

# Evaluating the effectiveness of TENS for maternal satisfaction in laboring parturients – Comparison with epidural analgesia

Ruchi Gupta, Gaganjot Kaur, Jasleen Kaur<sup>1</sup>, Sunil Chawla, Shubhdeep Kaur, Keerat K. Kullar, S. Aujla

Department of Anaesthesia, SGRD Institute of Medical Sciences and Research, Amritsar, <sup>1</sup>Department of Anaesthesia, Adesh Institute of Medical Sciences and Research, Bathinda, Punjab, India

## Abstract

**Background and Aims:** Labor pain is one of the most severe pain that a woman experiences in her lifetime. Various methods are being used to relieve this pain and to achieve higher maternal satisfaction. One such technique is transcutaneous electrical nerve stimulation (TENS) that uses low-frequency electrotherapy. The aim of our study was to evaluate TENS by comparing it to an established labor analgesia technique, i.e., epidural analgesia in terms of maternal satisfaction.

**Material and Methods:** This prospective study was conducted on 60 parturients in active stage of labor. The choice of analgesia was made by the parturient after informed consent. In group A (n = 30) TENS was used, while in group B (n = 30) epidural ropivacaine 0.125% + 2 µg/ml fentanyl was given. Continuous monitoring of maternal vitals, visual analogue score, and fetal heart rate (FHR) was done. Maternal satisfaction was scored considering pain relief, ability to move and experience of labor at the end of delivery and outcome was labeled as favorable and unfavorable.

**Results:** TENS was found to be favorable in 90% of parturients as compared to 96.6% in epidural ( $P=0.301$ ). The number of highly satisfied parturients was 4 (13.3%) in TENS group and 17 (56.6%) in the epidural group ( $P=0.000$ ). Three patients in the epidural group had assisted delivery and two had cesarean section whereas all patients in TENS group delivered normally ( $P=0.065$ ). No significant difference was found in the fetal outcome.

**Conclusions:** TENS is a good alternate choice for providing labor analgesia and may have a major role in future.

**Keywords:** Epidural analgesia in labor pains, labor analgesia, maternal satisfaction, transcutaneous electrical nerve stimulation (TENS)

## Introduction

Labor analgesia has evolved from the days of inhaled anesthetics administered by obstetricians to the present time of advanced neuraxial techniques. Scientific evidence on neuraxial blocks suggests that due to the availability of newer safer drugs like ropivacaine, levobupivacaine, shorter-acting

opioids, use of Patient Controlled Analgesia (PCA) pumps, these techniques have become a gold standard for providing labor analgesia.<sup>[1,2]</sup>

Although labor epidurals are being opted by more than 60% of the parturients in the developed world, in our country the average incidence and practice of labor analgesia is quite less.<sup>[2-4]</sup> There are numerous hindrances such as lack

Address for correspondence: Dr. Gaganjot Kaur,  
Department of Anaesthesia, SGRD Institute of Medical Sciences and Research, H. No 16 A, Mirankot Road, Amritsar, Punjab - 143 001, India.  
E-mail: drgaganjot@yahoo.com

Access this article online	
Quick Response Code:	Website: www.joacp.org
	DOI: 10.4103/joacp.JOACP_286_19

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

**For reprints contact:** WKHLRPMedknow\_reprints@wolterskluwer.com

**How to cite this article:** Gupta R, Kaur G, Kaur J, Chawla S, Kaur S, Kullar KK, *et al.* Evaluating the effectiveness of TENS for maternal satisfaction in laboring parturients – Comparison with epidural analgesia. *J Anaesthesiol Clin Pharmacol* 2020;36:500-5.

