Immersion in Water in the First Stage of Labor: A Randomized Controlled Trial

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ABSTRACT: Background: *Current forms of analgesia often have significant side effects for women in labor. Bathing in warm water during labor has been reported to increase a woman's comfort level and cause a reduction in painful contractions. The objective of this trial was to compare immersion in warm water during labor with traditional pain management for a range of clinical and psychological outcomes.* **Methods:** *A prospective randomized controlled trial of 274 pregnant women, who were free from medical and obstetric complications and expecting a singleton pregnancy at term, was conducted at the Women's and Children's Hospital, a maternity tertiary referral center in Adelaide, South Australia. Women in labor were randomized to an experimental group who received immersion in a bath or to a nonbath group who received routine care. Pharmacological pain relief was the primary outcome that was measured, and secondary outcomes included maternal and neonatal clinical outcomes, factors relating to maternal and neonatal infectious morbidity, psychological outcomes, and satisfaction with care.* **Results:** *The use of pharmacological analgesia was similar for both the experimental and control groups; 85 and 77 percent, respectively, used major analgesia. No statistical differences were observed in the proportion of women requiring induction and augmentation of labor or in rates of perineal trauma, length of labor, mode of delivery, or frequency of cardiotocographic trace abnormalities. Neonatal outcomes (birthweight, Apgar score, nursery care, meconium-stained liquor, cord pH estimations) revealed no statistically significant differences. Infants of bath group women required significantly more resuscitation than routine group women. Routine group women rated their overall experience of childbirth more positively than bath group women. Psychological outcomes, such as satisfaction with care or postnatal distress, were the same for both groups.* **Conclusion:** *Bathing in labor confers no clear benefits for the laboring woman but may contribute to adverse effects in the neonate. (BIRTH 28:2 June 2001)*

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During the last decade bathing for the relief of pain in labor has gained popularity in several western countries. In 1992, in the United Kingdom, the House of Commons Health Committee released a report that recommended that "all women should be offered the option of a birthing pool during labor and birth" (1). A large survey conducted from 1992 to 1993 confirmed that the use of baths during labor and birth was already widespread (2). Although no published data are available that estimate the extent of this practice in Australia, most delivery suites and birthing units in the major tertiary centers in Adelaide, the setting for this study, have at least one bath installed and demand for this option of care is increasing.

Most evidence on the effectiveness of water immer-

sion has been provided from observational studies, retrospective studies, and empirical reports (3–7). Many have reported favorable outcomes, such as a reduction in the psychological tension associated with labor and in the use of analgesia and rate of intervention.

Before the start of this trial, only two small, randomized controlled trials had been published. The first, conducted in the United States ($n = 93$), did not demonstrate any significant advantages with immersion in warm water during labor (8). A later study conducted in Belgium ($n = 110$) found no improvement in objective pain relief with immersion in warm water (9). Subsequent to the start of our trial, a larger study ($n = 785$) reported a reduction in the combined use of epidural blockade or narcotic analgesia in the tub group, but this did not reach statistical significance ($p = 0.06$) (10).

These previous trials did not examine neonatal mortality and morbidity adequately, despite several reports suggesting an increase in these outcomes (11–14) and an early systematic review requesting urgent further research (15). In addition, little is known about other hypothesized benefits such as improvements in maternal satisfaction and postnatal distress.

In 1995 the Queen Victoria Hospital amalgamated with the Adelaide Children's Hospital to form the Women's and Children's Hospital, a large tertiary referral center in Adelaide, South Australia. The installation of six baths in the new delivery suite provided a unique opportunity to examine these issues in a trial situation. At the time, water immersion was not a routine option of care provided to women and no protocol had been established for the use of the bath. The aim of our study was to evaluate the effectiveness of warm water bathing in reducing a woman's need for pharmacological pain relief and also to address psychological outcomes that have not been examined previously.

Methods

The trial was conducted from May 1995 until September 1998, including follow-up. Women were eligible to participate if they planned to deliver at the hospital, were expecting a singleton pregnancy at term, and were free from medical and obstetric complications. Exclusion from the trial occurred if women experienced labor before 37 completed weeks of pregnancy, planned to deliver their baby by means of cesarean section, or required continuous electronic fetal monitoring. A history of group B streptococcal vaginal colonization or the need for parenteral narcotic or epidural blockade shortly after admission also resulted in exclusion. Women with ruptured membranes were not excluded.

