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A Study to Compare Static and Dynamic Balance among Patients with Diabetic Neuropathy Versus Age Matched Normal Subjects

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Abstract: ***Diabetes mellitus (DM) is a complex and complicated disease that has many complications like heart disease, stroke, hypertension, blindness, eye problems, kidney disease and nervous system disease. (4) Diabetic peripheral neuropathy (DPN) significantly contributes to disturbed balance during daily activities through impairing feet sensation. DPN contributes significantly in falling among elderly patients. (2) Data will be collected from outpatient department of various hospitals in and around Chennai only. For the study, 60 subjects were selected, 30 subjects clinically diagnosed as diabetic peripheral neuropathy, and 30 subjects where normal age matched subjects. Within group comparison of pre-test and post-test scores in both groups demonstrated reduction in DNE scores [Graph 1] with P-value = 0.000 < 0.05, BBS Score [Graph 2] with P = 0 > 0.05, TUG Score [Graph 3] with P = 0 < 0.05. In this study the static and dynamic balance scores of group A diabetic neuropathy patients has less where compared to the group B age matched normal subjects, hence the study concluded that due diabetic neuropathy the group A patients will have more deficits in the static and dynamic balance when compared with the age matched normal subjects group B.***

Keywords: Diabetes Mellitus, Balance, Neuropathy, Berg Balance Scale, Time Up and Go test

1. Introduction

Diabetes mellitus (DM) is a complex and complicated disease that has many complications like heart disease, stroke, hypertension, blindness, eye problems, kidney disease and nervous system disease. [4] Approximately 60% to 70% of people with DM have mild to severe forms of nervous system affection. Nearly half of the patients with DM have one type or combination of motor, sensory, or autonomic neuropathy that tend to clearly appear many years after diagnosis of DM, especially in elderly patients. [6] Diabetic peripheral neuropathy (DPN) significantly contributes to disturbed balance during daily activities through impairing feet sensation. DPN contributes significantly in falling among elderly patients. People with DPN often experience balance disorder and abnormally increased postural sway, especially with the eyes closed. Balance is the process of maintaining the Center Of Gravity within the subject's limits of stability and influenced by the base of support. Postural instability caused by DPN increases the impact of micro-traumas and wounds. In the elderly, slips or falls are one of the most common causes of injury. [7] Patients with DPN suffer disturbed balance even with their eyes opened, and hence; increased risk for falling. [8] It was only in 1864 that DM was recognized as cause of peripheral neuropathy (PN). Some years later, the involvement of cranial nerves of diabetic patients has been observed (7) The loss of tendinous reflexes in lower limbs (LL) was described by Bouchard in 1884 and the presence of spontaneous symptoms such as pain and hyperesthesia was described by Pavy in 1885 Motor manifestations were documented by Buzzard in 1890. The first DN classification was suggested by Leyden (1893) who subdivided it in sensory and motor manifestations. Jordon and Crabtree (1935) in turn, were the first to mention pathophysiologic DN mechanisms. After the discovery of insulin in the 1930s to treat DM, the prevalence of DN has significantly increased since diabetic patients started to have longer life expectation. Studies by Fagerberg, Mulder et al.10 and Pirart, Lauvaux and Rey, have proven the correlation of DN with other microvascular complications such as diabetic nephropathy.

The International Diabetes Federation estimates that 425 million people worldwide have diabetes, making it the largest global epidemic of the 21st century.115 million people in China, 73 million in India and 30 million in the United States have diabetes. These numbers are dwarfed by the number of individuals with prediabetes, which is estimated to be 388 million in China, 133 million in India and 85 million in the United States.12% of global health expenditure, or $727 billion, is directed towards diabetes and its complications, and similar to the number of individuals with diabetes, this number continues to increase at an unsustainable rate.

