Journal of Metabolic Syndrome
ISSN: 2167-0943

Eze, et al., J Metabolic Synd 2015, 4:1
DOI: 10.4172/2167-0943.1000171

Research Open Access

The Prevalence of Cognitive Impairment amongst Type 2 Diabetes Mellitus Patients at Abakaliki South-East Nigeria

Chukwuemeka O Eze[1*], Basil C Ezeokpo[1], Uma A Kalu[1] and Ikenna O Onwuekwe[2]

[1]*Department of Medicine, Federal Teaching Hospital Abakaliki (FETHA), Ebonyi State, Nigeria*

[2]*Department of Medicine, University of Nigeria Teaching Hospital (UNTH), Enugu, Nigeria*

[*]**Corresponding author:** Chukwuemeka O Eze, Department of Medicine, Federal Teaching Hospital Abakaliki (FETHA), Ebonyi State, Nigeria, Tel: 2347033432117; E-mail: drezeconauth@gmail.com

Received date: July 18, 2014; **Accepted date:** December 22, 2014; **Published date:** December 26, 2014

Abstract

Type 2 diabetes mellitus (DM) could be associated with cognitive impairment. The spectrum of cognitive impairment ranges from mild deficits that are not clinically detectable to the most severe clinical form, dementia. Some of the potential mechanisms include the effects of brain infarcts, white matter disease, hyperinsulinaemia, advanced glycosylated end products, and Lipoprotein related proteins (LRP). There is limited data on the prevalence of cognitive impairment amongst type 2 DM patients in south –east Nigeria. Therefore, this study was undertaken to determine the prevalence of cognitive impairment in type 2 DM patients attending a diabetic clinic in Abakaliki south-east Nigeria. It is a cross-sectional, descriptive and hospital based study carried out over a three months period (October 2013 to September 2014). Mini mental state examination (MMSE) was used for cognitive functions assessment and interpreted as follows; a score of 25-30 as normal, and ≤ 24 as cognitive impairment. The data was analyzed using Statistical Package for Social Sciences (SPSS) version 19 software. Out of 499 type 2 DM patients that were screened for the study, 450 were eligible for the study with male to female sex ratio of 2 (190):3 (260). The age range was 30-89 years with mean age of 59.43 ± 9.28 years. One hundred and eighty (40%) patients had cognitive impairment with male to female sex distribution of 55 (28.9%) and 125 (48.1%) respectively. Advanced age, low education attainment, unskilled occupation and presence of diabetic complications were the identified risk factors for cognitive impairment. Mini mental state examination should be a frequent tool in routine assessment of diabetic patients as it is simple and sensitive in detecting cognitive impairment. Also, identified modifiable risk factors should be corrected.

Keywords: Prevalence; Type 2 diabetes mellitus; Cognitive impairment; Abakaliki; Nigeria

Introduction

Diabetes mellitus currently assumes a pandemic status, with global prevalence of 366 million in 2011 and an expected rise to 552 million by 2030 [1]. It is the second most common non-communicable disease in Nigeria [2]. Type 2 diabetes mellitus (DM2) is associated with cognitive impairment [3]. The spectrum of cognitive impairment ranges from mild deficits that are not clinically detectable to the most severe clinical form, dementia. Epidemiological studies have shown that DM2 patients have a twofold increased risk of developing either vascular dementia or Alzheimer's disease [3,4].

Both cognitive impairment and DM2 are disorders that are more common in the elderly. This co-occurrence could mean that the processes that lead to DM2 also cause cognitive impairment or that cognitive impairment is a result of complications of DM2. Some of the potential mechanisms of cognitive impairment in DM2 include the effects of brain infarcts, white matter disease, hyperinsulinaemia, advanced glycosylated end products, and Lipoprotein related proteins (LRP) [5]. In addition, diabetes has been associated with increased deposition and decreased clearance of beta amyloid [6]. Furthermore, poor glycemic control and chronic episodes of hypo- or hyperglycemia may lead to microangiopathy, neuronal loss, and cognitive impairment [7]. Finally, diabetes is associated with macro- and microvascular cerebral disease, all of which may independently increase the risk of cognitive impairment [7].

