Thai Scales for Outcomes in Parkinson's Disease-Nighttime Sleep and Modified Parkinson's Disease Sleep Scale for Assessment of Nighttime Sleep Disorder Compared with Pittsburgh Sleep Quality Index at the Faculty of Medicine Vajira Hospital

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Abstract

Objectives: This study aimed to evaluate the sensitivity and specificity of the Thai versions of Scales for Outcomes in Parkinson's Disease-Nighttime Sleep (SCOPA-NS) and Modified Parkinson's Disease Sleep Scale (MPDSS) test for patients with Parkinson's disease in comparison with the Pittsburgh Sleep Quality Index (PSQI) test.

Methods: This cross-sectional study enrolled patients with Parkinson's disease who sought treatment at the OPD department, Division of Neurology, Faculty of Medicine Vajira Hospital. The study was conducted from 1 March 2019 to 31 December 2019. Volunteers completed Thai SCOPA-NS and MPDSS sleep tests to obtain the sensitivity and specificity of each test, which was then compared with the PSQI test.

Results: Of the 216 volunteers, 200 met the study criteria. To evaluate nighttime sleep, SCOPA-NS test and MPDSS test in Thai language were used. The prevalence rates of sleep disorders in volunteers using the SCOPA-NS test and MPDSS test were 62.5% (95% confidence interval [CI] 55.4–69.2) and 52.5% (95% CI 45.3–59.6), respectively. Youden's index (1– (sensitivity + specificity)) was used to find the optimal cut-off points by comparing it with the PSQI test. SCOPA-NS test has a sensitivity of 83.1% (95%CI 75.3–89.2), specificity of 71.1% (95% CI 59.5–80.9), positive predictive value (PPV) of 82.4% (95% CI 74.6–88.6), and negative predictive value (NPV) of 72% (95% CI 60.4–81.8), whereas the MPDSS test has a sensitivity of 71.8% (95% CI 63.0–79.5), specificity of 78.9% (95% CI 68.1–87.5), PPV of 84.8% (95% CI 76.4–91.0), and NPV of 63.2% (95% CI 52.6–72.8). The volunteers preferred doing the SCOPA-NS test than the MPDSS test with preference rates of 65.5% and 34.5%, respectively.

Conclusion: Thai SCOPA-NS test has higher sensitivity but lower specificity than the MPDSS test. However, patients significantly prefer doing the Thai SCOPA-NS test than the MPDSS test. Both tests can be used to evaluate patients with Parkinson's disease at comparable accuracy. However, Thai SCOPA-NS test took shorter test, and patients with Parkinson's disease prefer this test. We recommend using Thai SCOPA-NS in screening for sleep disorder in this patient population.

Keywords: Parkinson's disease, sleep disorder, assessment, Thai PSQI, SCOPA, MPDSS

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การใช้แบบสอบถาม SCOPA และ MPDSS ฉบับภาษาไทย ประเมินการนอนหลับช่วงกลางคืน เปรียบเทียบกับแบบสอบถาม PSQI ในผู้ป่วยพาร์กินสันที่คณะแพทยศาสตร์วชิรพยาบาล

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บทคัดย่อ

วัตถุประสงค์: เพื่อศึกษาความไวและความจำเพาะของแบบทดสอบการนอนหลับช่วงกลางคืนของ SCOPA-NS และ MPDSS ฉบับภาษาไทย ในผู้ป่วยโรคพาร์กินสัน เทียบกับแบบทดสอบ PSQI

วิธีการศึกษา: เป็นการศึกษาแบบตัดขวาง (cross-sectional study) ของผู้ป่วยโรคพาร์กินสันที่แผนกผู้ป่วยนอกสาขาประสาทวิทยา คณะแพทยศาสตร์วชิรพยาบาล ตั้งแต่ 1 มี.ค. พ.ศ.2562 - วันที่ 31 ธ.ค. 2562 เพื่อทำแบบทดสอบการนอนหลับในช่วงกลางคืน Thai SCOPA-NS, MPDSS เทียบกับแบบทดสอบ PSQI เพื่อหาความไวและความจำเพาะของแต่ละแบบสอบถาม

