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Original Article

Increasing Oxytocin through Electroacupuncture Stimulation at LI4 and SP6 Points in Postpartum Cesarean Section

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ABSTRACT

Background: Pain from postoperative cesarean section stitches can cause physiological stress, thereby disrupting mobility and affecting the uterine involution process postpartum. Acupuncture at points LI4 and SP6 has been reported to stimulate uterine contractions and reduce pain. **Objective**: To look into how electroacupuncture (EA) stimulation works at particular places LI4, SP6, and the combination of LI4 & SP6 with frequencies of 30, 50, and 100 Hz on the increase in oxytocin levels postpartum cesarean section. **Method**: The number of respondents was 144 postpartum cesarean section patients who met the inclusion criteria, divided using the randomized controlled trial (RCT) method into 8 intervention and control groups. Oxytocin levels were analyzed through blood samples using the ELISA method, comparing results before and after the intervention as well as with the control group. **Result:** The electroacupuncture intervention group's analysis at points LI4 and SP6 showed a substantial (P<0.05) rise in oxytocin levels when compared to the control group. **Conclusion:** The findings of this research suggest that electroacupuncture intervention following a cesarean section can induce a rise in the levels of the hormone oxytocin.

Keywords: Oxytocin, Electroacupuncture, LI4, SP6, Postpartum.

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INTRODUCTION

A cesarean section is a surgical procedure involving an incision through the abdominal and uterine walls, performed under anesthesia to deliver the fetus, placenta, and amniotic fluid [1]. Cesarean section procedures can cause complications such as postoperative pain and changes in tissue continuity due to surgery, leading to pain effects that persist until the patient is discharged from the hospital [2,3]. This pain can affect the early mobilization process and postpartum lactation [4,5]. Another issue that arises postpartum after a cesarean section is the occurrence of bleeding and infection [2,3]. Postpartum bleeding after a cesarean section due to the use of anesthesia during the SC operation can lead to excessive myometrial relaxation, resulting in uterine atony and failure of the uterus to contract, which consequently causes postpartum hemorrhage[6].

Endogenous oxytocin plays a crucial role during labor and postpartum. Oxytocin can stimulate uterine contractions through the pituitary gland, which can help prevent and treat postpartum hemorrhage [7,8]. Selmer-Olsen et al. suggest that acupoints SP6 and LI4 are effective for labor induction according to classical TCM literature. According to Deadman et al., the manual acupuncture point Sanyinjiao (SP6) is located at the intersection of the three yin channels of the leg (Liver, Spleen, and Kidney) and plays a role in menstruation, conception, pregnancy, leucorrhea, and external genitalia [9].

The acupoint Hegu is indicated for enhancing uterine activity and reducing anxiety [10]. Located in the middle of the first dorsal interosseous muscle of the hand, the needle should be inserted 1 to 2 cun deep, which can enhance uterine contractions. The Sanyinjiao (SP6) point is located 3 cun above the medial malleolus, with the needle inserted to a depth of 1.5 to 2.5 cun, stimulating cervical ripening which can trigger uterine contractions. Acupuncture at Hegu (LI4) is considered effective in stimulating contractions during labor, where the labor induction success rate in full-term pregnancies, overdue pregnancies, and intrauterine fetal death is 78%. After receiving acupuncture stimulation, 90% of patients experienced more contractions, compared to 30% in the control group [11].

Research on acupuncture during labor has shown significant effects in stimulating uterine contractions and the duration of labor. Previous studies have also indicated that acupuncture can stimulate the pituitary gland to increase serum oxytocin levels in animal models. However, research measuring oxytocin levels in postpartum cesarean sections is still very limited. The purpose of this study is to ascertain if electroacupuncture, applied specifically at the LI4 and SP6 points or in combination with these points at frequencies of 30 Hz, 50 Hz, and 100 Hz, raises oxytocin levels in patients following postpartum cesarean sections.

METHODS

Study Design

The study's data collection took place during April and May of 2023. Under protocol number UA-01-22150 and with the following number, 130/KEP/2022, the research has received an ethical assessment and been approved.

