Original Article

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Transcutaneous Electrical Nerve Stimulation as a form of Labour Analgesia on the Severity of Labour Pain: A Prospective Interventional Study

Obstetrics and Gynaecology Section

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ABSTRACT

Introduction: The increasing demand for effective labour analgesia has led to the rediscovery of Transcutaneous Electrical Nerve Stimulation (TENS) as a non pharmacological pain relief method during labour. TENS involves the application of low-voltage electrical currents to the skin, which is thought to reduce pain through mechanisms such as the gate control theory and endorphin release. This method is considered safe with minimal side-effects, offering a potential alternative to pharmacological analgesia, especially in resource-constrained settings or for women with contraindications.

Aim: To compare the effect of TENS on the duration of labour, mode of delivery, pain score and condition of neonates, with those not receiving any analgesia during labour.

Materials and Methods: This prospective interventional study at the Department of Obstetrics and Gynaecology (OBG), Shimoga Institute of Medical Sciences, Shivamogga, Karnataka, India from August 2022 to December 2023 included 80 parturients (40 in the TENS group and 40 in the no analgesia group). The variables/outcomes compared included demographic parameters (age, weight, height, educational status), estimated foetal weight, labour duration, mode of delivery, neonatal outcomes and pain scores. Chi-square and t-tests were used for analysis.

Results: Demographic parameters (age, education, height, weight and estimated foetal weight) were comparable between the TENS and no analgesia groups ($p>0.05$). No significant difference was found in labour duration or mode of delivery ($p=1$). Statistically significant difference was noted in pain scores between the two groups (TENS: 4 and 8 vs. No Analgesia: 7.5 and 9 for the first and the second stages of labour respectively, $p<0.001$). Appearance, Pulse, Grimace, Activity and Respiration (APGAR) scores, Neonatal Intensive Care Unit (NICU) admission were similar ($p>0.05$). All mothers were healthy at discharge.

Conclusion: When used during labour, TENS provides satisfactory analgesia without adversely affecting the duration or outcome of labour. As a safe non pharmacological method, TENS plays a significant role in providing labour analgesia, especially in resource-constrained centres or for women who are unwilling or have contraindications to pharmacological methods.

Keywords: Labour duration, Neonatal outcome, Obstetric, Pharmacological analgesia

INTRODUCTION

Labour is possibly the most painful experience a woman might encounter in her life. Being largely subjective, the perception of pain is not only influenced by the anatomic and physiological factors but also a multitude of environmental, psychological and other factors and experiences [1]. In the first stage of labour pain is largely visceral in origin, whereas during the transitional and second stages somatic pain becomes more pronounced [2]. Labour in itself is associated with adverse physiological consequences for the parturient as a result of the generalised neuroendocrine response produced and also affects the well-being of the foetus [2,3], which warrants the need for an effective as well as safe form of analgesia during labour.

A wide variety of techniques- both pharmacological like inhalational agents, spinal and epidural anesthesia, pudendal nerve block and non pharmacological like acupressure, acupuncture, TENS- are being used worldwide for analgesia in labour. The complications associated with the formerly used inhalational agents and other forms of analgesia [4] has led parturients and medical professionals alike away from them and towards newer methods of analgesia like neuraxial analgesia, or non invasive methods like TENS [5]. TENS, an Food and Drug Administration (FDA) approved non pharmacological method of pain relief has been used for relieving chronic pain since decades. Its application in obstetrics took new strides after Melazack explained its mechanism of analgesia in his theory called The Pain Gate Control Theory in 1962, which explained that TENS stimulates the mechanoreceptive Aβ (A-beta) fibres that act through presynaptic and postsynaptic inhibition at the dorsal horn of the spinal cord, reaching higher centres in the brain to inhibit the transmission of signals from nociceptive Adelta and C fibres [6]. Though the widespread usage of TENS point towards potential safety and advantages in clinical usage, the results of systematic reviews in this regard have been inconsistent [7-10].

