in upright positions during the second phase of labor

Clinical and obstetric characteristics	Descriptive statistics			p-value
	Upright* n = 239	Supine* n = 1,489	Total cohort n = 1,728	
Maternal age, years (median, interquartile range)	25.0 (10)	26.0 (10)	26.0 (10)	0.177 ^a
Nuliparous, n (%)	116 (48.5)	628 (42.2)	744 (43.1)	0.065 ^b
Doula, n (%)	57 (23.8)	330 (22.2)	387 (22.4)	0.561 ^b
Induced labor (%)	61 (25.5)	445 (29.9)	506 (29.3)	0.169 ^b
Ambulation, n (%)	193 (80.8)	1087 (73.0)	1280 (74.1)	0.011 ^b
Non-pharmacological analgesia, n (%)	66 (27.6)	311 (20.9)	377 (21.8)	0.019 ^b
Bath to relieve labor pain, n (%)	171 (71.5)	944 (63.4)	1115 (64.5)	0.015 ^b
Birth ball, n (%)	71 (29.7)	304 (20.4)	375 (21.7)	0.001 ^b
Analgesia, n (%)	76 (31.8)	496 (33.3)	572 (33.1)	0.645 ^b
Oxytocin augmentation, 2nd period	61 (25.5)	411 (27.6)	472 (27.3)	0.503
Birthweight (median, interquartile range)	3.1 (0.5)	3.2 (0.5)	3.2 (0.5)	0.464 ^a
Episiotomy, n (%)	14 (5.9)	303 (20.3)	317 (18.3)	< 0.001 ^b
Forceps, n (%)	2 (0.8)	70 (5.3)	81 (4.7)	0.002 ^b
Shoulder dystocia, n (%)	5 (2.1)	25 (1.7)	30 (1.7)	0.650 ^b

Notes: *Birth position during delivery; ^aMann-Whitney test; ^bChi-squared test.

($p = 0.458$, ► **Table 2**). Cord prolapse did not occur in any of the groups, and only 1 out of 30 (4.5%) fetuses with shoulder dystocia was delivered using the Gaskin maneuver.

According to the univariate analysis, the rate of occurrence of OASIs was similar in the upright or supine groups ($p = 0.120$). The individual analyses of cofactors did not present evidence of any differences between the birth position subgroups, with or without OASIs, with respect to maternal age ($p = 0.615$), gestational age ($p = 0.745$), induced labor ($p = 0.419$), oxytocin augmentation during the second stage ($p = 0.072$), vacuum extraction ($p = 0.554$), and shoul-

der dystocia ($p = 0.187$) (► **Table 3**). However, the incidence of OASIs was higher in births with nulliparity ($p < 0.001$), epidural labor anesthesia ($p < 0.001$), episiotomy ($p = 0.013$), and the use of forceps ($p < 0.001$). Moreover, the median birth weight was higher in this particular group ($p = 0.004$).

The multivariate analysis revealed novel findings regarding the association between the occurrence of OASIs and the final birth position when the data was adjusted for the cofactors. Statistical evidence showed a protective effect of the supine positions against OASIs in contrast to the upright positions, reducing the chance of the incidence of severe lacerations by

Table 2 Clinical and obstetrical characteristics of pregnancies stratified by grade of perineal laceration

Position during the second stage		Women with severe lacerations (OASIs, n = 46)	Women with grade-I and -II lacerations (n = 1,356)	Women without lacerations (n = 326)
Supine				
Lithotomy, n (%)	528	12 (2.3)	418 (79.3)	98 (18.6)
Recumbent, n (%)	39	0 (0)	28 (71.8)	11 (28.2)
Semi-recumbent, n (%)	917	24 (2.6)	715 (78.0)	178 (19.4)
Lateral, n (%)	5	0 (0)	4 (80.0)	1 (20.0)
Upright				
Sitting, n (%)	188	7 (3.7)	152 (80.9)	29 (15.4)
Kneeling, n (%)	0	0 (0)	0 (0)	0 (0)
Gaskin, n (%)	22	2 (9.1)	17 (77.3)	3 (13.6)
Squatting, n (%)	18	1 (5.6)	15 (83.3)	2 (11.1)
Standing, n (%)	11	0 (0)	7 (63.6)	4 (36.4)

Abbreviation: OASIs, obstetric anal sphincter injuries.

Note: Chi-squared test: $p = 0.513$.

