

Transcutaneous Electrical Nerve Stimulation and Labor Pain

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Objective: To investigate the efficacy and safety of Transcutaneous Electrical Nerve Stimulation (TENS) on uterine activity, duration of labor, intrapartum fetal heart rate and APGAR score, in relieving the pain of parturition .

Design : A controlled study to investigate the role of TENS to relieve the pain of parturition at Department of Obstetrics, Kasturba Medical College Hospital, Manipal, India.

Material and Method: Seventy gravid women with cephalic presentation in active labor, with no obstetric or medical complications were studied. Fifty women in GROUP I (Study group) (25 primi and 25 multigravidae) received TENS stimulation and Twenty women (10 primigravida and 10 multigravida) in GROUP II (Control group) received SHAM TENS (placebo).

Results: Fifty two percent (primi) and 64% (multi) gravida in Group I and 8% in the Group II experienced good to excellent relief of back pain. Eight percent in primi and 12% in multigravida had no relief in Group I. Few had benefit in the second stage. The duration of labor was reduced by 120 minutes in multi and by 77 minutes in primigravida in group I (P value <0.001). There was no change in the intrapartum fetal heart rate in both the groups and none required immediate resuscitation.

Conclusion: TENS seems an effective, simple to administer method of pain relief with no side effects on the mother or the child. It is effective in relieving the low back pain in 50%, but has no effect on the lower abdominal pain with the present stimulation technique.

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The relief of pain during childbirth has been of great interest both to the obstetricians and the anaesthesiologists for many centuries, but no single method has been entirely satisfactory to alleviate the pain of labor and delivery.

The three essentials of obstetric pain relief are preservation of fetal homeostasis, effectiveness, simplicity and safety to the mother. The available techniques do not fulfill the above criteria.

This led us to investigate the usefulness, efficacy and safety of Transcutaneous Electrical Nerve Stimulation in relieving the pain of parturition (a) during I & II stage (b) the effect on uterine activity and duration of labor, (c) the effect on the intrapartum fetal heart rate and (d) APGAR score.

METHODS

Seventy gravida patients with no obstetric or medical complications in active labor, with cephalic presentation were divided at random into a study and a control group. Fifty women (25 primi and 25 multigravidae) were grouped as GROUP I (the study group) and twenty women (10 primi and 10 multigravidae) as GROUP II (Control group). The patients in both the groups were matched with regard to age, parity and gestational age in weeks.

All had general and obstetric examination with consent obtained after explanation of the procedure.

The exclusion criteria were advanced labor on admission (greater than 4 cm cervical dilatation) had received analgesia during labor, malpresentation, multiple pregnancy, premature labor and those booked for elective cesarean section.

In both the groups two pairs of moistened electrodes were placed on either side of the spine approximately 5cms from the midline at two different levels covering the dermatomes of the posterior rami from T₁₀-L₁, and from S₂ – S₄.

These electrodes were attached to an active TENS stimulator, of indigenous make (viz Jaipur Electricals Ltd., multiprobe model) powered by a 9 volts battery, producing biphasic pulses of varying frequency and amplitude.

The stimulation was initiated at a cervical dilation of 2-3cms. The pulses delivered were 5-10 Armstrong with a frequency of 100 Hz. Group I received TENS stimulation while Group II received TENS placebo (Sham TENS).

In group I the intensity of the stimulus to the thoraco-lumbar electrodes was gradually increased until a pleasant tingling sensation was felt. Patients in group II had no stimulation though the visual indicator was kept on. No other additional analgesia was given in both groups.

Monitoring consisted of a partogram, fetal heart rate, mode of delivery, maternal blood loss, duration of labor, APGAR scores at one minute of the newborn, (assessed by the paediatrician).

One hour after delivery, the patients were asked for their comments regarding the efficacy of the analgesia, site of pain relief and willingness to accept TENS again in future for labor pain.

Pain Assessment

An initial assessment of pain threshold to venepuncture with scoring system was made prior to institution of TENS stimulation.

- No physical or emotional reaction - 1.
- Tightening of hand without gripping - 2
- Wincing and gripping of observer's hand - 3
- Withdrawal or tight gripping of the observer's hand - 4.

The pain relief was assessed both by the subject (herself) and by the observer.

1. Subjective assessment (by the patient)

This variable was standardized by visual analog scale. The distance marked were calculated as a percentage of line length (from 0 - 100%). Scores were given according to the percentage of relief (Table 1).

