Effect of the Prince of Songkla University Locked-Upright Position on the Duration, Pain and Comfort of Second-Stage Labor in Primiparous Women

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Abstract : Most pregnant women experience severe pain and discomfort during the second stage of labor. In addition, the longer the duration of second-stage labor the greater the potential for a woman and her fetus to experience adverse effects. Thus, the purpose of this experimental study, using a randomized factorial design, was to determine the effects of the Prince of Songkla University (PSU) locked-upright position on the duration, pain (sensation and distress) and comfort of second-stage labor among 320 primiparous women with no known health complications.

The sample was divided into 4 groups of 80 subjects each, whereby: Group 1 used the supine lithotomy position; Group 2 used the PSU locked-upright position with knees-to-chest; Group 3 used the PSU locked-upright lithotomy position; and, Group 4 used the upright lithotomy position. Subjects in Groups 2, 3 and 4 had the head of the delivery table raised 45-60°.In addition, subjects in Groups 2 and 3 had their lumbar areas raised 30-40°, via a pillow.

Findings reveal the duration of second-stage labor, in Group 1 subjects, was longer than that of subjects in the other three groups. Although subjects in Groups 2, 3 and 4 did not show significant differences in the duration of second-stage labor, Group 3 experienced the shortest duration. This finding suggests the PSU locked-upright lithotomy position may be useful in decreasing the length of second-stage labor. No significant differences were found, among the four groups, regarding pain (sensation and distress), demographics, and obstetrical and infant data. However, of the four groups, subjects in the supine lithotomy position (Group 1) indicated having the greatest amount of back pain and discomfort while in their labor position.

Pacific Rim Int J Nurs Res 2010 ; 14(2) 112-121

Key words: PSU locked-upright position; Duration of second stage labor; Labor positions; Labor pain; Primiparous Thai women.

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Background and Significance of Study

During labor, most women experience severe pain.[1-3] The pain of labor, compared to pain from cancer, digital amputation, toothaches and arthritis is severe,[4] and has been described as severe, sharp, cramping, dull, sapping, tiring and exhausting.[5] Pain has been found to be most severe during

second-stage labor, due to uterine contractions increasing in intensity (70-100 mm Hg)[6] and lasting from one to two hours in primiparous women.[7] Thus, one may perceive second-stage labor as being endless.[8]

Prolonged second-stage labor is the primary reason for higher numbers of forceps extractions and development of increased acidosis, in women, leading to increased acidosis in their infants, as well as lower infant Apgar scores.[9] Second-stage labor, lasting over one hour, has been shown to lead to an increased number of cesarean sections, and a greater number of third and fourth-degree birth canal tears.[10] In addition, prolonged second-stage labor has been found to result in nerve injuries, in women, which can last up to two months.[11]

Various investigators have sought to determine if the positioning of pregnant women makes a difference, regarding their safety and the duration of their second-stage labor. For example, comparison of the use of birth stools versus being in the supine position has revealed no difference regarding women's safety.[12] In addition, no significant difference has been noted, in the duration of second-stage labor, when birth stools are used as compared to when women are placed in a supine position.[13] Compared with the semi-recumbent position, the use of birth stools resulted in higher rates of tearing of the birth canal, as well as postpartum hemorrhage. However, women have expressed greater satisfaction with the birth stool method than with a semi-recumbent position.[14]

The squatting position has been shown to increase both the transverse and anteroposterior diameters of the pelvic area.[15] However, it is difficult to employ during second-stage labor. Thus, most women have been found to prefer to be either upright, kneeling or leaning during labor.[16]

Use of the supine position during labor has been found to result in a higher than usual rate of episiotomies and usage of birth-assisting equipment.[17] In addition, the supine position generally prolongs second-stage labor, since it does not facilitate internal rotation of the infant who is in the occiput posterior position.[18]

