Oxytocin Levels with Acupuncture Stimulation at LI4 and SP6 Points in Postpartum Cesarean Section: Randomized Controlled Trial

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ABSTRACT

Background: Cesarean section surgery causes alterations in tissue continuity, resulting in painful trauma, which can pose challenges for lactation and early mobilization, thereby affecting the postpartum uterine involution process. Oxytocin plays a crucial role in stimulating uterine contractions and postpartum lactation.

Objective: This study aims to investigate the effectiveness of acupuncture stimulation at LI4 and SP6 points in stimulating the release of oxytocin hormone in postpartum Cesarean section cases.

Method: A randomized controlled group study included 72 postpartum Cesarean section participants from February to May 2023. A random sampling technique was employed to allocate subjects into intervention and control groups using a lottery method**.** The intervention group received electroacupuncture at LI4 and SP6 points, while the control group received no intervention. Selected respondents met the inclusion criteria and provided signed informed consent forms. Oxytocin levels were analyzed using ELISA testing.

Results: The acupuncture intervention at LI4 and SP6 points in postpartum Cesarean section cases effectively increased oxytocin levels compared to the control group, with a statistically significant p-value of less than 0.05.

Conclusion: The results of this study indicate that acupuncture intervention in postpartum Cesarean section cases can stimulate oxytocin hormone release, which may aid in lactation processes and promote uterine contractions during uterine involution..

Keywords Oxytocin, Acupuncture, LI4, SP6, Postpartum, Cesarean Section.

Introduction

Surgical procedures, such as cesarean section, can disrupt tissue continuity, leading to complications such as postoperative pain. This postoperative pain can present challenges to breastfeeding and early mobilization for postpartum cesarean section patients (1,2). Thus, it can trigger other issues in postpartum cesarean section patients, such as bleeding and infection. The rise in cesarean-section deliveries correlates with an increase in postoperative bleeding and infection incidents (3,4).

During the third stage of labor, oxytocin hormone levels in the plasma increase significantly, as this hormone plays a crucial role in the process of uterine involution. Optimal uterine involution relies on robust uterine contractions, necessitating interventions to enhance them (5). After the placenta detaches, the uterine cavity contracts inwardly against the uterine wall, with the anterior part pressing against the site where the placenta was attached, effectively closing the openings of large blood vessels (6). Oxytocin, a posterior pituitary nonapeptide, is synthesized in the paraventricular nucleus (PVN) and the supraoptic nucleus (SON) of the hypothalamus (7). This hormone stimulates uterine contractions during labor and the postpartum period. Additionally, oxytocin plays a role in the milk ejection reflex during breastfeeding (8,9).

Acupuncture, originating from Traditional Chinese Medicine, operates on the principle of alleviating pain and disease symptoms by restoring the balance of yin and yang. It is also employed in treating various reproductive issues in women (10). Research studies indicate that acupuncture stimulation during labor, with an indication of premature rupture of membranes, enhances cervical ripening, reduces labor pain, and expedites labor duration. Acupuncture points utilized include ST36, LV3, LI4, SP6, BL32, BL60, and BL67. Greater cervical ripening is evidenced by an increase in Bishop scores during the 24 hours in the acupuncture group compared to the control group (11).

Acupuncture at the LI4 point activates the hypothalamus and is presumed to be effective in stimulating oxytocin (12). The LI4 point, located on the dorsum between the first and second metacarpal bones at the distal crease of the hand (13), is a key point for issues related to the uterus. Stimulating the LI4 point rectifies imbalanced, blocked, or deficient energy along the organs or meridians it intersects (14). In intensive acupuncture studies, the induction and acceleration of labor duration have been extensively investigated, with no reported side effects (15). In addition to stimulating uterine contractions, LI4 has additional benefits, including reducing pain intensity and providing a higher degree of relaxation in laboring patients (16). Meanwhile, SP6, also known as sanyinjiao, is located four fingers above the inner ankle. Study results indicate that SP6 can serve as a strategy to expedite the duration of labor without causing adverse effects on the mother or newborn (17).

