

Randomised trial comparing the upright and supine positions for the second stage of labour

*P. R. de Jong Senior Specialist, †R. B. Johanson Senior Lecturer, **P. Baxen Chief Professional Nurse, **V. D. Adrians Senior Professional Nurse, *S. van der Westhuisen Lecturer, ††P. W. Jones Professor (Statistics)

*Department of Obstetrics and Gynaecology, University of Cape Town, and **St Monica's Nursing Home, Cape Town, South Africa; Keele University Academic Departments of †Obstetrics and Gynaecology and ††Mathematics, City General, Stoke on Trent, Staffordshire

Objective To assess the maternal and neonatal effects of upright compared with recumbent positions during delivery, in terms of defined outcome variables.

Design A randomised controlled trial.

Setting St Monica's Nursing Home, a midwife based maternity unit in Cape Town, South Africa.

Participants Five hundred and seventeen women of low obstetrical risk assigned to deliver at the nursing home.

Results The trial showed that women who adopted the upright posture for delivery experienced less pain, perineal trauma and fewer episiotomies than those who delivered in the supine position.

Conclusion The data suggest that in women of low obstetrical risk, choice of posture during delivery may be encouraged.

INTRODUCTION

In earlier times women commonly delivered in an upright or squatting position, and adoption of the conventional dorsal position for delivery is attributed to the French accoucheur Mauriceau in the 17th century. Considerable interest has recently been expressed in different positions during the second stage of labour¹. Physiological advantages have been claimed for non-recumbent labour, including an increase in pelvic dimensions²⁻⁴, smaller risk of aorto-caval compression⁵, better 'alignment' of the fetus during passage through the pelvis⁶, more efficient uterine contractions^{7,8}, and enlisting the force of gravity.

Many women wish to become more involved in decision making during childbirth, especially with regard to ambulation during the first stage of labour and posture for delivery¹. There is evidence to suggest that ambulation during the first stage is beneficial⁹, but opinion is divided on the subject of the most appropriate posture for delivery of low risk women. While many women feel that squatting in labour is appealing, research has shown that Western women have great difficulty in adopting this position¹⁰. Birthing chairs and other aids have been designed to facilitate some form of upright position during parturition. Several trials comparing

upright delivery using a birthing chair with conventional recumbent positions during labour have been carried out¹¹. In her review of these studies, Nikodem¹¹ found an increased rate of postpartum haemorrhage with the birthing-chair. One explanation is that postpartum haemorrhage is due to increased venous pressure and engorgement of the perineum which would cause greater blood loss with perineal trauma. Other devices have been developed to support women who wish to deliver in an upright position, for example the birth cushion¹⁰. The advantage of the cushion is that much of the downward pressure is supported by the thighs and not simply by the buttocks and perineum.

Sixteen randomised controlled trials have been carried out to assess the maternal and neonatal effects of upright positions compared with recumbent positions during the second stage of labour¹¹. However, there are a number of difficulties in interpreting these trials. In several of the studies women experienced difficulty in assuming the allocated upright position, adopting instead the recumbent position for delivery. For example, in the trial by Gardosi *et al.*¹², only 49% of women allocated to the upright position were able to kneel or squat during the second stage of labour, with 22% managing the upright position during the delivery. Only two women out of 73 managed to squat for the actual delivery. In addition, some of the studies reviewed may have been subject to selection bias, since only eight attempted to reduce the risk of foreknowledge of the

Correspondence: Dr P. de Jong, Department of Obstetrics and Gynaecology, University of Cape Town, Anzio Road, Observatory 7925, South Africa.

treatment allocation by using sealed envelopes¹¹. In several studies women were excluded after randomisation without adequate explanation.

The combined results of these studies suggest that the upright posture for the second stage has certain advantages over the recumbent position. Women experienced less discomfort, more tolerable pain, less difficulty in bearing down, reduced perineal or vulval trauma, less vulval oedema and fewer episiotomy infections. Women in the upright groups also expressed a preference for the upright posture for their next birth. There were, however, some disadvantages to upright delivery, in that women in this group experienced more labial tears, and possibly more third degree tears. In addition, the upright groups had an increased rate of postpartum haemorrhage, although almost all of these women used birthing chairs. No differences were noted in neonatal outcome, apart from the 1 min Apgar score: fewer infants born to women in the upright groups had a score of < 7¹¹. In her review, Nikodem suggests that other positions for the second stage should continue to be evaluated. Finding a way of enabling women unaccustomed to squatting to achieve delivery in an upright position is a priority.

