Hidden Neuropathic Pain in Chronic Low Back Pain: Prevalence, Pattern, and Impact on Quality of Life

Panya Luksanapruksa, M.D.*, Nantthasorn Zinboonyahgoon, M.D., Monchai Ruangchainikom, M.D.*, Ekkapoj Korwutthikulrangsri, M.D.*, Borriwat Santipas, M.D.*, Nhathita Panatreswas, B.Sc.*, Sirichai Wilartratsami, M.D.***

**Department of Orthopedic Surgery, **Department of Anesthesiology, Faculty of Medicine Siriraj Hospital, Mahidol University, Bangkok 10700, Thailand.*

ABSTRACT

Objective: A patient with Neuropathic Pain (NP) may suffer from pure NP or may have mixed nociceptive and neuropathic pain. No previous study has investigated NP among Thai patients with Chronic Low Back Pain (CLBP). This study aimed to investigate the prevalence and clinical presentation of NP, and the impact of NP on Quality of Life (QoL) in Thai Chronic Low Back Pain (CLBP) patients.

Materials and Methods: Adult patients with CLBP longer than 3 months were included. NP was detected by painDETECT questionnaire, and NP was defined as a score 19. Demographic data, pain characteristics, treatment, Oswestry Disability Index (ODI), and quality of life score (Short Form 36, SF-36) were recorded.

Results: 371 CLBP patients were enrolled. The overall prevalence of neuropathic pain was 50.1% (95% CI: 44.9-55.3%). The prevalence of NP in patients with axial low back pain, back pain with pain radiating above the knee, and back pain with pain radiating below the knee was 28.3%, 58.21%, and 59.5%, respectively. Only 48.9% of patients with NP received neuropathic pain medication. Multivariate analysis showed only older age to be associated with NP (OR: 1.017, 95% CI: 1.002-1.033). NP patients had a significantly higher ODI score. There is no difference in most dimension of SF-36 scores, except marginally higher general health and vitality dimension scores.

Conclusion: Prevalence of NP in Thai CLBP patients is high. Additionally, it is undertreated and associated with higher disability especially among patients with radiating pain above the knee. Older age is an independent predictor of NP.

Keywords: Neuropathic pain; chronic low back pain; quality of life; low back pain; Thailand. (Siriraj Med J 2022; 74: 480-486)

INTRODUCTION

In addition to being one of the most prevalent pain conditions[1,2], chronic low back pain (CLBP) is associated with high healthcare costs, reduced productivity, and disability.[3-5] Physicians generally consider CLBP to be nociceptive pain, so it is treated as such. However, several studies have reported a high prevalence of neuropathic pain (NP) in CLBP.[4,6-14]

NP and nociceptive pain are different both in their pathophysiology and their management. Additionally, the cost associated with treating neuropathic LBP is estimated to be 70% higher than the cost associated with treating nociceptive Low Back Pain(LBP).[8] A patient with NP may suffer from pure NP or may have mixed nociceptive and neuropathic pain. The recognition of the presence of NP in CLBP may represent an important advancement in

Corresponding author: Sirichai Wilartratsami
E-mail: sirichai_w@hotmail.com
Received 25 January 2022 Revised 16 March 2022 Accepted 22 March 2022
ORCID ID: https://orcid.org/0000-0001-7651-4196
http://dx.doi.org/10.33192/Smj.2022.57

the treatment of CLBP because NP requires treatment with agents different from those used to treat nociceptive pain. Instead of non-steroidal anti-inflammatory agents (NSAIDs) and/or skeletal muscle relaxants that are used to treat nociceptive pain, different classes of medications, such as gabapentinoids, tricyclic antidepressants, and/or selective serotonin reuptake inhibitors, were found to be more efficacious for managing NP.[6] Additionally, the treatment of NP requires comprehensive evaluation via a multimodal, multidisciplinary approach to restore function and prevent disability.[6]

No previous study has investigated NP among Thai patients with CLBP, so this study aimed to investigate the prevalence and clinical presentation of NP and to evaluate the impact of NP on quality of life in Thai CLBP patients. We used the painDETECT questionnaire to identify NP[15], the Oswestry Disability Index (ODI) to evaluate disability[16], and Short Form 36 (SF-36) to assess the quality of life (QoL).[17]

MATERIALS AND METHODS

Subject recruitment

After receiving approval from the Institutional Review Board (Si 215/2013 [EC3]), adult patients aged ≥ 18 years with CLBP for longer than 3 months during 2013-2014 were enrolled. Patients with a cognitive or mental disorder, or who had trauma, infection, or cancer at the lower back area were excluded.