The study included 144 postpartum cesarean section patients. Participants were selected using a randomized controlled trial (RCT) technique, with intervention and control groups determined

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by a lottery system. The study subjects were divided into 10 groups. Specific LI4 Intervention Groups: EA LI4 30 Hz (n=18), EA LI4 50 Hz (n=18), EA LI4 100 Hz (n=18), Control group. And Specific SP6 Intervention Groups: EA SP6 30 Hz (n=18), EA SP6 50 Hz (n=18), EA SP6 100 Hz (n=18), Control group. Inclusion criteria for respondents were: 24-48 hours following the cesarean section, when the anesthetic has worn off, and with just 500 mg of paracetamol three times a day being administered for pain, Age in the range of 20 to 40, parity < 4. Exclusion criteria included a history of blood clotting disorders, infectious diseases, heart disease, psychiatric disorders, retained placenta, cervical or vaginal lacerations, uterine rupture, uterine inversion, and injuries at the acupuncture sites LI4 and SP6. And among the withdrawal requirements were: respondents who felt pain throughout the electroacupuncture session and refused to continue. After being told about the electroacupuncture procedure and signing an informed consent form voluntarily and without force, the study's patients gave their assent to participate.

Electroacupuncture Procedure

An acupuncture professional from the Traditional Medicine (Batra) clinic performed the electroacupuncture intervention. The intervention was performed at the LI4 and SP6 points specifically, as well as at the combination of LI4 & SP6 simultaneously. The LI4 point, which is precisely in the muscle area between the base of the thumb and the index finger, was cleaned first in the process. At the end of the shinbone, the SP6 point was situated about three cun or four fingerbreadths above the ankle.

Electroacupuncture was administered using a power supply of 110V-220V, DC 9V, and Huanqiu needles sized 1 cun. It was proven that the needle was inserted correctly when the typical pain or numbness was felt. Electroacupuncture was applied with frequencies of 30 Hz, 50 Hz, and 100 Hz for a duration of 30 minutes. The only procedure performed in the control group was the collection of blood samples.

In order to keep an eye out for any reactions or side effects, including bleeding or infection at the acupuncture site, allergic reactions to the acupuncture needles, and scar formation at the acupuncture site, additional observations were made both during and after the electroacupuncture intervention.

Oxytocin Analysis

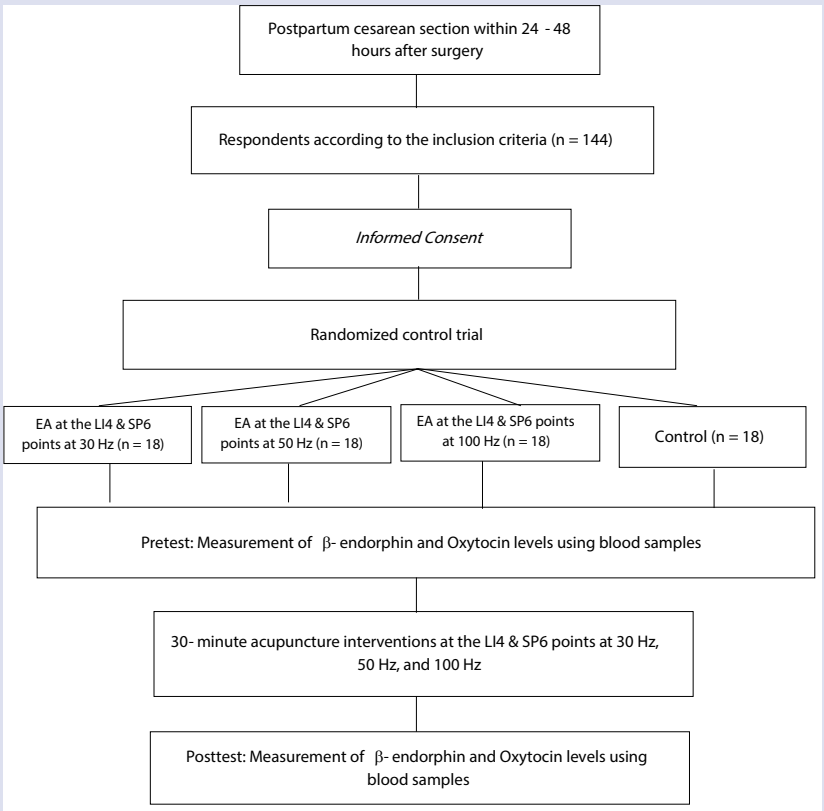
Blood samples were taken from respondents prior to and following the patients' electroacupuncture treatment at specific points LI4 and SP6, as well as when LI4 and SP6 were combined with frequencies of 30 Hz, 50 Hz, and 100 Hz for 30 minutes. This allowed for the assessment of oxytocin levels. A minimum of one day beforehand, 3 ml of blood samples were drawn, stored in EDTA tubes as an anticoagulant, and kept between 2 and 8 °C. After that, the blood samples were centrifuged at 1000 g for 15 minutes at 4 oC to extract 1 cc of plasma, which was used for the enzyme-linked immunosorbent assay (ELISA) method of measuring oxytocin levels.

