Prevalence of Psychiatric Morbidity and Cognitive Impairment among Patients Attending the Rural Noncommunicable Disease Clinic

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Abstract

Objective This study aimed to assess the prevalence of cognitive impairment and psychiatric morbidity among the patients attending the rural noncommunicable disease clinic after controlling for various confounders (i.e., psychological morbidity, obesity, gender, level of education, duration of the illness and age).

Materials and Methods One-hundred twenty-four patients were evaluated on the Hindi Mental State Examination for the cognitive function, Physical Health Questionnaire-9 for depression, and Generalized Anxiety Disorder-7 for anxiety disorders.

Results About one-fourth (26.6%) of the participants had cognitive impairment. The prevalence of cognitive impairment was more among patients with hypertension (35.5%) as compared with the diabetes mellitus (13.6%) and those with comorbid hypertension and diabetes mellitus (26.6%). About one of the participants had depression (35.5%) and 29% of the patients had anxiety disorder. No significant difference was found in the level of cognitive deficits between those with hypertension and diabetes mellitus, when the confounding factors were not taken into account in the analysis. However, after controlling for psychiatric morbidity, obesity, gender, level of education, duration of the illness and age, those with hypertension were found to have significantly higher level of cognitive impairment compared with those with diabetes mellitus. A higher level of dysfunction was seen in the domains of orientation, registration, attention, recall, language, and visuospatial domains.

Keywords
► cognitive impairment
► noncommunicable disease
► psychological morbidity
► cognitive neuroscience

Conclusion Present study suggests that patients of hypertension have higher level of cognitive impairment, when compared with those with diabetes mellitus, even after controlling for various confounders. Lack of difference between the two groups can be accounted by the confounding variables.

Introduction

Among all major health threats to emerge in the 21st century, none has challenged the foundations of public health as profoundly as the rise of chronic noncommunicable diseases (NCDs). The common NCDs include hypertension (HTN), diabetes mellitus (DM), ischemic heart diseases, cancers, osteoporosis, and chronic kidney diseases. The burden of NCDs is rising rapidly and remains among the most common cause of mortality and morbidity in the world.[1] As per the World Health Organization (WHO), more than 3.6 crore death occurred each year from the NCDs with majority of the death occurring in developing countries such as India and China.[2] Among the various NCDs, cardiovascular and DM

are the leading causes of mortality and morbidity across the world.[3,4] Looking at the current trend, by 2020, 73% of deaths and 60% of the disease will be attributable to NCDs globally.[5] As per WHO, in India in cardiovascular diseases are the most common NCDs which cause deaths (24%), followed by respiratory diseases (11%), injuries (10%), and others(10%).[6] Among NCDs, diabetes and HTN have a rising trend. It is projected that size of HTN group is expected to increase by 108% in India by 2050.[7,8] By 2030, the number of people with diabetes will increase from 40.6 million to 79.4 million.[8-10]

Studies from across the world have shown the association between NCDs and the decline of cognitive function leading to mild cognitive impairment (MCI) or dementia.[11-14] However, the etiological pathway of this relationship is not known. MCI is the transitional phase between the normal aging process and dementia.[15,16] The cognitive decline can impair the quality of life and also increase the burden on the patient as well as to their caregivers, leading to more financial constraints, stigmatization, increase distress, and isolation from the society.[13]

Studies around the world showed that patients with NCDs reported prevalence of cognitive impairment (CI) to be 1.7 to 40%.[17-19] Studies from India too suggest prevalence of CI to be around 4.6 to 10.8% in NCDs and have found a significant association between the NCDs and CI.[11-14,16,20] In recent years, there are accumulating epidemiological evidence that HTN and diabetes are important risk factors for MCI and dementia.[21-26]

Research showed that midlife DM had been associated with the occurrence of CI.[27-29] In terms of specific domains of cognitive functions, DM has been associated with impaired verbal memory, impaired attention, decreased executive function and processing and motor speed.[30-32] The risk factors for cognitive dysfunction in DM include obesity, female gender, hyperglycemia or poor glycemic control, the extremity of age, longer duration of illness, presence of microvascular complications, presence of comorbid depression, anxiety, and HTN.[14,33-38]