Table 3 Clinical and obstetric risk factors and association with severe perineum lacerations

Clinical and obstetric characteristics	Women with severe lacerations (OASIs) n = 46	Women without severe lacerations (OASIs) n = 1,682	OR (95%CI)	p-value ^a
Birth position (upright) n (%)	36 (78.3)	1,453 (86.4)	0.58 (0.28–1.16)	0.115
Maternal age, years (median, interquartile range)	24.0 (10)	26.0 (10)	0.99 (0.95–1.03)	0.615
Birthweight, Kg (median, interquartile range)	3.34 (0.57)	3.15 (0.54)	2.82 (1.40–5.67)	0.004
Nulliparity, n (%)	33 (71.7)	711 (42.3)	3.47 (1.81–6.63)	< 0.001
Induced labor, n (%)	11 (23.9)	495 (29.4)	0.75 (0.38–1.50)	0.419
Oxytocin augmentation, 2nd period	18 (39.1)	454 (27.0)	1.74 (0.95–3.17)	0.072
Labor anesthesia, n (%)	28 (60.9)	544 (32.3)	3.25 (1.78–5.93)	< 0.001
Episiotomy, n (%)	15 (32.6)	302 (18.0)	2.2 (1.18–4.15)	0.013
Forceps, n (%)	11 (23.9)	70 (4.2)	7.23 (3.53–14.85)	< 0.001
Shoulder dystocia, n (%)	2 (4.3)	28 (1.7)	2.7 (0.620–11.63)	0.187

Abbreviations: 95%CI, 95% confidence interval; OASIs, obstetric anal sphincter injuries; OR, odds ratio.
Note: ^aUnivariate logistic regression.

Table 4 Clinical and obstetric risk factors and association with severe perineum lacerations (OASIs) in cephalic live births of newborns with birth weight ≥ 2.5 Kg

Clinical and obstetric characteristics	n	OR (95%CI)	p-value ^{a,b}
Birth position: supine, n (%)	1,428/1,728	0.47 (0.22–0.99)	0.047
Birth weight, Kg (interquartile range)	...	3.30 (1.56–7.00)	0.002
Forceps, n (%)	81/1728	4.80 (2.15–10.70)	< 0.001
Labor anesthesia, n (%)	572/1728	1.84 (0.95–3.54)	0.070
Nulliparous, n (%)	744/1728	2.86 (1.44–5.69)	0.003
Episiotomy, n (%)	317/1728	...	0.559
Oxytocin augmentation, 2nd period	472/1728	...	0.228
Shoulder dystocia, n (%)	30/1728	...	0.670

Abbreviations: 95%CI, 95% confidence interval; OASIs, obstetric anal sphincter injuries; OR, odds ratio.

Notes: Constant of the model = -7.6 ($p < 0.001$). Model coefficients: $p < 0.001$. Calibration of the model: -2 Log likelihood: 375.2.
Hosmer–Lemeshow test: $p = 0.359$.

63%: 0.47 (95%CI: 0.22–0.99; $p = 0.047$; ► **Table 4**). Nulliparity ($p = 0.003$) and birth weight ($p = 0.002$) were non-modifiable risk factors associated with OASIs. The use of forceps increased the probability of occurrence of OASIs 4.80 (95%CI: 2.15–10.70; $p < 0.001$) times. Labor anesthesia ($p = 0.070$), oxytocin augmentation during the second stage ($p = 0.228$), shoulder dystocia ($p = 0.670$), and episiotomy ($p = 0.559$) had no significant effect on the rate of occurrence of OASIs.

Discussion

The main contribution of the present study was to provide a comprehensive view of the risk factors associated with OASIs in a transitional scenario of care that endorses less intervention in labor. The university centers in Brazil play an essential role in the revival of vaginal delivery supported by good practices to reduce the highest rates of cesarean delivery in

the world.¹⁰ The analysis is part of the continuous monitoring of the new evidence-based practices implemented to reduce unnecessary cesarean deliveries.

Our results seem to conflict with previous studies that reported higher rates of sphincter injuries associated with the lithotomy position.¹ In our analysis, the main supine position was the semi-recumbent position, with 53.1% of all births, and not the lithotomy position. On the other hand, Marschalek et al,² analyzing a national database, reported that the birth position had no effect on OASIs. Our interpretation has raised questions that range from a long history of births in the horizontal position to the effective approaches for perineal protection in upright positions. Added to this, there is the complexity of the factors involved in the occurrence of sphincter injuries and the diversity of its occurrence in different birth scenarios around the world.

Interestingly, the rate of episiotomy was significantly reduced in the present cohort, in contrast to the cohort analysis previously reported.⁹ In both analyses, in the same setting of delivery in different periods, episiotomy did not contribute to reduce the incidence of OASIs events. In the present study, the incidence of restrictive episiotomy was lower in the upright position subgroup than in the supine position subgroup (–Table 1). Other studies have also observed a reduction in the rate of episiotomy in upright positions, a slight decrease in the duration of the second stage of labor, reduction of pain, and a decrease in the number of births requiring surgical intervention.⁴ However, these studies reported a possible increase in the rate of grade-II perineal tears, and no clear difference in the number of perineal tears of grades III and IV.⁴

