EFFECT OF STRUCTURED EXERCISES FOR NEUROPATHIC PAIN IN DIABETES MELLITUS

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Abstract

Background: Diabetic patients frequently experience diabetic neuropathic pain(DPN) which has a relatively high incidence rate worldwide. The prevalence of developing neuropathic symptoms in type II diabetics is 40.3%. Drugs and exercise therapy are currently the most prevalent forms of treatment for DPN. As drug therapy has its side effects, as per the researchers and various studies, the role of exercise therapy has been proven more beneficial.
Objective: The aim of this study was to compare the effects of structured exercise protocol to the conventional physiotherapeutic protocol. The aim of structured protocol is to focus moderately on exercise for lower extremities and mildly on upper extremities which are doable as well as challenging for the patients that not only reduce pain but enhance functionality.
Methodology: 99 subjects experiencing neuropathic pain symptoms associated with Type II diabetes for more than 10 years were randomly assigned into experimental and control group out of which there were 12 dropouts during the study intervention. LANSS questionnaire was given to the subject pre and post intervention to measure the difference in the intensity of pain.
Result: 87 patients were filled the pre and post test forms which resulted, in the pre-test LANSS score of ≥12 was scored by 38 subjects from control group(n=49) and 39 subjects from experimental group(n=50), whereas after the intervention in the post-test LANSS score of ≥12 was scored by 35 subjects from control group(n=40) (p=0.3058) and 18 subjects from experimental group(n=47)(p=<0.0001).
Conclusion: Exercises performed with no need of special equipment and also that can be easily carried at home helps to reduce neuropathic pain symptoms resulting in immediate and long lasting effects of exercise therapy.

Keywords: Type II diabetes, Neuropathic pain, LANSS scale, Exercise for neuropathic pain,

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1. Introduction

Diabetes is a collection of metabolic illnesses that are defined by hyperglycemia brought on by deficiencies in insulin secretion, insulin action or both. Diabetes mellitus is a chronic condition that affects people of all ages and races. Diabetes-related chronic hyperglycemia is linked to long-term harm, dysfunction and failure of numerous organs, particularly the kidneys, heart, blood vessels, nerves and eyes(1). It is regarded as one of the most prevalent chronic diseases in nearly all of the world's countries, and its prevalence is continuing to rise mostly as a result of changes in lifestyle that have led to more inactivity and obesity.(2)

Peripheral nerve system damage caused by diabetes mellitus is distinctive yet incapacitating. Despite the fact that a variety of processes can affect peripheral neurons, they cause damage in a degenerative pattern that starts in the distal terminals. Also, sensory neurons are activated first and motor neurons second.(3) According to reports, 25% with Type 2 diabetic neuropathy will feel pain. Burning, lacerating, tingling and shooting pain, loss of the protective sense and hyperalgesia are the most common symptoms.(4)

A lesion or condition of the somatosensory system, comprising peripheral fibers (Aβ, A✿ & C fibers) results in neuropathic pain. Neuropathic pain has been linked to imbalances between excitatory and inhibitory somatosensory signaling, changes in ion channels and diversity in how pain messages are regulated in the central nervous system. Not all individuals with peripheral neuropathy or central nerve damage suffer neuropathic pain, for instance a large cohort study of people with diabetes mellitus found 21% of patients with clinical neuropathy had neuropathic pain symptoms overall(5). The treatment for neuropathic pain has been severely constrained by the severe side effects and high expense of pharmacological therapy(4). Conventional analgesics such as nonsteroidal anti-inflammatory medications(NSAIDS) have poor effect on neuropathic pain, which can also interrupt sleep, cause depression and interfere in everyday activities(6). As it is seen that frequent exercise has been proven to both retain and improve peripheral nerve function. Changes in the density of intra epidermal nerve fibers were discovered(7).

