Effectiveness Of Buerger - Allen Exercise In Improving The Peripheral Circulation Among Clients With Diabetes Mellitus

[1]Priyanka Jayakumar, [2]Dr. Swapna Mary A

[1]Assistant Professor, [2]Assosiate Professor/ HOD MSN

[1]Medical Surgical Nursing,

[1]SI-MET College of Nursing, Muttathara, Thiruvananthapuram

Abstract: This study has been undertaken to assess the effectiveness of Buerger-Allen exercise to improve the peripheral circulation among clients with Diabetes Mellitus. The data was generated by using investigator development foot assessment scale. Purposive sampling was adopted to select 60 subjects based on eligibility criteria. Thus, the data was obtained from the study; the subjects were analyzed and interpreted in terms of the objectives and hypothesis of the study. Data analysis is done by descriptive and inferential statistics, and the p value is set at 0.05 level. In experimental group the mean post test score was 33.07 which is higher than mean post test score 21.10 in right leg. In left leg the mean post test score was 35.20 which is higher than mean pre-test score 23.83. Within the group comparison using paired 't' test showed the significance in the peripheral circulation of experimental group at $P \leq 0.05$ level and 29 df (t=14.24, 15.71 for right leg & left leg respectively). Whereas there were no changes in the pre-test - post test scores in the control group. Between group comparison using student 't' test showed no significance in pre-test, (t=.90, 1.22 for right & left leg respectively) but high significance in the post test (t= 5.21, 5.78 for right & left leg respectively) at $P \leq 0.05$ for 58 df.

Key words: Peripheral circulation, Buerger – Allen exercise, Intermittent claudication, Ankle Brachial Index

1. INTRODUCTION

Diabetes Mellitus (DM) type 2 is a metabolic disorder that is characterized by high blood glucose in the context of insulin resistance and relative insulin deficiency. This contrasts with Diabetes Mellitus type 1, in which there is absolute insulin deficiency due to destruction of islet cells in the pancreas. Type 2 Diabetes Mellitus makes up about 90% of cases of Diabetes with the other 10% due primarily to Diabetes Mellitus type 1 and gestational Diabetes.[1] Diabetes Mellitus has increased markedly over the last 50 years in parallel with obesity. As of 2010 reports there are approximately 285 million people with the disease compared to around 30 million in 1985.[2] Type 2 Diabetes Mellitus is typically a chronic disease associated with a ten-year-shorter life expectancy. This is partly due to several complications with which it is associated, including: two to four times the risk of cardiovascular disease, including ischemic heart disease and stroke; a 20-fold increase in lower limb amputations, and increased rates of hospitalizations.[3] Type 2 diabetes mellitus is a major factor causing peripheral vascular resistance which leads to PAD.[4]

As per the report of International Diabetes Federation (IDF), India is looming epidemic of diabetes and known as the diabetes capital of the world. According to IDF, India has highest number of, 50.8 million people suffering from Diabetes Mellitus (DM), followed by China (43.2million) and US (26.8 million). The report projected 58.7 million DM case in India by the year of 2010- almost 7% of the adult population in the developing countries. Moreover 3.2 million deaths are due to DM. In Karnataka 22-26 % of people are suffering with diabetes mellitus.[5]

Diabetic neuropathies are disorders that are associated with diabetes mellitus. These conditions are thought to result from diabetic micro vascular injury involving small blood vessels that supply nerves (vasa nervorum) in addition to macro vascular conditions that can culminate in diabetic neuropathy. Relatively common conditions which may be associated with diabetic neuropathy include third nerve palsy, mononeuropathy, mononeuropathy

multiplex, diabetic amyotrophy, a painful polyneuropathy, autonomic neuropathy, and thoraco-abdominal neuropathy. People with diabetes can, over time, develop nerve damage throughout the body. Some people with nerve damage have no symptoms. Others may have symptoms such as pain, tingling, or numbness i.e., loss of feeling in the hands, arms, feet, and legs. Nerve problems can occur in every organ system, including the digestive tract, heart, and sex organs. About 60 to 70 percent of people with diabetes have some form of neuropathy. People with diabetes can develop nerve problems at any time, but risk rises with age and longer duration of diabetes. The highest rates of neuropathy are among people who have had diabetes for at least 25 years. Diabetic neuropathies also appear to be more common in people who have problems in controlling their blood glucose, as well as those with high levels of blood cholesterol and blood pressure and those who are overweight.[6]

