Increased blood loss in upright birthing positions originates from perineal damage

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Accepted 2 November 2006. Published OnlineEarly 8 January 2007.

Objective To assess whether the risk of severe blood loss is increased in semi-sitting and sitting position, and if so, to which extent blood loss from perineal damage is responsible for this finding.

Design Secondary analysis of data from a large trial.

Setting Primary care midwifery practices in the Netherlands.

Population About 1646 low-risk women who had a spontaneous vaginal delivery.

Methods Blood loss was measured using a weighing scale and measuring jug. Logistic regression analysis was used to examine the net effects of birthing position and perineal damage on blood loss greater than 500 ml.

Main outcome measures Mean total blood loss and incidence of blood loss greater than 500 ml and 1000 ml.

Results Mean total blood loss and the incidence of blood loss greater than 500 ml and 1000 ml were increased in semi-sitting and sitting position. In logistic regression analysis, the interaction between birthing position and perineal damage was almost significantly associated with an increased risk of blood loss greater than 500 ml. Semi-sitting and sitting position were only significant risk factors among women with perineal damage (OR 1.30, 95% CI 1.00–1.69 and OR 2.25, 95% CI 1.37–3.71, respectively). Among women with intact perineum, no association was found.

Conclusions Semi-sitting and sitting birthing positions only lead to increased blood loss among women with perineal damage.

Keywords Birthing positions, blood loss, perineal damage.

Introduction

The supine position is most commonly used for the second stage of labour in western cultures.1,2 Studies have shown that women use a variety of positions if they are allowed to make their own choices.3,4 Therefore, the routine use of the supine position can be considered an intervention in the normal course of labour. The evidence to support the use of this intervention is not clear.5

Several studies have compared the outcomes of labour in supine versus other positions. Two meta-analytic reviews have indicated some disadvantages of the supine position, most notably an increase in instrumental deliveries and episiotomies.5,6 In addition, women have reported reduced pain in nonsupine positions and a preference for other positions in quantitative studies.7–9 A qualitative study showed that women vary in their experiences with birthing positions but having an influence on the choice of position may contribute to a better birth experience.10

The main advantage of the supine position is reduced mean blood loss and incidence of blood loss greater than 500 ml compared with other positions.5,6 These differences were only found between supine and upright positions, mainly among women using the birthing chair or birthing stool. It is not clear which factors contribute to these findings.9,11

Measurement error may explain some of the differences found. The same amount of blood loss may appear to be more in upright than in recumbent position.9 In most studies, estimated blood loss is used as the outcome measure.9,12–15 We wanted to improve upon previous research and establish whether there is an actual increase in blood loss in sitting positions by using more accurate, objective measurements.

If there is a real difference, it is not clear whether this excess in blood loss originates from perineal damage or from the
uterus. Uterine atony is a serious cause of postpartum hae-
morrhage and is the second most important indication for
emergency peripartum hysterectomy after placenta accreta in
the Netherlands.16 If there is an increase in blood loss in
sitting positions, it is therefore important to establish where
this originates from.

Many studies into birthing positions include women
with risk factors for postpartum haemorrhage, such as oxy-
tocin infusion, epidural anaesthesia and instrumental deliv-
ery.9,12,14,17–20 Results of these studies may not apply to
women in low-risk settings. We therefore performed a study
among low-risk women only.

We had two main research questions. Is the risk of severe
blood loss increased in semi-sitting and sitting compared with
recumbent birthing positions when accurate measurements of
blood loss were used? If so, to what extent is the excess risk
due to blood loss from perineal damage?

Methods

We used data from a trial into active versus physiological
management of the third stage of labour (K.C. Herschederfer
et al., unpubl. obs.) for this secondary analysis. This trial was
conducted from 1 May 1995 to 1 September 1996. Twenty
independent midwifery practices with a total of 70 midwives
were recruited all over the Netherlands through advertise-
ment in the national midwifery journal and through local
midwifery groups.

Independent midwives only look after women who have
a spontaneous vaginal delivery at term with a single fetus in
cephalic presentation either at home or in hospital. When risk
factors occur, these women are referred to obstetrician-led
care. Many potential confounding factors, such as oxytoci
infusion, epidural anaesthesia and instrumental delivery, were
therefore not present in those cases delivered by these midwives.

Exclusion criteria in the trial were defined as previous post-
partum haemorrhage (blood loss more than 1000 ml), hae-
moglobin (Hb) ≤6.0 mmol/l, large uterine size, prolonged
first stage of labour and second stage of labour of more than
90 minutes in primigravidas or more than 45 minutes in
multigravidas. Women who were unable to read the Dutch
language were excluded because they would not be able to
answer the questionnaire used in this study.