Exercise has long been acknowledged as a therapeutic component in management of diabetes, but 31% of type II diabetic patients do not engage in even the most basic forms of exercise and those who have neuropathic pain, may find it challenging to engage in weight-bearing exercise due to pain or lack of sensation(8). When exercise counseling and nutrition are used to improve poor glucose tolerance, changes in electrophysiological measurements and the intensity of neuropathic pain are associated, demonstrating improvement in small fiber function.(7)

For individuals with DM, early aerobic and resistance training interventions are very beneficial because they improve insulin action for upto 72 hours and help regulate blood glucose levels(9). As we know that skeletal muscle is the primary site of glucose disposal at euglycemia and that isometric contractions have insulin-like effects on glucose uptake in isolated skeletal muscle mass may be a useful intervention to improve insulin sensitivity(10)

While not adhering to a regular and automatic rhythm. Exercise for neuropathic pain uses the full range of motion in the joints and can be performed both while sitting on a chair and while bearing weight(as in cycling).The adoption of such activities was associated with improvements in patients' balance and cardio-respiratory health(11). In addition to enhancing cardiovascular fitness, endurance exercise affects metabolic parameters like hypertension, lipid

disorders, insulin sensitivity and glucose regulation(12). Moreover, proprioceptive rehabilitation, balance training, and lower limb muscle strengthening increase range of motion, muscular strength, and glycated hemoglobin in diabetic patients. Low - intensity exercise boosts or improves neuropathic symptoms and enhances quality of life(9). Given the prevalence of diabetes, its expenses and side effects, the detrimental effects it has on patients' quality of life, and the fact that the current study aims to investigate the potential effects of low intensity exercises for peripheral neuropathy on neuropathic pain level among type 2 diabetic patients(13).

2. Methodology

A randomized control group trail was carried out with patients experiencing neuropathic pain associated with diabetes in Krishna Vishwa Vidyapeeth, Karad. Such patients were invited to participate for duration of 8 weeks with a sample size of 87 participants out of which they were divided into two groups i.e. Conventional group and experimental group. The subjects voluntarily participated by filling the consent letter in both languages(English and Marathi) for this study. The inclusion criteria were: subjects experiencing neuropathic pain, age group between 45-60 years, diagnosed with diabetes for more than 10 years, HbA1C levels more than 6, subjects should not be participating in any exercise plan before. The exclusion of the subjects depended if the patients had any other neurological conditions. Patients with undiagnosed medical conditions that could preclude exercise intervention, presence of any open wound on the weight bearing surface of the feet; patients underwent any type of amputation.

Procedure

The study protocol was approved by the protocol committee and ethical clearance obtained from institutional ethical committee, Krishna Vishwa Vidyapeeth,'Deemed to be University', Karad. Patients were screened based on inclusion and exclusion criteria. For this study, 99 patients were involved. The eligible patients were divided into two groups at random. Each patient gave their informed permission. There were a total of 12 dropouts in this trial, of which 7 were caused by other co-morbidities and 5 by patients who were unable to continue the receiving intervention. The pre-test was done using the outcome measure(LANSS Scale) .Group A will receive conventional physiotherapy that will be regular treatment which consist exercise focusing on keeping the patient active, for a duration of 8 weeks and Group B will receive a structured physiotherapeutic exercise protocol for a duration of 8 weeks followed by statistical analysis will be done.

Data Analysis:-

TABLE 1 – Statistical analysis for the pre-test result

SIGNS AND SYMPTOMS	PRE-TEST		
	n(%) patients answering yes		
	CONTROL GROUP	EXPERIMENTAL GROUP	*p*

1.Does the pain produce unpleasant sensations, such as tingling, pricking, or pins and needles?	44(88)	44(89)	0.77
2.Is there a different skin aspect in the painful areas, such as redder skin or mottled appearance?	35(71)	31(62)	0.324
3.Does stroking the skin in the painful area or wearing tight clothing items produce unpleasant sensations?	31(63)	38(76)	0.171
4.Are there any sensations, such as electric shocks, bursting, or jumping corresponding to painful episodes (i.e., unexplained bursts of pain)?	30(61)	35(70)	0.363
5.Are there burning sensations in the painful areas or a sudden temperature change?	32(65)	39(78)	0.164
6.Result of stroking the non-painful area and the described painful area with cotton wool.	36(73)	30(60)	0.158
7.Result to touching (pinprick) both areas with a 23 gauge needle.	31(63)	37(74)	0.024

TABLE 2 – Statistical analysis for the post-test result

	POST-TEST
SIGNS AND SYMPTOMS	n(%) patients answering 'YES'