Statistic analysis

The Shapiro-Wilk test was used to determine the normality of the data, and $P > 0.05$ indicated a normal distribution. A one-way ANOVA was used for statistical analysis, with a significance threshold of $P < 0.05$, to look at changes in mean scores between the pre- and post-test for both the intervention and control groups. The purpose of the analysis was to compare the oxytocin levels that were altered before and after the electroacupuncture intervention to those that were not altered in the control group.

RESULT AND DISCUSSION

Result



The characteristics of the study participants fulfilled the requirements for inclusion. Patients were randomly assigned to one of two groups: the control group or the electroacupuncture intervention group.

Table 1 shows that all 144 (100%) respondents in each group were in the low-risk age range of 20 to 35. With p-values > 0.05, the table shows that the study individuals were homogeneous with respect to parity, age, and maternal nutritional status. This implies that prior to the study's start, the groups were similar and the data were dispersed equally.Table 2: Variation in Mean Oxytocin Levels Before and After Electroacupuncture Intervention at the LI4 Point in the Intervention and Control Groups

Table 2 shows that, with a p-value of less than 0.000, the intervention group that received electroacupuncture at the LI4 point showed a significantly effective rise in oxytocin levels compared to the control group. Out of all the groups, the electroacupuncture group at LI4 with 50 Hz had the biggest increase in oxytocin levels, with a mean±SD of 86.3919.79.

According to Table 3 shows that, with a p-value of less than 0.000, the intervention group that received electroacupuncture at the SP6 point showed a significantly effective rise in oxytocin levels compared to the control group. Out of all the groups, the electroacupuncture group at SP6 with 50 Hz had the biggest increase in oxytocin levels, with a mean±SD of 37.69±9.52.

Table 1. Frequency Distribution of Postpartum SC Respondent Characteristics.

Characteristics	Intervensi (n=72)		Control (n=36)		P Value
	n%	mean± SD	n%	mean± SD	
Age					
Low Risk 20 – 35	108 (100%)	33.11±3.87	36 (100%)	27.22±4.17	0.784
High risk <20 – >35	0 (0%)		0 (0%)		
Parity					
Primigrafida	46 (42.5%)		6(16.6%)		0.665
Multigravida	62 (47.4%)		30(83.3%)		
Nutrition Status					
Good	73(67.5%)		26(72.2%)		
Poor	0 (0%)		0 (0%)		0.701
Obesity	35(32.4%)		10(27.7%)		

Table 2. Difference in Mean Oxytocin Levels Before and After Electroacupuncture Intervention at the LI4 Point in the Intervention and Control Groups.

	Intervensi EA LI4 (n=72)	N	Mean±Std. Deviation	95% CI	p-value
Oxytocin Pretest	30 Hz	18	37.54±7.76	33.68-41.40	0.111
	50 Hz	18	35.94±5.00	33.45-38.43	
	100 Hz	18	37.56±8.19	33.49-41.63	
	Kontrol	18	34.166±6.76	30.80-37.52	
	Total	72	37.26±7.27	36.19-38.33	
Oxytocin Posttest	30 Hz	18	88.31±7.30	84.68-91.95	0.000
	50 Hz	18	122.34±18.32	113.23-131.46	
	100 Hz	18	66.33±6.74	62.97-69.68	
	Kontrol	18	44.18±636	41.02-47.34	
	Total	72	74.74±21.66	71.56-77.93	
Difference Oxytocin	30 Hz	18	50.77±11.26	45.18-56.36	0.000
	50 Hz	18	86.39±19.79	76.55-96.24	
	100 Hz	18	28.76±9.99	23.79-33.73	
	Kontrol	18	10.02±8.81	5.63-14.40	
	Total	72	37.48±22.91	34.11-40.85	

Table 3. The difference in mean oxytocin levels before and after being given electroacupuncture intervention at the SP6 point between the intervention and control groups.