Diabetic neuropathy is a unique neurodegenerative disorder of the peripheral nervous system that preferentially targets sensory axons, autonomic axons and later, to a lesser extent, motor axons. How diabetes mellitus targets sensory neurons remains debated. Progressive diabetic neuropathy involves retraction and ‘dying back’ of terminal sensory axons in the periphery, with relative preservation of the perikarya (cell bodies). Its ‘stocking and glove’ pattern of involvement reflects damage to the longest sensory axons first with, for example, loss of distal leg epidermal axons preceding loss in more proximal limbs; for this reason, diabetic neuropathy is considered a length-dependent neuropathy. (3)

Diabetic neuropathies are a family of nerve disorders caused by diabetes. 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—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 controlling their blood glucose, also called blood sugar, as well as those with high levels of blood fat and blood pressure and those who are overweight. [7]

The causes are probably different for different types of diabetic neuropathy. Researchers are studying how prolonged exposure to high blood glucose causes nerve damage. Nerve damage is likely due to a combination of factors: metabolic factors, such as high blood glucose, long duration of diabetes, abnormal blood fat levels, and possibly low levels of insulin, neurovascular factors, leading to damage to the blood vessels that carry oxygen and nutrients to nerves, autoimmune factors that cause inflammation in nerves, mechanical injury to nerves, such as carpal tunnel syndrome, inherited traits that increase susceptibility to nerve disease, lifestyle factors, such as smoking or alcohol use

Symptoms depend on the type of neuropathy and which nerves are affected. Some people with nerve damage have no symptoms at all. For others, the first symptom is often numbness, tingling, or pain in the feet. Symptoms are often minor at first, and because most nerve damage occurs over several years, mild cases may go unnoticed for a long time. Symptoms can involve the sensory, motor, and autonomic—or involuntary— nervous systems. In some people, mainly those with focal neuropathy, the onset of pain may be sudden and severe.

Symptoms of nerve damage may include: numbness, tingling, or pain in the toes, feet, legs, hands, arms, and fingers, wasting of the muscles of the feet or hands, indigestion, nausea, or vomiting, diarrhea or constipation, dizziness or faintness due to a drop in blood pressure after standing or sitting up, problems with urination, erectile dysfunction in men or vaginal dryness in women, weakness.

2. Methodology

Data will be collected from outpatient department of various hospitals in and around Chennai only. For the study, 60 subjects were selected, 30 subjects clinically diagnosed as diabetic peripheral neuropathy, and 30 subjects where normal age matched subjects. Patients were evaluated using an assessment form, diabetic neuropathy examination score, patients were informed about the procedure, merits and demerits study. consent form is obtained from each patients for voluntary participation. Subjects were selected in the study on the basis of inclusion criteria (Age between 35 to 55 years, Both male and female patients, With type 2 diabetes for ten years, Subject is positive in diabetic neuropathy examination score (DNE), Willing to participate in the study). Patients taken in two groups; Diabetic Neuropathy Patients taken as group A and age matched normal subjects taken as group B

Variables

Primary measures of the diabetic neuropathy is Diabetic neuropathy examination score. Parameters used to measure static and dynamic balance are Berg Balance scale (BBS) and Timed UP and GO (TUG)

3. Procedure

Group A:

The subjects in this group are with diabetic peripheral neuropathy. In Group A the patients are clinically diagnosed with diabetic neuropathy examination score to conform diabetic neuropathy and then static and dynamic balance of the diabetic neuropathy patients where assessed using the Berg Balance Scale and Timed UP and GO test. In Berg Balance Scale it consists of 14 components and 56 points of score, if the static and dynamic balance is affected, the patient could not able to score 56. In Timed UP and GO test, the patient is asked to stand from the chair and walk for 10 feet and return to the chair, the therapist wants to note the time taken by the patient to complete the task. It is compared with the normative values.

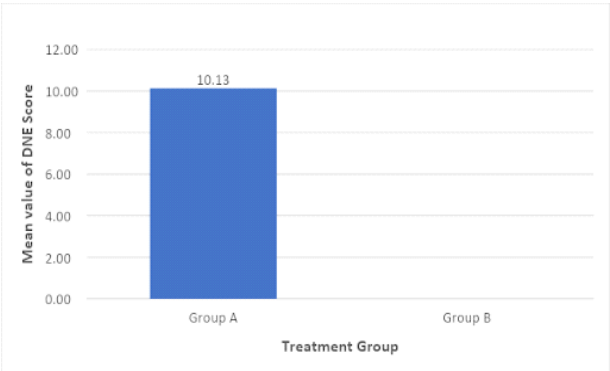
Group B:

The subjects in this group are age matched normal individuals. In Group B the individuals are normal subjects taken to compare with the diabetic neuropathy patients"s static and dynamic balance by Berg Balance Scale and Timed UP and GO test. The above same test is followed to this group.

