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Associations between maternal characteristics and women's responses to acupuncture during labour: a secondary analysis from a randomised controlled trial

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ABSTRACT

Background Patient characteristics are modulators of pain experience after acupuncture treatment for chronic pain. Whether this also applies to labour pain is unknown.

Aim To examine for associations between maternal characteristics and response to acupuncture in terms of labour pain intensity in close proximity to the treatment (within 60 min) and over a longer time period (up to 240 min), and whether or not epidural analgesia is used, before and after adjustment for obstetric status upon admission to the labour ward.

Methods Cohort study (n=253) using data collected for a randomised controlled trial. Associations were examined using linear mixed models and logistic regression analyses. Tests of interactions were also applied to investigate whether maternal characteristics were influenced by treatment group allocation.

Results In close proximity to the treatment, advanced age and cervical dilation were associated with lower pain scores (mean difference (MD) −13.2, 95% CI −23.4 to −2.9; and MD −5.0, 95% CI −9.6 to −0.5, respectively). For the longer time period, labour pain was negatively associated with age (MD −11.8, 95% CI −19.6 to −3.9) and positively associated with dysmenorrhoea (MD 5.5, 95% CI 1.6 to 9.5). Previous acupuncture experience and advanced cervical dilatation were associated with higher and lower use of epidural analgesia (OR 2.7, 95% CI 1.3 to 5.9; and OR 0.3, 95% CI 0.1 to 0.5, respectively). No interactions with treatment allocation were found.

Conclusions This study did not identify any maternal characteristics associated with women's responses to acupuncture during labour.

Trial registration number NCT01197950; Post-results.

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INTRODUCTION

During the process of childbirth, the experience of pain is not only associated with progress in labour[1–4] but also with women's physical and psychosocial backgrounds.[5] Nulliparous women may experience greater pain than multiparous women.[5 6] Some studies show that younger women report higher pain intensity than their older counterparts, while others show the opposite.[7–10] Both high and low levels of education have been associated with the experience of labour pain, and cultural background also plays a role.[5] Previous pain experiences are important, but findings here are also inconclusive. Dysmenorrhoea, for example, is associated with high pain intensity during labour,[5 9 11 12] but non-gynaecological pain experiences are associated with less pain.[5] Antenatal fear of pain and anxiety also increase the severity of pain during labour.[5] Women who are well prepared during pregnancy are more likely to have realistic expectations of labour pain.[13] Epidural analgesia effectively reduces labour pain, whereas evidence of the effects related to other forms of pharmacological pain relief, such as parenteral opioids,[14] is lacking.

Acupuncture is a commonly used method of pain relief during labour in spite of there being a lack of evidence regarding its effects on women's experience of pain intensity.[15–19] Acupuncture is, however, associated with a reduction in the use of pharmacological analgesia, suggesting that it helps some women to manage labour pain.[15–19] Acupuncture involves puncturing the skin with thin,

sterile needles.[20 21] We recently demonstrated that the mean estimated pain scores on a visual analogue scale (VAS) did not differ between women receiving acupuncture, either with manual stimulation (MA) or a combination of manual and electrical stimulation of the needles (EA), and women who received standard care without acupuncture (SC), during labour. However, women who received EA used fewer pharmacological pain relief methods including epidural analgesia, the rate of which was reduced by half.[1]

Patient characteristics have been discussed as possible modulators of the response to acupuncture treatment for chronic pain.[22] Whether patient characteristics may also act as modulators of acupuncture's effects in relation to acute pain, such as labour pain, is unknown. Such knowledge would be valuable, as it could help facilitate making the best choice of treatment for each individual woman. The aim of this study was to investigate whether maternal characteristics are associated with women's responses to acupuncture treatment during labour, in terms of labour pain intensity in close proximity to the treatment (baseline to 60 min) and over a longer time period (baseline to 240 min), and whether or not epidural analgesia was used.

METHODS

For this study, we used data previously collected in a three-armed randomised controlled trial of acupuncture treatment for labour pain, comparing MA versus EA versus SC.[1 23 24] The study was approved by the Regional Ethical Review Board, Gothenburg on 15 May 2008 (reference no. 136-08) and written informed consent was received from all participants.

