

To Find Frequency of Large Fibre Sensory Neuropathy in Diabetes Mellitus and to Compare Hand Grip Strength in patients of DM with and without Large Fibre Sensory Neuropathy

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ABSTRACT

Aim: To find frequency of large fiber sensory neuropathy in diabetes mellitus and to compare hand grip strength in patients of diabetes mellitus with and without large fiber sensory neuropathy

Study setting: The study was conducted at Department of Medicine/ Diabetic Foot Care Clinic, Mayo Hospital, Lahore.

Duration of study: August 25, 2020 to February 25, 2021

Study design: Cross-sectional study

Methods: Total 100 patients with diabetes were enrolled. Patients had their handgrip checked. Handgrip strength of each participant was tested in morning after routine breakfast, with the help of Jamar hand dynamometer. Three readings were taken for each patient with dominant hand and average of these three was calculated for final analysis. Large fiber sensory neuropathy was assessed as per operational definition. Data were entered and analyzed by SPSS v25.0. Peripheral neuropathy was tested by Chi Square test. Data were stratified for age, gender, duration of DM and BMI. Hand grip was compared between groups by t-test. A p-value of ≤ 0.05 was taken as significant.

Results: In this study, 100 patients presenting with diabetes mellitus were enrolled. Among these patients, 68(68.0%) were males, while 32(32.0%) were females. Age range in this study was from 18 to 60 years with mean age of 42.8 ± 11.6 year. Frequency of large fiber sensory neuropathy was 42(42.0%) among cases presenting diabetes mellitus. Mean handgrip strength in patients with large fiber sensory neuropathy was 20.71 ± 2.39 kg and 28.10 ± 5.18 kg among cases without large fiber sensory neuropathy with p-value as 0.0001, which is statistically significant.

Conclusion: Long-standing large fiber sensory neuropathy with type-II diabetes mellitus seems to result in a decrease in hand grip strength. This physical limitation may contribute to low productivity in people with large fiber sensory neuropathy among type-II diabetes mellitus.

Keywords: Hand Grip Strength, Type-2 Diabetes Mellitus, Large Fiber Sensory Neuropathy.

INTRODUCTION

Diabetes is associated with major mortality risk. Prevalence in Pakistan is alarmingly high upto 26.3% as per most recent data in 2017¹. It is known for micro and macrovascular complications that result in considerable increase in morbidity and mortality. Diabetic neuropathy is a complication that is symmetrical dependent sensorimotor polyneuropathy attributable to metabolic and microvessel alteration like accumulation of glycosylation end products/sorbitol, increased oxidative stress as well as nerve ischemia and impaired repair mechanism in type II DM,² seen in almost 50%³. It is more common with more duration of diabetes and poor blood glucose control and may progress to a lower extremity amputation. Typical DPN features of sensory (i.e. Numbness, paresthesia, loss of proprioception etc.) and motor (i.e. atrophy, weakness etc.) dysfunction progress in a distal to proximal or length dependent manner⁴⁻⁵.

Prolonged DPN results in significant skeletal muscle deficits leading to muscle atrophy, decreased strength, power and endurance⁶. Multiple scores/tools are available to check neuropathy in clinical/research settings. Few are Michigan Diabetic Neuropathy Scale (MDNS), Utah Early Neuropathy Scale (UENS), Nerve Conduction Study (NCS), Electromyography (EMG) and Biothesiometry. Vibration sense is the only component of DPN that can be accurately labelled in a quantifiable cut off value with help of vibration perception threshold (VPT) using a biothesiometer whose tractor is applied vertically on the pulp of hallux. VPT is stratified as abnormal if it is $>25v$, intermediate if $15-25v$ and normal if $<15v$ ⁷. Biothesiometry using VPT has a sensitivity greater than 80%, specificity of 70% with good reproducibility and easy to perform as compared to clinical scoring system. Sarcopenia "a condition characterized by progressive and generalized loss of skeletal muscle and strength in pathogenesis of functional limitation"⁸, is another condition that is recently being considered

as one of complications of DM. Recent researches have shown that older type-II DM patients are often affected by skeletal muscle impairment leading to reduced muscle mass, strength and physical performance.⁹ Insulin resistance, hyperglycemia, fatty infiltration in muscle mass, peripheral neuropathy, physical inactivity, oxidative stress, chronic inflammatory changes, hormonal changes (Sex and growth hormone) and decrease protein anabolism are fundamental mechanism leading to sarcopenia¹⁰⁻¹³, that leads to mobility disorders, increase risk of fall and fracture, impaired ability to perform activities of daily living, disabilities, loss of independence and increased risk of death¹⁴⁻¹⁵.

Sarcopenia is conclusively measured by Computed Tomography (CT), Magnetic Resonance Imaging (MRI), Dual Energy X-Ray Absorptiometry (DEXA) and Bioimpedance Analysis. Hand Grip Strength is an easy way to assess the muscle strength in clinical setting. Cut off values for women with BMI ranges <22.3 , $22.3-24.2$, $24.3-26.8$ and >26.8 are 14.6, 16.1, 16.5 and 16.4 respectively.¹⁶ Hand grip strength is influenced by factors such as age, gender, race & nutritional intake as well as hypertension & dyslipidemia¹⁷. Keeping in view the many factors like age, duration of diabetes, degree of hyperglycemia and nutritional factors that link between sensory neuropathy and decrease muscle strength,⁵ it is plausible to think that patient with sensory neuropathy (especially large fiber neuropathy) may have concomitant loss while of muscle strength.¹⁸ In Pakistan no study has so far evaluated this association.

