

## Pain during the first stage of labor

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### Abstract:

**Pain during the first stage of labor**

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*This study examined pain levels during the first stage of labor of 115 healthy primiparas. Pain was measured within 15 minutes of at least one routine pelvic examination from cervical dilation of 1 cm to 10 cm with the 100 mm Visual Analogue Scale (VAS) for both sensation and distress of pain. Both sensation and distress increased over time throughout the first stage of labor and paralleled each other except at cervical dilation of 10 cm. A unique change occurred in the level of pain during the first stage, especially in the sensation of pain. Sensation of pain was also significantly higher than the distress of pain at each*

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centimeter of cervical dilation except during cervical dilation of 6 cm. The graph of sensation of pain levels suggests that it could be used to determine cervical dilation and minimize the number of pelvic examinations.

**Key words:** labor pain, pain, childbirth

### บทคัดย่อ:

การศึกษานี้เกี่ยวกับระดับความปวดทั้งด้านร่างกายและความตึงเครียดจากความปวดทางกาย (ปวดทางอารมณ์) ในระยะที่ 1 ของการคลอดของมารดาครรภ์แรก 115 ราย ระดับความปวดถูกวัดภายในเวลา 15 นาที เมื่อมีการตรวจภายใน และปากมดลูกเปิดตั้งแต่ 1 เซนติเมตร ถึง 10 เซนติเมตร การวัดความปวดทั้ง 2 ประเภทใช้ Visual Analogue Scale พบว่าความปวดทั้ง 2 ประเภทเพิ่มขึ้นตลอดเวลาและขนานกันตลอดการเปิดของปากมดลูกตั้งแต่ 1 ถึง 9 เซนติเมตร ยกเว้นเมื่อปากมดลูกเปิด 10 เซนติเมตร ความปวดทางกายสูงกว่าความปวดทางอารมณ์ในแต่ละเซนติเมตรของการเปิดของปากมดลูก ยกเว้นขณะปากมดลูกเปิด 6 เซนติเมตร กราฟระดับความปวดและการเปลี่ยนแปลงในแต่ละเซนติเมตรของการเปิดของปากมดลูกมีลักษณะเฉพาะ ซึ่งพบว่ากราฟของความปวดทางกายน่าจะช่วยในการทำนายการเปิดของปากมดลูกได้เพื่อช่วยลดการตรวจภายในสำหรับการประเมินความก้าวหน้าของการคลอด

**คำสำคัญ:** การเจ็บครรภ์, ความปวด, การคลอด

### Introduction

Pain during the first stage of labor comes mainly from uterine contractions and cervical dilation<sup>1,2</sup> and knowledge of the level of pain could be useful for both pain management and to determine the progress of labor. However only a few studies have been evaluated pain intensity during the first stage of labor<sup>3-5</sup> and present knowledge is not enough to understand labor pain.<sup>6</sup> In addition, there is a lack of the use of patient self-rating tools by nurses to assess pain.<sup>7</sup> There is also a report of misinterpretation of pain levels, where 49% of physicians and midwives made errors (25% overestimated and 24% underestimated) when interpreting the labor pain of women during cervical dilation of 3-5 cm in the first stage of labor.<sup>8</sup> Misinterpretation of pain intensity may lead to inappropriate pain relief and intense pain or adverse effects from unnecessary analgesics. Another study,<sup>9</sup> in a postoperative setting, also supports the conclusion that inappropriate pain management for postoperative pain by nurses may reflect underestimated pain. The researchers found that one-third of 446 nurses had negative attitudes about administering opioids

to postoperative patients, such as giving minimal amounts of opioid and encouraging patients to have non-opioids rather than opioids for pain relief.

