Birth and Regulation of head Extension to Guide Manual perineal Assistance (BREGMA) study (a prospective cohort study)

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Research Article

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Abstract

Background: The exact positioning of the dominant hand at the time of manual perineal protection (MPP) is not clearly specified. The main aim of this work was to identify the place on the perineum where pressure needs to be applied to achieve optimal forward fetal head displacement away from the anal sphincters using the bregma to posterior fourchette distance (BFD) and the perineal body length (PBL).

Methods: This was a two-center study. Term cephalic singleton nulliparous women having spontaneous vaginal delivery were considered eligible for recruitment into the study. Once crowning was diagnosed and just prior the initiation of manual perineal protection (MPP) or cutting an episiotomy, the BFD and PBL were measured using a standardized measurement protocol.

Results: A total of 100 women (50 women in each center) were recruited into the study. The overall mean BFD was 2.8 ± 0.5 cm. The overall mean PBL was 4.4 ± 0.8 cm. There were no statistically significant differences between the measurements taken in both units regarding BFD or PBL ($p = 0.81$ and 0.10 respectively). There was a weak correlation between both measurements.

Conclusion: Based on our measured parameters, it seems that the most effective point to apply perineal pressure to displace the head away from the anus is approximately 1 – 1.5 cm anterior to the anal margin. This information will form the bases of future biomechanical studies to confirm their validity.

Background

Studies investigating perineal trauma at the time of vaginal birth found that primiparity, forceps delivery, midline episiotomy, persistent occipitoposterior position, and shoulder dystocia were significant risk factors [1]. Manual perineal protection (MPP) is an intrapartum intervention that is used to reduce the risk of severe perineal trauma and its consequences [2–4]. However, there is lack of complete understanding of how to accurately execute the technique and the intended value to be achieved by each of its components [5–9]. We believe that these factors, and the lack of objective evidence of how the technique relates to the dynamic changes occurring at the fetal head and the perineum at the time of crowning, are important limitations to the wide adoption of MPP amongst professionals and might account for the variation in the reproducibility of the technique's effectiveness in reducing perineal trauma.

Biomechanical analysis of a variety of MPP techniques that reduce the tension at the midpoint of the perineum identified the Finnish and Viennese maneuvers to be the most effective [4, 10–12]. Stereo-photogrammetric analysis and biomechanical studies have optimized the positioning of the thumb and finger(s) of the dominant hand to minimize tension at the midpoint of the perineum [10–13]. However, in addition to the reduction in perineal tension, both techniques also aim to regulate fetal head extension, while pushing it away from the anal sphincter complex, using the flexed middle finger or the ulnar border of the dominant hand respectively [14–17]. This component is considered to be important for the effectiveness of MPP [18].

In an occipital-anterior position, the bregma is the most posterior fetal head landmark in relation to the maternal perineum at the time of crowning. Therefore, to achieve the required anterior displacement of the head away from the anal sphincters, the pressure needs to be applied at a point on the perineum between the bregma and the anal margin. However, the normal range and variation of the position of the bregma in relation to the distended perineum at the time of crowning is not known.

Therefore, the primary aim of this work was to identify the optimal place on the perineum where pressure needs to be applied during MPP to achieve optimal forward fetal head displacement away from the anal sphincters. We proposed that this could be achieved by collecting data regarding the position of the bregma in relation to the perineum at the time of crowning using the bregma to the posterior fourchette distance (BFD) and the perineal body length (PBL) as objective surrogate measures. As a secondary aim we wanted to assess the degree of variability between these measurements in a diversified population.

Methods

This is a prospective cohort study conducted in 2 maternity units in Hagen, Germany (unit 1) and in Cairo, Egypt (unit 2). Women having their first spontaneous vaginal birth of a singleton term baby in vertex presentation and occipitoanterior position were considered eligible to participate in the study. Suspected fetal distress or fetal anomalies, occipitoposterior position, operative vaginal delivery, and history of vaginal or perineal operations were reasons for exclusion. Women meeting the inclusion criteria were informed about the study on admission to the labor ward during the first stage of labor. Favorable ethical approvals were granted to the study by the Hospital Board of Management at Allgemeines Hospital Hagen on 02.01.2020 and the Research Ethics Committee at Ain Shams University on 05.01.2021 (Ref. FMASU MS 704/2020/2021) (supplementary information). All study participants provided a valid written informed consent.

