

ORIGINAL ARTICLE

Acupuncture administered after spontaneous rupture of membranes at term significantly reduces the length of birth and use of oxytocin. A randomized controlled trial

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Abstract

Background. The objective was to investigate whether acupuncture could be a reasonable option for augmentation in labor after spontaneous rupture of membranes at term and to look for possible effects on the progress of labor. **Methods.** In a randomized controlled trial 100 healthy parturients, with spontaneous rupture of membranes at term, were assigned to receive either acupuncture or no acupuncture. The main response variables were the duration of active labor, the amount of oxytocin given, and number of inductions. **Results.** Duration of labor was significantly reduced (mean difference 1.7 h, $p=0.03$) and there was significant reduction in the need for oxytocin infusion to augment labor in the study group compared to the control group (odds ratio 2.0, $p=0.018$). We also discovered that the participants in the acupuncture group who needed labor induction had a significantly shorter duration of active phase than the ones induced in the control group (mean difference 3.6 h, $p=0.002$). These findings remained significant also when multiple regression was performed, controlling for potentially confounding factors like parity, epidural analgesia, and birth weight. **Conclusion.** Acupuncture may be a good alternative or complement to pharmacological methods in the effort to facilitate birth and provide normal delivery for women with prelabor rupture of membranes.

Key words: *Acupuncture, labor, duration, augmentation, PROM, prelabor rupture of membranes*

Acupuncture is a method with few side effects that supports the natural birthing process (1). It requires no assistance from personnel other than a midwife with acupuncture skills, nor extra surveillance of the fetus or the woman in labor. Acupuncture is well suited for healthy, pregnant women, and is in agreement with the guidelines of WHO; its purpose is to limit the use of drugs and to prevent unnecessary interventions in normal pregnancies and labor (2). Women increasingly request the use of acupuncture; it is therefore of great importance to document its effects. The main risk after prelabor rupture of membranes (PROM) at term is ascending intrauterine infection. Ninety percent of women with PROM will go into labor naturally within 48 h (5).

Our hypothesis is: “Women who experience spontaneous rupture of the membranes at term will have an earlier and more spontaneous start of labor and

thus a more natural labor when given acupuncture treatment”.

There was a Cochrane Review of studies on acupuncture to augment labor in 2004, which only accepted one small study (3). In this randomized controlled trial (RCT) study Rabl et al. found that acupuncture in women at term increased cervical ripening and shortened the period from time of confinement to delivery (15). We also found a randomized German study from 1998, on 900 primigravidas, where women in the acupuncture group experienced a significant reduction in the ripening phase of the cervix and a shorter duration of labor after acupuncture treatment starting several weeks before term (4).

The aim of our study was to evaluate if acupuncture treatment had an influence with regard to duration of labor and the outcome of delivery in

relation to conventional induction in women with PROM at term.

Material and methods

From April 1, 2003 to February 1, 2005, 100 protocol-eligible women with PROM agreed to take part in this study: 48 in the acupuncture group and 52 in the control group.

Routine care at our hospital is induction of labor approximately 24 h after PROM. All participants in our study were in the category to receive this routine treatment. When they arrived at the hospital to confirm that their waters had broken and to have a CTG, they were invited to participate in the study. Inclusion criteria were an uneventful pregnancy, a single, cephalic presentation at term and confirmed PROM. PROM was confirmed either by a midwife or an obstetrician by visual determination of amniotic fluid or by a PROM test, i.e. prelabor rupture of membranes test: vaginally performed test to detect amniotic fluid. An information interview took place and all signed a written informed consent in which they agreed not to have any acupuncture treatment, except the one they might receive as part of the study. When labor started all women were free to have acupuncture for pain relief. The midwife also determined whether labor had started. Women with contractions occurring at least every 10 min, lasting more than 30 s were excluded. The randomization list was computer generated in SPSS and participants were allocated to the acupuncture or control groups by the midwife who opened a closed, not transparent envelope, which was kept in the labor ward.

The research protocol of this study was accepted by the regional ethics committee.

