ORIGINAL ARTICLE

Correlation between cognitive impairment and depressive mood of Thai elderly with type 2 diabetes in a primary care setting

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Abstract

Objective: The objective of this study was to evaluate the relationship between cognitive impairment and depressive mood in Thai elderly with type 2 diabetes at primary care centres.

Materials and methods: Two-hundred and eighty three (283) older people with type 2 diabetes were enrolled in this study. Mini-Cog and mini-mental state examination (MMSE) Thai 2002 were used to measure cognitive impairment while Thai geriatric screening test (TGDS) was used to measure depressive mood in all participants. Spearmen correlation was applied to determine the relationship between cognitive function and depressive mood.

Results: There was a positive relationship between cognitive impairment and depressive mood in older people with type 2 diabetes. The scores from Mini-Cog and MMSE Thai 2002 were negatively correlated with TGDS scores while adjusting for the effects of age and years of education with rs = –0.1, p = 0.06 and rs = –0.2, $p<0.01$, respectively. Although it showed an inverse relationship of the scores between cognitive and depressive mood screening tests, the results between the tests were positive when interpreting the test scores. It means that the higher score in Mini-Cog and MMSE Thai 2002 (non-cognitive impairment) were associated with the lower score in TGDS (non-depressed mood).

Conclusion: The finding of this study showed that older people with type 2 diabetes who had cognitive impairment seemed to have depressive mood. Hence, these two co-morbidities should be considered in order to give an optimal care to older people with diabetes.

Introduction

The prevalence of type 2 diabetes increases with age.[1] More than 80% of people with diabetes live in low-and middle-income countries.[2] Diabetes care is important in lowering blood glucose level and maintaining a good metabolic control in order to help prevent complication of diabetes. For successful diabetes self-management, individuals must commit to lifelong daily self-care tasks such as adhering to diet, exercise, medication regimens and checking blood glucose level. The coordination of these tasks often requires complex cognitive functioning.[3]

Research has linked the disease to cognitive impairment in the elderly.[4,5] Recent evidence from epidemiological studies suggests that type 2 diabetes is a risk factor for cognitive impairment and dementia, both the vascular dementia (VaD) and Alzheimer's disease (AD)—the two most common forms of dementia.[6–9] Older individuals (aged 60–80 years) with type 2 diabetes are associated with approximately 1.5 fold risk of cognitive impairment compared to the group without diabetes.[10] Given the potential for cognitive problems to interfere with the attempts to diabetes self-care management and following a physician's recommendation, cognitive decline among elderly with diabetes could lead to further decline in health.[11]

Another problem which may relate to cognitive impairment and affect self-care diabetes is depressive mood. Depression is a

common comorbidity of type 2 diabetes.[12,13] People with diabetes are likely to suffer twice as often from depression as those without diabetes. Depressive symptoms may hinder diabetic patients' ability to adhere to diet, physical activity and oral medication.[14–16] Moreover, depression by itself is the most common reversible causes of cognitive impairment or pseudodementia, particularly in memory part.[17,18]

In Thailand, diabetes mellitus is one of the important public health concerns.[19,20] Recent economic change, reflected by rapid industrialisation, urbanisation and increased wealth at both national and household levels contribute to change of lifestyles, in particular high fat food diet and less physically active patterns. As mentioned earlier, type 2 diabetes is a major and complex public health problem accompanied with several complications and comorbidities, diabetes self-management activities require complex cognitive functioning.[21] Cognitive decline and depression are common, but often overlooked.[22] To date, there is no investigation of the relationship between cognitive impairment and depressive mood in diabetes, particularly in a Thai primary care setting. A primary care centre in Thai community (rural areas or sub-district level) is the first place of healthcare service that provides primary healthcare, prevention and promotion.[22] The purpose of this study was to identify and describe the relationship between cognitive function and depressive mood. This study intended to stimulate the healthcare providers' awareness of the potential link between cognitive function and depressive mood in type 2 diabetes for improving multidisciplinary practice and patients care.

Material and methods

A cross-sectional study was carried out from January to April, 2012 in all the 13 primary care centres in San-sai district, Chiang Mai, Thailand. A total of 283 consecutive patients aged 60 years and more with type 2 diabetes who have had at least 1 year of diagnosis (either control or uncontrolled blood sugar), were assessed. Participants excluded from the study were those with a previous diagnosis of either VaD or AD; presence of a formal diagnosis of depressive disorder, schizophrenia, or epilepsy; were receiving medical treatment with psychoactive drugs (anticholinergics, anticonvulsants, antiparkinsonians or major tranquilizers); had any cerebrovascular accident history or complicated hypertension or renal failure and or communication difficulties, which need an interpreter. The study was conducted in accordance with the declaration of Helsinki and approved by ethics committees of Ministry of Public Health, Thailand.