**Submitted:** 30-Aug-2019 **Revised:** 03-Dec-2019  
**Accepted:** 06-Mar-2020 **Published:** 18-Jan-2021

of knowledge, ignorance about the techniques available, increased cost factor, fear of needle pricks, and above all various superstitions related to labor. The majority of laboring women also prefer to have control over their labor with minimum interference in the natural process.<sup>[5,6]</sup>

To overcome these apprehensions some alternative non-invasive technique is required. Transcutaneous electrical nerve stimulation (TENS) is one such technique of pain relief that preserves the natural process to some extent. It works on the principle of "Gate Control Theory". TENS unit when applied to the lower back during labor, emits electrical impulses that excite the afferent nerves and thus inhibit the transmission of painful stimuli. Since it is not associated with motor blockade, it is unlikely to interfere with the natural bearing down efforts of the parturient. Although being tried for providing labor analgesia since 1970, the evidence on its efficacy has given us conflicting results.

On the other hand, epidural analgesia is proven to be effective in combating labor pains but its association with hypotension, urinary retention, and a misconception that it will decrease bearing down efforts of mother, has led to its underutilization. In the present era of obstetric anesthesia advancements, the target should be to attain better maternal satisfaction and acceptance rather than just achieving pain relief. So this study was conducted to evaluate maternal satisfaction not on the basis of visual analogue scale (VAS) reduction alone but considering other parameters like the overall experience of delivery and ability to move during labor comparing these two techniques. We also observed the effects of both techniques on hemodynamics, mode of delivery, duration of labor, and fetal outcome.

## Material and Methods

After obtaining ethical clearance from the institutional review board, a prospective open-label trial was conducted. The parturients admitted to the labor room for delivery were assessed for inclusion in the study for both the techniques – TENS and epidural analgesia. The inclusion criteria were American Society of Anesthesiologist (ASA) physical status II/ planned vaginal delivery without any obstetrical and non-obstetrical contraindications/singleton pregnancy/fetal vertex presentation /maternal request for analgesia / inactive stage of labor with cervical dilatation of >3 cm. The exclusion criteria were allergy to any study drug/contraindications to epidural anesthesia (local infections, generalized septicemia, platelet and clotting factor abnormalities)/ significant neurological disease with motor or sensory deficit/severe pre-eclampsia with features of increased intracranial pressure/spine abnormalities like scoliosis

and kyphosis/any electrical instrument in situ, e.g., pacemakers especially if TENS was to be used.

The advantages and disadvantages of each technique were described in detail and they were asked to choose the analgesia of their choice. Since both techniques differed in their acceptability and analgesic potential, the patient's choice was taken as a technique of randomization. Informed written consent was obtained from the willing parturients before the start of the study.

The sample size was calculated on the basis of maternal satisfaction scores of our pilot cases ( $n = 10$ ). Considering an alpha error of 0.05 and power of study >80%, 29 patients were required in each group, which was rounded off to 30.

Group A ( $n = 30$ ) received TENS. Group B ( $n = 30$ ) received epidural analgesia with 0.125% ropivacaine + 2  $\mu$ g/mL fentanyl. In both groups, under all aseptic conditions a 20 G intravenous line secured and intravenous fluids started. Mandatory monitors were attached to record heart rate, non-invasive blood pressure (NIBP) and oxygen saturation ( $SpO_2$ ). These parameters were recorded every 5 minutes for half an hour and thereafter every 30 minutes. Pain relief was measured in terms of reduction in VAS taken at the start of therapy and every 30 minutes till delivery. If reduction in VAS was 1–2 points, it was taken as mild pain relief, 3–5 point reduction as moderate pain relief, and >5 points reduction as significant pain relief.

In group A, after the start of active labor (three uterine contractions per 10 minutes, lasting for 30–40 seconds) the electrodes were positioned on the lower back on both sides of the spine at vertebral positions T10 and S2. These were corresponding to the nerve pathways through which painful impulses from the contracting uterus enter the spinal cord. The TENS unit was started at M mode, 50 Hz, 40 mA. The pulse repetition rate set at 3–4 was controlled and adjusted according to pain relief during the first and second stages of labor. (Photograph 1)

In Group B, parturients were placed in a sitting/lateral position for the placement of a lumbar epidural catheter. After aseptic preparation of the skin with betadine, sterile drapes were placed. The skin was infiltrated with xylocaine 2% and 18 G Tuohy needle was introduced in L3 – L4 interspace. The entry into the epidural space was confirmed by loss of resistance to air and the epidural catheter was threaded to keep 5 cm in the epidural space. A 3 ml test dose of lignocaine with adrenaline was given. After confirmed correct placement of the catheter, 10 ml of 0.125% ropivacaine with 2  $\mu$ g/ml fentanyl was injected as a primary dose on achieving cervical

dilatation of >3 cm. Subsequent top-up of 5 mL based on maternal request and progress of labor was given till the end of delivery.

