

Effect Of High Voltage Pulsed Galvanic Stimulation (HVPGS) On Neurogenic Pains-A Simple Randomized Clinical Controlled Trail.

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Abstract—

Objectives: To investigate the Effect of High voltage Pulsed Galvanic stimulation (HVPGS) on Pain and improving functional abilities confidence in patients with Neurogenic pains.

Methods: The study design is Single centred, single blinded, simple randomized clinical controlled trail. The study was conducted at Lalita Super speciality Hospitals, Guntur, Andhra Pradesh, India. 40 subjects were selected after satisfying inclusion criteria and were divided into two equal groups (A & B) (n=20).The experimental Group (n=20) was given HVPGS with pulse duration 63-75 μ s, for 20 min per day for 5 days a week for 2 weeks duration. The control group (n=20) was given TENS therapy with pulse duration 50-400 μ s for 20 min per day for 5 days a week for 2 weeks duration. In both the groups, the intensity was kept at patient tolerance level. The outcome measures of the treatment was assessed pre-test and post-test for pain by Pain visual analog scale and functional ability & confidence was assessed by the functional Abilities Confidence Scale (FACS) before and after the treatment sessions.

Results: 40 subjects were analysed. In Group A (Experimental group) (n=20) and Group B(control group) (n=20), all data was statistically analysed using paired 't' and independent 't' test to determine the statistical difference among the parameters at 0.5% level of significance. The pre-test mean value of VAS in Group A is 8.35, S.D +/- 0.93 & post-test value is 2.7 S.D +/- 1.03, p<0.05. The pre-test mean value of VAS in Group B is 8.15, S.D +/- 1.22 and post- test value is 5.7 S.D +/- 1.22 p <0.05.The mean of differences in VAS score pre-test & post-test in Group A is 5.65 and in Group B is 2.45, 't' value 10.19.,p<0.05. The pre-test mean value of FACS in Group A is 33.5 S.D +/- 9.88 & post- test value is 72.5 S.D 7.1, p<0.05. The pre-test mean value of FACS in Group B is 33.5 S.D 8.12 & post-test value is 54.5 S.D 6.86, p value <0.05. The mean of differences in FACS scores pre-test & post-test in Group A is 39 and in Group B is 21, 't' value 5.88, p<0.05. Statistical data showed that Group A is significantly different from Group B.

Conclusion: High Voltage Pulsed Galvanic stimulation (HVPGS) has a significant role in reducing Pain and improving Functional ability and confidence in patients with Neurogenic pains.

Index Terms—Neurogenic Pains, TENS, HVPGS, Pain Visual Analog Scale, Functional Abilities confidence scale (FACS).

1 INTRODUCTION

Neurogenic pain is defined as pain due to dysfunction of the peripheral or central nervous system ,in the absence of nociceptor stimulation by trauma or disease.(D Bowsher 1991)¹. Neurogenic pain in many clinical scenarios can interfere with several goals of rehabilitation, restoring maximal function and optimizing of quality of life.² Neurogenic pain is associated with abnormal sensations which may be episodic or continuous and is often described by the patient as stabbing, electric shock, burning, coldness, pins and needles, numbness and itching type of sensations. Painful diabetic Neuropathy was the most common cause of Neuropathic pain in Indian Population³. The Neurogenic pain is often associated with trigeminal neuralgia, radicular Neuropathic pains, Diabetic polyneuropathy, post herpetic Neuralgia, Piriformis syndrome, laminectomy, chronic post-operative pains and post

cancer patients. It is also associated with Nerve compression syndromes, phantom limb pains.^{4,5} Neurogenic pains are often treated conservatively by using medications^{6,7}, Electric modalities like TENS, IFT etc.

High -Voltage galvanic stimulation produces a high voltage current with a high peak intensity of a maximum of 300 to 400 ma but with a low frequency, very short duration ranging from 50-100msec. HVPGS is considered to be efficient in treatment of pain syndromes, relieving oedema and promoting wound healing. There is less evidence available relating to the use of HVPGS as a pain management tool, though it is often practiced in the clinical settings for management of pain.

This Study Is Conducted To Find The Efficacy Of HvpLgs On Neurogenic Pain Syndromes In Relieving Pain And Improving TheFunctionalAbilityConfidenceLevelsOfThePatient.