This study was conducted at a tertiary health facility in Abakaliki South-east Nigeria. Abakaliki is the capital of Ebonyi state which has only one tertiary health facility. This hospital recieves referral from the state which has a population of about 4,339,136 and its environs. However, the pattern of cognitive impairment in DM2 patients in this area is not known. Therefore, this study was undertaken to determine the prevalence of cognitive impairment in DM2 patients attending a diabetic clinic in a tertiary hospital in Abakaliki. This will help fill the knowledge gap and also create baseline data for comparison with future studies.

Materials and Methods

This is a cross-sectional, descriptive and hospital based study carried out at the diabetes mellitus clinic of the federal teaching hospital Abakaliki (FETHA) over a 1 year months period (October 2013 to September 2014). The clinic sees about fifty diabetic patients weekly. An investigator administered pretested and semi-structured questionnaires were used to obtain data from eligible and consenting DM2 patients of both sexes. Systematic random sampling method that is one in every ten patients selected was used. DM2 was diagnosed in patients attending the clinic that are on oral anti-diabetic agent with or without insulin [8]. Patients with previous stroke, visual impairment, hearing impairment, and speech problems were excluded from the study. Mini mental state examination (MMSE) was used for screening

cognitive functions and interpreted as follows; a score of 25-30 as normal, ≤ 24 as cognitive impairment [9,10]. The data was analyzed using Statistical Package for Social Sciences (SPSS) version 19 software. The qualitative data were expressed as frequencies and percentages, while the quantitative data were summarized as means and standard deviation. The statistical significance was tested using Chi-square test and p-value<0.05 was regarded as statistically significant.

Results

Out of 499 DM2 patients that were screened for the study, 450 were eligible for the study with male to female sex ratio of 2 (190):3 (260).

Age range (years)	Male n (%)	Female n (%)	Total n (%)
30-39	7 (1.56)	27 (6.00)	34 (7.56)
40-49	30 (6.67)	54 (12.00)	84 (18.67)
50-59	44 (9.78)	85 (18.89)	129 (28.67)
60-69	81 (18.00)	63 (14.00)	144 (32.00)
70-79	24 (5.33)	24 (5.33)	48 (10.66)
80-89	4 (0.89)	7 (1.56)	11 (2.44)
Total	190 (42.23)	260 (57.77)	450 (100)

Table 1: The sex and age distribution

The age range was 30-89 years with mean age of 59.43 ± 9.28 years. The sex and age distribution was shown in Table 1.

Variable		Cognitive Function				
		Normal n(%)	Impaired n(%)	Chi-square	df	p-value
Sex	Male	132 (29.33)	58 (12.89)	12.3		0.0005
	Female	138 (30.67)	122 (27.11)			
Age	<65 yrs	195 (43.33)	100 (22.22)	13.29	1	0.0003
	≥ 65 yrs	75 (16.67)	80 (17.78)			
Education	None	9 (2.00)	68 (15.11)	180	3	<0.0001
	Primary	79 (17.56)	98 (21.78)			
	Secondary	62 (13.78)	5 (1.11)			
	Tertiary	120 (26.67)	9 (2.00)			
Occupation	Civil servant	120 (26.67)	29 (6.44)	82.67	3	<0.0001
	Trader	78 (17.33)	59 (13.11)			
	Farmer	24 (5.33)	74 (16.44)			
	Artisan	48 (10.67)	18 (4.00)			
Family history of DM2	Absent	169 (37.56)	126 (28.00)	2.62	1	0.105
	Present	101 (22.44)	54 (12.00)			
Age at onset of DM2	<40 yrs	96 (21.33)	57 (12.67)	0.73	1	0.3935
	≥ 40 yrs	174 (38.67)	123 (27.33)			
Duration of DM2	<5 yrs	101 (22.44)	66 (14.67)	0.03	1	0.874
	≥ 5 yrs	169 (37.56)	114 (25.33)			