Intrapartum care was undertaken based on the participating unit’s protocol. One assessor (AA) performed all the measurements in both units. Measurements were performed while the woman was in a semi-recumbent lithotomy position with the legs flexed at the hip joints at an angle between 90° and 100° [19, 20]. Disposable sterile surgical skin marker and tape measure kits were used for the assessments (Viscot Medical, LLC; East Hanover, NJ 07936). The fixed reference points were the posterior fourchette (the posterior margin of the hymen), and the most anterior point on the anal epithelium at 12 o'clock from the center of the anal orifice [21]. PBL was defined as the distance between the posterior fourchette and the anterior margin of the anal opening [21]. We used the anterior margin of the anal opening rather than the center of the anus, as proposed by the International Continence Society, to mitigate inaccuracies resulting from the varying degrees of anal dilatation that may occur at the time of fetal head crowning.

Measurements were taken once crowning was diagnosed and just prior the initiation of MPP or cutting an episiotomy, whichever came first. The index finger was inserted through the vaginal introitus in the midline between the fetal head and perineum to palpate the fetal bregma. Using a sterile skin marker, a point was marked externally in the midline on the perineal skin corresponding to the point at which the

center of the fetal bregma was palpated. Using a sterile tape measure, the distance between this marked point on the perineum and posterior fourchette was measured (BFD). Using the same tape measure, the distance between the posterior fourchette and the anterior margin of the anal opening, (at 12 o'clock) was then measured (PBL) (Fig. 1). Additionally, we collected data on maternal age, BMI, duration of second stage of labor, birth weight, neonatal head circumference and any associated perineal trauma including episiotomy.

A convenience sample of 50 women per unit was set a priori for the study. Statistical analysis was performed using SAS 9.4 (SAS Institute Inc., Cary, NC, USA) statistical software. Difference in distribution of ranked data between groups was carried out with non-parametric ANOVA (2-sample Wilcoxon test or 2-sample Median test), while categorical variables were assessed by the $\chi 2$ test or Fisher´s exact test. The Pearson correlation and linear regression were used to assess the relation between PBL and BFD. A $p < 0.05$ was considered statistically significant.

Results

The study was conducted between January 2, 2020, and August 30, 2020, at unit 1 and between January 5, 2021, and May 30, 2021, at unit 2. A total of 100 primiparous women were recruited and contributed full data into the study in the two units. The number of patients approached and recruited to achieve the target sample is presented in Fig. 2. The demographic details and obstetrics variables are presented in Table 1. There was a statistically significant difference between the two centers regarding duration of the 2nd stage of labor ($p = 0.004$) and neonatal weight ($p = 0.02$). The overall mean BFD was 2.8 ± 0.5 cm (2.8 ± 0.6 cm in unit 1 and 2.8 ± 0.5 cm in unit 2). The overall mean PBL was 4.4 ± 0.8 cm (4.5 ± 0.8 cm in unit 1 and 4.3 ± 0.7 cm in unit 2). There were no statistically significant differences between both units regarding BFD or PBL ($p = 0.81$, and 0.10 respectively).