METHODS

All deliveries were carried out at St Monica's Nursing Home, a facility staffed by trained midwives. Women may deliver at this institution if they are considered to be of low risk, with no obstetric or neonatal complications present or expected. There are no resident medical staff, and no epidural service is available. As a rule, midwives do not perform operative deliveries. A referral hospital is situated nearby, and an ambulance is available to transfer women should the need arise.

Women were counselled for inclusion in the study at an antenatal clinic visit in the third trimester by a senior nursing officer and written consent was obtained. Eighteen women declined to participate because of a declared preference towards delivery posture. When the women were admitted in spontaneous labour, their details were reviewed and a further four women were excluded because of posture preference. Five hundred and seventeen women were included, all having singleton pregnancies with a cephalic presentation, at ≥ 34 weeks of gestation with no risk factors present. All women entering the second stage of labour at St Monica's Hospital were eligible for inclusion (women developing complications in the first stage transferred). Table 1 describes the characteristics of the two groups, which were similar for all obstetric parameters. Companionship in labour is encouraged at the nursing home, and women in both groups enjoyed comparable physical and moral support from their family members.

Table 1. Characteristics of the two groups. There were no significant differences. Values are shown as median (range), unless otherwise indicated.

| | Upright position (n = 257) | Recumbent position (n = 260) |
|------------------------|-------------------------------|---------------------------------|
| Maternal age (years) | 25 (16–41) | 24 (16–40) |
| Gestation (weeks) | 40 (34–43) | 40 (34–42) |
| Primiparous: n [%] | 107 [42] | 115 [44] |
| Gravidity | 2 (1–7) | 2 (1–7) |
| Infant birthweight (g) | 3100 (2020–4460) | 3200 (2100–4400) |
| Mean [SD] | 3166 [454] | 3184 [438] |

Randomisation envelopes were prepared from a single computer-generated number sequence. Late in the first stage of labour women were randomised by the use of sealed opaque consecutively numbered envelopes provided, and participants were allocated to either the 'squatting in the second stage' group or the 'routine management' group. At the end of the study all the envelopes were accounted for.

Until the beginning of the second stage of labour, management of the groups was identical with women being encouraged to walk, sit or recline. In both groups fetal monitoring was done according to the standard practice of intermittent auscultation, with cardiotocograph tracing if abnormalities were heard. The routine management of labour was unchanged. Analgesia was by means of pethidine and hydroxyzine as required.

Participants allocated to deliver in the recumbent position were managed according to established protocols. The second stage of labour and delivery were accomplished with the mother in the supine position on a delivery bed, supported and encouraged by her partner.

The upright second stage management took place in a separate delivery room containing a simple 'step stool' covered with a foam mattress. At the beginning of the second stage the woman assumed a squatting posture on the step stool. Helpers, supporting her on both sides, steadied the woman as she squatted during the contractions and as she bore down. The woman was encouraged to sit back and rest between the contractions. The midwife knelt on the mattress in front of her, supported her perineum if necessary, and performed an episiotomy if required. The infant was delivered and handed to the mother after drying. The placenta was delivered in the same position, and any perineal lacerations were repaired on an obstetric bed.

Two obstetricians (P.deJ. and R.J.) and two midwives (P.B. and V.A.) reviewed various types of squatting. It became clear that women need to be able to relax between contractions, and need to be supported by a companion (or two) during contractions. To facilitate the delivery and allow the midwife better perineal access it was thought that squatting should not take

Table 2. Labour and delivery outcomes. Values are given as median (range) unless otherwise indicated. OR = odds ratio; CI = confidence interval.

| | Upright position (<i>n</i> = 257) | Recumbent position (<i>n</i> = 260) | OR [95% CI] | <i>P</i> |
|-------------------------------------|---------------------------------------|---|-------------------|----------|
| Duration of second stage (min) | 15 (2–130) | 13 (3–190) | | 0.89 |
| No. > 60 min | 4 | 7 | 0.58 [0.18–1.94] | |
| Blood loss (mL) | 150 (50–800) | 150 (50–750) | | 0.88 |
| No. with blood loss > 500 mL | 3 | 3 | 1.01 [0.20–5.05] | |
| Post delivery haemoglobin | 11 (6–14) | 11 (6.6–14) | | 0.62 |
| No. with haemoglobin < 11 g/dL | 87 | 94 | 0.90 [0.63–1.30] | |
| No. with blood transfusion required | 2 | 1 | 1.98 [0.20–19.10] | |

place on the floor. Accordingly a squat-stool was devised, using the ordinary two-step stool usually used for climbing onto delivery beds. This was covered with foam rubber and placed against a wall in the delivery room. The mother squatted on the first step during the contractions, as she pushed, and then sat back on the second step against the wall while resting.