Exercise training for prevention of peripheral vascular disease among diabetic patients helps in potential mechanisms like formation of collateral circulation and increased blood flow, changes micro circulation and endothelial functions, changes in muscle metabolism and oxygen extraction, prevention inflammation and muscle injury, cost effective, preventing atherosclerosis and prothrombotic risk factors. Buerger - Allen exercise has shown an effect on improving peripheral circulation. Buerger - Allen exercise is an active postural exercise in which gravity alternatively fills and empties the blood vessels for preventing Peripheral vascular diseases (PVD) and promoting collateral circulation in lower extremities.[7]

2. BACKGROUND & NEED OF THE STUDY

The acute and chronic complications of diabetes are the major cause of hospital admission. Studies suggests that Asian population had more evidence of micro and macro vascular complications. The prevalence of micro and macro vascular complications is more in Asian population are 66.4% and it is 44.2% more than European populations. Among these macro vascular complications accounts for 27.8%.[8]

A study was carried out in south Indian people to find out the incidence of Diabetes Mellitus and its complications. It was carried out in young subjects of different parts of Asian countries and revealed that 42%-72% of all amputations are related to diabetic complications. Recurrence rates of foot ulcer in neuropathic subjects were estimated at 52% in 374 patients in India. The study concluded that patients should be educated regarding lifestyle modifications like body weight control; increased physical exercise and cessation of smoking are potentially beneficial for the patients for preventing diabetes complications.[9]

Diabetic neuropathy is the major microvascular complication with symptoms of numbness, tingling, pain and intermittent claudication which can lead to peripheral vascular resistance and later skin damage. Diabetes related foot problems may occur and can lead to amputation. Proximal Diabetic neuropathy causes painful muscle wasting and weakness. Exercise regimen plays a vital role in the treatment and prevention of vascular complications. Buerger – Allen exercise has shown an effect on improving peripheral circulation. It is an active postural exercise in which gravity alternatively fills and empties blood vessels for preventing Peripheral vascular diseases (PVD) and promoting collateral circulation in lower extremities. In India the percentage of peripheral vascular disease among diabetes patients are, Chennai 21%, Madurai 24%, Delhi 11 %, Hyderabad 16.6%, Kerala 16.3% and in Bangalore 12.4%.[10]

In South India it was found that patients without diabetic foot problems spent 9.3% of total annual income, while patients with diabetic foot problem had to spend 32.3% of the total income towards the treatment. Approximately 15% of people with diabetes develop one diabetic foot ulcer associated with peripheral neuropathy.[11]

Buerger - Allen exercises an active postural exercise (gravity alternatively fills and empties the blood vessels) for preventing PVD and promoting collateral circulation in lower extremities.28 Approximately 15 -40 % people with PVD is having diminished ability for performing daily activities. A Study was conducted among 14 patients showing that the subcutaneous blood flow is increasing in seven patients temporarily within 24 hours by doing Buerger - Allen exercise.[12]

3. STATEMENT OF THE PROBLEM

"A study to assess the effectiveness of Buerger - Allen exercise in improving the peripheral circulation among clients with Diabetes Mellitus in selected hospitals at Bangalore."

3.1 OBJECTIVES

1.Assess the peripheral circulation among clients with Diabetes Mellitus before and after the administration of Buerger - Allen exercise.

2. Assess the effectiveness of Buerger-Allen exercise in improving the peripheral circulation by comparing the experimental and control group.

3. Determine the association between interventional scores of Buerger- Allen exercise with selected variables among experimental group and control group.

3.2 HYPOTHESES

H01: There is no significant difference between the pre-test and post-test interventional scores regarding the peripheral circulation among clients with diabetes mellitus of experimental group after administering Buerger - Allen exercise. H02: There is no significant association between the post-test interventional scores and the selected demographic variables among clients with diabetes mellitus in the experimental group and control group.