The upright position has been noted to shorten second-stage labor due to its facilitation of stronger uterine contractions accompanied by longer relaxation periods.[19] The upright position also has been found to be as safe as the supine position, [20] and to decrease labor pain for those not needing to lie down until after cervical dilation reaches 6 cm.[21]

In a pilot study, conducted by the primary investigator (PI), a new birthing position was examined with 14 primiparous women. The position involved raising the head of the delivery table 45-60^{o} and having the women on their backs in either a knees-to-chest or lithotomy position (similar to the squatting position), with placement of a specially designed pillow under the lumbar area to provide back support. In this position, the mean duration of women's second-stage labor decreased to 25.86 minutes (Std. Dev. = 12.04 minutes), which was of shorter duration than usual (mean = 60 minutes).[7] This new birthing position, subsequently, was named the Prince of Songkla University (PSU) locked-upright position. Because the PSU locked-upright position was a new and innovative position, on which no empirical investigations had been conducted, this study sought to determine its effects on duration, pain (sensation and distress) and comfort during second-stage labor among primiparous women with no known health complications.

Method

Design: The study design was experimental using a randomized factorial approach. Data were collected from April 2007 to August 2009.

Sample and setting: The sample consisted of 320 primiparous women in the labor unit of a central hospital, which provides services, in

southern Thailand, to approximately 7,200 - 8,400 laboring women each year. Criteria for inclusion consisted of pregnant women who were: primiparous; married; between 18-35 years of age; receiving prenatal care at any antenatal clinic for at least the second trimester; between 38 to 42 weeks gestation; carrying a fetus with a fetal heart rate between 120 to 160 beats per minute and an estimated fetal weight of 2,500-4,000 grams; without any prolonged latent or active phases; and, without any known personal or fetal health complications.

Subjects were recruited when admitted, during daytime hours to the labor unit, while either in the latent or active phases of labor. At that time a nurse in the labor unit determined if a woman met the study's inclusion criteria. If a woman met the inclusion criteria, she was then approached, by a research assistant, who had been trained by the PI on all aspects of the research study. The research assistant explained the: purpose of the study; risks and benefits involved; interventions that would be used and when they would be implemented; and, participants would be randomly assigned to one of four groups, with each group having a different intervention. If a woman indicated interest in taking part in the study, the contents of the consent form were read to her. If she approved to take part in the study, she was asked to sign the consent form.

Procedure: Upon obtaining written consent, demographic information and the woman's weight to height ratio were obtained from her medical record. In addition, the method to be used for reporting labor pain (sensation and distress) was described. The research assistant then randomly assigned each subject to one of four research groups that consisted of 80 subjects each.

The four research groups included: a) Group 1 (control group), which used the supine lithotomy position; b) Group 2, which used the PSU locked-upright position with knees-to-chest; c) Group 3, which used the PSU locked-upright with lithotomy position; and, d) Group 4, which used an upright lithotomy position. For the two PSU locked-upright positions and the upright lithotomy position, the head of the delivery tables was raised 45-60°. In addition, for the two PSU locked-upright positions, the women's lumbar area was raised 30-40° via a specially designed pillow. The primary difference between the two PSU locked-upright positions was that women in Group 2 kept their knees to their chests, while those in Group 3 were placed in the lithotomy position (See **Figure 1**).



Figure 1 The two PSU locked-upright positions.

Note: Left photo - PSU locked-upright position with lithotomy
Right photo - PSU locked-upright position with knees-to-chest.

Upon arrival to the delivery room, and based upon the random group assignment, each woman was placed into the appropriate birthing position. Subjects were taken to the delivery room once they reached the second-stage of labor (after cervical dilation of 10 centimeters or full dilation, as determined by a vaginal examination conducted by a labor room nurse). They remained in the delivery room until after giving birth. Immediately after delivery, the research assistant: (a) assessed the women's labor pain (sensation and distress); (b) interviewed the women regarding their perceptions of comfort related to their respective delivery positions; and, (c) obtained study relevant obstetrical and infant information from the women's medical records. Study relevant information is described below in the section on instruments.