Intervention

The environment in each delivery room was exactly the same with the exception or availability of bathtubs. These were included in the new hospital design and not as part of an upgrade of facilities. As such, they were permanently installed in the corners of the rooms with a step up to afford easier access. The bathtubs are approximately triangular shaped and are bounded on two sides by a wall. The sides measure 120 cm, and the longest side, which allows access, measures 160 cm. The depth of the tub is 54 cm, which is comparable with that reported in an earlier trial (9). These dimensions allowed women the flexibility to change position, as desired, by sitting upright, squatting, kneeling, or floating immersed to the neck. Baths were filled with tap water only, and the temperature was maintained to a maximum of 37° C. Water temperatures were measured hourly.

Procedure

The hospital's Research and Ethics Committee approved the study protocol. Eligible women, who were interested in having the option to bathe during labor, were enrolled in the antenatal clinic at 28 to 32 weeks' gestation after giving their informed consent. Randomization was performed when a woman was admitted to the hospital in labor or for surgical induction. At this time the attendant midwife telephoned the admission and emergency area of the hospital where a designated clerk provided a study number and treatment allocation by selecting consecutively numbered sealed opaque envelopes. A research assistant who was not involved any further in the study prepared the randomization schedule. Treatment assignment was determined by a restricted randomization scheme (using balanced variable blocks of 10) devised from random number tables. Stratification was performed by place of birth (general delivery suite or midwives birth center) and parity.

If a woman was assigned to the bath group and in established labor, she was allocated the appropriate delivery room, in which she could partake of a bath for as little or long as she wished during labor, but ceasing when the second stage was apparent or imminent. Birth under water was not promoted. A woman's desire for other forms of pain relief was respected, and if parenteral analgesia or epidural blockade was required, further access to the bath was not possible. Women assigned to the bath group who did not wish to bathe were not compelled to use a bath. The nonbath

group received routine hospital care, which did not include the use of a bath but allowed the option of a shower. The same midwives provided care to women in both arms of the trial.

It was necessary for staff to be aware of treatment allocation so they could assign a delivery room with or without a bath. In-service lectures were conducted initially and at regular periods throughout the trial to ensure that all midwives were familiar with the purpose and procedures of the trial. Study protocols were also distributed to all patient care areas, and an infection control policy was initiated after consultation with the hospital's infection control coordinator. Baths were cleansed with a solution of hospital grade disinfectant (Diversol 5000, 25 g sachet with 220 g per kilo of available chlorine; Diversey Lever, Sydney, Australia) and allowed to air-dry between each use.

Data Collection

Data were collected by the midwives and documented on the trial entry form at the time of randomization. Information included age, marital status, gestational age, cervical dilation, parity, socioeconomic indexes for area (SEIFA) (16), place of birth, and cigarette smoking. The variables used to create the index of relative socioeconomic status are based on a woman's postcode of residence, providing a single measure for attributes, such as low income, low educational attainment, and high unemployment in a particular area (comprising postcodes) rather than individuals. All clinical data were collected at the trial's completion by a review of case records by a member of the research team who was not responsible for providing patient care, but was not blinded to the treatment allocation, since all case records revealed this information. A different member of the team reviewed random selections of case records and information regarding maternal complications. Where appropriate, the data analyst was blinded to the study group allocation.

The primary outcome measure was the incidence of pain relief in the first stage of labor. Secondary outcome measures comprised data on maternal complications, and on interventions used in labor and delivery. Neonatal events included data on signs of infant compromise, such as clinical and laboratory indications of infection, antibiotic use and nursery care.

Maternal Self-Report Measures

The first self-report questionnaire was collected at 24 to 48 hours after delivery. A research assistant not involved in providing care administered the survey on the postnatal floor. The tool measured perceptions of pain, expectations of labor and delivery, and satisfaction with care and treatment allocation. The second questionnaire, which was mailed to women's homes 8 to 9 months later, measured the same variables as the first but also included postnatal distress. Two reminder letters and questionnaires were sent to nonresponders followed by one telephone call. The questionnaires were developed in consultation with individual women in the postnatal wards of the hospital, a current literature review, and incorporation of previously validated scales that included satisfaction with care and pain relief, perceptions of pain, expectations and postnatal distress (17–21).

