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Effect of Magnesium Sulfate Wet Compress Intervention During the Second Stage of Labor on Maternal and Neonatal Outcomes in Vaginal Delivery

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Abstract: *Objective*: To investigate the effects of magnesium sulfate wet compress applied during the second stage of labor in vaginal delivery on maternal and neonatal outcomes, and to provide evidence for perineal protection in midwifery practice. *Methods*: In this retrospective cohort study, 117 women who delivered vaginally between September and October 2025 at the study center were enrolled. According to perineal management during the second stage of labor, participants were assigned to the magnesium sulfate wet compress group or the control group. Maternal outcomes (labor duration, perineal laceration rate, NRS pain score, perineal edema, and postpartum cold compress requirement) and neonatal outcomes (body length, birth weight, Apgar score, and transfer rate) were compared between groups. *Results*: There were no statistically significant differences in baseline characteristics between the two groups ($P > 0.05$). Compared with the control group, parturients in the observation group had significantly lower pain scores at 2 hours postpartum, as well as lower incidences of perineal edema and reduced demand for cold compress therapy; moreover, the rates of perineal laceration and episiotomy were significantly decreased ($P < 0.05$). No statistically significant differences were observed between the two groups with respect to neonatal length, birth weight, Apgar score, or neonatal transfer rate ($P > 0.05$). *Conclusion*: Magnesium sulfate wet compress during the second stage of labor is a safe and feasible intervention that effectively reduces perineal pain, edema, and birth-related perineal trauma without compromising neonatal outcomes. Larger randomized controlled studies are needed to confirm these findings.

Keywords: Magnesium sulfate; Wet compress therapy; Second stage of labor; Vaginal delivery; Perineal protection; Maternal and neonatal outcomes

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1. Introduction

The second stage of labor is a critical period affecting maternal and neonatal safety and comfort during vaginal delivery. As the fetal head descends and uterine contractions intensify, the perineal tissues are continuously stretched and compressed, resulting in impaired local blood circulation and varying degrees of edema and pain [1]. Although most cases of perineal edema resolve within 2–3 days postpartum with appropriate treatment and nursing care and have little impact on quality of life, severe edema is more challenging to manage and may cause local circulatory disorders, delayed wound healing, wound dehiscence, and secondary infection, leading to significant discomfort, endocrine disturbances, and possible adverse effects on breastfeeding [2–4]. Magnesium sulfate hot wet compress, a traditional physical therapy, reduces edema through its hyperosmotic effect by promoting the exudation of interstitial fluid and can also inhibit sympathetic neurotransmitter release, relax vascular smooth muscle, improve microcirculation, and exert anti-inflammatory, analgesic, and tissue-repair–enhancing effects [5]. In recent years, magnesium sulfate wet compress has been increasingly applied in perineal care during childbirth to alleviate congestion, relieve edema, and facilitate tissue recovery [6–8]; however, clinical evidence regarding its effectiveness when used specifically during the second stage of labor remains limited. Therefore, this retrospective analysis compared maternal and neonatal outcomes between women who did and did not receive magnesium sulfate wet compress during the second stage of labor, aiming to evaluate its clinical value and provide evidence for perineal protection in midwifery practice.

2. Methods

2.1. Study population

This retrospective cohort study was conducted using data obtained from the electronic medical record system of Zhaoqing Hospital of The Third Affiliated Hospital of Sun Yat-sen University. Clinical data of women who underwent vaginal delivery in the Department of Obstetrics between September and October 2025 were consecutively collected. The inclusion criteria were as follows: (1) term pregnancy with a gestational age of 37–42 weeks; (2) singleton pregnancy with cephalic presentation and vaginal delivery; (3) entry into the second stage of labor with complete labor records; and (4) complete maternal and neonatal clinical data. The exclusion criteria were: (1) presence of severe preeclampsia, heart disease, severe infection, or other pregnancy-related complications; (2) conversion to cesarean section due to fetal distress, labor arrest, or other reasons; (3) history of perineal surgery or vulvar skin disease; and (4) incomplete clinical data or missing key variables. All enrolled cases met the study criteria, and a total of 117 women were included. Personal information of all participants was anonymized to ensure privacy protection and data security.