3.3 CONCEPTUAL FRAMEWORK

The investigator thus adopted Wiedenbach's – A Helping art of clinical nursing (1964) conceptual framework in a modified form, believing that it will be helpful in assessing the improvement in peripheral circulation after practicing Buerger –Allen exercise among clients with Diabetes Mellitus.

Ernestine Wiedenbach is a nurse theorist, who later qualified as a nurse midwife; she proposed a prescriptive theory, which is described as conceiving of a desired situation and the ways to attain it. It is desired towards an explicit goal. Here a prescription is developed based on a central purpose and it is implemented according to the realities of the situation. Ernestine Wiedenbach theory explains the following.

Central purpose: It refers to what the nurse wants to accomplish (or) the overall goal towards which a nurse strives, by specifically directing towards the patient's good. In the present study, the central purpose is, "to make diabetes clients to improve their peripheral circulation by practicing the Buerger – Allen exercise."

Realities: Agent is the practicing nurse who has the personal attributes capacities, capabilities, capabilities, capabilities, commitment and competence to provide nursing care. In the present study, the agent is the investigator.

Recipient: The recipient is the one who receives a nurse's action or on whose behalf actions are taken. In this study the recipients are clients with Diabetes Mellitus with a history of 10 -15 years.

Goal: The goal is the desired outcome, i.e., the improvement in peripheral circulation of clients with Diabetes mellitus after administering Buerger –Allen exercise.

Means: They are the activities and devices used by the investigator to achieve the goal. It includes phases for achieving the goal like Identification, Ministration and validation in the study.

Framework: It refers to the facilities in which nursing is practiced; the framework in this study has been considered as the setting in which the study has been conducted. In this present study selected hospitals at Bangalore will be framework.

Nursing practice: Nursing practice consists of identifying need for help, ministering the needed help and validating that that needed help was met.

Identification: It involves the process of determining need for help based on the existence of a need. After obtaining consent from the samples the investigator will conduct pretest to assess the peripheral circulation to identify the need for help.

Ministration: It refers to provision of help needed. Administration of Buerger Allen exercise will be used to improve the peripheral circulation for the clients with Diabetes Mellitus.

Validation: It refers to the collection of evidence that shows need have been met as a direct result of the action. Post-tests will be conducted to assess the peripheral circulation followed by the intervention and analysis of the collected data to validate if need for help was met or not.

4. METHODOLOGY

4.1 Research Approach:

In view of the nature of problems selected for the study and objectives to be accomplished and evaluative research approach is considered appropriate for the present study.

4.2 Research Design

Pre-test- post-test control group only design, (O1 X O2) which belongs to Quasi -Experimental design was selected to assess the peripheral circulation of clients with diabetes mellitus. The quasi-experimental design consists of pre-test and post-test observations made on different days with only one selected group and without control group.

O1 - Administration of foot assessment scale on clients with diabetes mellitus to assess the peripheral circulation.

X - Administration of Buerger – Allen exercise on clients with Diabetes Mellitus.

O2- Administration of foot assessment scale on clients with diabetes mellitus to assess the peripheral circulation after 3 weeks.

4.3 Variables under study

Independent variable: Buerger – Allen exercise

Dependent variable: Peripheral circulation of clients with Diabetes Mellitus.

Demographic variables: Age, gender, education, socio-economic status, occupation, family income, dietary pattern, duration of illness, previous exposure to exercise training program, presence of any other associated illness.

4.4 Setting of the study

This study is planned to conduct at, Medical and special wards of Suguna Hospital, Panacea Hospital, Chord Road Hospital and Sri Lakshmi Hospital at Bangalore.

4.5 Population and Sample

Population consists of all the clients with diabetes mellitus in Suguna Hospital, Panacea Hospital and Chord Road Hospital at Bangalore. The sample consists of 60 clients (30 experimental group and 30 control group) with diabetes mellitus in selected hospitals by using purposive sampling techniques. Exclusion criteria for sample selection were the patients who have chronic diabetes mellitus with foot ulcer and gangrene, who are critically ill and previously practicing the exercise regimen.