Screening assessments

The researcher screened the cognitive impairment and depressive mood in all participants using the following instruments.

Cognitive screening tests

• Mini-Cog

Mini-Cog was developed as a very brief screening tool for primary care settings.[23,24] It consists of two orally presented tasks (a three-item word recall) combined with an executive clock drawing task (CDT). It takes 3 min to administer the test. Mini-Cog scores range from 0 (worst) to 5 (best).[23] A cut-off of two out of five provides the optimal combination of sensitivity (99%) and specificity (96%) for detecting cognitive impairment.[23] The concordance for rating the test result between the expert and naive is high at 96%.[24] Mini-Cog is less affected by education and language.[24] When considering the length of time to administer, Mini-Cog is suitable to apply in Thai primary care settings because the duration of time to visit primary care settings in Thailand varies between 3 to 5 min.[22] Hence, in this study, Mini Cog Thai version was used as this study was carried out in a primary care setting. In addition, a previous study had estimated the reliability of Mini-Cog and concurrent validity with the MMSE Thai 2002 in the same population with this study, as K = 0.8, $p<0.001$, 95% CI = 0.54, 1.00 and Pearson correlation of 0.47, 95% CI = 0.37, 0.55 (p = 0.007), respectively.[25] Nevertheless, Mini-Cog is new and has not been fully validated for sensitivity and specificity of the test in Thai. Therefore, the MMSE Thai 2002, a main clinical Thai cognitive screening, was used as an independent reference measure for the Mini-Cog.

- Mini-mental state examination (MMSE) Thai 2002

The mini mental state examination (MMSE) Thai 2002 has been translated from its original version in English.[26] MMSE remains the most commonly used screening instrument as a global cognitive test[27] and is used as a current clinical mainstay cognitive screening instrument in Thailand. The MMSE Thai 2002 is scored in terms of the number of correctly completed items; lower scores indicate poorer performance and greater cognitive impairment[26]. However, the main limitation of the MMSE Thai 2002 is the impracticality of its administration time (10–15 min) in Thai primary care setting and the low sensitivity of the test in low education level.[26]

Depressive mood screening test

- Thai geriatric screening test (TGDS)

Thai geriatric screening test (TGDS)[28] is used as a depressive mood screening test in this study. It is developed from the geriatric depression scale (GDS) by Yesavage, et al. (1983).[29]

The TGDS questionnaire contains 30 questions with a "yes/no" answer format. The optimal cut-off score of TGDS >12 showing depressive mood. TGDS was studied for validity and reliability by Train the Brain Forum Thailand (1994)[28] in 275 Thai older people, 154 women and 121 men, aged between 60 and 70 years old in all the regions of the country. The results showed that the average time to complete the questionnaire was 10.09 min. The reliability of internal consistency with the high Cronbach's α coefficients degree is 0.93[28] while the original version is 0.84.[29] TGDS questionnaire has has recently been used for both research and clinical assessment of geriatric depression in Thailand.[28]

Statistical analysis

Data were reported as the mean ± SD or percentage (%) for frequency data. Spearman's correlation was used to identify association between cognitive function and depressive mood score. All statistical analyses were carried out using statistical package for social sciences (SSPS-Version 14).

Results

Participants' characteristics

The demographic characteristics are shown in Table 1. A total of 283 participants, 103 (36.4%) men and 180 (63.6%) women were assessed. The mean age ±SD of participants was 68 ± 6 years. A total of 93% (264) of all the participants had attended school; however, the percentage of the participants who attended school for less than 4 years was 89.4% (253). Most participants lived with family (96.5%). A total of 90% of the participants in both groups received health cost support from the government.

