

OBSTETRICS

The association between fetal head station at the first diagnosis of the second stage of labor and delivery outcomes



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BACKGROUND: Controversy surrounds the impact of the fetal head station on labor duration and mode of delivery. Although an extensive body of evidence has been published evaluating fetal head station in early labor, there is a paucity of data on the impact of fetal head descent during the second stage.

OBJECTIVE: This study aimed to explore the association between fetal head station at the diagnosis of the second stage of labor and the second stage duration and the risk of operative delivery.

STUDY DESIGN: This is a retrospective cohort study of all singleton vertex deliveries in a single tertiary center (2011–2016). Women were grouped according to fetal head station upon the diagnosis of the second stage of labor as follows: above ($S < 0$), at the level ($S = 0$), and below ($S > 0$) the level of the ischial spine. The duration of the second stage and the risk of operative delivery were compared between the groups and stratified by parity.

RESULTS: Overall, 34,334 women met the inclusion criteria. Of these, 18,743 (54.6%) were nulliparous and 15,591 (45.4%) were multiparous. Of the nulliparous women, 8.1%, 35.8%, and 56.1% were diagnosed as

having fetal head above, at the level, and below the ischial spine upon second stage diagnosis. Of the multiparous women, 19.7%, 35.6%, and 44.7% were diagnosed as having fetal head above, at the level, and below the ischial spine. Fetal head station upon second stage diagnosis was independently and significantly associated with second stage duration ($P < .001$); however, its contribution was 4.5-fold among nulliparous women compared with multiparous women. In multivariable analysis, after controlling for maternal age, gestational age at delivery, prepregnancy body mass index, epidural anesthesia, and birthweight, the risk of operative delivery was substantially increased in a dose-dependent pattern for both nulliparous and multiparous women.

CONCLUSION: The fetal head station at the first diagnosis of the second stage is significantly and independently associated with the duration of the second stage and correlated with the risk of operative delivery in both nulliparous and multiparous women ($P < .001$).

Key words: delivery, head descent, labor, labor stages, mode of delivery, operative delivery, presenting part descent, second stage of labor

Introduction

Fetal descent refers to the downward passage of the presenting part through the birth canal. There are widely accepted classification systems of fetal station (-5 to $+5$ and -3 to $+3$)¹ that are based on a quantitative measure in centimeters of the distance of the leading bony edge from the ischial spines and the midpoint (0 station) is defined as the plane of the maternal ischial spines.

In early studies by Friedman et al,^{2–4} a high fetal station upon admission was associated with a dysfunctional labor pattern. Subsequent studies evaluated the fetal head station in the early active phase of labor and assessed its impact on

the second stage duration and mode of delivery; all indicated a positive correlation between an unengaged cephalic presenting part and second stage duration and cesarean delivery.^{5–9} In contrast, a recent secondary analysis, including 4018 nulliparous women, revealed the lack of a significant association between an unengaged fetal station and vaginal delivery after controlling for other factors.¹⁰

Various factors have been reported to predict the second stage duration including maternal age, ethnicity, maternal prepregnancy body mass index (BMI), parity, active phase duration, epidural analgesia, and birthweight.^{11–14} Although an extensive body of evidence has been published describing these factors, there is a paucity of data regarding the impact of fetal head descent during the second stage of labor, despite the fact that head descent occurs primarily during this stage.¹⁵

In this study, we aimed to determine the association between fetal station at

the diagnosis of the second stage of labor and delivery outcome in terms of second stage duration and mode of delivery.

Materials and Methods

Subjects and study design

This is a retrospective cohort study using comprehensive labor and delivery information from electronic medical records in a university-affiliated tertiary hospital, between January 1, 2011, and December 31, 2016. Detailed information on maternal demographic characteristics, medical history, prenatal history, labor, and delivery summary was obtained. Data on labor progression (repeated, time-stamped cervical dilation, and fetal head station) were extracted from the electronic labor database. We compared the second stage duration and labor outcome according to the fetal head station as noted at the time of documenting complete dilation of the cervix. This project was approved by the institutional review boards

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AJOG at a Glance

Why was this study conducted?