4.6 Data collection instruments

In this present study researcher developed foot assessment scale will be used for data collection. The prepared instruments along with the objectives, operational definitions, scoring key and a criteria check list for validation were submitted to seven experts including five nurse educators, one doctor and one statistician to establish content validity. Their valuable suggestions were followed, and final valid tool has been prepared. Initially the tool was prepared in English, and then the refined tool was translated into Kannada. The Kannada tool was checked by the experts for appropriateness. To achieve the reliability of the tool test-retest method is used. The tool is administered to 6 samples and repeated, and the correlation was found out by using Karl Pearson's correlation coefficient formula and significant of the correlation was tested by probable error. The reliability of the tool was found to be 0.98 and hence the tool was found to be highly reliable.

4.7 Description of tool

The tool consists of 2 parts

Part -1: It deals with demographic data of the samples, consists of total 11 items. It includes age, gender, education, socio-economic status, occupation, family income, diet pattern, duration of illness, previous exposure to exercise training programme, presence of any other associative illness.

Part -2: It is a researcher developed foot assessment scale, consisting of 8 items. The aspects are Skin colour, Temperature, Edema, Capillary refill, Pain, Skin integrity, Nail colour, Sensation

Interpretation

The resulting scoring was interpreted as follows,

- 1 -10 - critical claudication - inadequate peripheral circulation
- 11 -20 - severe claudication - inadequate peripheral circulation
- 21 -30 - moderate to mild claudication - moderate peripheral circulation
- 31 - 40 - micro claudication to normal – adequate peripheral circulation

4.8 Pilot study

The researcher conducted the pilot study in Sri Lakshmi Hospital, Sunkudkate, Bangalore. After granting permission from medical superintendent, the pilot study was conducted from 26/08/2014 to 2/09/2014 The toot was administered in 6 patients. After conducting pretest the intervention is done on the clients in the first day and posttest is done on the 7th day with the same instrument.

4.9 Data and Sources of Data

A formal permission has been obtained from the Nursing Superintendent of Chord Road Hospital and Panacea Hospital and Suguna Hospital at Bangalore for conducting the main study. The investigator took consent from the patients. Confidentiality was strictly maintained through out of the data collection process. Total samples are 60 in which 30 consist of experimental group and control group. The data collection was done from 15/10/2014 to 15/11/2014. 20 patients each is selected from each of the hospitals. Pretest has been done during the first day for both experimental and control group and then followed by exercise training session for only experimental group. The posttest is done after an interval of 3 weeks for both experimental and control group. The participants were assisted by clarifying the doubts & concerns regarding the Buerger- Allen exercise. Buerger-Allen exercise is an active postural exercise for preventing PVD and promoting collateral circulations of lower extremities. This exercise consists of three steps like elevation, dependency, and horizontal which allow the filling and emptying of the lower extremity blood vessels according to gravity alternatives.

Step 1 – Elevation The lower extremities are elevated to a 45-to-60-degree angle and supported in this position until the skin blanches (skin appears dead white), for about 2 to 3 minutes.

Step 2 – Dependency The feet and legs are then lowered below the level of the rest of the body until redness appears (care should be taken that there is no pressure against the back of the knees), for about 5 -10 minutes.

Step 3 – horizontal

The legs are placed flat on the bed in a horizontal position for 10 minutes. The length of time for each position varies with the patient's tolerance and the speed with which color change occurs. Usually, the exercises are prescribed for about 18 -23 minutes. Three series of steps can be repeated for a frequency of 3-4 times a day.

The current study was a Quasi experimental with Pretest – posttest control group design (O_1 X O_2). The sample consisted of 60 patients from Suguna Hospital, Chord Road hospital, and Panacea Hospital, Bangalore. Purposive random sampling was used to select the samples for the study. The present study was conducted during the period of 15/10/2014 to 15/11/2014.

The same intervention has been administered by the control group after the study.

5. RESULTS AND DISCUSSION

The findings of the study are discussed under the following headings:-

Section A: Demographic characteristics of respondents.

Section B: Aspect wise peripheral circulation level in pretest among experimental and control group.

Section C: Aspect wise peripheral circulation level in posttest among experimental and control group.

Section D: Overall pretest and posttest response on peripheral circulation level in experimental group.

Section E: Overall pretest and posttest response on peripheral circulation level in control group

Section F: Association between demographic variables and posttest peripheral circulation level among experimental group.

OBJECTIVE 1: To assess the peripheral circulation among clients with diabetes mellitus in experimental and control group, before and after the administration of Buerger - Allen exercise.