ผลการศึกษา: อาสาสมัครจำนวน 216 ราย เข้าเกณฑ์ศึกษาวิจัยจำนวน 200 ราย ไม่เข้าเกณฑ์ศึกษาวิจัย 16 ราย ประเมินการนอนหลับช่วงกลางคืนโดยใช้ SCOPA-NS และ MPDSS ฉบับภาษาไทย ผลการศึกษาพบอาสาสมัครมีความชุกของปัญหาการนอนหลับร้อยละ 62.5 (95%CI: 55.4 - 69.2) และ 52.5 (95%CI: 45.3 - 59.6) ตามลำดับ การศึกษานี้ได้ใช้วิธี Youden's index (1 – (sensitivity + specificity)) เพื่อหาจุดตัดที่เหมาะสม โดยเปรียบเทียบกับแบบสอบถาม PSQI ในการประเมินการนอนหลับช่วงกลางคืน แบบสอบถาม SCOPA-NS มีค่าความไว (sensitivity) ร้อยละ 83.1 (95%CI: 75.3-89.2) ความจำเพาะ (specificity) ร้อยละ 71.1 (95%CI: 59.5-80.9) ค่าคาดทำนายของผลบวก (Positive Predictive Value, PPV) ร้อยละ 82.4 (95%CI: 74.6-88.6) และค่าคาดทำนายของผลลบ (Negative Predictive Value, NPV) ร้อยละ 72 (95%CI: 60.4-81.8) ส่วนแบบสอบถาม MPDSS มีค่าความไว (sensitivity) ร้อยละ 71.8 (95%CI: 63.0-79.5) ความจำเพาะ (specificity) ร้อยละ 78.9 (95%CI: 68.1-87.5) ค่าคาดทำนายของผลบวก (Positive Predictive Value, PPV) ร้อยละ 84.8 (95%CI: 76.4-91.0) และค่าคาดทำนายของผลลบ (Negative Predictive Value, NPV) ร้อยละ 63.2 (95%CI: 52.6-72.8) และพบว่าอาสาสมัครมีความชอบในการตอบแบบทดสอบ SCOPA-NS มากกว่าแบบทดสอบ MPDSS โดยมีอาสาสมัครมีความชอบในการตอบแบบทดสอบ ร้อยละ 65.5 และ 34.5 ตามลำดับ

สรุปผลการศึกษา: แบบสอบถาม Thai SCOPA-NS มีความไวมากกว่า MPDSS และมีความจำเพาะน้อยกว่า เนื่องจากแบบสอบถาม MPDSS มีคำถามที่มากกว่าทำให้สามารถคัดกรองได้แม่นยำมากกว่า นอกจากนี้พบว่าผู้ป่วยมีความพึงพอใจในการใช้ Thai SCOPA-NS มากกว่า MPDSS อย่างชัดเจน โดยแบบประเมินทั้ง 2 สามารถใช้ประเมินผู้ป่วยโรคพาร์กินสันได้อย่างมีประสิทธิภาพใกล้เคียงกัน แต่แบบประเมิน Thai SCOPA-NS ใช้เวลาในการประเมินน้อยกว่า และผู้ป่วยโรคพาร์กินพึงพอใจในการประเมินมากกว่าจึงเห็นสมควรใช้แบบประเมิน Thai SCOPA-NS ในการคัดกรองผู้ป่วยพาร์กินสันมากกว่า

คำสำคัญ: โรคพาร์กินสัน, ประเมินการนอนหลับ,ปัญหาการนอนหลับ,แบบสอบถาม Thai SCOPA-NS, แบบสอบถาม MPDSS

วันที่รับบทความ 21 พฤษภาคม 2563 **วันแก้ไขบทความ** 10 พฤศจิกายน 2563 **วันตอบรับบทความ** 24 พฤศจิกายน 2563

Introduction

Thailand's urban area has been moving toward an aging society. Parkinson's disease is one of the common illnesses found in the older population. Moreover, 60%–90% of patients with Parkinson's disease were diagnosed with sleep disorders[1-3], such as nocturnal enuresis, insomnia, obstructive sleep apnea, or parasomnia, such as periodic leg movements, sleepwalking, nightmare, narcolepsy, excessive daytime sleepiness, and sleep attack [4-5]. The causes of these sleep disorders are currently unclear. However, for patients with Parkinson's disease, many of the factors that cause sleep disorders are related. These symptoms affect the patient's quality of life and everyday living in general. The symptoms also increase patient's burden and stress. Therefore, investigating methods of treating these symptoms is as important as curing movement disorders.[4, 6-7]

The number of older patients in the urban society, as well as patients with Parkinson's disease is currently increasing. Therefore, we are interested in evaluating sleep disorders in this population. The study was conducted to find cure or improve the sleep quality of these patients. Many Parkinson's disease sleep tests have been improved and developed, including the Thai versions of the modified Parkinson's disease sleep scale (MPDSS) test, which was adapted from PDSS[8], and the Scales for Outcomes in Parkinson's Disease-Nighttime Sleep (SCOPA-Sleep) scale [9]. We are interested in comparing both tests to identify which test is more appropriate to assess nighttime sleep quality of patients with Parkinson's disease, by using the PSQI sleep test as a standard of sleeping assessment. The PSQI sleep test is used worldwide to assess sleep quality for general patients[10-12].

Methods

Research Design

This study follows a cross-sectional design.

