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ORIGINAL ARTICLE

The Analgesic Effect of Transcutaneous Electrical Nerve Stimulation (TENS) on Caesarean Under Spinal Anaesthesia

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Abstract

Background and Aim: The pain is an important concern and unpleasant outcome for delivered mothers after cesarean section which might result in problems such as poor bonding between mothers and newborn. Trans-cutaneous electrical nerve stimulation (TENS) is a non pharmacological and non-invasive method that relieves pain. The aim of this study is to assess the analgesic effect of TENS on cesarean section under spinal anesthesia.

Material and Methods: This study included 108 patients from Mostafa Khomeini hospital Ilam, who have been enrolled as study subjects. 54 subjects were randomly allocated to each of study arms (TENS i.e. Intervention & Control group). A standardized questionnaire was used for data collection and Visual analogue Scale (VAS) was used to determine severity of pain. The surgery and anesthesia procedure in intervention and control groups was identical. Pain intensity and vital signs were monitored in both experimental and control group during first 24 hours.

Result: The result of this study showed that intensity of pain and usage of sedative drug remarkably reduced after use of TENS ($p<0.001$, $p<0.05$, $p<0.001$). The mean blood pressure and respiratory rate four hour after surgery in intervention group was significantly less when compared to control group ($p<0.001$). Patient satisfaction was significantly better in intervention group than the control group ($p<0.001$).

Conclusion: TENS may be used as an effective, non invasive and non pharmacological approach for reducing post caesarian section pain with reduced use of analgesics. This might lead to better outcomes in pain control and facilitating development of bonding between mother and baby.

Key word: Pain, Caesarean, TENS.

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Introduction

In spite of increased knowledge of pain and its treatment in recent years, the research over past 25 years demonstrated a high prevalence of pain in surgical patients [1],[2]. A recent study reported that 75% of surgical patients experienced moderate to severe postoperative pain [3]. It is widely accepted that postoperative pain can impair respiratory, cardiac and endocrine functions. It can also reduce mobility, which may cause joint stiffness, pressure sores or precipitate deep vein thrombosis or pulmonary embolus. Every year, millions of women (15% to 25% of deliveries in Western countries) give birth by cesarean section.

However, the associated risks of caesarean section (Cs) are considerable, one of which is the incidence of abdominal pain that immediately occurs after Cs [4]-[6]. Studies showed that post Cs pain adversely affects initiation and duration of breastfeeding and this is recognized as a main confounder of recovery in surgery wards [7]. Abdominal surgery is one of the most painful types because of the proximity to diaphragm and cross-innervations in the abdominal area. Analgesic medication does not always provide enough relief and may have side effects [8]. Cesarean section, may also lead to chronic pain in approximately 12-30% of patients [9]. Effective analgesia after caesarean delivery results in early mobilization and enhances bonding between mother and baby [10] Transcutaneous electrical nerve stimulation (TENS) is a one of the commonly utilized non pharmacological, non-invasive treatment for pain [11],[12] TENS has been reported to be successfully used in variety of conditions like neurogenic pain, musculoskeletal pain and visceral pain including dysmenorrhoea in women [13]. Aim of this study was to assess the analgesic effect of transcutaneous electrical nerve stimulation (TENS) on cesarean under spinal anesthesia. Assessment of pain by VAS, systolic and diastolic blood pressure, pulse and respiratory rate were considered as outcome parameters of this study.