In experimental group, during pretest 14 (46.7%) had inadequate, 10(33.3%) had moderate, 6(20%) had adequate peripheral circulation in right leg. During posttest, none of them were inadequate, 10(33.3%) had moderate, 20(66.7%) had adequate peripheral circulation in right leg. In left leg, during pretest 11(36.7%) had inadequate, 10(33.3%) was moderate, 9(30%) had adequate peripheral circulation. During posttest none had inadequate, 2(6.7%) was moderate, 28(93.3%) had adequate peripheral circulation.

In control group, during pretest 14 (46.7%) had inadequate, 8(26.7%) had moderate, 8(26.7%) had adequate peripheral circulation in right leg. During posttest, the same observations have been obtained. In left leg, pretest scores showed that 11(36.7%) had inadequate circulation, 10(33.3%) had moderate, 9(30%) had adequate peripheral circulation. The post test scores shown that 8(26.7%) were having inadequate circulation, 18(60%) had moderate circulation and 4(13.3%) were having adequate peripheral circulation.

The Mean ± SD (Standard deviation) during pretest in right leg is found to be 21.10 ± 8.7 with a mean percentage of 52.8 whereas during the posttest it is 33.07± 5 with a mean percentage of 82.7 and the mean difference is 11.97±4.6. During pretest in left leg that is found to be 23.83 ± 6.8 with a mean percentage of 59.6 whereas during the posttest it is 35.20 ± 4.2 with a mean percentage of 88.0 and the mean difference is 11.37±4.0.

Overall Post test Mean scores on Peripheral Circulation scores of Right leg among Control and Experimental group

N= (CG-30, EG-30)

Group	Sample (n)	Max. Score	Foot Assessment scale scores				't' Test
			Mean	SD	Mean (%)	SD (%)	
Control	30	40	23.17	9.2	57.9	22.9	5.21*
Experimental	30	40	33.07	5.0	82.7	12.4	

*Significant at 5% level, t (0.05, 58df) = 1.96

Overall Post test Mean scores on Peripheral Circulation scores of Right leg among Control and Experimental group

N= (CG-30, EG-30)

Group	Sample (n)	Max. Score	Foot Assessment scale scores				't' Test
			Mean	SD	Mean (%)	SD (%)	
Control	30	40	25.07	8.7	62.7	21.7	5.76*
Experimental	30	40	35.20	4.2	88.0	10.5	

*Significant at 5% level,   t (0.05, 58df) = 1.96

OBJECTIVE 2: To assess the effectiveness of Buerger-Allen exercise to improve the peripheral circulation by comparing the experimental and control group.

The posttest peripheral circulation level of right leg among respondents in both control and experimental group. In control group out of 30 respondents, 14(46.6%) were having inadequate peripheral circulation, 8(26.7%) were moderate and the remaining 8(26.7%) were having adequate peripheral circulation. In the experimental group out of 30 respondents, none of them had inadequate peripheral circulation, 10(33.3%) with moderate and remaining 20(66.7%) were having adequate peripheral circulation. The posttest peripheral circulation level of left leg among respondents in both control and experimental group. In control group out of 30 respondents, 8(26.7%) were having inadequate peripheral circulation, 18(60.0%) were having moderate and 4(13.3%) were having adequate peripheral circulation. In the experimental group out of 30 respondents, none of them had inadequate peripheral circulation, 2(6.7%) with moderate and remaining 28(93.37%) were having adequate peripheral circulation.

In control group the mean score in right leg is 23.17± 9.2 with a mean percentage of 57.9 while in experimental group it is found to be 33.07 ± 5.0 with a mean percentage of 82.7. The 't' test value is 5.21 which is found to be significant. In control group the mean score of right leg is 25.07± 8.7 with a mean percentage of 21.7. In experimental group it is found to be 35.20 ± 4.2 with a mean percentage of 88.0. The entire aspect of the study reveals that there is a significant difference in the post test scores of experimental groups compared to control group which clearly indicates the improvement in peripheral circulation after administering Buerger – Allen exercise.