Population

We enrolled 216 patients with Parkinson's disease who visited the outpatient clinic of the Division of Neurology, Faculty of Medicine, Vajira Hospital, from 1 March to 31 December 2019.

Inclusion Criteria

We included patients who were diagnosed with idiopathic Parkinson's disease according to the MDS-PD criteria[13], and with stage 1–4 Parkinson's disease as assessed by Hoehn and Yahr stage (H&Y)[14], at the Faculty of Medicine, Vajira Hospital.

Exclusion Criteria

1. Patients diagnosed with secondary parkinsonism, e.g., drug-induced parkinsonism and vascular parkinsonism, a disease caused by exposure to toxins or encephalitis.

2. Patients with communication issues and provide unreliable information.

3. Patients diagnosed with dementia, who scored ≥23 in the Thai Mental State Examination test.

Research Sample Size

The study participants were selected using purposive sampling technique from all patients who visited the outpatient clinic, Division of Neurology, Faculty of Medicine, Vajira Hospital, between 1 March 2019 and 31 December 2019 and met the specified criteria.

Research Procedure

Participants completed the nighttime sleep test by themselves. If they had any questions, they could ask the researcher. If they had any reading difficulty, the researcher would read the question for them. All tests must be completed– Pittsburgh sleep quality index (PSQI), Thai SCOPA-NS, and MPDSS.

Variable Measurement Tools

General record forms of patients with Parkinson's disease at the Faculty of Medicine, Vajira Hospital were reviewed.

Thai SCOPA-NS for patients with Parkinson's disease. This tool has five questions, scored 0–3 points, to assess the level of symptoms: high, 3 points; medium, 2 points; low, 1 point; none, 0 points. The patient is diagnosed with sleep disorders if the total score is ≥7[15].

Thai MPDSS nighttime sleep test for patients with Parkinson's disease. The questionnaire consists of 13 items, scored with 0–10 points, to assess the frequency of symptoms (10 points as never, and 0 points for always). A patient is diagnosed with sleep disorders if the score is <6 in each item[16].

Thai PSQI nighttime sleep test. This tool has seven items, and each item is scored 0–3 points. The possible total score ranges from 0 to 22 points. A total score of ≤5 means poor sleep quality[11-12].

Data Analysis

The baseline characteristics of the sample group, including general information (age, sex, level of education, occupation) and clinical features (duration of Parkinson's disease, H&Y stage of the disease, history of taking medications for Parkinson's disease, and history of taking sleeping pills), were collected.

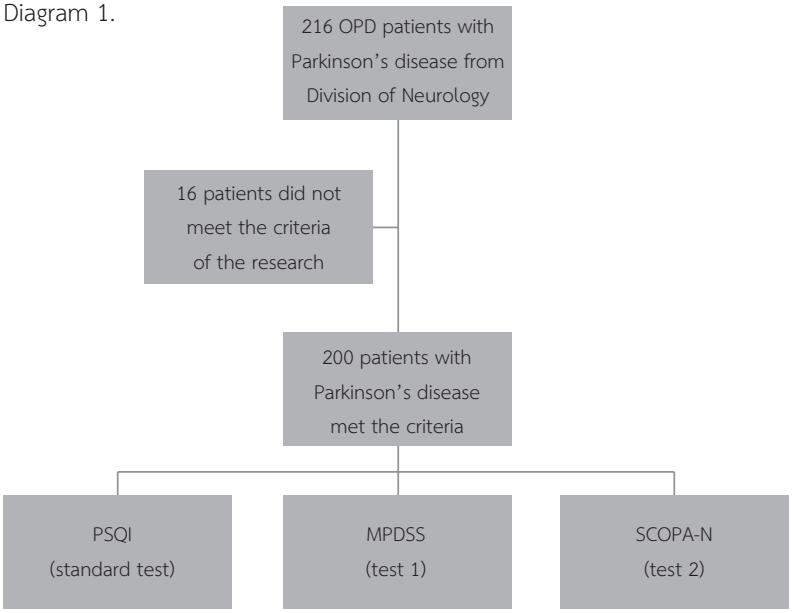
To identify the sensitivity and specificity of Thai SCOPA and MPDSS tests, we analyzed the receiver operating characteristic (ROC)[17-18] and calculate the area under the curve (AUC), by selecting an optimal cut-off point from Youden's index[19-20]. This is one of the most popular and reliable methods to measure sensitivity, specificity, accuracy, positive predictive value (PPV), negative predictive value (NPV), and AUC curves with a 95% confidence interval (CI).

All data analyses were performed using SPSS for Windows version 22.0, and statistical significance was determined at the level of 0.05.

