Sigma's VIRTUAL 31st International Nursing Research Congress (Wednesday, 22 July - Friday, 24 July)

Developing a Predictive Model of Diabetic Neuropathy by using Principal Component Analysis

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Purpose:
Diabetic neuropathy (DNP) is the most common diabetes-related microvascular complication and can significantly increase morbidity and mortality. Early detection will allow early interventions to prevent the progression of the disease. However, currently there is no effective screening strategies for early identifying DNP. Previous studies reported that loss of muscle strength in patients with diabetes is related to the presence and severity of DNP. Body measurements such as peripheral muscle strength and body circumference may be used as the parameters for predicting DNP. Additionally, aging and physical inactivity may cause a decline in muscle strength in patients with diabetes. Including level of physical activity may also help to predict DNP. Therefore, the purposes of the study are to explore the influences of body measurements and physical activity on the DNP and to build a predictive model for the development of DNP by using the principal component analysis.

Methods:
This is a cross-sectional correlational study. A convenient sample of 77 type 2 diabetes who were aged 50 or older. Data were collected by self-report questionnaires and physical measures. The participants answered the study questionnaires, including questions on demographics, history of diabetes, Michigan Neuropathy Screening Instrument (MNSI), and Physical Activity Scale for the Elderly (PASE). A research assistant measured each participant’s hand grip strength, 6 meters walking speed, strength of knee extension, ankle flexion, ankle extension, waist circumference, and calf circumference. DNP was assessed by using the MNSI. Chi-square tests, t-tests, and ANOVA were used to compare between differences on demographics, disease variables, physical activity, and other physical measures. In order to design a simple screening tool, we reduced the dimensionality to the leased factors by using principal component analysis. The first principle component score (FPCS) was used as a summary of the data. The ROC curve was used to further analyze the predictability of the FPCS for DNP.

Results:
There were 36 male and 41 females participated in the study. Among them, 41 were seen as having DNP based on their MNSI scores. The average age of participants was 69.2 years old and the average duration of being diagnosed with type 2 DM was 7.8 years. Results of bivariate analyses showed that the participants' MNSI scores were significantly associated with their hand grip, knee extension, ankle flexion, ankle extension and calf circumference. These variables were entered into factor analysis to find principle components for the MNSI score. The FPCS including the combination of hand grip strength, strength of knee extension, strength of ankle flexion, and strength of ankle extension was a good summary of our data. The area under the receiver operating characteristic curves (AUCs) in the ROC curve was .687, indicating an acceptable predictability of the FPCS for DNP.
Conclusion:
Results of the study suggests that FPCS as a new index can be used as a proxy for predicting DNP. Although, the use of FPCS is not computationally feasible in practice. However, we suggest that muscle strength and physical activity could be used in clinical practice as simple parameters for the identification of those at risk of DNP.

Title:
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Keywords:
Body Measurements, Diabetic Neuropathy and Principal Component Analysis (PCA)

Abstract Summary:
Muscle strength and physical activity could be used in clinical practice as simple parameters for the identification of those at risk of Diabetic Neuropathy. Otherwise, gender difference effected their appearance. We should give different attention to gender to find the appropriate predictive variables.

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