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A STUDY ON CLINICAL EVALUATION OF TRANSCUTANEOUS ELECTRIC NERVE STIMULATION IN RELIEF OF POST OPERATIVE PAIN AND COMPLICATIONS

Surgery

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ABSTRACT

INTRODUCTION The pain in the post-operative and its management continues to be a significant problem in surgical practice. A number of factors including; age, operative techniques, personality of the patient, physical status, site of operation and tissue affected are responsible for postoperative pain.

AIMS To estimate efficacy of TENS device in alleviating postoperative pain. To assess its effectivity in reducing post-operative paralytic ileus and curtailing postoperative pulmonary complications

MATERIAL AND METHODS This clinical study was conducted on 50 patients admitted to Mahatma Gandhi Hospital Jodhpur, and who underwent laparotomy for various abdominal pathology as planned or in emergency procedure. A similar number of patients with approximately identical illness and operation were taken for the purpose of making a control group and 6 patients were also studied as placebo group.

RESULTS 1. Continuous stimulation of pain area by TENS imparts better post surgical analgesia than intermittent stimulation. 2. TENS therapy was effective in controlling post surgical pain in 82 % (no analgesic drug) and partially effective in 12 %, (< 2 analgesic injection). 3. TENS effectivity was better observed in patients who underwent emergency surgery as preoperative pain was more excruciating as compared to the pain due to incision. 4. TENS application substantially reduced the duration of ileus post operatively due to its sympatholytic effect.

CONCLUSION The use of surgical TENS imparts an excellent relief of pain in the postoperative period, thereby use of both narcotic and nonnarcotic analgesics can be avoided.

KEYWORDS

INTRODUCTION

Pain is a distressing sensation, excited by injury, inflammation, pressure, great heat or cold, in muscles by ischaemia and in hollow organs by tension, of sufficient intensity acting on nerve endings in the skin, visceras, muscles, bones or joints. It had different types of sensation according to tissue affected and the producing agent. These sensations are described as cutting, stabbing, burning, boring, throbbing, griping, shooting or spasmodic.

The pain in the post-operative and its management continues to be a significant problem in surgical practice. A number of factors including; age, operative techniques, personality of the patient, physical status, site of operation and tissue affected are responsible for postoperative pain.

Age old strategies for the management of pain are based on the use of analgesics, narcotics and related drugs. The reports in the last two decades have highlighted that the use of these drugs are often inadequate and are associated with inherent side effects like excessive sedation, respiratory depression, nausea, vomiting, and decreased bowel movement. In order to overcome these side effects, the workers tried alternative approaches in the form of regional analgesia and the use of transcutaneous electric nerve stimulation.

AIMS AND OBJECTIVES

The present study was undertaken with the following aims:-

1. To estimate the efficacy of TENS device in alleviating the postoperative pain and compare with the postoperative control studies with analgesics and placebo.
2. To assess its effectivity in reducing the period of post-operative paralytic ileus.
3. To evaluate the efficacy of transcutaneous electric nerve stimulation in curtailing postoperative pulmonary complications

REVIEW OF LITERATURE

Transcutaneus Electric Nerve Stimulator (TENS)

TENS is a generic term for a variety of electronic devices used in pain control therapies and clinics. These devices are AC or- battery powered generators delivering electric stimulation to one, two or more paired of superficial electrodes applied to the skin. The electrodes are commonly placed in close proximity to the area of pain, but on occasions are applied to remote trigger points and contralateral location. The mechanism of pain relief by TENS is not yet fully understood. The TENS devices are mainly of three types e.g. high frequency low intensities (conventional) TENS, low frequency high intensities and pulse-train or burst- train.

TENS is used in broad range of therapies for relief of pain which includes postoperative pain (Rooney et al, 1983; Strayhorn, 1983; Klin et al 1984), chronic back pain(Melzack, 1975; Linger and Long , 1976; Erikson et a1,1979, Lundeberg, 1984), labour pain(Augustinsson et al 1977, Bundsen and Erikson, 1982) and arthritic pain(Taylor et al, 1981; Kumar and Beford, 1982; Lewis et al, 1984). In spite of TENS being effective for the control of postoperative pain as concluded in the study conducted by Hymes et al (1974), contradictory claims have been made in the form of ineffectivity (Galloway et al 1984) or partially effective (Klin et al 1984).

Cooperman et al conducted a trial for relief of post-operative pain in cases of midline laparotomy and found excellent to good results in 77 % of patients and use of TENS would seem particularly worthwhile for patients undergoing elective abdominal operations for benign disease with no history of narcotic usage. TENS when used continuously for the first 48-72 hours yielded better continuous pain relief (Wall and Melzack 1980).

