Perineal Outcomes and Maternal Comfort Related to the Application of Perineal Warm Packs in the Second Stage of Labor: A Randomized Controlled Trial

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ABSTRACT: Background: *Perineal warm packs are widely used during childbirth in the belief that they reduce perineal trauma and increase comfort during late second stage of labor. The aim of this study was to determine the effects of applying warm packs to the perineum on perineal trauma and maternal comfort during the late second stage of labor.* **Methods:** *A randomized controlled trial was undertaken. In the late second stage of labor, nulliparous women (*n *= 717) giving birth were randomly allocated to have warm packs (*n *= 360) applied to their perineum or to receive standard care (*n *= 357). Standard care was defined as any second-stage practice carried out by midwives that did not include the application of warm packs to the perineum. Analysis was on an intention-to-treat basis, and the primary outcome measures were requirement for perineal suturing and maternal comfort.* **Results:** *The difference in the number of women who required suturing after birth was not significant. Women in the warm pack group had significantly fewer third- and fourth-degree tears and they had significantly lower perineal pain scores when giving birth and on "day 1" and "day 2" after the birth compared with the standard care group. At 3 months, they were significantly less likely to have urinary incontinence compared with women in the standard care group.* **Conclusions:** *The application of perineal warm packs in late second stage does not reduce the likelihood of nulliparous women requiring perineal suturing but significantly reduces third- and fourth-degree lacerations, pain during the birth and on days 1 and 2, and urinary incontinence. This simple, inexpensive practice should be incorporated into second stage labor care. (BIRTH 34:4 December 2007)*

Key words: *childbirth, obstetrics, second stage of labor, perineum, pain, third- and fourth-degree lacerations, urinary incontinence after childbirth*

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Perineal trauma after childbirth can be associated with significant short- and long-term morbidity for women (1–3). Most women experience perineal pain or discomfort in the first few days after a vaginal birth; however, those who have an intact perineum report pain less frequently at 1, 2, 10, and 90 days postpartum (1,2). Of women who sustain perineal trauma, 40 percent experience pain in the first 2 weeks postpartum, up to 20 percent still report pain at 8 weeks (4), and 7 to 9 percent report pain at 3 months after birth (3,5). Perineal pain can make everyday activities, such as walking and sitting, difficult. Perineal trauma can result in fecal incontinence and painful sexual intercourse (3,4,6,7). Dyspareunia after vaginal birth is reported by 60 percent of women at 3 months and 30 percent at 6 months (8), and 15 percent report painful sexual intercourse up to 3 years (3). Women who give birth with an intact perineum make a quicker recovery than those experiencing tears or episiotomies (1).

The rates of perineal trauma reported after vaginal birth vary considerably, often due to inconsistency of definitions and reporting (9). These rates are especially high in women having their first baby (2). Studies indicate that where episiotomy is restricted to specific indications, such as fetal distress, 51 to 77 percent of women giving birth vaginally will sustain some degree of perineal trauma that requires suturing (2,5,10,11). In Australia, 252,871 women gave birth in 2004 (12) and 34.3 percent of women with a vaginal birth had an intact perineum (12). Almost one-third (28.8%) of primiparous women did not require a surgical repair for lower genital tract trauma.

Both childbearing women and health professionals place a high value on minimizing perineal trauma and reducing potential associated morbidity (13). Many factors contribute to genital tract trauma. Evidence supports restricting the liberal use of episiotomy (14,15); using vacuum extraction rather than forceps for instrumental deliveries (16); and using antenatal perineal massage to decrease perineal trauma (9). Consensus is not clear about the effect of perineal guarding (5,11), active directed pushing (17), maternal position (18), or perineal massage in the second stage of labor (19). In addition, a range of approaches to perineal care have yet to be evaluated to determine their impact on decreasing perineal trauma (20).

Finding ways to prevent or reduce genital trauma would offer benefits in terms of physical, emotional, and financial costs associated with ongoing morbidity. The pain associated with the advancement of the fetal head and stretching of perineal tissues can be severe (21,22,24).

Midwives and other accoucheurs report the use of a variety of techniques in the second stage of labor in the belief that they may lower rates of genital tract trauma and reduce pain (25). Perineal warm packs or warm compresses have been advocated for many years in the belief that they reduce perineal trauma and increase comfort during late second stage (21,26–29). Physiology literature supports the potential beneficial effects of warm packs in dilating blood vessels, increasing blood flow, influencing transmission of pain by reducing the level of nociceptive stimulation, and increasing collagen extensibility (30–32). A recent survey of 210 maternity units in the United Kingdom found that one-third used perineal warm packs (21). Randomized trial evidence of the efficacy of perineal warm packs is limited because of their small sample sizes, mixed methods, and lack of long-term follow-up and data on the effects on women's pain (25,33).