The aim of the study was to assess maternal satisfaction, which was quantified in terms of subjective three-point evaluation score with a minimum score of 0 and a maximum 6. All the participants were given a simple questionnaire within 12 hours post-delivery by one of the investigators and asked to rate their technique on the basis of three parameters, i.e., pain relief during labor, ability to move during labor, and overall experience of labor [Table 1]. Those having a score of 0–1 were categorized as not satisfied, 2–4 as fairly satisfied, and 5–6 as highly satisfied. This was taken as a primary outcome of the study. Since we were comparing TENS with a conclusively proven technique, the evaluation was done as favorable and unfavorable on the basis of maternal satisfaction scores. Those who were highly satisfied and fairly satisfied were considered as favorable and not satisfied as unfavorable.

To obtain an objective picture, duration of the first and second stages of labor, use of any instruments during delivery or conversion to lower (uterine) segment cesarean section (LSCS) due to any reason was also noted. The fetal outcome was assessed in terms of fetal heart rate (FHR) variation using continuous cardiotocography over course of labor and neonatal Apgar score taken at 1 and 5 minutes. Maternal pulse rate, blood pressure, and SpO<sub>2</sub> were monitored throughout labor. Fall in mean arterial pressure (MAP) >20% was considered as hypotension and if persistent a rescue bolus of 5 mg i/v mephenteramine injection was given. Parturients were observed 24 hours post-delivery and interviewed about any discomfort, back pain, motor weakness, allergy, nausea, vomiting, and urinary retention at 24 hours.

### Statistical analysis

Statistical analysis was done with Statistical Package for Social Sciences (SPSS 17 version, SPSS Inc., Chicago, IL, US) 17.0 software. Chi-square test was applied for nonparametric data and one-way analysis of variance (ANOVA) with post-hoc Tukey honestly significant difference (HSD) tests for parametric numerical data. Results were expressed as mean ± [standard deviation (SD)]. *P* value of <0.05 was considered significant and *P* < 0.001 highly significant.

## Results

Our study included 106 laboring patients admitted to the labor room who were first assessed on the basis of inclusion and exclusion criteria. Eight parturients were initially excluded and the rest 98 were then counseled about both the labor analgesia techniques by one of the investigators. Thirty-six parturients refused for any method of pain relief. The remaining 62 parturients who agreed for labor analgesia were then included in the group of their choice. Due to the inability to insert the epidural catheter in 1 patient and cerebrospinal fluid (CSF) tap in other, 2 parturients were not considered. Thirty parturients were analyzed in both the groups at the end of study.

The demographic data, age, weight, and height were comparable in both the groups [Table 1]. The number of primigravida and multigravida parturients were also comparable in both groups. (*P* = 0.301) Vitals such as mean HR, BP, and SpO<sub>2</sub> were within normal limits and comparable throughout labor in both the groups [Table 2 and 3].

We found that in the TENS group, 4 (13.3%) parturients were extremely satisfied, 23 (76.7%) were fairly satisfied, and the rest 3 (10%) parturients were not satisfied. Compared to this, in the epidural group, 21 (70%) parturients were extremely satisfied and the rest 9 (30%) were fairly satisfied [Figure 1]. This result was highly significant (*P* = 0.000). TENS was found to be favorable in 27 out of 30 parturients (90%) and the epidural was found favorable in 29 parturients out of 30 (96.6%). This result was not significant (*P* = 0.301) [Table 4].

The reduction in VAS score was significant in group B as compared to group A. (*P* < 0.001) After 30 minutes of initiation of epidural technique, highly significant pain relief observed in the epidural group [Figure 2].