The relationship between HTN and CI has also been documented, but findings are inconsistent, with few studies suggesting that high blood pressure (not necessarily HTN) is associated with CI[39,40] and others suggest an association of CI with low blood pressure[41,42] and a few suggest a "U"-shaped relationship between blood pressure and cognitive functioning.[43] However, a few studies reporting no association,[44,45] majority of the studies support the association of cognitive decline and HTN.[46-48] Risk factors associated with CI include female gender, poor medication compliance, poorly controlled blood pressure, elderly age, low level of education, higher number of medication, active treatment, the type of cognitive assessment scale, presence of comorbid depression, and DM.[24,49,50]

Patients with NCDs have also been shown to have a high prevalence of mental disorders. In HTN, the prevalence of depression varies from 15 to 58.1%[51,52] and that for anxiety disorders varies from 5 to 42.3%.[51,53] The rate of depression in patients with DM ranges from 14 to 41%.[54,55] Those with comorbid DM and HTN, the prevalence rate of depression

and anxiety rises up to 60.9%.[56] The coexistence of the NCDs and mental disorders has an important implication in terms of prognosis, quality of life, cost-effectiveness, general well-being, and expectancy of life.[57,58] The presence of psychiatric illness among patients with physical illnesses leads to poor treatment adherence, poor lifestyle, increased cost of the treatment, poor quality of life, worsening of physical illness, work absenteeism, increased hospital visits, poor self-care, and higher mortality.[59-61]

Studies that have assessed CI in NCDs have not controlled for various confounding variables, such as depression, anxiety, obesity, gender, level of education, duration of the illness, and age of the participants, which can also influence cognitive functioning. Accordingly, there is a need to control for these variables to have a better understanding of the prevalence of CI among patients with NCDs. Thus, the current study aimed to evaluate prevalence of CI among patients with NCDs attending the NCD clinic at the rural health clinic (RHC) in Naraingarh, North India, after controlling for depression, age, obesity, gender, level of education, duration of the illness, and anxiety.

Materials and Methods

It was a cross-sectional study conducted among the patients attending the NCDs clinic of a community RHC run in collaboration with the Postgraduate Institute Medical Education and Research (PGIMER), Chandigarh. This clinic was established exclusively for patients suffering from diabetes mellitus, HTN, hypothyroidism, and rheumatoid arthritis. The clinic runs every Tuesday and Thursday in a rural community health center, Nariangarh. On average, 40 to 50 patients attend the clinic each day and avail the health services. The medications are available free of cost at the rural community health center. At a stretch, medications are dispensed for a maximum of 2 weeks.

A faculty member from the Department of School of Public Health, PGIMER, Chandigarh, is the in-charge of the clinic, and the services are mainly provided by a senior resident and junior residents from the Department of School of Public Health, under the supervision of the faculty member. Other staff of the NCD clinic includes the nursing staff, public health nurse, and health worker.

The study period was from June to July 2018. At the time of the beginning of the study, 208 patients were registered with the NCD clinic. A majority of patients were suffering from HTN, diabetes, or both; only a few patients diagnosed with rheumatoid arthritis or hypothyroidism.

The approval was obtained from Ethics Committee of the Institute. To be included in the study, the study participants should be ≥ 18 years old of either gender and cooperative for physical and mental status examination, who provided the written informed consent. Patients who refused to give consent and were severely ill, had a history of mental illness, were on psychotropics, or had severe visual and auditory impairment to interfere in the formal assessment were excluded.

All adult patients attending NCD clinic were approached, explained about the study, and those fulfilling the selection

criteria were recruited into the study. Senior resident doctors, involved in the NCD clinic, recruited the patients and administered instruments for assessment of cognitive functions, depression, and anxiety.

