



## **Effect of Acupuncture TENS on Sciatic pain During Pregnancy**

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**Abstract :** Sciatica is a common discomfort of pregnancy experienced in the lower extremity, affecting quality of life and minimizing social and economic efficacy and it is a major cause of work absenteeism and a financial burden to society. **Objective:** This study is carried out to determine the effect of Acupuncture TENS on sciatic pain during pregnancy. **Methods:** Twenty pregnant women with an exclusive diagnosis of sciatic pain with age ranged from 20-40 years ,at the 2<sup>nd</sup> or 3<sup>rd</sup> trimester of pregnancy and their body mass index not exceeding 32 kg/m<sup>2</sup>. Assessment for all participants was performed through analysis of plasma serotonin level, visual analogue scale (VAS) ,Straight leg raising test (SLR) and slump test before and after intervention. **Results:** The results showed improvement in pain level in both groups. However, the study group consistently demonstrated greater improvement in the outcome measures than the control group. **Conclusion:** Acupuncture TENS can be used safely and effectively in reducing sciatic pain in pregnant women.

**Key words :** TENS, Acupuncture, stretching exercises, sciatic pain, pregnancy.

### **Introduction**

Sciatica is a frequent neuralgia produced by compression on nerve roots and inflammation or irritation of the sciatic nerve, characterized by radiating pain into the leg and is often represented by pain in the lower back and neurological manifestations in the lower limb. The sciatic pain is often accompanied with numbness, tingling and weakness of the leg; it may have sudden onset and then continue for several days or weeks [1]. The annual prevalence of sciatica is estimated to be between 1.6% and 43% [2].

The maternal risk of neuromuscular complications increased with the physiological changes of pregnancy, labor and the puerperium. Acquired compression radiculopathy and neuropathy may take place during pregnancy and delivery. Both mother and fetus are at risk if pregnancy is accompanied by inflammatory disorders of nerve and muscle. Hereditary disorders of muscle and nerve may require specialized management during pregnancy as they may become more symptomatic [3] .

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Sciatica is a common complaint of pregnancy experienced in the lower extremity. The prevalence of sciatica in pregnancy has rarely been investigated and on the few occasions that it has been examined this has been predominantly in conjunction with low back pain [4]. Back pain is reported by 50–76% of all pregnant women[5].

The weight of the gravid uterus is around 1,100 gm in addition to the infant birth weight with average of 3,000–3,600 gm. The musculoskeletal response to the weight gain, shifting center of gravity, and hormonal factors responsible for ligamentous laxity and pelvic joints changes can lead to sciatic pain. Back pain with radiation to the legs can result from nerve roots compression and neural elements ischemia due to uterine pressure on aorta and vena cava when lying on the back. Unilateral sciatica in pregnancies represents 41% while bilateral sciatica represents 21% [5].

There are several different approaches to physiotherapy treatment for sciatic pain. these approaches is hydrotherapy , Massage , Osteopathy or chiropractic may present possible solutions for relieving sciatic nerve pressure, Biofeedback and acupuncture may also be valuable as pain control methods [4] . Stretching exercises concerning the lower back, buttocks and hamstring muscles are also recommended[6].

From the very simple, practical, low-cost and noninvasive analgesic technique is TENS, which provide therapeutic electrical stimulation that delivers pulsed electrical currents through the intact surface of the skin to stimulate peripheral nerves. It uses biphasic and balanced pulses, with short width (about 150 ms) and frequencies ranging from 2 to 150 Hz [7-8].

Transcutaneous electrical nerve stimulation (TENS) is commonly used in western and developed countries to reduce a wide range of painful conditions. Moreover, it is safe with no major side effects, although studies have shown that it has no risky effects on either the mother or the fetus. TENS can be self-administered by patients following simple training because there is no potential for toxicity[9, 10].

Acupuncture is extensively used in Chinese clinical practice and in many Western countries, it depends on the philosophy of TCM as part of the healing system around 3000 years ago. [3]. Acupuncture-like Transcutaneous Electrical Nerve Stimulation (AL-TENS) is used for pain relief [11].

The rationale of AL-TENS is the stimulation of A $\delta$  afferent nerve fibers from deep structures to release opioid peptides in the CNS. AL-TENS is applied using a current of high-intensity at a low frequency (either single pulses <5 pps or <5 Hz bursts of high frequency pulses [~100 pps]) which is considered a form of hyperstimulation. AL-TENS is delivered at acupuncture points, painful sites, trigger points, and over motor points of the muscles [8, 9].

Serotonin which is the neurotransmitter initiating the reward cascade. The significance of serotonin in acupuncture has many evidences based on the analgesic effects of acupuncture, by increasing the amount of serotonin in the hypothalamus [12].