Six women were subsequently excluded because they had a cesarean delivery: four in the acupuncture group, and two in the control group. They were excluded because they did not deliver vaginally and the cesarean was performed for different reasons; we therefore found these labors impossible to compare with the others. Indications for cesarean were, in the control group, one woman delivered at 8 cm because of failure to progress, the other received a cesarean on maternal request before onset of labor because she refused an induction. In the acupuncture group there was one cesarean performed because of maternal infection, before onset of contractions, and the others were performed at fully dilated cervix: two because of fetal malposition, one because of a pelvic malformation, and one previous cesarean. In each of the groups one woman was excluded because of intact membranes.

One participant in the control group was excluded because she by mistake received an acupuncture treatment before labor had started. After exclusion, 43 women remained in the study group and 48 in the control group.

For the acupuncture treatment we used thin, sterile, stainless steel needles. All women in the study group received the same three points, which are believed to be important for women with PROM. These are called ST36, LR3, and CV4. ST36 was given to increase energy. LR3 was guided towards KI1 in order to soften the cervix, while CV4 was guided towards CV3 to open the meridian called conception vessel. In addition we used pulse and tongue diagnosis and the principles of traditional Chinese medicine to give each woman individual treatment. All together we used nine different points (Figure 1). The treatment lasted for approximately 20 min. After this treatment the women left the hospital to await spontaneous onset of labor. If this did not occur in approximately 24 h after PROM the women came back to hospital for induction of labor. The conventional treatment is induction either by oxytocin infusion or vaginal prostaglandins in accordance to Bishop's score. Bishop's score is a method to evaluate the maturity of the cervix on a scale from 0 to 10 points, if at more than 5 points we usually start an infusion of oxytocin, and at less we use prostaglandins to obtain a more favorable cervix. After 24 h we tested for signs of infection using serial C-reactive protein levels and leukocyte counts, maternal temperature, and pulse. For those women who had more than 3 cm dilatation on admission, the time for start of established contractions as registered in the women's journals was used for calculating the length of labor. Onset of active phase of labor was defined as: cervix dilated 3 cm and at least 2 contractions per 10 min.

Statistics

In addition to standard descriptive statistical analyses, several tests of significance were performed and confidence intervals calculated. For categorical variables, chi-square tests were used. In the continuous case, the Student's *t* distribution was used to calculate *p*-values and confidence intervals if the assumptions underlying these methods were appropriate. For non-normal data, the Mann-Whitney *U*-test was implemented. Kaplan-Meier plots were also made and *p*-values calculated based on the log-rank test. Bivariate correlations were assessed using Pearson or Spearman correlation, the latter when the assumption of normality did not apply. We used multiple regression as a control method for