Women's perceptions of pain and expectations of labor and delivery were measured using visual analog scales that ranged from zero at the far left of the scale (negative) to 100 mm at the extreme right (positive) (22). For satisfaction with care, each questionnaire item included a 5-point Likert scale ranging from 1, strongly agree to 5, strongly disagree. One-half of the items were negatively worded to reduce response bias. Only responses to items in which women strongly agreed were analyzed. This division was made on the assumption that women responding to other categories experienced some problem with the care they received (23).

Postnatal distress was measured using the Edinburgh Postnatal Depression Scale (24). Since the investigators were unable to intervene in a woman's care in the postnatal period, question 10 (the thought of harming myself had occurred to me) was omitted and a 9-item scale was used.

Sample Size and Analysis

The sample size was calculated with the expectation of a relative reduction of 20 percent in the use of pharmacologic analgesia during labor. Based on this information, a sample of 270 women would have an 80 percent probability, at the 5 percent level, to detect an effect of this magnitude ($p = 0.05$; 80% power). All data were analyzed on an intention-to-treat basis using Epi Info statistical package (25). Comparisons were made between groups for primary and secondary outcomes using the chi-square test for categorical data. The two-sample Student t test was used for normally distributed data, and Kruskal-Wallis nonparametric tests were used where data were not normally distributed. A p value of less than 0.05 was considered to be statistically significant. Relative risks with 95 percent confidence intervals were also calculated. Analysis of maternal satisfaction data included differences in proportions as the value for the bath group minus that for the group receiving routine care.

Results

Study Sample

On initial screening in the antenatal clinic, 611 women, fewer than 10 percent of the eligible population, returned signed consent forms and were registered for inclusion in the trial. Three hundred and thirty-seven women were found to be ineligible on admission to the hospital, primarily because of the need for immediate analgesia or electronic fetal monitoring. Subsequently, 274 women were randomized to the trial, 137 participants allocated to receive a bath and 137 allocated to routine hospital care (Fig. 1). Clinical data were unavailable for five newborns (3 bath, 2 routine care). One hundred and twenty-four (90%) women in the bath group returned the first postnatal questionnaire compared with 114 (83%) in the routine care group. Ninety-six (70%) women in the bath group responded to the second postnatal questionnaire compared with 91 (66%) in the routine care group. Randomization achieved similar groups (Table 1).

Seventy-one protocol violations occurred. Thirty-four women with group B streptococcal colonization were not excluded and were entered into the trial (17 in each group). One woman was less than 36 weeks' gestation (bath group). Of the 137 women allocated to receive routine care without bathing, 36 (26%) had access to the bath. High bed occupancy rates meant that it was not always possible to allocate a room

