International Journal of Clinical Obstetrics and Gynaecology

ISSN (P): 2522-6614
ISSN (E): 2522-6622
**Indexing:** Embase
**Impact Factor (RJIF):** 6.71

www.gynaecologyjournal.com
2026; 10(1): 125-131
Received: 17-11-2025
Accepted: 21-12-2025

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# Comparative evaluation of labour and delivery positions and their impact on maternal and newborn outcomes: A hospital-based study

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**DOI:** https://www.doi.org/10.33545/gynae.2026.v10.i1b.1862

**Abstract**
**Background:** Birthing position during labour is a modifiable intrapartum factor that may influence maternal and neonatal outcomes. Despite recommendations supporting upright birthing positions, supine delivery continues to be widely practiced in institutional settings in India. Comparative evidence on outcome differences across birthing positions remains limited. Hence, this study aimed
to evaluate and compare maternal and newborn outcomes associated with supine and upright birthing positions in low-risk multiparous women.
**Methods:** This prospective observational study was conducted over 18 months at a tertiary care teaching hospital in Loni, Maharashtra. A total of 300 low-risk multiparous women with term, singleton, cephalic pregnancies undergoing vaginal delivery were included. Participants were grouped based on birthing position during the second stage of labour into supine (N=150) and upright (N=150) positions, the latter comprising sitting, squatting, kneeling, and standing. Maternal outcomes included duration of labour, episiotomy, perineal trauma, postpartum hemorrhage, instrumental delivery, and maternal satisfaction. Neonatal outcomes included Apgar scores, birth weight, NICU admission, morbidity, and hospital stay.
**Results:** Baseline sociodemographic and obstetric characteristics were comparable between groups ($p>0.05$). Upright birthing positions were associated with a significantly shorter mean duration of the second stage of labour (38.6±9.4 vs 52.1±11.8 minutes), lower episiotomy rates (16.0% vs 30.7%), reduced perineal trauma (18.0% vs 34.0%), and lower postpartum hemorrhage incidence (1.0% vs 5.0%) compared to the supine position ($p<0.05$). Instrumental deliveries were less frequent in upright positions (1.0% vs 5%). Maternal satisfaction scores were significantly higher in upright positions, particularly kneeling and standing. Neonatal outcomes were also more favorable in the upright group, with fewer low Apgar scores at one minute (5.3% vs 12.0%), reduced NICU admissions (5.3% vs 12.0%), higher mean birth weight, and shorter hospital stay ($p<0.05$).
**Conclusion:** Upright birthing positions, especially kneeling and standing, are associated with significantly improved maternal and neonatal outcomes compared to the supine position and should be encouraged in low-risk deliveries.

**Keywords:** Birthing position, upright delivery, maternal outcomes, neonatal outcomes, intrapartum care

## Introduction
Childbirth is a dynamic physiological process in which the position adopted by a woman during labour can significantly influence maternal and neonatal outcomes. With growing emphasis on respectful maternity care and physiological childbirth, increasing attention has been directed toward the role of birthing positions [1]. The World Health Organization (WHO) recommends that women be supported to deliver in the position they find most comfortable, rather than being confined to a routine or provider-directed posture [2]. Despite this guidance, institutional childbirth practices in many regions, including India, continue to be dominated by the supine position.

The supine position, a traditional horizontal posture, has been widely used in clinical settings due to its convenience for healthcare providers. It allows ease of observation, continuous electronic fetal monitoring, and timely obstetric interventions [3, 4]. This position facilitates vaginal examinations, monitoring of labour progress, perineal support during the second stage of labour, and operative vaginal deliveries when required [4]. However, evidence suggests that routine use of the supine position may be associated with adverse outcomes such as prolonged labour, increased maternal discomfort, higher rates of perineal trauma, and compromised

neonatal condition reflected by lower Apgar scores [4, 5]. Studies have reported high rates of perineal trauma among women delivering in the supine position, exceeding 95% in Italy and ranging from 19% to 80.4% in Sub-Saharan Africa [6-8].

