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ORIGINAL ARTICLE

Warm tub bathing during labor: maternal and neonatal effects

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Aim. To study possible detrimental maternal and neonatal effects of immersion in warm water during labor.
Design. Prospective randomized controlled bathing during first stage of labor *vs* no bathing.
Setting. Obstetrical departments at a university hospital and two central hospitals.
Primary end-point. Referral of newborns to NICU.
Material and methods. Randomization took place by means of sealed opaque envelopes at each delivery unit. Preconditions for participation in the study were: singleton parturient wishing to bathe, a gestational duration of at least 35 weeks+0 days, a planned vaginal delivery, normal admission test, regular contractions and cervix dilated to at least 3–4 cm. Parturients randomized to the 'no bath' control group were allowed to use a shower. Rupture of the membranes was not a contra-indication to participation. Those excluded from randomization were women with intra-uterine growth retardation, meconium-stained amniotic fluid, or in the event that the tub was occupied by another randomized parturient.
Main results. On average, parturients stayed in the tub for 50–60 min. No significant difference was seen regarding the referral rate to NICU among 612 cases *vs* 625 controls, OR 0.8; 95% CL 0.2, 3.1. The OR for epidural analgesia was 1.0; 95% CL 0.8, 1.3. Nor was any significant difference seen in the rate of perineal tear grade III–IV (OR 1.3), instrumental delivery (OR 1.1), cesarean section (OR 1.8), or maternal post partum stay on the ward. During the neonatal period, no significant difference was seen in the number of newborns with Apgar <7 at 5 min (4 *vs* 5), neonatal distress (OR 2.2) or tachypnéa (OR 1.0).
Conclusion. In the present study no negative effects of bathing during labor could be discerned. The results indicate that expectant mothers wishing to bathe during labor may do so without jeopardizing their own, or their newborns' wellbeing after birth.

Key words: immersion in warm tub in labor; labor; maternal effects; neonatal effects

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Bathing in warm water for relaxation and pain relief has been practiced for decades. In pregnancy, body immersion has been used to relieve edema and reduce blood pressure (1). An increased trend to bathing during labor and delivery has definitely been evident since the paper by Odent in 1983, claiming that warm bathing facilitates the first stage of labor by shortening the time spent in first stage, and reducing the need for pain relief (2).

Benefits as well as risks of bathing during labor have been suggested. Benefits could include reduced use of pharmacological pain relief, acceleration of labor, less perineal trauma, and an increased feeling of control over labor for the mother (2). Possible maternal risks might include increased rates of post-partum infection, hemorrhage, and water embolus. Risks to the baby might

Abbreviations:
NICU: neonatal intensive care unit; OR: odds ratio; CL: confidence limits.

include infection, including an increased risk of neonatal distress and depressed Apgar score.

Three randomized controlled trials in the 1990s, involving altogether 988 women (1, 3, 4), have been included in a recent meta-analysis (5). No statistically significant difference was detected between groups undergoing immersion *vs* no immersion regarding the use of pain relief, augmentation of labor and duration of the first stage of labor, meconium-stained amniotic fluid, or perineal trauma. Neonatal outcomes such as Apgar score, pH in the umbilical cord, and neonatal infection rate did not reveal any differences. However, none of these studies reported a power analysis, which suggests that the number of cases included might have been too small to allow of any definite conclusions.

The aim of this prospective randomized controlled study was to ascertain if there were any detrimental effects of immersion in water during labor in a sufficiently large number of deliveries. As the primary end-point we chose the referral rate to NICU (Neonatal Intensive Care Unit).

Material and methods

The obstetrical unit at Karlskrona during the study period had about 1,700-1,900 deliveries each year. The cesarean section rate during the study period 1992–95 was 6–8%. The study started in Karlskrona and the protocol including the number of patients needed (*vide infra*) was based on the transferral rate to NICU. Those eligible for inclusion in the study were parturients with a gestational duration of at least 35 weeks+0 days, a planned singleton vaginal delivery, normal admission test, regular contractions and cervix dilated at least 3–4 cm. Neither hemorrhage considered to be a sign of the normal delivery, nor rupture of the membranes was regarded as a contra-indication to participation. Reasons for exclusion from randomization were a high temperature (≥38.0°C), gestation with intra-uterine growth retardation, meconium-stained amniotic fluid, or an occupied bath tub by another randomized parturient. In the final analysis, 'intention-to-treat' was used and no case or control parturient was excluded.