The addition of LI4 to SP6 can achieve maximum effectiveness in strengthening uterine contractions. By needling both of these points, it can induce rhythmic coordination of uterine muscles to stimulate oxytocin release and neuroendocrine changes (18). Research studies have indicated that acupuncture at the SP6 point can trigger labor contractions; hence, it should not be administered to pregnant women before reaching 37 weeks of gestation (19).

Traditional Chinese Medicine advocates the use of acupuncture to soften the cervix and induce uterine contractions (20).

A Cochrane review encompassing Western studies concluded that the effectiveness of acupuncture applied in the last month of pregnancy for inducing spontaneous labor onset still needs to be established due to insufficient data. The final analysis was based on a single report involving 54 women, and its results were not included in the review due to methodological bias (21). Biochemical studies indicate that acupuncture can stimulate the central release of oxytocin and increase the activity of the parasympathetic uterus, enhancing uterine contractility (22–24). Acupuncture stimulation can induce uterine contractions (25). Several studies have demonstrated that acupuncture stimulation can induce uterine contractions, potentially accelerating the duration of labor. Among these, acupuncture points LI4 and SP6 are believed to stimulate the reproductive organs, including the uterus, to contract during labor. According to the theory, uterine contraction is influenced by the hormone oxytocin, whose increased levels are not only essential during labor but also in the postpartum period, especially after surgery in postpartum uterine involution and lactation. Specific acupuncture research on the LI4 and SP6 acupuncture points to stimulate oxytocin secretion in postpartum cesarean section cases is still limited. In this study, we aim to investigate whether stimulation of the LI4 and SP6 acupuncture points can increase oxytocin levels in postpartum cesarean section cases.

Methods

Study Design

Data collection for this study was conducted between February and May 2023. The study protocol received approval from the hospital's ethical review board under protocol number UA-01-22150, with approval number 130/KEP/2022.

Subjects of this study comprised 72 postpartum cesarean section (SC) respondents. Subject selection utilized a random sampling technique for both the intervention and control groups, determined through a lottery method. The study comprised four groups: LI4 point intervention group (n = 18), SP6 point intervention group (n = 18), LI4 and SP6 combination point intervention group (n = 18), and a control group (n = 18). All subjects provided informed consent after receiving explanations about the acupuncture procedure and signed the informed consent form. Inclusion criteria for subjects were as follows: Postpartum SC patients within 24 hours of hospital admission, Postpartum SC patients within 24-48 hours after surgery with the effects of anesthesia medication wearing off, and receiving analgesia with only paracetamol 500mg 3x1.

Subjects had to be between 20-40 years old, have good nutritional status, and parity < 4. Exclusion criteria included patients with a history of heart disease, infectious diseases, blood clotting disorders, psychiatric disorders, and injuries or wounds at the LI4 and SP6 acupuncture points. Withdrawal criteria were applied if respondents complained of pain during the intervention and were unwilling to continue with the study.

Procedure

Acupuncture

The acupuncture procedure involved administering acupuncture at LI4, SP6, and LI4 & SP6 points. This commenced with the disinfection of the LI4 point, located between the base of the thumb and index finger, precisely in the muscle area, and the SP6 point, approximately three cun or about four fingers above the ankle, right at the tip of the tibia.

Both the combined LI4 and SP6 points were stimulated. Acupuncture needles of the Huanqiu brand, measuring 1 cun, were utilized for insertion. Proper needle insertion was ensured by a distinct tingling sensation upon insertion. The intervention lasted for 30 minutes. In the control group, only blood samples were collected without any intervention. Subsequently, observation for any side effects during or after acupuncture administration included postoperative nausea and vomiting, infection at the acupuncture site, bleeding at the acupuncture site, allergic reactions to acupuncture needles, and scar tissue formation at the acupuncture site.

