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Original Article

# Assessment of Cognitive Functioning in Diabetic Patients with Diabetic Foot

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## Abstract

**Objective:** To determine the prevalence of poor cognitive functioning in diabetics with diabetic foot.

**Methods:** This cross sectional study was undertaken at Combined Military Hospital (CMH) Rawalpindi, from September to December 2021. The study included 190 patients, known to be diabetic, aged 40 to 70 years of either gender, with diabetic foot, presenting to Department of medicine CMH Rwp. Patients with advanced kidney disease and dementia were excluded. Informed consent was taken from all patients. Mini-Mental State investigation (MMSE) results were used to evaluate overall mental condition (Folstein, Folstein, & McHugh, 1975). Score was noted and if MMSE score was found 24, poor cognitive function was labeled

**Results:** The mean age of the patients was 60±7.84 years. In our study, 132(69.47%) were males and 58(30.53%) were females. The mean duration of disease of the patients was 11.66±4.58 years. 22(11.70%) patients were on oral treatment, 72(38.30%) were on insulin and 94(50%) patients were on both. About 71(37.77%) patients were found to be hypertensive, and 70(36.8%) patients were smokers. The mean duration of diabetic foot was 2.23±1.93 months and the mean MMSE score was 23.86±2.95. Poor cognitive functioning was found in 99(52.11%) patients.

**Conclusion:** It is concluded that poor cognitive function in diabetic patients with diabetic foot significantly contributes to the disease.

**Keywords:** Poor Cognitive Functioning, Diabetic Foot, diabetes mellitus

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## Introduction

Foot ulceration is the commonest lower-extremity complication in diabetic patient.[1] Patients with diabetic foot ulcers are often older, have a lower body mass index (BMI), have had their diabetes for a longer period of time, and are more likely to have smoked before, had hypertension, or diabetic retinopathy.[2] 6% of diabetics experience foot disease, which can cause tissue damage to the foot or cause an infection or ulcer.[3] Future predictions indicate that the burden of diabetic foot will rise. On the other hand, those with diabetes have a 15% to 25% lifetime chance of getting a diabetic foot ulcer. The yearly incidence of foot ulceration is estimated to be between 1% and 4%, and its prevalence is between 4% and 10%.[4] In Pakistan, 13.9% of people have diabetic feet.[5]

The association between glucose management and difficulties seen in the foot and ankle has to be thoroughly explained to both primary care providers and patients.[6] The cognitive requirements for adhering to medical advice are also increased by this disease. There could be a disconnect between a patient's capacity to follow medical advice and it.[7] Thus the aim of this study was to determine the prevalence of poor cognitive functioning in diabetics with diabetic foot.

## Methods

The cross-sectional study was commenced at the Depart-

ment of Medicine, CMH Hospital, Rawalpindi after attaining approval from Institutional review board. Informed consent from patients was taken. Patients of age between 40 to 70 years of either gender presenting with diabetic foot, excluding those with recurrent or relapse diabetic foot (on medical record) or chronic renal failure stage IV, V, disabling stroke or dementia (on medical record) were excluded. Demographic data (name, age, gender, BMI, duration of diabetes, treatment of diabetes, hypertension, smoking and duration of diabetic foot) was noted. Mini-Mental State Investigation (MMSE) results were used to evaluate overall mental condition (Folstein, Folstein, & McHugh, 1975). Score was noted and if MMSE score was found ≤24, poor cognitive functioning was labeled. The data was entered & analyzed via SPSS v. 20. Poor cognitive functioning was calculated as frequency (%).

