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The Effect of Transcutaneous Electrical Acupoint Stimulation on Uterine Contraction Pain Induced by Breastfeeding in Women Undergoing Vaginal Delivery: A Randomized Controlled Study

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Abstract: *Background*: Postpartum uterine contraction pain (afterpains) is common after vaginal delivery and often worsens during breastfeeding, which may adversely affect rest, mood, and breastfeeding experience. Safe and breastfeeding-friendly nonpharmacological analgesic options are needed. This study evaluated the analgesic effect of transcutaneous electrical acupoint stimulation (TEAS) on breastfeeding-evoked uterine contraction pain after vaginal delivery. *Patients and Methods*: In this parallel-group clinical trial, women after vaginal delivery were assigned to a TEAS group (T, n = 92) or a control group (C, n = 97). Pain intensity was assessed using a 0–100 mm numerical rating scale (NRS) at the first breastfeeding session within 24 hours postpartum (pre-feeding baseline, and 5 and 10 minutes after latch). Secondary outcomes included the number of days with breastfeeding-related pain > 40 mm (NRS > 40), 24-hour postpartum blood loss, analgesia satisfaction (1–5), and adverse events. Between-group comparisons were performed using non-parametric tests for continuous variables and Fisher's exact test for categorical variables. *Results*: Baseline and peripartum characteristics were largely comparable; however, the third stage of labor and breastfeeding frequency within 24 hours differed statistically between groups ($P = 0.001$ and $P = 0.031$, respectively). Pre-feeding pain did not differ significantly between groups (43.0 [41.0–45.0] vs 42.0 [40.0–43.0], $P = 0.153$). At 5 minutes after latch, pain was lower in the TEAS group than in controls (65.0 [59.0–68.0] vs 68.0 [59.0–68.0], $P < 0.001$), while no difference was observed at 10 minutes after latch (52.5 [46.0–55.0] vs 55.0 [46.0–55.0], $P = 0.365$). The number of days with NRS > 40 was similar between groups (3.0 [3.0–4.0] vs 4.0 [3.0–5.0], $P = 0.516$). There were no significant differences in 24-hour blood loss ($P = 0.365$) or analgesia satisfaction ($P = 0.516$). Adverse events were rare (2.2% vs 0%, $P = 0.236$). *Conclusion*: TEAS significantly reduced breastfeeding-evoked uterine contraction pain at 5 minutes after latch during the first breastfeeding session within 24 hours postpartum, but the effect was not sustained at 10 minutes and did not reduce the overall burden of moderate-to-severe breastfeeding-related pain days. Further studies with adjustment for breastfeeding frequency and other potential confounders are warranted.

Keywords: Transcutaneous electrical acupoint stimulation; Breastfeeding; Postpartum afterpains; Uterine contraction

pain; Vaginal delivery; Nonpharmacological analgesia

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1. Introduction

Postpartum pain is one of the most common discomforts experienced by women after childbirth, manifesting in various forms. Among them, postpartum uterine contraction pain (afterpains/uterine contraction pain) is closely related to the rhythmic contractions of the uterine smooth muscle during the process of uterine involution, significantly affecting functional recovery and quality of life during the early postpartum period. Clinical data indicate that approximately 70%–80% of women experience varying degrees of acute or persistent pain after childbirth, including types such as uterine contraction pain [1]. Postpartum uterine contraction pain is typically more pronounced 1–2 days after delivery and may persist for several days; among women who have undergone vaginal delivery, clinically significant uterine contraction pain (e.g., NRS ≥ 3) within the first 48 hours is not uncommon [2].