## Participants and Methods

### Participants

This study is a prospective, randomized, parallel group, active controlled study with a 1:1 allocation ratio. Twenty pregnant women with an exclusive diagnosis of sciatic pain were recruited from outpatient clinic of king abdelaziz hospital. The women participated in the study after reading and signing an informed consent form before data collection ,with age ranged from 20-40 years in the 2<sup>nd</sup> or 3<sup>rd</sup> trimester of pregnancy and their body mass index not exceed 32 kg/m<sup>2</sup> participated in this study and were divided randomly into two groups (A&B) equal in number: group (A): consist of 10 pregnant women treated by acupuncture TENS & stretching exercise (home program) . Group (B) : consist of 10 pregnant women treated by same stretching exercise only (home program).

**Exclusion criteria** were fetal congenital anomalies, preeclampsia , diabetes, autoimmune diseases, Active implants such as pacemakers and ventricular assist devices (artificial hearts) epilepsy, malignancy, and renal, liver, or thyroid disorders.

## Randomization

The participants were randomly assigned to group (A) (n=10) or group (B) (n=10) by an independent person who selected blindly from sealed envelopes containing numbers created by a random number generator.

## Instrumentations

### Assessment Instrumentation

#### 1. Height and weight scale

(Floor type Model ZT-120, made in China) was used to measure the height and the weight in order to calculate the body mass index of each subject.

$$\text{BMI} = \frac{\text{Weight (Kg)}}{\text{Height (m}^2\text{)}}$$

#### 2. Transcutaneous Electric Nerve Stimulation (TENS)

Transcutaneous Electric Nerve Stimulation (EFT-320 Electronics CO., LTD. Shenzhen City, China) This device designed to provide relaxation, it generate very rhythmical and smooth stimulating effects , it allows to select 7 different types of mods and speeds and the parts of this device is main body, therapy pad , electrode wire ,therapy gel and acupuncture pen.

## Methodology

### Procedures of the study:

#### Assessment procedure:

- **History**

Take a history to determine localization; severity; loss of strength; sensibility disorders; duration; course; influence of coughing, rest, or movement; and consequences for daily activities.

- **Pain assessment:**

(Visual analogue scales) used pain assessment tool before the beginning of the study and repeated at the end of the study for both groups A and B.

A (VAS) was used to assess the pain intensity level. It is a 10 cm horizontal line with one end described as no pain (0) and other end described as worst pain (10) [13].

- **Plasma serotonin level:**

A blood sample was be taken before starting treatment procedure, in both groups (A&B). A radioimmunoassay(RIA)method was used for assessment of serotonin level in blood.

- **Physical Examination**

#### Straight leg raising test (Lasègue's sign):

With the patient lying down on his or her back on an examination table or exam floor, the examiner lifts the patient's leg while the knee is straight. The most applied diagnostic test is the straight leg raise to produce Lasègues sign, which is considered positive if pain in the distribution of the sciatic nerve is reproduced with

between 30 and 70 degrees passive flexion of the straight leg .While this test is positive in about 90% of people with sciatica [14].

### Slump test :

The Slump Test is a neural tension test used to detect altered neurodynamics or neural tissue sensitivity. To begin the test, have the patient seated with hands behind back to achieve a neutral spine. The first step is to have the patient slump forward at the thoracic and lumbar spine. If this position does not cause pain, have the patient flex the neck by placing the chin on the chest and then extending one knee as much as possible. If extending the knee causes pain, have the patient extend the neck into neutral. If the patient is still unable to extend the knee due to pain, the test is considered positive. If extending the knee does not cause pain, ask the patient to actively dorsiflex the ankle. If dorsiflexion causes pain, have the patient slightly flex the knee while still dorsiflexing. If the pain is reproduced, the test is considered positive. Repeat test on opposite side. [15]

### Treatment procedure

**Group (A) : study group** : consists of 10 pregnant women treated through acupuncture TENS & stretching exercise for 4weeks.

#### 1. TENS on acupuncture point

**TENS parameters** frequency: 80-100 Hz , pulse Duration: 150 , time: 1 hour , 3 time per week for 4 weeks.

Acupuncture was performed at the routinely sterilized points of :

**Shenshu (BL 23)** : 1.5 cm lateral to the lower border of the spinous process of the second lumbar vertebra (L2).

**Dachangshu (BL 25)** : 1.5 cm lateral to the lower border of the spinous process of the fourth lumbar vertebra (L4).

**Huantiao (GB 30)** : On the postero-lateral aspect of the hip joint, one third of the distance between the prominence of the greater trochanter and the sacro-coccygeal hiatus .

**Weizhong (BL 40)** : At the back of the knee, on the popliteal crease, in a depression midway between the tendons of biceps femoris and semitendinosus.

