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Effectiveness of Buerger Allen Exercise to Improve the Lower Extremity Perfusion among Patients with Type 2 Diabetes Mellitus

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KEYWORDS

Buerger Allen Exercise,
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A B S T R A C T

Individuals with diabetes mellitus have a two to fourfold increase in the rate of peripheral arterial disease. Peripheral arterial disease is a slow and progressive disease with systemic atherosclerosis. Lower extremity exercise helps to re-establish collateral blood flow to the legs and the heart. Primary care providers have an inevitable role to assess and diagnose the potential vascular complications of diabetes mellitus in initial stage and make the patient to do the buerger allen exercise to improve the collateral circulation. Purpose of the study is to investigate the level of lower extremity perfusion among patient with type 2 diabetes and assess the effect of Buerger Allen Exercise to improve lower extremity perfusion among patients with type 2 Diabetes Mellitus admitted at tertiary hospital, India. Non equivalent pre test post test control group design was followed to conduct the present study; divided 60 patients with type 2 diabetes mellitus admitted in chettinad hospital and research institute were grouped in to two groups. Subjects in experimental group were undergone intervention of buerger allen exercise under supervision for 2 times a day for 5 days and in control group, subjects were under regular treatment. Demographic data and ankle brachial index scale was used to assess the lower extremity blood circulation. In experimental and control group 24(80%), 15 (50%) had lower extremity arterial disease and 6(20%), 15 (50%) were in border line. In experimental group there was a significant difference between the pre-test mean value 0.922 with SD 0.0562 and post test mean value 0.980 with SD .0407 which projects that t value 9.108* was significant at the level of $p<0.05$. The findings of the present study revealed that here is a significant improvement in the lower extremity perfusion after doing Buerger Allen exercise .Buerger Allen exercise was found to be effective on improving the lower extremity perfusion among patients with type 2 diabetes mellitus.

Introduction

The Indian Diabetes federation estimated 381 million people have Diabetes Globally in 2013[1] by 2035 this will rise to 592 million[2] .The number of people with type 2 diabetes is increasing in every country and 80% of people with diabetes live in low- and middle-income countries. The greatest number of people with diabetes is between 40 and 59 years of age [3]. India currently has 62.4 million people with diabetes and is home to the second highest number of people living with diabetes in the world [4]. In India and other developing countries, the amputation rate is about 45% for peripheral arterial disease due to diabetes mellitus [5]. In India, the recent Indian Council of Medical Research-Indian Diabetes study reported the prevalence of diabetes mellitus and related lower extremity arterial disease (both known and newly diagnosed) in 4 regions of the country: 10.4% in Tamilnadu, 8.4% in Maharashtra, 5.3% in Jharkhand, and 11.6% in Chandigarh (Union Territory) [6]. In Chennai the incidence of peripheral arterial disease is about 6-8 per cent among diabetes mellitus patients who come to the outpatient unit. In those who are over 60 years, it is higher at 30 per cent [7].

Peripheral arterial disease is more frequent in those with diabetes mellitus. Epidemiological evidence confirms the association between diabetes mellitus and the increased prevalence of peripheral arterial disease. Individuals with diabetes mellitus have a two to fourfold increase in the rate of peripheral arterial disease [8]. People with long standing Diabetes mellitus develop complication of Peripheral Arterial Disease. Peripheral Arterial Disease leads to grave complication like gangrene in the lower limbs [9]. The most common symptom is muscle pain in the lower limbs on exercise. In diabetes, pain perception may be blunted by the presence of peripheral neuropathy. Therefore, a patient with diabetes and peripheral arterial disease is more likely to present with an ischemic ulcer or gangrene than a patient without diabetes. The use of ankle-brachial-pressure index in the clinic and bedside provide a measure of blood flow to the ankle. This could help early detection, initiate early therapy and may thus reduce the risk of critical limb ischemia and limb loss [10].Buerger allen Exercise is one of the intervention to stimulate the development of collateral circulation in the legs. Primary Care Provides should focus on prevention by early recognition and prevention of those at increased risk. An awareness of diagnostic and treatment strategies will enable primary care providers to inform patients. This will help to improve both concordance with treatment and disease outcome. Considering the above factors and review of literature, the investigator felt that all diabetes mellitus patients should do the Buerger Allen exercise to improve lower extremity perfusion.