Instruments: Data were obtained, from each subject, through the use of two paper and pencil questionnaires and an interview. The two questionnaires included: a researcher designed Demographic, Obstetrical and Infant Data Form (DOIDF), and the 100 millimeter Visual Analogue Scale (VAS).[22]

Demographic data, in the DOIDF, included the subject's: age; religion; education; occupation; and, family income. Obstetrical data consisted of: gestational age; weight to height ratio of the woman; type of delivery (vaginal or cesarean section) that occurred; whether the woman received oxytocin or any type of analgesic drug; duration of second-stage labor; and, whether any complications were sustained, by the woman, during second-stage labor. DOIDF infant data included: the Apgar score; the newborn's weight; and, whether any complications were sustained, by the infant, during second-stage labor.

Labor pain (sensation and distress), occurring during second-stage labor, was measured by the VAS.[22] The VAS consisted of two horizontal lines, each 100 millimeters in length. The line measuring pain sensation was anchored on the left side with the words, "no pain" and on the right with the words, "very severe pain." The line measuring distress was anchored on the left side with the words, "no distress" and on the right with the words, "very severe distress." Each subject was asked to place a slash mark (/) on the respective line indicating her perception of either the amount of pain or distress from pain she was experiencing. The two VAS scores were determined by measuring, in millimeters, the distance from the left side of each line to the point the woman marked. The higher the number of millimeters measured on each respective scale, the greater the labor pain sensation or distress. When compared to a 0 to 10 numerical rating scale, the VAS has supported a convergent validity of r = 0.90 to 0.92.[23]

An interview was conducted on each subject, after completion of the VAS, for the purpose of obtaining information about experiences regarding comfort related to the subject's respective second-stage delivery position. The interview questions were: "What discomfort did you experience regarding your second-stage delivery position?" and "Did you find your second-stage delivery position comfortable?"

Data analysis: Descriptive statistics were used to analyze demographic, obstetrical and infant data. One-way analysis of variance (ANOVA) and chi-square were used to evaluate differences in demographic, obstetrical and infant data among the four groups. One-way ANOVA also was used to assess differences, among the four groups, regarding duration of second-stage of labor, as well as perceived labor pain (sensation and distress). Post hoc tests were performed, using independent t-tests, when the F-test showed significant results. The interview data were assessed by way of quantifying the comfort/discomfort symptoms described.

Results

Demographic data: Although 326 primiparous women originally were recruited, only 320 participated in the study, since six failed to experience normal labor. The subjects' average age was 22.68 years (Std. Dev. = 4.1 years), and they primarily: were Buddhist (n = 245; 76.56%); had between 9 and 12 years of education (n = 203; 63.4%); were housewives (n = 150; 46.87%); and, had a low to moderate family income of 1,100 to 10,000 baht [30 baht = 1 USD] (n = 280; 88.5%).

Obstetrical data: All subjects had a full-term pregnancy, with an average gestational age of 38.8 weeks (Std. Dev. = 1.73 weeks). The women had a mean weight to height ratio of 0.4 (Std. Dev. = 0.06). All 320 women had a normal delivery. In each group, approximately two-thirds of the women (64.6% - 70%) received oxytocin, and slightly over one-third (34.7%-39.2%) received analgesic drugs. None of them experienced complications during second-stage labor. A perineal tear (no episiotomy) occurred in only: six (7.4%) in Group 2 (PSU locked-upright with knees to chest position); three (3.8%) in Group 3 (PSU locked-upright with lithotomy position); and, one (1.2%) in Group 4 (upright lithotomy position). In Group 1 (supine lithotomy position), every woman (n = 80; 100%) received an episiotomy.

Infant data: The average infant weight was 3,065 grams (Std. Dev. = 331 gms.). Most (n = 316; 98.75%) infants, regardless of group, did not experience any health complications; only four fetuses (1.25%) were distressed during second-stage of labor. After delivery, between 88.7% (n =71) and 95% (n = 76) of the infants, in each group, had one-minute Apgar scores of either 9 or 10. One-minute Apgar scores of less than 7 were found in: four (5%) infants delivered in the supine lithotomy position (Group 1); one infant (1.25%) delivered in the PSU locked upright knees-to-chest position (Group 2); and, one infant delivered in the upright lithotomy position (Group 4).