The current trial was designed to determine the efficacy of the application of warm packs to the perineum in the late second stage of labor on the rate of perineal trauma that required perineal suturing. Secondary objectives included women's perception of pain at birth on days 1 and 2 after birth and morbidity at 6 weeks and 3 months after birth.

Methods

The trial was conducted from November 1997 to July 2004 at two maternity hospitals in Australia. Approval was obtained from both the hospital and university human research ethics committees.

The area where the trial was conducted has the largest culturally and linguistically diverse childbearing population in the state of New South Wales. Three-quarters of women are born in countries other than Australia. To include women from these backgrounds in the research, all information forms, consent forms, and questionnaires were translated into Arabic, Turkish, Mandarin, Vietnamese, and Korean, and interpreters were used as needed.

Study Sample

Women who were at least 36 weeks pregnant were approached to participate in the trial in the antenatal clinics or in the labor wards if they were not in labor. Nulliparous women were eligible to join the trial if they met the following criteria: had a singleton pregnancy with cephalic presentation; anticipated a normal birth; had not performed perineal massage, did not intend to perform perineal massage antenatally; and were older than 16 years. Women could withdraw from the study at any point without prejudice to their

care or their relationship with their health practitioners. Eligibility and consent to participate were rechecked once the woman was in established labor. Women who were booked for an elective cesarean section, or had experienced an intrauterine fetal death, were excluded.

The primary outcome variable was suturing after birth. Using delivery records over the previous 7 years, it was estimated that 25 percent of all women required no perineal suturing. Little alteration in the numbers of women not requiring perineal suturing during this time had occurred. To detect a reduction of 10 percent in suturing with a power of 80 percent ($\alpha = 0.05$, two-sided t test), 694 women needed to be randomized.

Procedure

Clear protocols for use of the warm pack treatment were available in the delivery wards. All midwives involved in the trial were trained in the technique and had regular updates beginning several months before the trial. Perineal warm packs had not been used by most of the midwives participating in the trial previously, so education occurred before the start of the trial. Regular checking of the procedure by the chief investigator ensured protocol compliance.

Randomization was attended by the National Health and Medical Research Clinical Trials Centre using randomly generated numbers in sealed opaque envelopes. Participants were stratified into six subgroups by age (< 25, 25–34, and > 34 yr) and Asian (China, Vietnam, Hong Kong, Indonesia, Japan, Laos, Cambodia, Taiwan, North Korea, South Korea, Thailand, Philippines, Burma, Malaysia) and non-Asian ethnicity. The six subgroups were (Asian < 25, non-Asian < 25, Asian 25–34, non-Asian 25–34, Asian > 34, non-Asian > 34 yr). The focus on Asian women was due to the high rates of severe perineal trauma already identified in the population being studied (34).

Remote allocation concealment was used, with randomization occurring as close as possible to second stage of labor. Women assigned to the warm pack group received usual care during labor until the baby's head began to distend the perineum and the woman was aware of a stretching sensation. A sterile metal jug filled with boiled tap water (between 45° and 59°C) was used to soak a sterile perineal pad, which was wrung out before being placed gently on the perineum during contractions. The temperature range of the perineal pad over 15 minutes was 38° to 44°C. The pad was resoaked to maintain warmth between contractions. The water in the jug was replaced every 15 minutes until delivery (between 45.4° and 59.7°C). Women assigned to the standard care group did not have warm packs applied to their perineum in second stage.

Perineal trauma that required suturing was defined as greater than a first-degree tear; any tear that was bleeding and any tear that did not fall into anatomical apposition. Perineal trauma was repaired using a continuous interlocking technique to the vagina, interrupted sutures to the muscle, and a subcuticular technique to the skin. Perineal trauma was sutured with Vicryl 2/0 (Ethicon, Johnson & Johnson, Somerville, New Jersey, USA). Marcaine with adrenaline was used as local anesthesia, except for labial or clitoral trauma, or both, when lignocaine 1 percent was used. All the midwives who sutured had been trained in these techniques, which were the standard practice at both hospitals. Random audits of the clinical notes during the trial showed compliance of over 90 percent with the suturing protocol, which did not differ between the groups.

Allocation could not be concealed from the midwives who attended the women or from the women themselves. An independent, senior midwife blinded to the allocated group was asked to give an independent assessment of the degree of perineal trauma after the birth and whether or not suturing was required. Midwives were instructed not to let other midwives know the allocation. To attain blinding for the outcome, the equipment needed for the application of a warm pack was set up in the delivery room for every woman in the trial, regardless of allocated group. The allocation was not recorded on the postnatal data collection forms, and the midwives involved in the follow-up were unlikely to have been present at the birth or when the woman was randomized.