Study data

After granting informed consent, study data were collected from four questionnaires, including a demographic data questionnaire, ODI questionnaire, painDETECT questionnaire, and SF-36 questionnaire. Other data that were collected included gender, age, body mass index (BMI), underlying disease, previous spinal surgery, and duration of pain. The Thai version of the ODI[18] was used to assess disability, and this questionnaire has 10 questions. The score ranges from 0 (no disability) to 100 (high disability).

There are a variety of questionnaires that can be used to detect and diagnose NP, including Leeds Assessment of Neuropathic Symptoms and Signs (LANSS)[19] and Douleur Neuropathique 4 Questions (DN4).[20] However, we chose the painDETECT tool for this study because this questionnaire was specifically designed to detect NP in patients with CLBP. The painDETECT tool has high sensitivity (85%), specificity (80%), and positive predictive value (83%).[15] There is also no need for physical examination or for medical personnel to administer this questionnaire. NP was screened by painDETECT questionnaire that had 7 questions, pain course pattern, and radiating pain items. The score ranges from 0 (low risk for NP) to 38 (high risk for NP). The presence of NP was defined as a painDETECT score greater than 19.

Quality of life was assessed using the Thai version of the Short Form 36 (SF-36) health survey.[21] This is a 36-question patient-report questionnaire that includes the following domains: physical functioning, role-physical, bodily pain, general health, vitality, social functioning, role-emotional, and mental health.

Sample size calculation and statistical analysis

Hassan, *et al.* reported the prevalence of NP in CLBP to be 41%.[12] Using that prevalence rate, an alpha error of 0.05, and power of 80%, a sample size of 371 was calculated. The Chi-square test, Fisher's exact test, or Mann-Whitney U test was used to compare data between groups depending on the type and distribution of individual variables. Factors with a *p*-value less than 0.1 in univariate analysis were entered into multivariate analysis. All statistical analyses were performed using SPSS software, version 18.0, and two-tailed *p*-values less than 0.05 were considered statistically significant.

RESULTS

Three hundred and seventy-one patients (250 females, 121 males) were enrolled. The overall prevalence of NP in patients with CLBP was 50.1% (95% CI: 44.9-55.3%). The average age was 50.64±14.48 years, and the mean duration of back pain was 37.04±51.12 months. Patient characteristics, including gender, age, BMI, underlying disease, previous surgery, and pain duration, are shown in Table 1. The only variable that was found to be independently associated with a higher incidence of NP by multiple logistic regression was older age (odds ratio [OR]: 1.017, 95% confidence interval [CI]: 1.002-1.033).

Our study population (N=371) was also classified into three subgroups according to pain characteristic, as follows: 99 patients (27%) experienced predominant axial low back pain, 67 patients (18%) reported back pain and pain radiating above the knee, and 200 patients (54%) reported back pain and pain radiating below the knee. Five patients (1%) could not be classified into any category. The prevalence of NP from subgroup analysis was 28.3% (95% CI: 19.91-38.36), 58.21% (95% CI: 45.54-69.94), and 59.5% (95% CI: 52.33-66.3) for the axial pain, axial pain and pain radiating above the knee, and axial pain and pain radiating below the knee subgroups, respectively (Table 2).

Almost half (48.9%) of the patients suffering from NP were prescribed at least one neuropathic pain medication

TABLE 1. Characteristics of chronic low back pain patients.

