Acupuncture as an alternative technique in establishing uterine contractions in contraction stress test: A randomized controlled trial

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ABSTRACT

Background: Acupressure may stimulate oxytocin release from the pituitary gland, which in turn regulates uterine contractions to improve the progress of labor; hence, studies have shown that acupressure on the Spleen 6 (SP6) point may be a complementary strategy for augmenting labor and/or shortening the first stage of labor without causing adverse effects to the mother or the newborn.

Objective: To compare contractions produced by acupuncture technique from the contractions produced by conventional method using oxytocin in terms of: intensity, duration and interval of the uterine contractions and to determine if acupuncture technique at Sanyinjiao (spleen 6) and Hegu (Large Intestine 4) can be used as alternative method in establishing uterine contractions in Contraction Stress Test (CST) as a means of fetal surveillance.

Methodology: This is a Randomized Controlled Trial done in University of Santo Tomas Hospital. This included 54 term pregnant patients who met the inclusion criteria and were randomized into two groups: 27 patients in Acupuncture group and 27 patients in Oxytocin group (control group). All recruited patients were hooked to electronic fetal monitor to obtain baseline strips for 20 minutes. Acupuncture needles were applied bilaterally at Sanyinjiao (spleen 6) and Hegu (Large Intestine 4) for 20 minutes to the study subjects.

Results: Subjects who received acupuncture had greater intensity (p=0.551) and significant longer duration (p=0.001) of uterine contractions than the oxytocin group. However, there was significant shorter interval of uterine contractions after oxytocin treatment (p=0.013) than acupuncture. Furthermore, subjects who were in the acupuncture group obtained initial uterine contractions and achieved desirable uterine contractions faster than oxytocin.

Conclusion: Application of acupuncture in Spleen 6 (Sanyinjiao SP6) and Large Intestine 4 (Hegu LI4) can initiate and induce uterine contractions faster. Acupuncture technique when compared to the conventional method using oxytocin, produces stronger and longer contractions. Furthermore, there is shorter mean time to achieve initial and adequate contractions thru acupuncture technique. Contractions also disappear in a much shorter time in acupuncture technique than in oxytocin group hence ideal for outpatient setting

Keywords: Acupuncture, uterine contraction, oxytocin

INTRODUCTION

The contraction stress test (CST) or oxytocin challenge test is a form of fetal antenatal surveillance that evaluates the response of the fetal heart rate to induce uterine contractions. This test measures how well a fetus can cope with each contraction during the process of labor. Fetal oxygenation transiently worsens by uterine contractions. In the fetus with suboptimal oxygenation, the resulting intermittent worsening in oxygenation will, in turn, lead to the fetal heart rate pattern of late decelerations. The CST is used when the fetus is at risk for the consequences of uteroplacental pathology. This includes maternal conditions such as diabetes or hypertension and fetal conditions such as growth restriction or postdates1. This test should not be performed in conditions wherein vaginal delivery is contraindicated like placenta previa, previous extensive uterine surgery or classical cesarean section. The CST should not be performed below the gestational age at which intervention would be made on behalf of the fetus if abnormal (generally 24 weeks)[1]. The objective of this test is to induce three contractions, lasting one minute each, within a ten-minute period[2]. The results of the CST are categorized in the American College of Obstetricians and Gynecologists bulletin as follows:

- *Negative*. No late or significant variable decelerations.
- *Positive*. Late decelerations following 50 percent or more of contractions (even if the contraction frequency is fewer than three in 10 minutes).
- *Equivocal-suspicious*. Intermittent late decelerations or significant variable decelerations.
- *Equivocal-hyperstimulatory*. Fetal heart rate decelerations that occur in the presence of contractions that are more frequent than every two minutes or last longer than 90 seconds.
- *Unsatisfactory.* Fewer than three contractions in 10 minutes or a tracing that is not interpretable.

Acupuncture is used in obstetrics and gynecology not only during labor but also for other various reasons, such as infertility, pelvic pain, dysmenorrhea, and hyperemesis gravidarum. This technique was also reported to be an effective tool in initiating uterine contractions. It is hypothesized that acupuncture neuronal stimulation may increase uterine contractility either by central oxytocin release or by parasympathetic stimulation of the uterus[3,4]. The mechanism of acupuncture to induce labor may involve stimulation of the uterus by hormonal changes or by the nervous system. Stimulation of acupuncture points is known to increase the discharge of thalamic nuclei and the hypothalamic anterior pituitary system. It is hypothesized that acupuncture neuronal stimulation may increase uterine contractility either by central oxytocin release or by parasympathetic stimulation of the uterus without influencing locally active factors such as interleukin-8 and prostaglandin F2[5].