The study was conducted to assess the level of extremity perfusion among the two groups and to evaluate the effect of Buerger Allen Exercise among experimental group.

Hypothesis

Patients with type 2 Diabetes mellitus have reduced perfusion in the lower extremity and second hypothesis is Buerger Allen Exercise improve the lower extremity perfusion than that of the control group.

A study was conducted to assess the presence of peripheral arterial disease among type 2 diabetes mellitus with diabetic foot ulcer. The purpose of this study is to evaluate the occurrence of peripheral arterial disease using ankle-brachial index in diabetes mellitus patients with and without

foot ulcers and the risk factors associated with diabetic foot ulcer. The study concluded that diabetic foot ulcer patients with peripheral arterial disease showed a significant correlation with duration of diabetes but not with dyslipidaemia [11].

A cross-sectional study was conducted to assess the prevalence of diabetic peripheral neuropathy, neuropathic foot ulceration and peripheral arterial disease and potential risk factors for these complications among patients with type 2 diabetes mellitus attending primary care diabetes clinics in Bahrain. The study concluded that rates of peripheral arterial disease 36.6% and diabetic neuropathy 11.8% are high among diabetes mellitus patients in Bahrain [12].

A cross sectional study was conducted to assess the risk of asymptomatic and symptomatic peripheral arterial disease among diabetes mellitus patients. The study revealed that majority of the patients 200(50.2%) had symptomatic peripheral arterial disease and 100(20.4%) had asymptomatic peripheral arterial disease [13].

A multicentre cross sectional study was conducted to assess the prevalence of peripheral arterial disease and associated factors among people with type 2 diabetes mellitus. The study concluded that peripheral arterial disease is common among people with type 2 diabetes and needs to be properly evaluated by the medical professionals as early diagnosis can help prevent future complications [14].

A study was conducted to assess the prevalence of peripheral arterial disease in Japanese diabetes mellitus patients along with ankle-brachial index. The study revealed that patients with a low ankle brachial index (<0.9) on either side or on both sides were considered to have peripheral arterial disease. It concluded that the prevalence of peripheral arterial disease was high in Japanese patients with diabetes, especially in elderly patients [15].

A quasi experimental study was conducted to assess the effectiveness of Buerger Allen exercise on improving the lower extremity perfusion among diabetes mellitus patients in selected hospitals at Bangalore. A total number of 50 patients were selected with decreased lower extremity perfusion. Buerger Allen exercise was performed for 5 days. The study concluded that all the samples showed improved lower extremity perfusion [16].

Materials and Methods

Study participants

Present study included 60 participants with type 2 Diabetes Mellitus were admitted in Chettinad Hospital and Research Institute, TamiNadu, India during the month of October 2013. Criteria for case inclusion were patients with type 2 diabetes Mellitus in both gender belong to age group between 40 to 80 Years, eligible for study through an ankle brachial Index score confirming below 1. Subjects were excluded from the study if they had no palpable extremity pulse and severe Ischemia and who all are critically ill.

Study design

A Non equivalent pre test post test control group design was adopted in this study. Two groups were studied Experimental group (Buerger Allen Exercise) (n=30) and Control Group (Routine Management) (n=30). All patients continued their usual medical treatment throughout the duration of the study.

Measures

Measures included a self report questionnaire (completed by a participant) which assess the demographic information including (age, gender, education, occupation, type of job, dietary pattern, family history of peripheral arterial disease, complaints of pain in the leg, methods to control diabetes mellitus). The questionnaire was translated into Tamil to cater for groups run within the community. Questionnaire was independently assessed for accuracy.