This study aimed to explore the association between fetal head station at the diagnosis of the second stage of labor and the second stage duration and the risk of operative delivery.

Key findings

Fetal head station at the second stage onset is significantly and independently associated with the second stage duration in both nulliparous and multiparous women ($P<.001$). Fetal head station at the second stage onset significantly affects delivery mode, especially in nulliparous women ($P<.001$). There is a positive correlation between a high fetal head station and the risk of operative deliveries in a dose-dependent significant manner.

What does this add to what is known?

There is a paucity of data on the true impact of fetal head descent during the second stage of labor. This study suggests that fetal head station may be an independent predictor for second stage duration and mode of delivery in both nulliparous and multiparous women.

(#0220-17-TLV, obtained on May 10, 2017).

Inclusion and exclusion criteria

All women with a singleton gestation at term (37–42 weeks' gestation) with a vertex presentation and who progressed to the second stage of labor were eligible for inclusion. Exclusion criteria included stillbirths, pregnancy terminations, deliveries in which cervical dilation was 10 cm upon admission, or those that followed a prolonged (>25 hours) or induced labor. A comprehensive explanation with respect to missing data was previously reported.¹⁶ Briefly, women without cervical dilation measurements or those with only 1 documented cervical measurement ($n=6153$) or those without fetal head station documentation during the second stage ($n=812$) were excluded from the analysis. Of note, the demographic and obstetrical characteristics of those women were comparable with the included cohort.

Statistical analysis

Initially, participants were stratified by parity (nulliparous or multiparous), and baseline characteristics were compared. We used the χ^2 test for categorical variables, t test for continuous variables with normal distribution, and the

nonparametric rank-sum test for continuous variables with skewed distribution to examine statistical significance.

Our departmental protocol requires each obstetrical assessment in the labor and delivery unit to include both cervical dilation (in centimeters) and the presenting part station (using the -3 to $+3$ scale). All measurements were done by registered midwives, residents, or staff physicians. According to our departmental protocol, during the latent phase of labor, each parturient is assessed every 2 hours, unless indicated earlier (either for maternal or fetal reasons). During the active phase, the interval decreases to 1 to 1.5 hours, unless indicated earlier. During the second stage, the interval decreases to at least 0.5 to 1 hour unless indicated earlier.

Hence, we further divided the cohort according to fetal head station at the time of documenting complete dilation of the cervix as follows: (1) $S>0$, fetal head below the spinal process level (ie, $S+1$, $S+2$, or $S+3$; this group was used as a reference group); (2) $S=0$, fetal head at the spinal process level; and (3) $S<0$, fetal head above the spinal process level (ie, $S-1$, $S-2$, or $S-3$). According to our departmental protocols, prolonged second stage of labor was defined as second

stage durations of >1 hour for multiparous women without an epidural anesthesia, 2 hours for multiparous women with an epidural anesthesia and nulliparous women without an epidural anesthesia, and 3 hours for nulliparous women with an epidural anesthesia.

