Central European Journal of Nursing and Midwifery

Cent Eur J Nurs Midw 2021;12(1):257–267
doi: 10.15452/CEJNM.2020.11.0040

ORIGINAL PAPER

PERINEAL TEARS SUSTAINED DURING VAGINAL BIRTH: A CROSS-SECTIONAL STUDY

Jaqueline Sousa Leite[1], Adriana Caroci-Becker[2], Victor Hugo Alves Mascarenhas[3], Maria Luiza Gonzalez Riesco[4]

[1]*Adventist University Center of São Paulo, São Paulo, Brazil*
[2]*School of Arts, Sciences and Humanities, University of São Paulo, São Paulo, Brazil*
[3]*School of Nursing, University of São Paulo, São Paulo, Brazil*
[4]*Maternal-Child and Psychiatric Nursing Department, School of Nursing, University of São Paulo, São Paulo, Brazil*

Received July 7, 2020; Accepted December 31, 2020.

Abstract

Aim: To analyse the type, location, degree, shape and size of perineal tears sustained during normal birth. *Design*: Cross-sectional study. *Methods:* The sample was composed of 100 women with perineal tears whose length and depth were measured using the tool Peri-Rule™. Bivariate and multivariate analyses were carried out using a significance level of 5% (p = 0.05). *Results:* Similar numbers of women sustained single or multiple tears (51% vs 49%). Perineal tears occurred more frequently in the posterior than anterior region of the perineum (80% vs 58%). In 77.5%, 20.0% and 2.5% of the women, first-, second- and third-degree tears, respectively, occurred in the posterior region of the perineum, with over half of them having straight-line tears (62.5%), approximately one third having U-shaped tears (35.0%) and a minority having star-shaped tears (2.5%). Perineal oedema during labour (OR = 5.31) remained an independent predictor of second-degree tears. Infant birth weight (RC = -1.32), perineal body length (RC = 0.41) and oxytocin use (RC = -6.44) were statistically significantly associated with the size of perineal tears sustained. *Conclusion:* Perineal tears following normal birth were most likely of the first degree, straight-line and occurred mainly in the posterior region of the perineum. The degree, length and depth of the tears varied according to the location.

Keywords: lacerations, midwifery, obstetrics, parturition, perineum.

Introduction

Worldwide, many women sustain perineal trauma during vaginal birth, resulting from episiotomy or spontaneously occurring perineal tears. While a decline in routine use of episiotomy has been observed in some countries after large randomised controlled trials showing no benefit of this intervention, concerns persist regarding the increase in spontaneous perineal trauma (Jiang et al., 2017; National Health Service [NHS], 2019; Verghese et al., 2016).

Currently, routine observation of perineal trauma involves a subjective visual examination of the perineal area by a midwife or obstetrician to verify if trauma is present and if so, assessment of the extent of trauma sustained (National Institute for Health and Care Excellence [NICE], 2014).

Important support to midwifery practice is provided by the classification of perineal tears described by Sultan (1999). Tears range from first- to fourth-degree trauma based on the tissues affected according to this classification incorporated into the Royal College of Obstetricians and Gynaecologists (RCOG, 2015) and NICE (2014) intrapartum guidelines published in the United Kingdom (UK).

A prospective cohort study, which included data on 2,883 consecutive women who gave birth in Sweden between 1995–1997, studied the characteristics of perineal tears and proposed a classification model based on the location and shape of perineal trauma to support management and practice (Samuelsson et al., 2002).

The use of appropriate tools may enable attending clinicians to make a more accurate assessment and measurement of the extent of perineal trauma, producing data to inform "best practice" for perineal repairing techniques and management and improvement of morbidity. However, the adoption of tools specifically developed to assess the extent of perineal trauma in practice has been rare.

To improve the assessment and objective description of perineal trauma and support further research into

Corresponding author: Victor Hugo Alves Mascarenhas, School of Nursing, University of São Paulo, Avenue Dr. Enéas Carvalho de Aguiar 419, São Paulo, Brazil; email: victormascarenhas@usp.br

the possibility of suturing non-complex second-degree tears, a tool to assess the length and depth of perineal trauma called Peri-Rule™ was developed by the Birmingham Perineal Research Evaluation Group, UK (Metcalfe et al., 2002).

The Peri-Rule™ is a flexible plastic millimetre-scale ruler specifically developed to measure birth-related perineal trauma. The ruler is sterilisable, single-use, quick and easy to use in clinical practice, research and education. A pro forma to be used with the tool enables the attending midwife to document the length, depth and location of the tear. The tool was validated with measures from 130 perineal wounds taken by two midwife assessors that showed substantial agreement. It is noteworthy that a pattern emerged for small, medium and large second-degree tears. The use of the tool did not appear to cause any additional discomfort to the women (Metcalfe et al., 2002).

Despite the development of objective assessment tools such as the Peri-Rule™, their adoption into routine practice has been limited, and there is a gap in the literature as to how best to assess trauma, besides limited evidence of the type, shape and size of first- and second-degree perineal tears. Most studies to date have addressed the prevalence and degree of trauma based only on association of risk with maternal, obstetric and infant characteristics. Accordingly, due to lack of more extensive parameters, there remains a barrier to effective assessment and management of perineal trauma in practice (Colacioppo et al., 2011).

Aim

The aim of this study was to analyse the type, location, degree, shape and size of perineal tears sustained during normal birth, taking account of relevant obstetric and foetal characteristics.

Methods

Design

Cross-sectional study.