**Kunlun (BL 60)** : Behind the ankle joint, in the depression between the prominence of the lateral malleolus and the Achilles tendon on the affected side [16] .

#### 2. Stretching Exercises

- **Sciatica Stretching Exercise**

This exercise is essential to get right. It involves releasing the nerve gently by coaxing it free from its inflamed facet joint in the back.

The patient lying supine position with holding the affected leg behind the thigh then she bring the knee to the chest, In this position the patient will try to straighten her leg slowly by pushing the heel towards the ceiling, Hold in this position for 5 seconds and then release, repeating twice daily.

- **Standing Forward Bend Exercise**

The patient stand with feet together and knees slightly bent, then she bend forward from the waist as far as she can let her arms hang down toward the floor with Keeping her weight evenly distributed as she hold for five deep breaths Hold in this position for 5 seconds and then release, repeating twice daily.

**Group (B): control group** : consists of 10 pregnant women participated as the control group and they resumed their ordinary life style with stretching exercise for 4 weeks.

**Statistical Analysis:**

Data were represented as means and standard deviations. It was considered significant at P-value less than 0.05 and highly significant at P-value less than 0.001. Comparison between the mean values of different variables in the two studied groups (A and B) was made using the independent and dependant t-test. Statistical package for the social sciences (SPSS) computer program (version 16 for Windows; SPSS Inc., Chicago, AQ19 Illinois, USA) was used for data analysis.

**Results**

**I) Demographic characteristics of the participants**

Table (1) represents the physical characteristics of the participants in both groups (A&B) when enrolled in the study. There was a non-statistical significant difference ( $P > 0.05$ ) between both groups (A&B) before the treatment in age, height, weight and BMI..

**Table (1): Physical characteristics of subjects in each group.**

Items	Mean±SD		Comparison	
	Group(A)	Group(B)	t-value	P-value
Age (years)	28.1±4.2	29.2±5.1	0.604	0.561
BMI(Kg/m <sup>2</sup> )	28.5±0.9	28.25±1.3	0.932	0.376
parity	3.0± 1.33	2.60±1.3	0.84	0.423

BMI= Body Mass index SD: standard deviation, T:test statistic, P: probability  $P > 0.05$

**II) Physical Examination**

Table (2) represents the percentage of the number of patients who improved in the straight leg raising test (SLR) and Slump test before and after treatment in both groups. Regarding the study group (A) the percentage of number of patients who had a positive SLR test was (80%) pre treatment and was (10%) post treatment while the percentage of patients with positive slump test was (90%) pre treatment and was (60%) post treatment. For the control group (B) the percentage of patients was (70%) in positive SLR test pretreatment and (40%) post treatment while the percentage of patients with positive slump test was (80%) pre treatment and was (40%) post treatment

**Table (2): Physical Examination of SLR and Slump test in each group.**

Items	pre SLR		post SLR		pre slump		post slump	
	Positive	Negative	Positive	Negative	Positive	Negative	Positive	Negative
Group(A)	80%	20%	10%	90%	90%	10%	60%	40%
Group(B)	70%	30%	40%	60%	80%	20%	40%	60%

SLR= straight leg raisin test

**III) Pain Assessment:**

Table (3) represents the level of pain in Visual analogue scale (VAS) before and after treatment in both groups. There was a highly significant difference in the paired t-test between pain intensity after treatment for the study and control groups as the mean value of the study group (A) was (1.7±0.34) and t-value was (24.40) and P-value was (0.00). For the control group (B) was (5.4±0.37) where the t-value was (13.077) and P-value was (0.00). Also, there was a highly significant difference in the unpaired t-test between two groups where the t-value was (4.521) and P-value was (0.00).

**Table (3): Mean, SD, t and P values of pain intensity in group A and B**

<b>Pain Intensity</b>				
	<i>Pre-treatment</i>	<i>Post-treatment</i>	<i>t-value</i>	<i>p-value</i>
	<i>Mean±SD</i>	<i>Mean±SD</i>		
<b>Study group(A)</b>	9.1±0.87	1.7±0.34	24.40	0.00
<b>control group(B)</b>	9.2±0.78	5.4±0.37	13.077	0.00
<i>t-value</i>	6.39	4.521		
<i>p-value</i>	1.00	0.0001		

Table (4) represents the plasma serotonin level before and after treatment in both groups. There was a highly significant difference in the paired t-test between plasma serotonin level after treatment for the study and control groups, as the mean value of the study group (A) was (280.7±79.45) and t-value was (5.437) and P-value was (0.0004). For the control group (B) was (183.4±28.57) where the t-value was (4.95) and P-value was (0.0008). Also, there was a highly significant difference in the unpaired t-test between two groups post-treatment, where the t-value was (3.644) and P-value was (0.002).