Intense labor pain increases cardiac output, blood pressure, oxygen consumption, ventilation and catecholamine levels.<sup>10-12</sup> These increases can lead to metabolic respiratory alkalosis or metabolic acidosis, decreased uterine blood flow, impaired uterine contractions and fetal acidosis.<sup>10,12</sup> Therefore, it is important that pain be monitored and alleviated when appropriate. Pain during the first stage of labor increases over time,<sup>5,13</sup> thus the level of labor pain may be used to determine the progress of labor. However, pelvic examinations (Per vaginal examinations, PV) are used to determine cervical dilation and confirm the progress of labor, but they can introduce infection. A study of 8,428 Nigerian women showed that 4,272 (51%) women received pelvic examinations more than five times during labor<sup>14</sup> and a study of 92 Thai women showed that 67 (73%) women received pelvic examinations from 1 to 5 times and 5 (5.4%) women received pelvic examination more than 5 times during labor.<sup>15</sup> The researchers

in both studies determined that pelvic examinations are a significant factor in introducing postpartum infection.<sup>14, 15</sup> That pelvic examination leads to puerperal infection is also supported by the finding that bacterial vaginosis organisms caused endometritis (relative risk 14.2,  $p < .001$ ).<sup>16</sup> In addition, pelvic examination may cause women to feel discomfort or experience pain and embarrassment.

There have been few studies on the levels of labor pain. One study showed that the level of labor pain during cervical dilation of 5–8 cm was the most intense, followed by during cervical dilation of 8–10 cm, the second stage of labor, and cervical dilation of 0–5 cm.<sup>3</sup> Another study using the 100 mm Visual Analogue Scale measured pain in primiparas ( $n = 30$ ) and showed that during cervical dilation of 2–4 cm the average pain level was 62 mm, at cervical dilation of 5–7 cm, the average pain level was 54 mm, and at cervical dilation of 8–10 cm, the average pain level was 73 mm.<sup>4</sup> In another study, the sensation of labor pain (physical pain) reported by primiparas ( $n = 55$ ) when cervical dilation was 3–4 cm averaged 59.09 mm,  $SD = 14.84$  mm with the average of distress of pain (unpleasant feeling from sensation pain) 56.07 mm,  $SD = 16.75$  mm and it increased significantly in each hour for the three hours of the study.<sup>5</sup>

Currently no studies have reported on labor pain at each centimeter of cervical dilation throughout the first stage of labor. It would be useful to know the level of this pain, as health personnel could use it together with other information to consider appropriate pain management. Health personnel could also use it to predict the progress of labor and it may help in reducing the number of pelvic examinations (per vaginal examinations). The purpose of this study was to examine the level of sensation and distress of pain at each cervical dilation in the first stage of labor.

### Material and methods

A convenience sample of 115 healthy women who were in labor and met the inclusion criteria was recruited from a Health Center in Southern Thailand. The sample size was based on Kirk<sup>17</sup> that the number of 50–100 is sufficient to

receive normal sampling distribution, thus a sample of 115 can represent population. The sample inclusion criteria were: primipara, gestational age 38–42 weeks, having fetus in vertex presentation, age at least 18 years, healthy women with no anemia, no HIV, and no health complications, and not having induction of labor before the study was conducted. These criteria were used to ensure the healthy state of the primiparas with normal term pregnancy and a homogeneous sample by minimizing confounding effects on pain level. After recruitment to the study the co-investigator or nurse research assistants explained to the women the meaning of the sensation of pain and the distress of pain and how to rate the pain.

### Subject enrollment

The Ethics Committee of the Health Center approved the study. The researcher explained the study to the research assistants who were nurses and had worked in a labor room at least three years. When the women were admitted to the labor room the co-researcher or the research assistants screened and approached them and informed consent was obtained. The number of data collection points on pain level varied for each woman and depended on the number of routine pelvic examinations performed by the nurse research assistants or physician.

### Measures

Even though pain is a multidimensional phenomenon comprising sensory, affective, cognitive, and evaluative components,<sup>18–20</sup> this current study, like other studies,<sup>5, 21–23</sup> examined only the levels of sensation and distress of labor pain in primiparas. Sensation of pain was defined as the unpleasant feeling of hurt in the abdomen and back related to the intensity of uterine contractions and cervical dilation.<sup>24, 25</sup> Sensory pain was measured by self-reporting on a horizontal 100 mm Visual Analogue Sensation of Pain Scale.<sup>26</sup> The scale ranged from "no sensation" to "the most sensation imaginable". Distress (affective) pain was operationally defined as the reported emotional distress related to the sensation of labor pain.<sup>18, 27</sup> Distress was measured by self-reporting on a horizontal 100 mm Visual Analogue Distress of Pain Scale.<sup>26</sup>

The scale ranged from "no distress" to "the most distress imaginable".