	Frekuensi EA SP6 (n=72)	N	Mean±Std. Deviation	95% CI	p-value
Oxytocin Pretest	30 Hz	18	41.00±6.91	37.56-44.44	0.111
	50 Hz	18	34.11±7.31	30.47-37.75	
	100 Hz	18	38.92±4.66	36.60-41.24	
	Control	18	34.166±6.76	30.80-37.52	
	Total	72	37.26±7.27	36.19-38.33	
Oxytocin Posttest	30 Hz	18	66.81±6.05	63.80-69.82	0.000
	50 Hz	18	71.80±7.24	68.20-75.40	
	100 Hz	18	63.84±3.56	62.07-65.62	
	Control	18	44.18±636	41.02-47.34	
	Total	72	74.74±21.66	71.56-77.93	
Difference Oxytocin	30 Hz	18	25.81±7.91	21.87-29.74	0.000
	50 Hz	18	37.69±9.52	32.95-42.42	
	100 Hz	18	24.92±4.69	22.58-27.26	
	Control	18	10.02±8.81	5.63-14.40	
	Total	72	37.48±22.91	34.11-40.85	

Discussion

In the study, an electroacupuncture intervention was conducted with frequencies of 30 Hz, 50 Hz, and 100 Hz at the LI4 and SP6 points in postpartum cesarean section patients. The results showed a proven increase in oxytocin levels in patients who had cesarean sections following the intervention were higher than those in the control group. In addition, in comparison to the other groups, the one that had the LI4 point intervention at a frequency of 50 Hz showed the most increase in oxytocin levels.

Insertion of acupuncture needles into muscle layers followed by manual rotation (or low-frequency EA) results in the acquisition of 'qi,' which stimulates Aδ and C fibers to produce sensory afferents, is felt by the patient as pain, numbness, or a distending sensation, and by the acupuncturist as a fish eating the bait. These afferent signals increase the release of β-endorphin from the hypothalamus, which in turn reduces the secretion of luteinizing hormone (LH), gonadotropin-releasing hormone (GnRH), and sympathetic nerve activity (central impact). Acupuncture stimulation can result in both central and peripheral effects because it produces a segmental spinal impact that decreases ovarian sympathetic nerve activity.A segmental spinal effect is responsible for the peripheral effect. In the end, sympathetic nerve activity is inhibited by both central and peripheral effects [12].

In the paraventricular nucleus (PVN) of the hypothalamus, EA triggers the production of corticotrophin-releasing hormone (CRH) [13]. In order to affect how the human body functions physiologically, CRH can control the hypothalamic-pituitary-adrenal axis (HPAA) and the hypothalamus pituitary gonadal axis (HPGA) [14]. Through the arcuate nucleus of the hypothalamus, electroacupuncture stimulation causes an increase in the hormone oxytocin, which in turn influences the periaqueductal gray matter (PAG) in the midbrain, medulla oblongata, and spinal cord.Low-frequency electroacupuncture's analgesic effects are intimately linked to this brain circuit[15].Because there are more endorphinergic neurons in the hypothalamus, the acupuncture point at Hegu can stimulate endogenous antinociceptive pathways in the midbrain and hypothalamus. This increase is not seen at a sham acupoint, suggesting the specificity of the analgesic acupoint. These endorphinergic neurons descend to the PAG and the raphe nucle [16]. The activation of the mediobasal hypothalamic nuclei of the HPA axis by electroacupuncture particularly causes the pituitary gland to produce opiates [17].

The paraventricular nucleus (PVN) and supraoptic nucleus of the hypothalamus are the primary sites of oxytocin synthesis, a nonapeptide hormone produced by the posterior pituitary [18]. the activation of oxytocin receptors mediates the antinociceptive effects of oxytocin and involves M-opioid receptor activity in the nucleus raphe magnus [19]. The combined benefits of oxytocin and acupuncture: Clinical research has shown that in postpartum women with uterine inertia, oxytocin combined with 2-100 Hz electroacupuncture at bilateral Hegu acupuncture points increases uterine contractions and shortens the labor process [20]. Peripheral electrical stimulation is recognized to facilitate specific neuropeptide release in the central nervous system [21]. Peripheral stimulation factors, such as frequency, determine the kind of neurochemical substances released[22,23]. Previous studies have demonstrated the ability of electroacupuncture stimulation to modify brain levels of arginine vasopressin (AVP) and oxytocin (OXT) at frequencies of 2 Hz or 10–20 Hz [24].