2.2. Grouping and intervention

According to the perineal management methods used during the second stage of labor, the participants were divided into a magnesium sulfate wet-compress group (observation group) and a non-wet-compress group (control group). In the observation group, after full cervical dilation in the second stage, sterile gauze soaked in 50% magnesium sulfate solution was applied to the perineal area and the external vaginal opening following routine perineal cleaning and disinfection. The control group did not receive magnesium sulfate wet compress during the second stage of labor. All deliveries were attended by qualified midwives, and all women received standard labor management and perineal protection guidance throughout the birthing process, followed by routine postpartum maternal and neonatal care and observation.

2.3. Outcome measures

The primary aim of this study was to evaluate the effect of magnesium sulfate wet compress during the second stage of labor on maternal and neonatal outcomes. The assessed indicators included: (1) Maternal outcomes: duration of the first, second, and third stages of labor; incidence of perineal laceration; degree of perineal edema; pain score at 2 hours postpartum (NRS); incidence of perineal erythema or allergic reactions; and maternal demand for ice application. (2) Neonatal outcomes: neonatal birth weight and length; Apgar scores at 1, 5, and 10 minutes; and neonatal transfer rate. (3) General demographic data: maternal age, height, weight, gestational age, gravidity, and parity, which were recorded to determine the comparability of baseline characteristics between the two groups.

2.4. Statistical analysis

All data were analyzed using SPSS version 25.0. Continuous variables were tested for normality and expressed as mean ± standard deviation (Mean ± SD). Between-group comparisons were performed using independent-sample *t*-tests for normally distributed data or the rank-sum test for non-normally distributed data. Categorical variables were presented as frequencies (percentages) and compared using the $\chi 2$ test or Fisher's exact test, as appropriate. A two-tailed significance level of $\alpha = 0.05$ was adopted, and statistical significance was defined as $P < 0.05$.

3. Results

3.1. Comparison of general characteristics

There were no statistically significant differences between the two groups in maternal age, height, weight, gravidity, parity, or gestational age ($P > 0.05$), indicating good comparability of baseline characteristics (**Table 1**).

Table 1. Comparison of general data between the two groups of parturients

Variable	Observation group (*n*=32)	Control group (*n*=85)	*t*	*P*
Age (years)	29.81 ± 4.69	30.11 ± 3.92	-0.342	0.754
Height (cm)	159.03 ± 4.71	159.32 ± 4.67	-0.315	0.754
Weight (kg)	65.65 ± 9.28	65.56 ± 8.35	0.326	0.745
Gravidity	1.94 ± 1.24	1.99 ± 1.24	-0.338	0.756
Parity	0.56 ± 0.64	0.49 ± 0.63	-0.826	0.411
Gestation (weeks)	39.46 ± 0.89	39.34 ± 0.91	0.595	0.554

Note: Values are presented as mean (SD). An independent samples *t*-test was used for group comparisons. $P < 0.05$ indicates statistical significance

3.2. Comparison of maternal outcomes

Compared with the control group, the observation group had significantly lower perineal pain scores (NRS) at 2 hours postpartum ($P < 0.05$), suggesting that magnesium sulfate wet compress effectively reduced perineal pain. In addition, the observation group exhibited lower rates of postpartum perineal edema, reduced need for ice application, and lower incidences of perineal laceration and episiotomy ($P < 0.05$), indicating that magnesium sulfate wet compress may help reduce perineal trauma and enhance maternal comfort. No cases of local skin erythema or systemic allergic reactions were observed during the magnesium sulfate application (**Table 2**).

Table 2. Comparison of labor outcomes between groups

Variable	Observation group (*n*=32)	Control group (*n*=85)	t/x^2	*P*
First stage of labor (h)	6.46 ± 2.97	7.49 ± 3.14	-1.283	0.202
Second stage of labor (h)	0.75 ± 0.57	0.74 ± 0.59	-0.075	0.942
Third stage of labor (h)	0.18 ± 0.17	0.17 ± 0.18	-1.067	0.288
Postpartum 2h NRS score	0.28 ± 0.63	0.79 ± 0.93	-3.366	0.001
Need for cold compress	2 (6.25)	20 (23.53)	4.546	0.033
Perineal edema	7 (21.87)	25 (29.41)	4.194	0.041
Perineal laceration	15 (46.88)	57 (67.06)	4.001	0.045
Episiotomy	4 (12.50)	26 (30.59)	3.989	0.046

Note: Values are presented as mean (SD) or n (%). Independent samples *t*-test and chi-square test were used for group comparisons. $P < 0.05$ indicates statistical significance

3.3. Comparison of neonatal outcomes

There were no significant differences between the two groups in neonatal birth weight, length, Apgar scores at 1, 5, and 10 minutes, or neonatal transfer rate ($P > 0.05$), indicating that magnesium sulfate wet compress had no adverse effects on neonatal outcomes (**Table 3**).