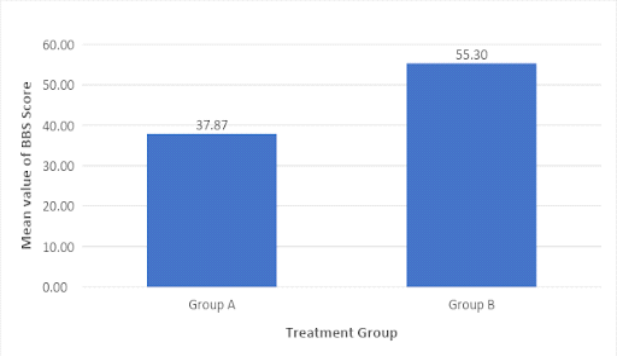
Statistical Analysis

The present study included 60 subjects, in which 30 subjects were on Group A (Diabetic Peripheral Neuropathy) and 30 subjects were on Group B (age matched normal individuals). [Table 1] [Table 2] represents demographic data of the study participants

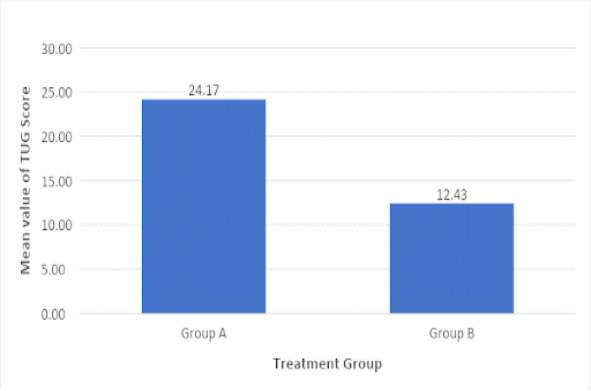
Within group comparison of pre-test and post-test scores in both groups demonstrated reduction in DNE scores [Graph 1] with P-value = 0.000 < 0.05, BBS Score [Graph 2] with P = 0 > 0.05, TUG Score [Graph 3] with P = 0 < 0.05.



Graph 1



Graph 2



Graph 3

4. Conclusion

In this study the static and dynamic balance scores of group A diabetic neuropathy patients has less where compared to the group B age matched normal subjects, hence the study concluded that due diabetic neuropathy the group A patients will have more deficits in the static and dynamic balance when compared with the age matched normal subjects group B.

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References

[1] **Amir Abdel-Raouf El-Fiky, Ashraf Abdelaal Mohamed Abdelaal and Omar Farouk Helal:** EVALUATION OF STATIC AND DYNAMIC BALANCE IN PATIENTS WITH DIABETIC PERIPHERAL POLYNEUROPATHY: *ORIGINAL RESEARCH ARTICLE, Int. J. Adv. Res.4 (12), 2315-2321*

[2] **Osvaldo José Moreira do Nascimento, Camila Castelo Branco Pupe, Eduardo Boiteux Uchôa Cavalcanti:** Diabetic neuropathy; *Rev Dor. São Paulo, 2016; 17 (Suppl 1): S46-51*

[3] **Rodica Pop Busui et al,** states about the diabetic pheripheral neuropathy [*2017]*

[4] **Delta Med Col J,** explains the epidemiology and physiology of neuropathic pain in the diabetes [*jan 2019]*

[5] **Lídia Karla Martinho Bruschi, Dayvson Araújo da Rocha1, Eusínio Lavigne Gesteira Filho, Nathália de Moura Pancoti Barboza, Poliana Aparecida Bresciane Frisanco, Raquel Milanesi Callegaro, Larissa Bianca Paiva Cunha de Sá, Alberto Krayyem Arbex:** Diabetes Mellitus and Diabetic Peripheral Neuropathy, *Open Journal of Endocrine and Metabolic Diseases, 2017, 7, 12-21 http: //www.scirp. org/journal/ojemd*

[6] **Kathrine Jáuregui-Renaud:** Postural Balance and Peripheral Neuropathy, *Additional information is available at the end of the chapter http: //dx. doi. org/10.5772/55344*