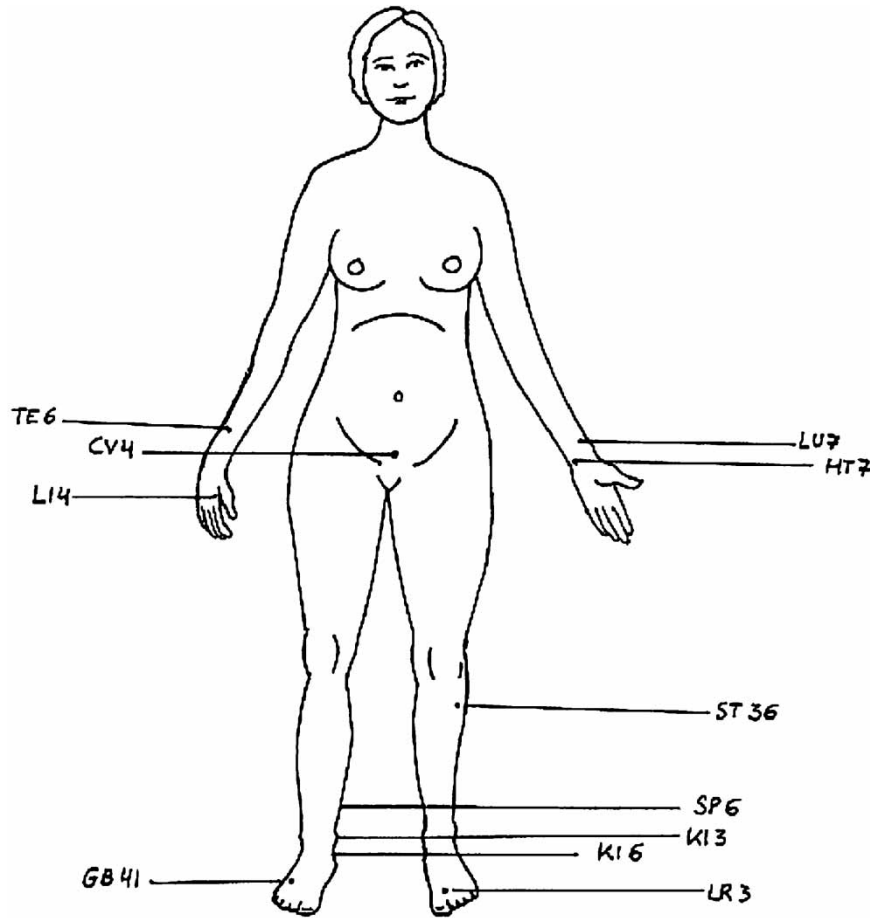


Figure 1. The points used in acupuncture.

potentially confounding variables like parity, epidural analgesia, and birth weight.

Results

Acupuncture shortened the time from PROM to delivery. On average the interval from PROM to delivery in the acupuncture group was 32.7 h compared with 29.1 h in the acupuncture group, but the result was not significant and therefore did not confirm our hypothesis.

Women who received acupuncture during the first 24 h after PROM had a significantly shorter duration of labor. The acupuncture was given between 1.7 and 21.8 h after PROM. On average the acupuncture group had an active phase lasting 4 h and 28 min, in contrast to the control group who had an active phase lasting 6 h and 5 min ($p=0.027$, mean difference 1.7, 95% confidence interval 0.2–3.1). Figure 2 shows the duration of active phase as a Kaplan–Meier plot. The p -value based on the log-rank test was slightly lower, 0.025, for this analysis compared to the previous. There were 27 nulliparous women in the control group and 25 in the

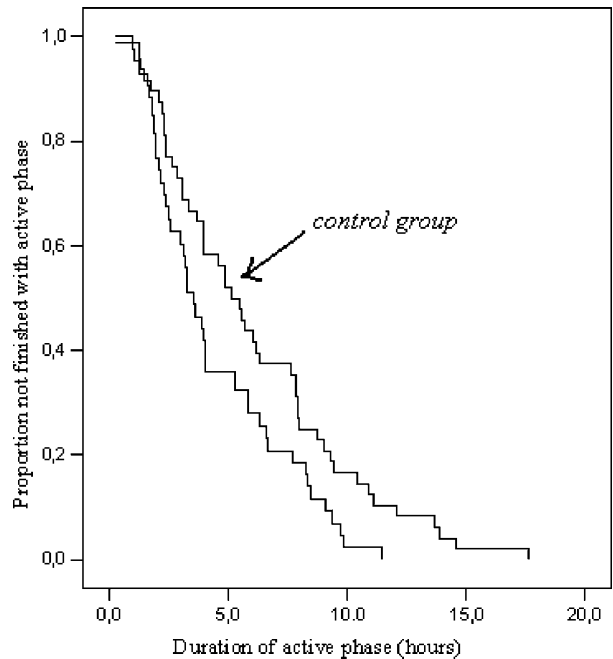


Figure 2. The Kaplan–Meier plot compares duration of active phase in acupuncture and control group (indicated in figure).

Table I. Some summary statistic of the acupuncture and control groups.