2 AIMS OF THE STUDY:

To find the effectiveness of the High voltage pulsed galvanic current in relieving pain and improving functional ability confidence levels of the patients with neurogenic pains.

2.1 Objectives of the study

1. To find the effectiveness of HVPGS on relieving pain in patients with neurogenic pains.
2. To find the effectiveness of HVPGS in improving functional abilities confidence of the patients with neurogenic pains.

3 MATERIALS AND METHODS : This study was conducted at Lalita Super speciality Hospital, Guntur, Andhra Pradesh in 2017-18 for a period of one year. A total of 40 patients diagnosed with neurogenic pain were selected. The study was approved by the ethical committee of the Lalita super speciality hospital. The patients included cervical radiculopathies, Diabetic Polyneuropathies, Post-chemotherapy neurogenic pains, Piriformis syndrome, and Post laminectomy patients. The patients were selected from both sexes at an average age group between 30-60 years. The patients were divided into two groups by the Physiotherapist and randomly assigned into two groups, Group A treatment group (n=20), Group B control group (n=20) by simple randomization by simple randomization technique by lottery method. The study is a single blind study, the participants in the study are blinded. Group A was given HVPGS for 20 minutes 5 days a week for 2 weeks. Group B was given conventional physiotherapy in the form of TENS.

3.1 Inclusion criteria:

1. Patients with chronic neurogenic pains for a minimum of 6 months duration.
2. Both Males and females
3. Age between 30- 60 years
4. Medically stable patients
5. Conscious and cooperative patients.

3.2 Exclusion criteria:

1. Patients with acute neurogenic pains.
2. Patients who are not medically stable
3. Unconscious patients

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4. Electro-Phobia patients.
5. Patients with lack of sensations or sensory disabilities

6. Open unhealed wounds at the area of treatment.

3.3 Technique :

Group A (treatment Group)

After randomization, the treatment group patients were explained the purpose of study and consent was taken as acceptance to participate in the study. The patients were explained the type of sensation, duration of treatment, effects clearly before the treatment.

Technique of application:

The area to be treated was cleaned with soap solution to decrease the skin resistance. A portable galvanic stimulator with monophasic waveform was selected. The electrode-skin impedance was minimized by applying a generous layer of conduction gel to promote good contact under the entire electrode. The pulse duration was kept at 63-75 μ s. The intensity was kept at patient tolerance level. The duration of treatment was 20 min. A single session per day was given for 5 days a week for 2 weeks duration.

The patients were assessed for pain by Pain visual analog scale and functional ability was assessed by the functional Abilities Confidence Scale (FACS) before and after the treatment sessions.

Group B (Control group)

The area to be treated was cleaned with soap solution to decrease the skin resistance. A portable pocket TENS was used to treat the patients. The electrode-skin impedance was minimized by applying a generous layer of conduction gel to promote good contact under the entire electrode. The amplitude is same as the intensity. It was set at 0-80 MA according to the tolerance level of the patient. The Pulse duration was kept at 50-400 μ sec. The electrodes were placed at the dermatome of pain. Burst TENS was used to treat the patients. Each patient is treated with 20 min each session, with 5 sessions a week.⁸

3.4 Out come Measures

The outcome measures of the treatment was assessed pre-test and post-test for pain by Pain visual analog scale and functional ability & confidence was assessed by the functional Abilities Confidence Scale (FACS) before and after the treatment sessions. A Pain Visual analog scale is a measurement instrument used to measure the pain that is believed to range across a continuum of values (0-10) and cannot easily be directly measured. Test-retest reliability has been shown to be good, but higher among literate ($r = 0.94$, $P < 0.001$) than illiterate patients ($r = 0.71$, $P < 0.001$) before and after attending a rheumatology outpatient clinic.⁹ The Functional Abilities Confidence Scale (FACS) was designed to measure the degree of self-efficacy or confidence a patient exhibits with various movements or postures. Self-efficacy has been shown to be a better predictor of treatment adherence and outcome than actual physical abilities. The FACS consists of 15 questions which are answered and scored on a 0 % (not confident at all) to 100 % (completely confident) basis. The higher the percentage the higher is the confidence level. The patients are asked to circle the percentage that best describes his/her level of confidence. The FACS showed good psychometric properties (i.e., test-retest reliability, internal consistency, responsiveness to