For the purpose of the present study, associations between maternal characteristics and responses to acupuncture for labour pain were compared between users of MA, EA and SC, and adjusted for obstetric status at admission to the labour ward. Recruitment took place between November 2008 and October 2011 in two labour wards in Sweden. Women were eligible for the study if they were nulliparous with a singleton pregnancy between 37+0 and 41+6 weeks gestation, with spontaneous onset of labour and a command of the Swedish language good enough to understand written and oral instructions and fill out a questionnaire. Women were asked to give consent to participate in the study when admitted to the labour ward. Data were collected by means of medical records, a specific study protocol and a self-reported questionnaire. A full description of the study design has been published[23] as well as the findings on the short-term[1] and long-term effects.[24]

Of approximately 4300 women who were eligible for the trial, 679 were approached and 303 agreed to participate. Of these, 253 followed the study protocol and received one of the treatments (MA, EA or SC), and therefore constitute the cohort for this study.

Maternal and labour characteristics

All independent variables with their potential responses and data sources are shown in table 1. Data on maternal background characteristics were retrieved from patient records and the self-reported questionnaire, which included questions on sociodemographic background, previous experience of acupuncture and experience of menstrual pain. The questionnaire was completed by the women upon arrival to the labour ward, before any pain relief was given. Worries about labour pain and pain in daily life were measured by single item questions used previously.[25] Data on obstetric status on admission to the labour ward (ruptured vs intact membranes and cervical dilation) were additionally retrieved from the study protocol and the patient records.

Acupuncture treatment

Of the 253 participants, 83 received MA, 87 received EA and 83 received standard care without acupuncture. The style of acupuncture in this study was based on Western medical acupuncture, which is an adaption of Chinese acupuncture based on our current knowledge of anatomy and physiology.[21 26] All women in the trial received care from midwives throughout labour and birth and, in cases of deviation from normal progress, from obstetricians, according to Swedish clinical practice. Women in the two acupuncture groups were treated bilaterally with 13 to 21 needles (mean 14.9 in both groups) at three distal points and four to eight local points located in muscles innervated by the same somatic segments as the cervix and uterus. Disposable Hegu Xeno needles were used, sized 0.30×30 and 0.35×50 mm. A complete list of the points that were allowed to be used in the study is provided in the study protocol.[23] The choice of local and distal points was left to the midwife with the instruction to use points with regard to the pain location. They mostly needled LI4, *Yintang* and LR3 as distal points, and KI11, SP12, BL27 and ST29 as local points.[1] The mean duration of acupuncture treatment was 50 min in the MA group and 48 min in the EA group.[1] The treatment began when pain relief was requested, and the needles were inserted and stimulated manually by the midwife every 10 min until *de qi* was achieved. For women in the EA group, eight of the local needles were connected to an electrical stimulator (Cefar Acus 4, CEFAR, Lund, Sweden), which was set at high frequency (80 Hz) and pulse width of 180 μs. The women adjusted the intensity (mA) themselves to a level just under the pain threshold. After the first treatment with acupuncture, women in the acupuncture groups had access to the same pharmacological and non-pharmacological methods of pain relief as

Table 1 Independent variables

	Survey question	Responses	Reference in analyses	Data source
Maternal characteristics				
Higher education	What is your level of formal education?	Yes (university or other higher education)/ No (elementary school or secondary school)	No	Q
Age (years)		≤25/26–34/≥35	≤25	MR
Single status		Yes/No	No	MR
Smoking 3 months before pregnancy		Yes/No	No	MR
BMI in early pregnancy		Normal or underweight (BMI <25)/ overweight or obese (BMI ≥25)	Normal or underweight (BMI <25)	MR
Dysmenorrhoea	Before your pregnancy, did you have painful menstruations?	Yes/No	No	Q
Acupuncture treatment before present pregnancy	Have you ever been treated with acupuncture for pain or for symptoms other than pain?	Yes/No	No	Q
Worried about labour pain[25]	How do you feel when you think about pain during delivery?	Not worried (not at all worried or not very worried)/Worried (quite worried or very worried)	Not worried	Q
Worried about pain in daily life[25]	When you think about other types of pain in your daily life, are you worried?	Not worried (not at all worried or not very worried)/Worried (quite worried or very worried)	Not worried	Q
Obstetric status				
Membranes ruptured before admission		Yes/No	No	SP
Cervical dilation at admission		≤3/>3	≤3	SP