Mode of delivery was normal vaginal delivery in 100% of group A parturients. In group B, majority delivered by vaginal delivery, 3 (10%) parturients required instrumental assistance and 2 had cesarean section (6.7%) due to non-progress of labor. This difference in delivery mode was not statistically significant (*P* = 0.065) but clinically added to obstetrician's apprehension [Figure 3].

**Table 1: Maternal satisfaction score**

Maternal Satisfaction score	0	1	2
Pain relief during labor (VAS reduction)	Mild (1-2)	Moderate (3-5)	Significant (>5)
Ability to move during labor	Not able to move legs or feet	Able to flex knees but not able to move feet	Free movement of legs and feet
Overall experience of labor	Fair	good	Excellent

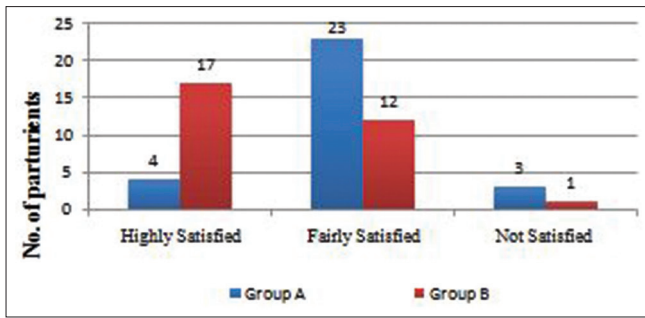


Figure 1: Maternal satisfaction score at the end of delivery

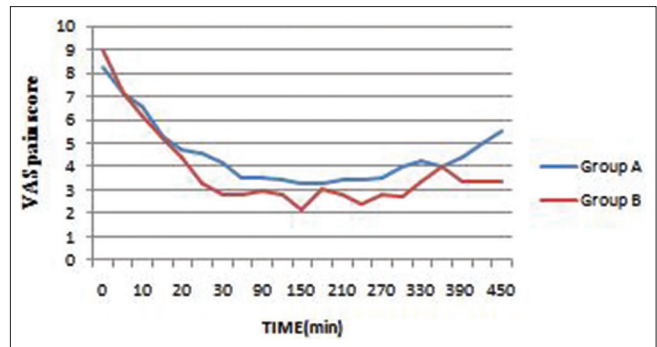


Figure 2: Mean visual analogue scale (VAS) pain score in two groups

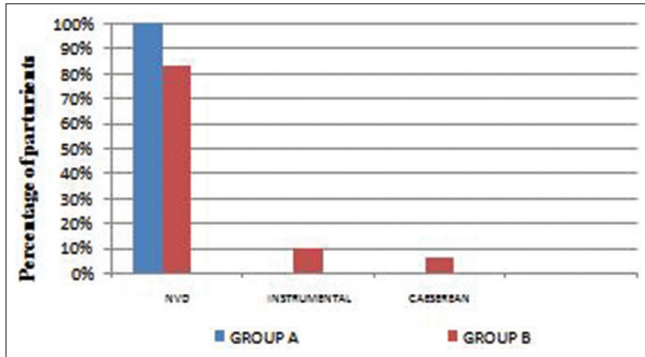


Figure 3: Mode of delivery in both groups

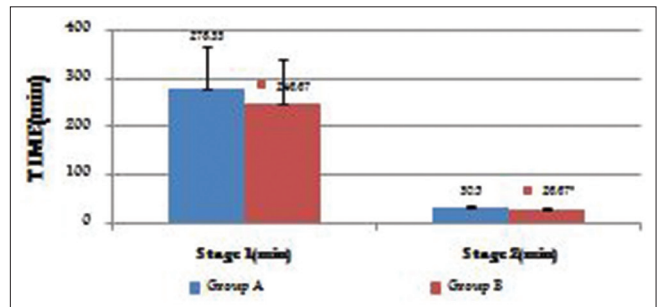


Figure 4: Mean duration of first stage and second stage of labor

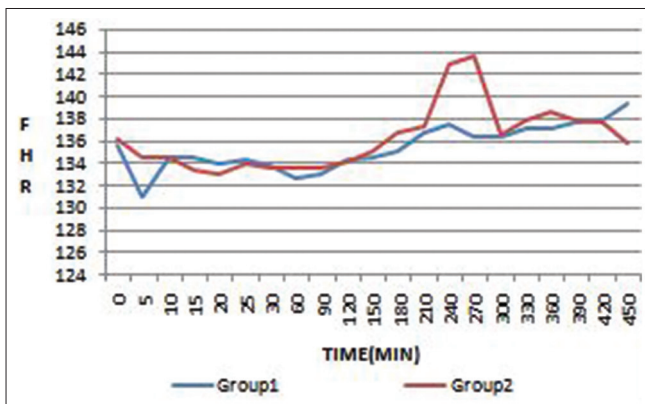


Figure 5: Mean fetal heart rate (FHR) variation

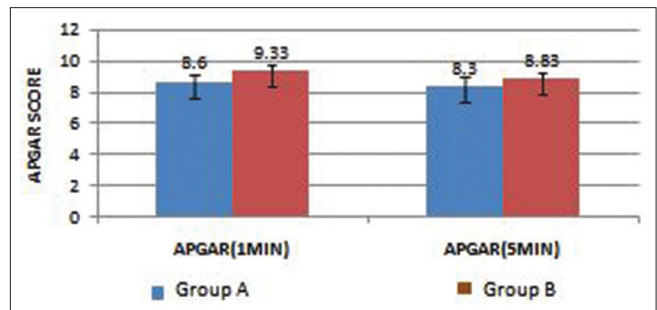


Figure 6: Mean Fetal Apgar score

The duration of the first stage of labor was not significantly affected in both groups. The second stage of labor was significantly shorter in group B compared to group A ( $P = 0.016$ ) [Figure 4].

Mean FHR was within normal limits in both groups. The neonatal Apgar score was statistically better in group B at 5 min ( $P = 0.000$ ) [Figures 5 and 6]. However, this difference was not clinically significant.

No incidence of hypotension, nausea, vomiting, urinary retention, or any allergic reaction was reported.