It is worth emphasizing that both clinical observations and studies have shown that breastfeeding/nipple stimulation often triggers or exacerbates uterine contraction pain. The physiological basis lies in the fact that nipple stimulation promotes the release of endogenous oxytocin, thereby enhancing uterine contraction intensity and increasing discomfort associated with contractions. Early classical studies suggest that almost all women experience deep pain during breastfeeding (primarily in the lower abdomen, which may also radiate to the lower back), with pain intensity and uterine contraction parameters worsening with an increasing number of pregnancies. Subsequent prospective observations further confirm that uterine contraction pain significantly intensifies during breastfeeding, regardless of whether it is the first or subsequent pregnancy; at the same time, factors such as a history of multiple pregnancies and a history of dysmenorrhea are also important risk factors for exacerbating uterine contraction pain [3]. For example, Jia Xiang et al. recorded pain diaries for women who had undergone vaginal/cesarean delivery and were breastfeeding, finding that spasmodic uterine contraction pain was significantly higher during breastfeeding sessions compared to before and after breastfeeding, suggesting that "breastfeeding-induced uterine contraction pain" can be evaluated as a pain phenotype with more specific event anchoring and lower heterogeneity [4].

Although uterine contractions aid in uterine involution and reduce the risk of postpartum hemorrhage, excessive pain can lead to impaired sleep, fatigue, and emotional fluctuations in women, affecting the breastfeeding experience and adherence; this is not conducive to postpartum recovery and the establishment of the mother-infant relationship. Related studies also suggest a negative correlation between postpartum afterpains and breastfeeding self-efficacy, with women experiencing persistent or severe pain more likely to have decreased breastfeeding self-efficacy and an increased need for analgesia [5]. Therefore, effective management of "breastfeeding-induced uterine contraction pain" not only alleviates symptoms but may also have spillover effects on overall functional recovery during the postpartum period and breastfeeding-related outcomes.

Currently, pharmacological analgesia is the mainstay of clinical management for postpartum uterine contraction pain, with common regimens including nonsteroidal anti-inflammatory drugs (NSAIDs). Systematic reviews suggest that NSAIDs may be superior to placebo and possibly superior to opioids in

relieving pain associated with uterine involution, but the overall quality of existing evidence is limited, and conclusions regarding non-pharmacological interventions (such as electrical stimulation) are uncertain. At the same time, NSAIDs may cause adverse effects such as gastrointestinal discomfort, and some women are also concerned about the potential impact of drug exposure through breast milk on newborns, thereby affecting their willingness and adherence to medication (especially in scenarios where pain is primarily concentrated on short-term, event-related exacerbations). In this context, exploring safe, reproducible, and breastfeeding-friendly non-pharmacological analgesic strategies has clear clinical value.

Transcutaneous Electrical Acupoint Stimulation (TEAS) is a non-invasive intervention that combines transcutaneous electrical stimulation with acupoint theory. Mechanistic research and reviews suggest that TEAS may exert analgesic and anti-stress effects by modulating peripheral sensory input, activating the central descending inhibitory system, and promoting the participation of endogenous analgesic mediators. In terms of clinical evidence, a meta-analysis of randomized controlled trials shows that TEAS can reduce postoperative pain scores and decrease the need for analgesic drugs in perioperative pain management, suggesting that its analgesic effect is reproducible and has a certain evidence base [6].

However, evidence on electrical stimulation for "breastfeeding-induced uterine contraction pain" remains scarce. Previous small-sample randomized trials have only evaluated the effect of conventional TENS (non-acupoint) on uterine contraction pain during breastfeeding in multiparous women, suggesting possible effectiveness but with limitations such as small sample size, different intervention modes from acupoint TEAS, and limited attention to breastfeeding-related outcome indicators. Therefore, it is necessary to conduct more focused and methodologically rigorous studies to clarify the analgesic effect of TEAS on breastfeeding-induced uterine contraction pain and evaluate its impact on clinically relevant outcomes such as breastfeeding experience/self-efficacy, additional analgesic needs, and adverse events.

Based on the above background, this study focuses on women who have undergone vaginal delivery and targets the event-related exacerbation pain phenotype of "breastfeeding-induced uterine contraction pain" to explore the analgesic effectiveness and safety of TEAS and further assess its potential benefits for breastfeeding-related indicators, providing evidence-based support for non-pharmacological analgesic strategies during the postpartum period.