All details of the delivery were recorded and the woman's subjective assessment of the delivery was recorded the following afternoon by an independent midwife blinded to the mode of delivery. If the woman was unable to assume her allocated position, this was noted. Blood loss was estimated visually by the attending midwife, and oedema of the vulva was recorded by midwives on the postnatal wards the day after delivery. The principal outcomes of the study were the proportion of women with a haemoglobin of < 11 g/dL on the second day after delivery, and second or third degree injuries to the perineum.

Power of the study and methods of analysis

The baseline incidence of low haemoglobin levels in the study was about 35%, and the baseline incidence of second or third degree injuries about 5%. A study with 250 women in each arm (thought to be feasible within the time limits of the project) would have a power of over 90% (with $P = 0.05$) of detecting a difference in the proportion of low haemoglobin levels, if this level were increased to 45%, or of only 70% of detecting a doubling of the proportion of perineal injuries (10%) by adoption of an upright position.

Although they had considerable experience with conventional birth, the majority of midwives had limited experience with mothers delivering in the upright position. Before the trial prejudices and misconceptions were expressed by certain staff, but education and coaching by P.B. and V.A. overcame the midwives' reservations.

Data analysis was by intention to treat. The Mann-Whitney U test was used to test differences of non-normally distributed continuous variables, with the χ^2

test being used to analyse frequency variables, the results being reported as odds ratios (95% confidence interval). Meta-analysis of the results of this paper combined with previous studies for Table 7 was carried out using Review Manager (Update Software Ltd, Oxford). The study protocol was approved by the University of Cape Town Ethics Committee.

RESULTS

Of the 517 women in the trial, 257 were allocated to the upright group for delivery and 260 were assigned to the recumbent group. A relatively modest number of women required transfer to the base hospital by the flying-squad ambulance. Three women required caesarean section: one in the upright group for arrest of progress and two in the recumbent group for arrest of progress and fetal distress. Three women in each group had an instrumental vaginal delivery with the ventouse for arrest of progress during the second stage. One woman was transferred with eclampsia, and three because of anaemia. In all, 13 women in the upright group and 12 in the recumbent group required transfer before delivery. All the women assigned to delivery in the recumbent delivery group were delivered in the allocated position (including those transferred). In the upright group, 249/257 women (97%) maintained this position in the second stage, and 229/257 women (89%) were in the upright position for the actual delivery. Table 2 provides details of labour and the condition of the mother after birth; there were no significant differences in length of labour or amount of blood loss. Table 3 gives details of perineal injuries. Although there were significantly fewer episiotomies in the upright group (perhaps because of the difficulty of performing an episiotomy under these circumstances), there was no difference between groups in terms of the total number of women with perineal trauma requiring suturing. Outcome details for the fetus and newborn infant are shown in Table 4. There were no significant differences between the groups. A high proportion of women in both groups had established breastfeeding by the time of discharge.

Table 3. State of perineum and vulva. UP = upright position; RP = recumbent position.

| | UP (n = 257) | RP (n = 260) | OR [95% CI] |
|--------------------------------|-----------------|-----------------|-------------------|
| Intact | 139 | 163 | 1.79 [0.92-3.45] |
| First degree tear | 94 | 83 | 1.23 [0.85-1.76] |
| Second degree tear | 24 | 13 | 1.95 [0.97-3.90] |
| Episiotomy | 19 | 52 | 0.31 [0.18-0.55] |
| Third degree tear | 0 | 1 | 0.14 [0.00-6.90] |
| Perineal trauma needing repair | 118 | 97 | 1.42 [1.00-2.20] |
| Vulval oedema mild/moderate | 7 | 2 | 3.13 [0.84-11.67] |
| Vulval haematoma | 2 | 2 | 1.01 [0.14-7.24] |

Table 4. Fetal and neonatal outcomes. Key as for Table 3.

| | UP | RP | OR [95% CI] |
|-------------------------------|----|----|------------------|
| Fetal condition (2nd stage) | | | |
| Abnormal fetal heart rate | 3 | 11 | 0.89 [0.07-0.97] |
| Condition of newborn | | | |
| 1 min Apgar < 7 | 5 | 5 | 1.01 [0.29-3.53] |
| Fetal resuscitation required | 9 | 11 | 0.82 [0.34-2.01] |
| Breastfeeding not established | 6 | 8 | 0.75 [0.26-2.20] |

Table 5. Pain of the birthing experience. Values are given as n (%). Trend test χ^2 (1 df) = 7.98, exact $P = 0.0034$. Key as for Table 3.