Table 1
The demographic data and obstetrics variables in the study group

Obstetric variable	Cohort	Mean ± SD	Median (IQR)	p-value
Maternal age, years	overall	28.0 ± 5.9	27.5 (24.0–32.0)	0.46 *
	unit 1	28.4 ± 6.2	27.5 (24.0–33.0)	
	unit 2	27.5 ± 5.6	27.5 (24.0–31.0)	
Body mass index, kg/m2	overall	29.3 ± 4.2	29.0 (26.0–32.0)	0.63 *
	unit 1	29.4 ± 4.3	30.0 (26.0–32.4)	
	unit 2	29.2 ± 4.0	29.0 (26.0–32.0)	
Duration of the 2nd stage of labor, min	overall	82.3 ± 24.9	83.5 (65.0–98.0)	0.004 *
	unit 1	89.7 ± 27.0	92.0 (70.0–103.0)	
	unit 2	74.8 ± 20.3	75.0 (60.0–90.0)	
Birth weight, g	overall	3446 ± 403	3440 (3225–3670)	0.02 *
	unit 1	3531 ± 463	3535 (3300–3820)	
	unit 2	3361 ± 314	3345 (3150–3550)	
Neonatal head circumference, cm	overall	35.3 ± 1.5	35.0 (34.0–36.5)	0.38 *
	unit 1	35.5 ± 1.6	35.0 (34.0–37.0)	
	unit 2	35.1 ± 1.4	35.5 (34.0–36.0)	
Bregma – fourchette distance, cm	overall	2.8 ± 0.5	2.8 (2.5–3.2)	0.81 *
	unit 1	2.8 ± 0.6	2.9 (2.4–3.2)	
	unit 2	2.8 ± 0.5	2,8 (2.5–3.1)	
Perineal body length, cm	overall	4.4 ± 0.8	4.2 (3.9–4.9)	0.10 *
	unit 1	4.5 ± 0.8	4.4 (3.9–5.1)	
	unit 2	4.3 ± 0.7	4.1 (3.8–4.6)	
**) Wilcoxon Two Sample Test*				

On assessing the relationship between BFD and PBL using Pearson coefficient, there was low correlation between both measurements (r = 0.4820) (Fig. 3).

Discussion

Summary of findings

To our knowledge, this is the first study to generate data for BFD and PBL at time of initiation of MPP. Our study demonstrated that there were no statistically significant differences between these measurements in two cohorts of women recruited in a unit in Germany and another one in Egypt despite some significant differences in participants' demographics. This observation suggests that ethnicity does not seem to affect these measurements; nonetheless, this finding may be limited by our sample size. The statistically significant difference in maternal age between the two groups may be explained by cultural and / or social differences between the two countries. There was also statistically significant difference in neonatal weight where the mean birthweight was higher in Germany compared to Egypt. Exploring the reasons for this difference is beyond the scope of our work, however, it is plausible that constitutional and / or nutritional factors have contributed to such difference.

When comparing the duration of second stage of labor between the two centers, there was a statistically significant difference between the two groups. This could be due to variations in the management protocols adopted by the two centers. Indeed, at Ain Shams University, getting women to commence active pushing as soon as full cervical dilatation is confirmed is the preferred policy to shorten the second stage of labor as much as possible to be able to manage the large number of women admitted in labor per day. Moreover, in the absence of a midwifery service in Egypt, labor is totally managed by a medical team, which might have had an impact on the observed difference.

Comparison Of Findings To Other Studies

Although our study group was not the first one to measure the PBL, to our knowledge, we are the first to measure it at the time of initiation of MPP and the first to propose and measure the BFD. Rizk et al. studied the relation between perineal length and position of the anus at the time of vaginal delivery in primigravidae. They measured PBL and the distance between the fourchette and the inferior margin of the coccyx to calculate the anal position index. Unlike our study, these measurements were obtained at the first stage of labor. In their study a short perineum and anterior displacement of the anus were associated with a traumatic vaginal delivery [22]. Interestingly, Rizk and associates' reported mean PBL measurement of 4.6 cm is comparable to the mean PBL in our study despite the difference in the stage in labor when the measurements were taken. In contrast, the mean PBL measured in our study was shorter than that reported by Meriwhether et al. where their mean reported PBL increase from 3.7 cm during the first stage to a maximum of 6.1 cm during the second stage [23]. Nonetheless, in Rizk et al and Meriwhether et al studies PBL was defined as the distance between the posterior fourchette and the center of the anal orifice [22, 23]. However, we opted to use the anterior anal margin rather than the center of the anus to mitigate the potential inaccuracies caused by the varying degrees of anal dilatation at the later stages of labor [21]. Hence, it is plausible that, not only the difference in the stage of labor at which measurements were taken but also the reference point used for measurement could have contributed to some of the unexpected comparisons. Furthermore, Pihl and colleagues, studied the relation between the anovaginal distance (AVD) measured by transperineal ultrasound and the occurrence of external anal sphincter injury before suturing the perineal laceration. They reported that a short AVD could be a warning