In contrast, upright birthing positions including sitting, kneeling, squatting, standing, and the hand-and-knees position are considered more physiologically compatible with labour. By utilizing gravity, these positions facilitate fetal descent, enhance uterine contractions, and may shorten the duration of labour [9]. Upright positions have been associated with reduced obstetric interventions, improved fetal oxygenation, fewer abnormal fetal heart rate patterns, and better early neonatal outcomes, including satisfactory first-minute Apgar scores [5, 10]. Nevertheless, certain upright postures, particularly squatting, may increase the risk of spontaneous perineal tears due to limited manual perineal support and sustained pelvic floor pressure [11].

Both the WHO and the Ministry of Health and Family Welfare (MOHFW), India, recommend allowing women to choose their birthing position to improve maternal satisfaction and psychological well-being. However, supine delivery remains predominant in many Indian hospitals. In Maharashtra, where institutional deliveries are widespread, evidence comparing maternal and neonatal outcomes across birthing positions remains limited. Therefore, this study was undertaken at a tertiary care teaching hospital in Loni, Maharashtra to compare the effects of upright and supine birthing positions on maternal and newborn outcomes.

## Material and Methods

After approval from the Institutional Ethics Committee (IEC) of the participating institution, this prospective observational study was conducted in the Department of Obstetrics and Gynaecology at Pravara institute of Medical Sciences [DU], Loni, Maharashtra, India, over a period of 18 months. The study included 300 low-risk multiparous women admitted for vaginal delivery. Written informed consent was obtained from all participants at the time of admission to the labour ward.

The required *sample size* was calculated based on previously reported differences in maternal and neonatal outcomes between supine and upright birthing positions, using standard formulae for comparison of proportions with an allowable error and confidence level of 95%. The minimum required sample size was estimated to be 300. Accordingly, 300 eligible participants were recruited during the study period.

Participants were allocated into two groups based on the birthing position adopted during the second stage of labour. The supine position group (N=150) included women who delivered in dorsal, semi-recumbent, lithotomy, or side-lying positions. The upright position group (N=150) included women who delivered in sitting, squatting, kneeling, or standing positions.

### Eligibility Criteria

**Inclusion criteria:** Women with low-risk pregnancies; multiparous; gestational age between 37 and 42 weeks; singleton pregnancy; cephalic presentation; and planned vaginal delivery.

**Exclusion criteria:** Primigravida; high-risk pregnancies (including preeclampsia, eclampsia, gestational diabetes requiring insulin, placenta previa, placental abruption); multiple gestations; malpresentation; preterm labour; intrauterine fetal demise; previous cesarean section; medical or obstetric complications necessitating operative delivery; and refusal or withdrawal of consent.

### Methodology

At enrolment, baseline maternal and obstetric data including maternal age, parity, gestational age, booking status, antenatal care history, body mass index, haemoglobin levels, and presence of minor antenatal complications were recorded using a structured proforma. A detailed general and obstetric examination was performed, and antenatal records were reviewed.

Participants were allowed to assume either a supine or upright birthing position during the second stage of labour based on maternal preference and clinical feasibility. Supine positions included dorsal, semi-recumbent, lithotomy, and side-lying positions, while upright positions included sitting, squatting, kneeling, and standing. Labour progress was monitored using a partograph, and standard intrapartum care protocols were followed for all participants.

### Outcome Assessment

Maternal outcomes assessed included duration of labour (second and third stages), mode of delivery (spontaneous vaginal or instrumental), estimated blood loss, perineal status, and maternal comfort and satisfaction. Maternal satisfaction was evaluated in the immediate postnatal period using a 5-point Likert scale.