Although neuraxial analgesia is found to be quite effective in labour, concerns over its effects on labour, the mother and the foetus its feasibility as well as the need for skilled personnel for administration are yet to be addressed [11-15]. The need for a safe, non invasive and economical method of pain relief during labour has led to the rediscovery of TENS as a form of analgesia in labour and warrants more study into its effect on the process of labour, the neonate and the overall satisfaction of the parturient. With this background the present study was conducted with aim to compare the effect of TENS on foetal and maternal outcomes in nulliparous parturients in India with those not receiving any analgesia during labour.

MATERIALS AND METHODS

A prospective interventional study was conducted in the Department of Obstetrics and Gynaecology, Shimoga Institute of

Medical Sciences, Shivamogga, Karnataka, India, from August 2022 to December 2023. This research was approved by the present institution Ethics Committee: SIMS/IEC/820/2022-23. Term pregnant women in labour, admitted under department of Obstetrics and Gynaecology, associated with the college form the study population.

Inclusion criteria:

- Nulliparous women;
- 37-41 weeks of gestation;
- Singleton pregnancy;
- Vertex presentation;
- Spontaneous onset of labour;
- Reactive Non Stress Test (NST).

Exclusion criteria:

- Pregnancy with multifoetal gestation, Antepartum haemorrhage, Preeclampsia, malpresentations, preterm labour;
- Medical disorders like diabetes, hypertensive disorders of pregnancy, cardiac disease in pregnancy, renal, liver disorders, neurologic or neuromuscular disorders;
- Suspected Cephalopelvic Disproportion (CPD) on pelvic examination;
- Presence of absolute indications for caesarean section;
- Presence of contraindications to TENS;
- Non reactive NST;
- Meconium-stained liquor;
- Patient refusal.

Study Procedure

Women referred to the delivery ward were assessed for inclusion criteria and those eligible and willing to participate in the study were recruited. Participants were explained the basic working and the possible risks and effects that came with the usage of the TENS device and those who were willing to use TENS for analgesia were grouped under 'TENS group' and those not willing were put under the 'No Analgesia group'. In the TENS group, Pain scores were recorded and TENS electrodes were applied to the back in an area between the 10th thoracic vertebra and the 1st lumbar vertebra within 5 centimeters from the middle vertebral line (two electrodes). Two electrodes were placed symmetrically between the 2nd and 4th lumbosacral vertebra within 5 centimeters from the vertebral column. The TENS device was then switched on and the voltage gradually increased until the woman felt a pleasant tingling sensation at the site of electrodes. Pain score was recorded after connecting the electrodes and hourly thereafter and in the second stage of labour. The 'no analgesia group' did not receive any analgesia during labour. Maternal vitals and foetal heart rate were continuously monitored and abdominal examination done to assess the intensity, duration and frequency of uterine contractions and descent of the foetal head. Duration and progress of labour was monitored using a partogram. Per-vaginal examination was done to note cervical dilatation, effacement, station of the head and membrane and liquor status.

Outcome assesed were duration of active phase of first stage of labour, duration of second stage of labour, mode of delivery, need for additional drugs for augmentation of labour, pain during first and second stages of labour by Visual Analogue Scale (VAS), APGAR score. Any significant peripartum findings and Neonatal and maternal condition postpartum were recorded.

STATISTICAL ANALYSIS

Continuous variables such as duration of labour, age and APGAR scores were analysed for normality using appropriate statistical tests (e.g., Shapiro-Wilk test). Data were analysed using IBM Statistical Package for Social Sciences (SPSS) version 16. Descriptive statistics, including mean, standard deviation, percentages and frequencies, were calculated. The Chi-square test was used to assess associations between categorical variables and t-test was used for continuous variables. A p-value of less than 0.05 was considered statistically significant.