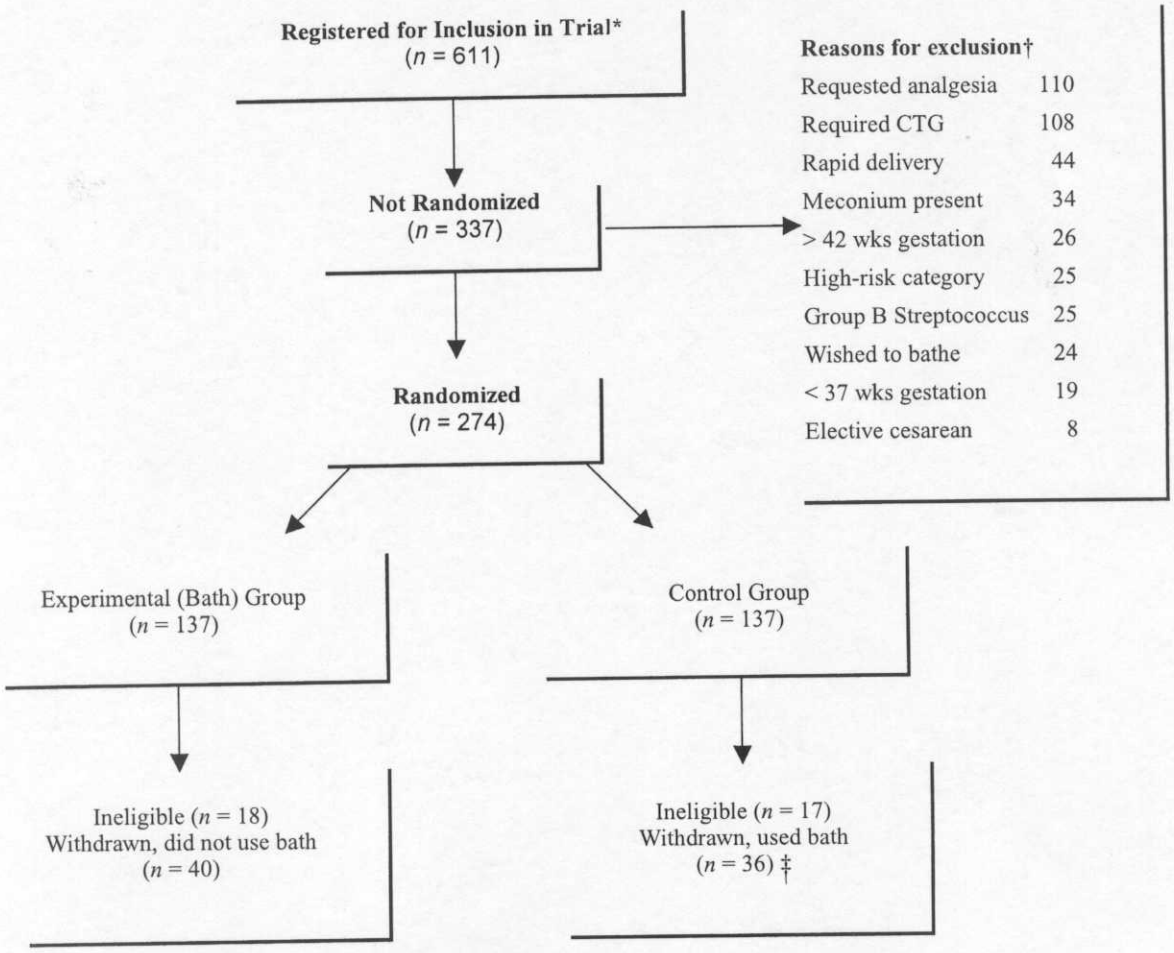

Fig. 1. Flow chart describing progress of participants through randomized trial.

*Enumeration of total eligible population prevented by practical constraints.
†A combination of reasons may have been documented.
‡Withdrawals due to a lack of participant cooperation. Analyzed by intention to treat. Participant flow chart calculated on clinical outcome data (primary outcome).

Table 1. Baseline Characteristics of Participants at Randomization

Characteristic	*Bath (n = 137)*	*Routine (n = 137)*
Maternal age (yr, mean ± SD)	28.4 (5.4)	27.2 (5.1)
Gestational age (wk, mean ± SD)	39.9 (1.0)	39.9 (1.0)
Cervical dilation at entry (cm, mean ± SD)	3.25 (2.1)	3.43 (2.5)
Parity		
Primiparous	79 (57%)	79 (57%)
Multiparous	58 (42%)	58 (42%)
Place of birth		
Birthing center	42 (31%)	40 (29%)
Delivery suite	95 (69%)	97 (71%)
Marital status		
Single	23 (17%)	18 (13%)
Married	108 (79%)	118 (86%)
Divorced/widowed/de facto	6 (4%)	1 (0.7%)
Smoking	29 (21%)	31 (23%)
Socioeconomic index (SEIFA)	998.5 (75.7)	994.1 (73.2)

SEIFA = Socioeconomic Index for Areas.
Variables used to create index of relative socioeconomic disadvantage focus on attributes, such as low income, low educational attainment, and high unemployment. The indices reflect the socioeconomic well-being of an area rather than an individual. Cutoff points divide the Australian population into 4 groups of equal numbers. These cutoff points were applied to the current study's sample to yield 4 categories (category 1 = highest to category 4 = lowest).
Data are presented as quantile ranges. For postcodes in South Australia, the 10% quantile is 905. One-tenth of postcode in South Australia have a score on the index below 905.

without a bath to those assigned to routine care, and some midwives did not think that they could refuse a woman's request to use the bath even though this was in breach of the study protocol. Despite the protocol violations, women were included in the analysis on an intention-to-treat basis. Of the 137 women allocated to the experimental group, 97 (71%) chose to use a bath. Common reasons given for not bathing included the need for pharmacological analgesia (10), labor progressed too quickly (10), continuous monitoring was required (2), the presence of group B streptococcal colonization (1) did not wish to use a bath (4), bath not available (1), or no reason was given (12).