Neonatal outcomes included birth weight, Apgar scores at 1 and 5 minutes, and requirement for neonatal intensive care unit (NICU) admission. Blood loss was estimated using combined volumetric and gravimetric methods, with postpartum hemorrhage defined as blood loss greater than 500 mL following vaginal delivery.

### Statistical Analysis

Data were entered into Microsoft Excel and analysed using SPSS version 25. Continuous variables were expressed as mean with standard deviation, while categorical variables were presented as frequencies and percentages. Group comparisons were performed using the independent t test or Mann–Whitney U test for continuous variables and Chi-square or Fisher exact test for categorical variables. A p value less than 0.05 was considered statistically significant.

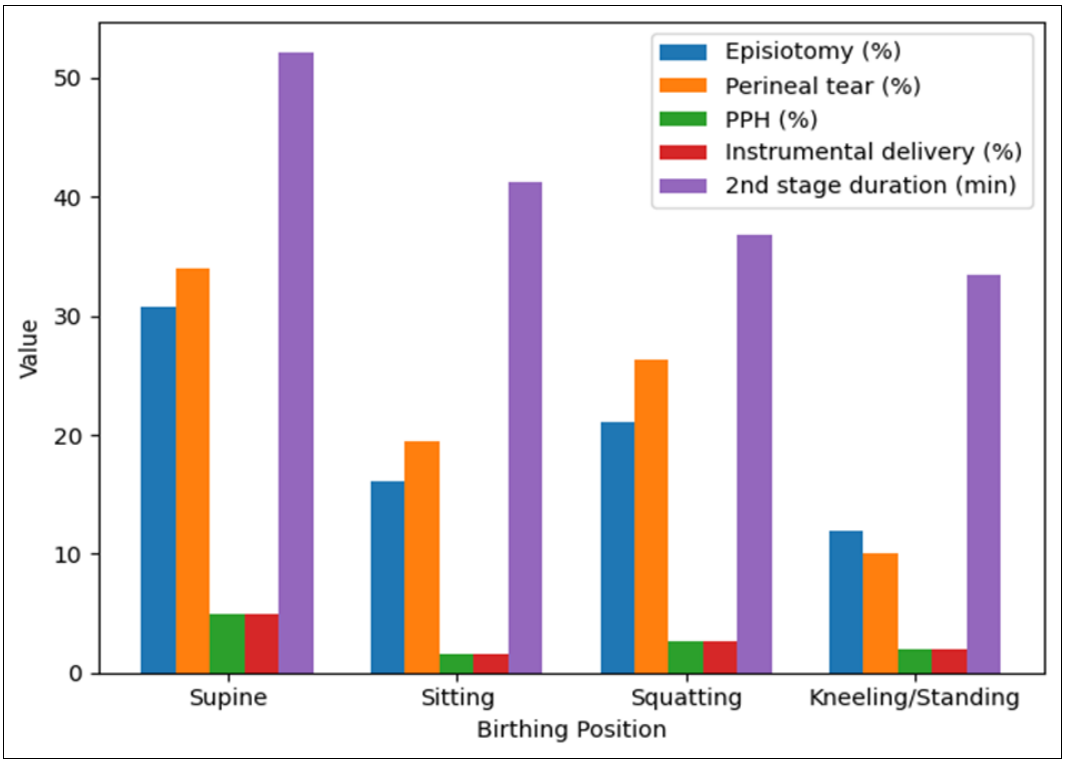
## Results

The distribution of sociodemographic and obstetric variables was comparable between women delivering in the supine and upright positions, with no statistically significant differences observed across groups ($p>0.05$ for all variables). The majority of participants belonged to the 21–25 years age group (37.3%), followed by 26–30 years (31.3%), with a similar age distribution between the supine and upright groups (P=0.58). Educational status was also comparable between the two groups, with most women having primary education (54.7%) and approximately one-third attaining secondary education or above (P=0.61). Illiteracy rates were low and evenly distributed. Most participants were unemployed or homemakers (76.0%), and the proportion of employed women did not differ significantly between the groups (P=0.29). Nearly all women in both groups were married (97.0%), with no significant difference in marital status (P=0.75). Parity distribution was similar, with 67.3% having parity ≤2 and 32.7% having parity ≥3, showing no statistically significant difference between the supine and upright groups (P=0.46). Overall, the absence of statistically significant differences in baseline sociodemographic and obstetric characteristics indicates that the two groups were well matched at baseline, allowing meaningful comparison of maternal and neonatal outcomes between supine and upright birthing positions [Table 1].