Table 2: Cognitive function and demographics of the study population

Variable		Cognitive Function				
		Normal n(%)	Impaired n(%)	Chi-square	df	p-value
FBG	<110	64 (14.22)	36 (8.00)	0.86	1	0.3546
	≥ 110	206 (45.78)	144 (32.00)			
CXS	Absent	138 (30.67)	32 (7.11)	51.05	1	<0.0001
	Present	132 (29.33)	148 (32.89)			
BP	Normal	211 (46.89)	143 (31.78)	0.11	1	0.742
	High	59 (13.11)	37 (8.22)			
Drugs Metformin only		94 (20.89)	69 (15.33)	0.58	1	0.4467
Metformin and Daonil		176 (39.11)	111 (24.67)			

Table 3: Cognitive functions and the clinical features of the study population. FBG=Fasting Blood Glucose; CXS=Complications; BP=Blood Pressure

Discussion

Cognitive impairment as defined by MMSE ≤ 24 was noted in 44% of the DM2 patients studied (Tables 2 and 3) [10]. This prevalence rate was high when compared to some other hospital based studies, but closely approximates 36% reported in India [11-13]. The difference could come from the varying tools for assessment of cognitive functions used in the studies and also the socio-demographics of the study populations. For instance, about 60% of the study population had primary or no formal education.

Slightly less than half (47%) of the female patients had cognitive impairment as compared to less than a third of their male counterpart (31%). This difference is statistically significant (p=0.0005). This is similar to the report of Zhang et al. [11]. This could result from early deprivation from formal education, perhaps lowering their brain "reserve", allowing the symptoms of cognitive impairment to appear at an earlier date during disease progression as alluded to by Zhang et al. [11]. Also the effects of female sex hormones could not be excluded [14]. Oestrogens are known to be a protective factor in development of cognitive impairment and most of the female patients in this study were postmenopausal.

There was statistically significant association between cognitive impairment and advanced patients age, low education attainment, unskilled occupation, and the presence of DM complications.

Advanced (≥ 65 years) age is associated with increased prevalence of cognitive impairment. This has multiple explanations. First, advanced age is a very strong independent risk factor for development

of cognitive impairment. Ageing process is characterized by the deposition of some insoluble protein metabolic products like senile plaques which results in neuronal death by apoptosis. This induces cerebral atrophy and attendant cognitive impairment [11]. Also, the preponderance of other risk factors for cognitive impairment in advanced age like stroke, dyslipidaemia, hypertension and cardiac diseases are also implicated.

Low education attainment was associated with higher prevalence of cognitive impairment. Illiteracy is an independent risk factor for cognitive impairment as the brain is not well developed resulting in reduced cognitive reserve. Also, illiterates are usually more involved in unhealthy lifestyle practices like smoking and excessive use of alcoholic drinks. Furthermore, they may be involved in unhealthy feeding habits and may not have access to adequate medical care. All these increase their risk of developing cognitive impairment. This finding is similar to the report in China [11].

Unskilled occupation like peasant farming was associated with higher prevalence of cognitive impairment. This is because those involved in unskilled occupation are mainly illiterates and those with mental retardation. They did not have the privilege of formal education or could not cope with the rigors of formal education and of skilled occupation. This is also similar to the report of Zhang et al. [11].

The presence of complications of DM was associated with cognitive impairment. Evidence suggests that the pathogenesis of cognitive impairment in DM2 is similar to that of the chronic diabetic complications [5-7]. This then makes it invariable to expect cognitive impairment whenever other chronic complications of DM2 are present.

There is no significant association between duration of DM2, presence of hypertension and family history of DM with cognitive impairment. DM2 is usually diagnosed several years after the actual onset of the disease. This is because of apparent subclinical manifestation of early DM2 for several years. In other words, the duration from point of diagnosis is gross under estimation of the correct duration. This makes it an unreliable means of classification of DM2.