The numbers of women in both groups who had analgesia or anesthesia, or both, during labor were equal (Table 2). The practice in both hospitals was to allow the epidural analgesia to wear off in second stage, so that most women had perineal sensation at the birth. A birthweight categorization of less than 3,500 g and greater than 3,500 g was used to examine perineal outcomes associated with babies above mean birthweight in comparison with those with mean or lower than mean birthweight. In clinical practice, large babies are observed to be associated with greater perineal trauma.

Data Collection and Analysis

Data collection instruments were modified from previous existing studies (35). Intrapartum and postpartum data were collected by midwives and from

medical records after discharge. Pain scores were collected immediately after the birth before the woman left the delivery ward. All women in the trial were asked to circle the comment on a scale that represented the pain they experienced when giving birth, from 1 (no pain) to 5 (the worst pain in my life). On days 1 and 2, a pain analog scale (0–10) was used, and women were asked to report the level of perineal pain experienced on that particular day. The women were interviewed by telephone at 6 weeks and 3 months postpartum to collect data on pain, sexual intercourse, incontinence, and breastfeeding.

All data were analyzed with Statistical Package for Social Sciences version 12 (36). Alpha was set at 0.05 for all analyses. Assumptions for all statistical tests were examined.

Analysis of the primary and secondary outcomes was based on intention-to-treat basis. Odds ratios, percentage differences, and confidence intervals are shown for the primary outcome. Percentages in the tables are based on numbers at the top of each table, unless otherwise stated. Chi-square and Student's *t* tests were used to examine group differences in the main outcome variables. A logistic regression model was fitted to account for potential confounders on the primary outcome of requirement for perineal suturing. Women who had a cesarean section were excluded from this analysis.

Potential confounders, which were identified from the literature, initially included mode of birth (normal vs instrumental), age (16–24, 25–34, and > 34 yr), ethnicity (non-Asian vs Asian), birthweight ($\leq$ 3,500 vs > 3,500 g), and birth position (semiseated, upright, flat, lateral). A screen of $p < 0.25$ was used to justify retaining the variables in the model except for group, which was retained regardless. Birth position was the only variable that did not consistently meet the $p < 0.25$ screen, and thus was removed from the final model. Pain scores at birth were analyzed using chi-square test. Pain scores on days 1 and 2 were analyzed using *t* test, and standard distributions are presented with the results.

Results

In total, 1,047 women were approached and consented to participate in the trial, and 717 were randomized—360 to warm packs and 357 to standard care. Three hundred and thirty women consented but were not

Table 1. Baseline Maternal Characteristics of Women by Allocated Group

Characteristic	*Warm Pack Group (n = 360)*	*Standard Care Group (n = 357)*
Mean age (yr) (SD)	27.0 (5.5)	27.2 (4.9)
Age group (yr), No. (%)		
16–24	128 (35.6)	116 (32.5)
25–34	199 (55.3)	213 (59.7)
> 34	33 (9.2)	28 (7.8)
Ethnicity*, No. (%)		
Non-Asian	244 (67.8)	238 (66.7)
Asian	116 (32.2)	119 (33.3)

**Women were defined as "Asian" if they were born in, or identified as being from, China, Vietnam, Hong Kong, Indonesia, Japan, Laos, Cambodia, Taiwan, North Korea, South Korea, Thailand, Philippines, Burma, and Malaysia.*

Table 2. Distribution of Clinical Outcomes for Women and Babies

Variables	*Warm Pack (n = 360)*	*Standard Care (n = 357)*	p
Duration of second stage (min), mean (SD)	82.09 (61.1)	86.64 (67.6)	0.35
Analgesia, No. (%)			0.36
Nil	57 (16.4)	52 (14.9)	
Nitrous oxide	139 (39.9)	124 (35.3)	
Pethidine	91 (26.1)	93 (26.6)	
Epidural	59 (17.0)	79 (22.6)	
Other	2 (0.6)	1 (0.3)	
Position for birth, No. (%)			0.45
Semiseated	246 (68.3)	263 (73.7)	
Upright (all fours, standing, birth stool, kneeling, squatting)	48 (13.3)	45 (12.6)	
Lateral	33 (9.2)	27 (7.6)	
Supine (lithotomy, cesarean section)	21 (5.8)	14 (3.9)	
Mode of birth, No. (%)			0.64
Spontaneous vaginal birth	305 (84.7)	301 (84.3)	
Forceps	11 (3.1)	9 (2.5)	
Vacuum	32 (8.9)	39 (10.9)	
Cesarean section	12 (3.3)	8 (2.2)	
Infant birthweight (g), mean (SD)	3,365 (447)	3,346 (450)	

randomized because staff were too busy to undertake randomization, the woman had a cesarean section before second stage, or the woman refused to participate after randomization. Five hundred and ninety-nine women completed the study as randomized, 302 in the warm pack group and 297 in the standard care group. Reasons for not complying with the assigned treatment are shown in Fig. 1, but most reasons were due to surgical intervention (forceps, vacuum, cesarean section).