Differences among the four research groups: No significant differences were found among the four groups regarding demographic, obstetrical or infant data. Significant differences were found among the four groups regarding duration of second-stage labor (See **Table 1**). As shown in **Table 2**, women in the supine lithotomy position (Group 1) experienced a longer duration of second-stage labor than those in the other three groups (Groups 2, 3 & 4). Even though there was no statistical difference between the PSU locked-upright position with lithotomy (Group 3) and the upright lithotomy position (Group 4), the effect size (effect on lower duration of second-stage labor) of the PSU locked-upright position with lithotomy was

Table 1 Analysis of variance of second-stage labor duration for the four groups

Sources of variance	*SS*	*df*	*MS*	*F*
Between groups	17289.184	3	5763.061	12.191*
Within groups	149381.413	316	472.726	
Total	166670.597	319		

*$p < .001$

Table 2 Differences between groups regarding duration of second-stage labor

Groups	Duration of time				
	M (min)	*SD* (min)	t-test	*p*-value	Effect size
Supine lithotomy	44.01	25.77	4.07	.000	.59
PSU locked knees-to-chest	28.21	23.25			
Supine lithotomy	44.01	25.77	5.55	.000	.72
PSU locked lithotomy	24.86	16.97			
Supine lithotomy	44.01	25.77	4.03	.000	.54
Upright lithotomy	29.33	19.96			
PSU locked knees-to-chest	28.21	23.25	1.041	.299	-
PSU locked lithotomy	24.86	16.97			
PSU locked knees-to-chest	28.21	23.25	.325	.746	-
Upright lithotomy	29.33	19.96			
PSU locked lithotomy	24.86	16.97	1.524	.130	-
Upright lithotomy	29.33	19.96			

higher than that of the upright lithotomy position. As shown in **Table 3**, no differences were found among the four groups, during second-stage labor, regarding scores for pain (sensation or distress). The average sensation of pain score was at a moderate level and the average distress from pain score was at a mild level.

From the interview data it was noted comfort and discomfort, related to the women's respective positions during second-stage labor, varied. Women in the supine lithotomy position (Group 1) indicated their discomfort as "pain throughout their bodies" (n = 23; 29.5%), along with "intense back pain and cramping" (n = 18; 23.1%). The majority (n = 51; 67.1%) found the position to cause "overall body discomfort." Over one-third of those (n = 24, 31.6%) in the PSU locked-upright knees-to-chest position (Group 2) stated they experienced "no back pain," with the majority (n = 70; 92.1%) indicating they "felt more comfortable in the delivery position than when in the supine position during first-stage labor." Only 17 (21.2%) in the PSU locked-upright lithotomy position (Group 3) reported discomfort as a "little tiring of the legs." Thirteen of the subjects (16.2%) indicated "not having any back pain." The vast majority (n =63; 81.81%) of those in Group 3 indicated "feeling comfortable while in the labor position." Women in the upright lithotomy position (Group 4) indicated their discomfort as "severe abdominal pain" (n = 11; 13.8%), and a "little back pain" (n = 11; 13.8%) or "cramping" (n = 7; 8.75%). The majority (n = 46; 60.52%), however, indicated "feeling comfortable in the labor position."