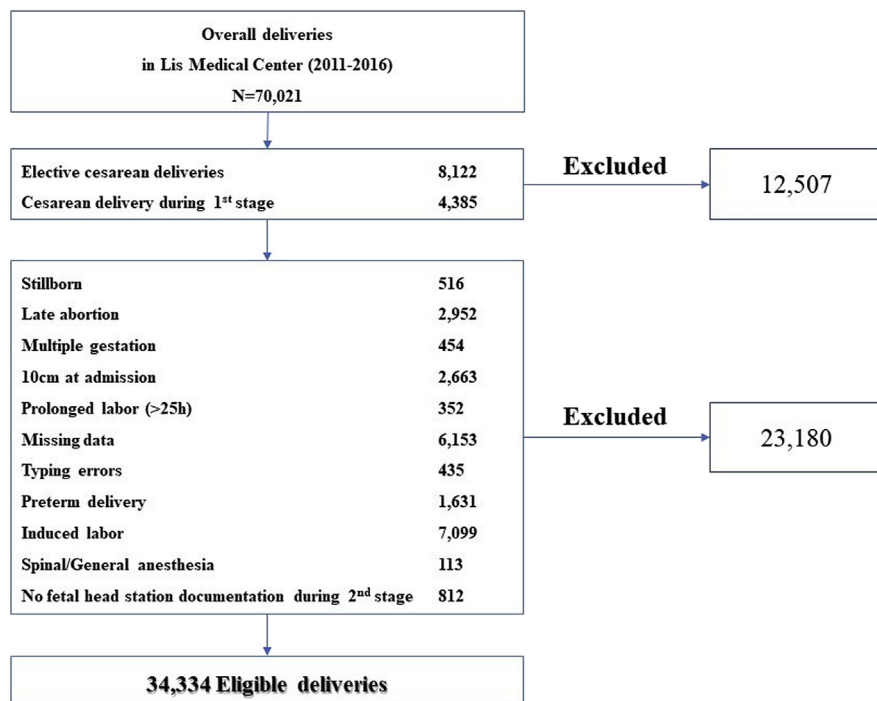
Kaplan-Meier survival analysis was used to compare the proportion of women undelivered by the time interval from the onset of the second stage to delivery, which was documented according to the fetal head position. The log-rank test was used to compare the survival distributions. To determine the association between fetal head station at the time of documenting complete dilation of the cervix and the second stage duration, we further performed a Cox regression analysis adjusting for maternal age, prepregnancy BMI, gestational age at delivery, epidural anesthesia, and neonatal birthweight (cesarean deliveries and operative vaginal deliveries were censored).

Finally, multivariable logistic regression analysis (using the Enter model) was performed to determine the association between fetal head station at the time of documenting complete dilation of the cervix and mode of delivery. Of note, according to our center policy, only vacuum applications are used for operative vaginal delivery. Models were adjusted for maternal age, prepregnancy BMI, gestational age at delivery, epidural anesthesia, and neonatal birthweight. The analysis was performed on nulliparous and multiparous women separately.

Data were analyzed using the SPSS statistical software version 24.0 (IBM Corp, Armonk, NY). Significance was set to a 2-sided P value of $<.05$.

Results**Patient characteristics**

The sample selection process for this study analysis was previously published.¹⁵ Of the 70,021 deliveries that occurred during the study period, 34,334 were eligible for inclusion (Figure 1). Of these, 18,743 (54.6%) were nulliparous and 15,591 (45.4%) were multiparous. Further details of the patient flow in this cohort can be found in the primary analysis of the cohort.¹⁶

FIGURE 1
Study profile

Of the overall 70,021 deliveries during the study period, 34,334 were included in the study. Exclusion criteria are detailed.

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The demographic and obstetrical characteristics stratified by parity are presented in Table 1. Mean maternal age, gestational age at delivery, prepregnancy BMI, and birthweight, although statistically significant ($P<.002$), were clinically comparable between the 2 groups. Higher rates of obesity and macrosomia were found in multiparous women. Most women in this study received epidural anesthesia. Of note, almost all of the multiparous women (96.2%) had spontaneous vaginal delivery, whereas higher rates of operative vaginal and cesarean deliveries were seen in the nulliparous group.

As expected, the median fetal head station at the time of documenting complete dilation of the cervix was higher in the multiparous group (engaged at the spinal level, but not below the spine as in the nulliparas). Although a greater proportion of multiparas had a fetal head station above the

spine, a higher proportion of nulliparas had a station below the spine. In nulliparous women, fetal head station at the time of documenting complete dilation of the cervix was above the spine ($S<0$), at the spinal level ($S=0$), and below the spine ($S>0$) in 8.1%, 35.8%, and 56.1%, respectively ($P<.001$). The corresponding values for multiparous women were 19.7%, 35.6%, and 44.7%, respectively ($P<.001$).