All the women were nulliparous and similar in age and ethnicity (Table 1). Five women had practiced perineal massage, despite this reason being a criterion for exclusion (2 in the experimental group and 3 in the control group). These women were retained in the analysis because they had already been randomized.

The duration of second stage, analgesia use, birth position, mode of birth, or infant birthweight was not significantly different between the groups (Table 2). No differences were observed in the proportion of women requiring perineal suturing (78.6% in the warm pack group and 79.9% in the standard care group) (Table 3); or in the rates of no or minor perineal trauma (< second degree) or major (≥ second degree) perineal trauma; or in the numbers of episiotomies. The difference in third- and fourth-degree tears was significant, with women in the standard care group 50 percent more likely to sustain a severe perineal tear than women in the warm pack group (31/357 vs 15/360, OR = 2.16, 95% CI = 1.1–4.3, $p = 0.02$) (Table 3).

In the logistic regression model, the three significant predictors of perineal suturing were instrumental birth, birthweight, and Asian ethnicity. Age did not significantly contribute to the need for perineal suturing (Table 4). Warm packs did not reduce the need for perineal suturing.

Pain scores while giving birth were collected for 272 women in the warm pack group (75%) and 290 in the standard care group (81%). Women who had warm packs were significantly less likely to report "bad pain" (25% vs 31%) or "the worst in my life" (34% vs 51%) experienced at birth compared with women who received standard care (Fig. 2). Reasons for not completing the pain scores included that the midwives were too busy, a change of shift occurred and midwives forgot, or the form was lost. Fewer pain scores were obtained from women who had forceps and vacuum extraction births (17.6% of these women completed a pain score) compared with those who had vaginal births (90.1%), and this factor may have been due to confusion over whether these women should

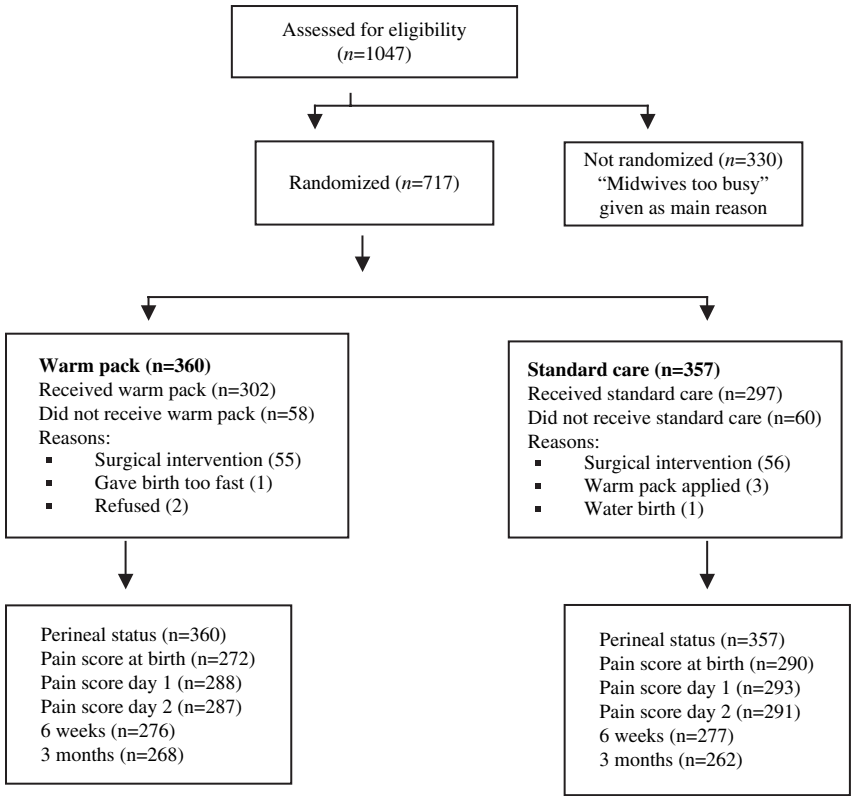

Fig. 1. Flow of participants.