Table 3 Differences in pain among groups during second-stage labor

Groups	Pain							
	Sensation				Distress			
	M (mm)[1]	*SD* (mm)	F	*P*-value	*M* (mm)	*SD* (mm)	F	*P*-value
Supine	47.30	23.47			23.05	20.48		
PSU locked[2]	42.37	24.78	1.243	.294[ns]	18.86	17.44	.748	.524[ns]
PSU locked[3]	39.92	21.79			19.22	19.13[a]		
Upright	44.17	28.81			21.06	22.28[a]		

Note: [1] = full score 100 mm
[2] = PSU locked-upright position with knees-to-chest
[3] = PSU locked-upright position with lithotomy
[ns] = not significant
[a] = skewed but with assumed homogeneity of variance

Discussion

Subjects in the PSU locked-upright knees-to-chest position (Group 2), the PSU locked-upright with lithotomy position (Group 3) and the upright lithotomy position (Group 4) had shortened durations of second-stage labor compared to subjects in the supine lithotomy position (Group 1). Thus, in both variations of the PSU locked-upright positions, being in an upright position, while using the specially designed pillow to raise their lumbar area, appears to have helped increase the rate of descent of the fetuses and widen the outlet diameter of the pelvic region. Placing the women's legs in a lithotomy position may have helped increase the pelvic outlet diameter.[24] The PSU locked-upright position (with knees-to-chest or with lithotomy) is similar to a squatting position (except women lie down), which has been shown to increase the outlet diameter of the pelvic area.[25,26]

The PSU locked-upright position with knees-to-chest resulted in a longer duration of second-stage labor than the PSU locked-upright position with lithotomy. This may have been due to the fact the subjects could not keep their knees to their chests all the time, while, due to the use of stirrups, they could maintain the lithotomy position as long as needed. The duration of second-stage labor for both positions, however, was not found to be significantly different between the two groups. These findings are similar to those of prior studies, wherein the upright position has been found to shorten the duration of second-stage labor.[19, 27] Golay and colleagues28 noted primiparous women using the squatting position had significantly shorter second-stage labor durations than did those using the semi-upright position. In addition, women in previous studies[19, 27,28] have been found to experience longer second-stage durations than those, in this study, who used the two PSU locked-upright

positions (knees-to-chest and lithotomy). No doubt this is due to the fact that both PSU locked-upright positions take advantage of gravity, increase the outlet diameter of the pelvic area and, subsequently, lead to a shorter duration of second-stage labor.

Three-fourths of the subjects in the four groups received oxytocin that helped them achieve stronger uterine contractions and resulted in them experiencing a decreased duration of the second-stage labor. However, for those in the PSU locked-upright lithotomy position, the shorter duration of the second-stage labor may have been the result of the position itself.

Subjects, in this study, reported moderate pain sensations, as well as mild distress from pain during second-stage labor. Due to the nature of the study, data were collected immediately after delivery of the infants, at which time subjects may have felt relief and, consequently, reported lower levels of pain than actually occurred during second -stage labor. This assumption is supported by prior findings regarding postpartum women who reported lower pain during second-stage labor than actually occurred. It is believed this is because women's memories of pain are overshadowed by feelings of happiness and satisfaction due to experiencing a successful birth.[29] The use of a pillow to raise the lumbar area, while in the two PSU locked-upright positions, appeared to help reduce back pain and increase comfort during delivery. This finding is supported by Neuberg,[30] who proposed use of a pillow for lumbar support can lower muscle strain in the lower back.

Conclusions

The results reveal that during second-stage labor, primiparous women in either the PSU locked-upright with lithotomy position (Group 3), the PSU locked-upright with knees-to-chest position (Group 2), or the upright lithotomy position (Group 4) experienced shorter durations of second-stage labor compared to those placed in the supine lithotomy position (Group 1). Of the four positions, the PSU locked-upright with lithotomy position (Group 3) resulted in the shortest duration of second-stage labor. In addition, the two PSU locked-upright positions and the upright lithotomy position were found to be much more comfortable for the subjects than the supine lithotomy position. These findings suggest the PSU locked-upright lithotomy position may be useful in decreasing the length of the second-stage labor for primiparous women who have no known medical complications, as well as increasing their comfort.