When the second stage duration in multiparas was stratified into the second delivery ($n=9108$ [58.4%]) and at or before third delivery ($n=6483$ [41.6%]), a significant reduction in the duration was also found in the third or lower delivery group (21 [10–53] and 13 [7–26], respectively [$P<.001$]).

The second stage duration according to fetal head station in nulliparous and multiparous women who had vaginal deliveries is presented in Table 2. In the nulliparous group, the lower the fetal

head station at the time of documenting complete dilation of the cervix, the shorter the median duration of the second stage of labor. In comparison, multiparous women progressed through the second stage faster than nulliparous women. In both nulliparous and multiparous groups, the 95th centile of duration did not largely differ between fetal head stations. It can be assumed that other factors play a role in the duration of the second stage including fetal size, maternal pelvic factors, and frequency and intensity of the contractions.

When further assessing the second stage duration and mode of delivery according to fetal head station below the ischial spine ($S+1$, $S+2$, $S+3$, and below), the same pattern was indicated as follows: the lower the fetal head at time of documenting complete dilation of the cervix to delivery, the shorter the duration of the second stage and the lower the rates of operative delivery, for both nulliparous and multiparous women (data not indicated).

Figure 2 depicts a survival analysis of the proportion of women undelivered from the time of documenting complete dilation of the cervix to delivery, stratified by fetal head station in nulliparas and multiparas. The percentage undelivered was lowest when the station was below the spine in both groups. In contrast, the percentage undelivered was highest when the station was above the spine for nulliparas and at the spinal level for multiparas.

The association between fetal head station at the time of documenting complete dilation of the cervix and second stage duration was also analyzed using the Cox regression analysis. Models were adjusted for maternal age, prepregnancy BMI, gestational age at delivery, epidural anesthesia, and neonatal birthweight. The hazard ratio (95% confidence interval [CI]) of fetal head station upon the second stage diagnosis in nulliparas was more meaningful than in multiparas using the level below the ischial spine as the reference value (0.54 [0.52–0.56] and 0.44 [0.42–0.48] when the fetal head station was above the spinal level and at the