## Discussion

Labor pain is ranked high in the severity of pain resulting in stress response leading to maternal hypertension, uterine irritability, meconium staining, and fetal distress. According to the ASA, “In the absence of a medical contraindication, maternal request is a sufficient medical indication for pain relief during labour”.<sup>[7]</sup> However very few parturients demand pain relief during labor in our country. We counseled 98 parturients majority of whom were unaware of the techniques used for labor analgesia. When told about both the techniques, they were concerned about their side effects on fetus and mother, any interference in labor leading to cesarean section. It was therefore easy to convince them for TENS compared to epidural analgesia. This was the rationale behind our study,



**Table 2: Parturients demographic profile**

Parameters	Group A (n=30)	Group B (n=30)	P
Mean Age(years)	24.77±3.23	25.77±4.57	0.332
Mean Weight(kg)	71.30±4.71	71.20±7.50	0.951
Mean Height(cm)	154±2.49	156.20±2.80	0.002*

n=No of parturients, Values given as mean±SD, \*P<0.05 Significant

**Table 3: Hemodynamic variables**

Parameters	Group A (n=30)	Group B (n=30)	P
Heart Rate (bpm)	100.30±11.72	96.67±10.31	0.208
Systolic Blood Pressure(mmHg)	125.40±7.08	125.53±5.50	0.935
Diastolic Blood Pressure (mmHg)	77.20±4.44	78.20±4.90	0.412
SpO <sub>2</sub> (%)	100.00	100.00	1.000

n=No of parturients, bpm=beats per minutes, Values given as mean±SD, \*P<0.05 Significant

**Table 4: Outcome of maternal satisfaction**

Study Groups	Favorable	Unfavorable	Total	P
Group A (n=30)	27	3	30	0.301
Group B (n=30)	29	1	30	
Total	56	4	60	

n=Number of parturients

to find an alternative, safe, and easily acceptable method of pain relief.