Sample

The study was conducted at an alongside midwifery-led birth centre in São Paulo, Brazil, funded by the public health system. At the study setting, midwives / nurse-midwives follow a selective episiotomy protocol. Following placental expulsion, they undertake perineal assessment with the woman in the lithotomy position. If women require perineal repair, a local anaesthetic is administered prior to commencing the repair and the wound is sutured using interrupted transcutaneous sutures (vaginal mucosa is sutured with continuous locking stitches and muscle and skin edges with interrupted stitches). Thus, the method of perineum repair is guided by assistance policy. Size 0 and 2–0 simple catgut thread is used to suture first- and second-degree tears, and polyglycolic acid (Vicryl™) in the case of third-degree tears. First-degree tears are repaired only in case they are long and bleeding does not stop after haemostasis using local compression.

Women who met the following inclusion criteria were eligible for recruitment: aged 18 years or over; 37 to 42 weeks of pregnancy; single live foetus with vertex presentation. The exclusion criteria were: caesarean section; use of forceps or ventouse delivery; intact perineum; episiotomy; birth conducted by a caregiver who was not part of the research team.

As this was a pragmatic study, a convenience sample of women was recruited. The sample size calculation was based on a prevalence of perineal tears of 40% at the study setting. A formula for infinite populations was adopted (Lwanga & Lemeshow, 1991); based on the estimated prevalence of perineal tears, relative accuracy of 10%, and 95% probability, a sample size of 93 women was required.

Data collection

Data were collected from October 2011 to January 2012 by one midwife and two nurse-midwives who were trained to follow the research protocol and were supervised by one of the authors.

The Peri-Rule™ was adopted to assess perineal tears and a pro forma was used to record the following information: type (single or multiple tears); location (anterior perineal region: clitoris, left or right labia minora, periurethral; posterior perineal region: left or right side and midline); vaginal wall; degree (first: injury to perineal skin and / or vaginal mucosa; second: injury to perineum involving perineal muscles but not involving the anal sphincter; third: injury to perineum involving the anal sphincter complex, considering grade 3a when < 50% of the external anal sphincter (EAS) thickness is torn, grade 3b when > 50% of EAS thickness is torn, grade 3c when both EAS and the internal anal sphincter (IAS) are torn; fourth: injury to perineum involving the EAS and / or IAS and anal anorectal mucosa) (NICE, 2014); shape (straight-line, star-shaped and U-shaped) (Samuelsson et al., 2002); size (millimetres).

Only straight-line and U-shaped tears were measured. In the posterior perineal region, tears were measured based on depth (from the fourchette into the greatest depth of the perineal body), length of vaginal mucosa (from the fourchette to the apex of the vaginal tear) and length of skin (from the fourchette along perineal skin towards the anus) (Metcalfe et al., 2002). In the anterior perineal region and vaginal wall, only the length of the tears was measured.

The type, location, degree, shape and size of tears were considered dependent variables. The independent variables were: previous perineal trauma; perineal body length; perineal oedema during labour; intravenous infusion of oxytocin; maternal position at the moment of birth; type of pushing during second stage of labour; infant birth weight; infant head circumference.

Data analysis

Statistical analysis was performed in the Minitab R2.14.1. Descriptive and inferential analyses were carried out using the two-tailed Fisher's exact test, Student's t-tests and one-way analysis of variance (ANOVA) (Kutner et al., 2005). Pearson's correlation coefficient was used to analyse the relationship between quantitative variables and tear size. The significance level was set at 5% ($p \leq 0.05$).

A multiple logistic regression and a multiple linear regression, both with backwards stepwise variable selection, were used to identify the factors that most likely predicted the degree and the size of perineal tears, respectively. Odds ratio (OR), regression coefficient (RC), and 95% confidence interval (CI) were calculated.

Results

In the study period, 407 women who met inclusion criteria during the first stage of labour were recruited. During birth, 307 women were excluded because of the following reasons: 219 were not under the care of midwives / nurse-midwives who were part of the research team; 44 had a caesarean section or instrumental birth; 43 had spontaneous birth with intact perineum or episiotomy; and one woman declined to participate after giving birth. The final study population thus comprised 100 women.

Maternal sociodemographic and clinical characteristics are described in Table 1. The characteristics of perineal tears regarding the type, location, degree, shape and size are also presented in Table 1. Of the 80 women who had tears in the posterior region of the perineum and vaginal wall, the majority had straight-line (62.5%, n = 50) or first-degree (77.5%, n = 2) tears.

Table 1 Maternal sociodemographic and clinical characteristics and perineal tear characteristics