The Medical Ethics Committee of the Netherlands Institute
of Applied Scientific Research (TNO) in Leiden granted eth-
cical approval for this trial.

The main outcome measures in our study were mean total
blood loss and the incidence of blood loss greater than 500 ml
and 1000 ml. The World Health Organization (WHO) has
defined postpartum haemorrhage as blood loss greater than
500 ml.21 In the Netherlands, this definition is restricted to
cases whereby the blood loss is greater than 1000 ml.22 We
therefore used both cutoff points for the purpose of this
study. Blood loss was measured from the delivery of the fetus
till 1 hour after the delivery of the placenta. All midwives
received a digital weighing scale, a measuring jug and perineal
pads to measure the blood loss accurately.

The Hb levels provided a more objective indication of the
consequences of blood loss. Hb levels were measured on the
fourth to sixth day postpartum and were compared with Hb
levels at 36 weeks of gestation. Hb meters (HemoCue AB,
Angelholm, Sweden) were provided and checked every 2
months to the standards required for national quality control.

Position at the time of delivery was recorded as recumbent
(supine or lateral), semi-sitting (supported by pillows or a
bedrest) or sitting (in bed supported by a person or on a
birthing stool or similar birthing aid). In the Netherlands,
women rarely give birth in lateral position, and the birthing
stool is most commonly used for the sitting position.

We categorised perineal damage into intact perineum and
perineal damage (perineal or labial tear in need of suturing or
episiotomy).

An association with an increased risk of postpartum hae-
morrhage has been reported in the literature for the following
factors other than birthing position: maternal age,23 primi-
parity,23,24 third stage of labour longer than 30 minutes,25 high
birthweight,25–27 perineal damage25,26 and prolonged second
stage of labour.25,26 Active management of the third stage of
labour decreases the risk of postpartum haemorrhage.15 We
examined the net effects of these factors on postpartum blood
loss greater than 500 ml.

If the difference in blood loss was due to uterine factors,
sitting positions would be significant risk factors regardless
of the presence of perineal damage. On the other hand, if
the difference was due to excessive bleeding from perineal
damage, this would be the case among women with perineal
damage only. We therefore examined the interaction between
birthing position and perineal damage.

Data analysis

We used t test and one-way analysis of variance for continu-
ous variables and chi-square and Fisher’s exact test for cate-
gorical variables. The Bonferroni post hoc test was used for
multiple comparisons to reduce the risk of erroneously find-
ing a significant difference due to multiple testing. A logistic
regression analysis was used to establish the net effects.

All statistical tests were two tailed, and P values < 0.05 were
considered statistically significant. SPSS 11.5 for Windows
was used for data analysis (SPSS Inc., Chicago, IL, USA).

Results

Most of the 1646 women in the study gave birth in recumbent
position followed by semi-sitting and sitting position
(Table 1).
The mean blood loss in the total group was 508 ml. Blood loss greater than 500 ml occurred in 38.5% and greater than 1000 ml in 9.1% of women. In semi-sitting and sitting position, the mean total blood loss was significantly greater than in recumbent position. A significant linear association was found for the following variables: the risk of blood loss greater than 500 ml and 1000 ml was greater in semi-sitting than in recumbent position and greater in sitting than in semi-sitting position.

Mean Hb level at the fourth to sixth day postpartum was lower in the semi-sitting and sitting position groups. In addition, variation was found between these groups in the difference between the postpartum Hb level and that at 36 weeks of gestation. Only the differences between recumbent and sitting position were significant.

Women in sitting positions were older than women in other positions. A higher proportion of women in sitting position had a second stage of labour longer than 60 minutes compared with women in other positions. Only 50 women were of non-Dutch origin.

The associations between various factors and blood loss are given in Table 2 for women with intact and damaged perineum.

Among women with perineal damage, semi-sitting and sitting position, primiparity and second stage of labour longer than 60 minutes were strongly associated with increased total blood loss and blood loss greater than 500 ml and 1000 ml. These associations were not found among women with an intact perineum. Third stage of labour longer than 30 minutes and birthweight more than 4 kg were risk factors for most outcomes in women with and without perineal damage. Active management of the third stage was a protective factor.

When logistic regression analysis was performed, the interaction between sitting position and perineal damage was almost significantly related to blood loss greater than 500 ml. We therefore reported the outcomes of the logistic regression analysis separately for women with and without perineal damage.