Variable	Acupuncture (n=43)	Control (n=48)	p-value	Effect measure
Nulliparous	25	27		
Duration of active phase (h)	4.4	6.1	0.027	diff 1.7 (0.2, 3.1)
Oxytocin >2 h (n)	9	21		
Oxytocin <2 h (n)	16	10	0.018	OR 2.0 (1.1, 3.8)
Instrumental deliveries (n)	6	13	0.16	OR 1.6 (0.8, 3.4)
Time from SROM to birth (h)	29	32.7		
Inductions (n)	15	19		
5 min Apgar score ≤7	0	0		
Epidural	13	15		
Maternal infection	0	1		
Fetal infection	0	0		
Bleeding (average ml)	355	375		
Vaginal tears	9	10		
Perineal tears (degree 1–2)	26	22		
Mean birth weight	3,427	3,549		

acupuncture group. The use of epidural analgesia was similar in both groups: 30.1% in the acupuncture group and 31.3% in the control group. To check for potential confounding effects of parity, epidural analgesia, and birth weight, we performed multiple linear regression with active phase as dependent variable. Parity and epidural analgesia turned out to be significant prognostic factors for duration, as could be expected. Birth weight was not significantly different in the groups. The *p*-value corresponding to group difference was reduced from 0.027 to 0.008 for this analysis.

The use of acupuncture leads to a significant reduction in the need of oxytocin infusion to augment labor as 21 women in the control group required oxytocin for more than 2 h compared with only 9 women in the acupuncture group (*p* = 0.018; OR = 2.0, 95% CI 1.1–3.8, see Table I). This finding remained significant (*p* = 0.016) in a multiple logistic regression where we controlled for the same potentially confounding variables as we did in the linear regression. Epidural analgesia was significant as anticipated, whereas parity and birth weight were not significant.

Twenty women in the control group and 15 from the acupuncture group needed conventional induction of labor with prostaglandins, oxytocin, and/or amniotomy. Prostaglandins were used for induction in 7 cases (16.3%) in the acupuncture group and 11 cases (22.9%) in the control group; this difference was not significant. Labor was induced by an oxytocin infusion in 8 cases (18.6%) in the acupuncture group and in 9 cases (18.8%) in the control group. Three women in each group had an amniotomy performed because membranes remain intact in front of the fetus head despite the fact amniotic fluid was leaking. High rupture (hindwater) (5) of the

membranes required amniotomy. Excluding these women led to essentially the same results.

Those in the acupuncture group who had an induction got through the active phase of birth in half the time compared to those who were induced in the control group. The difference was significant: 3.46 versus 7.06 h (*p* = 0.002, 95% CI for difference: 1.4–5.8). The duration of active phase is illustrated in the Kaplan–Meier plot of Figure 3. The *p*-value based on the corresponding log-rank test is also 0.002. It seems that the women who had received an acupuncture treatment benefited from this even

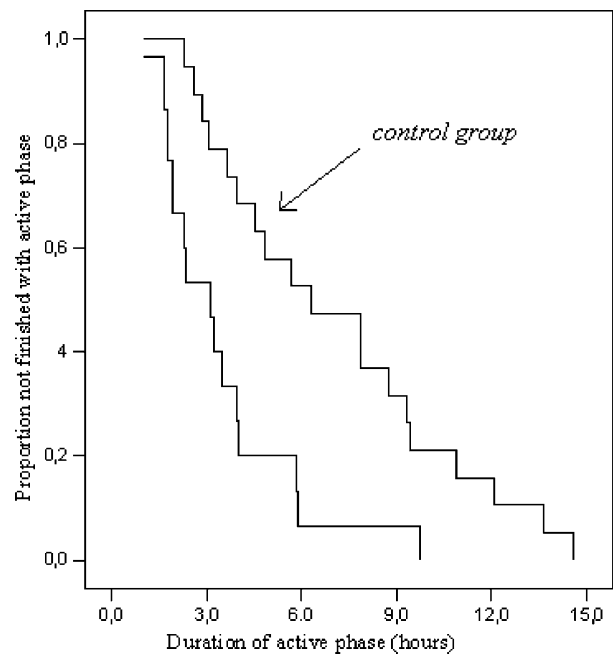


Figure 3. The Kaplan–Meier plot shows duration of active phase for induced births in the two groups. The indicated line corresponds to the longer durations in the control group.

when they belonged to the group who needed induction.