sign and should increase the awareness of accoucheurs of possible external sphincter injury before suturing a perineal tear [24]. Nevertheless, they measured the AVD after the vaginal birth and before suturing a perineal laceration, which does not reflect the actual perineal length at the time of crowning.

Jansova et al. investigated the role of the thumb and index finger in manual perineal protection and concluded that the optimal placement of the thumb and index finger is 2 cm anterior of the fourchette and 12 cm apart while the most effective distance and direction of movement is to approximate these digits by 1 cm on either side without changing their antero-posterior orientation to the fourchette [10–12]. We believe that the results of this study provide important clinical information for the optimization of the placement of the flexed middle finger, in the Finnish technique, or the ulnar border of the hand, in the Viennese technique, to facilitate the delivery of the fetal head through the perineum with the least possible head circumference. Indeed, the lack of such measurements to objectively describe the degree of flexion of the fetal head at the time of instigating MPP, has been a major limitation for studies investigating this intervention. Based on our findings and the difference between the BFD and the PBL, we recommend that for the pressure to achieve effective displacement of the fetal head at the time of crowning needs to be applied approximately 1–1.5 cm anterior to the anal margin.

Strengths And Limitations

We appreciate that our study has some limitations. The lack of availability of data on BFD and PBL at the time of crowning hindered our ability to perform a priori formal sample size calculation for this work. However, we were able to recruit a well-defined cohort of women from different ethnic backgrounds and were able to generate a fairly homogenous dataset for these measurements. Additionally, it could be argued that having one assessor collecting all the data could be a potential source for bias. Nevertheless, this design has negated the possibility of inter-rater variability.

Conclusion

This is the first study to generate data on the bregma to fourchette distance and the perineal body length just prior to fetal head expulsion. Based on our measured parameters, it seems that the most effective point to apply perineal pressure at the time of manual perineal protection is approximately 1–1.5 cm anterior to the anal margin. This information will form the bases of future in silico trials on birthing virtual twins to confirm their mechanistic validity.

Abbreviations

BFD
bregma to posterior fourchette distance.
PBL
perineal body length
MPP

manual perineal protection

Declarations

Ethical approval: Favorable ethical approvals were granted to the study by the Hospital Board of Management at Allgemeines Hospital Hagen on 02.01.2020 and the Research Ethics Committee at Ain Shams University on 05.01.2021 (Ref. FMASU MS 704/2020/2021). All study participants provided a valid written informed consent. All methods were performed in accordance with the relevant guidelines and regulations.

Consent for publication: not applicable

Availability of data and materials: The datasets used and analysed during the current study are available from the corresponding author on reasonable request.

Competing interests: The authors declare that they have no competing interests.

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Authors' contributions:

A Abouelhassan: literature search, protocol development, data collection, data analysis, prepared the first draft of manuscript.

V Kalis: conceived the idea, literature search, data analysis and interpretation, editing and revising the manuscript.

M Schüssler: data interpretation.

H Awwad: data interpretation.

R Hassan: data interpretation.

K M Ismail: protocol development, literature search, data analysis and interpretation, editing and revising the manuscript.