TENS acts by emitting the electrical impulses through the electrodes placed at the involved nerve pathways. Analgesia is achieved by exciting the afferent nerves leading to endorphin release and also by inhibiting the transmission of painful stimuli to the brain. It can thus be used to provide labor analgesia without causing much interference in the natural birth process. All 30 parturients who chose this technique for intrapartum pain relief, had a normal vaginal delivery without requiring any other mode of analgesia. In the questionnaire asked to determine maternal satisfaction, we found that 90% of the parturients receiving TENS gave a favorable response to it even though a few complained of pain during the second stage. Most of them said that it was a good choice for labor analgesia and were willing to use it in the future also. In a study by Harrison *et al.* comparing TENS and TENS placebo users, they found an evident consumer satisfaction for TENS with a highly significant difference.<sup>[8]</sup> Similarly, Chao AS *et al.* and Kaplan *et al.* also found significant VAS score reduction in more than 60% of patients using TENS and majority were willing to adopt it in the future.<sup>[9,10]</sup> Moreover, the duration of labor was found significantly shorter with the use of TENS. The study by Singh *et al.* also shows that patients receiving TENS alone as labor analgesia method had a shorter duration of labor compared to those having epidural analgesia, but their results were not significant.<sup>[11]</sup> On the contrary, we found that

the patients using TENS had a longer duration of second stage of labor compared to those taking epidural analgesia. It could be explained by the fact that the epinephrine levels are reduced by epidural analgesia resulting in decreased adrenergic receptor stimulation leading to enhanced uterine perfusion and more effective contraction.<sup>[12-14]</sup>

In the epidural group, all patients had excellent pain relief with significant VAS score reductions after 30 min of initiation of technique. But while using this technique as a mode of intrapartum pain relief, the duration of labor and mode of delivery are the main concerns of mother and obstetrician. Most of the obstetricians believe that labor epidurals prolong all stages of labor, delay pushing, and thus lead to increased cesarean rate or instrumental deliveries. In a meta-analysis done on 11 studies comparing low vs high concentration of local anesthetics in labor epidurals, they concluded that use of low concentrations (defined as ≤0.1% bupivacaine or ≤0.17% ropivacaine) reduces the incidence of assisted vaginal delivery. But there was no difference in the incidence of cesarean delivery.<sup>[15]</sup> Although there were three instrumental deliveries and two patients had cesareans due to non-progress of labor in our epidural group, but the results were statistically insignificant.

Pain relief undoubtedly is an important factor leading to maternal satisfaction but also not the sole factor. There is always a hidden third dimension to it. The previous experiences of the parturients, present expectations, the care she gets and the cultural factors all influence her satisfaction levels. Studies have shown that satisfaction rates are higher when the parturients preserve bodily sensations of labor, mobility, and strength to participate in labor.<sup>[16]</sup> This can explain the 90% favorable response we found with TENS. In addition to being non-invasive, TENS seemed cost effective also. Compared to epidural analgesia, the operating cost of TENS was minimal. As our hospital caters to poor socio-economic strata, this may be one of the factors leading to high satisfaction rates. This device can be of real help in the remote areas; financially constrained institutions where parturients come just to have free delivery; under government schemes like Janani Shishu Suraksha Karyakaram (JSSK). As it is easy to use, the midwives or nursing staff can be easily trained. With no adverse effects on the mother as well as fetus minimum monitoring is required during its use.

The second important concern while giving labor analgesia is fetal outcome. We found no adverse effects on fetus in both groups. Few studies have reported that TENS interferes with electronic monitoring of fetal heart, but we did not notice any such thing.<sup>[17,18]</sup>

There were a few limitations in our study like there was no placebo control group for comparison, maternal satisfaction was not recorded separately for nulliparous and multiparous parturients. Fetal cord blood sampling could have been done to measure the fetal outcome in a better way but it would have increased the cost of the study.