RESULTS

The two groups of participants were comparable in demographic profile, with no significant differences in terms of age, education (p=0.939), height (p=0.071), weight (p=0.706) and estimated foetal weight (p=0.762) [Table/Fig-1].

Characteristic	TENS group	No analgesia group	p-value
Age (years)			
16-20	2 (5)	3 (7.5)	0.766
21-25	23 (57.5)	20 (50)	
26-30	15 (37.5)	17 (42.5)	
Education			
No formal education	1 (2.5)	1 (2.5)	0.939
Upto Class 12	34 (85)	35 (87.5)	
Graduation and above	5 (12.5)	4 (10)	
Estimated foetal weight (kg)	2.84±0.241	2.8±0.271	0.487
Height (cm)	157.2±4.682	159.03±4.306	0.071
Weight (kg)	59.73±5.194	60.17±5.449	0.706

[Table/Fig-1]: Patient demographic data.
Data were analysed using the Chi-square test for categorical variables and the Independent t-test for continuous variables.

There was no significant difference in the duration of active phase of first stage of labour between the two groups (p=0.409) [Table/Fig-2].

Stage of labour	TENS group	No analgesia group	p-value
Active phase of stage 1 (min)	220±47.285	227.75±35.264	0.409
Stage 2 (min)	48.21±18.442	55.38±26.392	0.168

[Table/Fig-2]: Comparison of duration of labour.
Independent t-test

The 'TENS' and 'No Analgesia' groups experienced a statistically significant difference in pain during the first and second stages of labour (p<0.001) [Table/Fig-3]. The two groups were found to have no significant difference in terms of mode of delivery [Table/Fig-4].

Stage of labour	TENS group	No analgesia group	p-value
Active phase of stage 1	4±0.58	7.5±0.716	<0.001
Stage 2	8±0.677	9±0.501	<0.001

[Table/Fig-3]: Comparison of pain severity (VAS Score).
Independent t-test

Mode of delivery	TENS group (n=40) n (%)	No analgesia group (n=40) n (%)	p-value
Normal vaginal delivery	36 (90)	36 (90)	1
Instrumental delivery	3 (7.5)	3 (7.5)	
Caesarean section	1 (2.5)	1 (2.5)	

[Table/Fig-4]: Comparison of mode of delivery.
Chi-square test

In terms of neonatal outcome, neonates from both the groups had statistically similar APGAR score at one minute (p=0.158) and five minutes (p=0.16) [Table/Fig-5]. None of the neonates required NICU admission and all of them were healthy at discharge. There was no significant difference in the need for augmentation of labour between the two groups [Table/Fig-6].

A 95% (36/40) of the TENS device users participating in the study expressed satisfaction with the use of the device and were willing to use it in further labours. Maternal vitals were stable postdelivery

Outcome	TENS group (n=40) n (%)	No analgesia group (n=40) n (%)	p-value
APGAR at 1 minute	8±0.496	8±0.276	0.168
APGAR at 5 minutes	9	9±0.35	0.179

[Table/Fig-5]: Comparison of neonatal outcome.
Independent t-test

Group		No	Yes	Total
TENS group	Observed (% within column)	24 (52.2%)	16 (47.1%)	40 (50.0%)
No analgesia group	Observed (% within column)	22 (47.8%)	18 (52.9%)	40 (50.0%)
Total	Observed	46	34	80

[Table/Fig-6]: Oxytocin augmentation required.
p-value=0.651; Chi-square test

in both the groups and all participating mothers were healthy at discharge.

DISCUSSION

The present study showed statistically significant reduction in pain scores in the first and second stage of labour in participants using TENS analgesia compared to those not receiving any form of analgesia.

Shahoei R et al., conducted a randomised controlled trial on low-risk nulliparous women which studied the duration of first and second stages of labour in women using TENS analgesia in labour and compared it with those that did not and the results obtained are in line with the findings of current study, which showed no significant difference in the duration of active phase of first stage and of second stage of labour between the two groups [16].