TABLE 1
Demographic and obstetrical characteristics

	Nulliparous (N=18,743)				P value	Multiparous (N=15,591)				P value
		S<0 Above the spine (n=1515)	S=0 At the spinal level (n=6710)	S>0 Below the spine (n=10,518)			S<0 Above the spine (n=3069)	S=0 At the spinal level (n=5557)	S>0 Below the spine (n=6965)	
Maternal age, y	30.5±4.5	30.9±4.6	30.7±4.5	30.4±4.6	<.001	33.3±4.6	33.5±4.7	33.4±4.5	33.2±4.7	.002
Prepregnancy BMI, kg/m ²	22.0±3.6 (n=17,019)	22.7±3.9	22.2±3.7	21.8±3.5	<.001	22.6±4.1 (n=13,521)	23.3±4.6	22.6±4.0	22.3±3.8	<.001
Obesity (pregnancy BMI of ≥30 kg/m ²)	648 (3.5) (n=17,019)	81 (5.3)	242 (3.6)	324 (3.1)	<.001	739 (4.7) (n=13,521)	212 (6.9)	263 (4.7)	264 (3.8)	<.001
Previous single cesarean delivery	1486 (9.5%)	167 (5.4)	537 (9.7)	782 (11.2)	<.001	—	—	—	—	—
Cervical dilation at admission, cm	3.5 (2.5–5)	4 (3–5)	4 (3–5)	3.5 (2.5–5)	.10	4 (3–6)	4.5 (3.6)	4 (3–6)	4 (3–5.5)	<.001
Epidural anesthesia	16,336 (87.1)	1950 (63.5)	4499 (81.0)	5612 (80.6)	<.001	12,060 (77.4)	1358 (89.6)	6081 (90.6)	8897 (84.6)	<.001
First stage duration (min)	317 (171–506)	283 (159–462)	317 (169–501)	323 (175–515)	<.001	156 (68–285)	119 (36–243)	158 (71–282.5)	169 (78–303)	<.001
Fetal head station at the second stage onset	+1 (0–+1)	– (–1 to –1)	0 (0–0)	+1 (+1 to +2)	<.001	0 (0 to +1)	–1 (–2 to –1)	0 (0 to 0)	+1 (+1 to +2)	<.001
Second stage duration (min)	(49.7–160) 100	149 (93–194)	132 (80–180)	74 (36–131)	<.001	17 (9–39)	15 (7–42.5)	23 (11–56)	14 (8–28)	<.001
Gestational age at delivery, wk	39.4±1.1	39.4±1.1	39.4±1.1	39.4±1.2	.002	39.3±1.1	39.3±1.1	39.4±1.1	39.3±1.1	.004
Spontaneous vaginal delivery	15,509 (82.7)	1095 (72.3)	5213 (77.7)	9201 (87.5)	<.001	14,995 (96.2)	2934 (95.6)	5286 (95.1)	6776 (97.3)	<.001
Operative vaginal delivery	2735 (14.6)	295 (19.5)	1224 (18.2)	1216 (11.6)	<.001	454 (2.9)	82 (2.7)	205 (3.7)	167 (2.4)	<.001
Cesarean delivery	499 (2.7)	125 (8.3)	273 (4.1)	101 (1.0)	<.001	140 (0.9)	53 (1.7)	66 (1.2)	22 (0.3)	<.001
Birthweight, g	3238±398	3237±398	3215±399	3171±394	<.001	3375±405	3338±399	3355±406	3306±408	<.001
Macrosomia, >4000 g	548 (2.9)	59 (3.9)	219 (3.3)	270 (2.6)	.002	958 (6.1)	186 (6.1)	383 (6.9)	389 (5.6)	.010

Data are presented as mean±standard deviation, median (interquartile range), or n (percentage).

BMI, body mass index.

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TABLE 2

Second stage duration in minutes according to fetal head station stratified by parity

Second stage duration	Nulliparous				Multiparous			
	Overall	S<0 Above the spine	S=0 At the spinal level	S>0 Below the spine	Overall	S<0 Above the spine	S=0 At the spinal level	S>0 Below the spine
n (%)	18,244	1390 (7.6)	6437 (35.3)	10,417 (57.1)	15,449	3015 (19.5)	5491 (35.5)	6943 (50.0)
Median (IQR)	99 (49–158)	146 (91–188)	130 (79–177)	74 (36–130)	16 (9–39)	15 (7–40)	23 (11–55)	14 (8–28)
95th percentile	219	241	228	202.1	131	140	149.4	102

Data include only vaginal deliveries (excluding cesarean deliveries).

IQR, interquartile range.

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spinal level, respectively [$P<.001$, for both]). The corresponding values in multiparous women were 0.68 (0.65–0.71) and 0.77 (0.73–0.81), respectively ($P<.001$, for both).

The association between fetal head station at the time of documenting complete dilation of the cervix and the mode of delivery is presented in Table 3. More than 95% of multiparas had spontaneous vaginal delivery regardless of the fetal head station. By contrast, in the nulliparous group, a higher fetal station was seen with a lower incidence of spontaneous vaginal delivery. Of note, a positive correlation was found between the lack of fetal descent and the risk of operative deliveries in a dose-dependent manner for both nulliparous and multiparous women.

Comment

Main findings

This study aimed to assess the association between fetal station at the diagnosis of the second stage and delivery outcomes including the mode of delivery and second stage duration. Our findings indicate that most multiparous women (>95%) had spontaneous vaginal delivery regardless of the fetal head station. In contrast, 72.3% to 87.5% of nulliparous women had spontaneous vaginal delivery with rates differing based on fetal head station. A positive correlation was found between a high fetal station and the risk of operative delivery in a dose-dependent manner. The median

duration of the second stage in the nulliparous group was also seen to decrease with a lower fetal station, whereas in multiparous women the median durations were far shorter at all fetal head stations.