Factors	Total (n=371)	Neuropathic pain (n=186)	Non-neuropathic pain (n=185)	*P*-value
Gender				
Female	250 (67.4%)	127 (68.3%)	123 (66.5%)	0.713
Male	121 (32.6%)	59 (31.7%)	62 (33.5%)	
Mean Age (Yr)	50.64±14.48	52.36±13.66	48.91±15.11	0.031*
BMI categories				
Obese II (> 30 kg/m^2)	34 (9.2%)	14 (7.6%)	20 (10.9%)	0.224
Obese I (25.0-29.9 kg/m^2)	109 (29.4%)	57 (30.8%)	52 (28.3%)	0.930
Overweight (23.0-24.9 kg/m^2)	68 (18.3%)	33 (17.8%)	35 (19.0%)	0.558
Normal (18.5-22.9 kg/m^2)	140 (37.7%)	74 (40.0%)	66 (35.9%)	1.000
Underweight (< 18.5 kg/m^2)	18 (4.85%)	7 (3.8%)	11 (6.0%)	0.269
Underlying disease	161 (43.4%)	78 (41.9%)	83 (44.9%)	0.633
Previous spinal surgery	8 (3.1%)	2 (1.1%)	6 (3.6%)	0.176
Mean Duration of pain (month)	37.04±51.12	38.02 ±54.65	36.05±47.44	0.573

Values are presented as mean±standard deviation or number (%), *Multiple logistic regression

TABLE 2. Show prevalence of neuropathic pain and treatment by pain location.

Pain location	Prevalence of neuropathic pain (%) (95% CI)	Neuropathic pain receiving neuropathic pain medications* (%)
Axial low back pain	28.3 (19.91, 38.36)	25
Back pain with radiating pain above knee	58.21 (45.54, 69.94)	30.8
Back pain with radiating pain below knee	59.5 (52.33, 66.3)	60.5

*considered gabapentinoid (gabapentin, pregabalin), tricyclic antidepressants or selective serotonin reuptake inhibitors

(gabapentinoid, tricyclic antidepressant, or selective serotonin-norepinephrine reuptake inhibitors). The prevalence of prescription of NP medication was 25%, 30.8%, and 60.5% in the axial low back pain, axial pain and pain radiating above the knee, and axial pain and pain radiating below the knee subgroups, respectively (Table 2).

Overall, NP was also found to be significantly associated with higher disability as measured by Oswestry Disability Index (ODI). The ODI was also found to be higher in all 3 of the aforementioned subgroups; however, only the back pain with pain radiating above the knee subgroup showed a statistically significantly higher ODI (Table 3). There was no significant difference between the NP and non-NP groups relative to SF-36 score, except for the general health dimension (47.77±7.61 vs. 46.19±7.33, p=0.020) and the vitality dimension (49.08±5.81 vs. 47.57±6.35, p=0.025), which demonstrated a statistically significantly higher score in NP patients, respectively (Table 4).

TABLE 3. Show Oswestry disability index by pain location.

Pain location	ODI neuropathic pain	ODI non-neuropathic pain	*P*-value
Over all	34.11±11.08	29.71±12.86	<0.001
Axial low back pain	29.59±11.83	26.41±12.27	0.212
Back pain with radiating pain above the knee	31.84±8.04	26.93±9.15	0.023
Back pain with radiating pain below the knee	35.92±11.39	33.58±13.45	0.146

Abbreviation: ODI; Oswestry disability index,
Values are presented as as mean±standard deviation. p-value by Chi-square test, Fisher's exact test, or Mann-Whitney U test

TABLE 4. Show quality of life scoring in each dimension of SF-36.

Dimensions	Neuropathic pain (n=186)	Non-Neuropathic pain (n=185)	*P*-value
Physical Functioning	35.90± 8.37	36.18 ±9.08	0.842
Role-Physical	35.80± 7.41	36.21± 8.51	0.937
Bodily Pain	34.49±5.34	34.78±6.69	0.673
General Health	47.77±7.61	46.19±7.33	0.020*
Vitality	49.08±5.81	47.57±6.35	0.025*
Social Functioning	37.29±7.84	38.35±9.83	0.554
Role-Emotional	30.91±9.68	31.18±10.09	0.978
Mental Health	42.20±6.77	41.53±7.66	0.520
PCS	39.01±5.374	39.02±6.24	0.654
MCS	40.83±6.38	40.43±7.20	0.470

Values are presented as mean±standard deviation. *Multiple logistic regression

DISCUSSION

The prevalence of NP in CLBP in the present study was 50%. Surprisingly, patients with back pain and pain radiating above the knee, which is what most physicians consider nociceptive pain, had the highest prevalence of NP (58.21%). Previous studies reported a prevalence of NP in CLBP that ranged from 1.6% to 80%.[4,11-13,22,23] The wide range of reported prevalence may be explained by differences in sample size, differences in the reference scores and/or type(s) of questionnaires used, and differences in the locations of pain.