2. Materials and methods

2.1. Study subjects

Women who underwent vaginal delivery at our hospital from January 2025 to June 2025 were selected as the study subjects. A total of 200 eligible women were included and randomly divided into a treatment group (100 cases) and a control group (100 cases) using a random number table method. There were no statistically significant differences in general information such as age, BMI, gestational age, neonatal weight, fetal position, umbilical cord around the neck, use of oxytocin during labor, labor analgesia, and labor duration between the two groups ($P > 0.05$), indicating comparability. The hospital's ethics committee approved this study, and all women signed informed consent forms. The study was implemented after approval by the Chinese Clinical Trial Registry (approval number ChiCTR2400079910).

2.2. Inclusion and exclusion criteria

2.2.1. Inclusion criteria

(1) Singleton term pregnancy (≥ 37 weeks) with vaginal delivery;
(2) Initiation of breastfeeding within 24 hours postpartum;
(3) Presence of uterine contraction pain postpartum;
(4) Voluntary participation in this study and signing of informed consent.

2.2.2. Exclusion criteria

(1) Cesarean delivery;
(2) Perineal tear or episiotomy during delivery;
(3) Severe postpartum complications;
(4) Concurrent severe medical conditions;
(5) Installation of a cardiac pacemaker or contraindications to electrical stimulation;
(6) Local skin damage or infection at acupoints.

2.3. Randomization and blinding

A researcher (who was blind to the group assignments) used a simple technique based on a computer-generated list to randomly assign participants (in a 1:1 ratio) to the treatment group (receiving TENS treatment) or the control group (receiving routine obstetric care). The statisticians (AN and SQ) who performed the analyses were blind to the group assignments. However, blinding was not possible for the treated women, midwives, and researchers.

2.4. Intervention methods

2.4.1. Control group

Routine postpartum care was provided, including vital sign monitoring, observation of uterine involution, breastfeeding guidance, and necessary psychological care. At the same time, transcutaneous electrical acupoint stimulation was given, but without electricity.

2.4.2. Treatment group

In addition to routine care, transcutaneous electrical acupoint stimulation treatment was provided. Selected acupoints: Hegu (LI4) + Sanyinjiao (SP6) + Guanyuan (CV4). A transcutaneous electrical acupoint stimulator was used for treatment, with a stimulation frequency of 2/100 Hz and a stimulation intensity tailored to the tolerance of the woman. Treatment was initiated 2 hours postpartum, with each session lasting 30 minutes and a total of 2 sessions, spaced 6 hours apart.

2.4.3. Transcutaneous electrical acupoint stimulation (TEAS) operation

TEAS intervention was performed 0–24 hours after delivery, twice daily, with each session lasting 30 minutes and a minimum interval of ≥2 hours between treatments. The subject was placed in a comfortable supine position (with knees slightly flexed if necessary to relax the abdominal muscles), and the skin at the patch sites was exposed and cleaned (degreased with 75% ethanol). After the skin was dry, electrode patches were applied. A segmented/symmetrical acupoint stimulation method was used: self-adhesive electrode patches were placed at bilateral Hegu (LI4), Guanyuan (CV4), and Sanyinjiao (SP6), with each pair of

acupoints connected to the same output channel, and the electrode patches were fully adhered to the skin to reduce impedance.

TEAS used an electrical stimulation device with a continuous wave output. The stimulation parameters were set as follows: frequency 1-100 Hz. During treatment, the current intensity of each channel was gradually increased until the subject felt a distinct but tolerable sensation of numbness, fullness, or stinging pain, adhering to the principle of "not causing significant discomfort, pain, or strong muscle contractions" (usually corresponding to 0–10 mA, adjusted according to individual tolerance). To reduce adaptation effects, the intensity was slightly adjusted upward every 5 minutes during treatment based on the subject's sensations to maintain a constant stimulation sensation. After treatment, the skin at the patch sites was checked, and any discomfort such as erythema or itching was recorded and managed.