Maternal characteristics (n = 100)		**n (%)**	**Perineal tear characteristics**	**n**		**n (%)**
Ethnicity	white	47 (47.0)	**Type**	100	single	51 (51.0)
	mixed	44 (44.0)			multiple	49 (49.0)
	black	9 (9.0)	**Location**	100	posterior	42 (42.0)
Education level	primary	13 (13.0)			anterior and posterior[a]	38 (38.0)
	secondary	35 (35.0)			anterior	20 (20.0)
	high	44 (44.0)	**Degree**	80[b]	first	62 (77.5)
	university	8 (8.0)			second	16 (20.0)
Marital status	with a partner	77 (77.0)			third[c]	2 (2.5)
	without a partner	23 (23.0)	**Shape**	80[b]	straight-line	50 (62.5)
Previous birth	yes	50 (50.0)			u-shaped	28 (35.0)
	no	50 (50.0)			star-shaped	2 (2.5)
Previous perineal trauma	yes	39 (39.0)	**Size** (mm)			**mean (SD)**
	no	61 (61.0)		58	length of mucosa – anterior region	28.6 (12.9)
Pelvic floor muscle exercises	yes	7 (7.0)		56	length of mucosa – posterior region	26.1 (10.5)
	no	93 (93.0)		58	length of skin	24.3 (10.4)
Companion in labour	yes	82 (82.0)		56	depth	18.1 (8.6)
	no	18 (18.0)				
Foetal head position	occiput anterior	98 (98.0)	**Maternal characteristics**			
	occiput posterior	2 (2.0)		**n**	**range**	**mean (SD)**
Shoulder dystocia	yes	4 (4.0)	**Age** (year)	100	18–44	25.3 (5.4)
	no	96 (96.0)	**BMI**	100	19.8–39.7	26.9 (3.8)
Umbilical cord around the neck / body	yes	12 (12.0)				
	no	88 (88.0)				

[a]Includes 23 women with vaginal tears, among which 4 had vaginal wall tears exclusively; [b]Only tears in the posterior region; [c]3a = 1; 3b = 1

In total, 173 tears were documented among the 100 women, of which 67 (38.7%) were in the posterior region (midline, n = 54; left or right side, n = 13), 24 in the vaginal wall (13.9%), and 82 (47.4%) in the anterior region (periurethral, n = 72; labia minora, n = 5; clitoris, n = 5). Repair of first-degree tears was not considered necessary in 20 women by the attending midwife or nurse-midwife (data not shown in the table).

If the woman had more than one tear recorded, only the largest tear sustained was included in the calculation of the mean length and depth of the tears. As reported in the Methods section, star-shaped tears were not measured.

The results of the bivariate analysis of the type, location, degree and shape of perineal tears associated with variables of interest are presented in Table 2.

Table 2 Bivariate analysis of the type, location, degree and shape of perineal tears and qualitative / quantitative variables

Variable	Characteristics of perineal tears										
	Type		**Location**			**Degree**			**Shape**		
	Single	**Multiple**	**Anterior**	**ant / post**	**Posterior**	**1st**	**2nd**	**3rd**	**Straight**	**"U"**	**Star**
Qualitative	**n = 49 (%)**	**n = 51 (%)**	**n = 20 (%)**	**n = 38 (%)**	**n = 42 (%)**	**n = 62 (%)**	**n = 16 (%)**	**n = 2 (%)**	**n = 50 (%)**	**n = 28 (%)**	**n = 2 (%)**
Previous perineal trauma											
yes	15 (30.6)	24 (47.1)	8 (40.0)	12 (31.6)	19 (45.2)	28 (45.2)	3 (18.8)	-	19 (38.0)	12 (42.9)	-
no	34 (69.4)	27 (52.9)	12 (60.0)	26 (68.4)	23 (54.8)	34 (54.8)	13 (31.2)	2 (100)	31 (62.0)	16 (57.1)	2 (100)
p-value*	0.105			0.462			0.073			0.610	
Perineal oedema											
yes	10 (20.4)	9 (17.6)	3 (15.0)	9 (23.7)	7 (16.7)	8 (12.9)	7 (43.8)	1 (50.0)	7 (14.0)	8 (28.6)	1 (50.0)
no	39 (79.6)	42 (82.4)	17 (85.0)	29 (76.3)	35 (83.3)	54 (87.1)	9 (56.2)	1 (50.0)	43 (86.0)	20 (71.4)	1 (50.0)
p-value*	0.802			0.676			0.008			0.109	
Oxytocin use											
yes	37 (75.5)	39 (76,5)	16 (80.0)	29 (76.3)	31 (73.8)	48 (77.4)	11 (68.8)	1 (50.0)	42 (84.0)	17 (60.7)	1 (50.0)
no	12 (24.5)	12 (23.5)	4 (20.0)	9 (23.7)	11 (26.2)	14 (22.6)	5 (31.2)	1 (50.0)	8 (16.0)	11 (39.3)	1 (50.0)
p-value*	1.000			0.953			0.445			0.035	
Maternal position											
semi-recumbent	47 (95.9)	47 (92.2)	17 (85.0)	36 (94.7)	41 (97.6)	59 (95.2)	16 (100)	2 (100)	47 (94.0)	28 (100)	2 (100)
lateral	2 (4.1)	3 (5.8)	2 (10.0)	2 (5.3)	1 (2.4)	3 (4.8)	-	-	3 (6.0)	-	-
lithotomy	-	1 (2.0)	1 (5.0)	-	-		-	-	-	-	-
p-value*	1.000			0.206			1.000			0.583	
Type of pushing											
spontaneous	47 (95.9)	48 (94.1)	19 (95.0)	36 (94.7)	40 (95.2)	60 (96.8)	15 (93.8)	1 (50.0)	49 (98.0)	26 (92.9)	1 (50.0)
directed	2 (4.1)	3 (5.9)	1 (5.0)	2 (5.3)	2 (4.8)	2 (3.2)	1 (6.2)	1 (50.0)	1 (2.0)	2 (7.1)	1 (50.0)
p-value*	1.000			1.000			0.073			0.043	
Quantitative	**mean (SD)**										
Perineal length (mm)	45.4 (7.6)	46.9 (8.0)	44.9 (7.4)	47.8 (8.3)	45.3 (7.5)	45.9 (8.0)	47.9 (7.8)	52.5 (3.5)	46.7 (7.8)	45.6 (8.3)	52.5 (3,5)
p-value	0.355**			0.236***			0.365***			0.469***	
Infant birth weight (g)	3,130 (400)	3,290 (370)	3,200 (500)	3,300 (400)	3,200 (400)	3,180 (400)	3,320 (350)	3,520 (350)	3,200 (370)	3,220 (430)	3,420 (350)
p-value	0.057**			0.500***			0.322***			0.733***	
Infant head circumference (cm)	33.9 (1.3)	34.3 (1.3)	33.9 (1.4)	34.3 (1.2)	33.9 (1.3)	33.9 (1.9)	34.4 (1.5)	36.2 (0.3)	33.9 (1.2)	34.1 (1.4)	36.2 (0.3)
p-value	0.129**			0.358***			0.026***			0.044***	