The World Health Organization (WHO) mentions acupuncture as a non-pharmacological method to use during labor and emphasizes the necessity of ‘‘. . . clinical studies as a way of validating acupuncture, improving its acceptability to modern medicine and thus extending its use as a simple, inexpensive and effective therapeutic option.” In a preliminary study done by Martinez A., Rivera L and Arcangel C, showed that acupuncture when applied to certain loci can induce uterine contractions. Patients who received acupuncture had significantly more number of contractions (p=6.06-12) and greater intensity (p=0.01) of uterine contractions than the controls. There was also a significant reduction in the interval of uterine contractions after acupuncture treatment ($p<0.05$). Furthermore, the duration of uterine contractions was significantly prolonged (p=2.63-08). Their results suggest that it may be a good alternative or as a complement to oxytocin.[6]

According to a recent prospective survey on adverse events associated with acupuncture, the risk is estimated to be 0.01 per 10,000 acupuncture sessions and 0.09 per 10 000 individual patients, which are regarded as ‘very low’[7]. Acupuncture is regarded as highly safe in the general population however the risk-benefit profile among pregnant patients may differ. Park et al. did a systematic review on all available reports on adverse effects associated with acupuncture treatment during pregnancy. The total incidence of adverse effects among those who underwent acupuncture sessions was 1.9%. The review showed that adverse events associated with acupuncture are very rare. Majority of these were mild and most common would be needling or unspecified pain followed by bleeding. They also found out that acupuncture treatment during pregnancy was associated with hypertension and/or preeclampsia in the mother and congenital defects in the baby. However, most of these complications were evaluated as unlikely to have been caused by acupuncture treatment.

Acupressure may stimulate oxytocin release from the pituitary gland, which in turn regulates uterine contractions to improve the progress of labor hence studies have shown that acupressure on the Spleen 6 (SP6) point may be a complementary strategy for augmenting labor and/or shortening the first stage of labor without causing adverse effects to the mother or the newborn[8]. The addition of Hegu (Large Intestine 4) to Sanyinjiao (Spleen 6) achieved the maximum effects in strengthening uterine contraction. Needling the two points can produce the rhythmic coordination of the uterus muscles during the oxytocic process and neuroendocrine alteration.[9] In studies where acupuncture was intensively researched in induction of labor, or shortening the length of delivery, no adverse event occurred.[10]

In addition to stimulation of uterine contraction, Hegu (Large Intestine 4) has additional benefits of decreasing pain intensity and providing better degree of relaxation on patients in labor[9]. Pain relief is mediated by activation of myelinated nerve fibers subsequently activating neurons located in the spinal cord and supraspinal regions, including neurons in the deep layers of spinal dorsal horn, nucleus raphe magnus in the brain stem, hypothalamus and thalamus. These neurons modulate pain by inhibiting neurons located at the superficial layer of the dorsal horn and small unmyelinated fibers as well as releasing neurotransmitters, such as b-EP and 5-HT.[9]

GENERAL OBJECTIVE

To compare contractions produced by acupuncture technique from the contractions produced by conventional method using oxytocin in terms of: intensity, duration and interval of the uterine contractions and to determine if acupuncture technique at Sanyinjiao (spleen 6) and Hegu (Large Intestine 4) can be used as alternative method in establishing uterine contractions in Contraction Stress Test (CST) as a means of fetal surveillance.

Specific Objectives:

1. To determine contractions produced by Acupuncture technique in terms of duration:
   a. from initiation of the test up to when contractions are first elicited
   b. from initiation of the test up to when the desired (intensity, duration, and interval) of contractions were achieved
   c. from removal of the needle to the disappearance of the contractions
2. To determine contractions produced by Oxytocin challenge test in terms of duration:
   a. from initiation of the test up to when contractions are first elicited
   b. from initiation of the test up to when the desired (intensity, duration and interval) of contractions were achieved
   c. from stopping the oxytocin to the disappearance of the contractions
3. To determine if the difference between the contractions produced by acupuncture technique and oxytocin challenge test is statistically significant.
4. To compare the cost-effectiveness of the use oxytocin vs. acupuncture
5. To determine secondary outcomes from both groups (oxytocin vs. acupuncture technique) in terms of the following maternal morbidities:
   - pain or discomfort from needling measured by pain score (0 to10)
   - bleeding or hematoma formation at the needle site
   - infection on the needle site
   - uterine hyperstimulation
   - hypersensitivity reactions

