Original Article

The Reliability of the Michigan Neuropathy Screening Instrument Thai version

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Background: The prevalence of peripheral neuropathy as complication of diabetes is high. Appropriate tool is needed for using in primary care.

Objective: The present study aimed to assess the intratester and intertester reliability of an instrument for screening peripheral neuropathy, the Michigan Neuropathy Screening Instrument (MNSI) patient form questionnaire and examination.

Materials and Methods: The participants were 31 diabetes patients with foot numbness. The questionnaire was cross translated into Thai and administered twice. Two physical therapists performed the foot examinations in the same day and reexamination at one week interval.

Results: The test-retest reliability of MNSI patient form was good (ICC = 0.830). For the examination part, the intratester was excellent (ICC = 0.905 to 0.931) and intertesters reliability was good (ICC = 0.780 to 0.869).

Conclusion: MNSI is a good screening tool for peripheral neuropathy. The Thai version has good reliability and is recommended to use in outpatient and community settings.

Keywords: Peripheral neuropathy, Instrument, Reliability

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Diabetes Mellitus (DM) is common worldwide. The report of the International Diabetes Federation in 2014 estimated the prevalence of DM in Thailand to be 8.45%[1]. Another survey in Thailand reported the prevalence of 9.6% with one half of cases undiagnosed[2]. The disease burden was also very high due to several complications. Peripheral neuropathy (PN) is a common and serious complications of DM. Studies found 10% of patients had PN at the time of DM diagnosis, more than 50% after 25 years[3], 45% of patients had polyneuropathy[4], and 44.2 % of patients aged 70-79 years had PN[5]. In Thailand, the prevalence of PN in patients with Type 2 DM was 38.3%, with 15% had foot problems, protective sensation loss and deficit pedal pulse. The incidence rates of PN were 91.1 per 1,000 person-years[6].

Early detection of PN will promote the patients to get timely management and prevent them from disability. However, the accurate diagnosis of PN needs invasive and costly examinations such as nerve biopsy and electrodiagnosis. In clinic, the screening is performed by the history and neurological tests. In 1994, Feldman et al. developed "the Michigan Neuropathy Screening Instrument" (MNSI) for using in outpatient settings[7]. The instrument has been tested for validity and recommended to be a good screening tool[7-10]. The reliability of the examination part was excellent if performed by physicians[11].

An appropriate non-invasive instrument to use in clinic and community in Thailand is essential. The present study then cross-translated the patient form MNSI instrument and tested the reliability both intertester and intratester of the clinical part when the examinations were performed by physical therapists.

Materials and Methods

The participants of the present study were patients from the DM clinics of two primary health care settings and one community hospital in Salaya district, Nakornpathom, Thailand. The inclusion criteria of

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patients were diagnosed with Type 2 DM, receiving medical treatments, and having foot numbness complaint. They also could read and understand the Thai questionnaires and could follow instruction during the physical examination. The participants were excluded if they had any other conditions which could affect the foot appearance such as systemic joint diseases and neurological conditions. All eligible subjects were invited to participate in the study. The inform consent was signed before data collection. The procedure of the study was approved by the Ethical Review Board of Mahidol University, Thailand.

The examiners were two physical therapists with 17 and 13 years of clinical experiences. The medical history and symptoms of DM and its complications were recorded. The participants then filled in the patient form of the MNSI, Thai version. The questionnaire consisted of 15 yes-no questions, 13 questions about common symptoms of neuropathy, one about vascular problem, and another one about general sensation deficit. The English version was translated into Thai. The Thai version was then verified for content by three physical therapists who worked in community and three laypersons for language and understanding. The questionnaire was attuned then back-translated into English and compared with the original version for content consistency. The Thai version of MNSI patient form has been slightly adapted from the original version for cultural appropriateness.

After the participant finished the questionnaire, the physical examination was performed by the first assessor according to the MNSI clinical part. The examination included inspecting of foot deformity, skin and ulceration, ankle reflex, testing vibration sense with tuning fork, and tactile sense with 10 gram monofilament. After finished, the second assessor who did not observe or know the results of first testing session performed all tests. The patients then were contacted for reexamination by both testers 7-14 days after the first session. The order of testing by each examiner was random.

The data analysis was performed using SPSS version 17. The Kappa coefficients were calculated for each question of the patient form and each examination item. The ICC was analyzed for the total score of questionnaire and the clinical examination.

Results

There were 31 patients with DM participated in the study. The characteristics of the participants were presented in Table 1.

The questionnaire

The responses of the patient form in the first visit were reported in Table 2. Due to the inclusion criteria of having foot numbness, all subjects responded as yes in the first question. Two questions had response of "no" by all participants. The test-retest agreements of each question in the patient form were also presented. The Kappa coefficients range from 0.519 to 1.0. The ICC (2,1) of the total score was 0.830.

The examination

The Kappa coefficients of each examination item were presented in Table 3. The agreement coefficients were ranged from 0.529 to 1.00. The reliability coefficients of total scores of the examination were presented in Table 4.

Discussion

The participants in the present study were patients diagnosed with of DM who came to the health care settings for the follow up session by physicians. Almost all patients received medical treatments as oral and/or injection. Most of the participants had duration of disease over 10 years and the blood sugar level was rather high. This might be related to the recruiting criteria of having symptom of foot numbness. Although the patients reported having foot numbness at the day of examination, not all of them had been diagnosed by the medical team to have peripheral neuropathy. This might be because to diagnose as PN is complicated and the health care team especially in primary care setting might not be able to diagnose without screening tool. Using MNSI should be a good way to monitor before sending patients to confirm the diagnosis in the appropriate setting[7]. However, most of the patients reported that they were aware of foot symptom as the DM complication.