**Table (4): Mean, SD, t and P values of Serotonin level between and within groups A and B**

<b>Serotonin level</b>				
	<i>Pre-treatment</i>	<i>Post-treatment</i>	<i>t-value</i>	<i>p-value</i>
	<i>Mean±SD</i>	<i>Mean±SD</i>		
<b>Study group(A)</b>	133.2 ±24.94	280.7±79.45	5.437	0.0004
<b>control group(B)</b>	133.1±13.24	183.4±28.57	4.95	0.0008
<i>t-value</i>	0.013	3.644		
<i>p-value</i>	0.99	0.002		

## Discussion

Sciatica is a common reported complaint affecting the quality of life and reducing economic and social efficiency, which is due to loss of productivity in addition to the cost of the medical treatment [17]. Relieving of pain is the main aim of conservative treatment for sciatica in the form of analgesics, muscle relaxants and epidural steroid injections, or by decreasing nerve root compression, and also includes hot packs, acupuncture, spinal manipulation, and spinal traction therapy, [18].

Acupuncture is considered a treatment for many disorders and an analgesic method for relieving chronic pain[19]. The intricate feeling induced by acupuncture- such as numbness and soreness beneath the acupoint in the deep tissue is important to acupuncture induced analgesia [20]. Acupuncture is suggested to activate inhibitory fibers for a short time, resulting in decreasing the pain signal transmission to the brain [21]. Also Acupuncture stimulates endogenous opioid analgesic mechanisms resulting in secretion of endorphin [22] and triggering adenosine release leading to effective and rapid analgesia on radicular sciatica [23].

Stimulation of high-threshold, small-diameter nerves is the trigger for acupuncture analgesia. [24]. A cohort study revealed that the symptoms of radicular sciatica were directly and significantly decreased following electroacupuncture (EA) to the nerve root, [25]. Animal experiments found that acupuncture is an efficient treatment than diclofenac sodium for crushed sciatic nerves regeneration [26]. It was reported that EA can reduce pain through regulation of multiple proteins expression in the hypothalamus [27].

This study was aimed to determine the effect of TENS Acupuncture and stretching exercises in reducing sciatic pain during pregnancy. the results showed improvement in pain in both groups. However, there was a highly significant between study group and control group in level of pain after treatment. As there has been no prior systematic review related to TENS acupuncture for sciatica during pregnancy published in

English, we hope this review will help clinicians make decisions in practice and promote the progress of acupuncture research in the Obstetrics and Gynecological field.

The improvement in pain in present study have several explanations. Firstly, TENS acupuncture causes relieve of pain by activate(excitation) large diameter of the A beta ( $A\beta$ ) sensory fibers without activating smaller diameter nociceptive fibers ( $A\delta$  and C) this causes excitation of certain sensory neural pathways which activate PAG area involved in the pain control system, with release of endogenous opioid peptides. Simultaneous suppression of pain transmission at the spinal pain-gate by acupuncture [28]. This factors play a role in reduce pain level.

The current study results supported by the work of Hashmi, S et al, who compare the effectiveness of Transcutaneous Electrical Nerve Stimulation and Kati Basti in reducing the Sciatica, The study shows that after two weeks of intervention, there was a significant reduction of pain and improvements in Straight Leg Raise Test in both (TENS) and Kati Basti. However, patients in Transcutaneous Electrical Nerve Stimulation have improved more in terms of reduction of pain than in patients who were treated with Kati Basti [29].

The results of the current study are also come in consistence with the study of Cherian J.J et al, that concluded that about 70% of the patients experienced pain reduction when treated with low-TENS [30].

Chaitali Shah et al, reported the high (conventional ) TENS is more effective than Low (acupuncture ) TENS which is used for acute dysmenorrhea pain while sciatica is a chronic pain condition so low (acupuncture ) TENS will be more effective [31].

In a systematic review of 12 studies (1842 participants), the pooled results of this meta-analysis revealed that acupuncture is effective in decreasing pain intensity, and increasing pain threshold in sciatica patients in comparison with medication. The results of subgroup analysis, did not change in different methods of treatment and categories of the drug. And in the sensitivity analysis, omitting the study of Zhan and Liang [32] in 1993 or Chen [33] in 2010.

Han [34] found that acupuncture can promote release of neurotransmitter such as 5- hydroxytryptamine and in addition it generates neuropeptide through electrical stimulation of different frequencies that has significantly effect to pain reduction.

These studies confirm and add strong evidences that Acupuncture TENS is an good method of mitigation sciatica pain during pregnancy that the physiotherapist is able to use it in treating such cases

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### **Conflicts of Interest:**

No conflict of interests for the publication of this paper.

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