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Perineal Body Length As A Predictor Of Perineal Lacerations In Primigravida Undergoing Vaginal Delivery - A Nested Case Control Study In South India.

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ABSTRACT

Perineal trauma during vaginal delivery, especially severe forms like obstetric anal sphincter injuries (OASI), results in significant risks to maternal health and contributes to long-term morbidities. Determining the role of anatomical predictors such as perineal body length (PBL) can help in targeted interventions to reduce the incidence of severe perineal injuries. This was a prospective observational nested case-control study conducted between February 2023 and February 2025 at Government Cuddalore Medical College and Hospital, Tamil Nadu. Term, primigravida women aged 18–40 years with singleton pregnancies planned for vaginal delivery were recruited. Intrapartum perineal body length was measured during the first stage of labour. A total of 126 women were included (14 cases and 112 controls). A significantly higher proportion of women with Grade 3 perineal tears had perineal body length <3.0 cm compared to controls (85.7% vs. 17.0%; p=0.01). Shorter perineal body length was associated with an unadjusted odds ratio of 29.4 for severe perineal tears. Birth weight ≥3.5 kg (p=0.02) and newborn head circumference ≥75th percentile (p=0.04) were also significantly associated with higher risk of severe perineal trauma. No significant association was found between perineal tear severity and maternal age, BMI, gestational age, or prolonged second stage of labour. Measurement of perineal body length during labour could help in early identification and management of women at high risk, to minimize the incidence of obstetric anal sphincter injuries.

Keywords: Perineal body length, Episiotomy, Perineal tears.

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INTRODUCTION

India's Maternal Mortality Ratio (MMR) is 97 per 100,000 live births (2020), with obstetric haemorrhage being the leading cause of maternal deaths [1,2]. One of the factors leading to obstetric haemorrhage is obstetric or perineal trauma. Perineal trauma during vaginal childbirth is a frequent obstetric event, ranging from minor lacerations to severe injuries involving the anal sphincter complex. The risk factors for perineal injuries include primigravida, prolonged second stage of labour, labour induction, occipito-posterior foetal positioning, instrumental deliveries, shoulder dystocia, and large birth weight [3, 4]. Severe perineal tears or Obstetric Anal Sphincter Injuries (OASI) are associated with long term complications including anal incontinence, pelvic organ prolapse, sexual dysfunction, and impaired quality of life [5]. The identification of women at higher risk for such injuries is therefore essential, particularly among primigravida women who are inherently more vulnerable to perineal injuries. The perineal body, a pyramidal fibromuscular structure located between the vaginal introitus and the anal canal, plays a key role in maintaining the integrity of the pelvic floor. It serves as a point of convergence for multiple muscles essential for continence and pelvic organ support [6]. Some studies suggest that the shorter length of perineal body can reflect the risk of severe perineal tears due to its hypothesized role in pelvic organ support during delivery. Limited studies exist in India on the role of perineal body length as a predictor of OASIS among Indian women, and such evidence are further limited by the possibility of confounding [7–11]. Also, factors such as measurement timing (antepartum vs. intrapartum), mode of delivery (spontaneous vs. instrumental), and regional obstetric practices like routine episiotomy can influence study outcomes, making different contextual studies necessary for different study settings. Understanding whether perineal body length predispose pregnant women to severe perineal tears can help in targeted intrapartum interventions. In this background, we set an objective to assess the association between perineal body length and Obstetric Anal Sphincter Injury (OASI) among primigravida undergoing normal vaginal delivery in a tertiary care facility in Tamil Nadu.

MATERIALS AND METHODS

Study design and setting

This was a prospective observational nested case-control study conducted in the Department of Obstetrics and Gynaecology at Government Cuddalore Medical College and Hospital, Tamil Nadu, India, over a period of February 2023 to February 2025.

Study participants

The study population included primigravida women aged 18–40 years with singleton term pregnancies planned for normal vaginal delivery. Participants were recruited during the first stage of labour after obtaining informed consent.

Inclusion criteria: The inclusion criteria were: (a) age between 18 and 40 years, (b) singleton pregnancy, (c) term gestation (≥37 to ≤42 weeks), (d) foetus in cephalic presentation, and (e) women planned for vaginal delivery.

Exclusion criteria: The exclusion criteria were: (a) multiparous women, (b) planned or emergency caesarean delivery, (c) malpresentation other than cephalic, (d) preterm labour (<37 weeks), (e) multiple gestation, (f) history of pelvic or perineal surgery, trauma, or anatomical abnormalities, (g) instrumental vaginal delivery (vacuum or forceps), and (h) baby's birth weight >4500 g or head circumference >99th percentile.

Cases: Grade 3 or 4 perineal tear

Controls: Grade 1 or 2 perineal tear (or) absence of perineal tear; For each case, eight individually matched controls (based on age within ±5 years and same BMI category (<30 kg/m^2 or ≥30 kg/m^2)) were selected from the same cohort.

