

Article

The Effect of Labor Position during Second Stage of Labor on Mode of Delivery in Low Risk Women

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A B S T R A C T

Background: Delivery in an upright position aligns the uterine forces with the pelvic cavity and decreases the duration of the second stage of labor. The upright position is also reported to reduce the risk of cesarean deliveries. The present study was planned to compare the mode of delivery in women delivering in supine versus upright (squatting and kneeling) positions. **Material and Methods:** This prospective observational study was conducted in a tertiary care center's Obstetrics and Gynecology department. Women in early stage of labor were counseled about various labor positions. Women who adopted supine, kneeling, and squatting positions in second stage of labor were divided into three groups according to their choice. The women were followed for effect of position in second labor stage on delivery mode. **Results:** A total of 210 women were enrolled in the study. The three groups were comparable in terms of demographic parameters, except that women in the supine group were younger than women assuming upright positions in the second stage of labor. The rate of cesarean section and moderate/severe PPH was increased in women assuming the supine position in the second stage of labor. However, the difference was not statistically significant, $p=0.209$ and 0.223 , respectively. The mean duration of the second stage of labor was significantly increased in women delivering in the supine position, $p=0.001$. **Conclusion:** Upright (kneeling and squatting) position significantly decreases duration of second stage of labor but is not associated with a difference in cesarean delivery rate compared to women in the supine group.

I. INTRODUCTION

Normal labor is spontaneous in onset, initiates at term with the cephalic presentation, and ends with the delivery of a healthy newborn. During the course of labor, normal labor can suddenly take an abnormal course, even in low-risk women, leading to maternal and perinatal severe morbidity and mortality.(1) The number of women delivering in hospitals has increased across the world due to various initiatives to decrease the rate of maternal morbidity and mortality.(2,3) The rise in institutional deliveries and deliveries supervised by skilled birth attendants has played a crucial role in reducing maternal morbidity and mortality.

The rising rate of supervised pregnancies has led to deliveries being conducted in the supine position. Despite the evidence of benefits from delivering women in an upright position, maximum deliveries take place in the supine position.(4,5) Delivery in a supine position has a risk of aortocaval compression. This issue has gained increasing significance as women are now allowed to be in the second stage of labor for a longer duration.

Traditionally, women used to deliver in an upright position, but due to the institutionalization of deliveries, women started delivering in a supine or lithotomy position. The supine position favors health care providers due to the ease of monitoring the fetal heart and the labor progress in this position. Another reason for preferring the supine/lithotomy position was the ease of giving episiotomy and conducting operative vaginal deliveries. These interventions are now reserved for a few specific indications. Also, it is reported that an upright labor position increases pelvic diameters to some extent and better aligns the bearing down forces from the uterus to the pelvis, favoring smooth expulsion of the fetus.(4) The upright position has been reported to reduce the duration of the second stage of labor and the risk of fetal distress, along with a controversial reduction in operative deliveries.(6-8)

With the concern over rising rates of cesarean deliveries, any intervention that can contribute to a reduction in cesareans should be widely practiced. WHO guidelines for Intrapartum Care for a Positive Childbirth Experience recommend delivery in the position of maternal choice but advise against women assuming a supine position during the first stage of labor.(9) Therefore, the Labor Care Guide marks the supine position as an alert parameter.(10) The main disadvantage of the supine position is fetal distress due to a decrease in placental blood flow secondary to the aortocaval compression.(4)

A recent meta-analysis reported a significant reduction in the duration of labor with upright and lateral positions compared to supine positions.(6) Various International Societies recommend lateral labor positions for women with epidural analgesia and upright labor positions for women delivering without epidural analgesia.(9,11-13) Despite these recommendations, most of the deliveries supervised by skilled birth attendants, in and out of healthcare centers, are conducted in the supine position.(4,5)

A review of three Cochrane systematic reviews reported a reduction in the duration of the second stage of labor and cesarean delivery in women delivering in the upright position. However, the quality of evidence was very low to moderate.(14) Any position of the woman more than 45 degrees horizontal qualifies to be called an erect/upright position. However, a pilot study done at our institute comparing kneeling and supine birthing positions did not find any significant reduction in the cesarean rate.(7) The present study was planned to determine the mode of delivery among women adopting various labor positions and to compare the mode of delivery in women delivering in supine versus squatting, kneeling, or upright (squatting and kneeling) positions.