Pharmacological Pain Relief Requirements

Neither group demonstrated a difference in the amounts of pharmacological analgesia (Table 2). Although women expressed initial enthusiasm, 40 (29%) of the 137 in the bath group did not use the bath. Of those who bathed, the median duration of time spent in the bath was 60 minutes (minimum 5 min, mean 78.90 min, maximum 360 min). The most frequent reason given for why women left the bath was that the bath became too uncomfortable when the intensity of the contractions increased and further pain relief was required. When subgroup analysis was performed on the use of major analgesia (in women who actually used the bath in both groups [133] and the routine care group [101], excluding 36 women who crossed over from routine care to immersion in labor), 99 (84%) women who bathed required major analgesia compared with 82 (81%) in the group who did not use the bath (RR 0.92, CI 0.80–1.05, $p = 0.22$). Therefore, even though 40 women randomized to the bath group reneged, a high proportion of women who used the bath required major analgesia.

Maternal and Neonatal Clinical Outcomes

No differences occurred between groups in the proportion of women requiring induction (bath 21%, routine care 20%; RR 1.07, 95% CI 0.62–1.67) or augmentation of labor (bath 32%, routine care 36%; RR 0.88, 95% CI 0.63–1.22). Perineal trauma was comparable in both groups. Four bath group women and 2 routine care group women experienced a third degree tear, and 1 woman in the bath group had a fourth degree tear (RR 2.54, 95% CI 0.50–12.85). Length of labor, both for each stage or overall, was the same in both groups (Table 3). Similarly, modes of delivery did not differ statistically. One unintentional water birth occurred in the bath group. The frequency of cardiotocographic trace abnormalities during labor did not vary between the two groups (bath 42%, routine care 43%; RR 0.98, 95% CI 0.75–1.29). A high proportion of women breastfed their infant on discharge from the hospital (bath 91%, routine care 95%).

Analysis of neonatal outcomes revealed no statistically significant differences between the two groups (Table 4). Although no difference occurred between the groups in the individual use of oxygen, bag and

mask, and intermittent positive pressure ventilation, when these measures were combined, newborns in the study group required significantly more resuscitation than those in the control group (RR 1.41, 95% CI 1.06–1.89, $p = 0.01$).

Factors Relating to Maternal and Neonatal Infectious Morbidity

No statistically significant differences were detected between the two groups for factors relating to maternal infectious morbidity. Overall, the time from ruptured membranes to delivery between the bath and routine care groups did not differ (bath: mean minutes 314 [SD 261], routine care: mean minutes 281 [SD 277], $p = 0.31$). Three women receiving routine care experienced prolonged ruptured membranes (> 24 hr) and were prescribed prophylactic antibiotics. The mean number of vaginal examinations performed during labor was similar (bath: mean 3.10 [SD1.84], routine care: mean 3.15 [SD1.88] $p = 0.89$). Seven women (5%) in the bath group compared with 4 women (3%) in the routine care group experienced pyrexia in excess of 37.5°C (RR 1.75, 95% CI 0.52–5.84, $p = 0.35$) in

Table 2. Pharmacological Pain Relief Requirements

*Pain Relief**	*Bath (n = 137)* No.	(%)	*Routine (n = 137)* No.	(%)	*RR, 95% CI*	
No pain relief	23	(17)	27	(20)	0.85	(0.52–1.41)
Nitrous oxide	80	(58)	79	(58)	0.98	(0.83–1.16)
Pethidine	55	(40)	48	(35)	1.11	(0.83–1.47)
Epidural or spinal anesthesia	46	(33)	49	(35)	0.91	(0.67–1.23)
IV fentanyl	16	(12)	9	(6)	1.88	(0.74–4.85)
General anesthesia	2	(1)	1	(0.7)	1.93	(0.18–20.98)
Major analgesia†	117	(85)	106	(77)	1.10	(0.98–1.24)

**A combination of methods may have been used.*
†Includes pethidine/fentanyl/epidural blockade combined.
RR = relative risk; CI = confidence interval.