Table 3. Genital Tract Trauma by Allocated Group

Outcomes	*Warm Pack (n = 360) No. (%)*	*Standard Care (n = 357) No. (%)*	*OR (95% CI)*
Perineal suturing required*	283 (78.6)	284 (79.9)	1.0 (0.69–1.47)
Degree of trauma			
Minor or no trauma (intact, 1st degree, vaginal, labial tear	144 (41.4)	141 (40.4)	1.04 (0.78–1.41)
Major trauma (2nd, 3rd, 4th degree episiotomy)	204 (58.6)	208 (59.6)	
Episiotomy	39 (10.8)	41 (11.5)	0.94 (0.59–1.5)
Severe perineal trauma (3rd and 4th degree)	15 (4.2)	31 (8.7)	2.16 (1.15–4.10)

**Women who had a cesarean section were removed from this analysis (12 in warm pack group and 8 in standard care group).*

Table 4. Logistic Regression Model for Primary Outcome of Requirement for Perineal Suturing and Influencing Variables

Variables	*Unadjusted OR (95% CI)*	*Adjusted OR (95% CI)*
Group		
Warm pack	1.0	1.0
Standard care	1.0 (0.7–1.5)	1.0 (0.7–1.5)
Age (yr)		
16–24	1.0	1.0
25–34	2.1 (0.9–4.7)	1.7 (0.7–3.8)
≥ 35	1.1 (0.5–2.5)	1.1 (0.5–2.5)
Ethnicity*		
Non-Asian	1.0	1.0
Asian	2.7 (1.7–4.3)	2.6 (1.6–4.4)
Mode of birth		
Normal vaginal	1.0	1.0
Instrumental vaginal	4.5 (1.8–11.2)	3.7 (1.4–9.3)
Birthweight (g)		
≤ 3,500	1.0	1.0
> 3,500	1.7 (1.1–2.6)	1.8 (1.2–2.9)

**Women were defined as "Asian" if they were born in, or identified as being from, China, Vietnam, Hong Kong, Indonesia, Japan, Laos, Cambodia, Taiwan, North Korea, South Korea, Thailand, Philippines, Burma, and Malaysia.*

have been followed up because they did not have the treatment. No women who were asked refused to complete the pain score.

Pain scores were collected for 288 (80%) women in the warm pack group and 293 (82%) women in the standard care group 1 day after they gave birth. Women in the warm pack group had significantly lower mean pain scores than women in the standard care group based on the 0 to 10 visual analog scale (mean 3.86 [SD 2.3] vs 4.67 [SD 2.3]). Pain scores obtained from 278 (77%) women in the warm pack group and 291 (82%) in the standard care group on day 2 were also found significantly lower among women in the warm pack group (mean 3.00 [SD 2.1] vs 3.71 [SD 2.2]) (Fig. 3). Pain scores collected on days 1 and 2 were more likely to be from women who had a vaginal birth than from women who had an instrumental birth.

No significant differences occurred between the groups in perineal pain scores or pain experienced when walking or sitting, during a bowel motion, and on urination; in the number of women who had resumed sexual intercourse or had pain with sexual intercourse; or in the number of women who were

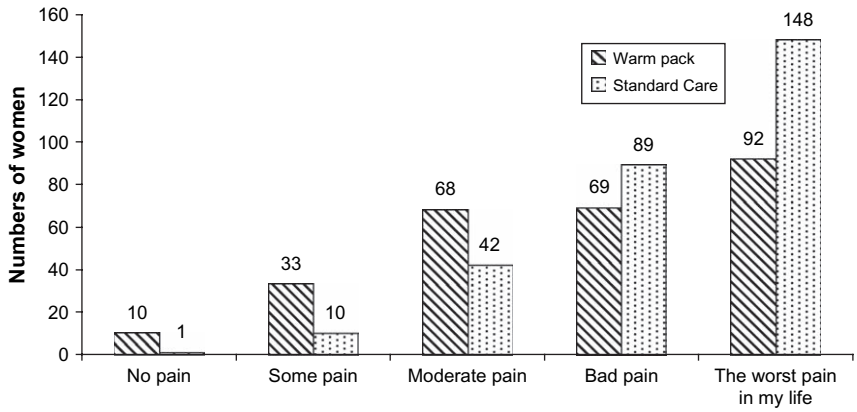

Fig. 2. Pain reported by women when giving birth. A chi-square test was performed to examine differences between the groups, $p < 0.001$.