| | UP (n = 257) | RP (n = 260) |
|----------|-----------------|-----------------|
| Mild | 27 (10.5) | 7 (2.7) |
| Moderate | 138 (53.7) | 126 (48.5) |
| Severe | 90 (35) | 118 (45.4) |
| Extreme | 2 (0.8) | 9 (3.5) |

The maternal assessment of pain during the second stage as recorded by an independent midwife the day after delivery is shown in Table 5. There was a significant difference between the two groups in terms of the observed frequency of the responses. Fewer women in the upright group had significant pain during delivery. Overall 76/257 women (30%) in the upright group and 88/260 women (34%) in the supine group had pethidine in labour. Three of these women in the upright group and four in the supine group had two doses. Post-delivery analgesia was requested by 77 in the upright group and 79 in the supine groups. The satisfaction of the mother with her birthing experience, as recorded by an independent midwife the day after delivery is summarised in Table 6.

DISCUSSION

Important findings were that there was no increase in postpartum haemorrhage, third degree tears or vulval haematoma in the upright group. Blood loss and

Table 6. Satisfaction with the birthing experience. Values are given as n (%). Trend test χ^2 (1 df) = 2.82, exact $P = 0.09$. Key as for Table 3.

| | UP (n = 257) | RP (n = 260) |
|------------------|-----------------|-----------------|
| Very unhappy | 3 (1.2) | 4 (1.5) |
| Slightly unhappy | 5 (1.9) | 4 (1.5) |
| Satisfied | 83 (32.3) | 96 (36.9) |
| Very satisfied | 66 (25.7) | 78 (30) |
| Very happy | 100 (38.9) | 78 (30) |

Table 7. Outcome data pooled with 15 trials in review (11). Upright versus recumbent position during second stage of labour

| Effect on: | No. of trials | OR [95% CI] |
|--|---------------|------------------|
| Abnormal fetal heart rate pattern | 4 | 0.64 [0.43-0.96] |
| Experience of severe discomfort in 2nd stage | 2 | 0.55 [0.52-0.58] |
| Intolerable pain | 2 | 0.23 [0.08-0.63] |
| Operative delivery | 16 | 0.83 [0.69-0.99] |
| Ventouse delivery | 5 | 1.11 [0.65-1.91] |
| Caesarean section | 10 | 0.69 [0.34-1.37] |
| Perineal/vaginal trauma (need for repair) | 9 | 0.92 [0.80-1.07] |
| Third degree tears | 4 | 0.21 [0.05-0.86] |
| Vulval oedema | 3 | 0.76 [0.51-1.13] |
| Postpartum haemorrhage | 9 | 1.83 [1.38-2.44] |
| Haemoglobin < 11 g/dL | | |
| 2-4 days postpartum | 2 | 1.12 [0.87-1.46] |
| Blood transfusion postpartum | 3 | 1.87 [0.84-4.19] |
| Resuscitative treatment of infant | 2 | 0.63 [0.34-1.17] |

duration of the second stage in the two groups were surprisingly similar, and there was no difference in the need for obstetric intervention.

Important outcomes in this study included the women's perception of intrapartum pain, maternal satisfaction with the birthing experience, and any increase in complications in the upright group. It was hoped that low risk women would show no difference in obstetric or neonatal outcome when delivered in the squatting position, thereby making it possible to offer this option with confidence to women in labour. The results confirm that there is no increase in obstetric or neonatal mishap in the study population, and in fact there appear to be several advantages. Women in the upright group were subjected to fewer episiotomies than women delivering in the supine position, with significantly less perineal trauma. In addition, women in the upright group experienced significantly less pain, although no difference in the degree of maternal satisfaction was expressed 24 hours after delivery.

The majority of our women were able to remain squatting during contractions for the second stage when supported by assistants on either side. Between contractions the mother sat back on her step stool. No other devices were required to facilitate the upright position for delivery.

The results of this study are compatible with those of other comparisons between upright and recumbent positions for delivery (Table 7). The combined data suggest that the move for women to adopt the upright birthing position will not adversely affect their labour outcome. It may, in fact, be beneficial in that there will be significantly fewer women who experience discomfort in the second stage of labour, and significantly fewer women who experience intolerable pain. Overall, there appears to be a very slight but significant reduction in the need for abnormal delivery (assisted or caesarean section) and a significant reduction in the number of third degree tears. Although there is a reduction in the number of abnormal fetal heart-rate patterns, this is not linked with improved early neonatal outcome. While the combined data continue to suggest a significant increase in the rate of postpartum haemorrhage, this is not supported by the more objective evidence derived from postnatal haemoglobin measurement and rates of blood transfusion.

The data suggest that in women of low obstetric risk, choice of posture during delivery should be encouraged. Mothers-to-be should be informed of the benefits that appear to be associated with an upright position.

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