### Table 2. Demographic and obstetric data of the population by birthing position

<table>
<thead>
<tr>
<th></th>
<th>All positions combined (n = 1646)</th>
<th>Recumbent (n = 922)</th>
<th>Semi-sitting (n = 605)</th>
<th>Sitting (n = 119)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total blood loss (ml), mean [range]</strong></td>
<td>508 [30–2830]</td>
<td>480*** [30–2830]</td>
<td>538* [40–2301]</td>
<td>570** [95–1700]</td>
<td>0.001</td>
</tr>
<tr>
<td>&gt;500, n (%)</td>
<td>633 (38.5)</td>
<td>322 (34.9)</td>
<td>251 (41.5)</td>
<td>60 (50.4)</td>
<td>0.001***</td>
</tr>
<tr>
<td>&gt;1000, n (%)</td>
<td>150 (9.1)</td>
<td>73 (7.9)</td>
<td>61 (10.1)</td>
<td>16 (13.4)</td>
<td>0.083****</td>
</tr>
<tr>
<td><strong>Age (years), n (%)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25 years or younger</td>
<td>145 (8.9)</td>
<td>85 (9.3)</td>
<td>55 (9.2)</td>
<td>5 (4.2)</td>
<td></td>
</tr>
<tr>
<td>26–30</td>
<td>552 (33.8)</td>
<td>312 (34.1)</td>
<td>213 (35.6)</td>
<td>27 (22.9)</td>
<td></td>
</tr>
<tr>
<td>31–35</td>
<td>712 (43.6)</td>
<td>399 (43.6)</td>
<td>252 (42.1)</td>
<td>61 (51.7)</td>
<td></td>
</tr>
<tr>
<td>36 years or older</td>
<td>223 (13.7)</td>
<td>119 (13.0)</td>
<td>79 (13.2)</td>
<td>25 (21.2)</td>
<td>0.019</td>
</tr>
<tr>
<td><strong>Non-Dutch origin, n (%)</strong></td>
<td>50 (3.0)</td>
<td>25 (2.7)</td>
<td>19 (3.2)</td>
<td>6 (5.0)</td>
<td>0.384</td>
</tr>
<tr>
<td>Primiparous, n (%)</td>
<td>640 (39.3)</td>
<td>336 (36.8)</td>
<td>251 (42.0)</td>
<td>53 (44.9)</td>
<td>0.057</td>
</tr>
<tr>
<td><strong>Duration of second stage &gt;60 minutes, n (%)</strong></td>
<td>211 (12.9)</td>
<td>104 (11.3)</td>
<td>81 (13.5)</td>
<td>26 (21.8)</td>
<td>0.005</td>
</tr>
<tr>
<td>Duration of third stage &gt;30 minutes, n (%)</td>
<td>120 (7.3)</td>
<td>66 (7.2)</td>
<td>43 (7.1)</td>
<td>11 (9.3)</td>
<td>0.689</td>
</tr>
<tr>
<td><strong>Active management of third stage, n (%)</strong></td>
<td>834 (50.7)</td>
<td>457 (49.6)</td>
<td>317 (52.4)</td>
<td>60 (50.4)</td>
<td>0.556</td>
</tr>
<tr>
<td>Perineal damage, n (%)</td>
<td>1178 (71.7)</td>
<td>655 (71.1)</td>
<td>442 (73.4)</td>
<td>81 (68.1)</td>
<td>0.405</td>
</tr>
<tr>
<td>Hb level 4–6 days postpartum minus Hb level at 36 weeks of gestation (g/dl), mean [range]</td>
<td>0.22 [−5.16 to 6.29]</td>
<td>0.29 [−5.16 to 6.29]</td>
<td>0.19 [−4.84 to 5.00]</td>
<td>−0.16 [−4.03 to 3.06]</td>
<td>0.015</td>
</tr>
</tbody>
</table>

Missing values are excluded.

*Multiple comparisons (Bonferroni) mean difference = 58 [−101 to −14], significant at 0.05 level.