change, discriminant abilities, and convergent validity).¹⁰

4 RESULTS AND DATA ANALYSIS

In this study to analyse the effects on the outcome measures before and after HVPGS therapy in Group A (Experimental group) and TENS therapy in Group B (Control group), all data was expressed as Mean \pm standard deviation (SD) and was statistically analysed using paired and unpaired t-test to determine the statistical difference among the parameters at 5% level of significance.

Paired t-tests were used to examine the changes in dependent variables from baseline to after completion of intervention in each group. Unpaired t-test was used to analyse the difference in the general characteristic values for between group comparisons to check the homogeneity between the groups at 5% level of significance.

The pre-test mean value of VAS in Group A is 8.35 SD \pm 0.93. The Post- test mean value of VAS in Group A is 2.7 SD \pm 1.03 with P value <0.05 (Table 1) which shows there is significant change in pre-test and post- test VAS. The pre-test value of VAS in Group B is 8.15 SD \pm 1.22. The Post- test mean value of VAS in Group B is 5.7 SD \pm 0.57 with P value <0.05 (Table 1) which shows there is significant change in pre-test and Post-test VAS scores. Independent t test is done to calculate the significance of difference in VAS scores between the Group A and Group B. The mean of differences in VAS scores between Pre-test and Post- test in Group A is 5.65 and in Group B is 2.45, with t value is 10.19, the test is significant at $p<0.05$ (Table 4) . This indicates the results are statistically significant, and hence we reject the null hypothesis, The Group A (experimental Group) showed a better and higher reduction in pain than the control group

The pre-test mean value of FACS in Group A is 33.5 SD \pm 9.88. The post-test mean value of FACS in Group A is 72.5 SD \pm 7.1 with P value <0.05 (Table 2) which shows there is significant change in pre-test and post-test FACS. The pre-test mean value of FACS in Group B is 33.5 SD \pm 8.12 . The Post-test mean value of FACS in Group B is 54.5 SD \pm 6.86 with P value <0.05 (Table 2) which shows there is significant difference in Pre-test and post-test values of FACS in Group B. Independent t test is done to calculate the significance of difference in FACS scores between the Group A and Group B. The Mean of differences in FACS scores between Pre-test and Post-test in Group A is 39 and in Group B is 21 with t value is 5.88, the test is significant at $P<0.05$.(Table 3) This indicates the results are statistically significant, and hence we reject the null hypothesis, The Group A (experimental Group) showed a better and higher confidence levels and functional abilities than Group B (control Group).

The pre-test mean value of VAS in Group A is 8.35 SD \pm 0.93. The Post- test mean value of VAS in Group A is 2.7 SD \pm 1.03 with P value <0.05 which shows there is significant change in pre-test and post- test VAS. The pre-test value of VAS in Group B is 8.15 SD \pm 1.22. The Post- test mean value of VAS in Group B is 5.7 SD \pm 0.57 with P value <0.05 which shows there is significant change in pre-test and Post-test VAS scores.

Independent t test is done to calculate the significance of difference in VAS scores between the Group A and Group B. The mean of differences in VAS scores between Pre-test and Post-test in Group A is 5.65 and in Group B is 2.45, with t value is 10.19, the test is significant at $p<0.05$. This indicates the results are statistically significant, and hence we reject the null hypothesis, The Group A (experimental Group) showed a better and higher reduction in pain than the control group.

5 DISCUSSION

In this study the High voltage Pulsed Galvanic currents promoted Pain relief and improved confidence levels and functional abilities in experimental group than in control group, hence thereby we reject the null hypothesis.

High voltage Pulsed Galvanic Currents promoted Pain relief and improved the confidence levels and functional abilities in patients with neurogenic pains.

The randomized single blinded controlled clinical trial evaluated the efficiency of High voltage Pulsed galvanic stimulations in Neurogenic pains. There is less evidence available relating to the use of High voltage pulsed galvanic currents as a pain management tool. Mostly it was used for wound management.