OBJECTIVE 3: To find out the association between interventional scores of Buerger - Allen exercise with selected variables among experimental group and control group

It is evident that, Chi square value computed for the educational status, occupation, type of family and following of other exercises is statistically non- significant which indicates that there is no association between the posttest peripheral circulation level of right leg with these demographic variables. Whereas the Chi square values computed for age group, gender, family monthly income, dietary pattern and associate illness are statistically significant at 0.05 level of significance (P≤ 0.05) which indicates that the research hypothesis, **H0₂**: There is no significant association between the posttest interventional scores and the selected demographic variables among clients with diabetes mellitus in the experimental group and control group, is rejected.

Recommendations

- A similar kind of study can be done in a larger population to generalize the findings.
- A comparative study can be done on the effectiveness of Buerger-Allen exercise between normal people and Diabetes Mellitus clients.
- Study can be undertaken with the objective of developing a standard protocol for Buerger-Allen exercise.
- Comparative study can be done by selecting two different exercise regimen and Buerger-Allen exercise in improving peripheral circulation among Diabetes Mellitus clients.
- A similar study can be done in assessing the knowledge regarding the Buerger-Allen exercise among Diabetes clients.
- A similar study can be done in assessing the knowledge regarding the Buerger-Allen exercise among nurses.
- A similar study can be done in assessing the effectiveness of structured teaching program on Buerger-Allen exercise in improving peripheral circulation.

References

1) Kumar, Vinay, Robbins 'et al', "Robbins and Cotran Pathologic Basis of Disease", 7th edition, Pa Saunders, Philadelphia, Page no. 1194– 1195 ISBN 0-7216-0187-1, Available from URL: http://en.wikipedia.org/wiki/Diabetes_mellitus_type_2

2) Williams, "Textbook of endocrinology", 12th edition, Elsevier Saunders publishers,page no. 1371–1435. ISBN 978-1-4377-0324-5. Available from URL: http://en.wikipedia.org/wiki/Diabetes_mellitus

3) Pasquier, F, "Diabetes and cognitive impairment:how to evaluate the cognitive status?", Diabetes & metabolism, (2010 Oct). 36 Supplement 3: S100-5, PMID 21211730. doi:10.1016/S1262-3636(10)70475-4. Available from URL: http://en.wikipedia.org/wiki/Diabetes_mellitus_type_2

4) "Peripheral Vascular Disease", E Medicine Health, page no 1-2.

Available from URL: http://www.emedicinehealth.com/peripheral_vascular_disease/article_em.htm

5) "Latest Diabetes Figure Paint gim global picture", International Diabetes Federation, published on 2009. Available from URL: http://www.idf.org/latest-diabetes-figures-paint-grim-global-picture

6) King SA (October 1, 2008). "Diabetic Peripheral Neuropathic Pain: Effective Management", consultant 48(11). Available from URL: http://en.wikipedia.org/wiki/Diabetic_neuropathy

7) Suzanne C. Smeltzer, Brenda G. Bare, "Brunner and Suddarth's Text book of Medical and Surgical Nursing", Assessment of patient with vascular disease, 9th edition, page no: 691-693.

8) Viswanathan v, et. al. ,(1999), "Need for education on foot care diabetic patients in India", Journal Association of physicians India 47(11).

9) Wild S, Roglic G, Green A, Sicree R, King H (2004). "Global prevalence of diabetes: Estimates for the year 2000 and projections for 2030", Diabetes Care 27 (5): 1047 –53.dfoi:10.2337/diacare.27.5.1047. PMID 15111519. Available from URL: http://en.wikipedia.org/wiki/Epidemiology_of_diabetes_mellitus#cite_note-Gale-6

10) Society of statistics-"peripheral vascular disease". Available from URL http://www.wrongdiagnosis.com/p/peripheral_vascular_disease/stats

11) Shobana R, Rama P, Lavanya P. "Cost Burden of Diabetic Patients with Foot Complications-A Study from South India. Journal of Association of Physicians India", 2008 Dec; 55(12):42-49.

12) Bjerre-Jepsen K, Faris I, Henriksen O, B. Paaschburg-Nielsen, "European Journal of Nuclear Medicine and Molecular Imaging Increased subcutaneous blood flow for 24 hours", 2004 Dec 1. Available from URL: http://www. SringerLinkcom/content