Table 5. Urinary Incontinence at 3 Months by Allocated Group

Incontinence	*Warm Pack Group (n = 267) No. (%)*	*Standard Care Group (n = 263) No. (%)*
Urinary incontinence	26 (9.7)*	59 (22.4)*
Occasional, but improving	14 (5.2)	32 (12.3)
When coughing and lifting	12 (4.5)	24 (9.2)
Most days and for no reason	3 (1.1)	2 (0.8)

Note: A chi-square test was performed to examine differences between allocated groups for urinary incontinence, p = *0.0001.*The numbers in the subgroups do not add up to the total incontinence numbers because two women in the warm pack group selected more than one option and one woman in the standard care group said she had incontinence, but no further information was reported.*

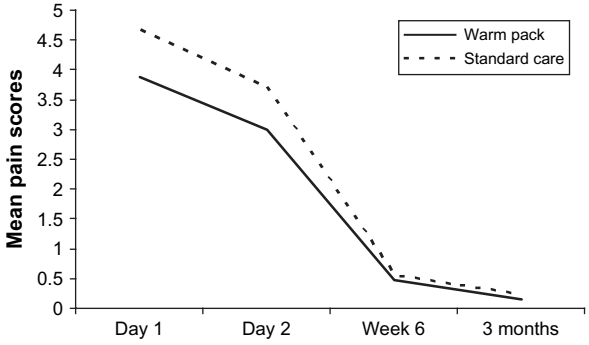

Fig. 3. Mean perineal pain scores reported by women on days 1 and 2, and at 6 wk and 3 mo using a visual analog scale (0–10). The t *test was used for analysis,* p < *0.001; Y axis 0–5, since no pain scores were > 5 on the visual analog scale.*

breastfeeding at 6 weeks or 3 months postpartum. Although no significant difference was observed in the number of women experiencing urinary incontinence at 6 weeks (36/276 vs 46/277, $p = 0.15$), a significant difference occurred at 3 months, with more women in the standard care group reporting urinary incontinence (26/277 vs 59/262, $p = 0.0001$) (Table 5).

Discussion

The application of perineal warm packs or compresses is widely advocated by midwives to reduce perineal trauma and improve comfort during the birth (21). The current study is the largest randomized trial to evaluate the effect of the use of perineal warm packs during late second stage on women's perineal trauma and comfort. Although we found no reduction in perineal suturing, the trial was underpowered to assess third- or fourth-degree tears; however, the difference in the rates was sufficient (OR = 2.16, CI = 1.1–4.3) to warrant further investigation.

The high rate of severe perineal trauma (6.4%) among women in this study is partly explained by the fact that they were all nulliparous and nearly one-third were Asian. Both factors were found to be strongly associated with severe perineal trauma in a previous study of women giving birth in these same two hospitals (34). Severe perineal trauma constitutes a serious morbidity with a high incidence of fecal incontinence for women who experience it (7) and any possible reduction in the incidence should be pursued with further research. One of the limitations of this study was that we did not examine the incidence of fecal incontinence. We reported a significant reduction in urinary incontinence at 3 months after the birth in the warm pack group, although the reason why is unclear.

The power analysis estimated that 694 participants were needed to show a 10 percent difference in suturing. Because of time factors, recruitment ceased at 717, despite only 599 women actually having received the allocated treatment. It is highly unlikely that an additional 95 women would have led to a statistically significant difference in the primary outcome measure.

The use of perineal warm packs was associated with a significant reduction in pain reported at birth and on days 1 and 2 after birth. Pain associated with advancement of the fetal head and stretching of the perineal tissues can be severe (24,37,39–41). Few studies have examined the effect of analgesia in relation to perineal pain during and after birth. Lowe (23) and Lowe and Roberts (24) concluded that a woman's expectations and confidence in dealing with her pain is a key variable in explaining variation in pain experienced during labor and birth.

Perineal pain scores remained statistically significantly lower in the warm pack group on days 1 and 2, despite no difference in the incidence of suturing between the groups. Three explanations for this outcome are possible. First, this finding may be because the treatment could not be blinded and women who received the warm packs expected their pain to be lower. Women who did not receive the warm packs may have been disappointed and assumed that they suffered additional trauma because they did not receive the treatment. Second, the warm packs somehow altered connective tissue on a superficial level, leading to less small splits and grazes, all of which may contribute to overall levels of pain. Third, the presence of the warm pack on the perineum made midwives touch the perineum less, which led to less bruising. Since it was impossible to conceal the allocated treatment from the midwives, potential exists

for reporting bias in data collection. However, this bias is unlikely because the study midwives had never used warm packs before and were generally not convinced of their value. In addition, a large number of midwives contributed to the data collection, making systematic distortion unlikely.

Different pain score measurements were used at birth and on days 1 and 2. The descriptions of pain associated with the pain scores at birth were used to reflect comments that women made to midwives about the experience of giving birth. These different measures of pain had also been used during a previous smaller warm pack trial (35).