In a study by Abidin Tankrut et.al (2003) "High voltage galvanic stimulation in Myofacial pain syndrome, have found that pain levels decreased more significantly and trigger point tenderness index was decreased more significantly in patients treated with HVPGS¹¹.

In another study by Ankarcali et.al (2002) " The role of high voltage electrical stimulation in the rehabilitation of Patello femoral pain have found there was no significant difference found between the experimental group and control group at the sixth week, however at the 3rd week, pain reduction in the HVPGS (experimental) group was significantly higher than in control group.

In a study by Stralka SW et.al (1998) "treatment of hand and wrist pain. A randomized clinical trial of high voltage pulsed direct current built into a wrist splint" have found there was a useful contribution to pain management issues by HVPGS¹³.

William Holcomb et.al (2007) in their study "Effect of the simultaneous application of NMES and HVPC on knee extension torque", found that they provide an efficient treatment when managing atrophy, strength loss, pain and oedema associated with reconstructive surgery¹⁴.

In a study by Morris L et.al (1987)," Use of high voltage pulsed galvanic stimulation for patients with Levator ani syndrome, they found that the use of HVPGS has a significant role in reducing brief intermittent pain and discomfort in the perirectal or rectal region in Levator ani syndrome¹⁵.

Newton (1987) recommended that HVPGS can be used for controlling all kinds of pain-Acute, chronic, Neurogenic and Pain from many other sources.

The present study "Effect of high voltage pulsed galvanic stimulation (HVPGS) on neurogenic pains-a simple randomized clinical controlled trail." We have found that HVPGS had a significant role in decreasing Pain from various neurogenic origin and improves the confidence levels and functional abilities in patients with neurogenic pains than the control

group.

The reduction in pain by HVPGS is by stimulation to release of opiate substances, β -endorphins in the central nervous system. It can also be attributed to stimulation of pain gate control and encephalin- type pain control. β -endorphins are mainly synthesized and stored in the anterior pituitary gland¹⁶. β -endorphins are neuropeptides involving in pain management and are having morphine like effects and play an important role in pain management. In central nervous system, β -endorphins bind mu-opioid receptors and act at pre-synaptic nerve terminals. They cause analgesic effect by inhibiting the release of GABA, resulting in excess production of dopamine^{17,18}. Enkephalins also known as enkephalins are pentapeptides involved in pain inhibition.

5 CONCLUSION

The following conclusions are drawn from the present study

1. HVPGS has a significant role in reducing pains of neurogenic origin.
2. HVPGS improves the confidence levels and functional abilities in patients with neurogenic pains.

6 CONFLICTS OF INTERESTS

The authors declare no conflicts of Interest.

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TABLES:

TABLE 1: Comparison of Pre-test and Post –test Pain VAS values in Group A and Group B

Pain VAS	Group –A			Group-B		
	Mean	SD	P-value	Mean	SD	P-value
Pre-Test	8.35	0.933	P<0.05	8.15	1.22	P<0.05
Post-Test	2.7	1.03		5.7	0.57	

19.

TABLE 2: Comparison of Pre-test and Post –test FACS values in Group A and Group B.

FACS	Group –A			Group-B		
	Mean	SD	P-value	Mean	SD	P-value
Pre-Test	33.5	9.88	P<0.05	33.5	8.12	P<0.05
Post-Test	72.5	7.1		54.5	6.86	

TABLE 3: Comparison of Pre-test and Post –test Differences in FACS values in Group A and Group B.

Pre-test and Post Test differences in FACS values	Mean	SD	T value	P value
Group A	39	10.2	5.88	P<0.05
Group B	21	9.11		

Table 4: Comparison of Pre-test and Post-Test differences in Pain VAS values in Group A and Group B

Pre-test and Post Test differences in Pain VAS values	Mean	SD	T value	P value
Group A	5.65	0.87	10.18	P<0.05
Group B	2.45	1.09		

GRAPH 1: COMPARISON OF PRETEST & POST TEST PAIN VAS AND FACS SCORES IN GROUP A & B

GRAPH 2: COMPARISON OF DIFFERENCE IN THE PRETEST & POST TEST PAIN VAS & FACS SCORES IN GROUP A & B