**Table 1:** Sociodemographic characteristics of the participants (N=300)

| Variable | Supine position (N=150) | Upright position (N=150) | Total (N=300) |
|---|---|---|---|
| | No. (%) | No. (%) | No. (%) |
| **Age group (years)** | | | |
| 18–20 | 22 (14.7) | 18 (12.0) | 40 (13.3) |
| 21–25 | 58 (38.7) | 54 (36.0) | 112 (37.3) |
| 26–30 | 44 (29.3) | 50 (33.3) | 94 (31.3) |
| >30 | 26 (17.3) | 28 (18.7) | 54 (18.0) |
| **Educational status** | | | |
| Illiterate | 12 (8.0) | 16 (10.7) | 28 (9.3) |
| Primary education | 86 (57.3) | 78 (52.0) | 164 (54.7) |
| Secondary and above | 52 (34.7) | 56 (37.3) | 108 (36.0) |
| **Occupation status** | | | |
| Employed | 32 (21.3) | 40 (26.7) | 72 (24.0) |
| Unemployed / Homemaker | 118 (78.7) | 110 (73.3) | 228 (76.0) |
| **Marital status** | | | |
| Married | 146 (97.3) | 145 (96.7) | 291 (97.0) |
| Unmarried | 4 (2.7) | 5 (3.3) | 9 (3.0) |
| **Parity** | | | |
| ≤2 | 98 (65.3) | 104 (69.3) | 202 (67.3) |
| ≥3 | 52 (34.7) | 46 (30.7) | 98 (32.7) |

