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

Linda Vixner,1,2 Erica Schytt,3,4 Lena B Mårtensson5

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 dilatation 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.

INTRODUCTION

During the process of childbirth, the experience of pain is not only associated with progress in labour1–4 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,
Acupuncture treatment: A randomized controlled trial comparing manual acupuncture, electrical acupuncture, and standard care in labour pain relief

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For the purpose of the present study, associations between maternal characteristics and 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. 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 treatment during labour 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 is provided in the study protocol. The complete list of the points that were allowed to be used in the study is provided in the study protocol. 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.

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. The mean duration of acupuncture treatment was 50 min in the MA group and 48 min in the EA group. 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 men.
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 VAS27 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

Table 1 Independent variables

| Maternal characteristics | Survey question | Responses | Reference in analyses | Data source |
|--------------------------|----------------|----------|----------------------|-------------|
| 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            | Yes/No | No | Q |
| Acupuncture treatment before present pregnancy | Yes/No | No | Q |
| Worried about labour pain25 | Not worried (not at all worried or not very worried)/ Worried (quite worried or very worried) | Not worried | Q |
| Worried about pain in daily life25 | 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.
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 \(p \leq 0.25\) 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

| Maternal characteristics                        | Total n  | %     | MA n  | %     | EA n  | %     | SC 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.
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

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

| Maternal characteristics + obstetric status + treatment | 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) |

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

| Maternal characteristics + obstetric status + treatment | 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                 | 66.8 (1.3)              | 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)      |

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.

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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. 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 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

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

|                      | Use of epidural analgesia (%) | Univariate analyses | Maternal characteristics + obstetric status + treatment | Interactions* p Value |
|----------------------|------------------------------|---------------------|-------------------------------------------------------|----------------------|
|                      | Unadjusted OR (95% CI)       | Adjusted OR (95% CI) |                                                                 |                      |
| 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 paint† | 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

|                          | Use of epidural analgesia (%) | Univariate analyses | Maternal characteristics + obstetric status + treatment | Interactions* p Value |
|--------------------------|------------------------------|---------------------|-------------------------------------------------------|----------------------|
|                          | Unadjusted OR (95% CI)       | Adjusted OR (95% CI) |                                                                 |                      |
| 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

|       | Use of epidural analgesia (%) | Univariate analyses | Maternal characteristics + obstetric status + treatment | Interactions* p Value |
|-------|------------------------------|---------------------|-------------------------------------------------------|----------------------|
|       | Unadjusted OR (95% CI)       | Adjusted OR (95% CI) |                                                                 |                      |
| 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

|                      | Use of epidural analgesia (%) | Univariate analyses | Maternal characteristics + obstetric status + treatment | Interactions* p Value |
|----------------------|------------------------------|---------------------|-------------------------------------------------------|----------------------|
|                      | Unadjusted OR (95% CI)       | Adjusted OR (95% CI) |                                                                 |                      |
| Treatment†           |                              |                     |                                                                 |                      |
| Acupuncture treatment before present pregnancy |                     |                     | 0.42                                                     |                      |
| 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.
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, 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, 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 dysmenorrhea is associated with higher pain scores. An explanation for this could be that women with dysmenorrhea are more sensitive to pain stimuli than non-dysmenorrheic women and the fact that primary dysmenorrhea has been classified as a central sensitivity syndrome. Our finding that there is a negative association between labour pain and maternal age is also supported by other studies. Given that increased age is often associated with a more complicated labour, 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. 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. 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, 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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Associations between maternal characteristics and women's responses to acupuncture during labour: a secondary analysis from a randomised controlled trial

Linda Vixner, Erica Schytt and Lena B Mårtensson

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