Table 1. Scores according to percentage of relief

0 - 25 %	1
26 - 50 %	2
51 - 75 %	3
76 - 100 %	4

2. Observer Assessment

This was done by one of the authors grading the degree and scoring.

- i) Moaning or shouting during contraction (0-25% relief)- 1
- ii) Wincing during contraction (26 - 50% relief)- 2
- iii) Restless with discomfort (51 - 75% relief)- 3
- iv) Comfortable and sleeping (76 - 100% relief)- 4

Pain index was calculated by multiplying the pain relief scores assessed both by the subject and observer. The degree of pain relief was graded accordingly (Table 2).

Table 2. The pain index and degree of pain relief

Pain Index	Degree of pain relief
1 - 4	No relief
5 - 8	Fair relief
9 - 12	Good relief
13 - 16	Excellent relief

The results were tabulated and analyzed statistically, using student's 't' test.

RESULTS

None of the patients had prior knowledge about the pain relief in both groups. The subgroups in each of the groups showed no significant difference with regard to age, parity, educational status and pain threshold.

There were more patients between 25-30 years in multigravida (16 in study and 3 in control group) and 20-25 years in primigravida (19 in study and 7 in control group).

Pain threshold showed no significant difference statistically between primi and multigravida in both the groups, but clinically, it was higher in the multigravida patients.

In early first stage of labor back pain was predominant, while abdominal pain became apparent in the late first stage. In the study group, (Table 3) 52% of the primi (n=13) and 64% (n=16) of the multigravida experienced good to excellent relief of back pain compared to 8% (n=2) in primi and 8% (n=2) in multigravida of the control group.

Table 3. Back pain - Pain index

Pain Index	Test group Primi	group Multi	Control group Primi	group Multi	Total
1 - 4	2 (8%)	3 (12%)	4 (16%)	3 (12%)	12
5 - 8	10 (40%)	6 (24%)	4 (16%)	5 (20%)	25
9 - 12	12 (48%)	13 (52%)	2 (4%)	2 (4%)	29
13 - 16	1 (4%)	3 (12%)	-	-	4
Total	25	25	10	10	70

*P Values: <0.5, Primi/Multi study - not significant
Primi/primi control - significant, Multi/multi control - significant*

Few women experienced good relief of the abdominal pain in both groups (Table 4). However, in multigravida 28% (n=7) had good and 32% (n=8) fair relief, while in primigravida 8% (n=2) had good and 32% (n=8) fair relief in the study group. In the control group 30% (n=3) had fair and 20% (n=2) had good relief in the multigravida while it was 30% (n=3) fair relief and 10% (n=1) good relief in primigravida .

Table 4. Abdominal Pain – Pain Index

Pain Index	Test group		Control group		Total
	Primi	Multi	Primi	multi	
1 - 4	15 (60%)	9 (36%)	6 (24%)	5 (20%)	35
5 - 8	8 (32%)	8 (32%)	3 (30%)	3 (30%)	22
9 - 12	2 (8%)	7 (28%)	1 (10%)	2 (20%)	12
13 – 16	--	1 (4%)	--	-	1
Total	25	25	10	10	70

1-4 No relief 5-8 Fair relief 9-12 Good relief 13-16 Excellent relief

P Values: <0.05 Primi/Multi study - significant

Primi/Prirni control - not significant Primi/multi control - not significant

Although many women experienced good relief of back pain in the study group they graded the overhaul pain during the first stage as severe similar to the control group. Very few found benefit from TENS in the second stage, when the expulsive reflex was strong.

The duration of labor was markedly reduced in the study group by 120 minutes in multigravida and by 77 minutes in primigravida compared to the control group (P value < 0.001) whose average duration of labor was 7 hours.

There was no variation in the intrapartum fetal heart rate in both groups and none required immediate resuscitation.

Both groups showed no significant change in the uterine action and in progress of labor, 12% in Group I (primi(n=3) and multi (n =1) had instrumental delivery (outlet forceps application) while none in Group II (control group).

No local complications relating to the electrodes or electrode jelly were recorded. About 50% of patients in both groups preferred TENS as a form of analgesia in future.