**Multiple comparisons (Bonferroni) mean difference = 90 [−170 to −9], significant at 0.05 level.

***Linear-by-linear association P = 0.000.

****Linear-by-linear association P = 0.027.
Table 2. Associations between various factors and blood loss for women with intact perineum and women with perineal damage

| Risk factor present | Blood loss >500 ml, n (%) | Blood loss >1000 ml, n (%) | Mean total blood loss (ml) | | Risk factor present | Blood loss >500 ml, n (%) | Blood loss >1000 ml, n (%) | Mean total blood loss (ml) | |
|---------------------|---------------------------|-----------------------------|-----------------------------|---------------------------|---------------------------|---------------------------|-----------------------------|-----------------------------|
| **Women with intact perineum (n = 464)** | | | | | **Women with perineal damage (n = 1178)** | | | | |
| Birthing position | | | | | | | | | |
| Recumbent | 266 | 70 (26.3) | 17 (6.4) | 422 | 655 | 252 (38.5) | 56 (8.5) | 504 |
| Semi-sitting | 160 | 53 (33.1) | 11 (6.9) | 465 | 442 | 197 (44.6) | 50 (11.3) | 566 |
| Sitting | 38 | 12 (31.6) | 1 (2.6) | 421 | 0.306* | 1 (2.6) | 421 | 0.673** | 0.361 |
| Duration of second stage labour (minutes) | | | | | | | | | |
| More than 60 | 39 | 15 (38.5) | 3 (7.7) | 524 | 172 | 86 (50.0) | 27 (15.7) | 607 |
| Up to 60 | 424 | 120 (28.3) | 0.182 | 26 (6.1) | 0.726 | 429 | 0.067 | 525 | 0.005 |
| Birthweight (kg) | | | | | | | | | |
| More than 4 | 55 | 24 (43.6) | 5 (9.1) | 545 | 155 | 94 (60.6) | 32 (20.6) | 706 |
| Up to 4 | 408 | 111 (27.2) | 0.012 | 24 (5.9) | 0.370 | 422 | 0.006 | 510 | <0.001 |
| Management of third stage of labour | | | | | | | | | |
| Active | 243 | 59 (24.3) | 11 (4.5) | 412 | 589 | 216 (36.7) | 43 (7.3) | 485 |
| Physiological | 221 | 76 (34.4) | 0.017 | 18 (8.1) | 0.108 | 463 | 0.074 | 589 | <0.001 |
| Duration of third stage of labour (minutes) | | | | | | | | | |
| More than 30 | 46 | 27 (58.7) | 12 (26.1) | 705 | 73 | 46 (63.0) | 18 (24.7) | 678 |
| Up to 30 | 416 | 108 (26.0) | <0.001 | 17 (4.1) | <0.001 | 407 | <0.001 | 527 | <0.001 |
| Maternal age (years) | | | | | | | | | |
| 25 years or younger | 50 | 16 (32.0) | 1 (2.0) | 414 | 95 | 41 (43.2) | 11 (11.6) | 536 |
| 26–30 | 153 | 42 (27.5) | 7 (4.6) | 419 | 398 | 169 (42.5) | 54 (13.6) | 563 |
| 31–35 | 183 | 48 (26.2) | 14 (7.7) | 429 | 529 | 220 (41.6) | 38 (7.2) | 510 |
| 36 years or older | 77 | 28 (36.4) | 0.375 | 7 (9.1) | 0.268 | 501 | 0.239 | 510 | 0.112 |
| Parity | | | | | | | | | |
| Primiparous | 133 | 42 (31.6) | 7 (5.3) | 438 | 507 | 249 (49.1) | 66 (13.0) | 581 |
| Multiparous | 328 | 91 (27.7) | 0.410 | 22 (6.7) | 0.563 | 434 | 0.896 | 659 | 0.001 |

*Linear-by-linear association, P = 0.186.
**Linear-by-linear association, P = 0.659.
***Linear-by-linear association, P = 0.000.
****Linear-by-linear association, P = 0.006.
damage. In Table 3, variables that were significantly related to the outcome are shown. More details are available from the first author on request. Birthweight was linearly related to the log-odds of blood loss greater than 500 ml and was therefore included as a continuous variable. Maternal age was not and was included as a categorical variable.

In the group with perineal damage, semi-sitting and sitting positions were significantly associated with an increased risk of blood loss greater than 500 ml (OR 1.30 and OR 2.25, respectively). Among women with an intact perineum, this association was not found. Other significant factors in both groups were birthweight, active management of the third stage of labour and third stage longer than 30 minutes. Among women with perineal damage, primiparity was also a significant factor.

**Discussion**

In this study, mean total blood loss and the incidence of blood loss greater than 500 ml and 1000 ml were increased in semi-sitting and sitting positions. These positions were only significant risk factors among women with perineal damage and not among women with intact perineum.