Material and methods

After obtaining approval from institutional review board and written informed consent, 108 patients who were candidates for cesarean section under spinal anesthesia and hospitalized in surgery ward were enrolled into this study. This is a quasi-experimental study carried out in Ilam Shahid Mostafa Khomeini hospital during 2006-2007. 58 study subjects were randomly allocated to two study arms (TENS-ON i.e. Intervention group and TENS- OFF i.e. Control group). Inclusion criteria were: 18-35 years of age, 50-75 kg of body weight and 150-170 cm of height, term pregnancy, and same dose of spinal anesthesia drugs, prime porous, transverses cesarean section and patients of a particular surgeon. The exclusion criteria were: skin allergy, co morbidities, use of narcotic drugs during surgery and in recovery and administration of additional anesthesia for completing insufficient spinal anesthesia. The physical component summary (PCS) and mental component summary (MCS) scores were assessed by patient's response. Spinal anesthesia was performed with 2.5–3 mL of 5 % lidocaine using a 25-gauge pencil-point needle at L3/4 inter space. The patients were kept either in right lateral position or sitting position during spinal anesthesia. TENS intensity thresholds were determined with two pair of electrodes placed 5 cm above and below the surgical incision, respectively. The electrodes were placed on the paraspinus muscles at T_{10}-L_1, and $S_{2\text{-}4}$. Intensity thresholds were determined according to the manufacturer's recommendation of a setting just below muscle contraction; all TENS intensity thresholds occurred approximately at 18-20 mA. Precaution was taken to avoid the hazards of the technique and equipments. All TENS settings were standardized, with all patients receiving a pulse rate which was automatically modulated every three seconds from 66 to 100 Hz (modulation mode) with a pulse width of 310 μ sec.

Questionnaire used for data collection from study subjects had two sections. First section included demographic data that is completed with interview and the second section included details on severity of pain, palliative drug usage, lactation period note, satisfaction rate and vital signs (For first 24hours of surgery). VAS was used for assessing severity of pain before surgery and after screening of study subjects. VAS rating is a standard tool for evaluating of pain severity having ratings from 0 to 10. 0 means no pain and 10 means the maximum pain in this scale. The patients were provided with the complete details of the study and informed consent was obtained. After the informed consent process TENS device was fitted to patients.

The study group received bi channel pulse frequency of 100 HZ/s with a current intensity of 30 mA and pulse duration of 100 μs. TENS device was continuously used for first 24 hours except temporary breaks for walking, using toilets, etc. Electrodes were placed 5cm apart from incision site on skin. The study group also received routine palliative (analgesics) drugs similar to control group. Severity of pain was assessed using VAS before surgery and after surgery at different time intervals viz 0.5, 1, 1.5,2, 4, 8, 12, 16, 20 and 24h in both the groups. Additionally dosage of analgesics used, time of starting breast feeding were also documented. At the end of study patients'

perception about reduction in pain was assessed by questionnaire.

Collected data were analyzed using the statistical software (SPSS, Ver.13). Descriptive statistics, T test, Man-Whitney and Chi-square test were performed to analyze the results.

Results

108 patient candidates for Cs under spinal anesthesia assessed and two groups was matched with respect to age, gestational age, weight, height, pre- intervention pain severity and vital sign. [Table/Fig 1]

Table/Fig1. Demographic data

Patient characteristics Mean[SD]	Intervention group n= 54	Control group n= 54	p values
Age (years)	24.6[3.9]	25.3[3.8]	>.05
Weight (Kg)	68.8[2.7]	68.6[2.6]	>.05
Height (cm)	162.7[5.9]	161.3[3]	>.05
Gestational age (weeks)	38.8[.663]	39.1[.743]	>.05

Man-Whitney test showed that the mean pain severity score in TENS group after intervention was significantly less than control group at various time intervals. Mean respiratory rate, systolic blood pressure and pulse rate 4h after intervention in intervention group was significantly less than control group [Table/Fig 2].

