An exploration of the relationship between the hallux grip force and diabetic peripheral neuropathy severity.

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Summary

Diabetes (DM) is closely related to foot-ankle function and muscle losses, that can affect gait biomechanics and balance. Identifying these changes should be part of the risk assessment for this population, helping in the prevention and clinical management of complications. This study explored the relationship between diabetic peripheral neuropathy (DPN) characteristics, including severity, symptoms, tactile and vibratory sensitivities, and hallux grip force, joint mobility, and the functional capacity of a cohort of 170 participants. The main findings revealed that greater DPN severity, characterized by larger areas of insensitivity and impaired vibratory sensitivity, was directly linked to a reduced hallux grip force and functional capacity. These results emphasize the importance of assessing motor function in individuals with DM, as it is closely associated with both DPN and functional decline, although the current guidelines do not incorporate this assessment into their recommendations.

Introduction

DPN is a chronic complication of DM that leads to sensory loss, muscle atrophy, and dysfunction in foot muscles, affecting daily functional capacity, gait biomechanics and increasing the risk of falls[1]. The foot plays a crucial role in gait and balance, ensuring functionality and independence. Chatzistergos et al. proposed the Enhanced Paper Grip Test (EPGT)[2] as a tool to assess hallux grip force, which reflects overall foot-ankle strength. Authors showed it can potentially identify functional decline in DPN population[2] and could play a vital role in the early detection and management of chronic DM-related complications. This study explored how DPN is supposedly linked to muscle strength loss and its subsequent impact on functionality. We aimed to investigate the relationship between hallux grip force and DPN characteristics, joint mobility, and functional capacity.

Methods

The study was approved by the Institutional Ethics Committee (CAAE:63457822.0.0000.0068) and included a cohort of 170 adults with DM, both sex (60.7±10.9yrs old). All participants had their clinical and functional outcomes assessed: ankle and 1st MPT ROM (goniometers), DPN symptoms (Michigan Neuropathy Screening Instrument score), DPN severity (fuzzy score), tactile and vibratory sensitivities, functional capacity, balance and mobility (Time-Up-Go, TUG) and hallux grip force (EPGT). The correlation between hallux grip force and other clinical variables was tested by Spearman's test with Bonferroni correction ($p<.05$).

Results and Discussion

We found a significant correlation between hallux grip force (right) and: (1) DPN symptoms ($p=0.003$, $r=-0.22$), (2) DPN severity ($p=0.003$, $r=-0.22$), (3) tactile sensitivity ($p=0.001$, $r=-0.24$), and (4) vibratory sensitivity ($p=0.044$, $r=0.15$). Similarly, left hallux grip force showed significant correlations with: (1) DPN symptoms ($p=0.005$, $p=-0.21$), and (2) DPN severity ($p=0.010$, $r=-0.19$). No correlation was found between the other variables. These findings suggest that the presence and severity of DPN, as indicated by the increased presence of symptoms, a greater number of insensitive areas, and alterations in vibratory sensitivity, negatively correlate with hallux grip force. The results also indicated that the reduction in hallux grip force was associated with an increased TUG time, highlighting a functional decline in people with DPN due to loss in foot muscle strength.

Conclusions

DPN severity was associated with a reduced hallux grip force and impaired functional capacity. While consensus guidelines (IWGDF) emphasize sensory and vascular assessments as predictors of risk level, we showed the importance of muscle function assessment for predicting long-term functionality losses in DPN. This underscores the need for discussion among specialists to incorporate this assessment into the foot risk evaluation of people with DM.

Acknowledgements

To Sao Paulo Research Foundation (FAPESP 23/09860-4, 21/00807-8, 17/17848-3; 19/02522-0), CNPq/MCTI (402307/2023-2) and CAPES (grant code 001).

References

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