<table>
<thead>
<tr>
<th>Predictor variable</th>
<th>Intact perineum, N = 457, &gt;500 ml (n = 133)</th>
<th>Intact perineum, N = 1153, &gt;500 ml (n = 487)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Birthing position</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recumbent</td>
<td>1.0 (reference)</td>
<td>1.0 (reference)</td>
</tr>
<tr>
<td>Semi-sitting</td>
<td>1.33 (0.84–2.10)</td>
<td>1.30 (1.00–1.69)</td>
</tr>
<tr>
<td>Sitting</td>
<td>0.97 (0.43–2.20)</td>
<td>2.25 (1.37–3.71)</td>
</tr>
<tr>
<td>Birthweight (kg)</td>
<td>3.17 (1.91–5.25)</td>
<td>3.98 (2.89–5.49)</td>
</tr>
<tr>
<td>Management of the third stage of labour</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physiological</td>
<td>1.0 (reference)</td>
<td>1.0 (reference)</td>
</tr>
<tr>
<td>Active</td>
<td>0.57 (0.37–0.88)</td>
<td>0.59 (0.46–0.76)</td>
</tr>
<tr>
<td><strong>Duration of the third stage of labour (minutes)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤30</td>
<td>1.0 (reference)</td>
<td>1.0 (reference)</td>
</tr>
<tr>
<td>&gt;30</td>
<td>4.14 (2.11–8.19)</td>
<td>2.41 (1.43–4.06)</td>
</tr>
<tr>
<td><strong>Parity</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Multipara</td>
<td>1.0 (reference)</td>
<td>1.0 (reference)</td>
</tr>
<tr>
<td>Primipara</td>
<td>1.18 (0.70–1.97)</td>
<td>2.30 (1.70–3.11)</td>
</tr>
</tbody>
</table>

*Variables shown are significantly related to the outcome after controlling for other factors. Other variables included in the analysis were duration of second stage >60 minutes and maternal age (in categories).
gives way when a woman is bearing down, did not increase blood loss compared with supine position. We found a linear association between a more sitting position (recumbent, semi-sitting and sitting) and an increased risk of blood loss in the subgroup of women with perineal damage but not among women with an intact perineum. This indicates that venous obstruction caused by the birthing stool or hard mattress caused the increase in blood loss.

Obstruction in venous return may be prevented by alternating positions during the second stage of labour. In addition, positions could be used in which venous return is not obstructed, such as squatting, lateral and hands-and-knees positions.

The incidence of perineal damage did not differ between position groups. Thirty-one women had a third or fourth degree tear, and the incidence did not differ between the groups \(P = 0.656\). Lithotomy, sitting, standing and squatting positions have all found to be associated with an increase in third degree tears, although the differences with the control group were not always significant because of the low number of women with this complication.\(^7,37-43\) Other studies have not confirmed these findings,\(^6,36\) and some showed less perineal trauma in sitting, semi-sitting, hands-and-knees or kneeling positions.\(^44-47\) The association between birthing positions and severe perineal trauma is still unclear and is not a reason for restricting women’s choice of birthing position.\(^17,33,47\)

In our study, perineal damage was independently associated with blood loss greater than 500 ml. A policy of restricted rather than routine use of episiotomy leads to less perineal damage.\(^48\) Regardless of the birthing position, restricting the use of an episiotomy to medical indications may reduce the number of women with severe blood loss.

There are some limitations in this study. First, a common problem in studies examining different birthing positions is that the distinction between the various positions is not always clear-cut.\(^49\) Some misclassifications, especially between recumbent and semi-sitting position, might have decreased the observed differences. Nevertheless, significant differences were found between these two groups.

Second, the midwives and the study population may not have been entirely representative for the whole country. The sample of midwifery practices was self-selected based on their willingness to participate. However, the selection was not based on midwives’ attitudes towards birthing positions, and position was only registered as a possible confounder in the trial. Therefore, selection bias was unlikely to influence the measurement of blood loss in the various birthing positions.

The exclusion of women who were unable to read the Dutch language resulted in a very small number of women of non-Dutch origin in the sample. It is therefore unclear to which extent our results apply to ethnic minority populations in the Netherlands.

Third, the data were collected a decade ago. The characteristics of women and midwifery management may have changed since then. Even so, we have no reason to believe that practices with regard to birthing positions and management of the third stage of labour have changed significantly during this time period. The findings on the relationship between birthing position, perineal damage and blood loss are still relevant today.

Although postpartum haemorrhage is defined by the WHO as blood loss greater than 500 ml, healthy women can tolerate at least twice this amount without serious consequences.\(^21,31\) It is reassuring that the increased blood loss found in upright birthing positions is unlikely to be of uterine origin, as this can lead to excessive amounts of blood loss in a very short time.

**Acknowledgements**

Many thanks to Dr Charles Agyemang for his useful comments on earlier versions of this article.

**References**

Blood loss and perineal damage in upright birthing positions