Results

Initial eligibility screening was carried out by face-to-face (N = 216) interview at the outpatient neurology clinic. In this study, 200 participants with Parkinson's disease met the inclusion criteria. Sixteen participants were excluded, as they have essential tremors (n = 2), atypical Parkinson (n = 5), secondary Parkinsonism (n = 2), and dementia (n = 7) as in shown in Diagram 1.

Diagram 1.



The baseline characteristics of the sample group indicated that 53.5% of the volunteers were female. The average age of patients was 72.95 (standard deviation, 9.00). Most patients had primary educational level (38.5%), and 30.0% and 25.0% of the patients were in their secondary and tertiary education, respectively. As regards occupation, 89.5% of the patients were unemployed. Before retirement, the participants were mostly government officers, followed by employees and unemployed (31.0%, 23.0%, and 21.0%, respectively). The median duration of having Parkinson's disease was 4 years (interquartile range, 2–9). The most common stage of Parkinson's disease was stage 3, followed by stages 2, 1, and 4. For the medication history, 96.0% of the patients used levodopa, 49.0% used dopamine agonists, 7.5% used monoamine oxidase B inhibitor, 29.0% used catechol-O-methyltransferase inhibitor, and 3.5% used anticholinergics, and 28.0% of them used sleeping pills (Table 1).

Patients had an average PSQI test score of 7.06 ± 3.61. Then, patients were divided into two groups: with and without sleep disorders. Each group's average scores were 9.27 ± 2.58 and 3.43 ± 1.46, respectively. The group with sleep disorders diagnosed by PSQI test obtained average scores of 6.13 ± 3.75 and 2.05 ± 2.06 in the SCOPA-NS test and MPDSS test, respectively. The group without sleep disorders obtained average scores of 2.05 ± 2.06 and 115.57 ± 11.58 in SCOPA-NS test and MPDSS test, respectively. Moreover, the group with and without sleep disorders obtained SCOPA-NS test average scores of 9.61 ± 2.34 and 2.63 ± 1.98 respectively. In the MPDSS test, the average scores of the two groups were 110.26 ± 11.87 and 68.79 ± 12.69, respectively (Table 2).

The prevalence of sleep disorders in patients assessed by the PSQI test was 62% (95% CI 54.9–68.8). However, in Thai SCOPA-NS and MPDSS tests, the prevalence rates of sleep disorders were 62.5% (95% CI 55.4–69.2) and 52.5% (95%CI 45.3–59.6), respectively (Table 3).

To explore the accuracy of Thai SCOPA-NS and MPDSS tests by comparing with the PSQI test, we analyzed the ROC and calculated the AUC. The result showed that the Thai SCOPA-NS and MPDSS test had AUC of 0.82 (95% CI 0.76–0.88) and 0.83 (95% CI 0.77–0.88), respectively (Fig 2).

We selected the optimal cut-off point to assess the nighttime sleep compared with the PSQI test by using Youden's index (1 – (sensitivity + specificity)). The SCOPA-NS test had the optimal cut-off point of ≥3 points. Its sensitivity, specificity, PPV, and NPV were 83.1%. (95%CI 75.3–89.2), 71.1% (95% CI 59.5–80.9), 82.4% (95% CI 74.6–88.6), and 72% (95% CI 60.4–81.8), respectively. For the MPDSS test, the optimal cut-off point for assessing nighttime sleep compared with the PSQI test was ≤110. The corresponding sensitivity, specificity, PPV, and NPV were 71.8% (95% CI 63.0–79.5), 78.9% (95% CI 68.1–87.5), 84.8% (95% CI 76.4–91.0), and 63.2% (95% CI 52.6–72.8), respectively (Table 4).

We analyzed the agreement between Thai SCOPA-NS and MPDSS tests in comparison with the PSQI test by using Cohen's kappa statistic and reported with Cohen's kappa coefficient. The result demonstrated good agreement between Thai SCOPA-NS and MPDSS tests compared with the PSQI test, with statistical significance ($p < 0.001$). The agreement level was moderate. Cohen's kappa coefficients were 0.543 (95% CI 0.422–0.663) and 0.484 (95% CI 0.364–0.604), respectively. The proportions of agreement were 78.5% and 74.5%, respectively. As regards the agreement between using SCOPA test to assess nighttime sleep compared with MPDSS test, the study demonstrated good agreement with significance ($p < 0.001$). The agreement level was moderate. Cohen's kappa coefficient was 0.453 (95% CI 0.331–0.575), and the proportion of agreement was 73.0% (Table 5).

The study found that the patients preferred SCOPA-NS test than MPDSS test. The preference rates were 65.5% and 34.5%, respectively (Table 6).