Those patients who screened positive for psychiatric illness (depression, anxiety, or CI) were referred to a psychiatric out-reach outpatient clinic for further evaluation. The psychiatric out-reach outpatient's clinic runs every Wednesday by the Department of Psychiatry, PGIMER, Chandigarh, in collaboration with the Department of School of Public Health and Community Health Center of Naraingarh.

Instruments

Hindi Mental Status Examination (HMSE): Cognitive functions were assessed by using HMSE. This is designed mainly for illiterate Hindi speaking population. It can be said that this a modified version of mini-mental state examination (MMSE) with a less emphasis on calculation ability.[62] It is a validated tool to evaluate cognitive decline. The sensitivity and specificity of the scale are 94 and 98%, respectively.[63,64] Many researchers have used it for screening not only for dementia but also for delirium, but the authors did not present the detailed scores. Hence, the HMSE suitably adapted for the participants. In the current study, those with HMSE scores ≤ 25 were considered "cognitively impaired"[64].

Patient Health Questionnaire-9 (PHQ-9): Hindi version of this tool was used to assess depression. It is a self-report questionnaire, which comprises of nine items, each evaluating the Diagnostic and Statistical Manual (DSM) of Mental Disorders criteria of depression, rated as "0" (not at all) to "3" (nearly every day). Score ≥10 has a sensitivity of 88% and a specificity of 88% for the diagnosis of major depression made by a mental health profession. We used the cutoff of 10 for making the diagnosis of depression.[65]

Generalized Anxiety Disorder-7 (GAD-7) scale: It is a 7-item scale with good reliability as well as a criterion, constructs, procedural, and factorial validity. Mild, moderate, and severe levels of anxiety are interpreted on the cutoff points of 5, 10, and 15. There is a good agreement between self-report and interviewer-administered versions of the scale. However, the diagnostic threshold has been reported to be a cutoff score of 10 or more. In the present study, a cutoff score of 10 or more was used to make the diagnosis of an anxiety disorder, which has been used in the previous studies.[66,67]

Sociodemographic profiles such as age, gender, type of family, socioeconomic status, occupation, marital status, number of years of education, and locality were recorded.

Details of the NCD, such as type of NCDs (HTN, DM, or both), duration of illness, age of onset, blood pressure, height in centimeters, weight in kilograms, were recorded. The height was measured by making the patient stand with their back against a fixed wall by using a stadiometer. The weight was measured by using a particular standard weighing machine. The blood pressure was recorded by using a mercury sphygmomanometer; the standard location of the measurement was the brachial artery.

Statistical Analysis

The statistical analysis was performed using SPSS 14.0 for Windows (SPSS for Windows, Version 14.0. Chicago, SPSS Inc., Chicago, Illinois, United States). Descriptive analysis was performed using mean and standard deviation (SD) with a range for continuous variables. Descriptive analysis was computed as frequency and percentages for discontinuous variables. For the inferential analysis, correlation analysis was done. Analysis of covariance was applied to see the relationship between the domain of the HMSE and NCDs. The dependent variables were DM, HTN, and comorbid HTN and DM. The independent variables were the mean score of the HMSE and various domains of the HMSE. The covariates were age, gender, duration of the illness, age of onset, depression, anxiety, body mass index (BMI), and education.

Results

One-hundred twenty-four participants were recruited into the present study. Mean age of the participants was 55.5 years (range: 26–90, SD: 11.9). The mean number of years of education was 5.7 (SD: 5.2). A majority of the participants were from a rural background and were not on any paid employment. About two-thirds were females. A little more than one-third (*n* = 48, 38.7%) patients were diagnosed with HTN only, one-sixth (*N* = 22; 17.7%) were diagnosed with DM only, and 54 (43.5%) patients were diagnosed with both HTN and DM. The mean BMI of the participants was 27.3 kg/m^2 (►**Table 1**).