[7] **JAN-WILLEM G. MEIJER, MD ERIC VAN SONDEREN, PHDEDDIE E. BLAAUWWIEKEL, MD ANDRIES J. SMIT, MD, PHD JOHAN W. GROOTHOFF, PHD WILLEM H. EISMA, MD THERA P. LINKS, MD, PHD:** Diabetic Neuropathy Examination. A hierarchical scoring system to diagnose distal polyneuropathy in diabetes, **Diabetes Care 23: 750–753, 2000**

[8] **Hoda Salsabili et al,** dynamic stability training improve standing balance control in diabetic neuropathy, balance assessed by Berg balance scale [*volume 48 pg. no 775-786 7 nov 2011]*

[9] **Katrine Lyders Johansen*, Rikke Derby Stistrup, Camilla Skibdal Schjøtt, Jacqueline Madsen, Anders Vinther Department of Rehabilitation, Copenhagen University Hospital, Herlev Gentofte Hospital, Herlev, Denmark:** Absolute and Relative Reliability of the Timed 'Up & Go' Test and '30second Chair-Stand' Test in Hospitalised Patients with Stroke, *PLOS ONE | DOI: 10.1371/journal. pone.0165663 October 31, 2016*

[10] **Berg K, Maki B, Williams JI, Holliday P, Wood-Dauphinee S:** A comparison of clinical and laboratory measures of postural balance in an elderly population. *Arch Phys Med Rehabil, 73: 1073-1083, 1992.*

[11] **American Diabetes Association.** Diagnosis and Classification of Diabetes Mellitus. (Position statement). *Diabetes Care 2005; 28: S37-S42.*

Table 1

S No.	Age	Gender	Group	DNE Score	BBS Score	TUG Score
1	48	Female	A	8	42	18 sec
2	51	Female	A	13	32	30 sec
3	53	Female	A	16	28	32 sec
4	45	Male	A	8	41	16 sec
5	50	Female	A	16	28	30 sec
6	40	Female	A	8	40	17 sec
7	40	Female	A	8	42	16 sec
8	39	Female	A	8	42	16 sec
9	38	Female	A	8	41	17 sec
10	43	Female	A	8	40	22 sec
11	55	Female	A	16	30	34 sec

12	55	Male	A	16	28	35 sec
13	55	Male	A	16	29	34 sec
14	50	Female	A	11	35	30 sec
15	42	Male	A	8	42	24 sec
16	45	Male	A	8	42	18 sec
17	47	Male	A	8	41	24 sec
18	49	Female	A	8	41	28 sec
19	39	Female	A	8	41	20 sec
20	47	Male	A	8	42	23 sec
21	47	Male	A	8	42	25 sec
22	46	Male	A	8	41	25 sec
23	51	Male	A	16	30	32 sec
24	39	Female	A	8	40	16 sec
25	36	Female	A	8	40	17 sec
26	42	Female	A	8	41	25 sec
27	52	Female	A	16	28	35 sec
28	46	Female	A	8	42	25 sec
29	46	Female	A	8	42	25 sec
30	44	Male	A	8	43	16 sec

Table 2

S No	Age	Gender	Group	DNE Score	BBS Score	TUG Score
1	48	Female	B	0	55	10 sec
2	51	Female	B	0	54	15 sec
3	53	Female	B	0	54	15 sec
4	45	Male	B	0	56	10 sec
5	50	Female	B	0	55	15 sec
6	40	Female	B	0	56	10 sec
7	40	Female	B	0	56	10 sec
8	39	Female	B	0	56	10 sec
9	38	Female	B	0	56	10 sec
10	43	Female	B	0	56	12 sec
11	55	Female	B	0	53	15 sec
12	55	Male	B	0	54	15 sec
13	55	Male	B	0	53	15 sec
14	50	Female	B	0	54	16 sec
15	42	Male	B	0	56	12 sec
16	45	Male	B	0	56	11 sec
17	47	Male	B	0	56	13 sec
18	49	Female	B	0	56	13 sec
19	39	Female	B	0	56	10 sec
20	47	Male	B	0	56	12 sec
21	47	Male	B	0	56	13 sec
22	46	Male	B	0	56	13 sec
23	51	Male	B	0	54	15 sec
24	39	Female	B	0	56	10 sec
25	36	Female	B	0	56	10 sec
26	42	Female	B	0	56	12 sec
27	52	Female	B	0	53	16 sec
28	46	Female	B	0	56	12 sec
29	46	Female	B	0	56	12 sec
30	44	Male	B	0	56	11 sec