Oxytocin Analysis

Blood samples for oxytocin hormone measurement were collected both before and after the acupuncture intervention administered to the patients, which lasted for 30 minutes. Approximately ± 3 ml of blood was drawn and stored in EDTA tubes as an anticoagulant. These blood samples were stored at a temperature between 2-8 °C at least one day before the procedure. Subsequently, the blood samples underwent centrifugation at 1,000 g for 15 minutes at a temperature of 4º C to separate the plasma. Approximately 1 cc of plasma was extracted for the oxytocin hormone level analysis using the Enzyme-Linked Immunosorbent Assay (ELISA) method.

Statistical Analysis

Normality testing was conducted using the Shapiro-Wilk test, which indicated that the data were normally distributed ($p > 0.05$). Statistical analysis utilized the one-way ANOVA method, with a significance level set at $P < 0.05$, to examine the changes in mean scores between the pretest and posttest within each group. The analysis aimed to identify differences in oxytocin hormone levels before and after acupuncture interventions at the LI4 and SP6 points compared to the control group.

Results

The characteristics of all 72 respondents met the inclusion criteria for this study. During the randomization process, patients were divided into intervention groups receiving acupuncture at the LI4, SP6, and combined LI4 & SP6 points, and a control group. The following chart outlines the flow of the research process:

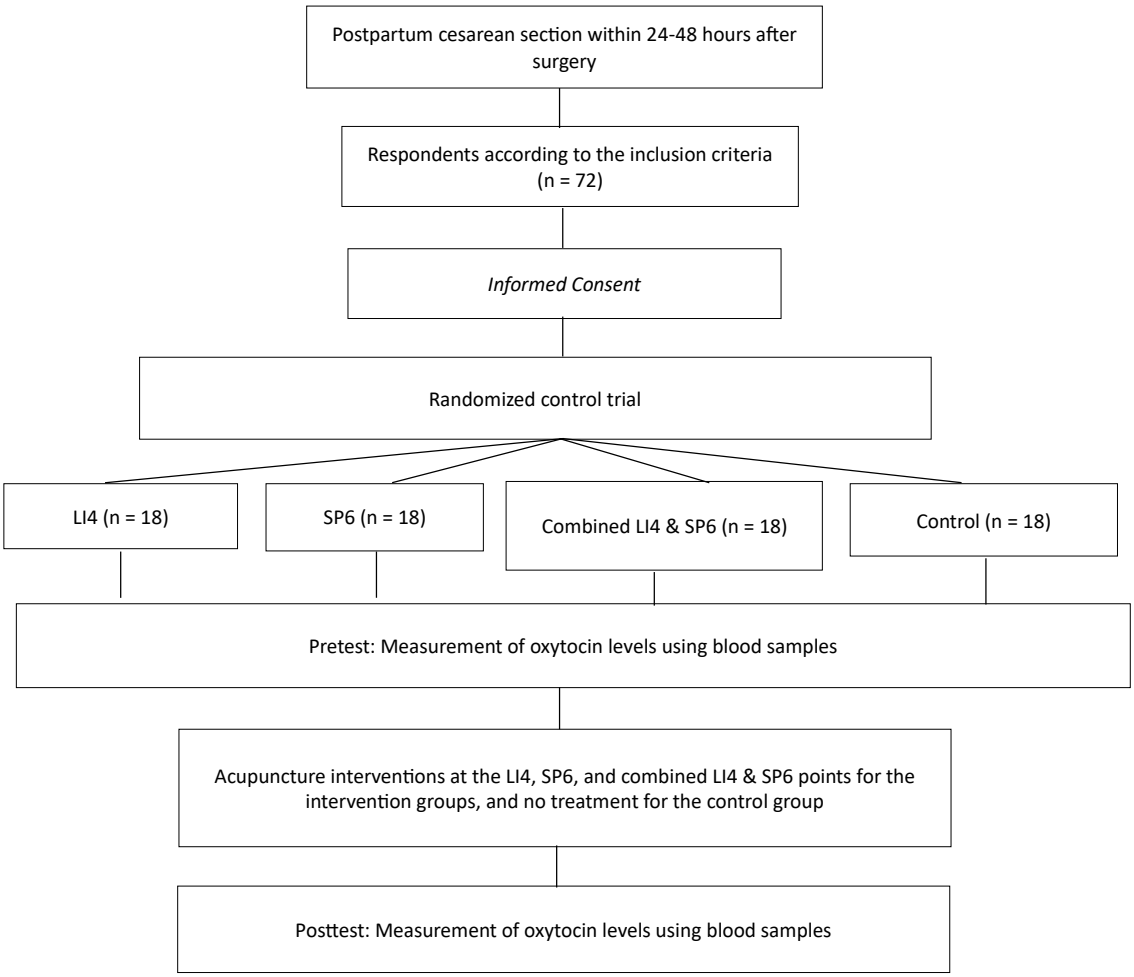

Diagram: Process of randomizing respondents and conducting research data collection

Table 1. Frequency Distribution of Respondent Characteristics

Characteristics	Intervention (n = 54)		Control (n = 18)		P-value
	n%	Mean ± SD	n%	Mean ± SD	
Age					
Low-risk 20–35	54 (100%)	33.11 ± 3.87	18 (100%)	27.22 ± 4.17	0.315
High-risk < 20 – > 35	0 (0%)		0 (0%)		
Parity					
Primigravida	29 (53.7%)		10 (55.55%)		0.615
Multigravida	25 (46.29%)		8 (44.44%)		
Nutrition					
Good	29 (53.7%)		9 (50%)		
Poor	0 (0%)		0 (0%)		0.413
Obesity	25 (46.2%)		9 (50%)		

Table 1 illustrates a homogeneous distribution of research subjects, indicating comparability. Research variables such as age and parity showed no significant differences ($p > 0.05$), indicating evenly distributed data before the study commenced.

Table 2. Distribution of Oxytocin Levels Before and After Acupuncture Interventions at the LI4 and SP6 Points in Postpartum Cesarean Section

	Frequency of at the LI4 and SP6 points	**N**	**Mean ± Std. Deviation**	**95% CI**	***p-value***
Pretest	LI4	18	46.908 ± 11.817	41.031-52.785	0.71
	SP6	18	46.291 ± 7.880	42.372-50.210	
	LI4&SP6	18	41.442 ± 11.498	35.724-47.160	
	Control	18	39.353 ± 8.140	35.305-43.401	
	Total	72	43.498 ± 10.304	41.077-45.920	
Posttest	LI4	18	65.933 ± 6.696	62.603-69.263	0.000
	SP6	18	68.337 ± 5.455	65.624-71.051	
	LI4&SP6	18	95.344 ± 8.318	91.208-99.481	
	Control	18	44.016 ± 6.035	41.015-47.018	
	Total	72	68.408 ± 19.480	63.830-72.985	
Difference	LI4	18	19.024 ± 8.897	14.600-23.449	0.000
	SP6	18	22.056 ± 8.585	17.776-26.316	
	LI4&SP6	18	53.902 ± 13.240	47.318-60.486	
	Control	18	4.663 ± 6.537	1.412-7.914	
	Total	72	24.909 ± 20.413	20.112-29.706	

Table 2 presents the intervention groups receiving combined acupuncture at the LI4 and SP6 points in postpartum cesarean section. Prior to the acupuncture intervention, the mean oxytocin level was 41.442 ± 11.498. Post-intervention, the mean oxytocin level increased to 95.344 ± 8.318, signifying a mean elevation of 53.902 ± 13.240. In contrast, the control group demonstrated a mean oxytocin elevation of 4.663 ± 6.537. The analysis yielded a p-value of 0.000 ($P < 0.05$), indicating a noteworthy escalation in oxytocin levels after the intervention in postpartum cesarean section.