Because it serves as a paracrine hormone and a neurotransmitter to control a variety of physiological and central nervous system activities, oxytocin (OXY) is unusually versatile. OXY is mostly produced in the hypothalamic supraoptic and paraventricular nuclei (SON and PVN), and once released into the bloodstream, it is widely recognized for its function in lactation and birthing [25]. However, oxytocin is also intimately linked to normative social and psychological functions, such as maternal behavior, attachment and affiliation connected to partner bonding, mood, depression, anxiety, appetite, memory, sexual function, and stress regulation [26,27]. Clinically, oxytocin has also been used in the treatment of autism [28]. Sexual dysfunction [29], Migraine [22]. Schizophrenia [30]. and other central nervous system dysfunctions [31] . Numerous hazards linked to the use of oxytocin therapy have been discovered through the widespread use of therapeutic interventions in experimental investigations[32]. Aside from those related to accidental overdose [33,34]. Oxytocin is known to affect central nervous system functions on tissue functions through spinal actions, such as changes in uterine motility [35]. and bladder emptying [36]. The psychological mechanism via which oxytocin is linked to pain is that it improves mood, which in turn lessens sensitivity to pain. There is a small body of research on humans that suggests oxytocin may influence somatosensory transmission, including pain perception.

Oxytocin can increase uterine smooth muscle contractions. The sensitivity of the uterus to oxytocin is related to the content of oxytocin receptors in the uterine muscle tissue. The concentration of oxytocin receptors at the time of labor is 2-3 times higher compared to before delivery, and approximately 30 times higher compared to 13-17 weeks of gestation [20]. Research has shown that acupuncture at Hegu (LI4) is quite effective in enhancing cervical dilation during labor, as well as intensifying the strength and frequency of uterine contractions [37]. Research results also indicate that maternal blood pressure, heart rhythm, heart rate, respiratory rate, as well as fetal heart rate and Apgar scores of newborns in both groups all remained within normal ranges during labor, suggesting the safety of using Hegu (LI4) acupuncture and oxytocin for childbirth [20].

Electroacupuncture utilizes small electrical charges to stimulate neurotransmitters in the body. Electroacupuncture is frequently chosen over manual acupuncture because it produces less tissue damage, allows for stronger stimulation, and uses consistent electrical charges. It is also easier to measure and offers a more objective and standardized approach than manual acupunctur(Mayor, 2013). Cervical ripening may be achieved with the help of electroacupuncture. The literature that is currently available points to encouraging outcomes[21,39,40]. Acupuncture at LI4 and SP6 has minimal side effects and a low probability of causing cervical dilatation, which is statistically significant ($p = 0.0001$) [10,41].

This research indicates that electroacupuncture stimulation significantly stimulates the release of oxytocin in postpartum women undergoing cesarean sections compared to the control group. This study only measured blood oxytocin levels after electroacupuncture stimulation. Future research could extend by measuring oxytocin levels during electroacupuncture stimulation to determine peak time and the duration of oxytocin levels, as well as identifying the specific effects of increased oxytocin on uterine involution with a larger sample size.

CONCLUSION

Electroacupuncture has been shown to stimulate the release of oxytocin with stimulation at LI4 and SP6 points during postpartum cesarean sections. Thus, it is hoped that the results of this research will assist midwives, doctors, and people seeking non-pharmacological pain relief while making decisions related to preventing bleeding and interventions for accelerating uterine involution.

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AUTHOR CONTRIBUTIONS

NA: Research concept, research methodology, data collection, manuscript preparation, and article drafting and revision.

BS: Research concept, data collection, and manuscript preparation.

ABD: Research concept, data collection, and manuscript preparation.

HB: Research concept, data collection, and manuscript preparation.

AI: Acupuncture intervention, data collection, and critical drafting and revision of the article.

CONFLICTS OF INTEREST

The authors declare that there are no conflicts of interest

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