Table 1:

Demographic and health characteristics of the patients (n = 200)

Variables	
Sex	
Male	93 (46.5)
Female	107 (53.5)
Age (years)	72.95 ± 9.00
Level of education	
No education	10 (5.0)
Primary	77 (38.5)
Secondary	50 (25.0)
Tertiary	60 (30.0)
Not indicated	3 (1.5.0)
Current occupation	
Unemployed	179 (89.5)
Government officer	1 (0.5)
Merchant	6 (3.0)
Employee	14 (7.0)
Former occupation before retirement	
Unemployed	42 (21.0)
Government officer	62 (31.0)
Merchant	38 (19.0)
Employee	46 (23.0)
Others	12 (6.0)
Median duration of Parkinson's disease (years)	4 (2 - 9)
Stage of Parkinson's disease (H&Y)	
1	47 (23.5)
2	50 (25.0)
3	75 (37.5)
4	28 (14.0)

Table 1:

Demographic and health characteristics of the patients (n = 200) (Continued)

Variables	
Parkinson's disease medication history	
Levodopa	192 (96.0)
Dopamine agonists	98 (49.0)
Monoamine oxidase B inhibitor	15 (7.5)
Catechol-O-methyltransferase inhibitor	58 (29.0)
Anticholinergics	7 (3.5)
Sleeping pills use history	56 (28.0)

Data are presented as n (%), mean ± SD, or median (interquartile range).

Table 2:

Clinical data of 200 patients with Parkinson's disease

Sleep disorders	Total		Poor sleep quality		Good sleep quality	
	Mean ± SD	Min - Max	Mean ± SD	Min - Max	Mean ± SD	Min - Max
PSQI	7.06 ± 3.61	(0 - 16)	9.27 ± 2.58	(6 - 16)	3.43 ± 1.46	(0 - 5)
Thai SCOPA-Sleep Scale	4.58 ± 3.77	(0 - 15)	6.13 ± 3.75	(0 - 15)	2.05 ± 2.06	(0 - 8)
MPDSS	104.25 ± 18.9	(33 - 129)	97.32 ± 19.2	(33 - 129)	115.57 ± 11.58	(71 - 129)
Thai SCOPA-Sleep Scale	4.58 ± 3.77	(0 - 15)	9.61 ± 2.34	(7 - 15)	2.63 ± 1.98	(0 - 6)
MPDSS	104.25 ± 18.9	(33 - 129)	110.26 ± 11.87	(83 - 129)	68.79 ± 12.69	(33 - 82)

Table 3:

Prevalence of sleep disorders

Sleep disorders	n (%)	95%CI
Pittsburgh Sleep Quality Index	124 (62.0)	(54.9 - 68.8)
Thai SCOPA-Sleep Scale	125 (62.5)	(55.4 - 69.2)
Modified Parkinson's Disease Sleep Scale	105 (52.5)	(45.3 - 59.6)