Table 3. Maternal Clinical Outcome Measures

Outcome	*Bath (n = 137)*		*Routine (n = 137)*		*RR, 95% CI* p	
Duration of labor (min, mean ± SD)						
First stage	404.23	(225.23)	407.21	(222.56)	0.89	
Second stage	64.94	(66.25)	68.80	(69.80)	0.65	
Third stage	15.58	(33.36)	13.42	(17.74)	0.15*	
Total duration of labor (min, mean ± SD)	459.75	(244.23)	450.42	(247.83)	0.76	
Mode of delivery						
Spontaneous vertex	102	(74%)	99	(72%)	1.03	(0.89–1.19)
Instrumental (forceps/ventouse)	26	(19%)	35	(25%)	0.74	(0.47–1.16)
Vaginal breech	1	(0.7%)	1	(0.7%)	1.00	(0.06–15.83)
Emergency cesarean	11	(8%)	9	(6%)	1.22	(0.52–2.86)
Rupture of membranes in bath†	17	(17.5%)	7	(19.4%)	0.90	(0.41–1.99)
Perineal trauma‡						
Intact perineum	53	(42%)	54	(42%)	1.00	(0.75–1.33)
Grazes	30	(24%)	27	(21%)	1.11	(0.70–1.77)
Episiotomy	35	(28%)	32	(25%)	1.09	(0.72–1.66)
Episiotomy, extended	3	(2%)	2	(1%)	1.50	(0.25–8.84)
First degree tear	26	(21%)	22	(17%)	1.18	(0.71–1.98)
Second degree tear	32	(25%)	43	(33%)	0.74	(0.50–1.10)
Third degree tear§	5	(4%)	2	(1%)	2.54	(0.50–12.85)

Level of K = 0.05.
**Kruskal-Wallis nonparametric test.*
†Denominator includes number who bathed in each group.
‡Denominators exclude emergency cesarean section.
§Numerator includes third degree tears + 1 fourth degree tear in bath group.
RR = relative risk; CI = confidence interval.

Table 4. Neonatal Clinical Outcome Measures

Outcome	Bath (n = 137)		Routine (n = 137)		RR, 95% CI p	
Birthweight (g, mean ± SD)†	3536	(384)	3548	(424)	0.79	
Apgar scores†						
< 7 at 1 min	26	(19%)	18	(13%)	1.44	(0.83–2.51)
Overall at 1 min (median ± SD)	9.00	(1.7)	9.00	(1.5)		0.23
< 7 at 5 min	1	(0.7%)	0	(0%)		–
Overall at 5 min (median ± SD)	9.00	(0.7)	9.00	(0.6)		0.68*
Nursery care†						
Direct room in (yes/no)	77	(57%)	77	(57%)	1.01	(0.82–1.24)
Level I (days)‡	1.17	(0.54)	1.10	(0.31)		0.12*
Level II (days, mean ± SD)‡	4.66	(6.3)	5.00	(5.2)		0.94
Level III (days, mean ± SD)‡	1.50	(0.70)	2.66	(2.08)		0.51
Neonatal signs of compromise						
Meconium-stained liquor	33	(25%)	28	(21%)	1.18	(0.76–1.84)
Meconium present on baby	10	(7%)	10	(7%)	1.01	(0.43–2.34)
Cord pH (mean ± SD)	7.29	(0.07)	7.27	(0.06)		0.25
Neonatal resuscitation measures						
Nil resuscitation	52	(39%)	59	(44%)	0.89	(0.67–1.18)
Aspiration	76	(57%)	72	(53%)	1.06	(0.86–1.32)
O_2 alone	47	(35%)	36	(27%)	1.32	(0.92–1.89)
Bag & mask	15	(11%)	10	(7%)	1.51	(0.70–3.24)
IPPV via ETT§	4	(3%)	1	(1%)	4.03	(0.46–35.59)
Combined resuscitation¶	66	(49%)	47	(35%)	1.41	(1.06–1.89)