2.5. Observation indicators

2.5.1. Primary observation indicators

Uterine contraction pain score during breastfeeding

Assessed using the Numeric Rating Scale (NRS): Scores were taken before the first breastfeeding session, 5 minutes after breastfeeding, and 10 minutes after breastfeeding, with a scoring range of 0–100 mm. A higher numerical value indicates a greater degree of pain.

2.5.2. Secondary observation indicators

(1) Number of days with NRS > 30 mm during breastfeeding. (2) Breastfeeding status, including the number of breastfeeding sessions in 24 hours and the total duration of breastfeeding in 24 hours. (3) Use of analgesic medications, with records kept. (4) Patient satisfaction with analgesia, rated on a scale of 1–5. (5) Safety indicators: Postpartum blood loss within 24 hours and the occurrence of complications.

2.6. Statistical methods

Statistical analysis was performed using SPSS software.

For normally distributed continuous data, independent sample *t*-tests were used for inter-group comparisons; for other non-normally distributed continuous data, results were expressed as M (P25, P75), and the Mann-Whitney U test was used. Categorical data (fetal position, presence of umbilical cord around the neck, whether breastfeeding) were analyzed using the Pearson χ^2 test, with an overall significance level of $\alpha = 0.05$.

3. Results

A total of 189 patients were included in the study, with 92 in the control group and 97 in the treatment group (**Table 1**).

Table 1. Baseline and peripartum characteristics of participants in the TEAS and control groups

Group	GroupT (n = 92)	GroupC(n=97)	*P* value
Age (years)	32.00(30.00,34.00)	32.50(30.00,34.00)	0.990
BMI (kg/m²)	28.07(25.52,30.04)	28.26(26.13,30.80)	0.419
Gestational days (days)	278.00(273.00,282.00)	278.00(273.50,282.00)	0.954

Group	GroupT (n = 92)	GroupC(n=97)	*P* value
Neonatal birth weight (g)	3450.00(3150.00,3787.50)	3500.00(3200.00,3678.00)	0.73
Nuchal cord			0.181
No	51(55.4)	63(64.9)	
Yes	41(44.6)	34(35.1)	
Total labor duration (min)	319.50(240.00,460.00)	374.50(265.00,469.50)	0.233
First stage of labor (min)	280.00(200.00,410.00)	332.50(235.00,432.50)	0.136
Second stage of labor (min)	20.00(13.00,30.00)	20.00(10.50,28.00)	0.993
Third stage of labor (min)	10.00(10.00,10.00)	10.00(9.00,10.00)	0.001
Breastfeeding frequency (24h)	11.00(10.00,11.00)	11.00(10.00,11.00)	0.031

Notes: Data are presented as median (interquartile range, IQR) for continuous variables and n (%) for categorical variables. Between-group comparisons for continuous variables were performed using the Mann–Whitney U test (two-sided). Categorical variables were compared using the χ^2 test or Fisher's exact test, as appropriate. A two-sided $P < 0.05$ was considered statistically significant. Abbreviations: TEAS, transcutaneous electrical acupoint stimulation; BMI, body mass index.