II. METHODS

This prospective observational study was conducted in the Department of Obstetrics & Gynecology of Safdarjung Hospital over eighteen months from August 2022 to February 2024. Before starting the study, ethical clearance was taken from the Institutional Ethical Committee, IEC/VMMC/SJH/Thesis/06/2022/CC-14.

Low-risk primigravidae and multigravidae were recruited in early labor. Women with multifetal pregnancy and noncephalic presentations were excluded from the study. Women who fulfilled the inclusion criteria were recruited after obtaining written informed consent. Women were then shown visual images and provided with information related to various labor positions. The supine, kneeling, and squatting positions in the second stage of labor were explained. They were asked to choose the position they were comfortable with and wished to adopt. Women were instructed to be in the position chosen by them for at least 60% of the time in the second stage of labor. The women were recruited till there were at least 70 women in each group.

The sample size was calculated by taking a rate of cesarean delivery as 26.1% in the supine position and 5.8% in women delivering in alternative positions. Taking these values as a reference, the minimum required sample size with 90% power of study and 5% level of significance was 64 women in each study group. The Sample size of 210 (women per group) was taken to reduce the margin of error.(15)

Group A was comprised of women choosing the Kneeling position during the second stage of labor. In this position, the woman knelt on her knees, leaned forward, and supported herself with her hands holding bars on the side of the labor bed. Group B had women delivering in the Squatting position. In this position, her knees were flexed, and the woman's weight rested mainly on her feet. She was allowed to lean or pull on the handlebars on the side of the bed. The Group C women preferred to deliver in the supine position. They lay flat on their back with their trunks slightly raised up to 45 degrees. The legs in this position were straight or bent, with her feet flat on the bed.

A predesigned data collection format was used to collect the demographic information, detailed history, and examination. Routine labor observations were plotted using the WHO labor care guide as per the existing hospital protocol.

During the second stage of labor, fetal heart monitoring was done for one minute after every uterine contraction using doptone. Delivery was conducted on labor beds, which had support for the back and side handles. During delivery, mediolateral episiotomy was given if the perineum was rigid and threatening to tear, or instrumental delivery was carried out. After delivery of the head, group A and B patients were put in the supine position to complete the delivery of the fetal trunk. All deliveries were conducted by one researcher.

Women in three groups, A, B, and C (supine, squatting, and kneeling), were followed till delivery, and the study outcomes were recorded.

The main study outcome was the mode of delivery (cesarean/vaginal). Other outcome measures included the duration of the second stage of labor, fetal heart decelerations, second-degree perineal tears, postpartum hemorrhage, APGAR score at 5 min, and NICU admission. We also noted patient satisfaction and their recommendations for others regarding the position in the second stage of labor.

Statistical Analysis

Data were recorded in MS Excel spreadsheet program. SPSS 23 (IBM Corp) was used for data analysis. Group comparisons for continuously distributed data were made using independent sample 't' test when comparing two groups. For non-normally distributed data, non-parametric tests were recorded on the Wilcoxon Test. The chi-squared test was used for group comparisons of categorical data. In case the expected frequency in the contingency

tables was found to be <5 for $>20\%$ of the cells, Fisher's Exact test was used. Statistical significance was kept at $p < 0.05$.