Ali et al (1981) studied post-operative pain and pulmonary function in control group, Sham group and TENS group. Pulmonary function were least depressed in the TENS group and so less chances of pulmonary complications. Reduction of pulmonary complications can be attributed to a reduced perception of pain after TENS application and patient could breath and cough effectively. Fields, 1981; Lewis et al, 1984 conducted a study for the placebo effect on the pain and found significant reduction in 35 - 43 % of cases. Lee 1985; Chung et al, 1984; Du et al, 1984 studied animal models and observed substantial decrease activity in the pain carrying fibers of spinothalamic tract and concluded that the placebo effect of TENS was virtually absent.

MATERIALS AND METHOD

Surgical TENS is a portable device with electrodes having a 9 volt output. It has an oscillating circuit which continues generating monophasic square pulse designed to suit the relief of pain.

Selection of patients

This clinical study was conducted on 50 patients admitted to Mahatma Gandhi Hospital Jodhpur, and who underwent laparotomy for various abdominal pathology as planned or in emergency procedure. The study was discontinued during extremes of climatic condition. A similar

number of patients with approximately identical illness and operation were taken for the purpose of making a control group and 6 patients were also studied as placebo group.

***Criteria for exclusion* in the study**

1. Pregnant patients
2. Patients with active cardiac problems.
3. Patients with history of epilepsy, neurological dysfunction.
4. Diabetic patients
5. Patients on chronic analgesic medication, antidepressent drugs and mood elevators

Parameters evaluated

Observations were made on subjective reduction of pain, pulmonary complication, and duration of post-operative ileus

Description of main appliance It is a small portable device with size of 11.45 cm x 5.75 cm x 2.25 cm with 9.3 volt D C adaptor pin and outlet for stimulation cords to electrodes. Electrodes are for placement over skin. There are two knobs, one for power and other for frequency. The LED blinks red when appliance is on and rate of blinking coincides with frequency. It has a compartment for holding a 9 volt battery and there is a device for functioning and a contact arrangement.

Stimulators Frequency These were judged pre-operatively by applying the TENS and noting altered sensation in the form of tingling, pricking within the limits of tolerance of 1 to 100 cycles/sec.

Pulse width A pulse width of 100 micro seconds was fixed for all patients.

Amplitude This was adjusted pre-operatively so as to fix it in post-operative period and was adjusted on a desired point.

Preoperative procedure The appliances were preset in frequency and amplitude till patient experiences altered sensation for knowing the probable frequency and amplitude he would require in post-operative period. The power knob was switched " ON " and increased slowly till pricking/ tingling sensations was felt. This was increased to an uncomfortable level and brought to the most comfortable of sensation *Operating room procedure* Sterilized electrodes were placed on either side of suture about 2.5 cm away, with prior application of sterile jelly on skin surface of electrode.

Post-operative room procedure Anaesthesia used in all groups was Nitrous oxide, Oxygen, pavulon after induction by pentothal sodium.
1. In *control group* of 50 patients Diclofenac sodium, Pentazocine and Prochlorperazine were used to alleviate the pain.The first prick of analgesic was given between 2-4 hours. The second prick was given one / two hours after the first prick .

2. In *study group* surgical TENS was connected to power source through adaptor. The amplitude and frequency was adjusted to predetermined setting. When the patient was out of anaesthesia and was alert, the amplitude and frequency was readjusted within the patient's tolerance and locked. The TENSET unit was kept functioning for three days and adjusted intermittently, if needed. After twelve hours the skin under the electrode were checked for any evidence of skin irritation and rashes. A record of intolerance to TENSET and subjective feeling of pain was maintained for three postoperative days. Pain relief was categorized as effective when no analgesics required, partial effective when less than two pricks of analgesics were required and ineffective when more than two pricks of analgesics with pentazocine and prochlorperazine were required, as used in the control period.

3. In *placebo group*, the same procedure of placement of TENSET was followed without the power supply and record of drugs required in postoperative period maintained.

OBSERVATIONS AND RESULTS

TABLE 1: ***Effectivity Of TENS In Relation To Sex***

S.No.	Sex	TENS group		Effectivity					
				Effective		Partially		Not Effective	
		No.	%	No.	%	No.	%	No.	%
1.	Male	23	46	17	73.92	4	17.39	2	8.69
2.	Female	27	54	24	88.88	2	7.41	1	3.71

TABLE 2: ***Effectivity Of Tens In Relation To Elective/Emergency Surgery***

S. No.	Sex	TENS group		Effectivity					
				Effective		Partially		Not Effective	
		No.	%	No.	%	No.	%	No.	%
1.	Elective	42	84	34	80.95	5	11.91	3	7.14
2.	Emergency	8	16	7	87.5	1	12.5	-	-