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Sampling and sample size

Sample size was calculated based on the odds ratio of 5.18 observed by Djusad et al. (2021) for the association between perineal body length <3 cm and severe perineal tear.[10] At 95% confidence level and 80% power, 14 cases and 112 controls (1:8 matching) were estimated as required.

Study procedure

Following recruitment, baseline data including age, pre-pregnancy BMI, and gestational age were collected. Perineal body length was measured during the first stage of labour in the dorsal lithotomy position, from the posterior fourchette to the anus using a measuring tape. Two independent trained observers took measurements, and the average value was recorded. Labour was managed per hospital protocols, including routine mediolateral episiotomies for all the mothers. Data on duration of second stage of labour was collected. Prolonged second stage was defined as those lasting more than 2 hours without epidural or more than 3 hours with epidural analgesia. Women were followed until 6 hours postpartum to assess the occurrence of perineal tear. If occurred, the grade of perineal tear was noted to classify cases and controls. Anthropometry was performed for the neonate to obtain birth weight (in kg) and head circumference (in percentile).

Ethical considerations

The study was approved by the Institutional Ethics Committee of Government Cuddalore Medical College and Hospital. Written informed consent was obtained from all participants. Confidentiality of data was ensured throughout the study.

Statistical analysis

Data entry was performed in Microsoft Excel and analysed using Stata version 16.0. [12] Categorical variables were summarized using frequencies and percentages. Associations between variables and perineal tear severity were assessed using Chi-square test or Fisher's exact test where appropriate. A p-value <0.05 was considered statistically significant. Unadjusted odds ratios were calculated for association between severe perineal tear and perineal body length.

RESULTS

A total of 126 primigravida women were included in the study, comprising 14 cases (women with Grade 3/4 perineal tears) and 112 controls (women with Grade 1/2/no tear). Among the control group, 89 women (79.5%) did not sustain any perineal tear, while 15 women (13.4%) had Grade 1 tears, and 8 women (7.1%) had Grade 2 tears. All women in the case group sustained Grade 3 perineal tears (14/14, 100%), and none had Grade 4 tears.

The distribution of age and BMI was similar between the two groups. There was no statistically significant difference in gestational age between the two groups (p=0.73). Although a higher proportion of prolonged second stages was observed among cases compared to controls, the difference was not statistically significant (P = 0.17). (Table 1)

Table 1

Variables	Total	Grade 3/ 4 perineal tear (Case) (n=14)	Grade 1/2/no perineal tear (Control) (n=112)	$\chi 2$	P value
Age group (in years) *					
<25	99	11 (78.6)	88 (78.6)	-	1.00
≥25	27	3 (21.4)	24 (21.4)		
Obesity*					
Absent	90	10 (71.4)	80 (71.4)	**-**	**0.61**
Present	36	4 (28.6)	32 (28.6)		
Gestational age*					

<40 weeks	102	11 (78.6)	91 (81.2)	**-**	**0.73**
≥40 weeks	24	3 (21.4)	21 (18.8)		
Duration of second stage of labour					
Normal	95	9 (64.3)	90 (80.4)	1.97	0.17
Prolonged	27	5 (35.7)	22 (19.6)		
Baby's birth weight (kg)					
<3.5	99	7 (50.0)	89 (79.5)	5.96	0.02
≥3.5	27	47 (50.0)	23 (20.5)		
Baby's head circumference (percentile)					
<75 percentile	98	8 (57.1)	90 (80.4)	3.88	**0.04**
≥75 percentile	28	6 (42.9)	22 (19.6)		
Perineal body length (cm)*					
<3.0^	31	12 (85.7)	19 (17.0)	**-**	**0.01**
≥3.0	95	2 (14.3)	93 (83.0)		

In terms of neonatal birth weight, 7 cases (50.0%) delivered babies weighing less than 3.5 kg, while the other 7 cases (50.0%) delivered babies weighing 3.5 kg or more. Among the controls, 89 women (79.5%) delivered babies weighing less than 3.5 kg and only 23 women (20.5%) delivered babies weighing 3.5 kg or more. This difference was statistically significant (P = 0.02). (Table 1) A total of 8 cases (57.1%) delivered babies with head circumference less than the 75th percentile, while 6 cases (42.9%) delivered babies with head circumference at or above the 75th percentile. Among the controls, 90 women (80.4%) had babies with head circumference below the 75th percentile, and 22 women (19.6%) had babies with larger head circumference. This association between larger head circumference and severe perineal tear was statistically significant (P = 0.04). (Table 1) When comparing perineal body length, 12 cases (85.7%) had a perineal body length less than 3.0 cm, while only 2 cases (14.3%) had a perineal body length of 3.0 cm or more. Among controls, only 19 women (17.0%) had a perineal body length less than 3.0 cm, and 93 women (83.0%) had a perineal body length of 3.0 cm or more. The association between shorter perineal body length and the occurrence of Grade 3 perineal tear was statistically significant (P = 0.01). (Table 1) The unadjusted odds ratio for women with a perineal body length <3.0 cm having a severe perineal tear was 29.4.