Limitations and Future Research

As with all studies, this study has limitations. The sample consisted of only primiparous women who came from only one hospital located in one geographic region of Thailand. Therefore, future studies need to obtain subjects from multiple health care institutions, throughout all four regions of Thailand, and include both primiparous and multiparous women. The fact subjects in the PSU locked-upright knees-to-chest position had difficulty maintaining their position needs to be examined further. It may be necessary to find alternative ways to assist women in maintaining a knees-to-chest position when in a locked-upright position so as to determine if, in fact, such a position can shorten the duration of second-stage labor. Subjects, in this study, had their second-stage labor pain assessed after delivery occurred. Such a delay in assessment most likely influenced their pain perception. Therefore, future studies may need to consider assessing second-stage labor pain at the actual time of occurrence.

Acknowledgement

The authors gratefully acknowledge the financial support received from Prince of Songkla University for implementation of this study.

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ผลของการใช้ท่า Prince of Songkla University Locked-Upright ต่อระยะเวลาความปวดและความสุขสบายในระยะที่ 2 ของการคลอดในหญิงครรภ์แรก

ศศิธร พุมดวง, สรัลภัค หมอกเรืองใส, เสงี่ยม เตชะภัทรกุล, จิตติ ลาวัลย์ตระกูล, ปัทมา จันทร์สุวรรณ

บทคัดย่อ: ในระยะที่ 2 ของการคลอดมารดาส่วนใหญ่มีความปวดมากและไม่สุขสบาย และระยะเวลาที่ยาวนานมีผลเสียต่อสุขภาพของมารดาและทารก ดังนั้นการวิจัยเชิงทดลอง (randomized factorial design) นี้ มีวัตถุประสงค์เพื่อทดสอบการใช้ท่า Prince of Songkla University locked-upright (PSU locked-upright) ต่อการย่นระยะเวลา ความปวด (sensation และ distress) และ ความสุขสบาย ในระยะที่ 2 ของการคลอด ศึกษาในมารดาครรภ์แรก 320 ราย ที่ไม่มีปัญหาสุขภาพ สุ่มกลุ่มตัวอย่างเป็น 4 กลุ่ม กลุ่มละ 80 ราย ดังนี้ กลุ่ม 1 นอนราบ กลุ่ม 2 PSU locked-upright เข่าชิดอก กลุ่ม 3 PSU locked-upright ขาขึ้นขาหยั่ง และกลุ่ม 4 นอนศีรษะสูง 45-60° ขาขึ้นขาหยั่ง สำหรับท่า PSU locked-upright หมายถึงนอนศีรษะสูง 45-60^0 บริเวณเอวหนุนด้วยหมอนสูง 30-40°

ผลการวิจัยพบว่ากลุ่ม 1 มีระยะเวลาของระยะที่ 2 ของการคลอดนานกว่าอีก 3 กลุ่มอย่างมีนัยสำคัญ ถึงแม้ว่าระยะเวลาของระยะที่ 2 ของการคลอดของกลุ่ม 2, 3 และ 4 ไม่แตกต่างอย่างมีนัยสำคัญ แต่ระยะเวลาในระยะที่ 2 ของการคลอดของกลุ่ม 3 สั้นที่สุด จากผลการวิจัยกล่าวได้ว่าการใช้ท่า PSU locked-upright ขาขึ้นขาหยั่งช่วยย่นระยะเวลาในระยะที่ 2 ของการคลอดให้สั้นลง นอกจากนี้ไม่พบความแตกต่างของความปวด ความตึงเครียดจากความปวด ลักษณะทาง ประชากรศาสตร์ สูติศาสตร์ และทารกของทั้ง 4 กลุ่ม นอกจากนี้พบว่ามารดาในกลุ่มนอนราบ (กลุ่ม 1) ปวดหลังมากที่สุด และไม่สุขสบายกับการนอนราบ

Pacific Rim Int J Nurs Res 2010 ; 14(2) 112-121

คำสำคัญ: PSU locked-upright position, ระยะที่ 2 ของการคลอด, ท่าในระยะคลอด, ความปวด, หญิงไทยครรภ์แรก

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