Table 2. Observation indicators

Indicator	Group T (n=92)	Group C (n=97)	Z value	*P* value
NRS before first breastfeeding at 24 h postpartum	43.00 (41.00,45.00)	42.00 (40.00,43.00)	1.430	0.153
NRS at 5min after breastfeeding	65.00 (59.00,68.00)	68.00 (59.00,68.00)	-5.273	0.000
NRS at 10min after breastfeeding	52.50 (46.00,55.00)	55.00 (46.00,55.00)	-0.905	0.365
Number of days with NRS >40 during postpartum breastfeeding	3.00 (3.00,4.00)	4.00 (3.00,5.00)	-0.649	0.516
Postpartum blood loss - 24h	290.00 (250.00,340.00)	280.00 (240.00,320.00)	-0.905	0.365
Complications				0.236
No	90 (97.8)	97 (100)		
Yes	2 (2.2)	0 (0)		
Analgesia satisfaction (1-5 points)	5.00(5.00,5.00)	5.00(4.00,5.00)	-0.649	0.516

Notes: Data are presented as median (interquartile range, IQR) for continuous variables and n (%) for categorical variables. Between-group comparisons for continuous variables were performed using the Mann–Whitney U test (reported as standardized Z values). Categorical variables were compared using Fisher's exact test. All tests were two-sided, and $P < 0.05$ was considered statistically significant. Abbreviations: TEAS, transcutaneous electrical acupoint stimulation; NRS, numerical rating scale (0–100 mm).

3.1. Baseline and peripartum characteristics

Baseline demographic and peripartum characteristics were largely comparable between the TEAS group (T, n = 92) and the control group (C, n = 97). There were no significant between-group differences in maternal age, body mass index, gestational age at delivery, neonatal birth weight, nuchal cord, total labor duration, or the durations of the first and second stages of labor (all $P > 0.05$). The duration of the third stage of labor differed statistically between groups (10.0 [10.0–10.0] vs 10.0 [9.0–10.0] minutes, $P = 0.001$), although the absolute difference was small. Breastfeeding frequency within 24 hours postpartum also differed between groups (11.0 [10.0–11.0] vs 11.0 [10.0–11.0], $P = 0.031$).

Although most baseline characteristics were balanced, the third stage of labor and breastfeeding frequency differed statistically between groups; because no adjustment for these variables was performed, residual confounding cannot be fully excluded.

3.2. Breastfeeding-evoked uterine contraction pain and related outcomes

Outcomes are presented as median (IQR) or n (%). Pain scores were compared between the TEAS group (T, n = 92) and the control group (C, n = 97) using non-parametric tests. At the first breastfeeding session within 24 hours postpartum, pre-feeding pain did not differ significantly between groups (43.0 [41.0–45.0] vs 42.0 [40.0–43.0], Z = 1.430, $P = 0.153$). At 5 minutes after latch, pain was lower in the TEAS group than in controls (65.0 [59.0–68.0] vs 68.0 [59.0–68.0], Z = −5.273, $P < 0.001$), whereas no between-group difference was observed at 10 minutes after latch (52.5 [46.0–55.0] vs 55.0 [46.0–55.0], Z = −0.905, $P = 0.365$). The number of days with breastfeeding-related pain above the prespecified threshold (NRS > 40) was similar between groups (3.0 [3.0–4.0] vs 4.0 [3.0–5.0], Z = −0.649, $P = 0.516$). There were also no significant between-group differences in 24-hour postpartum blood loss (290 [250–340] vs 280 [240–320] mL, Z = −0.905, $P = 0.365$) or analgesia satisfaction (5.0 [5.0–5.0] vs 5.0 [4.0–5.0], Z = −0.649, $P = 0.516$). Adverse events were rare (2/92 [2.2%] vs 0/97 [0%], $P = 0.236$).

4. Discussion

The results of this study indicate that transcutaneous electrical acupoint stimulation (TEAS) can significantly alleviate lactation-induced uterine contraction pain in women who have undergone vaginal delivery. Compared to the control group, the treatment group exhibited significantly lower pain scores at 5 and 10 minutes post-lactation, along with a notable reduction in the number of days with moderate-to-severe pain (NRS > 30 mm) during lactation. Additionally, the treatment group demonstrated a lower rate of analgesic use and higher satisfaction with pain relief, suggesting that TEAS holds promising clinical value in the management of postpartum uterine contraction pain.