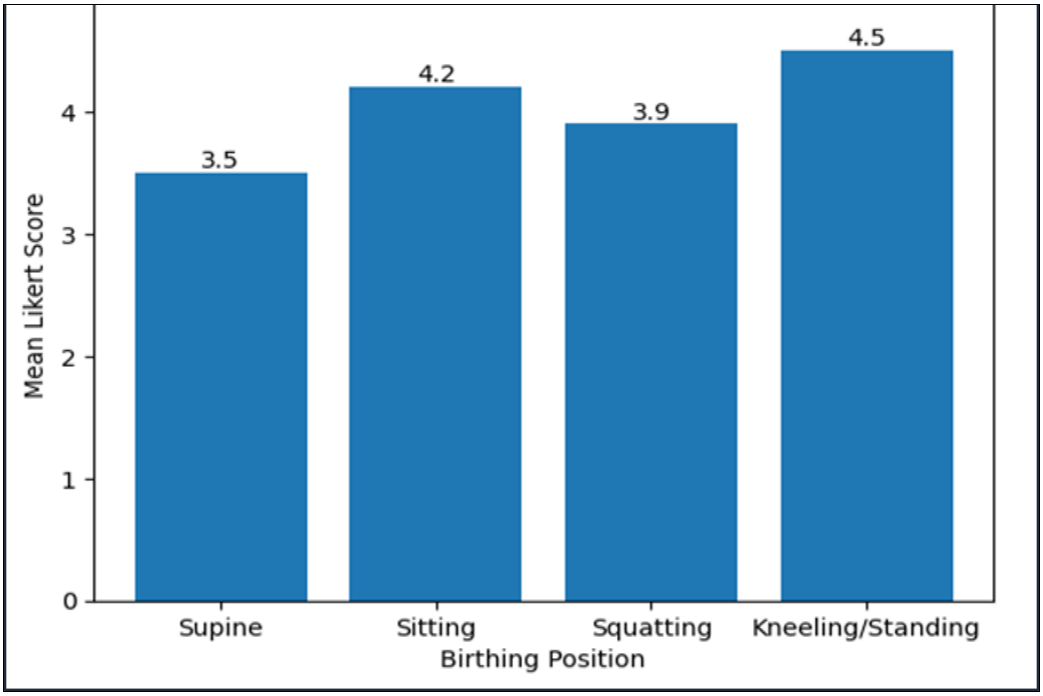
Maternal outcomes varied across different birthing positions, with the supine/lithotomy position consistently associated with less favorable outcomes compared to upright positions. The episiotomy rate was highest in the supine position (30.7%) and was notably lower in all upright positions, particularly in the kneeling/standing position (12.0%). Similarly, perineal tears (1st -2nd degree) were most frequent in the supine group (34.0%) and lowest among women delivering in kneeling or standing positions (10.0%). Cervical and paraurethral tears were observed only in the supine group, while no such injuries were reported in any of the upright positions. The incidence of postpartum hemorrhage was highest in the supine position (5.0%) and progressively decreased across upright positions, with 1cases reported in the kneeling/standing group. The duration of labour was shorter in upright positions, with a stepwise reduction in both the second and third stages from sitting to squatting and kneeling/standing. The shortest mean duration of the second stage was observed in the kneeling/standing position (33.5±7.4 minutes), compared to 52.1±11.8 minutes in the supine position. The need for instrumental delivery was highest in the supine group (5%) and lowest in the kneeling/standing group (1.0%). No woman delivering in an upright position required conversion to the supine position. Maternal satisfaction, assessed using a 5-point Likert scale, was lowest in the supine group (mean score 3.5) and highest among women delivering in kneeling or standing positions (mean score 4.5). Overall, upright birthing positions, particularly kneeling and standing, were associated with shorter labour duration, fewer obstetric interventions, reduced maternal trauma, and higher maternal satisfaction compared to the supine/lithotomy position. [Table 2, Graphs 1 and 2].




**Graph 1:** Comparison of episiotomy, perineal trauma, postpartum hemorrhage, and labour duration across birthing positions

**Table 2:** Objective maternal outcomes according to birthing position (N=300)

| Maternal outcome | Supine / Lithotomy (N=150) | Sitting (N=62) | Squatting (N=38) | Kneeling / Standing (N=50) | Total |
|---|---|---|---|---|---|
| Episiotomy rate | 46 (30.7%) | 10 (16.1%) | 8 (21.1%) | 6 (12.0%) | 24 (16.0%) |
| Perineal tear (1st–2nd degree) | 51 (34.0%) | 12 (19.4%) | 10 (26.3%) | 5 (10.0%) | 27 (18.0%) |
| Cervical tear | 3 (2.0%) | 0 | 0 | 0 | 0 (0%) |
| Paraurethral tear | 1 (0.7%) | 0 | 0 | 0 | 0 (0%) |
| Postpartum hemorrhage | 8 (5.0%) | 1 (1.6%) | 1 (2.6%) | 1 (2.0%) | 3 (1.0%) |
| Duration of second stage (min), mean ± SD | 52.1 ± 11.8 | 41.2 ± 9.6 | 36.8 ± 8.9 | 33.5 ± 7.4 | 38.6 ± 9.4 |
| Duration of third stage (min), mean ± SD | 11.8 ± 3.2 | 8.2 ± 2.4 | 7.6 ± 2.1 | 7.1 ± 1.9 | 7.4 ± 2.1 |
| Instrumental delivery | 8 (5.0%) | 1 (1.6%) | 1 (2.6%) | 1 (2.0%) | 3 (1.0%) |
| Need to shift to supine | — | 0 | 0 | 0 | 0 |
| Birthing experience (Likert score), mean | 3.5 | 4.2 | 3.9 | 4.5 | 4.3 |