## Results

In this study total 190 patients were enrolled. The mean age of the patients was 60±7.84 years. About 132 (69.47%) were males and 58 (30.53%) were females. The male-to-female ratio was 2.3:1. The mean BMI was 28.46±4.19 kg/m$^2$. The mean duration of disease of the patients was 11.66±4.58 years. According to this study 22(11.70%) patients were on oral treatment, 72(38.30%) patients were on insulin and 94(50%) patients were on both oral and insulin treatment. The study results showed that the hypertension was found in 71(37.77%) patients and 70(36.8%) patients were smokers. The study results showed that the mean duration of diabetic foot was 2.23±1.93 months. The mean MMSE score of the patients was 23.86±2.95 with minimum and maximum MMSE scores of 19 & 30 respectively. Poor cognitive functioning was found in 99(52.11%) patients. In patients having age ≤ 50 years the poor cognitive functioning was found in 5(19.2%) patients and in patients having age >50 years the poor cognitive functioning was found in 94(57.3%) patients (p-value=<0.001). Table 1

**Table 1:** *Comparison of poor cognitive functioning between age groups*

| | | Poor cognitive Functioning | | Total | p-value |
|---|---|---|---|---|---|
| | | Yes | No | | |
| Age Groups | ≤ 50 | 5 | 21 | 26 | <0.001 |
| | | 19.2% | 80.8% | 100.0% | |
| | >50 | 94 | 70 | 164 | |
| | | 57.3% | 42.7% | 100.0% | |
| Total | | 99 | 91 | 190 | |
| | | 52.1% | 47.9% | 100.0% | |

In males the poor cognitive functioning was found in 7(58.3%) patients and in female patients the poor cognitive functioning was found in 22(37.9%) patients, the difference being statistically significant.

In patients having duration of disease ≤ 15 years the poor cognitive functioning was found in 81(48.5%) patients and in patients having BMI >15 years the poor cognitive functioning was found in 18(78.3%) patients, the difference being statistically significant.

**Table 2:** *Comparison of poor cognitive functioning between duration of disease*

| | | Poor cognitive Functioning | | Total | p-value |
|---|---|---|---|---|---|
| | | Yes | No | | |
| Duration of disease | ≤15 | 81 | 86 | 167 | 0.007 |
| | | 48.5% | 51.5% | 100.0% | |
| | >15 | 18 | 5 | 23 | |
| | | 78.3% | 21.7% | 100.0% | |
| Total | | 99 | 91 | 190 | |
| | | 52.1% | 47.9% | 100.0% | |

The patients on oral treatment the poor cognitive functioning was found in 7(31.8%) patients, patients on insulin the poor cognitive functioning was found in 29(40.3%) patients and patients on both treatment the poor cognitive functioning was found in 61(54.9%) patients, the difference being statistically significant.

## Discussion

In this study the poor cognitive functioning was found in 99(52.11%) patients with diabetic foot. According to Ryan et al., 24% of adolescents with early-onset diabetes (diagnosed before the age of six) exhibited clinically significant cognitive deficits, as opposed to 6% of patients with later-onset diabetes and 6% of non-diabetics.[8,9]

Walid M. Gamal et al. found that 40% of individuals exhibited overall cognitive impairment (MMSE 24) and that the mean Mini-Mental State Investigation "MMSE" score was 24.6. Both episodic memory impairment and MMSE impairment were associated with foot amputation and comorbidities in senior participants (aged 65). Psychomotor sluggishness and impairment in abstract processing were more likely in elderly patients with HbA1c >7%.[10] Studies have shown abnormalities in several cognitive areas in diabetic patients, however these findings were not found in adult participants. Patients with type 2 diabetes perform less quickly while processing information and have worse executive, memory, and attention skills.[11-13]

According to a research by Rania Naguib et al., 33.8% of participants had severe cognitive damage, while 80.3% overall had cognitive damage. Patients with severe cognitive damage had levels of HbA1c that were considerably higher, and as HbA1c levels rose, so did the

likelihood of cognitive damage.[14]

Compared to people without diabetes, people with midlife diabetes experience a 19% higher rate of cognitive impairment over the course of 20 years.[15] Worldwide, 415 million individuals have diabetes mellitus, and by 2040, it is expected that number would rise to nearly 640 million.[16]

In Saudi Arabia, 46% of people aged 60 and above have cognitive impairment, according to a research examining the prevalence of the condition.[17] According to a research done on people of younger ages; cognitive impairment was present 19.5% of the time.[18]

## Conclusion:

The study showed that significant cognitive impairment is seen in diabetic correlating statistically with age, male gender, duration of disease and need for insulin therapy in patients with diabetic foot.