Table 3. Comparison of neonatal outcomes between groups

Variable	Observation group (*n*=32)	Control group (*n*=85)	t/x^2	*P*
Neonatal weight (kg)	3.35 ± 0.35	3.28 ± 0.37	0.261	0.795
Neonatal length (cm)	49.41 ± 1.68	49.14 ± 1.62	0.657	0.503
1-min Apgar score	9.59 ± 0.50	9.50 ± 0.49	0.571	0.569
5-min Apgar score	9.91 ± 0.28	9.86 ± 0.35	1.423	0.156
10-min Apgar score	10.00 ± 0.00	10.00 ± 0.00	-	-
Transfer to NICU	5 (15.63)	27 (31.76)	0.002	0.965

Note: NICU: neonatal intensive care unit. Values are presented as mean (SD) or n (%). Independent samples t-test and chi-square test were used for group comparisons. $P < 0.05$ indicates statistical significance

4. Discussion

In recent years, with the continuous advancement of medical technology and the increasing awareness of natural childbirth, more women have voluntarily chosen vaginal delivery. However, during labor, factors such as a large fetal head, malposition, or rapid labor progression may lead to perineal tears, which can have significant physical and psychological impacts on mothers [9–10]. Therefore, to facilitate smooth delivery, episiotomy is frequently employed in clinical practice. Nevertheless, episiotomy is an invasive procedure, and some women may experience postoperative discomfort, including perineal edema and pain, thereby increasing the risk of complications such as urinary retention and infection [11–12].

Magnesium sulfate solution is a calcium ion antagonist with anti-inflammatory, anti-edematous, and sedative effects. It can alleviate spasms of capillaries and small arterioles and activate both cellular protein kinases and

ATPases, thereby altering cell membrane permeability, stabilizing membrane potentials, and promoting the resolution of mucosal edema. In addition, magnesium sulfate exerts vasodilatory effects and enhances local blood circulation as well as endothelial cell function [13]. Because magnesium sulfate is water-soluble, applying it as a wet compress to the perineal incision facilitates transdermal absorption and subsequently contributes to its anti-inflammatory and analgesic effects.

The findings of this study indicate that the application of magnesium sulfate wet compress during the second stage of labor effectively reduces perineal pain, lowers the incidence of perineal laceration and episiotomy, and decreases the need for postpartum ice analgesia. These results suggest that this intervention plays a beneficial role in perineal protection and improving maternal comfort. The underlying mechanisms may be related to the high osmotic pressure and local physiological effects of magnesium sulfate. Through osmotic action, magnesium sulfate facilitates the exudation of interstitial fluid, thereby reducing local edema. Meanwhile, magnesium ions can inhibit the release of norepinephrine from sympathetic nerve endings and relax vascular smooth muscle, leading to improved local microcirculation [14]. In addition, magnesium sulfate has inhibitory effects on inflammatory responses, reducing the release of cellular cytokines and alleviating pain and congestion. These synergistic actions help minimize perineal tissue injury and promote wound healing. Regarding neonatal outcomes, no significant differences were observed between the two groups in Apgar scores, umbilical cord blood gas parameters, or neonatal transfer rates, indicating that magnesium sulfate wet compress is merely a localized physical intervention without adverse effects on fetal circulation or the nervous system. This further supports the safety of its clinical application.

This study has several limitations. First, it was a single-center retrospective study with a relatively small sample size, and the findings may have been influenced by incomplete data and potential confounding factors. Second, the study did not perform stratified analyses based on the duration, temperature, or frequency of magnesium sulfate wet compress application; variations in these parameters may affect the intervention's effectiveness. Finally, pain assessment relied primarily on subjective ratings, and future studies could incorporate objective physiological indicators to enhance the accuracy of outcome evaluation.

5. Conclusion

The application of magnesium sulfate wet compress during the second stage of labor can effectively reduce perineal edema and pain, lower the incidence of perineal laceration and episiotomy, and does not adversely affect maternal or neonatal outcomes. This intervention demonstrates good safety and practicality. It is recommended for wider adoption in clinical midwifery practice. Further large-sample, multicenter, randomized controlled studies are warranted to validate its long-term effects and optimize the operational protocol.

Disclosure statement

The authors declare no conflict of interest.

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