This correlates with the findings of similar studies, most recently by Njogu A et al., where VAS was used for pain assessment in 161 low-risk women in labour which demonstrated significantly lower mean VAS scores compared to the control group (p <0.001). The study also showed a reduction in the mean duration of active phase of labour the participants receiving TENS compared to the control group, correlating with the findings of the current study [17]. The findings also correlate with that of a similar study by Joseph SE et al., which showed significant reduction in pain scores at the end of first stage of labour in the group where TENS was applied (4.9±0.43) compared to the control group (9.5±0.23) (p<0.001) [18] and that of the literature review by Günaydın S et al., which showed nine out of the 11 studies showing significant reduction in intensity of pain [19].

No increase in instrumental deliveries or caesarean section rate was noted in the TENS Group, compared to the group receiving no analgesia. This correlates with the findings of Shaban MM which showed no significant difference in the mode of delivery between the two groups [20]. The need for augmentation of labour with oxytocin was found to be similar among the participants of both groups, with similar results (p=0.92) being obtained in a recent study by Njogu A et al., [17].

A 2020 randomised controlled trial by Farra HAA et al., showed no significance in neonatal outcome in terms of similar APGAR scores among babies born to mothers receiving TENS and those that did not [21].

Similarly, the present study showed no significant difference in neonatal outcome in terms of APGAR score at one and five minutes of birth between the two groups. This correlates with the findings of the study by Shahoei R et al., which found comparable one and five minute APGAR scores of neonates (p=0.25 and p=0.71 at one and five minutes, respectively) born to participants of TENS and control group [16]. Meta-analyses by Mello LF et al., and Bundsen P et al., also show no significant difference in APGAR scores at one and five minutes in included studies [9,22].

The van der Spank JT et al., conducted a study which suggested that TENS produces a statistically significant decrease in pain during labour, with 96% of the participants expressing satisfaction with the analgesic effect [7]. The present study shows similar findings, with 95% of participant users expressing satisfaction and willingness to use TENS in further labours.

TENS can be a viable, safe and effective alternative for managing labour pain, particularly for women seeking a non invasive approach to analgesia. It offers an additional option in settings where pharmacological interventions may not be feasible, either due to resource constraints or maternal preference. Additionally, since TENS is associated with minimal side-effects, it could be especially useful for women with contraindications to drugs like opioids or epidurals. Its high level of satisfaction among users suggests that TENS may serve as an acceptable adjunct to or even replacement for more traditional pain management methods, expanding the choices available to parturient. The ability to administer TENS without medical supervision during labour also makes it a useful option in low-resource environments.

Limitation(s)

The study was conducted on nulliparous women only. Larger studies involving nullipara and multipara should be done. The effect of tens was compared to those receiving no analgesia during labour. More studies exploring the placebo effect of the device are warranted.

CONCLUSION(S)

The use of TENS as a mode of labour analgesia shows reduction in pain severity with no impact on the duration and outcome of labour. It can be used as a mode of analgesia in women not willing for or have contraindications to pharmacological methods of analgesia.