**Fisher's exact test; **Student's t-test; ***ANOVA; significance level ≤ 0.05*

There was a statistically significant association between the degree of tear and perineal oedema during labour (p = 0.008), and between the degree of tear and infant head circumference (p = 0.026). As to the shape of the tear, a statistically significant association was found with intravenous infusion of oxytocin (p = 0.035), type of pushing (p = 0.043) and infant head circumference (p = 0.044).

The results of the bivariate analysis of the associations between the size of perineal tears and qualitative variables are presented in Table 3, and of the correlation between the size of tears and quantitative variables are presented in Table 4. There were statistically significant associations between the length of skin and perineal oedema during labour (p = 0.042) and intravenous infusion of oxytocin (p = 0.035), length of mucosa of posterior region and perineal body length (p = 0.041), and length of mucosa of anterior region and infant birth weight (p = 0.001).

There was also a significant association between the degree and the shape of the tear (p < 0.001). Among 62 women with first-degree tears in the posterior region of the perineum, 72.6% (n = 45) had straight-line tears, and among 16 women with second-degree tears, U-shaped tears were more frequent (68.8%; n = 11). The two cases of third-degree tears in the study population were star-shaped (data not shown in the table).

Variables that were significant at p < 0.10 were included in the multiple regression model. This level was set arbitrarily to identify independent predictors of the degree, shape and size of perineal tears. Despite being significantly associated, the shape of the tears was not included in this analysis because of the correlation between the degree and shape. Only perineal oedema during labour (OR = 5.31) remained an independent predictor of second-degree tears. As for the size of perineal tears, the variables that remained associated were infant birth weight (RC = -1.32), perineal body length (RC = 0.41) and intravenous infusion of oxytocin (RC = -6.44) (Table 5).

Table 3 Bivariate analysis of the size of perineal tears and qualitative variables

Variable	Size of the perineal tears (mm)							
	Length of mucosa anterior		Length of mucosa posterior		Length of skin		Depth	
	n	mean (SD)	n	mean (SD)	n	mean (SD)	n	mean (SD)
Previous perineal trauma								
yes	20	26.4 (11.5)	24	24.0 (10.7)	25	23.2 (12.1)	22	17.9 (10.2)
no	38	29.8 (13.5)	32	27.8 (10.2)	33	25.1 (9.1)	34	18.2 (7.6)
p-value*	0.331		0.178		0.499		0.892	
Perineal oedema								
yes	12	28.7 (11.3)	12	31,2 (10.2)	47	30.0 (7.4)	12	20.4 (8.4)
no	46	28.6 (13.4)	44	24.8 (10.3)	11	22.9 (10.6)	44	17.5 (8.7)
p-value*	0.973		0.058		0.042		0.300	
Oxytocin use								
yes	45	28.3 (13.0)	41	25.3 (10.1)	42	22.5 (10.6)	40	17.1 (7.9)
no	13	30.0 (12.8)	15	28.3 (11.6)	16	28.9 (8.6)	16	20.7 (9.9)
p-value*	0.669		0.355		0.035		0.159	
Maternal position								
semi-recumbent	53	28.3 (12.9)	54	26.2 (10.7)	57	24.5 (10.3)	55	18.1 (8.7)
lateral	4	30.2 (14.2)	2	25.0 (7.1)	1	10.0 (-)	1	20.0 (-)
lithotomic	1	40.0 (-)	-	-	-	-	-	-
p-value**	0.805		0.851		-		-	
Type of pushing								
spontaneous	55	28.4 (13.0)	54	25.8 (10.5)	58	24.3 (10.4)	54	17.9 (8.7)
directed	3	33.3 (11.5)	2	35.0 (7.1)	2	20.0 (14.1)	2	22.5 (3.5)
p-value*	0.521		0.230		0.560		0.469	

**Student's t-test; **ANOVA; significance level ≤ 0.05*

Table 4 Pearson's correlation between the size of perineal tears and quantitative variables

Variable	Length of mucosa anterior	Length of mucosa posterior	Length of skin	Depth
Perineal length	0.019	0.276*	0.137	0.234
Infant birth weight	-0.408**	0.211	0.08	0.061
Infant head circumference	-0.123	0.187	0.07	-0.106

**p = 0.041; **p = 0.001; significance level ≤ 0.05*

Table 5 Odds ratio (OR), regression coefficient (RC), 95% confidence interval (CI) and p-value concerning perineal tear characteristics (degree, shape and size)

Perineal tear characteristics	**Measure of effect OR or RC**	**95% CI**	**p-value**
Second degree (OR)			
perineal oedema during labour (yes)	5.31	1.64 – 17.58	0.005
Length of mucosa – anterior region (RC)			
infant birth weight (100g)	-1.32	-2.11 – -0.54	0.001
Length of mucosa – posterior region (RC)			
perineal length (mm)	0.41	0.02 – 0.81	0.041
Length of skin (RC)			
oxytocin (yes)	-6.44	-12.39 – -0.48	0.035

Discussion

There is a gap in the literature concerning the characterisation of perineal tears in normal birth as to the type, shape and extent, given that most studies address their prevalence, degree and factors related to. The use of appropriate instruments favours the best assessment of the tears and enables a more accurate diagnosis and, consequently, improves the care to reduce perineal morbidity.