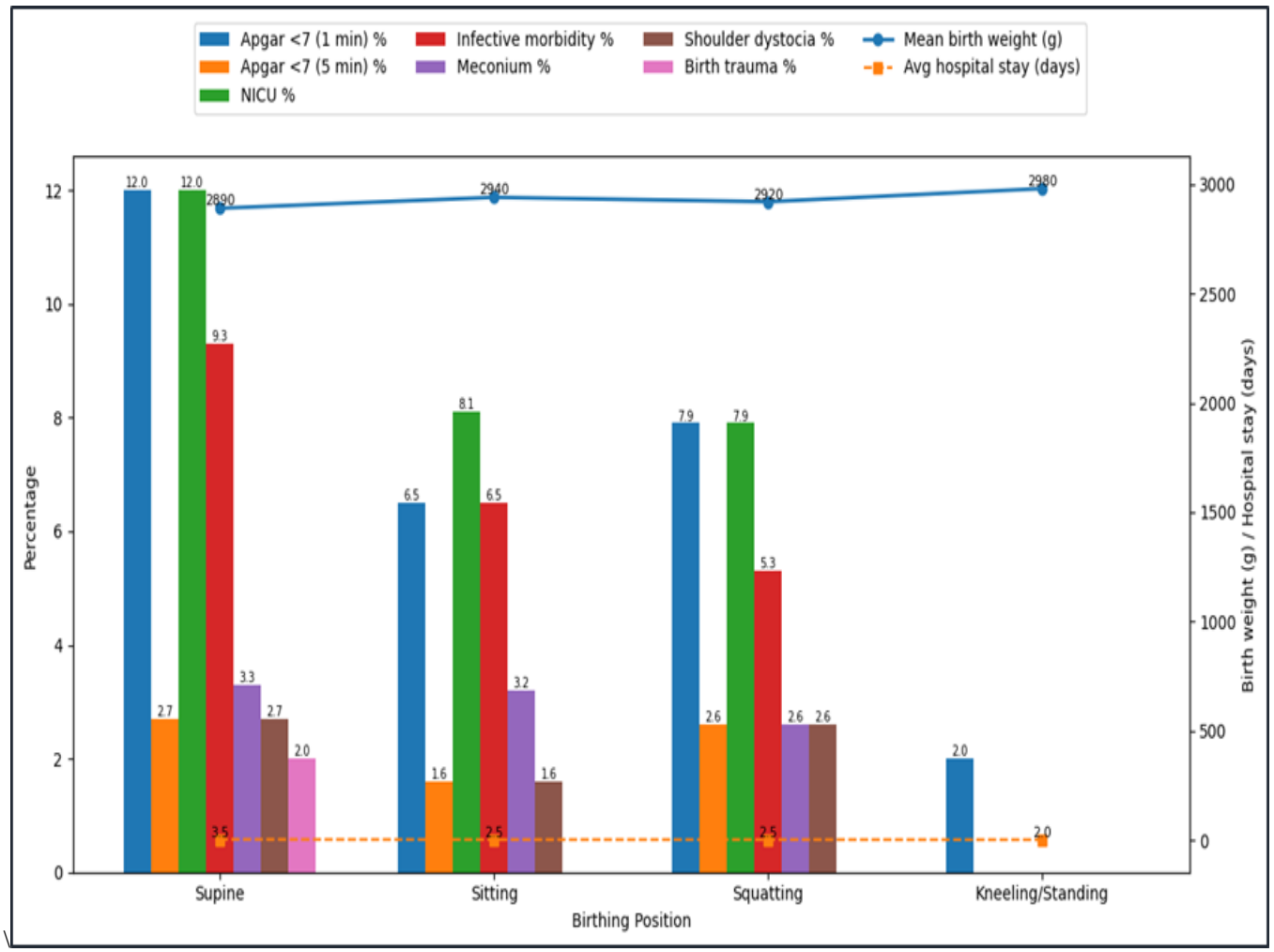



**Graph 2:** Maternal Birthing Experience (Likert Score) Across Different Birthing Positions

Perinatal outcomes were significantly better among neonates delivered in upright birthing positions compared to the supine/lithotomy position. The incidence of low Apgar score at 1 minute was highest in the supine group (12.0%) and progressively lower across upright positions, with the lowest rate observed in the kneeling/standing group (2.0%; P=0.03). Apgar scores at 5 minutes improved in all groups, with no statistically significant difference (P=0.62). NICU admissions were more frequent following supine delivery (12.0%) compared to upright positions (8.1% in sitting, 7.9% in squatting, and 0% in kneeling/standing; P=0.02). Birth trauma occurred only in the supine group (2.0%) and was absent in all upright positions (P=0.04). The rates of infective morbidity were higher in the supine group (9.3%) compared to upright positions (6.5% sitting, 5.3% squatting, and 0% kneeling/standing; P=0.03). Shoulder dystocia was uncommon overall but occurred more frequently in the supine position (2.7%) compared to upright positions (P=0.04). Fresh stillbirth was rare and observed only in the supine group (0.7%). Mean birth weight was higher among neonates delivered in upright positions (2950±360 g in kneeling/standing vs 2890±340 g in supine; P=0.04).

**Table 3:** Perinatal outcomes according to individual birthing positions

| Perinatal outcome | Supine position (N=150) | Upright position (N=150) | | | |
|---|---|---|---|---|---|
| | Supine / Lithotomy (N=150) | Sitting (N=62) | Squatting (N=38) | Kneeling / Standing (N=50) | Total |
| Apgar <7 at 1 min | 18 (12.0%) | 4 (6.5%) | 3 (7.9%) | 1 (2.0%) | 8 (5.3%) |