Level of K = 0.05.
**Kruskal-Wallis nonparametric test.*
†Denominators include data for all randomized participants; other denominators exclude unknown data (bath/routine care 3/2, respectively).
‡Any period less than 24 hr = 1 day spent in nursery.
§Intermittent positive pressure ventilation (IPPV) via endotracheal tube (ETT).
¶Includes oxygen/bag and mask/IPPV combined.
RR = relative risk; CI = confidence interval.

the intrapartum period. Similarly, no differences were detected between the groups in postpartum pyrexia (bath 7%, routine care 10%; RR 0.71, 95% CI 0.33–1.55, $p = 0.39$). No cases of chorioamnionitis were detected in either group. Despite the protocol specifying hourly monitoring of bath temperatures, these were recorded for only 51 of the 97 (50%) women who used a bath (mean 35.8°C, median 37°C).

No significant differences occurred between the groups for either clinical or laboratory indicators of possible neonatal infection. Clinical indicators included hyperthermia (> 38°C), hypothermia (< 35.5°C), hypoglycemia (defined as a blood glucose level < 2.3 mmol/L via bedside testing using a glucometer, or a plasma glucose level of < 2 mmol/L followed by treatment, e.g., early feed, IV glucose) and hyperglycemia (defined as a blood glucose level of > 9 mmol/L). Three infants (2%) in the bath group compared with 5 (4%) in the routine care group had temperatures in excess of 37°C (RR 0.60, 95% CI 0.15–2.48), and of these, 1 infant in each group had a temperature exceeding 38°C (not significant).

Similar frequencies of laboratory testing occurred in the two groups. Eighteen newborns received antibiotic therapy (bath 7%, routine care 6%). Three cases of antepartum hemorrhage occurred (bath 0.7%, routine care 1%), and 31 cases of postpartum hemorrhage (a blood loss of ≥ 600 ml) (bath 14%, routine care 9%; RR 1.58, 95% CI 0.80–3.13).

Psychological Outcomes, Experiences, Expectations, and Satisfaction with Labor and Birth

At 24 to 48 hours and at 8 months post delivery, no differences in mean score ratings occurred for impression of pain experienced or adequacy of pain relief (Table 5). Women in the routine care group rated their overall experience of childbirth more positively than women allocated to the bath group (routine care: mean 74.62 [SD 22.08]) vs bath: mean 68.74 [SD 24.31], $p = 0.05$). This effect was not evident at 8 months postpartum.

In the bath group the percentage of women satisfied with their relationship with staff, social support, information, choices, and decisions and general satisfaction was generally lower than in the routine care group. However, these differences did not reach statistical significance.

We observed no statistically significant differences between the two groups for postnatal distress. Fourteen women (15%) in the bath group compared with 12

Table 5. Women's Self-Reported Experiences of Labor and Birth Measured at 24–48 Hours and 8 Months After Birth

	24–48 Hours			*8 Months*		
Outcome	*Bath (n = 121)*	*Routine Care (n = 111)*	p	*Bath (n = 96)*	*Routine Care (n = 91)*	p
Labor more/less painful *(0 = much less, 100 = much more painful)*	64.63 (27.55)	60.46 (26.16)	0.23	58.63 (28.20)	59.36 (25.68)	0.85
How painful were your contractions *(0 = no pain, 100 = worst possible pain)*	75.92 (19.05)	76.26 (19.36)	0.89	73.34 (19.87)	74.45 (20.65)	0.70
Given adequate pain relief *(0 = very dissatisfied, 100 = fully satisfied)*	84.95 (21.60)	86.60 (20.69)	0.55	76.17 (27.68)	79.95 (23.99)	0.32
Feeling in control *(0 = not in control, 100 = in complete control)*	63.48 (26.91)	67.03 (26.35)	0.30	58.28 (30.98)	63.83 (27.66)	0.19
Labor/delivery met with expectations *(0 = did not meet expectations, 100 = totally met expectations)*	61.26 (30.97)	64.80 (29.70)	0.37	63.05 (31.13)	64.05 (30.42)	0.82
Overall experience of childbirth *(0 = thoroughly unsatisfactory,100 = absolutely wonderful experience)*	68.74 (24.31)	74.62 (22.08)	0.05	72.68 (27.86)	77.21 (22.21)	0.22

Results presented = mean score (± SD).
Level of K = 0.05.

women (13%) in the routine care group recorded a score of ≥ 13 on the Edinburgh Postnatal Depression Scale.