Results in context

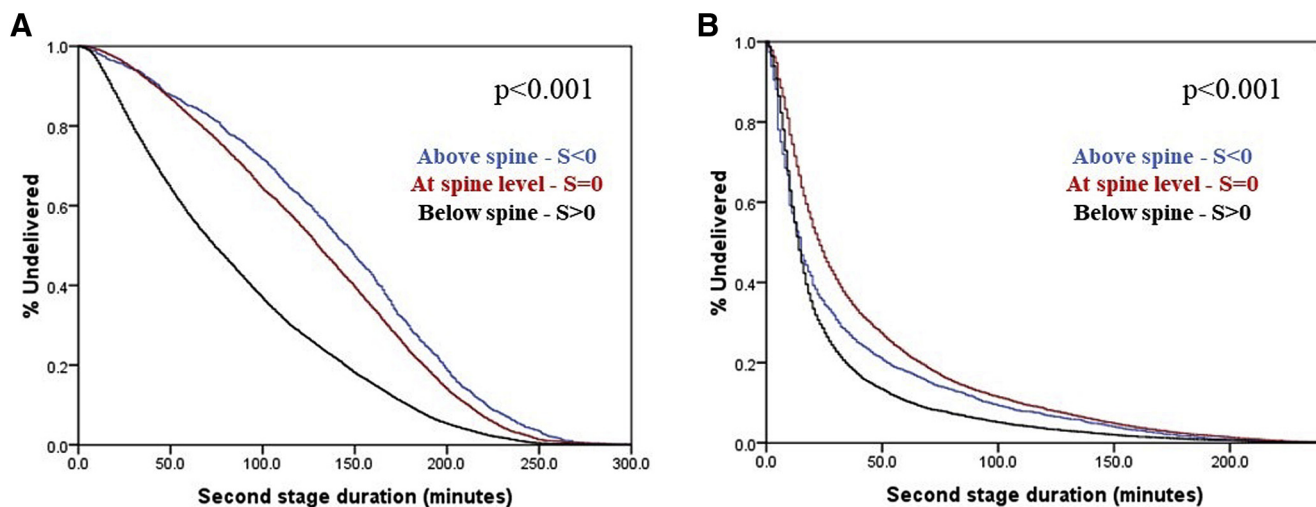
We found that for nulliparous women a higher fetal head station is associated with a lower likelihood of spontaneous vaginal delivery. This is contradictory to a previous finding that reports no association between fetal head station and vaginal delivery rate.¹⁰ Differences in study methods may account for these contradictory findings. Segel et al¹⁰ measured fetal station in women presenting with spontaneous labor at the time of admission. This cohort was further categorized based on a cervical dilation of ≥ 4 cm or < 4 cm at admission. Therefore, this previous study focused on the impact of fetal station in the first stage of labor, when the cervix is actively dilating. In contrast, our study measured fetal station at maximal cervical dilation of 10 cm, when the second stage is diagnosed. Using these measurements, a significant association was indeed found between fetal head station at the time of documenting complete dilation of the cervix and the rate of vaginal delivery, after adjusting for similar confounding factors as the previous study ($P<.001$). This suggests that fetal station is a better predictor for mode of delivery in nulliparous women

later, rather than earlier, in the course of labor.