Table/Fig 2. Outcome parameters of intervention and control group

Outcome parameters	Intervention group	Control group	p value
1. Pain score by VAS at various intervals (hours)	Mean [SD]		
Before treatment	8.7[1.03]	8.3[1.3]	0.17
0.5	6 [1.4]	6.9 [1]	<0.05
1.0	4.8[1.8]	6.6[1.9]	<0.001
1.5	3.1[1.7]	4.2[1.6]	<0.05
2	2.9[.65]	3.7[.78]	<0.001
4	1.6[.65]	2.7[.63]	<0.001
8	1.2[.47]	3.2[.52]	<0.001
12	1[.19]	2.4[.63]	<0.001
16	0.98 [.13]	2 [.27]	<0.001
20	87 [.33]	1.9[.29]	<0.001
24	0.5[.5]	1.2[.42]	<0.001
2. Total dosage of Diclofenac (mg)	88.8[29.4]	147.2[14.2]	<0.001
3. Total dosage of pethidine (mg)	20.8[9.4]	48.1 [9.5]	<0.001
4. BP Systolic (mm/Hg)	107[5.9]	111[6.1]	<0.001
5. BP Diastolic (mm/Hg)	69[3.4]	73[4.8]	<0.001
6. Pulse rate	70[1.4]	77[1.9]	<0.001
7. Respiratory rate	17[.46]	18.1[.37]	<0.001
8.First time breast feeding (min)	52.8[3.8]	63.7 [2.3]	<0.001

One way ANOVA showed that analgesic drugs consumption and initiation time of breastfeeding was significantly less than control group [Table/ Fig 2]. Willingness to use TENS for future caesarian section was high among intervention group compared to control group ($p< 0.001$). Satisfaction was also high among patients of intervention group than control group ($p<0.001$).

Discussion

Studies have shown that post Cs pain has an adverse effect on initial and duration of breastfeeding and this is recognized as a main confounder in recovery and surgery wards [14],[15]. Most postoperative patients will experience pain, and this pain is not only uncomfortable and distressing but can also lead to complications and delayed recovery. Effective analgesia after caesarean delivery results in early mobilization and enhances bonding between mother and baby [6]. Among various alternative methods of analgesia TENS has been evaluated for number of painful conditions. The origin of concept of TENS can be traced back to 1965 with the Gate Control Theory introduced by Dr. Ronald Melzac and Dr. Patrick Wall. According to the gate-control theory, pain is experienced when certain small unmyelinated fibers are stimulated (the "gate" is opened). Pain is not felt when larger mylelinated fibers that inhibit the feeling of pain are stimulated (the gate is closed [16] The electrical currents produced by a TENS unit stimulate these large myelinated fibers, blocking pain stimuli transmitted by the smaller unmyelinated fiber.

Other similar alternative methods for pain control are reported in literature. A number of studies have compared TENS to other similar therapeutic modalities, including Percutaneous Electrical Nerve Stimulation, Interferential Current therapy, and acupuncture. In one study of elderly patients with chronic Lower Back Pain, both acupuncture and TENS had demonstrable benefits, with the acupuncture group demonstrating improvement in spinal flexion. In patients with chronic LBP and sciatica, PENS was more effective than TENS in providing short-term pain relief and improved function, including an improved quality of sleep and sense of well-being. Overall, 91% and 73% of patients, respectively, chose PENS as the preferred modality for pain relief in LBP and sciatica [17].

Both IFC and TENS had a statistically significant effect on median nerve excitation threshold in young women [18]. These alternative approaches are gaining recognition of health care providers for providing pain relief to their patients.

In a study reported by Navaro Nunez, et al (2000) where TENS was compared against

intravenous analgesics, it was shown that TENS has reduced usage of analgesics by 50% and improved accompanying parameters of pain similar to current study [6]. Another study by Barker et al also reported significant reduction of pelvic pain in young women [20]. Our findings are also in agreement with previous findings with significant reduction in pain with TENS. This approach was also reported to be effective in other types of pain like dermal, lumbar and various type of surgical pain [21]

Conclusion

This study showed that TENS can be used as a non-invasive, supplemental, non-pharmacologic method for reduction of pain due to cesarean section. It also led to reduction of analgesic drug use and subsequent risk of adverse effects of drugs. TENS resulted in better treatment outcomes like earlier recovery and mobility. As a result Patients were highly satisfied with this treatment modality and were able to start feeding their babies earlier facilitating better bonding between them and babies.

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