TABLE 3: ***Effectivity Of Tens In Relation To Duration Of Operation (N-50)***

S. No.	Duration of operation in minutes	TENS group		Effectivity					
				Effective		Partially		Not Effective	
		No.	%	No.	%	No.	%	No.	%
1.	up to 90	22	44	19	86.36	3	13.64	-	-
2.	91 - 120	5	10	4	80	1	20	-	-
3.	121 +	23	46	18	78.27	2	8.69	3	13.04

TABLE 4: ***Effectivity Of Tens In Relation To Anatomy Of Incision***

S. No.	Type of incision	TENS group		Effectivity					
				Effective		Partially		Not Effective	
		No.	%	No.	%	No.	%	No.	%
1.	Midline -upper -lower	10 12	20 24	7 11	70 91.66	2 -	20 -	1 1	10 8.33
2.	Paramedian -upper -lower	3 8	6 16	3 5	100 62.5	- 2	- 25	- 1	1 12.5
3.	Kocher's	9	18	7	77.77	2	22.22	-	-
4.	Lumber	6	12	6	100	-	-	-	-
5.	Others	2	4	2	100	-	-	-	-

TABLE 5: ***Effectivity Of Tens On Paralytic Ileus***

Ileus period	TENS group (50) Bowel Flatus Motion			Control group (50) Bowel Flatus Motion			Placebo group Bowel Flatus Motion		
1st Post	34	29	3%	-	-	-	-	-	-
Operative day	68%	58%	6%	-	-	-	-	-	-
2nd Post	14	17	10	15	14	2	5	5	-
Operative day	28%	34%	20%	30%	28%	4%	83.83%	83.83%	-
3rd Post	2	2	23	19	20	18	1	-	3
Operative day	4%	4%	46%	38%	40%	36%	16.66	-	50%
4th Post	-	2	9	11	11	20	-	1	1
Operative day	-	4%	18%	22%	11%	40%	1	16.66%	16.66%
5th Post	-	-	3	5	5	7	-	-	1
Operative day	-	-	3	5	5	7	-	-	1
6th Post	-	-	2	-	-	3	-	-	1
Operative day	-	-	4%	-	-	6%	-	-	16.66%

TABLE 6: ***Pulmonary Complications***

S. No.	Pulmonary Complications	TENS	Control	Placebo
1	Dry Cough Percentage	3 6	10 20	2 4
2	Cough and Expectoration %	2 4	2 4	- -
3	Atelectasis Percentage	- -	2 4	- -

DISCUSSION

The present clinical study was conducted on 50 patients who underwent various abdominal/ thoracic operations, at Mahatma Gandhi . Hospital, Jodhpur to evaluate the efficacy of Trans Cutaneous Electric Nerve Stimulation (Surgical TENS) to alleviate post surgical pain and the effect on paralytic ileus and incidence of pulmonary complications was studied.

The study group (TENS) were compared with equal number of well matched (diagnosis and nature of surgery) control group.

1. PAIN RELIEF:

A. Continuous stimulation of pain area by TENS imparts better post surgical analgesia than intermittent stimulation.
B. TENS therapy was effective in controlling post surgical pain in 82 % (no analgesic drug) and partially effective in 12 %, (< 2 analgesic injection).
C. Sedative like effect were observed in some patients, probably due to relief in pain and reverted to normal sleep pattern. Few patients also had pleasant experience on its application and requested to continue this device till their discharge from the hospital.
D. **Age:** TENS is effective in all age groups.
E. Female and rural patients exhibited better pain relief.
F. **Emergency surgery:** TENS effectivity was better observed in patients who underwent emergency surgery as preoperative pain was more excruciating as compared to the pain due to incision (though number of cases were small).
G. **Incision:** Better analgesia was obtained in lumbar and midline incisions in TENS group of patients. This was probably due to injury to less number of nerve endings.
I. **Duration of operation:** Effectivity of TENS decreases proportionally to duration of operation.

2. PARALYTIC ILEUS: TENS application substantially reduced the duration of ileus post operatively due to its sympatholytic effect. Thus TENS reduces morbidity and makes convalescence comfortable.

3. PULMONARY COMPLICATIONS: Pulmonary complication was less in TENS group in comparison to control group. This was due to better analgesia, wherein patients could breath deeply and cough more effectively. Also it reduced intake of narcotic analgesic and sedative drugs.

4. PERSONALITY: No correlation could be established between type of neurotic personality and effectivity of TENS.

5. COMPLICATIONS: No complications both on skin or systemic were observed.

6. PLACEBO GROUP: No definite correlation could be established between placebo group and control group.

CONCLUSION

The use of surgical TENS imparts an excellent relief of pain in the postoperative period, thereby use of both narcotic and nonnarcotic analgesics are avoided. Its low cost, direct effect in relief of paralytic ileus and indirect contribution in lesser incidence of pulmonary complication contribute amply towards early convalescence of patients. Thus its routine use to allay pain is recommended.

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