BMI, body mass index; MR, medical record; Q, questionnaire; SP, study protocol.

women in the standard care group. The proportions of women in the MA, EA and SC groups using nitrous oxide were 95.1%, 95.4% and 93.8%, respectively. A total of 61.4%, 46.0% and 69.9%, respectively, opted for epidural analgesia, while 12.2%, 4.7% and 10.0%, respectively, used sterile water injections (SWI). A total of 14.5%, 12.6% and 48.1%, respectively, used transcutaneous electrical nerve stimulation (TENS) and 9.6%, 1.1% and 4.8% respectively received morphine.[1]

Outcome measurements

The outcome measurements were women's assessments of labour pain on the VAS during the first stage of labour, both in close proximity to the treatment (baseline to 60 min) and over a longer time period (baseline to 240 min), as well as the use of epidural analgesia.

The women assessed their labour pain using a VAS[27 28] that had a 100 mm horizontal ungraded line with two endpoints ('no pain' on the left and 'worst imaginable pain' on the right). The VAS is the most commonly used instrument for the assessment of pain, and its ability to detect changes in pain intensity has been validated.[27 28] It has been used in nearly all prior studies of acupuncture for labour pain.[29–34] Assessments were made before the first treatment once the woman had requested pain relief, immediately after the first treatment, every 30 min for 5 hours, and thereafter every hour until birth or until epidural analgesia was administered. A person independent of those administering the intervention (assistant nurse or midwife) assisted the woman with the measurement of her pain.[23] According to the protocol, pain assessments should have been made before the first treatment (baseline), directly after the first treatment, and then every 30 min. However, for practical reasons, such as contractions and toilet visits, pain scores were assessed at slightly variable time points. The scores were therefore categorised into time intervals from baseline onwards and the mean pain score within each 30 min interval was calculated.

Statistical analysis

To investigate the associations between maternal characteristics and women's assessments of labour pain on the VAS over time, we used two linear mixed models for repeated measures that included two different time periods: (1) baseline to 60 min (three time intervals, in close proximity to the treatment); and (2) baseline to 240 min (eight time intervals). We assumed that the covariance structure for time was a first order autoregressive model.

All analyses were conducted for the two time periods (baseline to 60 min, and baseline to 240 min). Initially, variables were analysed one-by-one in a univariate analysis. Then, all maternal characteristics were included in one model, and each maternal characteristic with a value of $p>0.25$ was removed sequentially. The model was then

adjusted for obstetric status at time of admission to the labour ward, by adding cervical dilation and membrane status, and all variables with a value of $p>0.25$ were removed. To investigate whether there were any associations between maternal characteristics and the treatment administered (SC, MA or EA), study group allocation was added. Since our intention was to investigate whether maternal characteristics were associated with the response to acupuncture treatment, we also tested for potential interactions between the treatment group and each characteristic with a value of $p<0.05$. We also used the same logistic regression strategy to investigate the associations between maternal characteristics and the use of epidural analgesia, and to investigate if there were any significant differences between the three groups at baseline. A p values <0.05 was regarded as statistically significant. Analyses were conducted using the Statistical Package for the Social Sciences (SPSS) V.22.0 for Windows (SPSS Inc, Chicago, Illinois, USA).

RESULTS

A total of 253 nulliparous women were included in the study. Their maternal characteristics and obstetric status at admission to the labour ward are presented in table 2. No differences were found between the three groups, with the exception of women in the SC group who were relatively more educated than women in the MA group (greater incidence of higher education).

The univariate analyses identified five characteristics that were associated with women's assessments of labour pain from baseline to 60 min; low pain scores were associated with higher maternal age, and high pain scores were associated with smoking, dysmenorrhoea, and concern about labour pain (table 3). Cervical dilation >3 cm on admission was associated with low pain scores.

In the final model (which included all variables with a value of $p\leq0.25$ and treatment group allocation), only two variables remained statistically significant, namely maternal age and cervical dilation. No differences were found in women's evaluation of pain intensity between the MA, EA and SC groups. There was no significant interaction between treatment and either maternal age or cervical dilation ($p>0.05$), suggesting that no maternal characteristics were associated with response to acupuncture, in close proximity to the treatment.