The test-retest reliability of VAS on recalled labor pain in postpartum women is high,  $r = .95$ .<sup>28</sup> It also has a high correlation ( $r = .70$ ) with reported pain of back pain patients and the physician's ratings of patient improvement<sup>29</sup> which supports the concurrent validity. The dual VAS is quick and easy to use and does not require reading ability.<sup>30</sup> The VAS is more sensitive to changes in pain than numerical or simple descriptive scales.<sup>31-36</sup>

#### Data collection

Demographic data and some obstetric factors that might have an effect on the variation of labor pain were collected. Obstetric data collected were history of painful menstruation, receiving oxytocin or analgesics, rupture of membranes, type of delivery, length of time in labor, and complications. Also duration and frequency of uterine contractions were collected.

The physician or nurse research assistant attending the subject determined when it was necessary to perform a pelvic examination and the level of cervical dilation was recorded. Within 15 minutes the women were asked to rate their pain for both sensation and distress using 100 mm VAS.

#### Data analysis

Descriptive statistics: frequency, percent, mean, and standard deviation were used to analyse the data. In addition, inferential statistics (t-test and correlation) were also used to test the difference and correlation of pain levels.

### Results

#### Sample characteristics

The sample group consisted of 115 primiparas with an average age of 23.5 years, (SD = 4.2 years). Ninety-five (83%) were Buddhist and 20 (17%) were Muslim. Half of the women had high school education or higher. Nearly half (45%) were housewives, followed by employees (29%), and small business owners (12%). More than three-fourths had low family income (< 10,000 baht/month).

#### Obstetric data

Seventy (61%) had a history of painful menstruation. More than a half (59%) received oxytocin during the active phase of labor. Fifty two percent received artificial rupture of membranes. Only 10 (9%) women received an analgesic during labor. Three-fourths (86) had normal vaginal delivery; 17(15%) had vacuum extraction delivery; 5 (4.5%) had forceps delivery; only 2 (1.8%) received cesarean section. One hundred and two (88%) had no complications during labor. Thirteen (15%) women had complications, such as fetal distress, prolonged second stage, or thick meconium stain. The average time of the active phase of labor (cervical dilation of 4-7 cm, including 5 cases from 3 cm who had cervical dilation with a rate of 1.2 cm/hr) was 4.2 hours, SD = 2.8 hours. However, time in the latent phase (onset of labor to cervical dilation of 3 cm) could not be defined exactly due to difficulty of the women in reporting. The mean length of uterine contractions at each cervical dilation increased over time (Table 1, Figure 1) while the interval of uterine contractions decreased (Table 1).

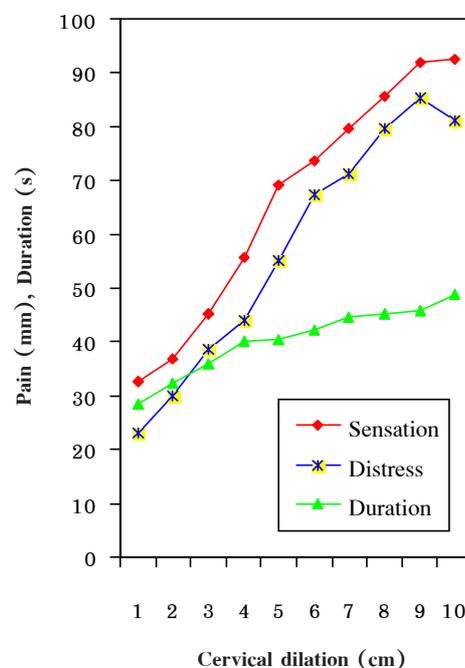


Figure 1 The mean sensation and distress of pain scores and duration of uterine contraction at each cervical dilation

**Table 1 Uterine contractions at each cervical dilation**

Cervix (cm)	N	Duration		Interval	
		Mean (s)	SD (s)	Mean (min)	SD (min)
1	22	28.41	5.65	3.89	2.90
2	50	32.24	6.84	3.22	2.18
3	80	36.04	6.30	3.65	1.07
4	55	40.09	5.73	3.08	0.82
5	36	40.56	6.63	2.80	0.83
6	25	42.48	6.19	2.64	0.90
7	30	44.50	6.21	2.59	0.69
8	34	45.15	7.64	2.07	0.59
9	46	45.87	8.78	2.22	0.57
10	106	48.75	4.44	1.95	0.56