The number of randomized parturients was based on the assumption that it would be possible to detect an increase in the referral rate to NICU, from 6% to 12% (alpha=0.05 and beta=0.15, indicating a power of 0.85). Altogether, 1,000 randomized parturients would be needed in order to accept or reject this hypothesis. The randomization took place by means of sealed opaque envelopes containing the method of treatment – tub bath in warm water, or no bath. Already during antenatal visits to the maternity unit, each pregnant woman was informed about the study and its design. Randomization took place when the parturient had regular contractions and was eligible for the study. Parturients randomized to 'no bath' were allowed to use the shower. During the study period, no parturient was allowed to use the tub unless participating in the study. All women included in the study gave their informed consent. The study was approved by the local medical ethics committees.

After about 2 years' recruitment of eligible parturients it became obvious that to complete the study within a reasonable period of time it would be necessary to include at least 1 or 2 other units. Without considering the rate of transferrals to NICU in Lund or in Ostersund, and without further calculations, the planned total number of women was increased to 1,200–1,300. Identical methods were now used at the three units, including eligibility, randomization, methods of cleaning the tub after use, and follow-up.

The obstetrical unit in Lund during the study period had an overall cesarean section rate for its own population of about 7–9% (regional delivery unit) and the annual number of deliveries was about 3,000. The cesarean section rate at Ostersund was 7–9% and the annual number of deliveries, about 2,000. A considerable degree of unanimity between the units was evident due to the similarity of education of the obstetricians in charge of the three units.

No stratified or logistic regression analyses were made. Odds ratios (OR) with 95% confidence limits were calculated according to Miettinen (6). The unique personal identification number given to all newborns in Sweden shortly after birth made it possible, when appropriate, to cross-check with maternal information stored at the Medical Birth Registry (MBR), the National Board of Health and Welfare, Stockholm. In all, the following secondary end-points regarding differences between cases and controls were agreed upon: rate of analgesia (paracervical or epidural), instrumental delivery, cesarean section, hemorrhage, perineal tear grade III–IV, maternal stay post partum, Apgar score at 5 min less than 7, neonatal distress, tachypnéa, and neonatal jaundice.

Results

Altogether, 1,237 parturients at the three obstetrical units were included in the final analysis. In all, 15 women from Östersund, 21 from Lund and six from Karlskrona had to be excluded, because they did not fulfil one criterion for inclusion: *viz.*, they were randomized when the cervix was dilated less than 3 cm. One woman in Lund went home undelivered. There was no obvious difference regard-

Table I. Maternal and neonatal characteristics

	Karlskrona		Lund		Ostersund	
	Cases 364	Controls 376	Cases 153	Controls 152	Cases 95	Controls 97
Maternal age (years, mean)	26.2	26.3	27.5	28.3	27.6	28.5
Parity (mean)	1.5	1.5	1.4	1.6	1.7	1.9
Gestational duration (weeks, mean)	40.2	40.1	40.4	40.2	39.8	39.8
Cervical dilatation at random (cm, mean)	4.3	4.1	4.7	4.7	4.5	4.5
Immersion in water (min, mean)	58	0	56	0	48	0
No immersion cases (*n*; %)	17;	11.1	16;	4.4	0	
Birthweight (g, mean)	3,701	3,653	3,605	3,623	3,658	3,691

ing potential confounders such as maternal age, parity, gestational duration, or birthweight for cases *vs* controls (Table I). At Karlskrona, 11.1% of parturients randomized to bathe did not do so. The corresponding proportion in Lund was 4.4%, whereas all women in Ostersund did in fact bathe.

The primary end-point, referral to NICU, did not vary between cases and controls (Table II). Although the number of days in NICU differed significantly for newborns between Karlskrona (10.1 *vs* 6.4 days; $p<0.05$) and Lund (1.5 *vs* 5.0 days; $p<0.05$), respectively, the trends were contrary. Apgar scores <7 at 5 min were alike in the two groups. Because of missing values, pH determination of arterial blood from the umbilical cord at this time was routine only in Lund, and a valid comparison including all units could therefore not be performed. No significant differences were seen (data not shown).

No significant difference was found regarding the use of epidural analgesia for cases *vs* controls (Table III). A significantly lower risk of abnormal presentation was found in the 'case' group, and at all units (Table III). There was no obvious difference in the rate of perineal tears. Neither the rate of instrumental delivery nor that of cesarean section differ between cases and controls. Nor did hemorrhage or maternal stay after delivery differ between the groups (data not shown).

No obvious difference between cases and controls was evident for tachypnéa, neonatal jaundice, or cerebral irritation, although neonatal distress tended to be more common in the case group (Table II).

Discussion

The results of this study indicate that taking a warm tub bath during labor has no significant detrimental effects. This is important information for the mother-to-be who wishes to use the tub with hot water. However, we used a rather 'weak' primary end-point. Transferral of the newborn to NICU is a rather blunt parameter when comparing possible detrimental effects between cases and controls. At Lund, control babies stayed significantly longer in NICU, whereas the converse was true of the Karlskrona unit. We believe that this variation is attributable to the small numbers studied.