In terms of cognitive functions, the mean total score of the study sample was 26 (SD: 4.1), and 33 (26.6%) patients had HMSE score ≤24, indicating possible CI. A slightly more than one-third of the study participants were diagnosed with depressive disorder (*n* = 44, 35.5%) and 29% (*n* = 36) of the participants were diagnosed with an anxiety disorder. One-fourth of patients had both depressive and anxiety disorders. In general, CI was higher among patients with psychiatric morbidity (►**Table 2**).

Relationship of Cognitive Functions with NCDs

To assess the impact of NCDs on cognitive functions, the study sample was divided into three groups: DM (Group-I), HTN (Group-II), and those with both (Group-III). When the three groups were compared, no significant differences were seen. However, when age, gender, duration of illness, number of year of education, mean score of PHQ-9, mean score of GAD-7, and mean BMI were taken as covariates as is evident from ►**Table 3**, patients with HTN performed poorly than those with DM on all the domains of HMSE and had significantly lower HMSE score. When the combined DM and HTN group was compared with those with only DM, combined group had significantly scored low on HMSE, performed poorly on attention, language and visuospatial abilities. On the similar lines, when the combined group was compared with those with HTN only, significant differences were noted for total HMSE score and all the domains of HMSE except for recall,

Table 1 Sociodemographic and clinic profile

Variables	Mean/frequency (n = 124)
Age (in years)	55.1 (11.9)
Sex—female	83 (66.9%)
Marital—married	100 (80.6%)
Education (number of years)	5.7 (5.2)
Duration of illness (in months)	63.4 (65.1) (range: 1–364)
Occupation—not on paid employment	90 (72.6%)
Income (patient)	4,394.0 (9,639.8)
Socioeconomic status—lower/ middle/upper	65(52.4%)/55 (44.4%)/ 4 (3.2%)
Type of family—extended/joint	68 (54.8%)
Locality—rural	120 (96.8%)
Primary diagnosis	
Hypertension	48(38.7%)
Diabetes Mellitus	22 (17.7%)
Hypertension+ diabetes mellitus	54 (43.5%)
Mean duration of illness (in months)	63.4 (65.1)
Systolic blood pressure in mm Hg	134.5 (16.2)
Diastolic blood pressure in mm Hg	81.1 (10.1)
Body mass in Index in kg/m²	27.3 (5.5)

with patients with HTN only performing poorly than those with both HTN and DM.

Discussion

In developing countries such as India, the prevalence of NCDs and the elderly population is increasing rapidly. Despite these facts, so far, CI in patients with NCDs largely remains neglected. The present study shows prevalence of CI in patients with NCDs was 26.6%, the prevalence of depression was 35.5%, and that of anxiety disorder was 29%. One-fourth of patients had both depressive and anxiety disorders. Previous studies from India, which have evaluated prevalence of CI in elderly (aged >65 years) by using the HMSE or modified MMSE, report prevalence to vary from 3.5 to 11.5%.[63,68-72] However, none of these studies have been done specifically among the subjects with NCDs. Findings of the current study are compared with these studies, and it is evident that prevalence of CI is more in patients with NCD. Existing data from other parts of the world suggest that the prevalence of dementia in patients with NCD ranges from 2.34 to 38.6%[73-78] and the current study also reported within range. Among patients with DM, the prevalence of CI in the present study was 13.63%. Previous studies from India, which have assessed CI in DM, have reported prevalence rates of 11.6,[13] 13.7 to 16.9,[9] and 33.7%,[12] respectively; present study also reported within the range. Similarly, prevalence of CI among patients with HTN in the present study was 31.2%. Previous

studies from India, which were conducted among patients with HTN, have reported prevalence rates of reported 11.9[13] and 13%,[79] respectively. Findings of the present concur with the available literature. Prevalence of CI among those with both DM and HTN was 26.6%, and this is also supported by the existing literature, which suggests higher prevalence rates when patients have both illnesses.[49,80,81] These findings suggest that patients with NCDs form a high-risk group for CI and dementia. Accordingly, there is a need to screen these patients routinely for cognitive functioning, and these patients must be provided information about the development of CI, factors contributing to the same, lifestyle changes, and cognitive exercises to prevent CI and early detection.