III. RESULT

A total of 210 women were enrolled in the study, 70 in each group. The mean age of participants was 26.25 ± 3.76 years, most (88.5%) were 18-30 years, and the majority (62.9%) were illiterate. The mean period of gestation was 38.13 ± 1.58 weeks. Mean gestation of women in groups A, B, and C was 38.14 ± 1.40 , 38.07 ± 1.18 , and 38.19 ± 2.05 , respectively, $p=0.3651$. Women who preferred to deliver in the supine position were younger than women choosing to deliver in the kneeling and squatting position, $p=0.002$. The rest of the demographic parameters were equally distributed in the three groups, $p>0.05$.

Table 1: Distribution of Clinical and Demographic Parameters in Study Groups

Parameters	Position			p value
	Group A (n = 70)	Group B (n = 70)	Group C (n = 70)	
Age				
18-25 Years	32 (45.7%)	13 (18.6%)	37 (52.9%)	<0.001 [†]
26-30 Years	29 (41.4%)	50 (71.4%)	25 (35.7%)	
31-35 Years	8 (11.4%)	7 (10.0%)	7 (10.0%)	
>35 Years	1 (1.4%)	0 (0.0%)	1 (1.4%)	
Mean age (years)	38.14 ± 1.40	38.07 ± 1.18	38.19 ± 2.05,	0.3651 [*]
Education				
Illiterate	43 (61.4%)	51 (72.9%)	38 (54.3%)	0.240 [†]
Primary	23 (32.9%)	14 (20.0%)	22 (31.4%)	
Secondary	3 (4.3%)	3 (4.3%)	7 (10.0%)	
Graduate	1 (1.4%)	2 (2.9%)	3 (4.3%)	
Booking Status				
Booked	48 (68.6%)	49 (70.0%)	51 (72.9%)	0.852 [*]
Parity				
Primigravida	33 (47.1%)	35 (50.0%)	35 (50.0%)	0.927 [*]
Multigravida	37 (52.9%)	35 (50.0%)	35 (50.0%)	
Mean POG (Weeks)	38.14 ± 1.40	38.07 ± 1.18	38.19 ± 2.05	0.365 [*]

Statistical test * Chi-Squared test, * Kruskal Wallis test, † Fishers Exact test

Out of 210 participants, 175 delivered vaginally, 17 had assisted vaginal delivery, and 18 had cesarean section. The overall cesarean rate in the second stage of labor amongst 210 patients was 8.6%. The rate of cesarean section and moderate/severe PPH was increased in women assuming the supine position in the second stage of labor, but the difference was not statistically significant, $p=0.209$ and 0.223 , respectively. The mean duration of the second stage of labor was significantly increased in women delivering in the supine position, $p=0.001$. A greater number of women in the supine group had late deceleration, $p=0.001$, but

there was no statistically significant difference in the NICU admissions, $p=1.000$. There was a significant reduction in second-degree perineal tears in women delivering in the supine position, $p=0.010$.

A significant number of women in group A were likely to recommend the labor position to others, but satisfaction with the position was reported to be significantly higher for women choosing to be in the supine position during the second stage of labor.

Table 2: Distribution of Outcome Measures in Study Groups

Outcome Measures	Group A (n = 70)	Group B (n = 70)	Group C (n = 70)	P value
Cesarean delivery	2.9%	8.6%	14.3%	0.209*
Mean duration of Second stage	12.46 min	18.43 min	26.13 min	0.001*
Late decelerations	2.9%	11.4%	27.1%	0.001 [†]
Second Degree Perineal tears	18.6%	15.7%	4.3%	0.010 [†]
Moderate/Severe PPH	5.7%	8.5%	14.3%	0.223 [†]
NICU admission	1.4%	2.9%	1.4%	1.000 [†]
Recommend to others	78.9%	69.6%	74.3%	$P<0.005^*$
Highly satisfied	77.5%	66.7%	82.9%	$P<0.005^{\dagger}$

Statistical test * Chi-Squared test, * Kruskal Wallis test, [†] Fishers Exact test

The statistical significance for the outcome measures was similar when supine position in the second stage of labor was compared with the upright position (kneeling and squatting combined).