Ankle Brachial Index Scale

Assessment of lower extremity perfusion by using ankle brachial index scale and was done by standard manual sphygmomanometer and standard hand Doppler.

Ankle and brachial pressure with Doppler

BP cuff tied on upper arm ,palpate the brachial pulse ,then place the Doppler after applying gel and inflate at about 20 -30 mmHg where pulse is not audible and then deflate and mark the first heard pulse as the systolic blood pressure and repeat for the other arm .

BP cuff tied on 2.5 cm above the malleolus ,palpate the dorsalis pedis or posterior tibial pulse, then place the Doppler after applying gel and inflate at about 20 -30 mmHg where pulse is not audible and then deflate and mark the first heard pulse as the systolic blood pressure and repeat for the other extremity .

Formula for Calculating Ankle Brachial Index

Divide the higher of the dorsalis pedis systolic pressures for each ankle by the higher of the two upper extremity brachial systolic pressures to obtain the ankle brachial index for each of the lower extremities. Upon completing calculations, compare each reading with the interpretations below.

$$\text{Ankle brachial Index} = \frac{\text{Highest ankle pressure}}{\text{Highest brachial arm pressure}}$$

Score interpretation

Procedure

Sixty type 2 diabetes mellitus patients who had ankle brachial index scale score below 1 were selected for the study. In that 30 patients were selected for the experimental group and 30 patients were selected for the control group using purposive sampling. The objectives of the study were explained. Informed consent was obtained from both the groups .Demographic data was collected by using the self report questionnaire .Ankle brachial index scale was used to assess the lower extremity perfusion by using aneroid sphygmomanometer and standard hand Doppler. On day 1, lower extremity perfusion was assessed by means of ankle brachial scale among experimental group and control group. Buerger Allen exercise was taught on same day (duration- 6 minutes (2 times per day), frequency-2 and interval-6 hours to the experimental group and they were doing Buerger Allen Exercise for 5 days under supervision. Post test was conducted on the 5^{th} day among experimental group and control group with ankle brachial index scale after the second session.

Ethical considerations

The research proposal was approved by the institutional human ethical committee of Chettinad Academy of Research and Education prior to conduct of the study. The

written permission was obtained from the Dean and HOD of General Surgery, Chettinad Hospital and Research Institute, TamilNadu, India. The investigator explained about the study to the patient and obtained written consent prior to the data collection.

Statistical analysis

Data processing and analysis were done with SPSS version 17. Data were summarised using standard procedures. Descriptive statistics are presented as frequencies, mean and standard deviation for normally and non-normally distributed parameters respectively. Students 't' test, Karl Pearson's correlation co efficient and Chi square test was used. P values of less than 0.05 was assumed to be significant ($p<0.05$).

Results and Discussion

Table II shows the demographic characteristics of the studied groups n=60. Most participants were belonging to age group of 51 to 60 years in experimental and control group 53% and 60%. Distribution of male and female in experimental and control group were 60%, 40% and 27%, 73%. Both groups interested in taking Non vegetarian diet 70%, 30% in experimental and control group. Most of the participant's attained graduate educations in experimental group 47% .Nearly half of the participants were unemployed in experimental and control group 47%. Both the group of the participants had been affected with Diabetes mellitus within 1 to 10 years. In both group the majority of the participants had the family history of peripheral arterial disease. All the participants had pain in the leg in both experimental and control group.

Figure I shows the level of lower extremity perfusion in both group assessed by ankle brachial index scale Most of the subjects had lower arterial disease in both experimental and control group.

Table III illustrate the effect of buerger allen exercise to improve lower extremity perfusion among subjects with type 2 diabetes mellitus. It shows that in the experimental group there was a significant difference between the pre-test mean value 0.922 with SD 0.0562 and pos test mean value 0.980 with SD .0407 which projects that t value 9.108^{*} was significant at the level of $p<0.05$ whereas in the control group there was no significant difference between the pre test mean value 0.8427 with SD 0.0714 and post test mean value 0.8400 with SD 0.0675 which projects that t value 1.000 was not significant at the level of $p<0.05$.