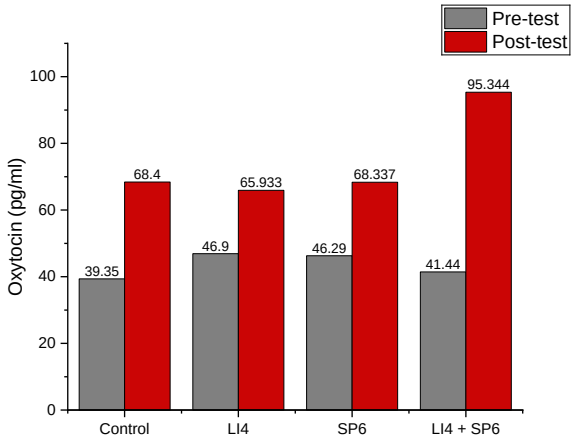

Figure 1. Differences in mean oxytocin levels in the intervention and control groups before and after acupuncture interventions at the LI4 and SP6 points.

Based on Figure 1, the acupuncture intervention group at LI4 & SP6 points demonstrates an increase in oxytocin levels after receiving acupuncture interventions at the combined LI4 & SP6 points, proving to be the most effective.

Discussion

This study describes the impact of acupuncture stimulation on increasing oxytocin levels 24 hours after interventions compared to the control group. Patients subjected to acupuncture exhibited no post-acupuncture side effects, and nearly all participants in the acupuncture intervention groups reported sound sleep during the acupuncture session. Furthermore, there were no significant differences between the study groups concerning the incidence of anxiety.

The research findings indicate that acupuncture stimulation effectively increases oxytocin levels, a factor considered pivotal for the postpartum period. Oxytocin stimulation holds particular significance for postpartum cesarean section (C-section) recovery, given the potential impact of surgical trauma on uterine involution. Previous studies suggest that oxytocin is a hormone known to stimulate uterine contractions and prevent postpartum bleeding during Cesarean surgeries (26,27). Oxytocin exhibits a short onset time, with a half-life of only a few minutes. While enhancing uterine contractions can elevate central venous pressure (28,29), oxytocin is secreted by the pituitary gland and peripheral reproductive tissues, interacting with receptors in the brain and the myometrium (30,31).

The characteristics of the respondents also significantly influence oxytocin release. The effect of oxytocin on uterine contractions depends on the number of oxytocin receptors in the uterus (32). The response to uterine contractions depends on dosage and varies significantly based on oxytocinase activity, oxytocin receptor expression, and post-receptor metabolism within each uterus (30). This process is influenced by a woman's age, gestational age, parity, and cervical dilation. Postpartum, oxytocin is needed in relatively lower amounts to achieve therapeutic effects following physiological childbirth, whereas other delivery methods, such as cesarean section, require higher doses and longer-term oxytocin stimulation to achieve similar results to physiological childbirth (33).

The mechanism of acupuncture in inducing labor involves stimulating the uterus through hormonal changes and the nervous system. Acupuncture is believed to increase oxytocin levels, resulting in enhanced uterine contractility by stimulating uterine parasympathetic activity without affecting local active factors such as interleukin-8 and prostaglandin F2 (34). Oxytocin stimulation is crucial for postpartum cesarean section because, during pregnancy, oxytocin levels increase not only in the supraoptic (SON) and paraventricular (PVN) hypothalamic nuclei but also in other nuclei (35). In vaginal delivery, oxytocin is substantially released into the systemic circulation from the posterior pituitary. Peripherally released oxytocin induces uterine contractions during labor by activating oxytocin receptors on uterine smooth muscle cells (36). The concentration of oxytocin in cerebrospinal fluid significantly decreases after epidural anesthesia, indicating the inhibition of central oxytocin release during labor (37). Therefore, oxytocin stimulation is necessary to ensure that uterine involution proceeds smoothly and without hemorrhage. Elevated oxytocin hormone levels in the blood stimulate smooth muscle fibers in the myometrium to activate IP3 and DAG, releasing Ca2+ and MLCK to enhance contraction. Effective contractions can inhibit hemorrhage and improve uterine involution (38,39).