Table 3: Outcome Measures in Women delivering in Upright and Supine Positions

Outcome Measures	Upright (Squatting+kneeling) (n=140)	Supine (n=70)	P value
Cesarean delivery	5.7%	14.3%	0.110*
Mean duration of Second stage in minutes	15.44	26.13	0.001*
Late decelerations	7.1%	27.1%	0.001 [†]
Second Degree Perineal tears	17.1%	4.3%	0.012 [†]
Moderate +Severe PPH	7.1%	14.3%	0.118 [†]

NICU admission (admitted %)	2.9%	1.4%	1.000 [†]
Recommendation to others (Yes)	74.3%	74.3%	1.000*
Patient satisfaction (Highly satisfied)	72.9%	82.9%	0.033 [†]

Statistical test * Chi-Squared test, * Wilcoxon-Mann-Whitney U test, [†] Fishers Exact test

IV. DISCUSSION

The alarming rise of cesarean rates worldwide beyond the acceptable rate of 15% has motivated the WHO to recommend various nonmedical interventions to decrease the cesarean rate.(16) One such intervention is increasing awareness about various positions that can be adopted during the second stage of labor. The new WHO Labor care guide, FIGO, and ACOG have advocated that patients should be counseled and made aware of the different labor positions (erect/supine), which can be adopted in the second stage of labor to increase positive childbirth experience and normal vaginal delivery rates.(10,12,13)

Erect positions, as compared to supine positions, are associated with faster descent of the fetal head aided by gravity and improved alignment of fetal passage, more robust and more efficient contractions, and increased outlet diameters.(4-8) There is also a lower incidence of non-reassuring fetal heart rate due to decreased aortocaval compression and lesser fall in cardiac output in an erect position compared to the supine position.(4) In erect positions like kneeling and squatting, the coccyx is free to move, and the force of the fetal head rotates the coccyx outwards, thereby increasing the diameter of the pelvic outlet.(4) All these factors increase the possibility of vaginal delivery. People in India are used to adopting squatting positions, especially during defecation. Therefore, it is an easy position for them to adopt in labor.

Supine positions are associated with vena cava compression, decreased cardiac output, and increased fetal heart abnormalities. In these positions, coccyx movement is restricted and occurs at a rotation of 3.6 degrees of the coccyx.(14)

In the present study, we recruited 210 women who were counseled about the different labor positions and, depending on their choice, were allocated into the following groups: upright (kneeling, squatting) or supine. The women spent around 60% of the duration of the second stage of labor in their desired positions.

In our study, all the participants in three positions had comparable demographic profiles with no statistically significant difference in any of the demographic parameters except age. This is due to the younger women choosing to deliver in the supine position. We observed a decrease in the cesarean rates in the kneeling and squatting positions compared to the supine position adopted in the second stage of labor. However, the difference was not statistically significant, 2.9%, 8.6%, and 14.3%, respectively, $p=0.209$. Similar to our observations, two Cochrane reviews published in 2017 and 2018, including 16 trials in women delivering without epidural analgesia and 8 trials with epidural analgesia, respectively, also found no difference in the cesarean deliveries in women assuming upright position or supine positions in the second stage of labor.(17,18) Another metaanalysis comparing upright and recumbent positions in the second stage of labor failed to demonstrate a significant difference in the cesarean delivery in women without epidural analgesia.(19) However, a recent Cochrane review that reviewed three Cochrane database reviews and an observational study found a significant reduction in the cesarean delivery rate in an upright position as compared to the supine position with these positions assumed from the first stage of labor.(15,17,18,20) Therefore, assuming the upright position from the first stage of labor seems to be more

beneficial than resorting to upright position only during the second stage of labor. In our study, the Labor Care Guide was followed for labor monitoring, and women during the first stage of labor were encouraged to be ambulatory, sitting, or standing rather than lying in bed. However, still, there was no difference in the cesarean section rate. The difference in the results, despite assuming an upright position during the first stage of labor, could be due to the small sample size.