The same characteristics, with the single exception of smoking, were identified in the univariate analyses for the longer time period as being associated with women's assessments of labour pain (table 4). In the final model, low pain scores were associated with higher maternal age, and high pain scores were associated with dysmenorrhoea. The three treatment groups did not differ with respect to the assessment of pain intensity. We found no interactions between treatment and maternal age or dysmenorrhoea, suggesting that no maternal characteristics are associated with the response to the acupuncture treatment over a longer time period (from baseline to 240 min) post-intervention.

Finally, the univariate analyses showed that prior experience of acupuncture was associated with the use of epidural analgesia (table 5). In the final model, prior experience of acupuncture remained statistically

Table 2 Maternal characteristics and obstetric status at admission to the labour ward

	Total		MA		EA		SC	
	n	%	n	%	n	%	n	%
Maternal characteristics								
Higher education	249	45.0	80	35.0	87	44.8	82	54.9*
Age (years)								
<25	96	37.9	38	45.8	29	33.3	29	34.9
26–34	138	54.5	40	48.2	53	60.9	45	54.2
>35	19	7.5	5	6.0	5	5.7	9	10.8
Single status	253	16.2	83	14.5	87	18.4	83	15.7
Smoking 3 months before pregnancy	222	21.6	74	23.0	77	22.1	71	19.7
Overweight or obese (BMI ≥25) in early pregnancy	215	37.2	72	34.7	75	36.0	68	41.2
Dysmenorrhoea	252	68.7	83	73.5	87	72.4	82	59.8
Acupuncture treatment before present pregnancy	249	27.3	82	9.6	87	10.8	80	6.8
Worried about labour pain	246	65.9	80	68.8	86	61.6	80	67.5
Worried about pain in daily life	251	9.2	83	12.0	87	8.0	81	7.4
Obstetric status								
Membranes ruptured before admission	250	20.8	82	30.5	87	28.7	81	33.3
Cervical dilation >3 cm at admission	240	54.2	81	53.1	80	61.3	79	48.1

*p<0.05 tested with logistic regression.
BMI, body mass index; EA, acupuncture with a combination of manual and electrical stimulation; MA, manual acupuncture; SC, standard care.

Table 3 Associations between maternal/labour characteristics and labour pain on a VAS from baseline to 60 min

		Univariate analyses		Maternal characteristics + obstetric status + treatment		
	Valid n	Unadjusted mean estimate (SE)	Mean difference (95% CI)	Adjusted mean estimate (SE)	Mean difference (95% CI)	Interactions* p Value
Maternal characteristics						
Higher education†	199	61.2 (1.5)	−4.0 (−8.1 to 0.1)	NI		
Age (years)						
<25	162	67.3 (1.6)	Ref	58.9 (3.7)	Ref	
26–34	238	62.0 (1.4)	**−5.3 (−9.5 to −1.1)**	56.5 (3.6)	−2.3 (−7.2 to 2.5)	
>35	27	55.7 (4.0)	**−11.5 (−19.9 to −3.1)**	45.8 (5.9)	**−13.2 (−23.4 to −2.9)**	
Single status†	67	62.8 (2.6)	−0.9 (−6.5 to 4.7)	48.8 (6.7)	−9.8 (−22.9 to 3.3)	
Smoking 3 months before pregnancy†	82	68.3 (2.4)	**6.1 (0.8 to 11.5)**	56.1 (4.2)	4.8 (−0.9 to 10.5)	
Overweight or obese (BMI ≥25) in early pregnancy†	128	64.7 (1.9)	2.0 (−2.7 to 6.7)	NI		
Dysmenorrhoea†	289	65.5 (1.2)	**6.1 (1.8 to 10.4)**	55.8 (3.9)	4.1 (−1.0 to 9.2)	
Worried about labour pain†	281	65.2 (1.3)	**5.5 (1.2 to 9.9)**	56.0 (3.8)	4.5 (−0.4 to 9.3)	
Worried about pain in daily life†	40	68.4 (3.4)	5.2 (−1.7 to 12.4)	NI		
Acupuncture treatment before present pregnancy†	111	61.1 (2.0)	−3.3 (−7.9 to 1.3)	NI		
Obstetric status at admission to labour ward						
Membranes ruptured before admission†	129	63.4 (1.9)	−0.1 (−4.6 to 4.3)	NI		
Cervical dilation >3 cm at admission†	219	61.3 (1.4)	**−5.1 (−9.2 to−0.9)**	51.2 (4.0)	**−5.0 (−9.6 to −0.5)**	
Time interval (min)						
0–30	246	64.5 (1.2)	Ref	56.5 (3.7)	Ref	
31–60	38	58.9 (2.4)	**−5.6 (−10.4 to −0.9)**	50.4 (4.5)	−6.1 (−11.7 to −0.6)	
61–90	143	62.4 (1.5)	−2.1 (−5.5 to 1.2)	54.3 (3.9)	−2.2 (−6.0 to 1.5)	
Treatment						
SC	171	64.2 (1.7)	Ref	55.5 (4.1)	Ref	
MA	125	64.4 (1.8)	0.2 (−4.8 to 5.1)	52.9 (4.1)	−2.6 (−8.1 to 3.0)	
EA	131	62.2 (1.8)	−2.2 (−6.9 to 2.9)	52.9 (4.1)	−2.6 (−8.2 to 3.0)	
Interactions						
Treatment† Age						0.44
Treatment† Cervical dilation >3cm at admission						0.35
Treatment† Time interval						0.71