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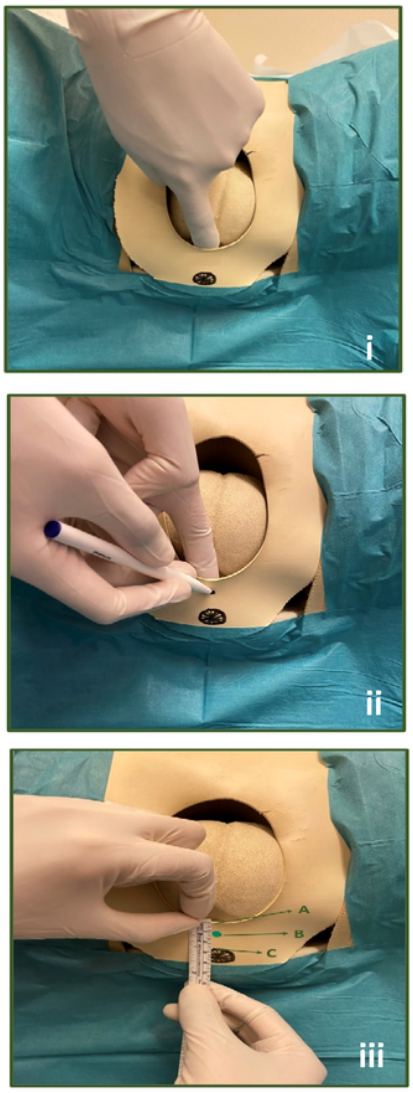
Figures



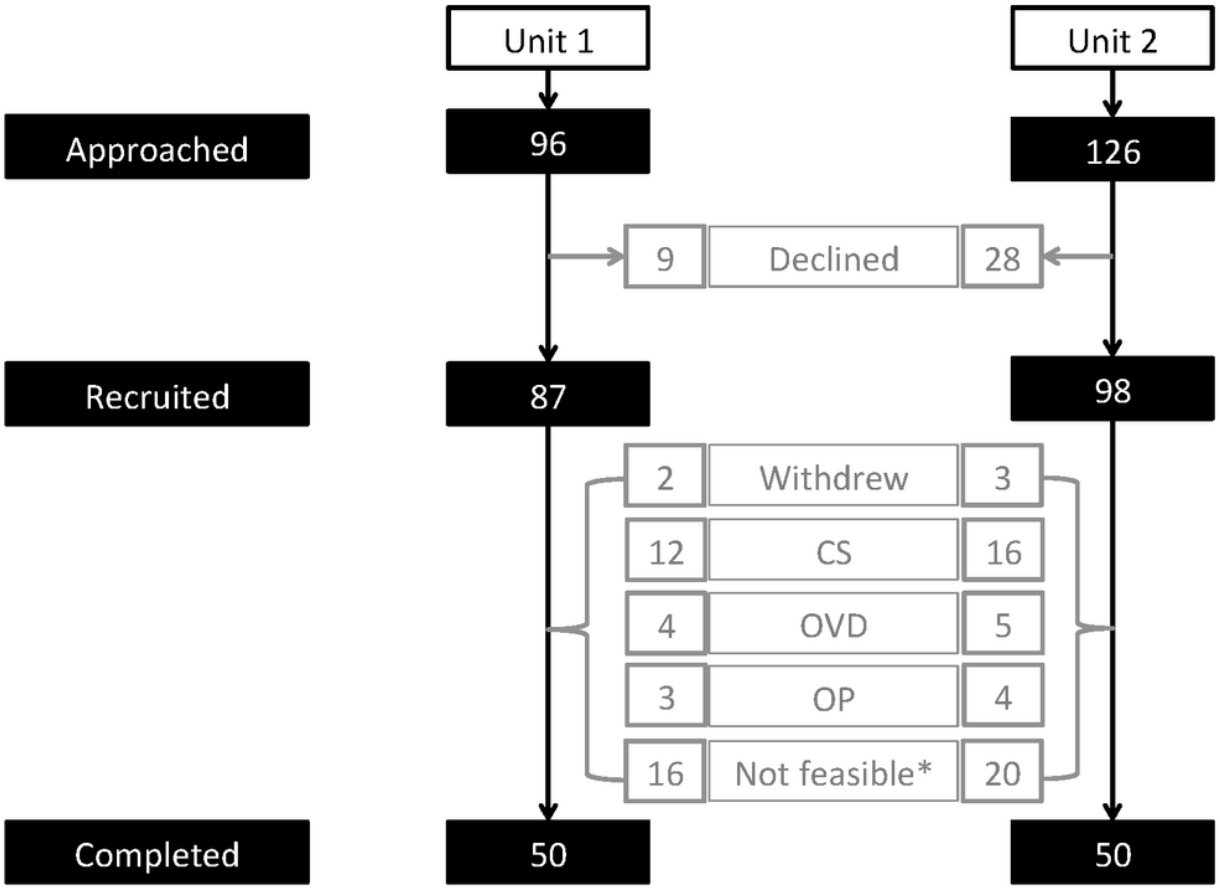
i) Index finger was inserted through the vaginal introitus in the midline between fetal head and perineum to palpate the fetal bregma.