The level of perineal pain that women experience when actually giving birth and methods that might ease this pain, although maximizing the physiology of normal birth, need to be studied further. A focus on reducing perineal trauma is certainly worthwhile, as is research into nonpharmacological methods for reducing pain during birth. Although pain-free births do occur, they are uncommon (38). It is more common that advancement of the fetal head and stretching of the perineum in the minutes before giving birth are accompanied by pain, which is sometimes severe (24,37,39–41). Although thousands of studies have examined the issue of analgesia's effects on pain in labor, much of this work has overlooked the pain associated with the actual birth (21). In fact, the most severe pain is often experienced in the second stage of labor (24,37,41). In an observational study of 20 women during second stage who were interviewed after giving birth, 7 described the second stage of labor in nothing but negative terms, such as painful, miserable, or horrible (42). The authors concluded that strategies to alleviate some of the intense sensations of second stage labor are needed.

The study had some limitations. Since all participants were nulliparous women, we cannot draw conclusions about the effects of warm packs on women having subsequent births. We also did not record the length of time the warm packs were applied to the perineum. Although midwives observed that most babies were born within 15 minutes of the warm packs being applied, it is possible that had the packs been applied longer the effect may have been more pronounced. We could not blind women to which group they were allocated, which could have biased the amount of pain they reported, since women who received warm packs could have expected to experience less pain as a result of the treatment. Women who did not receive warm packs may have been disappointed and thus perceived their births more negatively. The inclusion of a third group of women, who received an application of a tepid perineal pack, would have been optimal. Our attempt to have an independent midwife assessor, who was blinded to the group allocation, review all perineal trauma was, in reality, hard to achieve because midwives working closely together tend to have knowledge of events in the delivery ward. Another limitation was an inability to use data collected on the postpartum use of analgesia due to poor documentation. This factor may have added important supporting evidence to the finding that warm packs reduced perineal pain on days 1 and 2 after the birth.

Conclusions

Although the application of warm packs in labor did not decrease the likelihood of nulliparous women requiring perineal suturing, it showed evidence of other benefits, including reducing pain experienced during the birth and on days 1 and 2 postpartum, urinary incontinence, and a reduction in severe perineal trauma. This simple, inexpensive practice should be incorporated into the care of second stage labor.

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References

1. Klein MC, Gauthier RJ, Robbins JM, et al. Relationship of episiotomy to perineal trauma and morbidity, sexual dysfunction, and pelvic floor relaxation. *J Obstet Gynecol* 1994; 45(7):318–323.
2. Albers L, Garcia J, Renfrew M, et al. Distribution of genital tract trauma in childbirth and related postnatal pain. *Birth* 1999;26(1):11–15.
3. Sleep J, Grant A. West Berkshire perineal management trial: three-year follow-up. *Br Med J* 1987;295:749–751.
4. Glazener C, Adballa M, Stroud P. Postnatal maternal morbidity: extent, causes, prevention and treatment. *Br J Obstet Gynaecol* 1995;102:282–287.
5. McCandlish R, Bowler U, van Asten H, et al. A randomized controlled trial of care of the perineum during second stage of normal labor. *Br J Obstet Gynaecol* 1998;105:1262–1272.
6. Johanson R. Perineal massage for prevention of perineal trauma in childbirth. *Lancet* 2000;355:250–251.
7. Sultan AH, Thakar R. Lower genital tract and anal sphincter trauma. *Best Pract Res Clin Obstet Gynaecol* 2002;16(1): 99–115.
8. Barrett G, Pendry E, Peacock J, et al. Women's sexual health after childbirth. *Br J Obstet Gynaecol* 2000;107(2):186–195.