DISCUSSION

Pain is a subjective sensation, hence the severity of pain experienced depends both, on neural pathways and psychological factors such as previous experiences, present expectations, stress and cultural factors. In labor, these have a profound effect¹ making it difficult to measure the pain despite a double blind placebo controlled method. In this study, the groups were initially comparable in terms of pain threshold and pain concepts.

The pain in the first stage of labor, may be due predominantly to cervical dilatation with contractions of the uterus contributing significantly as labor progresses. Repeated stimulation reduce the high threshold of receptors, while contractions may cause cellular breakdown releasing "Pain producing substances". These Pain impulses are transmitted via the A-delta and C-afferent fibers reaching segments T¹¹ and T¹². The increasing intensity gives rise to pain in segments corresponding to dermatome distribution T¹⁰ and L¹. The full dilation², extension and stretching of the birth canal activates the pudendal nerves and roots S²⁻⁴.

The pain of uterine contraction is referred to the back because, the cutaneous branches of the posterior primary rami of T11 supply the skin over the spines of L3-L4, and of T12 over L5-S1 and those of the L1 over the sacrum. The abdominal pain is felt in the distribution of the anterior primary rami of T10-L1. The convergence theory of pain transmission lends credence to the concept of stimulating the cutaneous receptors for relief of visceral pain (viscero cutaneous reflex).

The treatment of back pain with TENS is impressive³. In our study, similar to others^{4,5} 52% of primi and 64% of multigravida had good to excellent relief of back pain while only 8% in primi and 12% in multigravida had no relief.

Very few in both groups benefited in the second stage. This is because, the suprapubic and the perineal pain of the second stage are due to stretching of the perineal structures innervated by large somatic "A" fibres which are not inhibited by further stimulation with TENS suggesting that TENS does not provide analgesia in the presence of strong expulsion reflex⁶.

The effect of TENS to reduce anterior pain could be improved by stimulation over the lower abdomen. However the suprapubic stimulation with conventional electrodes might induce irregularities in the fetal heart rate owing to high current density, and convulsions due to close proximity to the fetal fontanelles⁷. Hence in our study, anterior stimulation was not given.

Although TENS has a good effect on back pain, this study is in agreement that it is only a complement to other methods in providing total relief of labor pain^{8,9}.

Unlike this study, others studies¹⁰⁻¹² found no difference between TENS and TENS placebo. All forms of therapy have a placebo component and TENS is no exception¹³. Nevertheless, there is strong evidence of the analgesic action of TENS on pain mechanisms¹⁴. The possible mechanism is that the electrical stimulation excites afferents connected to tactile receptors and on entering the spinal cord these afferents ascend in the dorsal columns. However, at spinal cord level these A beta afferent fibers give rise to collaterals which synapse with short interneurons, the endings of which end in proximity to the terminations of the C-fibers in substantia gelatinosa cells. These interneurons probably release gamma aminobutyric acid, which causes presynaptic blockade of the C-afferents, preventing them from exciting the substantia gelatinosa cells and blocking the onward transmission of nociceptive information¹⁵. It may also release endorphins at the local site¹⁶.

The duration of labor has a strong positive correlation with pain intensity¹⁷ and TENS by decreasing the pain, reduced the duration of labor markedly by 120 and 77 minutes in multi and primigravida respectively, similar to other studies^{5,15}.

Patients having short labors have difficulty in obtaining a totally satisfactory analgesia with conventional methods¹⁸. Hence a possibility that TENS with its rapid onset and decay of analgesia of less than 30 minutes may be better suited as the sole analgesic to those having short labors⁵. The fact that all patients receiving TENS had normal deliveries confirms that it does not interfere with the progress of labor.

In this study the absence of variation in intrapartum fetal heart rate and infant resuscitation in both groups suggests that TENS is safe for the infant similar to the findings of Lee¹⁰ and Bundsen¹⁹. Since the effect is exerted by using the body's own defense mechanisms^{9,20} it is unlikely that late negative effects on the mother or child will occur^{10,16}. No follow up was done to permit any conclusions regarding the late effects either on the newborn or the mother in this study.

In the present study, no side effects were noted and the stimulation was acceptable to all the patients, but the willingness to accept TENS as a mode of relief was equivocal^{9,11}.

CONCLUSION

In conclusion, TENS by neuro-physiological means seems to help in relieving backache during the first stage of labor which in itself is useful. It fulfills the criteria of an efficacious, simple to administer method of pain relief with no side effects on the mother or the child. It would be a useful addition to the present methods of pain relief in labor.

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