Diabetes mellitus is a complex, progressive disease, accompanied by multiple complications. Diabetes patients have more worsened peripheral vascular disease and are at high risk of lower extremity amputation and had high rate of mortality and morbidity. The main purpose of this study was to investigate the effect of buerger allen exercise in lower extremity perfusion among patients with type 2 diabetes mellitus.

The present study showed that both in experimental group and control group, none of them were normal. In the experimental group, 24 (80.0%) were in lower extremity arterial disease and 6 (20.0%) were in border line. In the control group, 15 (50.0%) were in lower extremity arterial disease and 15(50.0%) were in border line. A similar study was reported that the risk for peripheral arterial disease is increased in patients with type 2 diabetes mellitus. Peripheral arterial disease was diagnosed by an ankle-brachial index less than 0.9 [18].

Table.1 shows the Ankle brachial index scale[17]

>1.4	Indicates noncompressible vessels
≥1.0	Normal
≤ 0.9	Lower Extremity Arterial Disease
≤ 0.6 to 0.8	Borderline
≤ 0.5	Severe ischemia

Table.2 Demographic characteristics of studied group N=60

Characteristics	Experimental Group		Control Group	
	N	%	N	%
AGE 40-50 years	1	3	0	0
51 -60 years	16	53	18	60
61-70 years	8	27	4	13
71-80 years	5	17	8	27
Gender Male	18	60	8	27
Female	12	40	22	73
Diet Vegetarian	15	50	12	40
Non vegetarian	15	50	18	60
Education Illiterate	5	17	10	33
Primary	8	26	12	40
High school	3	10	8	27
Graduate	14	47	0	0
Occupation Unemployed	14	47	14	47
Business	5	17	9	30
Govt / Private	9	30	5	17
Others	2	6	2	6
Type of Job Sedentary	0	0	1	3
Standing	7	23	6	17
Both sedentary & standing	23	77	24	80
None	0	0	0	0
Duration of Diabetes Mellitus 1-10 years	16	53	18	60
11-20years	14	47	12	40
More than 20 years	0	0	0	0
Family History of peripheral arterial disease Yes	23	77	28	93
No	7	23	2	7

Table.3 Effect of Buerger Allen exercise in lower extremity perfusion among experimental and control group

Group	Mean		SD		Paired t test	P value
	Pre test	Post test	Pre test	Post test		
Experimental group	0.9220	0.9800	0.0562	0.0714	9.108*	<0.05 Significant
Control group	0.8427	0.8400	0.0407	0.0675	1.000	<0.05 Not significant