In contrast to the above reports, one metaanalysis reported an increased risk of cesarean delivery in squatting position as compared to supine position.(21) In the sensitivity analysis of metaanalysis, Walker et al. also found an increased risk of cesarean deliveries in an upright position as compared to the recumbent position, but the recumbent position in their studies was lateral positions as supine positions were not preferred due to the risk of aortocaval compression. (18) These systematic reviews observing the increased risk of cesarean delivery in recumbent positions included studies with women receiving epidural analgesia for pain relief, but many women delivering in low and middle-income countries do not have access to epidural analgesia. Also, in labor, women were in lateral positions and not on their backs.

Despite these conflicting reports, various international guidelines advise avoiding a supine position during labor.(10-13) It is difficult for pregnant women to be in any one position throughout labor. Women can change to any of the convenient positions during labor.(13) If a woman cannot be in an upright position due to epidural analgesia or comorbidities, she can take a lateral position during labor.(11)

In our study, there was a statistically significant decrease in the duration of the second stage of labor in an upright position compared to a supine position. The duration of the second stage was least in kneeling position. This reduction in the duration can be explained by the effect of gravity in an erect position, which directs the fetal head into the pelvic inlet in an anterior position thus stimulating dilatation of cervix also as direction of forces from uterine contractions acts in concordance with the direction of gravitational force promoting efficient uterine contractions and shortening the duration of labor.(4) Most of the authors reported similar findings of decrease in the duration of second stage of labor in upright position as compared to supine position.(14,15,17) The systematic review and metaanalysis by Dokmak et al that reported increased risk of cesarean delivery in squatting position as compared to supine position, observed no difference in the duration of the second stage of labor.(21)

We found that upright positions were associated with a significantly greater number of second-degree perineal tears than supine positions. Among upright positions, second degree perineal tears were more in kneeling position as compared to squatting position. Many RCTs and metaanalyses have reported an increased risk of perineal tears with upright position.(19,22,23) This could be due to the faster descent of the head in an erect position, and we experienced more difficulty in controlling head descent between contractions and providing perineal support in an erect position. In a retrospective study of women with high prevalence of upright labor position, no difference in the occurrence of perineal tears was reported with labor position, $p=0.285$.(24)

Compared to supine position, erect position causes less aortocaval compression, thus causing fewer fetal heart decelerations. Our study found a statistically significant reduction in fetal heart decelerations in upright position when compared with supine position. Few authors reported a similar decrease in fetal distress with upright positions.(15,17) However, Walker et al. found no difference in fetal heart abnormalities in erect positions.(18)

There was no statistically significant difference in NICU admission in erect positions in our study. Only 3 out of 210 participants in the study had their babies admitted to NICU. We enrolled only low-risk pregnancies, and timely cesarean sections were done when fetal heart

abnormalities were identified. Previous studies have also found no statistically significant difference in the neonatal outcomes with labor positions.(8,17,18)

In our study, participant satisfaction was higher with supine labor positions. The Cochrane review analyzing the BUMPES trial reported better patient satisfaction in recumbent than upright positions.(18,22) This could be because patients are more comfortable in this position, which requires less physical effort by the patient. Also, women were more likely to recommend supine and kneeling positions for labor than squatting position.

Upright (kneeling and squatting) positions are not associated with a reduction in cesarean deliveries, but they significantly reduce the duration of the second stage of labor and fetal heart decelerations. Women are more satisfied in the supine position during the second stage of labor than in the kneeling or squatting position. Upright position increases the risk of second degree perineal tears. Position in second stage of labor does not affect rate of postpartum hemorrhage and NICU admissions.

V. CONCLUSION

The main strength of our study was that there were no dropouts. Recruited women could be in the position they choose for more than 60% of the second stage of labor. The small sample size was the main limitation of the study.

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