In the current study, half of the women had multiple types of tears. A study with 5,404 women who had spontaneous vaginal births described a range of locations of tears, including perineal, vaginal, labial, clitoral and rectal sites. Periurethral tears often extended into the urethra and cervix (Albers et al., 1999). Another study identified tears located in the labia minora in 18.1%, in the vaginal wall in 19.4% and in the midline posterior region of the perineum in 34.8% of women (Samuelsson et al., 2002). An observational study about the incidence and risk factors for perineal trauma with 2,355 women who gave birth in a hospital in the UK showed that anterior perineal tears occurred only in the labia minora (31.3%) and 9.4% of the women had only vaginal wall tears (Smith et al., 2013).

Establishing a causal relationship between the location and number of lacerations seems to be difficult, as they are inherent to specificities of normal birth. However, the consequences of multiple lacerations in the postpartum context and the impact on the morbidity of puerperal pathologies have not been clarified so far. There is therefore a need for longitudinal research on this scientific gap.

Regarding the degree and shape of the tears in the posterior region of the perineum, the results of the current study did not support the findings of a prospective cross-sectional study conducted with 2,883 Swedish women (Samuelsson et al., 2002), the only previous study in which the shape of perineal tears sustained during birth was classified. The researchers reported that the number of first- and second-degree tears was similar, with first-degree tears being mostly U-shaped and star-shaped, second-degree tears being mostly straight-line and the majority of third-degree tears having no specific shape.

The fact that there are a large number of deeper lacerations in the present study may be closely linked to the place of delivery, as demonstrated by a prospective multicentre study (Smith et al., 2013). In this research, there was no evidence of an association between factors related to obstetric practices and the incidence of tears, but there was a lower number of second-degree lacerations in births that took place in a birth centre or at home than in those that happened in the hospital environment. Despite the limitations as to the number of pregnant women assisted in extrahospital environments, making genuine comparisons difficult, the smaller number of interventions and low medicalisation of these institutions may explain these differences.

In a Cochrane review of episiotomy for vaginal birth, tears in the posterior region of the perineum were reported to occur more frequently when episiotomy was performed routinely rather than selectively (Carroli & Mignini, 2009). In contrast to the Cochrane review findings, most of the women who had tears in the current study were found to sustain these tears in the posterior region of the perineum, similar to findings of a previous cross-sectional study of 317 primiparous women who had vaginal birth without episiotomy (Caroci et al., 2014). It is difficult to postulate why more posterior trauma was found in these two studies, but this could be a reflection of the maternal position at birth, interventions during birth to protect or support the perineum, and exclusion of women who had an episiotomy.

In the current study, tears had greater length when occurring in the vaginal mucosa than when being restricted to perineal skin. In a previous study at the same site that used the Peri-Rule™ to assess the size of first- and second-degree tears, the mean length of tears in the mucosa ranged from 16 mm (SD = 1) to 35 mm (SD = 12), those in the skin ranged from 3 mm (SD = 7) to 25 mm (SD = 13), and the depth was 3 mm (SD = 4) to 23 mm (SD = 12) (Colacioppo et al., 2011).

An observational study found a mean length of perineal skin tears of 40 mm among 62 primiparous women with or without episiotomy, which was greater than that observed in the current study, although the authors did not describe how the perineal tears were measured. The study was conducted in a tertiary hospital in the US and differences in tear size may be attributed to the methodology, since the length of episiotomy was included in this measure. The authors found that episiotomy increased by approximately 30 mm the extent of the trauma sustained. Among the women who had an episiotomy, the only variable associated with the size of the tear was the BMI of the woman assessed at the end of pregnancy (Smith et al., 2013).

A study of second-degree tears showed that 26.4% of the women had tears ≤ 3 cm, and 9.9% > 3 cm. When vaginal wall trauma was considered, 16% of the women had tears ≤ 5 cm, and 1.1% > 5 cm. When only nulliparous women were considered, the proportion of women with a vaginal wall tear > 5 cm was 2.3% (Samuelsson et al., 2002).

Current evidence to support the need to suture all spontaneous perineal tears, particularly second-degree tears, is inconclusive (Elharmeel et al., 2011). In the UK, the NICE intrapartum guideline recommends that the muscle should be sutured in all second-degree tears in order to improve healing; if the skin is opposed after suturing of the muscle, there is no need to suture it (NICE, 2014). This may not be a requirement in other countries and in other birth settings. In the study site of the present work, there is no protocol for perineal repair. In general, the decision to repair perineal trauma depends on the judgement of the attending clinician and is likely influenced by the length, depth and location of the tear. Thus, accurate identification of the type, length, depth and location of the tear and consideration of potential consequences for healing and maternal health are critical in the decision to suture or not suture the laceration. If the suture is made, evidence-based suturing techniques and materials must be used (Kettle et al., 2012). There is no ongoing work at the study site to encourage clinicians, midwives and nurse-midwives to use these techniques yet, which can be easily taught in practice (Ismail et al., 2013). This is an issue that must be addressed if short-term postnatal morbidity is to be reduced.