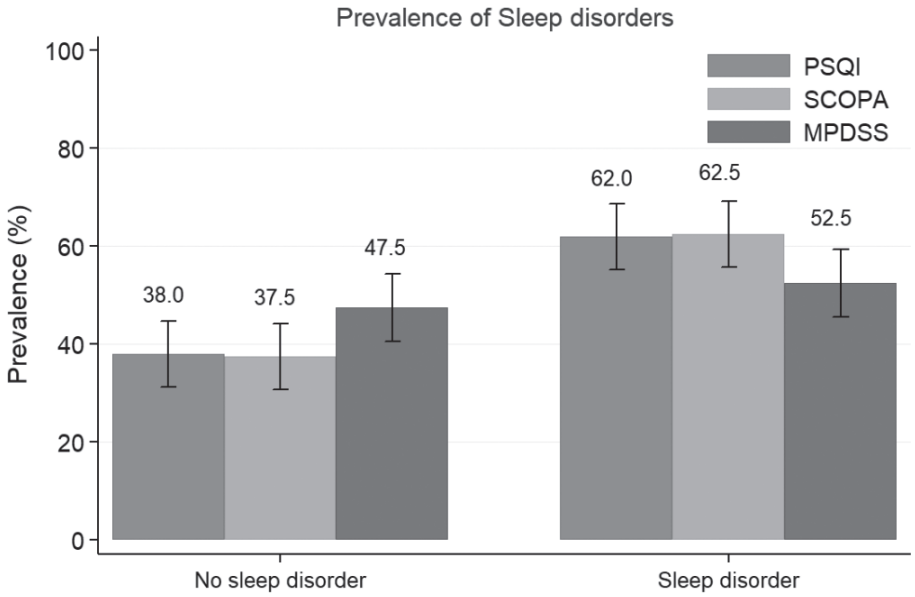


Figure 1: Prevalence of sleep disorders

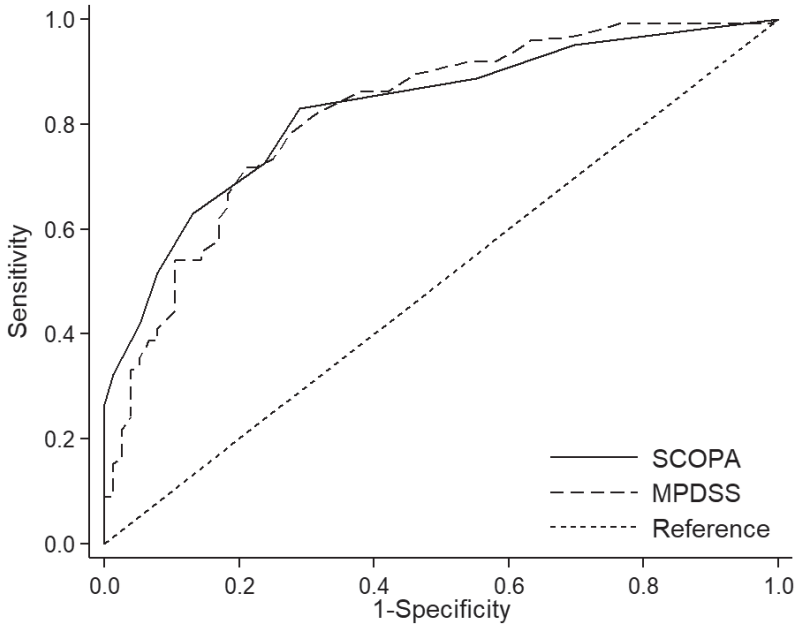


Figure 2: Predictive ability for sleep disorders. The area under the receiver operating characteristic curve value were 0.82 (95%CI 0.76–0.88) for SCOPA-NS and 0.83 (95% CI 0.77–0.88) for MPDSS.

Table 4:

Measures of diagnostic test performance for predicting sleep disorders

Test	Cutoff*	Sensitivity	Specificity	PPV	NPV	LR+	LR-
SCOPA-NS	≥3	83.1 (75.3 - 89.2)	71.1 (59.5 - 80.9)	82.4 (74.6 - 88.6)	72 (60.4 - 81.8)	2.87 (2.00 - 4.12)	0.24 (0.16 - 0.36)
MPDSS	≤110	71.8 (63.0 - 79.5)	78.9 (68.1 - 87.5)	84.8 (76.4 - 91.0)	63.2 (52.6 - 72.8)	3.41 (2.18 - 5.34)	0.36 (0.26 - 0.48)

Note: PPV, positive predictive value; NPV, negative predictive value
* Optimal diagnostic thresholds were determined by Youden's index.

Table 5:

Agreements among the diagnostic tests

Test	Agreement	K	95%CI	p-value*
PSQI vs SCOPA-NS	78.5	0.543	(0.422 - 0.663)	<0.001
PSQI vs MPDSS	74.5	0.484	(0.364 - 0.604)	<0.001
SCOPA-NS vs MPDSS	73.0	0.453	(0.331 - 0.575)	<0.001

Note: K, Cohen's kappa coefficient
*Cohen's kappa statistic

Table 6:

Preference of the nighttime sleep tests

Test	n (%)
Thai SCOPA-Sleep Scale	131 (65.5)
Modified Parkinson's Disease Sleep Scale	69 (34.5)

Discussion

This study found that, on average, patients with Parkinson's disease were 72.95 years old, which agreed with previous studies that reported the common occurrence of this disease in the older population[15-16, 21-22]. Moreover, we found that the patients were mostly in H&Y stage 3 of Parkinson's disease and the second common stage was stages 2. This result was similar to those in previous studies[5,16,21]. The most common medicine used was levodopa, with the same result as in previous studies [16,21-22], and 28% of the patients used sleeping pills. The percentage was very low, which does not agree with the incidence of sleep disorders found[15-16]. This might indicate that many patients with sleep disorders did not get proper care and medical treatment.

The incidence of sleep disorders using Thai SCOPA-NS, with the cut-off point modified into ≥3, agreed with the incidence by PSQI. If the cut-off

point was 6/7 (Appendix 4), the incidence would be similar to that in previous study[15]. This agreed with the previous study that scores >3 indicated impaired quality of sleep[15,23]. Moreover, in the present study, MPDSS detected lower incidence of sleep disorders than reported in previous studies[16,22]. Since this study used only 13 terms for assessment, the problems found were fewer than those in the previous study. Thai people tend to score higher than foreign participants[16], which agrees with the result of this study.

In this study, the incidence rates of sleep disorders found using the PSQI, Thai SCOPA-NS test, and MPDSS test were 62%, 62.5%, and 52.2% respectively. The rate for the PSQI test was close to that in a previous study[24]. For Thai SCOPA-NS test, the rate agreed with the previous study and was close to the doctor's diagnosis[22]. However, for MPDSS test, the percentage did not agree with previous finding, and possible reason is that this study focused only on nighttime sleep, so some of the questions were not included, and the incidence obtained was therefore lower[22].