The estimate represents scale steps on the VAS from 1–100. A positive mean difference indicates a higher pain score compared to the reference group, while a negative number indicates a lower pain score.
Statistically significant results ($p<0.05$) are indicated by bold text.
*Tested one-by-one in the final model.
†Reference=women not exposed to the variable studied.
BMI, body mass index; EA, acupuncture with a combination of manual and electrical stimulation; MA, manual acupuncture; NI, not included in model; SC, standard care; VAS, visual analogue scale.

significant and increased the odds of having an epidural, whereas cervical dilation >3 cm on admission reduced the odds. Allocation to the EA treatment group was associated with a lower odds of epidural analgesia use; however, we found no interactions between treatment and prior acupuncture experience or cervical dilation, suggesting that no a priori maternal characteristics are associated with the response to acupuncture treatment with regards to the use of epidural analgesia.

DISCUSSION

We were unable to identify any maternal characteristics or factors regarding obstetric status upon admission to the labour ward that were associated with women's responses to acupuncture during labour. This was true in relation to the experience of labour pain within 60 min and 240 min time frames, as well as the use of epidural analgesia.

This is the first study to have explored whether there are certain women who would benefit more

Table 4 Associations between maternal/labour characteristics and labour pain on a VAS from baseline to 240 min

		Univariate analyses		Maternal characteristics + obstetric status + treatment		
	Valid n	Unadjusted mean estimate (SE)	Mean difference (95% CI)	Adjusted mean estimate (SE)	Mean difference (95% CI)	Interactions* p Value
Maternal characteristics						
Higher education†	534	63.5 (1.4)	−2.9 (−6.5 to 0.7)	NI		
Age (years)						
<25	457	68.7 (1.5)	Ref	67.0 (1.6)	Ref	
26–34	658	63.7 (1.2)	**−5.0 (−8.7 to −1.3)**	63.0 (1.3)	−3.9 (−7.8 to −0.5)	
>35	72	57.5 (3.5)	**−11.2 (−18.7 to −3.7)**	55.2 (3.7)	**−11.8 (−19.6 to −3.9)**	
Single status†	178	65.5 (2.3)	0.3 (−4.6 to 5.2)	NI		
Smoking 3 months before pregnancy†	227	67.6 (2.1)	3.1 (−1.7 to 7.9)	NI		
Overweight or obese (BMI ≥25) in early pregnancy†	382	65.5 (1.7)	0.4 (−3.8 to 4.6)	NI		
Dysmenorrhoea†	809	67.3 (1.1)	**6.6 (2.7 to 10.4)**	64.5 (1.6)	**5.5 (1.6 to 9.5)**	
Worried about labour pain†	807	66.5 (1.1)	**4.5 (0.6 to 8.4)**	NI		
Worried about pain in daily life†	122		2.2 (−3.9 to 8.2)	NI		
Acupuncture treatment before present pregnancy†	311	62.5 (1.8)	−3.4 (−7.6 to 0.6)	NI		
Obstetric status at admission to labour ward						
Membranes ruptured before admission†	364	64.4 (1.7)	−1.2 (−5.1 to 2.8)	NI		
Cervical dilation at admission >3 cm†	562	64.1 (1.3)	−2.6 (−6.3 to 1.1)	60.7 (1.7)	−2.1 (−5.8 to 1.6)	
Time interval (min)						
0–30	246	64.5 (1.3)	Ref	61.3 (1.7)	Ref	
31–60	38	58.6 (2.4)	**−5.9 (−10.4 to −1.4)**	55.8 (2.7)	**−5.5 (−10.1 to −0.9)**	