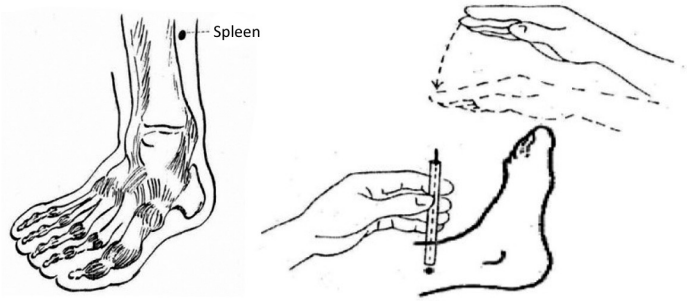

Figure 1. Application of acupuncture to Spleen 6. The tip of the tube is positioned directly over the selected point. Pushed firmly against the area at the point using the left hand. The needle is inserted inside the tube with the right hand and tapped downward

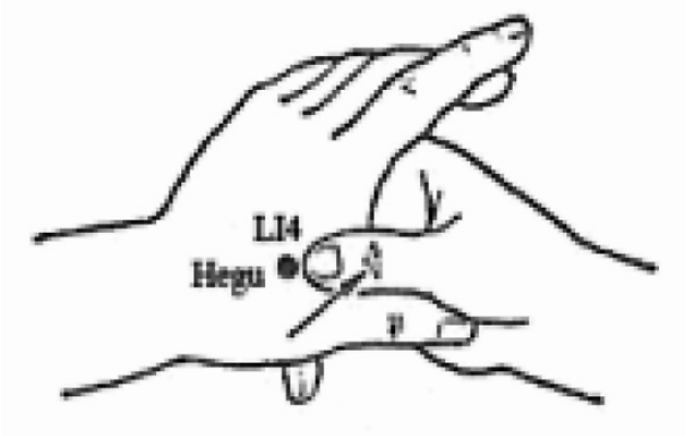

Figure 2. Application of acupuncture to Large Intestine 4. The tip of the tube is positioned directly over the dorsal surface of the hand between the web of the thumb and the index finger

METHODOLOGY

Fifty-four pregnant patients at the University of Santo Tomas Hospital who are 18 years old and above, term (>/= 37 0/7 weeks age of gestation) and who are eligible for a contraction stress test were recruited in the study. A written consent was obtained from all recruited patients Gestational ages were estimated by a reliable last menstrual period or ultrasonographic parameters before 20 weeks. The 54 pregnant patients were randomly divided in two groups: control group (oxytocin) or acupuncture group.

An internal examination was done on all patients prior to start of the study to note the cervical dilatation in centimeters and percent cervical effacement. Baseline vital signs were recorded and will be repeated on both groups after the procedure. All patients were hooked to electronic fetal monitor (EFM) to determine fetal status for ten (10) minutes.

Acupuncture group

Acupuncture needles were inserted by the primary author and anesthesiologist (co-author) on bilateral points of Spleen 6 (Sanyinjiao SP6) located 3 cm above the medial malleoli[11] and Large Intestine 4 (Hegu LI4) located on the dorsal surface of the hand between the web of thumb and index finger[12] (Figures 1 & 2). After the needles have been properly placed, the following were determined: time to initial contractions were elicited and time to desired contractions were achieved. After three contractions were achieved within a 10-minute period, a twenty (20)-minute strip was recorded to obtain an interpretable data for a contraction stress test. After the test was completed, needles were removed. The time from removal of the needle until the contractions disappeared were noted. Acupuncture technique was considered failed if within thirty minutes that the needle was in place did not produce adequate contractions to have an interpretable data. The patient was then transferred to the control group (oxytocin challenge test) and will be included in that group instead. During the entire procedure, the patient were monitored of bleeding or hematoma formation at needling site, pain

or discomfort felt from needling, uterine hyperstimulation and any hypersentitivity reaction.

Control group (Oxytocin Challenge Test)

Oxytocin was administered beginning with 0.5 to 2.0 mU/min. Dosage of oxytocin infusion will be increased by 0.5 to 1.0 mU/min at 15-minute intervals until the contraction frequency was three in 10 minutes of 40 seconds or more duration. The time from initiation of oxytocin infusion to time to elicit contractions and to time desired contractions were achieved were noted. Oxytocin was discontinued once an interpretable strip of 20 minutes was already recorded. After stopping the infusion, the time to disappearance of contractions was noted. During the entire procedure, the patient was monitored of any presence of uterine hyperstimulation or hypersentitivity reaction.