Figure.1 Level of lower extrimity perfusion in both groups

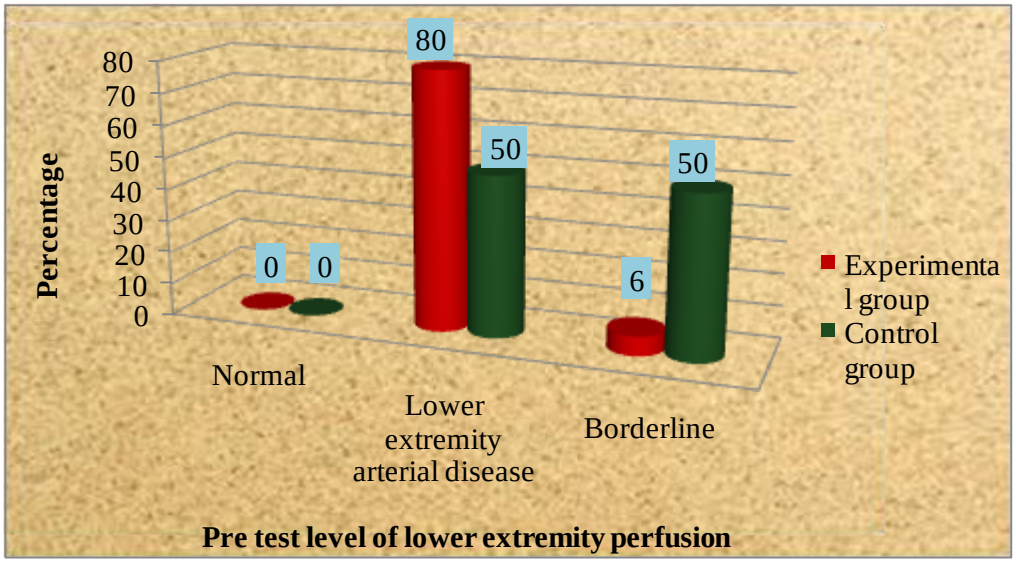
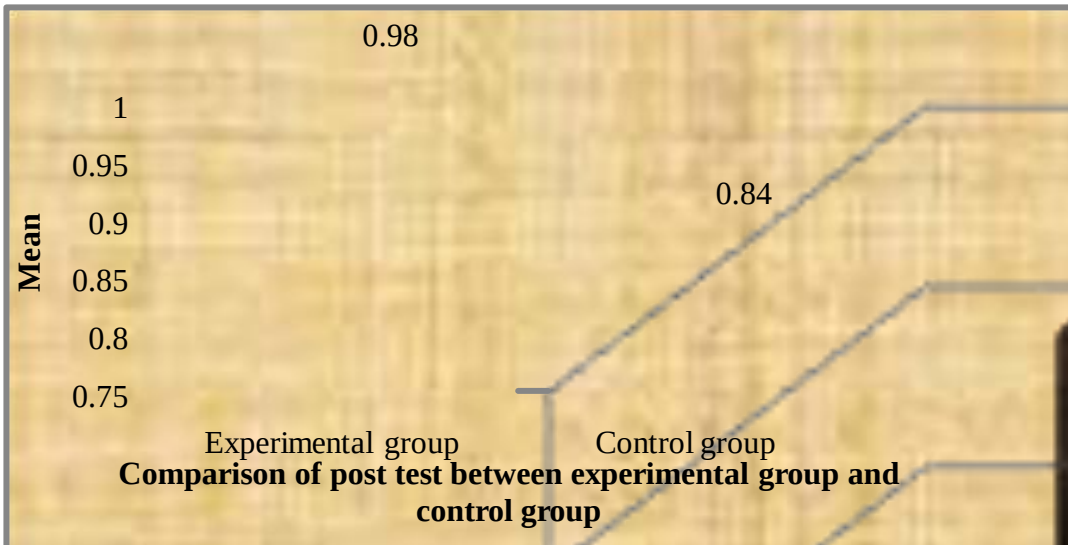


Figure.16 Mean value regarding comparison of post test level of lower extremity perfusion among samples in control group and experimental group



The study showed a significant improvement in the lower extremity perfusion after the Buerger Allen exercise .Data depicts that the mean post test ankle brachial index score was higher than the mean pre test ankle brachial index score. The calculated t value was greater than the table value. The computed t value shows that there was a significant difference between the two mean ankle brachial index score. This indicates that Buerger Allen exercise is effective in improving the lower extremity perfusion among type 2 diabetes mellitus patients. K. Bjerre-Jepsen (2004)[19], Neil j.Snowling(2006)[20] showed that buerger allen exercise improved the lower extremity perfusion.

This study has some possible limitations. The small sample size may be a limiting factor; another limitation is that duration of intervention is too short to determine the effect of buerger allen exercise on lower extremity perfusion.

Conclusion

One person in the world dies of diabetes every ten seconds, while two new diabetic cases are identified every ten seconds. Every 30 seconds, a diabetic undergoes a major amputation. The result from the study reveals that the patients with diabetes mellitus have poor lower extremity perfusion .This has to be taken into consideration.

The findings of the present study revealed that here is a significant improvement in the lower extremity perfusion after doing Buerger Allen exercise .Buerger Allen exercise was found to be effective on improving the lower extremity perfusion among patients with diabetes mellitus. However studies with larger sample size and longer duration of intervention suggest.