Therefore, aim of study is to investigate compare hand grip strength in type-2 DM pts with and without large fiber sensory neuropathy. It will guide us about significance of functional motor capacity and development of possible motor disability coexisting with large fiber sensory neuropathy.

Operational definitions:

Diabetics: BSR >200 mg/dl diagnosed at least five years ago and less than 10 years. Maximum power of voluntary flexion of all fingers under normal condition by dominant hand as measured by Jamar Dynamometer for hand grip testing. Three readings were

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taken for each patient with dominant hand and average of these three was calculated for final analysis. It was measured in kg.

Large fiber sensory neuropathy: Neuropathy was defined by VPT >25v with the help of neuropathy screening device Neuro Vibe™ MDX USA Medical Equipment Solutions¹⁸.

MATERIALS AND METHODS

Study was conducted in the Department of Medicine/ Diabetic Foot Care Clinic, Mayo Hospital, Lahore from August 25, 2020 to February 24, 2021 after granting permission from hospital ethical committee. It was cross sectional study and has non-probability consecutive sampling. Sample size of 100 cases was calculated with 95% confidence level and 9% margin of error and taking an expected percentage of large fiber sensory neuropathy as 68.5%¹⁷. Diabetes Mellitus of either gender and age ranging from 18-60 years diagnosed at least 5 years before and less than 10 years as per operational definition were **included** while patients having coexistent acute or chronic medical condition or hand disability e.g. hand injury, uremia and heart failure (as evident by their medical record or physical examination) were **excluded**. All patients with diabetes who fulfilled the inclusion and exclusion criteria, their weight was measured using standardized weighing scale with patients wearing light clothes only. Similarly, their height was measured on height scale. After that they had their handgrip checked after informed consent. They were requested not to take any caffeinated beverage or energy drink on the morning of testing.

Handgrip strength of each participant was tested in morning after routine breakfast, with the help of Jamar hand dynamometer. Three readings were taken for each patient with dominant hand and average of these three was calculated for final analysis. Later on, each participant was educated and treated according to his/her own condition of illness. Large fiber sensory neuropathy was assessed as per operational definition. Data were entered and analyzed by SPSS v25.0. Quantitative variables like age, duration of diabetes and handgrip strength were presented as Mean±S.D. Qualitative variable like gender was presented as frequency and percentage. Peripheral neuropathy was tested by Chi Square test. Data were stratified for age, gender, duration of DM and BMI. Hand grip was compared between groups by t-test. A p-value of ≤0.05 was taken as significant.

RESULTS

In this study, 100 patients presenting with DM were enrolled. Among these, 68(68%) were males, while 32(32%) were females. Age range was from 18 to 60 years with mean age of 42.8±11.6 year. Majority of patients 54(54.0%) had age >45 years, while 14(14%) and 32(32%) patients were between 18-30 years and 31-45 years respectively. Among these, 64(64%) had normal BMI, while 32(32%) were overweight. Among patients, 48(48%) had duration of diabetes for 5-7 years, while 52(52%) had for 8-10 years. Frequency of large fiber sensory neuropathy was 42(42%) among cases presenting diabetes mellitus. Mean handgrip with large fiber sensory neuropathy was 20.71±2.39 kg and 28.10±5.18 kg among cases without large fiber sensory neuropathy with p-value as 0.0001, which is statistically significant.

DISCUSSION

DM is usually associated with mild hand muscle weakness with peripheral sensory neuropathy¹⁹. Results showed that there is a significant reduction of handgrip strength in DM compared with apparently healthy ones. Similar findings were derived by Savas *et al* who noted significantly lower handgrip in diabetics than controls (p<0.05)²⁰. Results are also in close proximity with present study which showed that type 2 DM result in a decrease in handgrip in both sexes. This may lead to low productivity with type 2 DM patients²⁰⁻²¹. Some have reported reduced handgrip in type 2 DM²²⁻²³. Insulin resistance may contribute for this weakness²⁴ and,

therefore, decreased grip but loss of strength could also be due to advancing age²⁵.

A study by Kim *et al*, reported an association between type-II DM and risk of sarcopenia at various ages¹⁶. A recent cross sectional hospital based study in Lahore performed on 113 newly diagnosed type II DM patients had a prevalence of 68.5% in those with poor glycemic control (HbA1c>6.5) and 50% in those with good glycemic control (HbA1c <6.5). Sarcopenia is conclusively measured by Computed Tomography (CT), Magnetic Resonance Imaging (MRI), Dual Energy X-Ray Absorptiometry (DEXA) and Bioimpedance Analysis. Hand Grip is an easy way to assess muscle strength in clinical setting. Kaur *et al* compared hand grip between DM and non-DM and found a significant difference of mean values of hand grip between both male and female diabetics and non-diabetics (p<0.001). In a study, hand grip in diabetics was (20.7±3.5 kg) and in controls as (32.9±7.6 kg)²⁶.

In another study, hand grip in diabetics was (31.4±0.4 kg) and in control as (32.7±0.1 kg)²⁶. Decrease muscle strength is evident with passing age due to loss of muscle mass.

CONCLUSION

Long-standing large fiber sensory neuropathy with type-2 DM seems to result in a decrease in hand grip strength. This limitation may lead to low productivity in those with large fiber sensory neuropathy among type-2 DM.

Conflict of interest: Nil

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