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REFERENCES

[1] Lowe NK. The nature of labour pain. American Journal of Obstetrics and Gynecology. 2002;186(5):S16-24.
[2] Brownridge P. The nature and consequences of childbirth pain. European Journal of Obstetrics & Gynecology and Reproductive Biology. 1995;59:S9-S15.
[3] Reynolds F. Labour analgesia and the baby: Good news is no news. International Journal of Obstetric Anesthesia. 2011;20(1):38-50.
[4] Landon MB, Galan H, JER M, Driscoll DA, Berghella V, Grobman WA, et al. In: Gabbe's obstetrics essentials: Normal and problem pregnancies. Philadelphia PA: Elsevier, 2019. p. 292-93.
[5] Field T. Pregnancy and labour alternative therapy research. Alternative Therapies in Health & Medicine. 2008;14(5).
[6] Sluka KA, Walsh D. Transcutaneous electrical nerve stimulation: Basic science mechanisms and clinical effectiveness. J Pain. 2003;4:109-21.
[7] Van der Spank JT, Cambier DC, De Paepe HM, Danneels LA, Witvrouw EE, Beerens L. Pain relief in labour by transcutaneous electrical nerve stimulation (TENS). Archives of Gynecology and Obstetrics. 2000;264:131-36.
[8] Dowswell T, Bedwell C, Lavender T, Neilson JP. Transcutaneous electrical nerve stimulation (TENS) for pain relief in labour. The Cochrane Database of Systematic Reviews. 2009;15(2):CD007214.
[9] Mello LF, Nóbrega LF, Lemos A. Transcutaneous electrical stimulation for pain relief during labour: A systematic review and meta-analysis. Brazilian Journal of Physical Therapy. 2011;15:175-84.
[10] Carroll D, Tramèr M, McQuay H, Nye B, Moore A. Transcutaneous electrical nerve stimulation in labour pain: A systematic review. BJOG: An International Journal of Obstetrics &Gynaecology. 1997;104(2):169-75.
[11] Lieberman E, O'donoghue C. Unintended effects of epidural analgesia during labour: A systematic review. American Journal of Obstetrics and Gynecology. 2002;186(5):S31-S68.
[12] Liu EH, Sia AT. Rates of caesarean section and instrumental vaginal delivery in nulliparous women after low concentration epidural infusions or opioid analgesia: Systematic review. BMJ. 2004;328(7453):1410.
[13] Anim-Somuah M, Smyth R, Howell C. Epidural versus non-epidural or no analgesia in labour. (Cochrane Review). Cochrane Database of Systematic Reviews. 2005;4(4):CD000331.

[14] Jones L, Othman M, Dowswell T, Alfirevic Z, Gates S, Newburn M, et al. Pain management for women in labour: An overview of systematic reviews. Cochrane Database of Systematic Reviews. 2012;2012(3):CD009234.
[15] Cambic CR, Wong CA. Labour analgesia and obstetric outcomes. British Journal of Anaesthesia. 2010;105(suppl_1):i50- i60.
[16] Shahoei R, Shahghebi S, Rezaei M, Naqshbandi S. The effect of transcutaneous electrical nerve stimulation on the severity of labour pain among nulliparous women: A clinical trial. Complementary Therapies in Clinical Practice. 2017;28:176-80.
[17] Njogu A, Qin S, Chen Y, Hu L, Luo Y. The effects of transcutaneous electrical nerve stimulation during the first stage of labour: A randomized controlled trial. BMC Pregnancy Childbirth. 2021;21(1):164.
[18] Joseph SE, Thomas A, Mhaskar R, Michael J. Effect of Transcutaneous Electrical Stimulation (TENS) on labour pain and the duration of first stage of labour. Gynecol Obstet. 2024;14:4.
[19] Gunaydın S, Sen E, Yılmaz T, Kaya HD. Use of Transcutaneous Electrical Nerve Stimulation (TENS) in labour pain: An integrative review. Pain Manag Nurs. 2025;26(1):85-92.
[20] Shaban MM. Labour pain relief using transcutaneous electrical nerve stimulation, maternal and fetal impacts: A randomized-controlled study. Journal of Evidence-Based Women's Health Journal Society. 2013;3(4):178-82.
[21] Farra HAA, Shalaby HS, Fahmy AA, Nawara M. The safety and efficacy of Transcutaneous Nerve Stimulation (TENS) in reducing vaginal delivery labour pain: Randomized controlled clinical trial. OJOG. 2020;10(05):657-70.
[22] Bundsen P, Ericson K, Peterson LE, Thiringer K. Pain relief in labour by transcutaneous electrical nerve stimulation: Testing of a modified stimulation technique and evaluation of the neurological and biochemical condition of the newborn infant. Acta Obstetricia Et Gynecologica Scandinavica. 1982;61(2):129-36.

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