Relationship between cognitive impairment and depressive mood (controlling for potential confounders)

As mentioned earlier in the method, Mini-Cog is new and has not been validated for sensitivity and specificity in Thai population. There are only reliability (K = 0.8, p<0.001, 95% CI = 0.54, 1.00) and concurrent validity (Pearson correlation (r_p) = 0.47, 95%, CI 0.37, 0.55, p = 0.007) with MMSE Thai 2002.[25] Thus, in order to propose Mini-Cog as a new cognitive screening tool in Thailand, it is necessary to compare the results of Mini-Cog with MMSE Thai 2002, which is a known reference standard in Thailand.[26]

Also, as stated in screening assessments, the variables potentially confounding the cognitive screening test and depressive mood screening test in Thai population are age and years of education.[26,30] Thus, partial correlations were performed to examine the relationship between the cognition scores and depressive mood scores while adjusting for the effects of variables such as age and years of education. With regard to non-normal distribution of the data, spearman correlation was analysed in this study.

Age and years of education are most likely to be positive confounders. The association between cognitive impairment and depressive mood is more extreme. Therefore, on controlling these variables, it would be expected to weaken the association (see Tables 2–4).

Table 1. Summary of the participants' characteristics

Characteristics	N (%)
Gender	
Men	103 (36.4%)
Women	180 (63.6%)
Age[a]	67.60 + 6.42
Age (years)	
60–64	121 (42.8%)
65–69	60 (21.2%)
70–74	52 (18.4%)
75+	50 (17.7%)
Education	
Never attended to school	19 (6.7%)
Attended to school	264 (93.3%)
Year in school	
≤ 4	253 (89.4%)
> 4	30 (10.6%)
Living arrangement	
Alone	10 (3.5%)
With family	273 (96.5%)
Health cost support	
National health care (30 baht scheme policy)	261 (92.2%)
Social/welfare health care	6 (2.1%)
Self-funding/family support	16 (5.7%)

[a]Mean + SD

Table 2. Correlation coefficients between cognitive function scores and TGDS scores (partial correlations controlling age)

Scores	Mini-Cog	MMSE Thai 2002
TGDS	−0.2*	−0.3**

*$p<0.01$; **$p<0.001$

Table 3. Correlation coefficients between cognitive function scores and TGDS scores (partial correlations controlling years of education)

Scores	Mini-Cog	MMSE Thai 2002
TGDS	−0.1*	−0.2**

*$p<0.05$; **$p<0.001$

Table 4. Correlation coefficients between cognitive function scores and TGDS scores (partial correlations controlling for age and years of education)

Scores	Mini-Cog	MMSE Thai 2002
TGDS	−0.1	−0.2*

*$p<0.01$

As shown in Table 2, after controlling age, the depressive mood (TGDS) scores were significantly correlated with cognitive scores by Mini-Cog (r_s = –0.2, $p<0.01$). Likewise, the depressive mood (TGDS) scores were significantly correlated with cognitive scores by MMSE Thai 2002 (r_s = –0.3, $p<0.001$). However, the correlations between Mini-Cog and MMSE Thai 2002 with TGDS were negative.

In Table 3, after controlling for the years of education, the depressive mood scores were significantly correlated with cognitive scores by Mini-Cog (r_s = –0.1, $p<0.05$). Similarly, the depressive mood scores were significantly correlated with cognitive scores by MMSE Thai 2002 (r_s = –0.2, $p<0.001$). Nonetheless, the correlations between Mini-Cog and MMSE Thai 2002 with TGDS were negative.

After controlling the age and years of education (Table 4), the depressive mood scores were still significant and correlated with cognitive scores from MMSE Thai 2002 (r_s = –0.2, $p<0.01$) but there was no significant correlation between the depressive mood scores and cognitive scores from Mini-Cog (r_s = –0.1, p = 0.06).

Overall, the negative correlation coefficients in Tables 2–4 show that higher of depression scores was associated with lower of cognitive function. This implied that the participants who had high scores in depressive mood screening test (scores >12 showing law mood) tended to have low level of cognitive function (scores ≤2 for Mini-Cog and scores ≥14 for MMSE Thai 2002 showing low cognitive function).

It can be seen from Tables 2–4 that the scores from Mini-Cog and MMSE Thai 2002 were weak negatively correlated with TGDS scores. It seemed that the higher score (cognitive impairment) in Mini-Cog and MMSE Thai 2002 might associated with the lower score in TGDS (depressive mood). In other words, the participants who had cognitive impairment seemed to have depressive mood.

In order to see the correlation between Mini-Cog and MMSE Thai 2002, the Spearman correlation was analysed. As it can be observed from Table 5, there was a significant positive correlation between the scores of Mini-Cog and MMSE Thai 2002 with Spearman's rank order correlation coefficient r_s = 0.44, P = 0.001. It was clear that the scores in Mini-Cog were moderate positively correlated with the scores in MMSE Thai 2002. The higher score in Mini-Cog was associated with the higher score in MMSE Thai-2002. Therefore, it was shown that Mini-Cog and MMSE Thai 2002 screening tests yielded the results in the same direction.