Moreover, it was found that Thai SCOPA-NS test had more sensitivity than MPDSS test and had less specificity because MPDSS test had more numbers of questions which resulted in more specificity and might resulted in less sensitivity. The Previous study[15] about sensitivity and specificity of Thai SCOPA-NS test found the lower numbers than this study, because the cut-off points used were different. If the cut-off points used were the same, the result obtained would be similar (appendix 5).

Appendix 1:

Thai PSQI nighttime sleep test

Sleep quality		
Duration of Sleep (hours)	8	(7 - 9)
≥ 7	159	(79.5)
6	18	(9.0)
5	15	(7.5)
< 5	8	(4.0)
Sleep latency (min)	27.5	(10 - 60)
≤ 15	86	(43.0)
16 - 30	46	(23.0)
31 - 60	36	(18.0)
> 60	32	(16.0)
6. overall sleep quality overall		
Very good	43	(21.5)
fairly good	107	(53.5)
fairly bad	44	(22.0)
Very bad	6	(3.0)

Questions	Not during the past month		Less than once a week		Once or twice a week		Three or more times weeks	
	n	(%)	n	(%)	n	(%)	n	(%)
5. During the past month, how often have you trouble sleeping because you...								
5.1 Cannot get to sleep within 30 min	74	(37.0)	28	(14.0)	16	(8.0)	82	(41.0)
5.2 Wake up in the middle of the night or early morning	61	(30.5)	40	(20.0)	22	(11.0)	77	(38.5)
5.3 Have to get up to use the bathroom	59	(29.5)	15	(7.5)	17	(8.5)	109	(54.5)
5.4 Cannot breathe comfortably	165	(82.5)	14	(7.0)	9	(4.5)	12	(6.0)
5.5 Cough or snore loudly	115	(57.5)	22	(11.0)	12	(6.0)	51	(25.5)
5.6 Feel too cold	164	(82.0)	21	(10.5)	7	(3.5)	8	(4.0)
5.7 Feel too hot	149	(74.5)	16	(8.0)	16	(8.0)	19	(9.5)
5.8 Have bad dreams	138	(69.0)	38	(19.0)	12	(6.0)	12	(6.0)
5.9 Have pain	108	(54.0)	35	(17.5)	22	(11.0)	35	(17.5)
7. During the past month, how often have you taken medicine (prescribed or “over the counter”) to help you sleep?	134	(67.0)	6	(3.0)	5	(2.5)	55	(27.5)
8. During the past month, how often have you had trouble staying awake while driving, eating meals, or engaging in social activity?	170	(85.0)	16	(8.0)	3	(1.5)	11	(5.5)
9. During the past month, how much of a problem has it been for you to keep up enthusiasm to get things done?	146	(73.0)	37	(18.5)	11	(5.5)	6	(3.0)

10. Do you have a bed partner or roommate?	n	(%)
No bed partner or room mate	84	(42.0)
Partner/roommate in other room	21	(10.5)
Partner in same room but not same bed	57	(28.5)
Partner in same bed	38	(19.0)

10 If you have a roommate or bed partner, ask him/her how often in the past month you have had:								
Symptoms	Not during the past month		Less than once a week		Once or twice a week		Three or more times weeks	
	n	(%)	n	(%)	n	(%)	n	(%)
10.1 Loud snoring	144	(72.0)	10	(5.0)	9	(4.5)	37	(18.5)
10.2 Long pauses between breaths while asleep	196	(98.0)	3	(1.5)	0	(0.0)	1	(0.5)
10.3 Legs twitching or jerking while you sleep	152	(76.0)	26	(13.0)	10	(5.0)	12	(6.0)
10.4 Episodes of disorientation or confusion during sleep	161	(80.5)	24	(12.0)	10	(5.0)	5	(2.5)
10.5 Other restlessness while you sleep, please describe	168	(84.0)	21	(10.5)	1	(0.5)	10	(5.0)

Pittsburgh Sleep Quality Index (PSQI)

PSQI	0		1		2		3	
	n	(%)	n	(%)	n	(%)	n	(%)
Duration of sleep	159	(79.5)	18	(9.0)	15	(7.5)	8	(4.0)
Sleep disturbance	11	(5.5)	148	(74.0)	41	(20.5)	0	(0.0)
Sleep latency	59	(29.5)	44	(22.0)	39	(19.5)	58	(29.0)
Day dysfunction to sleepiness	131	(65.5)	49	(24.5)	18	(9.0)	2	(1.0)
Sleep efficiency	46	(23.0)	46	(23.0)	42	(21.0)	66	(33.0)
Overall sleep quality	43	(21.5)	107	(53.5)	44	(22.0)	6	(3.0)
Need medication to sleep	134	(67.0)	6	(3.0)	5	(2.5)	55	(27.5)