Our study showed that 13 women in the control group had instrumental deliveries, in contrast to 6 women in the acupuncture group. However, this difference was not significant. In the acupuncture group 5 women had instrumental delivery for failure to progress and one for threatening birth asphyxia. In the control group the reasons were failure to progress in 7 cases and threatening birth asphyxia in 6 cases.

No adverse effects of acupuncture were found in relation to delivery outcome (Table I).

Discussion

The main finding of this study is that acupuncture treatment resulted in a significantly shorter active phase of labor (p -value 0.027). The multiple regression analyses show that epidural analgesia, birth weight, and parity cannot reasonably explain this difference. Three randomized trials (6–8) and a Cochrane review (17) have shown that epidural analgesia prolonged the duration of labor. In response to this effect more administration of epidural in the control group could have explained the longer duration of the active phase, and if we had more nulliparas in the control group we could have seen the same effect, because nulliparas usually have longer labors (9).

The other main findings in our study were that women in the acupuncture group needed significantly less oxytocin to stimulate contractions during labor ($p = 0.018$), and that the induced women in the study group got through the active phase of labor in half the time compared to those who were induced in the control group.

Other researchers on acupuncture have proposed explanations as to why acupuncture has beneficial effects on the laboring process. Römer et al. (a RTC) (4), Zeisler et al. (not a RTC) (13), and Rabl et al. (RTC) (15) show that prelabor acupuncture leads to a considerably improved ripening of the cervix. The first paper describes a significant increase in the Bishop score, while the second finds a significant increase in the serum level of prostaglandin E₂ in the acupuncture group. Rabl et al. found a significant shortening of the cervix in the acupuncture group. Römer et al. (4) and Zeisler et al. (14) show a significant shortening of the active phase of labor in the acupuncture group. Rabl et al. (15) find a significant shortening of the time from expected date of confinement to delivery in the acupuncture group, but no difference in the active phase of labor. This is a small study, with 25 in the acupuncture

group and 20 in the control group, while Romer et al. had a larger study with 900 participants.

Tempfer et al. (16) performed a matched pair study to see if a weekly acupuncture treatment from week 35 to week 39 would increase maternal serum levels of interleukin-8, prostaglandin F_{2α}, and β-endorphin, which are seen as important contributors in cervix ripening. They did not find a rise in these substances in the study group, however they found that women in the acupuncture group had a significantly shorter first stage of labor. They conclude that the acupuncture treatment might increase uterine contractility either by parasympathetic stimulation of the uterus or by central oxytocin release. This is in accordance with our second main finding that acupuncture significantly reduces the need of oxytocin infusion to augment labor. A possible explanation is that with acupuncture in order to ripen cervix, we obtain more favorable contraction co-ordination. This has also been seen in animal tests (4). The mechanism of cervical ripening is far from understood; an increased concentration of hyaluronic acid and content of water in cervix, which leads to a softening and change of consistency in the period before contractions begin is a possible explanation (4). Acupuncture supports the natural process of giving birth. No adverse effects such as abnormal contractions or infections were recorded (Table I). Severe uterine contractions, which have caused cervical rupture and abnormal CTG, are described after administration of oxytocin or prostaglandins (5,12). Pharmacological induction/augmentation must take place in hospital and requires surveillance of the mother and fetus (10). A RCT shows that continuous surveillance of the fetal heart during labor leads to unnecessary interventions (11). Other randomized trials have already shown that acupuncture results in a significant reduction of labor pain (12) and WHO mentions acupuncture as a nonpharmacological method to use during labor (2).

Conclusion

We suggest acupuncture to be a good alternative or complement to pharmacological methods as a part of the treatment of women with PROM. Ideally, acupuncture treatment should be offered to all women with PROM, and other pregnant women who wish to use this method, in order to facilitate their birth and keep it normal. Further trials with a larger number of patients are required to study effects on labor. The labor experience as well as duration of labor should be scrutinized in these trials.

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