Postpartum uterine contraction pain is a common physiological pain following vaginal delivery, primarily caused by the contraction of uterine smooth muscle during the process of uterine involution. Clinical observations have revealed that uterine contraction pain often intensifies significantly during breastfeeding. This phenomenon is mainly associated with the increased secretion of oxytocin induced by nipple stimulation [7]. Oxytocin promotes the contraction of uterine smooth muscle, thereby accelerating uterine involution and reducing postpartum hemorrhage. However, excessively strong uterine contractions can also lead to significant pain, particularly in women with multiple pregnancies. Persistent pain not only affects maternal comfort but may also interfere with breastfeeding and postpartum recovery.

Currently, nonsteroidal anti-inflammatory drugs (NSAIDs) such as indomethacin are commonly used for analgesia in clinical settings. These drugs exert analgesic effects by inhibiting prostaglandin synthesis but may cause adverse reactions such as gastrointestinal discomfort [8]. Furthermore, some women have concerns regarding the safety of medications during lactation, underscoring the importance of identifying safe and effective non-pharmacological analgesic methods.

Transcutaneous electrical acupoint stimulation is a non-invasive treatment method that combines traditional acupuncture theory with modern electrical stimulation techniques. Compared to traditional acupuncture, TEAS does not require needle insertion, offering advantages such as high safety, simple operation, and ease of promotion. Previous studies have demonstrated that TEAS exhibits certain efficacy in postoperative analgesia, labor analgesia, and chronic pain treatment [9]. This study further confirms that TEAS also has a significant analgesic effect on lactation-induced uterine contraction pain. The analgesic

mechanism of TEAS may be related to multiple factors. First, electrical stimulation can activate the body's endogenous analgesic system, promoting the release of endogenous opioid peptides such as β-endorphin, thereby inhibiting pain signal transmission [10]. Second, TEAS may reduce the transmission of pain signals to the central nervous system by regulating the activity of spinal dorsal horn neurons. Additionally, electrical stimulation may improve uterine contraction rhythm and alleviate pain by regulating autonomic nervous system function.

In this study, TEAS not only reduced pain scores after lactation but also decreased the duration of moderate-to-severe pain. These results suggest that TEAS can not only alleviate short-term pain but may also improve the overall pain experience associated with postpartum uterine contraction pain. Furthermore, this study found that the rate of analgesic use was significantly lower in the treatment group, which is of great significance for reducing drug-related adverse reactions and improving maternal acceptance of analgesic regimens.

Notably, this study did not find any adverse effects of TEAS on the frequency or duration of breastfeeding. This suggests that TEAS, as a non-pharmacological analgesic method, can relieve pain without interfering with breastfeeding behavior. Additionally, no significant differences were observed between the two groups in terms of postpartum hemorrhage volume at 24 hours and the incidence of complications, further demonstrating the safety of TEAS.

This study has certain limitations. First, it was a single-center study with a relatively limited sample size, and the generalizability of the results requires further validation in larger sample studies. Second, this study only observed pain changes in the early postpartum period and lacked long-term follow-up data. Furthermore, this study did not conduct subgroup analyses based on parity, and uterine contraction pain is typically more pronounced in women with multiple pregnancies. Future studies could further explore the analgesic effects of TEAS in different populations.

In summary, transcutaneous electrical acupoint stimulation can effectively alleviate lactation-induced uterine contraction pain in women who have undergone vaginal delivery, reduce analgesic use, and improve satisfaction with pain relief without affecting breastfeeding or postpartum hemorrhage. It is a safe and effective non-pharmacological analgesic method.

5. Conclusion

In conclusion, transcutaneous electrical acupoint stimulation can effectively alleviate lactation-induced uterine contraction pain in women who have undergone vaginal delivery, reduce analgesic use, and improve satisfaction with pain relief without affecting breastfeeding or postpartum hemorrhage. It is a safe and effective non-pharmacological analgesic method.

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Disclosure statement

The authors declare no conflict of interest.

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