61–90	143	60.9 (1.5)	**−3.7 (−6.8 to −0.5)**	57.7 (1.9)	**−3.6 (−6.9 to −0.4)**	
91–120	193	62.5 (1.4)	−2.1 (−5.3 to 1.2)	59.5 (1.8)	−1.8 (−5.1 to 1.5)	
121–150	180	66.1 (1.5)	1.6 (−1.9 to 5.1)	63.2 (1.8)	1.9 (−1.7 to 5.4)	
151–180	157	68.0 (1.5)	3.5 (−0.3 to 7.2)	64.6 (1.9)	3.2 (−0.6 to 7.1)	
181–210	139	67.9 (1.6)	3.4 (−0.5 to 7.4)	64.7 (1.0)	3.4 (−0.7 to 7.5)	
211–240	91	70.6 (1.9)	6.1 (1.6 to 10.6)	66.9 (2.3)	5.6 (1.0 to 10.2)	
Treatment						
SC	412	66.2 (1.6)	Ref	63.6 (1.9)	Ref	
MA	391	64.4 (1.6)	−1.9 (−6.3 to 2.6)	59.8 (2.0)	−3.8 (−8.3 to 0.7)	
EA	384	65.2 (1.6)	−1.0 (−5.4 to 3.4)	61.7 (2.0)	−1.9 (−6.5 to 2.7)	
Interactions						
Treatment† Age						0.44
Treatment† Dysmenorrhoea						0.22
Treatment† Time interval						0.21

The estimate represents scale steps on the VAS from 1–100. A positive mean difference indicates a higher pain score compared to the reference group, while a negative number indicates a lower pain score.
Statistically significant results ($p<0.05$) are indicated by bold text.
*Tested one-by-one in the final model.
†Reference=women not exposed to the variable studied.
BMI, body mass index; EA, acupuncture with a combination of manual and electrical stimulation; MA, manual acupuncture; NI, not included in model; SC, standard care;
VAS, visual analogue scale.

from acupuncture for labour pain than others. A previous trial investigating patient characteristics and the effect of acupuncture treatment on chronic pain showed that female gender and living in a multi-person household predicted a positive response to future acupuncture treatment. Furthermore, an earlier positive acupuncture experience increased the probability of a positive outcome of subsequent

Table 5 Associations between maternal/labour characteristics and use of epidural analgesia

		Univariate analyses	Maternal characteristics + obstetric status + treatment	
	Use of epidural analgesia (%)	Unadjusted OR (95% CI)	Adjusted OR (95% CI)	Interactions* p Value
Maternal characteristics				
Higher education†	58.9	1.0 (0.6 to 1.7)	NI	
Age (years)				
<25	61.5	Ref	NI	
26–34	57.2	0.8 (0.5 to 1.4)	NI	
>35	57.9	0.9 (0.3 to 2.3)	NI	
Single status†	63.4	1.3 (0.6 to 2.5)	NI	
Smoking 3 months before pregnancy†	62.5	1.2 (0.6 to 2.4)	NI	
Overweight or obese (BMI ≥25) in early pregnancy†	61.3	1.2 (0.7 to 2.1)	1.8 (0.9 to 3.6)	
Dysmenorrhoea†	57.2	0.8 (0.4 to 1.3)	NI	
Worried about labour pain†	63.0	1.6 (0.9 to 2.8)	1.6 (0.8 to 3.2)	
Worried about pain in daily life†	56.5	0.9 (0.4 to 2.1)	NI	
Acupuncture treatment before present pregnancy†	69.1	1.8 (1.0 to 3.3)	2.7 (1.3 to 5.9)	
Obstetric status at admission to labour ward				
Membranes ruptured before admission†	51.9	0.6 (0.4 to 1.1)	0.5 (0.3 to 1.1)	
Cervical dilation >3 cm at admission†	46.2	0.3 (0.2 to 0.5)	0.3 (0.1 to 0.5)	
Treatment				
SC	69.9	Ref	Ref	
MA	61.4	0.7 (0.4 to 1.3)	0.5 (0.2 to 1.1)	
EA	46.0	0.4 (0.2 to 0.7)	0.3 (0.1 to 0.6)	
Interactions				
Treatment† Acupuncture treatment before present pregnancy				0.42
Treatment† Cervical dilation >3 cm at admission				0.18