Appendix 2:

Thai version of the scale for outcomes in Parkinson's disease sleep scale for assessment of nighttime sleep (Thai SCOPA-NS) test

Night-time sleep	Not at all		A little		Quite a bit		A lot	
	n	(%)	n	(%)	n	(%)	n	(%)
Difficulty falling asleep	78	(39.0)	67	(33.5)	36	(18.0)	19	(9.5)
Being awake too often	62	(31.0)	73	(36.5)	45	(22.5)	20	(10.0)
Being awake too long	83	(41.5)	69	(34.5)	28	(14.0)	20	(10.0)
Waking too early	101	(50.5)	60	(30.0)	26	(13.0)	13	(6.5)
Having too little sleep	99	(49.5)	57	(28.5)	28	(14.0)	16	(8.0)

Appendix 3:

Modified Parkinson's Disease Sleep Scale

Questions	Median (IQR)	MPDSS < 6		MPDSS ≥ 6	
		n	(%)	n	(%)
1. Overall, did you sleep well during the last week?	7 (6 - 8)	45	(22.5)	155	(77.5)
2. Did you have difficulty falling asleep each night?	8 (5 - 9)	57	(28.5)	143	(71.5)
3. Did you have difficulty staying asleep?	8 (5 - 10)	56	(28.0)	144	(72.0)
4. Did you have restlessness of legs or arms at nights causing disruption of sleep?	10 (8 - 10)	27	(13.5)	173	(86.5)
5. Was your sleep disturbed due to an urge to move your legs or arms?	10 (8 - 10)	24	(12.0)	176	(88.0)
6. Did you suffer from distressing dream at night?	10 (8 - 10)	15	(7.5)	185	(92.5)
7. Did you suffer from distressing hallucinations at night	10 (9 - 10)	15	(7.5)	185	(92.5)
8. Did you get up at night to pass urine?	8 (5 - 9)	60	(30.0)	140	(70.0)
9. Did you feel uncomfortable at night because you were unable to turn around in bed or move due to immobility?	10 (8 - 10)	20	(10.0)	180	(90.0)
10. Did you feel pain in your arms or legs which woke you up from sleep at night?	10 (9 - 10)	18	(9.0)	182	(91.0)
11. Did you have muscle cramp in your arms or legs which woke you up while sleeping at night?	9 (7 - 10)	38	(19.0)	162	(81.0)
12. Did you wake early in the morning with painful posturing of arms and legs?	10 (7.25 - 10)	30	(15.0)	170	(85.0)
13. On waking did you experience tremor?	10 (9 - 10)	21	(10.5)	179	(89.5)

Appendix 4:

Prevalence of Thai SCOPA-NS (cut-off point 6/7)

Table 2: Prevalence of sleep disorders

Sleep disorders	n (%)	95%CI
Pittsburgh Sleep Quality Index	124 (62.0)	(54.9 - 68.8)
Thai SCOPA-Sleep Scale	56 (28.0)	(21.9 - 34.8)

Appendix 5:

Sensitivity and specificity of Thai SCOPA-NS

Table 3: Measurement of the diagnostic test performance for predicting

Test	Cutoff	Sensitivity	Specificity	PPV	NPV	LR+	LR-
SCOPA	≥7	41.9 (33.1 - 51.1)	94.7 (87.1 - 98.5)	92.9 (82.7 - 98)	50 (41.6 - 58.4)	7.97 (3 - 21.15)	0.61 (0.52 - 0.72)

Note: PPV, positive predictive value; NPV, negative predictive value

Thai SCOPA-NS test and MPDSS test were in good agreement, and both agreed with the PSQI test. Therefore, both tests can be used effectively to assess sleep disorders in patients with Parkinson's disease.

Conclusion

Thai SCOPA-NS and MPDSS tests can be used to assess patients with Parkinson's disease with comparable accuracy. Patients significantly prefer performing Thai SCOPA-NS test than MPDSS test. However, the time used for completing Thai SCOPA-NS test was shorter and patients with Parkinson's disease preferred this test. Thus, we recommend using the Thai SCOPA-NS in screening sleep disorders in patients with Parkinson's disease for before referring the patients to a doctor for further diagnosis.

Suggestions and Limitations

This study focused solely on nighttime sleep, not included daytime sleep, which was an important part in sleep disorder assessment. Therefore, the study should continue in the future. As a further matter, both tests were in the form of self-assessment. Since Parkinson's disease was commonly found in the elderly, there should be a person guiding them to do the test, because some of the tests might confuse some patients. For example, in the MPDSS test, the scoring system and some questions that might occur during reading the test that must be asked for clarification.

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