**Table 2 Pain scores, differences and correlation between sensation and distress by cervical dilation**

Cervix (cm)	N	Sensation		Distress		Diff.	Correl.
		Mean	SD	Mean	SD	t <sup>a</sup>	r
1	20	32.60	17.59	23.20	18.24	2.67*	.61**
2	52	36.71	20.35	29.96	22.12	2.32*	.51***
3	82	45.16	20.93	38.59	23.41	2.72**	.52***
4	56	55.75	22.62	43.96	26.75	4.15 ***	.64***
5	36	69.17	18.64	55.08	25.65	3.51**	.45**
6	26	73.73	18.50	67.38	23.64	1.76 <sup>ns</sup>	.64***
7	31	79.77	12.26	71.32	17.27	3.75**	.69***
8	32	85.66	11.80	79.69	15.52	2.33*	.47**
9	42	91.86	8.39	85.33	16.95	3.27**	.67***
10	103	92.57	10.62	81.01	22.87	5.81***	.47***

**Note:** Diff. = difference between sensation and distress of pain scores.

Correl. = Correlation between sensation and distress of pain scores. a = two-tailed test.

\* = p < .05, \*\* = p < .01, \*\*\* = p < .001, ns = non-significant

**Pain**

The mean level of pain of both sensation and distress increased over time at each cervical dilation and the SD were quite stable in the latent and early active phases but became smaller in the late active phase and during the transition phase. The highest peak of pain was the transition phase (during cervical dilations of 8 to 10 cm) (Table 2, Figure 1). The

graph also shows the changes in the increasing curve of sensation at three points: after cervical dilation of 2 cm, 5 cm, and 9 cm (Figure 1). The graph of distress of pain paralleled sensation of pain but the curve of increasing pain changed after 6 cm and decreased after 9 cm of cervical dilation (Figure 1).

The range of the mean sensation of pain during cervical dilation of 1 to 3 cm was 33–45 mm, SD = 18–21 mm; the range of mean in the active phase (cervical dilation of 4 to 7 cm) was 56–80 mm, SD = 12–23 mm; the range of mean in the transition phase (cervical dilation of 8 to 10 cm) was 86–93 mm, SD = 8–12 mm. The range of the mean of distress pain in the latent phase was 23–39 mm, SD = 18–23 mm; in the active phase it was 44–71 mm, SD = 17–27 mm; and the transition phase was 80–85 mm, SD = 16–23 mm. There were significantly higher sensation pain scores than distress of pain scores at each cervical dilation except at the 6 cm of cervical dilation (see Table 2).

#### Additional findings

According to magnitude of correlation by Munro,<sup>37</sup> there were medium correlations between the sensation and distress of labor pain through the first stage ( $r = .51-.69$ ,  $p < .001$  to  $p < .01$ ) and low correlation at cervical dilation of 5 cm, 8 cm, and 10 cm ( $r = .45-.47$ ,  $p < .001$  to  $p < .01$ ). Also the time from cervical dilation of 3 cm to 4 cm of 24 women ranged from 15 minutes to 5.58 hours with a mean of 2.27 hours and SD = 1.71 hours. Five (20%) women reached active phase between cervical dilation of 3 cm to 4 cm in less than 50 minutes (range 15–45 minutes) or the accepted cervical dilation of 1.2 cm/hr in primiparas.<sup>38</sup>

#### Discussion

The sensation of pain increases over each cervical dilation due to the strong uterine contractions which cause high pressure in the uterus and a lack of oxygen supply<sup>10</sup> and increased more dilation of the cervix can cause tissue injury.<sup>12, 39, 40</sup> Also greater stretching of the cervix increases the number and the intensity of uterine contractions<sup>10, 41</sup> leading to more labor pain over time. The small standard deviation during cervical dilation from 7 to 10 cm suggests that almost all of the women experienced a lot of pain from the stronger contractions and more injury or stretching of the cervix and pressure of presentation as the baby descended into the birth canal. In addition, there may be a ceiling effect in the use of VAS that also

occurred in 4–7% of women reporting pain in the active phase of labor as reported by Phumdoung and Good.<sup>5</sup>