*Tested one-by-one in the final model.
†Reference=women not exposed to the variable studied.
BMI, body mass index; EA, acupuncture with a combination of manual and electrical stimulation; MA, manual acupuncture; NI, not included in model; SC, standard care.

acupuncture treatment, as did a failure to respond to other therapies. However, previous acupuncture treatment (without considering whether or not the treatment was successful) increased the probability of insufficient analgesia.[22] In the present study, we found that prior experience of acupuncture treatment antecedent to the present pregnancy increased the use of epidural analgesia in all three groups. It is likely that the nulliparous women in our study who had previously been treated with acupuncture had received it for pain of much lesser intensity than labour pain, given that they identified neck/shoulder pain, low back pain and headache to be the most common reasons for receiving acupuncture treatment in the past. This could have rendered the present acupuncture experience a relative disappointment due to high expectations, leading to increased demand for alternate forms of pain relief. However, the impact of previous acupuncture experience on the use of epidural analgesia among those women who received standard care demands an alternative explanation. Unfortunately, we did not collect any data pertaining to whether the previous acupuncture experience was positive or negative in our study, a variable that could have had an impact on the increased use of epidural analgesia, and therefore we can only speculate whether or not this may have differed between women receiving acupuncture versus standard care.

This study comprised a secondary analysis of data from a randomised controlled trial. While the original sample size was estimated to be able to detect differences in labour pain scores after acupuncture treatment, it may have been too small to detect statistically significant differences between some of the maternal characteristics and treatment outcomes. In addition to this, the choice of background characteristics was limited to those relevant for the original trial, and could have been extended for the purpose of the present study, for example, to include expectations of the acupuncture treatment and preparation during pregnancy. However, preparation is likely to have been similar for all women in the study since the large majority of primigravida in Sweden follow the standard antenatal programme, which includes six to nine visits to a midwife. Most of them also partake in parental education, which includes information about

labour pain and strategies for pain relief. The women's assessments of their worries about labour pain, as well as pain in daily life, may have been affected by whether or not they were already experiencing some degree of pain. The pain experience includes many more aspects than just intensity,[36] and measuring responses during labour using VAS assessments alone is likely to be limited. As labour progresses, the pain intensity increases and there is a possibility that the meaning of a value on the VAS is changed (recalibrated) due to the higher pain intensity,[37] although this would be expected to apply to all three treatment groups to a similar extent. Additional assessments as a complement to the VAS, perhaps capturing the emotional aspects of pain, such as fear and anxiety, or enquiring as to whether the pain was manageable or not, would have been valuable.

Some of our findings are supported by other studies, for example, the observation that dysmenorrhoea is associated with higher pain scores.[5 9 12] An explanation for this could be that women with dysmenorrhoea are more sensitive to pain stimuli than non-dysmenorrhoeic women[38 39] and the fact that primary dysmenorrhoea has been classified as a central sensitivity syndrome.[39] Our finding that there is a negative association between labour pain and maternal age is also supported by other studies.[8–10] Given that increased age is often associated with a more complicated labour,[40] a positive association between age and labour pain may be expected. However, pain threshold also increases with age, which may partially explain the lower pain scores reported by older women.[41] We found that acupuncture using a combination of manual and electrical stimulation reduced the odds of epidural use. This may be explained by the fact that this treatment was partly self-managed, which may have increased the women's sense of control and influence over their own care, which is known to be important in the management of labour pain.[42] In addition to this self-management aspect, acupuncture deactivates limbic areas in the brain that contribute to the emotional aspects of pain, such as fear and anxiety,[35 43] and EA may have a larger impact on some of these structures than MA.

CONCLUSION

This study did not identify any maternal characteristics that were associated with women's responses to acupuncture treatment during labour, in terms of labour pain intensity or whether or not epidural analgesia was used.

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