Discussion and Conclusions

The trial did not demonstrate a reduction in the use of pharmacologic analgesia from nitrous oxide, pethidine, or epidural blockade in the bath group. When the major forms of analgesia (pethidine, fentanyl, epidural) were combined, no significant differences occurred between the two groups. As well as objective pain relief measures, women's perceptions of pain did not differ, as previously reported (9).

This study had sufficient power to determine if bathing in labor had an effect on pain relief requirements. Its evaluation of psychological outcomes, experiences, expectations, and satisfaction with labor and birth offers new information. A shortcoming of the trial related to our inability to obtain precise estimates for the total population of eligible women who attended the antenatal clinics, which inevitably affected the external validity of the trial. In addition, an obvious limitation was that 40 women (29%) in the bath group declined a bath, and a similar proportion (26%) in the routine care group bathed. Although the results of this study are presented on the basis of intention to treat, an analysis of actual treatment received did not alter the results.

Knowledge of the treatment status may have contributed to women's dissatisfaction with group allocation and noncompliance. In anticipation of this potential source of bias, we asked women if they were happy with the group to which they were allocated. Of the 104 women in the bath group who responded to this question, only one was dissatisfied compared with 30 percent (28/96) of women in the routine care group. Despite this fact, women in the routine care group were more positive about their labor and birth compared with those in the bath group, suggesting that changing the environment by allowing women the option of a bath did not influence the way that care was provided to study participants. The advocacy of baths by hospital antenatal educators and physiotherapists during hospital tours, women's magazine articles, and the media made many women aware of the possible beneficial effects of bathing in labor. It is possible that women assigned to the bath group may have experienced raised expectations and then were disappointed with the outcome.

Maternal outcome measures, such as rate of induction and augmentation, perineal trauma, duration of stages of labor, and mode of delivery were similar between the two groups. These results are consistent with those reported in a recent systematic review of trials of immersion in water during pregnancy, labor, and birth (26). We also found no increase in infectious morbidity in women who bathed during labor, but the trial had the power only to detect a large rise in infection and clinically significant rises were not ruled out.

It is of some concern that infants in the bath group required significantly more resuscitation than those receiving routine care. This observation requires confirmation in other studies. One possibility is that water

temperatures were not well monitored in the bath group in our study, as has been observed elsewhere, and water temperatures greater than 37° C may have been used, resulting in an adverse fetal effect (14,27–29). Anecdotally it is often believed that a warm or hot bath may soothe pain in labor. In fact, informal interviews with delivery suite midwives revealed that many were unaware that water temperatures above body temperature may compromise the fetus. These facts highlight the need for further education in the importance of frequently measuring bath water temperatures and discouraging relatives or support persons from running hot water into the baths.

No other differences in neonatal outcomes, such as Apgar scores and length of time spent in the nursery, were observed between the groups. Neonatal infectious morbidity associated with bathing in labor has been reported (11,12,30). We found no statistical differences between the groups in suspected or confirmed cases of infection.

Bathing in labor confers no clear benefits for women in labor. Although the results demonstrate no risks from water immersion, other than an increased use of neonatal resuscitation in the bath group, the trial was not designed to address these issues adequately, and the potential for adverse events such as infection and fetal hyperthermia exists. Hypothesized benefits of a reduction in pain relief from bathing during labor have been suggested, but this and other trials do not support them. This finding has important implications for the planning and provision of labor services, not only in new delivery units, but also in the refurbishing of existing units. The potential waste of resources required for a form of care that provides little benefit could be substantial. Therefore, if immersion in water is to continue as a form of care, it should do so only in the context of a much larger clinical trial or comprehensive audit of all cases. Written protocols for temperature control, bath sterilization, fetal monitoring, and appropriate exclusion criteria are essential requirements.

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