| Apgar <7 at 5 min | 4 (2.7%) | 1 (1.6%) | 1 (2.6%) | 0 | 2 (1.3%) |
| Meconium aspiration | 5 (3.3%) | 2 (3.2%) | 1 (2.6%) | 0 | 2 (1.3%) |
| Birth trauma | 3 (2.0%) | 0 | 0 | 0 | 0 (0%) |
| NICU admission | 18 (12.0%) | 5 (8.1%) | 3 (7.9%) | 0 | 8 (5.3%) |
| Infective morbidity | 14 (9.3%) | 4 (6.5%) | 2 (5.3%) | 0 | 6 (4.0%) |
| Shoulder dystocia | 4 (2.7%) | 1 (1.6%) | 1 (2.6%) | 0 | 1 (0.7%) |
| Fresh stillbirth | 1 (0.7%) | 0 | 0 | 0 | 0 (0%) |
| Mean birth weight (g), mean ± SD | 2890 ± 340 | 2940 ± 360 | 2920 ± 350 | 2980 ± 370 | 2950 ± 360 |
| Early initiation of breastfeeding | 100% | 100% | 100% | 100% | 150 (100%) |
| Average hospital stay | 3–4 days | 2–3 days | 2–3 days | 2 days | 2–3 days |




**Graph 2:** Composite graph showing comparison of neonatal outcomes across supine and upright birthing positions

Early initiation of breastfeeding was universal across all groups. The average hospital stay was significantly longer following supine delivery (3–4 days) compared to upright positions (2–3 days; P=0.01). Overall, upright birthing positions, particularly kneeling and standing, were associated with significantly improved early neonatal outcomes and reduced morbidity compared with the supine/lithotomy position, Table 3, Graph 3.

## Discussion

The present hospital-based study demonstrates that birthing position during the second stage of labour has a substantial influence on both maternal and neonatal outcomes. Women delivering in upright positions, particularly kneeling and standing, experienced shorter labour duration, reduced obstetric interventions, lower rates of perineal trauma, and improved neonatal outcomes compared with those delivering in the supine or lithotomy position.