We found that in nulliparas, the higher the station, the longer the duration of the second stage and the higher the risk of operative delivery, consistent with other studies.^{3,17} Ludvigsen and Skjeldestad⁹ similarly found that the fetal head station at complete cervical dilation was significantly associated with the duration of the second stage of labor. Of note, the authors categorized their cohort ($n=3311$) according to the fetal head station at complete cervical dilation differently as follows: at the pelvic floor, beneath the ischial spines but above the pelvic floor, and at or above the ischial spines. However, their results did not include mode of delivery. A recent randomized controlled trial (RCT) suggested that prolonging the second stage of labor actually decreased the incidence of cesarean deliveries.¹⁸ A few points may explain this disparity. First, the main purpose of that RCT was to evaluate whether extending the duration of labor in nulliparous women with prolonged second stage affects the incidence of cesarean delivery. Second, this RCT did not consider fetal head station as a possible explanation for the link found between second stage duration and cesarean delivery rates. Given our finding that a lower fetal station is associated with a lower likelihood of operative delivery, one may speculate that prolonging the second stage of labor may give women the chance to acquire a lower

FIGURE 2

Survival analysis of women undelivered from the second stage to delivery



Survival analysis of the proportion of women undelivered by the time interval from the onset of the second stage to delivery, stratified by fetal head station in nulliparous (A) and multiparous (B) women. *Black line* denotes below the spine, *red line* denotes at the spinal level, and *blue line* denotes above the spinal level. The log-rank test was used to compare the survival distributions.

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fetal station and therefore a higher rate of vaginal delivery. The obstetrical care consensus by the American College of Obstetricians and Gynecologists recommends that at least 3 hours should be allotted to nulliparous women in the second stage of labor before diagnosing arrest of descent.¹⁹ This guideline was extended by 1 hour in the intervention group by the recent RCT. Interestingly, the 95th centile of the second stage duration in our nulliparous group (the majority of whom received epidural anesthesia) was also longer than 3 hours. Our study period included the years 2011 to 2016. During this period, our policy stated a prolonged second stage of labor was defined as durations of >1 hour for multiparous women without an epidural anesthesia, >2 hours for multiparous women with an epidural anesthesia and nulliparous women without an epidural anesthesia, and >3 hours for nulliparous women with an epidural anesthesia. Unfortunately, we cannot comment on the durations of the pushing times because those are not routinely documented.

In comparison with nulliparas, the second stage duration was overall shorter

in multiparas regardless of the fetal station. This is consistent with previous studies showing that although multiparous women maintain a higher fetal station during labor than nulliparous women, they ultimately progress through the second stage more quickly.²⁰ To further illustrate this point, we stratified multiparas into second delivery and third or lower delivery and again found a significant reduction in the second stage duration in the third or lower delivery group ($P<.001$). This is consistent with previous descent curves reported in grand multiparous women.²¹

Strengths and limitations

A limitation of this study is that we did not document the position of the baby's head. Thus, it remains to be addressed whether an occiput anterior, posterior, or transverse position could have influenced the delivery outcomes. Another limitation is that given our exclusion of women with induced labor and with preterm labor, the associations we found between fetal head station at the time of documenting complete dilation of the cervix and delivery outcomes may not be generalized to these excluded

populations. Another limitation is the subjectivity that is inevitably present with measuring fetal head station, which may increase the standard error. Previous studies have reported that intrapartum sonographic findings can objectively predict the duration of the active second stage of labor and also the likelihood of vaginal delivery.^{22–24} Similarly, a third issue to be addressed is the possible inaccuracy of diagnosing the onset of the second stage. We diagnosed the onset of the second stage once women reached a cervical dilation of 10 cm. The examination intervals during the second stage of labor extremely vary because the intervals are influenced by parity, fetal position, presence or absence of meconium, fetal tracing category, and the parturient's state (pain, stress, fatigue, etc). Given the study design, we could not control for the time interval of assessments during the second stage. Hence, whether the time of diagnosis represented the true onset of the second stage and whether the fetal station remained the same between the time of true onset and the time of documenting complete dilation of the cervix remain questionable. The Obstetric Care

TABLE 3

Association between fetal head station at the second stage onset and mode of delivery—multivariable analysis