The level of pain in this study was generally higher than in Swedish primiparas in the study of Gaston-Johansson et al.<sup>4</sup> This may be because more than half (59%) of the women in the present study received oxytocin during the active phase of labor and slightly over half (52%) received artificial rupture of membranes, both of which can heighten pain. More women in the Swedish study received analgesics (pethidine,  $n = 22$ , 72% and epidural block,  $n = 9$ , 30%) whereas only a small number (9%) of women in the present study received analgesics. Also, a large number of these Thai women (61%) had a history of painful menstruation which has been shown to be related to labor pain throughout the first stage of labor.<sup>42</sup> Cultural experiences are known to have an effect on pain level as found in the study of Weisenberg and Caspi,<sup>43</sup> and this may also account for some differences in experiencing pain. Another reason the women in the present study may have experienced more pain is that their low family income might be related to other factors that influence pain, such as stress.<sup>44</sup>

The sensation of pain was significantly higher than distress except at a cervical dilation of six cm. This might have been due to severe tissue injury from cervical dilation and ischemic pain as a result of strong uterine contractions that increased over time and also leading to increased waste products influencing pain levels.<sup>39, 45</sup> Another possible reason that distress was lower than sensation could have been due to positive thoughts of women, such as feeling that pain helps delivery (reflects labor progress) and that there are periods of relief between contractions. The effect of positive thoughts during labor is noted by Price<sup>46</sup> who demonstrated that desire and expectations have an effect on distress of pain levels. This is also supported by the dropping of distress of pain levels at a cervical dilation of 10 cm (Figure 1). The finding that sensation of pain was not significantly higher than distress of pain during cervical dilation of 6 cm may have been influenced by the small number of women ( $n = 26$ ) in this comparison. Also the women might have had negative feeling

about having to face pain for a long period of time before delivery.

Generally the magnitude of correlations ( $r = .51-.69$ ) were similar to those ( $r = .63-.72$ ) of the laboring women in the study of Phumdoung and Good.<sup>5</sup> This medium correlation also suggests that the more women experienced the sensation of pain, the higher were the levels of distress except at a few points. This also suggests that it is only necessary to assess the level of sensation of pain to give some idea of cervical dilation (Figure 1). In the gate control theory, the sensory and affective components of pain do not necessarily have a one-to-one relationship,<sup>18</sup> and the amount of correlation in this study supports this belief.

The transition time from cervical dilation of 3 cm to 4 cm was highly, variable from 15 minutes to 5.58 hours. This shows that for some women the labor progresses very fast while for some labor may be slow. This finding of a large range of time from cervical dilation of 3 cm to 4 cm is also supported by the findings in 1,699 healthy laboring women (1060 primiparas and 639 multiparas) of Peisner and Rosen.<sup>47</sup> They found that less than 50% of women, both primiparas and multiparas, came into the active phase (the time that cervix dilates 1.2 cm/hr in primiparas and 1.5 cm/hr in multiparas) when cervical dilation is 4 cm. This is also a reminder that health personnel need to be aware of the progress of labor, as it can be rapid in some women.

#### Limitation

This study was conducted with a convenience sample of only primiparas and the women mostly had low education and low socioeconomic status. Thus, there are limits on generalizing to other women with different backgrounds than these women. Also the small number of women at some cervical dilations reduces the power of the study and a larger sample of both primiparas and multiparas needs to be studied with some other factors relating to labor pain, such as age, history of painful menstruation, and time. However, the researchers will study labor pain levels and relating factors at each cervical dilation in larger sample, develop the graphs of pain curve and test them in the future.

#### Conclusion

**In the first stage of labor of primiparas, the sensation and distress of pain increased over time and the sensation of pain was uniformly higher than distress. There was a medium correlation between the sensation and distress of labor pain throughout the first stage of labor. Thus, health personnel could use the curve of sensation of pain alone or with the curve of uterine contraction to assess the progress of labor. This knowledge of labor pain level will help health personnel to provide proper pain management and timely induction and reduce the number of pelvic examinations.**

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