RESULTS

Overall, there were 54 subjects randomized to treatment with oxytocin (N = 27) and with acupuncture (N = 27). Table 1 shows no significant difference in terms age, gravidity and parity, systolic and diastolic blood pressure, age of gestation, and indication between groups.

Table 2 shows that all of the subjects in the acupuncture group and the majority (92.6%) in the oxytocin group had no interval of uterine contraction at baseline. The intensity of uterine contractions induced on both groups during the CST. For both groups, the majority of the subjects had strong contraction during the CST (74.1% for oxytocin group and 70.4% for acupuncture group). However, the intensity of uterine contraction during the CST did not differ significantly between groups (p=0.551). Table 3 shows the intensity of the contractions, measured

Table 1. Demographic Profile of Subjects

Demographic	Oxytocin N = 27	Acupuncture N = 27	p-Value[a]
Age (years)[b]	30.48 ± 6.32	28.33 ± 6.07	0.208
OB Score[c] Gravidity Parity	 1 (1-4) 0 (0-2)	 1 (1-4) 0 (0-3)	 0.775 0.750
AOG (weeks)[b]	38.74± 1.40	39.19 ± 1.08	0.198
Blood pressure[b] Systolic BP Diastolic BP	 124.81± 13.97 81.11± 8.92	 118.15 ± 13.020 78.52 ± 8.64	 0.75 0.283
Indication; n (%) Gestational Diabetes Mellitus	 8 (29.7)	 13 (48.1)	0.910
Hypertensive disorders in Pregnancy	10 (37.0)	3 (11.1)	
Postmaturity	5 (18.5)	3 (11.1)	
Amniotic fluid disorders	4 (14.8)	8 (29.7)	

[a] *Significant at 5% level of significance*
[b] *The data are expressed as mean ± SD*
[c] *The data are expressed as range (min-max)*

Table 2. Intensity of Uterine Contractions:

	Intensity Grade	Oxytocin N=27	Acupuncture N=27	p-Value
Baseline (prior initiation of test)	None	25 (92.6)	27 (100)	0.150
	Mild	0	0	
	Mild-Mod	2 (7.4)	0	
	Moderate	0	0	
	Mod-Strong	0	0	
	Strong	0	0	
During contraction stress test	None	0	0	0.551
	Mild	0	0	
	Mild-Mod	0	0	
	Moderate	0	2	
	Mod-Strong	7	6	
	Strong	20 (74.1)	19 (70.4)	

by Montevideo units (mVu), that on the average, a higher intensity of uterine contraction (mVu) was observed in the acupuncture group compared to oxytocin group (319 mVu versus 302 mVu), which is not significant (p=0.167).

The duration of contraction on the acupuncture group was significantly different between the two groups (p=0.001). Moreover, the majority (74.1% and 92.6% for oxytocin and acupuncture groups, respectively) of the subjects had a duration of 50 to 60 seconds of contractions. (Table 4)

During the contraction stress test, uterine contractions occurred more frequently in the oxytocin than the acupuncture groups (Table 5), which was statistically different (p=0.013).

In general, there is no significant difference in the baseline intensity (p=0.150), duration (p=0.9), and interval (p=0.27) of uterine contractions for both groups (Table 2, Table 4, and Table 5, respectively).

It is shown in Table 6 that the acupuncture group had significantly shorter mean time to achieve initial uterine contractions (5.29 versus 10.62 minutes; p=0.000), shorter mean time to achieve adequate or desirable contractions (14 versus 30.89 minutes; p=0.001), and shorter waiting time for disappearance of the contractions (36.70 versus 57.74; p=0.000) than in oxytocin group.

Table 7 revealed that there are no adverse effects developed in any of the subjects in oxytocin group during the course of the study, while there were 3 subjects in the

Table 3. Intensity of Uterine Contractions (mVu)

	Oxytocin	Acupuncture	p-Value
Baseline (prior initiation of test)	NC	NC	NC
During contraction stress test	302.59 ± 35.14	319.62± 51.90	0.167

[a] *Significant at 5% level of significance.*
[b] *The data are expressed as mean ± SD.*
NC = not computed.