In the present study, psychiatric morbidity was found in 39.51% of the patients, with depression in 35.5% and anxiety disorder in 29.9% of cases, with a majority of them having comorbid depression and anxiety. These prevalence figures are in the reported range in the available literature for psychiatric morbidity among patients with NCD, DM, and HTN from India and abroad.[82]

The present study also supports the existing literature that prevalence of CI is higher in the presence of psychiatric morbidity in the form of depression and anxiety disorders.[14,38]

Very few studies have compared the CIs among patients with DM, HTN, and both, after controlling for various confounding variables. In the present study, after controlling for the covariates (age, gender, duration of illness, number of year of education, mean score of PHQ-9, mean score of GAD-7, and BMI) when patients of HTN and DM were compared, patients with HTN were found to have significantly higher level of CI. Further, the higher level of dysfunction was seen in the domains of orientation, registration, attention, recall, language, and visuospatial domains. These findings suggest that HTN possibly has a more negative impact on cognitive functions when compared with DM.

When patients with DM were compared with those with both DM and HTN, those with both the illnesses had higher impairment in the form of lower HMSE score, impairment in attention, language, and visuospatial domains. Similarly, when HTN group was compared with those with both HTN and DM, those with both the illnesses had higher impairment in the form of lower HMSE scores and lower scores in all the domains, except recall. These findings provide preliminary evidence about the differential effect of DM and HTN on cognitive functions.

A small sample size limits the present study. Only HMSE was used to screen for a cognitive profile, which has its limitations. Psychiatric morbidity was evaluated by using PHQ-9 and GAD-7, and the mental health professionals did not confirm the diagnosis. The assessment was cross-sectional. The study did not asses the cognitive profile before the illness, and hence, it cannot be said that the level of cognitive deficits noted can be attributed to the NCDs only. The study did not evaluate the course of the NCDs and fluctuation in the symptoms. Similarly, other factors, such as dietary patterns and lifestyle, were not assessed. The study did not have a comparative group without NCDs.

To conclude, the present study suggests that about one-fourth of patients with NCD have CI and 39.51% have

Table 2 Cognitive profile, depressive, and anxiety symptoms as per HMSE

Variables	Score (mean)[range]
Orientation	9.4 (1.1) [5–10]
Registration	2.8 (0.4) [1–3]
Attention	4.3 (1.1) [1–5]
Recall	2.2 (0.7) [0–3]
Language	7.4 (1.6) [3–9]
Visuospatial	1.6 (1.2) [0–3]
Total	26.0 (4.1) [12–30]
Severity	
Normal (≥25)	91 (73.4%)
Cognitively impaired (≤ 24)	33 (26.6%)
HMSE score (≤ 24)	
Among patients with hypertension	15 (31.25%)
Among patients with diabetes mellitus	3 (13.63%)
Among patients with both hypertension and diabetes mellitus	15 (27.77%)
Among patients of hypertension without psychiatric morbidity	9 (28.12%)
Among patients of hypertension with psychiatric morbidity	6 (37.5%)
Among patients of diabetes mellitus without psychiatric morbidity	1 (7.7%)
Among patients of diabetes mellitus with psychiatric morbidity	2 (22.22%)
Among patients with both hypertension and diabetes mellitus and without psychiatric morbidity	8 (26.6%)
Among patients with both hypertension and diabetes mellitus and with psychiatric morbidity	7 (29.16%)
PHQ severity	
Normal or no depression (<10)	80 (64.5%)
Depression (≥10)	44 (35.5%)
PHQ total score	8.3 (6.9)
Prevalence of depression according to NCDs	
Hypertension (n = 48)	14 (29.2%)
Diabetes (n = 22)	9 (40.9%)
Co-morbid hypertension + diabetes mellitus (n = 54)	21 (38.9%)
Psychiatric morbidity in patients with hypertension	16 (33.33%)
Psychiatric morbidity in patients with diabetes mellitus	9 (40.9%)
Psychiatric morbidity in patients with hypertension and diabetes mellitus	24 (44.44%)
Number of patients with psychiatric morbidity	49 (39.51%)
GAD severity	
Normal or no anxiety disorder	88 (70.96%)
Anxiety disorder	36 (29.0%)
Total score	7.0 (6.2)
Prevalence of anxiety according to NCDs	
Hypertension	14 (29.2%)
Diabetes mellitus	6 (27.3%)
Comorbid hypertension+diabetes mellitus	16 (29.7%)
Comorbid (anxiety+ depressive) disorder	31 (25.0%)