Few studies have explored the relationship between perineal oedema that occurs during labour and perineal trauma during childbirth because oedema, in general, is studied as a condition that occurs after childbirth due to perineal trauma (Riesco & Oliveira, 2007; Samuelsson et al., 2002). Some authors estimated that the odds of second-degree tears were lower in cases of minimal perineal oedema than in cases of moderate or severe oedema. In the current study, among 16 women with perineal oedema and posterior tears, half had second- or third-degree tears; the mean length of vaginal wall and skin tears was also longer. Perineal oedema increased almost six times the chance of second-degree lacerations and also increased the length of tears in the skin. This happened possibly because the oedema hindered the distention of the tissues (Samuelsson et al., 2002).

In the current study, intravenous oxytocin was administered during labour in three-quarters of the women. The use of oxytocin was more often associated with straight-line and shorter tears, but not with the degree of tear sustained. In Brazil, most hospitals routinely prescribe oxytocin for women during labour. Studies have identified lower degrees of perineal tears among women who did not receive oxytocin (Silva et al., 2012). According to a prospective observational study conducted in a hospital in Pakistan, the induction of labour with oxytocin showed a statistical association with the presence of perineal rupture, probably due to increased pressure in the perineum promoted by intense uterine contractility (Brohi et al., 2012). The routine intrapartum oxytocin use in our study probably prevented the establishment of a statistical relationship between the use of the drug and the classification of perineal lacerations.

We did not find a significant association between the degree of perineal tears and the type of pushing during the second stage of labour. Nevertheless, some studies have shown the influence of the type of pushing on the perineal outcomes. For example, a study showed an increased risk of perineal trauma among primiparous women who used the Valsalva manoeuvre during the birth of their baby (Albers et al., 2006; Colacioppo et al., 2011). A clinical trial identified that spontaneous pushing appeared to be a protective factor against perineal tears, reporting that only 26% of 103 women who underwent spontaneous pushing had perineal trauma, whereas 49% of 53 women who underwent directed pushing had third-degree perineal trauma (Colacioppo et al., 2011). In contrast, a randomised study and a systematic review which compared spontaneous and directed pushing during the second stage of labour found no significant difference in the frequency or severity of perineal trauma (Lemos et al., 2017; Yildirim & Beji, 2008). When adopting the Grading of Recommendations Assessment, Development and Evaluation (GRADE) hierarchy, authors found only low-quality evidence of an association between the type of pushing, perineal trauma and the need for perineal suturing (Tohill & Kettle, 2011).

An observational study found no association between perineal body length and perineal trauma sustained (Nager & Helliwell, 2001). Anecdotally, in clinical practice, health professionals and protocols often refer to an increased risk of perineal trauma in women who have a shorter perineal body (< 3 cm) due to the proximity between the vaginal and anal orifices. A study conducted with the objective of determining if shortened perineal body length (< 3 cm) was a risk factor for ultrasound-detected anal sphincter tear at first delivery in 73 pregnant nulliparous women reported that a shorter perineum was associated with perineal injury. In the current study, in contrast, the length of the tear in the mucosa of the posterior region of the perineum was greater when the perineal body was longer. Thus, further research is needed to explore the association between perineal body length and perineal trauma outcomes (Geller et al., 2014).

Previous studies have analysed the association between perineal trauma outcomes and infant birth weight and head circumference. A case-control study that analysed records of 5,377 vaginal births to identify risk factors for third- and fourth-degree perineal tears in women who had spontaneous or forceps births routinely combined with mediolateral episiotomy found that higher infant birth weight (3,325 g to 3,847 g) was an independent risk factor for third or fourth-degree tears (OR = 1.68, 95%; CI = 1.18–2.41) (Hudelist et al., 2005).

A study found that infant birth weight ≥ 3,500 g was associated with second-degree tears in 1,078 women. When infant birth weight was considered in the current study, there was a negative correlation with the length of the tears in the mucosa in the anterior region of the perineum. Each 1,000 g decreased by about 1.3 cm the length of the tear in the mucosa of the anterior region. A possible explanation for this correlation is that there is an interaction between the variables, but more studies are needed to clarify these findings (Silva et al., 2012).

Some studies discuss the impact of lacerations on the emotional aspects of women in the postpartum. A systematic review of mixed methods reported that particularly severe perineal lacerations can affect the mental health of women in the puerperium and called attention to the fact that this area needs greater investment (Crookall et al., 2018). A qualitative study on the experiences of women revealed that some obstetric professionals do not adequately assess or guide their patients with perineal trauma on the proper care and this lack of guidance causes continuous psychological suffering in puerperal women. Therefore, developing research in this area is important to understand the multidimensional aspects involved in perineal trauma (Wiseman et al., 2019).

Limitation of study

Among the possibilities of bias, it is noteworthy that the classification depends on the subjective assessment of professionals, who tend to underestimate or overestimate the level of perineal tears. Furthermore, the specific characteristics of a cross-sectional study make it difficult to conclusively associate an effect with its possible risk factors.

Regarding the potentialities of the present study, adopting data collection directly during birth instead of medical records was important to reduce information bias. Also, the thorough assessment of perineal trauma supported by international scientific literature provided a unique aspect for the present study in the sense that it is a pioneer in the analysis of location of lacerations and the influence of oedema during delivery, for example.