Acupuncture stimulation proves effective in mitigating postpartum pain in primiparous women undergoing cesarean section, reducing hospital stay duration and decreasing the incidence of postpartum complications, such as postpartum hemorrhage, urinary retention, and constipation, thereby facilitating postpartum rehabilitation (40). Selmer-Olsen et al. state that acupuncture points SP6 and LI4 are effective for inducing labor according to classical Traditional Chinese Medicine literature (41). The study results also reveal that acupuncture point SP6 can alleviate labor pain, as evidenced by significant differences in pain scores between the intervention groups. Moreover, it expedites the duration of labor with more regular contractions observed in the acupuncture intervention group at the SP6 point compared to that in the control group (42). Acupuncture has also been proven beneficial for disease prevention and treatment, rehabilitation, and immune enhancement. Additionally, it has been noted to alleviate stress, anxiety, pain, nausea, vomiting, and other disease symptoms (43).

Tempfer et al. also states that acupuncture has a neural stimulation component that can enhance uterine contractions without affecting local active factors (such as IL-8 and PGF2A), either through central oxytocin release or via uterine parasympathetic stimulation (44,45). The selected acupuncture points can activate afferent nerve fibers and influence hormonal changes through ascending pathways to the hypothalamus or activation of autonomic efferent reflexes to the uterus. Acupuncture can be hypothesized to activate biochemical processes that optimize uterine contractility. Biochemical studies indicate that acupuncture stimulates central oxytocin release and parasympathetic uterine activity, enhancing contractility (46,47). A clear reduction in uterine fundus descent, coupled with a higher rate of cessation of vaginal bleeding at 30 days postpartum, was notably greater in the treatment group compared to the control group. The ratio of incomplete uterine involution was significantly lower in the treatment group than in the control group. Low-intensity ultrasound (USG) proves effective in enhancing uterine contractions and promoting uterine involution following cesarean section (48). Subsequent research could focus on identifying the direct measurement of oxytocin levels immediately following acupuncture stimulation, considering oxytocin's relatively short half-life. This would provide deeper insights into the immediate effects of acupuncture on oxytocin release.

The study exhibits strengths in selecting research subjects who met the inclusion criteria and were randomly assigned to research groups, minimizing potential biases in the results. Additionally, the research underwent an ethical review and obtained participant consent, ensuring patient rights were respected. However, a limitation of this study is the relatively long duration between oxytocin measurements. A suggestion for future research is to conduct oxytocin testing immediately after intervention administration. Furthermore, subsequent studies could be expanded to investigate various acupuncture points that may stimulate oxytocin release through different receptors.

Conclusion

A critical review of acupuncture-related literature supports the notion that acupuncture effectively stimulates uterine contractions. This aligns with the findings of this study, indicating that the release of oxytocin hormone can also be stimulated through acupuncture interventions. The results of this research indicate that postpartum cesarean section patients receiving acupuncture at the LI4 and SP6 points exhibited a significant increase in oxytocin levels in the blood. These findings are expected to serve as a reference for doctors, midwives, and other medical professionals, as well as women themselves, in seeking alternative treatments for postpartum SC patients as a preventive measure against hemorrhage.

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Author Contributions:

NA: Conceptualization, research methodology, data collection, manuscript drafting, manuscript editing, and revision.
BS: Conceptualization, data collection, manuscript drafting.
ABD: Conceptualization, data collection, manuscript drafting.
HB: Conceptualization, data collection, manuscript drafting.
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Conflict of Interest:

The authors declare no conflicts of interest.

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