Abbreviations: GAD, generalized anxiety disorder; HMSE, Hindi Mental State Examination; NCD, noncommunicable diseases; PHQ, patient health questionnaire.

Table 3 Correlation of cognitive profile with the NCDs

Variables	Whole group (n = 124)	Hypertension Group I (n = 48)	Diabetes Group II (n = 22)	Diabetes + hypertension Group III (n = 54)	F-Value	p-Value	Comparison of Group I vs. II ANCOVA F-value (p-value)	Comparison of Group II vs. III ANCOVA F-value (p-value)	Comparison of Group I vs. III ANCOVA F-value (p-value)
Total HMSE score	26.0 (4.1)	25.3 (4.3)	27.8 (2.5)	25.9 (4.3)	2.894	II>III>I	5.901 (<0.001)[a]	2.786 (0.010)[b]	4.595 (<0.001)[a]
Orientation	9.4 (1.1)	9.2 (1.2)	9.8 (0.5)	9.3 (1.3)	2.567	II>III>I	3.659 (0.002)[c]	1.886 (0.077)	2.995 (0.005)[c]
Registration	2.8 (0.4)	2.7 (0.4)	2.8 (0.4)	2.8 (0.4)	0.806	II=III>I	2.906 (0.008)[c]	1.300 (0.259)	2.803 (0.008)[c]
Attention	4.3 (1.1)	4.2 (1.1)	4.7 (0.8)	4.3 (1.2)	2.016	II>III>I	3.417 (0.003)[c]	2.646 (0.014)[b]	2.967 (0.005)[c]
Recall	2.2 (0.7)	2.0 (0.7)	2.5 (0.5)	2.1 (0.7)	5.055	II>I[c] II>III[b] III>I	2.779 (0.011)[b]	1.513 (0.169)	1.842 (0.079)
Language	7.4 (1.6)	7.2 (1.7)	7.9 (1.2)	7.3 (1.6)	1.431	II>III>I	5.987 (<0.001)[a]	4.109 (<0.001)[a]	5.371 (<0.001)[a]
Visuospatial	1.6 (1.2)	1.5 (1.3)	2.0 (1.0)	1.6 (1.2)	1.229	II>III>I	6.483 (0.001)[a]	3.651 (0.001)[c]	5.029 (<0.001)[a]

Abbreviations: ANCOVA, analysis of covariance; BMI, body mass index; GAD, generalized anxiety disorder; HMSE, Hindi Mental State Examination; NCD, noncommunicable diseases; PHQ, patient health questionnaire.
[a]$p < 0.001$
[b]$p < 0.05$
[c]$p < 0.01$
Note: covariates = age, gender, education, duration of illness, BMI, PHQ total, GAD total.

psychiatric morbidity. The present study also suggests that prevalence of CI is higher among patients of NCD with psychiatric morbidity. When severity and prevalence of CI are compared between patients of HTN and diabetic, it was seen that prevalence and severity of cognitive deficits are higher among patients with HTN. Hence, it can be said that patients with NCDs should be routinely screened for cognitive functioning and these patients must be provided information about the development of CI, factors contributing to the same, lifestyle changes and cognitive exercises to prevent CI and early detection. Similarly, these patients must also be routinely screened for psychiatric morbidity and this must be treated adequately.

Conflict of Interest
None declared.

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