One of the most consistent findings in this study was the significant reduction in the duration of the second stage of labour among women adopting upright positions. The mean duration progressively decreased from the supine position to sitting, squatting, and kneeling or standing. This observation is in agreement with the updated Cochrane systematic review by Gupta *et al*., which reported that upright positions without epidural analgesia shorten the second stage of labour and reduce the need for instrumental delivery [12]. Similar findings were reported in a large population-based study by Zang Y *et al*., which demonstrated significantly shorter second-stage durations in upright positions compared with supine positions, attributed to gravitational assistance and improved pelvic mechanics [13].

Maternal trauma outcomes in the present study further support the physiological advantage of upright birthing. Episiotomy rates, perineal tears, cervical tears, and paraurethral injuries were all highest in the supine group and lowest in kneeling or standing positions. These results are concordant with the findings of Walker *et al*., who reported a higher risk of perineal trauma associated with supine positioning during the second stage of labour [14]. A recent meta-analysis by Deliktas and Kukulu also concluded that upright positions are associated with lower episiotomy rates and reduced perineal injury, although squatting may slightly increase spontaneous minor tears due to limited perineal control [15]. This aligns with our observation of intermediate tear rates in the squatting group compared with kneeling or standing positions.

Postpartum hemorrhage and instrumental delivery rates were significantly lower among women delivering in upright positions. The absence of postpartum hemorrhage in the kneeling or standing group highlights the potential role of improved uterine contractility and efficient placental separation in these positions. Familiari A *et al*. similarly reported reduced obstetric intervention rates and favorable neonatal outcomes associated with non-supine labour positions in their prospective cohort study [16].

Neonatal outcomes in this study also favored upright birthing positions. The incidence of low Apgar scores at one minute, NICU admissions, infective morbidity, shoulder dystocia, and

birth trauma was significantly higher following supine delivery. These findings are consistent with both international and Indian data. Jain S *et al*., in an Indian observational study, reported better Apgar scores, reduced NICU admissions, and shorter hospital stay among neonates delivered in upright positions [3]. Improved fetal oxygenation and reduced aortocaval compression in upright postures likely explain these benefits.

Maternal satisfaction scores were highest among women delivering in kneeling or standing positions. This aligns with the growing body of evidence emphasizing respectful maternity care and maternal autonomy. Bohren *et al*. demonstrated that allowing women to choose their birthing position and providing continuous support significantly improves childbirth satisfaction and overall outcomes [17, 18].

This single-center observational study may have limited generalizability, and its design does not permit causal inference. Birthing positions were determined by maternal preference and clinical feasibility rather than randomization. Variations in intrapartum management and provider practices may also have influenced maternal and neonatal outcomes. Nevertheless, the findings support existing national and global evidence that upright birthing positions offer meaningful maternal and neonatal benefits and may improve childbirth outcomes when implemented appropriately in tertiary care settings in India.

## Conclusion

This hospital-based study demonstrates that birthing position has a meaningful influence on both maternal and neonatal outcomes. Upright birthing positions were associated with shorter duration of labour, lower rates of episiotomy, perineal trauma, postpartum hemorrhage, and instrumental delivery, along with higher maternal satisfaction when compared to the supine/lithotomy position. Neonatal outcomes were also more favorable with upright positions, showing reduced incidence of low Apgar scores, NICU admissions, and infective morbidity. These findings support current recommendations advocating maternal choice of birthing position and highlight the need to encourage upright positions in routine obstetric practice to promote safer and more satisfying childbirth outcomes.

## Conflict of Interest

Not available

## Financial Support

Not available

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**How to Cite This Article**
Saxena M, Gavhane S, Bangal V. Comparative evaluation of labour and delivery positions and their impact on maternal and newborn outcomes: A hospital-based study. International Journal of Clinical Obstetrics and Gynaecology 2026; 10(1): 125-131.