Mode of delivery	Fetal head station at the second stage diagnosis	Nulliparous			Multiparous		
		Rate, n (%)	Crude OR (95% CI)	Adjusted OR ^a (95% CI)	Rate, N (%)	Crude OR (95% CI)	Adjusted OR ^a (95% CI)
S>0 (below the spinal level—reference group)	Spontaneous vaginal delivery	9201 (87.5)	1	1	6776 (97.3)	1	1
	Operative vaginal delivery	1216 (11.6)	1	1	167 (2.4)	1	1
	Cesarean delivery	101 (1.0)	1	1	22 (0.3)	1	1
S=0 (at the spinal level)	Spontaneous vaginal delivery	5213 (77.7)	0.50 (0.46–0.54) ^b	0.54 (0.49–0.59) ^b	5286 (95.1)	0.54 (0.45–0.66) ^b	0.55 (0.45–0.68) ^b
	Operative vaginal delivery	1224 (18.2)	1.71 (1.57–1.86) ^b	1.58 (1.44–1.73) ^b	205 (3.7)	1.56 (1.27–1.92) ^b	1.55 (1.24–1.94) ^b
	Cesarean delivery	273 (4.1)	4.37 (3.47–5.51) ^b	4.26 (3.23–5.45) ^b	66 (1.2)	3.79 (2.34–6.15) ^b	3.74 (2.16–6.48) ^b
S<0 (above the spinal level)	Spontaneous vaginal delivery	1095 (72.3)	0.37 (0.33–0.42) ^b	0.40 (0.35–0.46) ^b	2987 (95.6)	0.61 (0.48–0.76) ^b	0.51 (0.40–0.66) ^b
	Operative vaginal delivery	295 (19.5)	1.85 (1.61–2.13) ^b	1.71 (1.48–1.99) ^b	82 (2.7)	1.12 (0.85–1.46) ^b	1.37 (1.02–1.83) ^b
	Cesarean delivery	125 (8.3)	9.27 (7.09–12.13) ^b	8.50 (6.36–11.37) ^b	53 (1.7)	5.55 (3.37–9.13) ^b	6.26 (3.55–11.04) ^b

BMI, body mass index; CI, confidence interval; OR, odds ratio.

^a Values reflect the results of multivariable logistic regression analysis to determine the association between fetal head station at the time of documenting complete dilation of the cervix and mode of delivery. Models are adjusted for maternal age, prepregnancy BMI, gestational age at delivery, epidural anesthesia, and neonatal birthweight; ^b Significant associations.

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Consensus¹⁹ published in 2014 recommended against using a specific absolute maximum length of time spent in the second stage of labor beyond which all women should undergo operative delivery and suggested allowing 2 or 3 hours of pushing in nulliparous and multiparous, respectively, before diagnosing arrest of second stage. Our data cannot truly relate to those criteria because the pushing intervals are not routinely documented according to our departmental protocols. Finally, owing to the retrospective nature of this study we were unable to adjust for important potential confounders such as the timing of rupture of membranes, clinical and/or histologic chorioamnionitis, oxytocin augmentation (onset, duration of administration, and total dosage used), and the presence and absence of caput succedaneum.

Despite these limitations, this study has important strengths. We looked at a large cohort of 34,334 women who

delivered in a single tertiary university-affiliated medical center between 2011 and 2016. Our cohort comprises merely women with a spontaneous onset of labor to delineate the course of the physiological labor and delivery pattern. In addition, the same departmental protocols were applied to all women in our cohort. By controlling for confounding factors and separating the cohort based on parity, we were able to isolate the effect of fetal head station on the second stage of labor and delivery outcomes, including the duration of the second stage and the mode of delivery.

Conclusion

Our study addresses the controversy surrounding the impact of the fetal head station on labor and delivery outcomes by reporting that the fetal head station at the first diagnosis of the second stage is significantly and independently associated with the duration of the second stage and correlated with the risk of

operative delivery ($P<.001$). Therefore, we provide important findings that may allow the assessment of fetal head station to be used as a predictor for the chances of vaginal and operative modes of delivery in nulliparous and multiparous women. ■

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