A limitation of the current study was the small sample size, which did not allow for more detailed statistical analyses and gave wide confidence intervals. In order to better understand these interactions, further research using larger samples of women is required. The strongest points were the use of the Peri-Rule™, an objective intervention to accurately measure the size of the tears, the adoption of a classification of the shape and severity of the tears, and the training of the team for data collection.

Implications for practice

The divergences regarding the findings on spontaneous perineal tears demonstrate that several factors are involved in the results of this assessment. In spite of this, the women's choice for environments such as midwifery-led birth centres was shown to be an important element influencing positive maternal outcomes, contributing to the reduction of the depth of lacerations and excessive medicalisation.

The findings can be useful in the education of midwives on how to enhance perineal assessment and evidence-based management and on the possibility of offering more appropriate information to women about the interventions they could self-administer to promote perineal integrity when giving birth vaginally.

Conclusion

There was a statistically significant association between perineal tear characteristics and some maternal, obstetric and infant aspects. The posterior region of the perineum was the location with greater chance of spontaneous trauma and the mean size of the tears varied according to the location of the trauma. The occurrence of third-degree tears and the frequency of tears in the vaginal wall highlight the importance of careful clinical assessment of the entire perineal area, including examination of the anal sphincter, even when there is no apparent trauma to the perineum.

This study provides evidence to support midwifery practice and highlights the need for accurate assessment of perineal trauma. It also stresses the importance of continuing education for health professionals in perineal assessment and documentation to ensure skills and competencies are maintained. The use of an objective tool such as the Peri-Rule™ to make an accurate assessment of the characteristics of perineal tears, which requires the midwife to undertake a detailed examination and document the findings, could help to characterise perineal trauma to inform immediate clinical management and postnatal care. More information must be provided to women about the extent and type of perineal trauma they have sustained. Further larger studies are now needed to assess the effectiveness of subjective versus objective perineal assessment approaches.

Ethical aspects and conflict of interest

This study was approved by the Research Ethics Committee of the School of Nursing of University of Sao Paulo. Women were included in the study during the first stage of labour, after receiving oral and written information from the researchers and providing voluntary consent. The consent form was reviewed with participants before signing. The authors declare that there are no conflicts of interest associated with this publication.

Funding

This research received no specific grant from any funding agency, commercial or not-for-profit sectors.

Author contributions

Conception and design (JSL, MLGR), data analysis and interpretation (JSL, ACB, MLGR), manuscript draft (ACB, VHAM, MLGR), critical revision of the manuscript (JSL, ACB, VHAM, MLGR), finalization of the manuscript (ACB, VHAM, MLGR).

References

Albers, L., Garcia, J., Renfrew, M., McCandlish, R., & Elbourne, D. (1999). Distribution of genital tract trauma in childbirth and related postnatal pain. *Birth*, *26*(1), 11–17. https://doi.org/10.1046/j.1523-536x.1999.00011.x

Albers, L. L., Sedler, K. D., Bedrick, E. J., Teaf, D., & Peralta, P. (2006). Factors related to genital tract trauma in normal spontaneous vaginal births. *Birth*, *33*(2), 94–100. https://doi.org/10.1111/j.0730-7659.2006.00085.x

Brohi, Z. P., Sadaf, A., Zohra, N., & Perveen, U. (2012). Frequency and severity of perineal tears in Countess Lady Duffrin Fund Hospital, Hyderabad. *The Journal of the Pakistan Medical Association*, *62*(8), 803–806. https://jpma.org.pk/article-details/3611?article_id=3611

Caroci, A., Riesco, M. L., Rocha, B. M., Ventura, L., & Oliveira, S. G. (2014). Evaluation of perineal muscle strength in the first trimester of pregnancy. *Revista Latino-americana de Enfermagem*, *22*(6), 893–901. https://doi.org/10.1590/0104-1169.3600.2492

Carroli, G., & Mignini, L. (2009). Episiotomy for vaginal birth. *Cochrane Database of Systematic Reviews*, (1), CD000081. https://doi.org/10.1002/14651858.cd000081.pub2

Colacioppo, P. M., Riesco, M. L. G., & Koiffman, M. D. (2011). Use of hyaluronidase to prevent perineal trauma during spontaneous births: a randomized, placebo-controlled, double-blind, clinical trial. *Journal of Midwifery & Women's Health*, *56*(5), 436–445. https://doi.org/10.1111/j.1542-2011.2011.00056.x

Crookall, R., Fowler, G., Wood, C., & Slade, P. (2018). A systematic mixed studies review of women's experiences of perineal trauma sustained during childbirth. *Journal of Advanced Nursing*, *74*(9), 2038–2052. https://doi.org/10.1111/jan.13724

Elharmeel, S. M. A., Chaudhary, Y., Tan, S., Scheermeyer, E., Hanafy, A., & van Driel, M. L. (2011). Surgical repair of spontaneous perineal tears that occur during childbirth versus no intervention. *The Cochrane Database of Systematic Reviews*, (8), CD008534. https://doi.org/10.1002/14651858.CD008534.pub2

Geller, E. J., Robinson, B. L., Matthews, C. A., Celauro, K. P., Dunivan, G. C., Crane, A. K., Ivins, A. R., Woodham, P. C., & Fielding, J. R. (2014). Perineal body length as a risk factor for ultrasound-diagnosed anal sphincter tear at first delivery. *International Urogynecology Journal*, *25*(5), 631–636. https://doi.org/10.1007/s00192-013-2273-x