Table 4. Duration of Uterine Contractions (in seconds):

	Duration (seconds)	Oxytocin N = 27	Acupuncture N=27	p-Value
Baseline (prior initiation of test)	None	25	27	0.9
	0-20	0	0	
	20-30	0	0	
	30-40	0	0	
	40-50	2	0	
	50-60	0	0	
During contraction stress test	None	0	0	0.001
	0-20	0	0	
	20-30	0	0	
	30-40	0	0	
	40-50	0	1	
	40-60	4	1	
	50-60	20	25	
	60-70	3	0	

Table 5. Interval of Uterine Contractions (in minutes)

	Interval	Oxytocin N = 27	Acupuncture N=27	p-Value
Baseline (prior initiation of test)	None	25 (92.6)	27 (100)	0.27
	2-3	0	0	
	2-4	0	0	
	3-4	1 (3.7)	0	
	>4	1 (3.7)	0	
Repeat (during the test)	None	0	0	0.013
	2-3	17 (63.0)	14 (51.9)	
	2-4	9 (33.3)	10 (37.0)	
	3-4	1 (3.7)	3 (11.1)	
	>4	0	0	

Table 6. Time to achieve initial contractions, desired contractions and time to disappearance of contractions (average in minutes)

	Oxytocin N = 27	Acupuncture N = 27	p-Value
From initiation of the test up to when contractions are first elicited	10.62± 5.73	5.29± 2.93	0.000
From initiation of the test up to when the desired contractions were achieved	30.89±23.71	14.00± 8.83	0.001
From removal of the needle/stopping of oxytocin to the disappearance of the contractions	57.74± 16.26	36.70±15.14	0.000

Table 7. Secondary Outcomes

Outcomes, n (%)	Oxytocin N = 27	Acupuncture N = 27	p-Value
Pain or discomfort from needling measured by pain score (0-10)		1 (3.7)	
Bleeding or hematoma formation at the needle site		2 (7.4)	
Infection on the needle site		0	
Uterine hyperstimulation	0	0	
Hypersensitivity reactions	0	0	

Table 8. Cost (per patient/in peso)

	Oxytocin	Acupuncture
EFM strips used	2,215.00	2,215.00
IVF insertion and materials	1,175.00	
Alcohol swab		12.00
Delivery room stay (per hour)	610.00	610.00
TOTAL	4,000.00	2,837.00

acupuncture group who experienced bleeding formation at the needle site (1 subject) and who complained pain from needling (2 subjects).

During the conduct of the study, it revealed that subjects in the acupuncture group spent less than in the oxytocin group (Table 8).

DISCUSSION

Several studies reported acupuncture technique to be an effective tool in initiating uterine contraction[10]. Thus, this study was performed to assess if acupuncture technique can be used as alternative technique in establishing uterine contractions in contraction stress test among patients who gave birth in the USTH.

The results of this study showed all parameters of the baseline measurement in the two groups were not significantly different. During the test, both duration and interval of uterine contractions (p=0.001 and p=0.013, respectively) were significantly different except for the intensity (p=0.551). Thus, this study shows that acupuncture had significantly longer duration and shorter interval of uterine contraction than oxytocin. A greater intensity and a longer duration of uterine contractions were achieved after acupuncture was applied in the subjects than oxytocin. However, significantly more subjects in the oxytocin than acupuncture group had uterine contractions more frequently and this is opposing the result revealed in one of studies in our literature review[6].

Moreover, subjects who received acupuncture group had significantly shorter mean time to achieve initial uterine contractions, shorter mean time to achieve adequate or desirable contractions, and shorter waiting time for disappearance of the contractions than in oxytocin group. This, in turn, acupuncture needles, when applied to a selected locus like the meridian Sanyinjiao (spleen 6) and Hegu (Large Intestine 4), do initiate and/or augment uterine contractions[3,4,6].

This study also revealed that there were incidences of pain and bleeding after the acupuncture considered as mild and transient. Same result was found in the research conducted by Park et al, but contrary to other literatures[8,10] that no adverse event occurred after the

acupuncture technique. Nevertheless, the few adverse effects occurred on our study are not serious and alarming.

Furthermore, this study revealed that acupuncture treatment is cheaper than oxytocin treatment.

In conclusion, acupuncture when applied to selected locus such as Spleen 6 (Sanyinjiao SP6) and Large Intestine 4 (Hegu LI4) is effective in initiating and inducing uterine contractions. Acupuncture technique when compared to the conventional method using oxytocin, produces stronger and longer contractions. Furthermore, this study showed that contraction stress test can be completed in a shorter time thru acupuncture technique as it shows shorter mean time to achieve initial and adequate contractions thru this technique. Contractions also disappear in a much shorter time in acupuncture technique than in oxytocin group hence ideal for outpatient setting.

Acupuncture should be considered as an alternative technique for contraction stress test as this is, in theory, simple, practical, cheap, and safe for the women and her infants.

RECOMMENDATION

Research on acupuncture as an alternative technique in establishing uterine contractions in contraction stress test is promising. It is therefore recommended that a larger sample size in the future studies be used to establish the role of this technique in antenatal surveillance especially in populations where financial resources are limited. ■

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