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References

1. Simple treatment to curb diabetes. January 20, 2014.
2. 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. doi: 10.2337/diacare.27.5.1047. PMID 15111519.
3. International Diabetes Federation, Diabetes Atlas, Sixth Edition, 2013.
4. Mohan V., Anbalagan.VP., 2013. Expanding role of the Madras Diabetes Research Foundation - Indian Diabetes Risk Score in clinical practice. Indian J Endocr Metab [serial online] 17:31-36. Available from: http://www.ijem.in/text.asp?2013/17/1/31/107825
5. Shobha., Shukla., 2013. Managing Editor of Citizen News Service (CNS), New Interventions to Treat Diabetic Foot Infections, accessed June.
6. R. M. Anjana., R. Pradeepa., M. Deepa et al., 2011. "Prevalence of diabetes and prediabetes (impaired fasting glucose and/or impaired glucose tolerance) in urban and rural India: phase I results of the Indian Council of Medical Research-India diabetes (ICMR-INDIAB) study," Diabetologia, vol. 54, no. 12, pp. 3022–3027.
7. Vascular ageing value higher in India. The Hindu 2011 Sep 6.
8. Melton LJ., 1995. Peripheral vascular disease and diabetes; National Diabetes

Data Group, 2nd ed. NIH Publication.; 401-8.

9. Brass SE., Hiatt WR., Nehler M., 2000. Peripheral arterial disease. Philadelphia: Lippincott Williams and Wilkins: 339-46.
10. Palumbo PJ et al., 1991. Progression of peripheral occlusive arterial disease in diabetes mellitus. Archives of Internal Medicine. 151:717-21.
11. Rosemary Ikem et al., 2010. An assessment of peripheral vascular disease in patients with diabetic foot ulcer; the international journal of clinical foot science.2010 Mar 21; cited 2010 Sep 9].20(4); 114-117.
12. Al-Mahroos., Al-Roomi., 2007. Peripheral vascular disease and potential risk factors among patients with diabetes in Bahrain: a nationwide primary care diabetes clinic-based study. Jan; 27(1):25-33. Available from http://www.ncbi.nlm.nih.gov/ PMC
13. Eason SL., Petersen NJ., Suarez-Almazor M., Davis B., Collins TC., 2005. Diabetes mellitus and the risk for asymptomatic peripheral arterial disease: whom should we screen? 18(5):355-61.Available from http://www.ncbi.nlm.nih.gov/PMC.
14. Sinharay K et al., 2012. Prevalence of diabetic foot ulcers in newly diagnosed diabetes mellitus patients. Sep; 110(9):608-11.Available from http://www.ncbi.nlm.nih.gov/PMC
15. Maeda Y et al., 2008. High prevalence of peripheral arterial disease diagnosed by low ankle-brachial index in Japanese patients with diabetes: the Kyushu Prevention Study for Atherosclerosis. 82(3):378-80.
16. Effectiveness of Buerger Allen exercise on improving the lower extremity perfusion among diabetes mellitus patients in a selected tertiary hospital, Karnataka.
17. Vowden K.R., & Vowden P., 2001. Doppler and the ABPI: How good is our understanding? Journal of Wound Care.10 (6):197–202.
18. Maeda Y et al**.,** 2008. High prevalence of peripheral arterial disease diagnosed by low ankle-brachial index in Japanese patients with diabetes: the Kyushu Prevention Study for Atherosclerosis. 82(3):378-80.
19. K. Bjerre-Jepsen., I. Faris., O. Henriksen., and B. Paaschburg-Nielsen., 2004. European Journal of Nuclear Medicine and Molecular Imaging Increased subcutaneous blood flow for 24 hours. Available from http://www. SringerLinkcom/content
20. Neil j., Snowling., Will G Hopkins., 2006. Effect of different mode of exercise programme on glucose control and risk factors for complication in type2 diabetic patients: http://www. ncbi. nlm.nih.gov/PMC