Hudelist, G., Gelle'n, J., Singer, C., Ruecklinger, E., Czerwenka, K., Kandolf, O., & Keckstein, J. (2005). Factors predicting severe perineal trauma during childbirth: role of forceps delivery routinely combined with mediolateral episiotomy. *American Journal of Obstetrics and Gynecology*, *192*(3), 875–881. https://doi.org/10.1016/j.ajog.2004.09.035

Ismail, K. M. K., Kettle, C., Macdonald, S. E., Tohill, S., Thomas, P. W., & Bick, D. (2013). Perineal assessment and repair longitudinal study (PEARLS): a matched-pair cluster randomized trial. *BMC Medicine*, *11*, 209. https://doi.org/10.1186/1741-7015-11-209

Jiang, H., Qian, X., Carroli, G., & Garner, P. (2017). Selective versus routine use of episiotomy for vaginal birth. *Cochrane Database of Systematic Reviews*, *2*(2), CD000081. https://doi.org/10.1002/14651858.CD000081.pub3

Kettle, C., Dowswell, T., & Ismail, K. M. K. (2012). Continuous and interrupted suturing techniques for repair of episiotomy or second-degree tears. *The Cochrane Database of Systematic Reviews*, *11*(11), CD000947. https://doi.org/10.1002/14651858.CD000947.pub3

Kutner, M. H., Nachtsheim, C. J., Neter, J., & Li, W. (2005). *Applied Linear Statistical Models* (5th ed.). McGraw-Hill.

Lemos, A., Amorim, M. M. R., de Andrade, A. D., de Souza, A. I., Cabral Filho, J. E., & Correia, J. B. (2017). Pushing/bearing down methods for the second stage of labour. *The Cochrane Database of Systematic Reviews*, *3*(3), CD009124. https://doi.org/10.1002/14651858.CD009124.pub3

Lwanga, S. K. & Lemeshow, S. (1991). *Sample size determination in health studies: a practical manual*. World Health Organization. https://apps.who.int/iris/handle/10665/40062

Metcalfe, A., Tohill, S., Williams, A., Haldon, V., Brown, L., & Henry, L. (2002). A pragmatic tool for the measurement of perineal tears. *British Journal of Midwifery*, *10*(7), 412–417. https://doi.org/10.12968/bjom.2002.10.7.10582

Nager, C. W., & Helliwell, J. P. (2001). Episiotomy increases perineal laceration length in primiparous women. *American Journal of Obstetrics and Gynecology*, *185*(2), 444–450. https://doi.org/10.1067/mob.2001.116095

National Institute for Health and Care Excellence. (2014, December). *Intrapartum care: care of healthy women and babies: clinical guideline [CG190]*. https://www.nice.org.uk/guidance/cg190

National Health Service (NHS) Digital. (2019, October). *NHS maternity statistics, England 2018–19 [PAS]*. NHS maternity statistics. https://digital.nhs.uk/data-and-information/publications/statistical/nhs-maternity-statistics/2018-19

Riesco, M. L., & Oliveira, S. M. (2007). Avaliação do edema perineal no pós-parto: concordância entre observadores [Postnatal perineal edema assessment: agreement among observers]. *Revista Gaucha de Enfermagem*, *28*(4), 465–472.

Royal College of Obstetricians and Gynaecologists. (2015, June). *The management of third- and fourth-degree perineal tears. Green-top Guideline No. 29*. https://www.rcog.org.uk/globalassets/documents/guidelines/gtg-29.pdf

Samuelsson, E., Ladfors, L., Lindblom, B. G., & Hagberg, H. (2002). A prospective observational study on tears during vaginal delivery: occurrences and risk factors. *Acta Obstetricia et Gynecologica Scandinavica*, *81*(1), 44–49. https://doi.org/10.1046/j.0001-6349.2001.10182.x

Silva, F. M., Oliveira, S. M., Bick, D., Osava, R. H., Tuesta, E. F., & Riesco, M. L. (2012). Risk factors for birth-related perineal trauma: a cross-sectional study in a birth centre. *Journal of Clinical Nursing*, *21*(15–16), 2209–2218. https://doi.org/10.1111/j.1365-2702.2012.04133.x

Smith, L. A., Price, N., Simonite, V., & Burns, E. E. (2013). Incidence of and risk factors for perineal trauma: a prospective observational study. *BMC Pregnancy and Childbirth*, *13*, 59. https://doi.org/10.1186/1471-2393-13-59

Sultan, A. H. (1999). Editorial: Obstetrical perineal injury and anal incontinence. *AVMA Medical & Legal Journal*, *5*(6), 193–196. https://doi.org/10.1177/135626229900500601

Tohill, S., & Kettle, C. (2011). Perineal care. *BMJ Clinical Evidence*, 2011, 1401.

Verghese, T. S., Champaneria, R., Kapoor, D. S., & Latthe, P. M. (2016). Obstetric anal sphincter injuries after episiotomy: systematic review and meta-analysis. *International Urogynecology Journal*, *27*, 1459–1467. https://doi.org/10.1007/s00192-016-2956-1

Wiseman, O., Rafferty, A. M., Stockley, J., Murrells, T., & Bick, D. (2019). Infection and wound breakdown in spontaneous second-degree perineal tears: an exploratory mixed methods study. *Birth*, *46*(1), 80–89. https://doi.org/10.1111/birt.12389

Yildirim, G., & Beji, N. K. (2008). Effects of pushing techniques in birth on mother and fetus: a randomized study. *Birth*, *35*(1), 25–30. https://doi.org/10.1111/j.1523-536X.2007.00208.x