9. Beckmann MM, Garrett AJ. Antenatal massage for reducing perineal trauma. *Cochrane Database Syst Rev* 2006;(1): CD005123. doi: 10.1002/14651858.CD005123.pub2
10. Sleep J, Grant A, Garcia J, et al. West Berkshire perineal management trial. *Br Med J* 1984;289:587–590.
11. Mayerhofer K, Bodner-Adler B, Bodner K, et al. Traditional care of the perineum during birth. A prospective, randomized, multicenter study of 1067 women. *J Reprod Med* 2002; 47(6):477–482.
12. Laws P, Grayson N, Sullivan E. *Australia's Mothers and Babies 2004*. Sydney, Australia: AIHW National Perinatal Statistics Unit, 2006.
13. Stamp G. Care of the perineum in the second stage of labor: a study of views and practices of Australian midwives. *Midwifery* 1997;13:100–104.
14. Hartman K, Viswanathan M, Palmieri R, et al. Outcomes of routine episiotomy: a systematic review. *JAMA* 2005;293: 2141–2148.
15. Carroli G, Belizan J. Episiotomy for vaginal birth. *Cochrane Database Syst Rev* 1999;(3):CD000081. doi: 10.1002/14651858. CD000081
16. Johanson RB, Menon V. Vacuum extraction versus forceps for assisted vaginal delivery. *Cochrane Database Syst Rev* 1999;(2): CD000224. doi: 10.1002/14651858.CD000224
17. Albers LA, Sedler KD, Bedrick EJ, Teaf D, Peralta P. Factors related to genital tract trauma in normal spontaneous vaginal births. *Birth* 2006;32:94–100.
18. Gupta JK, Hofmeyr GJ, Smyth R. Positions in the second stage of labour for women without epidural anaesthesia. *Cochrane Database Syst Rev* 2004;(1):CD002006. doi: 10.1002/ 14651858.CD002006.pub2
19. Stamp G, Kruzins G, Crowther CA. Perineal massage in labor and prevention of perineal trauma: randomized controlled trial. *BMJ* 2001;322:1277–1280.
20. Renfrew M, Hannah W, Albers L, Floyd E. Practices that minimize trauma to the genital tract in childbirth: a systematic review of the literature. *Birth* 1998;25:143–160.
21. Sanders J, Peters T, Campbell R. Techniques to reduce perineal pain during spontaneous vaginal delivery and perineal suturing: a UK survey of midwifery practice. *Midwifery* 2005;21(2):154–160.
22. Sanders J, Campbell R, Peters TJ. Effectiveness of pain relief during perineal suturing. *BJOG* 2002;109(9):1066–1068.
23. Lowe NK. Self-efficacy for labor and childbirth fears in nulliparous pregnant women. *J Psychosom Obstet Gynaecol* 2000; 21:219–224.
24. Lowe NK, Roberts J. The convergence between in labor report and postpartum recall of parturition pain. *Res Nurs Health* 1998;11:11–21.
25. Albers LL, Sedler KD, Bedrick EJ. Midwifery care measures in the second stage of labor and reduction of genital tract trauma at birth: a Randomized trial. *J Midwifery Women's Health* 2005;50(5):365–372.
26. Albers L, Anderson D, Cragin L. Factors related to perineal trauma in childbirth. *J Nurse Midwifery* 1996;41:269–276.
27. Balaskas J. *Activebirth*. London, UK: Unwin Hyman Ltd, 1983.
28. Schrag K. Maintenance of pelvic floor integrity during childbirth. *J Nurse Midwifery* 1979;24:26–31.
29. Kitzinger S, Simkin P. *Episiotomy and the Second Stage of Labor*. 2nd ed. Seattle, Washington: Penny Press Inc., 1984.
30. Fritz S. *Mosby's Fundamentals of Therapeutic Massage. St*. Louis, Missouri: Mosby Lifeline, 1995.
31. Porth C. *Pathophvsiologv—Concepts of Altered Health States*. 3rd ed. Philadelphia, Pennsylvania: J.B. Lippincott, 1990.
32. Hayes KW. *Manual for Physical Agents*. 5th ed. Upper Saddle River, New Jersey: Prentice Hall Health, 2000.
33. Musgrove H. Perineal preservation and heat application during the second stage of labor. *Midwifery Today E-News* 1999;1(33).
34. Dahlen H, Ryan M, Homer C, Cooke M. An Australian prospective cohort study of risk factors for severe perineal trauma during childbirth. *Midwifery* 2007;23(2):196–203.
35. Musgrove H. Perineal preservation and heat application during the second stage of labour. A randomized controlled trial. In: ACMI, ed. *Proceedings of Australian College of Midwives Inc 10th Biennial National Conference*. Melbourne, Australia: ACMI, 1997:381–395.
36. SPSS. *Statistical Package for Social Sciences (SPSS) for Windows*. Chicago, Illinois: SPSS inc, 2003.
37. Niven C, Murphy-Black T. Memory of labor pain: a review of the literature. *Birth* 2000;27(4):244–253.
38. Jowitt M. Pain in labor: is it insufferable? *Midwifery Matters* 2000;85:12–16.
39. Anderson T. Feeling safe enough to let go: the relationship between a woman and her midwife during the second stage of labor. In: M Kirkham, ed. *The Midwife-Mother Relationship*. London, UK: Macmillan Press Ltd, 2000:92–119.
40. Melzack R, Taenzer P. Labor is still painful after childbirth training. *Clin Mol Allergy* 1981;125:357–363.
41. Niven C, Gijsbers K. A study of labor pain using the McGill Pain Questionnaire. *Soc Sci Med* 1984;19:1347–1351.
42. McKay S, Barrows T, Roberts J. Women's views of second stage of labor as assessed by interviews and videotapes. *Birth* 1990;17:192–198.