## Conclusions

The use of TENS for labor analgesia has been studied by other authors however those results may have limitations in their applicability in different socioeconomic groups. Hence, there is a need to study this technique in different populations. Being non-invasive, it is readily accepted by parturients and provides good maternal satisfaction. Although the reduction in VAS is not as good as with the use of epidural analgesia, considering maternal satisfaction and their willingness to use it again, it can be a useful alternative for rural poor socioeconomic strata as ours. Our aim remains “no labor should go unattended without pain relief”.

## Financial support and sponsorship

Nil.

## Conflicts of interest

There are no conflicts of interest.

## References

1. Anim-Somuah M, Smyth R, Jones L. Epidural versus non-epidural or no analgesia in labour. *Cochrane Database Syst Rev* 2011;12:CD000331.
2. Cambic CA, Wong CA. Labour analgesia and obstetric outcomes. *Br J Anaesth* 2010;105(Suppl 1):50-60.
3. Pandya ST. Labour analgesia: Recent advances. *Indian J Anaesth* 2010;54:400-8.
4. Hussain SST, Maheswari P. Barriers for labour analgesia in south India-Knowledge and attitude of relevant stakeholders: A hospital-based cross-sectional study. *Indian J Anaesth* 2017;61:170-3.
5. Cluett E. Analgesia in labour: A review of the TENS method. *Prof Care Mother Child* 1994;4:50-2.
6. Prakash A, Yadav A, Karim HMB, Sahoo SK, Jena P, Aman K. Knowledge, awareness and acceptance of labor analgesia among antenatal women in a remote island: A questionnaire based study. *BJMMR* 2017;21:1-7.
7. Obstretic analgesia and anesthesia. *Practice Bulletin No. 177. Obstet Gynecol.* 2017;129(4):e73-e89
8. Harrison RF, Woods T, Shore M, Mathews G, Unwin A. Pain relief in labour using transcutaneous electrical nerve stimulation: A TENS/ TENS placebo controlled study in two parity groups. *Br J Obstet Gynaecol* 1986;93:739-46.
9. Kaplan B, Rabinerson D, Lurie S, Bar J, Krieser UR, Neri A. Transcutaneous electrical nerve stimulation for adjuvant pain relief during labour and delivery. *Int J Gynaecol Obstet* 1998;60:251-5.
10. Chao AS, Chao A, Wang TH, Chang YC, Peng HH, Chang SD, et al. Pain relief by applying TENS on acupuncture points during the first stage of labor-a randomised double blind placebo controlled trial. *Pain* 2007;127:214-20.
11. Singh AK, Tiwari D, Verma N. Comparison of methods of pain relief during labour: Epidural analgesia, intravenous tramadol and TENS. *Ann Int Med Den Res* 2017;3:9-16.
12. Wong CA, Scavone BM, Peaceman AM, McCarthy RJ. The risk of cesarean delivery with neuraxial analgesia given early versus late in labor. *N Engl J Med* 2005;352:655-65.
13. Yancey MK, Pierce B, Schweitzer D, Daniels D. Observations on labor epidural analgesia and operative delivery rates. *Am J Obstet Gynecol* 1999;180:353-9.
14. Sawant V, Kumbhar A. Labour with low dose epidural analgesia: Maternal perception and fetal outcome. *Int J Reprod Contracept Obstet Gynecol* 2018;7:689-93.
15. Sultan P, Murphy C, Halpern S, Carvalho B. The effect of low concentrations versus high concentrations of local anesthetics for labour analgesia on obstetric and anesthetic outcomes: A meta-analysis. *Can J Anaesth* 2013;60:840-54.
16. Richardson MG, Lopez BM, Baysinger CL, Shotwell MS, Chestnut DH. Nitrous oxide during labor: Maternal satisfaction does not depend exclusively on analgesic effectiveness. *Anesth Analg* 2017;124:548-53.
17. Augustinsson LE, Bohlin P, Bundsen P, Carlsson CA, Forssman L, Sjöberg P et al. Pain relief during delivery by transcutaneous electrical nerve stimulation. *Pain* 1977;4:59-65.
18. Bundsen P, Peterson LE, Selstam U. Pain relief in labor by transcutaneous electrical nerve stimulation. A prospective matched study. *Acta Obstet Gynecol Scand* 1981;60:459-68.