Table 5. Correlation coefficients between the scores of Mini-Cog Thai version and MMSE Thai 2002

	MMSE Thai 2002	
	Spearman rho (r_s)	p
Mini-cog	0.44	0.001

Discussion

Correlation between cognitive impairment and depressive mood

The scores of both cognitive screening tests (Mini-Cog and MMSE Thai 2002) were negatively correlated with the score of depressive mood test (TGDS) in this study. This implied that the participants who had high scores in cognitive tests (showing possible non-cognitive impairment) seemed to have low scores in depressive mood screening test (showing non-depressed mood). This study was consistent with the previous studies[13,17,30], which showed similar trend of the correlation between cognitive decline and depressive mood.

In addition, the previous studies found that the association between the scores of cognitive screening tests and depressive mood screening test persisted after controlling age, years in school and potential confounding factors in cognitive and depressive mood screening test.[31] The correlation between cognitive impairment by Mini-Cog and depressive mood seemed not to correlate after controlling age and years in school. It could be possible that this study did not

control the potential confounding factors such as disease severity, complications, blood sugar level and concomitant disease. Also this study had limitations in the heterogeneity of education in the population. The vast majority of the sample in this study (89%) had equal or less than 4 years in school. Therefore, the evidence is still ambiguous in the variable of years in school. However, the result showed a small trend of the correlation between cognitive impairment and depressive mood.

Depressive mood may relate to cognitive impairment in many possible ways. First, prolonged hypercortisolemia associated with depressive symptom may have negative impact on memory through hippocampal damage.[32,33] Second, depressive symptoms are common in diabetic patients and may hinder their ability to adhere to diet, physical activity and medication and therefore cause poor glucose control (hyperglycaemia) which may also affect vascular and brain function.[14–16] Lastly, hyperglycaemia and hyperinsulinaemia can affect brain tissue and its metabolism by decreasing the neurotransmitter function, which induce organ damage.[33]

Thus, it would be of interest to propose that when cognitive impairment is suspected, screening depression is recommended. Moreover, depression could be the reversible cause of memory impairment and people with diabetes.[10] Treatment of depression may improve the cognitive function, which may also support self-care management and behaviour of the older people with type 2 diabetes.[26]

Correlation between Mini-Cog and MMSE Thai 2002

As mentioned earlier, Mini-Cog is new and has not been validated in Thai population. Thus, in order to propose Mini-Cog as a new cognitive screening tool in Thailand, it is necessary to compare the results of Mini-Cog with MMSE Thai 2002, which is a known reference standard in Thailand.[26]

The data in this study showed that both Mini-Cog and MMSE Thai 2002 seem to detect the cognitive impairment in the same direction. The results clearly indicated that the scores in Mini-Cog are moderate positively correlated (r_s = 0.44, p = 0.001) with the result the scores of MMSE Thai 2002 (Table 5). This finding demonstrated significant correlations between Mini-Cog as a new test and MMSE Thai 2002 as a standard test in Thailand. This means that Mini-Cog seems to perform in similar direction with MMSE Thai 2002, a standard test, for screen cognitive impairment in this study.

Conclusion

This study shows that older people with type 2 diabetes who had cognitive impairment seemed to have depressive mood. As cognitive impairment and depression have important consequences for diabetic patients and diabetes self-care management,[34–36] they are crucial components in the individual needs to control an appropriate blood glucose level (an optimal goal for diabetes care) by maximising adherence to diet, exercise, and dosing schedules of the medicine.[36] It is important to recognise these two comorbidities and great insight is needed in how cognitive impairment and depressive mood influence the diabetes care and quality of life in the diabetic patients.[13]

How does this paper make a difference to general practice?

- It is important for healthcare providers to review the diabetic patients with a high depression score, to rule out other possible reversible causes of cognitive impairment. This is because the initial poor screening score of the cognitive test may have been due to transient diagnoses such as depression.[37]

- Cognitive impairment and depression are overlooked in the elderly with chronic disease. An early detection of cognitive impairment can improve the quality of care and life and reduce care expenditures for the diabetic patients and their families.[38–40]

Acknowledgements

Conflicts of interest

None.

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