Regarding the low OASIs incidence in the cohort (2.7%), we speculate that it is probably due to the maintenance of and adherence to good practices during intrapartum care,¹¹ and to the quality of the computerized registry in the maternity.¹² For the purpose of comparison, Marschalek et al,² in a national population-based study including only term single cephalic deliveries, reported a 2.6% incidence of OASIs. Similarly, a lower incidence, of 2.1%, was recently reported in an Indian tertiary healthcare center when the data was adjusted for birth weight > 500 g.³ However, previous studies have reported higher rates of severe perineal tears in the group including term births only, ranging from 4.5 to 5.9%.^{13,14}

In the multivariate analysis, supine positions were associated with 53% of reduction in the rate of OASIs, whereas induced labor, analgesia, oxytocin use in the second stage of labor, and episiotomy did not have a significant effect. Although these findings corroborate the previous report, revealing a relative risk of 4.41 (95%CI: 3.15–6.17) for any perineal trauma,¹⁵ one must be cautious when interpreting this outcome because of our preliminary data concerning upright positions. Only physicians performed the final stage of birth and, in this teaching scenario, perineal protection in upright positions is a new challenge. In our maternity department, upright positions have been recently preferred by women during the second stage of labor. However, limitations in the facilities still restrict its adoption. This practice has been stimulated by a national program to reduce cesarean sections and by the inclusion of obstetric nurses into the team performing the delivery.

The limitations of a retrospective design have to be taken into account, mainly those concerning the accuracy of OASIs diagnosis in cases that were not monitored or were evaluated by different physicians. Concerning the number of subjects, our sample covered 8 predictor variables with at least 30 events per variable in a binary regression model, which is more than what is recommended by the rule of ten.¹⁶ Type-II error was still avoided with a comprehensive analysis of variables prospectively collected in the electronic health record system.¹² Nevertheless, the use of forceps in upright positions occurred two times, both without OASIs, a situation that seems a register error. The generalizability of the risk factors associated with severe perineal trauma is possible among tertiary healthcare centers, considering cephalic and single deliveries with birth weight $\geq 2,500$ g.

For the interpretation of the results, it is important to acknowledge that there is no consensus regarding the risk factors or improvements in diagnosis that can explain the observed increase in the rate of grade-III and grade-IV tears in many settings, even in the populational analysis.¹³ The perineum naturally stretches during the second stage of labor. However, the threshold of physiological efforts to stretch the perineum needs to be determined, with particular attention to perineal muscle injury and its negative impact on the pelvic floor, resulting in pelvic floor dysfunction.^{17,18} Upright positions would be more physiologically appropriate because they promote effective uterine contractions, significantly reducing the risk of aortocaval compression, and they facilitate fetal expulsion directed by gravity.¹⁹ Besides, it has been reported that when women freely adopt a comfortable position, they feel in control of the parturition process, which results in a better experience when compared with the experience with pre-established positions.⁷ Moreover, the classification of upright positions is not unanimous. According to Walker et al,²⁰ *the knee-elbow (all fours) position is considered recumbent because the axis of the trunk is horizontal.*

Birth weight, a positive factor for OASIs in the present study and in many others,¹⁴ is presumed to be an antenatal factor that can be controlled and depends on maternal health conditions and prenatal healthcare quality. Although it is not modifiable at delivery, adequate prenatal maternal healthcare favors satisfactory fetal weight gain and interventions that can promote perineal distensibility, thus potentially preventing the occurrence of perineal tears. Clinical or instrumental approaches involving the antenatal determination of risks using pelvic floor distensibility measurements,¹⁸ perineal massage,²¹ and the proper training of healthcare professionals concerning perineal protection methods²² are strategies to reduce severe obstetric perineal trauma. Regarding instrumental delivery, we have reinforced the use of forceps as a critical predictor of severe perineal trauma in the present analysis. A previous systematic review reported that the incidence of OASIs was higher with the use of forceps than with the vacuum extractor, regardless of episiotomy.²³ The vacuum-extraction method is relatively recent in our department, and its use remains limited due to its high cost.

Women-centered healthcare practices offer the opportunity to take collaborative decisions during labor assistance. The psychological benefits of upright positions include reduced perception of pain, increased feeling of being in control, and active involvement of the woman's partner.²⁴ Changes in obstetric practice, such as the restricted practice of episiotomy, better management of perineal support, and the choice of birth position on the part of the woman, are potentially modifiable factors associated with perineal trauma.¹⁴ Well-informed women can make better choices and guarantee the full exercise of individual autonomy. The encouragement to adhere to new scientific evidence gains worldwide focus, reducing the excessive use of medication during labor, and opening a dialog about the preferences of the mother concerning delivery methods.²⁵

Conclusion

Being in an upright position in the second stage of birth was not associated with a lower rate of perineal tears. Episiotomy was not found to be protective. Maternal and fetal factors, such as nulliparity, birth weight, and the use of forceps, should be taken into account before adopting a non-supine birth position. The interpretation of the findings regarding this position raised doubts about perineal protection that are still unanswered.

Contributors

All authors contributed with the project and the interpretation of data, the writing of the article, the critical review of the intellectual content, and with the final approval of the version to be published.

Conflicts to Interest

The authors have none to declare.

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