DISCUSSION

The present nested case-control study showed statistically significant association between shorter perineal body length and the occurrence of severe perineal trauma (Grade 3/4 perineal tears) among primigravida women undergoing vaginal delivery, highlighting its potential role as an anatomical risk factor for severe obstetric perineal trauma. This finding is consistent with previous literature. Batoum et al. (2021) in Cameroon observed that perineal body length less than 2.5 cm significantly increased the risk of spontaneous perineal tears [13]. Similarly, Ali et al. (2021) in Egypt reported that women with perineal length less than 4 cm had a significantly higher incidence of perineal tears and episiotomy compared to those with longer perineum [14]. Farghaly et al. (2017) also observed the role of short perineal length in increasing the risk of spontaneous perineal injuries in women who delivered without episiotomy [15]. Lane et al. (2017) in the United States supported these findings, showing that perineal body length ≤3.5 cm was predictive of third- and fourth-degree tears [16]. In India, Ganiga et al's study were similar to our study results.[8]However, some studies reported contrasting results. Tsai et al. (2018) did not find significant association between perineal body length and the risk of severe lacerations [9]. Likewise, Meriwether et al. (2016) did not find any correlation between dynamic perineal stretch and perineal lacerations [11]. Differences in measurement technique (static vs dynamic) and study population could explain these discrepancies. Shorter perineal body length is hypothesized to reduce the tissue buffer available between the vaginal introitus and the anal sphincter, resulting in greater mechanical strain during the crowning phase of labour. The lack of sufficient tissue to accommodate foetal descent may predispose to direct injury of the anal sphincter complex. Apart from perineal body length, our study identified that higher neonatal birth weight (≥3.5 kg) was significantly associated with the risk of severe perineal injuries. This finding aligns with the results of multiple previous studies. Theobald et al. (2020) reported that birth weight above

3500 grams independently increased the risk of Grade 3/4 perineal tears [17]. Ganiga et al. (2022) also found higher birth weight to be significantly correlated with the occurrence of severe perineal trauma in Indian primigravida women [8]. Similarly, the systematic review by Raihan et al. (2023) established birth weight as a consistent risk factor across multiple studies [18]. Macrosomic foetuses might exert greater pressure on the perineal tissues and reduce the time for gradual tissue distension, leading to increased rates of sphincter damage.Our study further found that larger foetal head circumference (≥75th percentile) was significantly associated with severe perineal tears. Previous studies have supported this observation, with Raihan et al. (2023) meta-analysis showing a pooled odds ratio of 1.92 for obstetric anal sphincter injuries when neonatal head circumference exceeded 35±1 cm [18]. Jansson et al. (2020) similarly identified large foetal head circumference as an independent predictor for OASI [19]. Larger heads of the babies might exert prolonged and increased mechanical stress on the perineum, increasing the risk of tissue rupture. Although the proportion of prolonged second stage of labour was higher among women who sustained severe perineal tears (35.7%) compared to controls (19.6%), this association did not achieve statistical significance in our study, possibly due to the limited sample size. However, other studies such as Addisu et al. (2024) and Raihan et al. (2023) have reported prolonged second stage as an independent risk factor for perineal trauma [18, 20]. Prolonged pressure of the foetal head on the perineal tissues may lead to tissue ischemia, loss of elasticity, and eventual tearing. For measurement of exposure, we employed various measures to reduce misclassification like considering average of two readings to reduce inter-observer variability, formulating standard operating procedure for measurement, and training of professionals before measurement. By this way, the standardized measurement of perineal body length was a strength of this study, reducing misclassification of exposure. Excluding multiparous women, instrumental deliveries, and preterm births increased the internal validity of our findings, though generalizability was limited. Matching for age, BMI, and head circumference ensured comparability between cases and controls. Our study, by restricting the population to low-risk term primigravida women and individual matching, attempted to reduce potential confounding and focus more specifically on perineal body length. However, the possibility of residual confounding cannot be ruled out. Though nested case control design helped us to assess a relatively rare outcome of severe perineal tears in our setting, the low sample size might limit the power to detect significant associations for other variables other than perineal body length. Analyses to address residual confounding could not be performed due to limited sample size. The generalizability of findings might be further limited due to single-centre design, and the practice of universal routine episiotomy in the study setting.

CONCLUSION

Short perineal body length (<3.0 cm) is a risk factor for Grade 3/4 perineal tears in primigravida women undergoing vaginal delivery in Southern India. Measurement of perineal body length during labour could help in early identification and management of women at high risk, to minimize the incidence of obstetric anal sphincter injuries.

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