It is surprising that there was no significant association between hypertension and cognitive dysfunction owing to the fact that hypertension is an independent risk factor [15]. This could result from the number of the study population which is relatively small though it was calculated using WHO formula for sample size in a finite population. Also the effects of the confounding variables could not be excluded as about 60% of the study populations were illiterates.

Conclusion

The prevalence of cognitive impairment is high amongst DM2 patients seen at Abakaliki south east Nigeria with female preponderance. Advanced age, low education attainment, unskilled occupation and presence of DM complications were the identified risk factors. MMSE should be a frequent tool in routine assessment of diabetic patients as it is simple and sensitive. There should be legislation on compulsory female education in order to reduce the impact of illiteracy on their cognition. Also, modifiable risk factors should be corrected if present as management of severe cognitive impairment is rather disappointing.

Acknowledgement

We wish to acknowledge the staff of the medical records department of Federal Teaching Hospital Abakaliki for retrieving the data for the study.

References

1. Whiting DR, Guariguata L, Weil C, Shaw J (2011) IDF diabetes atlas: global estimates of the prevalence of diabetes for 2011 and 2030. Diabetes Res Clin Pract 94: 311-321.
2. Akinkugbe OO (1997) (ed): Diabetes Mellitus. In non-communicable diseases in Nigeria; final report of a national survey. Lagos Fed Min of Health and social services 64-90.
3. Stewart R, Liolitsa D (1999) Type 2 diabetes mellitus, cognitive impairment and dementia. Diabet Med 16: 93-112.
4. Peila R, Rodriguez BL, Launer LJ; Honolulu-Asia Aging Study (2002) Type 2 diabetes, APOE gene, and the risk for dementia and related pathologies: The Honolulu-Asia Aging Study. Diabetes 51: 1256-1262.
5. Luchsinger JA (2012) Type 2 diabetes and cognitive impairment: linking mechanisms. J Alzheimers Dis 30 Suppl 2: S185-198.
6. Sasaki N, Fukatsu R, Tsuzuki K, Hayashi Y, Yoshida T, et al. (1998) Advanced glycation end products in Alzheimer's disease and other neurodegenerative diseases. Am J Pathol 153: 1149-1155.
7. Roberts RO, Geda YE, Knopman DS, Christianson TJ, Pankratz VS, et al. (2008) Association of duration and severity of diabetes mellitus with mild cognitive impairment. Arch Neurol 65: 1066-1073.
8. Odusan O, Familoni OB, Raimi TH (2008) Correlates of cardiac autonomic neuropathy in Nigerian patients with type 2 diabetes mellitus. Afr J Med Med Sci 37: 315-320.
9. Folstein MF, Folstein SE, McHugh PR (1975) "Mini-mental state". A practical method for grading the cognitive state of patients for the clinician. J Psychiatr Res 12(3): 189-98.
10. Mungas D (1991) In-office mental status testing: a practical guide. Geriatrics 46: 54-58, 63, 66.
11. Zhang MY, Katzman R, Salmon D, Jin H, Cai GJ, et al. (1990) The prevalence of dementia and Alzheimer's disease in Shanghai, China: impact of age, gender, and education. Ann Neurol 27: 428-437.
12. Ugoya SO, Agaba EI, Ladep NG, Puepet FH, Ogunniyi A (2008) Cognitive Dysfunction in Diabetes Mellitus in Jos, North-Central Nigeria. Hung Med J 2: 215-219.
13. Kataria L, Pandya H, Shah S, Shah H, Gerg R (2013) Prevalence And Pattern Of Cognitive Dysfunction In Type 2 Diabetes Mellitus. Int J Med and Appl Sci 2: 246- 247.
14. Hogervorst E (2013) Effects of gonadal hormones on cognitive behaviour in elderly men and women. J Neuroendocrinol 25: 1182-1195.
15. Reitz C, Tang MX, Manly J, Mayeux R, Luchsinger JA (2007) Hypertension and the risk of mild cognitive impairment. Arch Neurol 64: 1734-1740.