**Ethical Approval:** The IRB/EC approved this study via letter no. CMH dated 01-11-2022.

**Conflict of Interest:** None

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**Authors' Contribution:** Role and contribution of authors followed ICMJE recommendations

## References

1. Armstrong DG, Boulton AJM, Bus SA. Diabetic Foot Ulcers and Their Recurrence. New England J Med. 2017;376(24):2367-75.
2. Zhang P, Lu J, Jing Y, Tang S, Zhu D, Bi Y. Global epidemiology of diabetic foot ulceration: a systematic review and meta-analysis. Ann Med. 2017; 49(2): 106-16.
3. Mishra SC, Chhatbar KC, Kashikar A, Mehndiratta A. Diabetic foot. BMJ. 2017;359:j5064.
4. Amin N, Doupis J. Diabetic foot disease: From the evaluation of the "foot at risk" to the novel diabetic ulcer treatment modalities. World J Diab. 2016;7(7):153-64.
5. Khan A, Junaid N. Prevalence of diabetic foot syndrome amongst population with type 2 diabetes in Pakistan in primary care settings. J Pak Med Assoc. 2017; 67(12): 1818-24.
6. J. A. The diabetic foot. Diabetes & Metabolic Syndrome: Clin Res Rev. 2016;10:(01):48-60.
7. Natovich R, Kushnir T, Harman-Boehm I, Margalit D, Siev-Ner I, Tsalichin D, et al. Cognitive dysfunction: part and parcel of the diabetic foot. Diab Care. 2016; 39(7):1202-7.
8. Ryan C, Vega A, Drash A. Cognitive deficits in adolescents who developed diabetes early in life. Pediatr. 1985;75(5):921-7.
9. Ryan CM. Diabetes and brain damage: more (or less) than meets the eye? Diabetologia. 2006;49(10):2229-33.
10. Gamal W, Abbas M, Mohamed A. Study of Cognitive Impairment between Diabetic Foot Patients. J Vasc Med Surg. 2018;6(369):2.
11. Kanaya AM, Barrett-Connor E, Gildengorin G, Yaffe K. Change in cognitive function by glucose tolerance status in older adults: a 4-year prospective study of the Rancho Bernardo study cohort. Arch Intern Med. 2004;164(12):1327-33.
12. Gregg EW, Yaffe K, Cauley JA, Rolka DB, Blackwell TL, Narayan KV, et al. Is diabetes associated with cognitive impairment and cognitive decline among older women? Arch Intern Med. 2000;160(2):174-80.
13. Van den Berg E, Reijmer Y, De Bresser J, Kessels R, Kappelle L, Biessels G. A 4 year follow-up study of cognitive functioning in patients with type 2 diabetes mellitus. Diabetologia. 2010;53(1):58-65.
14. Naguib R, Soliman ES, Neimatallah FM, AlKhudhairy NS, ALGhamdi AM, Almosa RS, et al. Cognitive impairment among patients with diabetes in Saudi Arabia: a cross-sectional study. Middle East Cur Psychiat. 2020; 27(1):1-11.
15. Rawlings AM, Sharrett AR, Schneider AL, Coresh J, Albert M, Couper D, et al. Diabetes in midlife and cognitive change over 20 years: a cohort study. Ann Intern Med. 2014;161(11):785-93.
16. Whiting DR, Guariguata L, Weil C, Shaw J. IDF diabetes atlas: global estimates of the prevalence of diabetes for 2011 and 2030. Diab Res Clin Pract. 2011;94(3):311-21.
17. Alkhunizan M, Alkhenizan A, Basudan L. Prevalence of mild cognitive impairment and dementia in Saudi Arabia: a community-based study. Dementia Geriatric Cognitive Disorders Extra. 2018;8(1):98-103.
18. Roy S, Kim N, Desai A, Komaragiri M, Baxi N, Jassil N, et al. Cognitive function and control of type 2 diabetes mellitus in young adults. North Am J Med Sci. 2015; 7(5):220.