Table 1. Characteristics of participants (n = 31)

Characteristics	
Gender (female/male)	F21/M10
Medication	Oral 19/inject 6/both 5/none1
Family DM History	Present 18/absent 12/missing 1
Age (mean±SD)	69.68±8.88 (53 to 85)
Weight (kg.)	64.39±11.56 (40 to 83)
Height (cm.)	161.04±6.85 (150 to 171)
BMI	25.57±4.57 (15.57 to 34.47)
Blood glucose (mmol/L)	174.21±66.22 (86 to 330)
DM duration since first diagnosis (years)	11.27±7.53 (1 to 30)

Table 2. Responses and the test-retest agreement of the patient form (n = 31)

Questions	Number of responses	Kappa	p-values	
	yes	no		
1. Are your legs and/or feet numb?	31	0	1.0	<0.001
2. Do you ever have any burning pain in your legs and/or feet?	9	22	0.687	<0.001
3. Are your feet too sensitive to touch?	0	31	1.0	<0.001
4. Do you get muscle cramps in your legs and/or feet?	1	30	0.649	<0.001
5. Do you ever have any prickling feelings in your legs or feet?	17	14	0.845	<0.001
6. Does it hurt when the bed covers touch your skin?	2	29	1.0	<0.001
7. When you get into the tub or shower, are you able to tell the hot water from the cold water?	6	25	0.598	0.002
8. Have you ever had an open sore on your foot?	9	22	0.913	<0.001
9. Has your doctor ever told you that you have diabetic neuropathy?	6	25	0.708	<0.001
10. Do you feel weak all over most of the time?	0	31	1.0	<0.001
11. Are your symptoms worse at night?	12	19	0.530	0.006
12. Do your legs hurt when you walk?	10	21	0.639	0.001
13. Are you able to sense your feet when you walk?	6	25	0.598	0.002
14. Is the skin on your feet so dry that it cracks open?	6	25	0.519	0.003
15. Have you ever had an amputation?	1	30	1.0	<0.001

The MNSI has been reported to be a good screening tool for PN in patients with DM. The validity of the examination part has been proved to be acceptable in four studies[7-10]. The instrument was also used as standard criteria to test the sensitivity of other tests in primary care clinical setting[12]. The validity of MNSI test to diagnose PN was better than vibration perception threshold, Neuropathy Symptoms Score, Neuropathy Disability Score, and 10 g monofilament[9]. This is because the MNSI used composite scores of several clinical tests. The cut point of examination score for PN diagnosis was proposed to be 2[9,10] to 2.5[11] out of 10. With cut point of 2, all patients in the present study were suspected to have PN.

There was good test-retest reliability (ICC = 0.830) of the total score of the MNSI patient form in the present study. Considering the agreement of each question, there were 5 questions which the participants answered with absolute consistency including numbness symptom, sensitive to touch of foot, the hurt feeling when touching the bed cover, feeling of general weakness, and having amputation. Other 4 questions about temperature sensation, worse symptom at night, foot sensation during walking, and dry and cracked skin of foot, had Kappa coefficients lower than 0.6. The lower agreement of these questions especially the sensation might be due to the blood sugar level which might diverse between two sessions in different days. The intratester reliability of the examination in the present study was excellent. The clinical examination part of MNSI includes foot observation, reflex, vibration, and monofilament which most physical therapists already have some skills. Therefore, foot evaluation performing by two experienced physical therapists with specific training yielded reliable results in two sessions. The intratester reliability of MNSI examination was also reported in previous studies to be excellent by two physicians[11].

The intertester reliability was also good to excellent in the present study. The previous study reported the examination reliability to be good between two physicians[11]. There were items including foot observation, ankle reflex and foot vibration which had agreement between two testers less than 0.6. This might come from the scoring style of MNSI which needs the testers to rate the abnormality as different levels. So the chance of having disagreement was increased when analyzing with Kappa Coefficients.

Conclusion

The Thai version of MNSI patient form and the examination has good test-retest and intertester reliability when using by trained physical therapists. This instrument is valuable to be used in outpatient

Table 3. Kappa Coefficients of examination items

	Kappa	*p*-values
Foot observation		
Intrarater 1	0.688	<0.001
Intrarater 2	0.774	<0.001
Interrater day 1	0.663	<0.001
Interrater day 2	0.529	0.002
Foot ulcer		
Intrarater 1	0.780	<0.001
Intrarater 2	1.00	<0.001
Interrater day 1	0.770	<0.001
Interrater day 2	0.835	<0.001
Ankle reflex		
Intrarater 1	0.892	<0.001
Intrarater 2	0.749	<0.001
Interrater day 1	0.597	<0.001
Interrater day 2	0.506	<0.001
Vibration		
Intrarater 1	0.534	<0.001
Intrarater 2	0.690	<0.001
Interrater day 1	0.448	<0.001
Interrater day 2	0.648	<0.001
Monofilament		
Intrarater 1	0.742	<0.001
Intrarater 2	0.704	<0.001
Interrater day 1	0.658	<0.001
Interrater day 2	0.797	<0.001

Table 4. The reliability coefficients of total scores of the MNSI examination part

	ICC Single Measures	*p*-value
Intrarater 1	0.931	<0.001
Intrarater 2	0.905	<0.001
Interrater day 1	0.869	<0.001
Interrater day 2	0.780	<0.001

and community setting to screen the DM patients with complication of peripheral neuropathy. The timely detection of such condition could benefit the management of the complication of high prevalence disease as DM.

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What is already known on this topic?

The MNSI is a valid and reliable screening tool for PN and has been used in the clinical settings and research.

What is this study adds?

The MNSI Thai version of patient form is proved to be reliable in patients with DM. The examination part is also reliable when performed by trained clinicians.

Potential conflicts of interest

The author declare no conflict of interest.

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