ii) Using a sterile skin marker, a point was marked externally in the midline on the perineal skin corresponding to the point at which the center of the fetal bregma was palpated

iii) Using a sterile tape measure, the distance between the marked points on perineum and posterior fourchette were measured.
(BFD = Distance A to B; PBL = Distance A to C)

Figure 1

Simulation of how the BFD and PBL measurements were assessed.



* Not feasible to take measurements because the participant was too distressed, labor progressed too fast or the assessor was not available at time of birth.

Figure 2

Flowchart of patient flow into the study

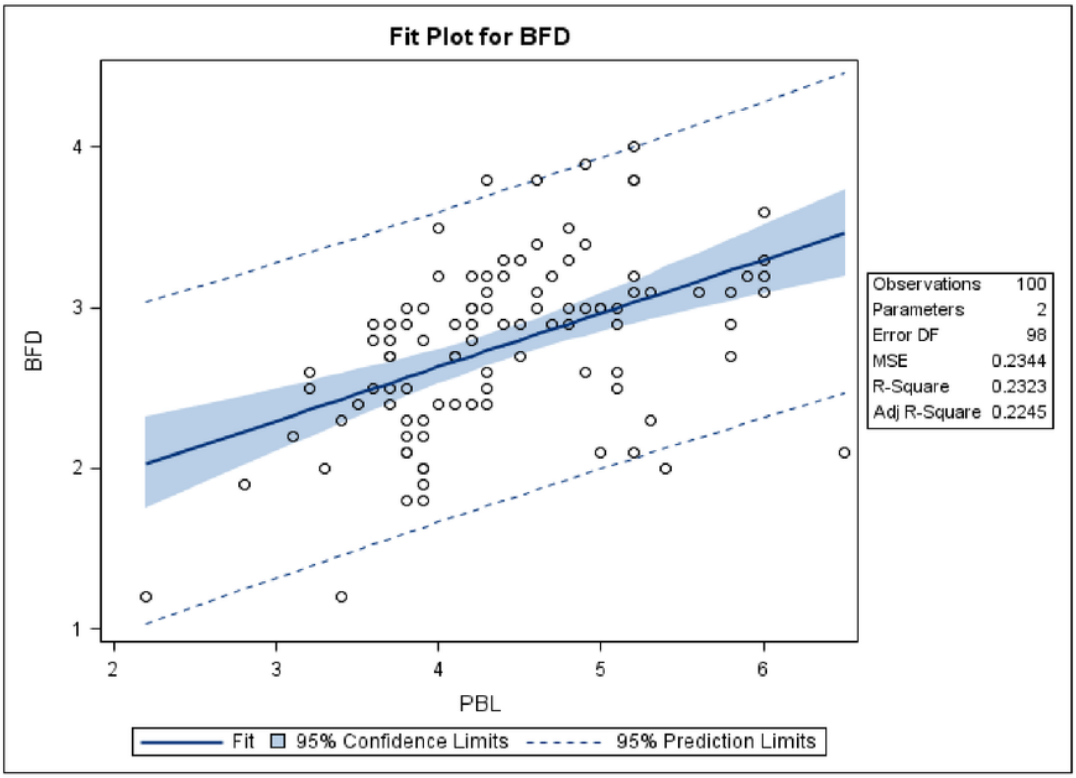


Figure (3): Relationship between BFP and PBL using Pearson coefficient

Figure 3

Relationship between BFP and PBL using Pearson coefficient.