A more solid and important end-point would have been perinatal death or neonatal septicemia. With similar requirements as in the present study about 8,000 parturients would be needed to gain a power in the study of at least 0.8. Obviously, very few obstetrical units would be capable of dealing with such a huge study during a restricted time period. Gilbert and Tookey recently published a

Table II. Neonatal primary and secondary end-points among 612 cases and 625 controls

	Cases *n*	Controls *n*	OR, 95% CL
Stay in NICU	41	43	1.0; 0.6, 1.5
Apgar s. <7 at 5 min	4	5	0.8; 0.2, 3.0
Cephalic hematoma	7	7	1.0; 0.4, 2.9
Fractured clavicle	6	8	0.8; 0.3, 2.2
Neonatal distress	13	6	2.2; 0.9, 5.8
Tachypnéa	7	7	1.0; 0.4, 2.9
Neonatal jaundice	14	12	1.2; 0.5, 2.6
Neonatal seizures	1	1	1.0; 0.1, 16.4

Table III. Maternal secondary end-points

	Cases *n*	Controls *n*	OR, 95% CL
Epidural analgesia	123	126	1.0; 0.8, 1.3
Paracervical blockade	60	79	0.7; 0.5, 1.1
Secondary arrest	45	33	1.4; 0.9, 2.3
Perineal tear gr. III–IV	28	22	1.3; 0.7, 2.3
Instrumental delivery	52	50	1.1; 0.7, 1.6
Cesarean section	17	10	1.8; 0.8, 3.8
Placental retention	7	15	0.5; 0.2. 1.1
Occiput posterior+deep transverse presentation	13	29	0.5; 0.2, 0.9

paper dealing with perinatal mortality and morbidity among babies delivered *in water* (7). Using a postal survey they were able to identify 4,032 such deliveries, and found no substantially increased perinatal mortality. In our protocol, no baby was allowed to be born under water.

Odent (2), in his publication from 1983, points out that bathing during labor is of particular benefit for parturients having painful and ineffectual contractions. In observational studies following his publication, these findings have been corroborated (8, 9). The present study could not confirm that bathing during labor influences the need for epidural analgesia. In the meta-analysis, including three rather small randomized studies, a significant reduction was found in the use of epidural analgesia. However, the overall use of any analgesia was virtually the same in the bathing group as in the non-bathing group (5).

Also in the meta-analysis no difference was observed in the incidence of perineal trauma (5), a result that is supported by our data. Information regarding prescription of maternal antibiotics or the measuring of maternal temperature following delivery may be biased for several reasons. Therefore, as a measure of potential complications, we chose to evaluate maternal stay in hospital following delivery. No obvious difference between cases and controls was seen at any unit.

In Sweden about 1% of all newborns have an Apgar score <7 at 5 min (10), but in the present study we found a lower incidence, caused by our inclusion criteria. However, there was no obvious difference between the two groups. In the meta-analysis based on the three small randomized studies, the controls had a tendency to lower Apgar scores and also a reduced rate of low umbilical artery pH <7.20 (5). Our study can neither confirm, nor reject, the hypothesis that newborn infants of mothers who bathed during labor have an increased incidence of acidosis. At the time of the study, only Lund had routines for the analysis of pH. At the other units, pH determination was only performed at the discretion of the individual midwife or obstetrician. No difference between cases and controls in the mean pH value was evident at any of the units. The same was true of massive aspiration, tachypnéa and cerebral irritation.

Contrary to the meta-analysis of assisted vaginal delivery, where Nikodem (5) found a trend to a reduced incidence in the case group (OR 0.76; 95% CL 0.54, 1.07), the results of our study did not reveal any real difference between the two groups (OR 1.1; 95% CL 0.7, 1.6). Regarding cesarean section, we observed results similar to those in the meta-analysis (OR 1.2; 95% CL 0.7, 2.0), our OR being 1.8 (95% CL 0.8, 3.8). It is noteworthy that the overall cesarean section rate in our study (2.2%) is considerably lower than that in the meta-analysis (7.1%).

Once the study was planned and eventually started, there was no difficulty in implementing the idea of an investigation designed to reveal the negative or positive effects of bathing. As for obvious reasons the study could not be performed double-blind, one objection might be that a diagnostic bias was introduced. However, we believe that the majority of collaborating midwives and obstetricians were not prejudiced about bathing during labor. Regarding the pediatricians, we believe that the majority at all three units did not even know the study was running.

In conclusion, the results of the present study indicate that bathing during labor does not lead to any obvious detrimental effects for either the mother or her baby. On the other hand, beneficial effects such as a reduced proportion of epidurals, or a reduced rate of perineal tears, as claimed in previous observational studies, was not confirmed for the bathing parturient.

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