	CONTROL GROUP	EXPERIMENTAL GROUP	*p*
1.Does the pain produce unpleasant sensations, such as tingling, pricking, or pins and needles?	30(75)	20(42)	0.002
2.Is there a different skin aspect in the painful areas, such as redder skin or mottled appearance?	27(67)	16(34)	0.001
3.Does stroking the skin in the painful area or wearing tight clothing items produce unpleasant sensations?	29(72)	16(34)	0.0002
4.Are there any sensations, such as electric shocks, bursting, or jumping corresponding to painful episodes (i.e., unexplained bursts of pain)?	28(70)	20(42)	0.009
5.Are there burning sensations in the painful areas or a sudden temperature change?	27(67)	22(46)	0.053
6.Result of stroking the non-painful area and the described painful area with cotton wool.	24(60)	18(38)	0.044
7.Result to touching (pinprick) both areas with a 23 gauge needle.	28(70)	19(40)	0.005

3. Result

Statistical analysis of the data was done by using the software instats. Data was statistically analyzed using Paired and unpaired t test. According to table1, it shows the pre-test results where the subjects answered yes for the questions in

the questionnaire and TABLE 2 shows the post test results. 87 patients meeting the inclusion criteria were included in the study.They received the LANSS questionnaire in the pre-test; 38 subjects from the control group(n=49) had a LANSS score of ≥12, whereas from the experimental group(n=50) 39 subjects had a score of ≥12. After undergoing the intervention of 8 weeks, Post-test questionnaire was filled by the subjects, where it was observed that, from the control group(n=40) 35 subjects had a LANSS score of ≥12 (p=0.3058) and from experimental group(n=47) 18 had a score of ≥12(p=<0.0001).The observed changes in the intensity of neuropathic pain were significant. The Leeds Assessment of Neuropathic Symptoms and Signs(LANSS) showed that the observed difference in intensity of neuropathic pain between the control group and experimental group.

4. Discussion

The randomized controlled study explored the effect of conventional exercise protocol and structured physiotherapeutic exercise protocol to manage neuropathic pain in chronic diabetic patients. The participants included in the study were diabetic patients that experienced symptoms of neuropathic pain.

The previous studies suggested that conventional exercise programme generally focused on the condition and not much on the symptom particularly neuropathic pain, but the structured physiotherapeutic exercise programme focused on neuropathic pain symptoms only that focused in decreasing the severity of the pain and had moderate significant improvement in patients who have neuropathic pain with diabetes. To improve such conditions, exercise for neuropathic pain which included exercise that mainly focused on the lower extremities and partially focused on the upper extremities. The exercise included neural mobilization exercises, gradual stretching and strengthening of all lower limb muscles, ROM exercises for lower limb joints. There was a study where it was demonstrated that exercise for neuropathic pain along with resistance exercise help in reducing symptoms of neuropathic pain following which our findings suggest that exercise for neuropathic pain along with nerve mobilization is an effective treatment that not only improves neuropathic pain symptoms.

Exercise properly can be utilized as an effective alternative treatment or complementary therapy for neuropathic pain in diabetes patients and different exercise programmes may have some benefits in terms of reducing pain and enhancing functionality(15). EPN exercises are perfectly matched to the patients with physical conditions and prevent the patients from completing challenging movements on equipment. Such exercises are double and simple for the patient to perform and they also enable them to do more of the activity.(11)The individuals in the study noticed an improvement in their average scores on the clinical examination based on the LANSS questionnaire. An experimental study demonstrates that effect of exercise for neuropathic pain can significantly lessen the neuropathic pain experienced by patients.

The groups showed significant differences in resolving the neuropathic pain symptoms of the patients. The Group A (control group) pre-test examination the total no. of subjects who scored a LANSS score of ≥12 was 44 and post-test examination no. of subjects who scored a LANSS score of ≥12 was 35 so the p value achieved was (p= 0.3058) which was considered to be not significant. Now, the Group B (experimental group) pre-test examination the total no. of subjects who scored a LANSS score of ≥12 was 43

and post-test examination no. of subjects who scored a LANSS score of ≥12 was 18 so the p value achieved was (p<0.0001) which was considered to be extremely significant.

Due to the above-mentioned figures, it is concluded that type 2 diabetic patients experiencing neuropathic pain symptoms can benefit greatly from the experimental therapy strategy.

5. Conclusion

In this study, we found that the structured protocol has its benefits in improving neuropathic pain symptoms in diabetic patients as compared to conventional treatment. Exercise and physical activity are among the many strategies employed to help diabetic patients with neuropathic pain feel better.

Actually, exercise with its immediate and long-lasting effects can help to reduce the effect of neuropathic pain, which will lessen the difficulties faced by diabetes patients. The most important benefits for these patients are there is no need for any special equipment and they can exercise at home.

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