Studies that used the painDETECT survey reported 1.6-50.1% prevalence of NP, while studies that used the DN4 tool reported 15-80%, and studies that used the LANSS tool reported 2.8-55%. However, Sakai, *et al.*[10] used a painDETECT NP cutoff of 13, whereas the others used an NP cutoff of 19. Interestingly, we found a 58.2% prevalence of NP among patients reporting back pain and pain radiating above the knee; however, Atta, *et al.*[11] reported only a 15% prevalence of NP among patients complaining of the same combination of pain. A possible explanation for this difference between studies

is that Atta, *et al.* used DN4 instead of painDETECT as a screening tool. Physicians usually consider radiating pain to the posterior thigh as referred pain from nociceptive low back pain. Surprisingly, patients with back pain and pain radiating above the knee had a similarly high prevalence of NP as patients with back pain and pain radiating below the knee. Moreover, and importantly, patients in the group with back pain and pain radiating above the knee had a significantly higher disability score, and a far lower proportion of patients being treated with NP medication compared to the below the knee group.

Many independent risk factors for NP in CLBP were reported from previous studies, including advanced age[4,7], female gender[4,7,14], male gender[9], pain intensity[9,14], diabetes mellitus[4,7], lumbar, abdominal, or pelvic surgery[7,23], alcohol consumption[23], Caucasian race[7], and smoking.[7] The present study found only advanced age to be an independent risk factor for NP, which is consistent with the results of studies conducted by El Sissi, *et al.*[4] and Kaki, *et al.*[7] A review of the literature is shown in Table 5.

We found that patients with NP had a higher disability than those who didn't have NP, and this finding was also previously reported.[9,13,24] Spahr *et al.* reported that CLBP patients with NP had significantly greater visual analog scale (VAS) pain scores, anxiety, depression, and psychological distress. The patients in that same study also had significantly poorer quality of life according to SF-36, including vitality, physical functioning, bodily pain, social function, and mental health.[13] In our study, there is no difference in most of the dimensions of SF-36, except vitality and general health dimensions, which were found to be statistically significantly higher in the NP group than in the non-NP group. Nevertheless, even if, the minimal clinically important difference (MCID) for these two SF-36 dimensions has not yet been established, these marginal differences (47.77±7.61 VS 46.19±7.33 and 49.08±5.81VS 47.57±6.35) are unlikely to have clinical significance. Chaisewikul, *et al.* reported the effectiveness of original and generic gabapentin in 356 patients who presented with neuropathic pain in each group. The original group enrolled 82 lumbar spondylosis with radiculopathy (23.0%), 15 herniated nucleus pulposus (4.2 %), and 52 spinal stenosis with radiculopathy (14.6%). The generic group enrolled 101 lumbar spondylosis with radiculopathy (28.4%), 16 herniated nucleus pulposus (5.1 %), and 51 spinal stenosis with radiculopathy (14.3%). The result showed the favorable response was reported in 91% in the original group and 95.2% in the generic group. Unfortunately, this study did not clearly define the exact number of patients who had chronic back pain with neuropathic pain. However, the result may help physicians choose the proper analgesic drug for neuropathic pain.[25] The other treatments including physiotherapy and Thai traditional treatment were reported. The back exercises including pelvic tilting, back extension, and knee to chest at least 3 days a week for 12 weeks can effectively relieve lower back pain and improve disabilities among patients who suffer from chronic low back pain.[26] Thepsongwat, *et al.* report the effectiveness of royal Thai traditional massage in the neck, shoulder, or back patients. This study enrolled the chronic pain patients (pain more than 6 months) for 42.6 %. The result showed 74.5% response rates in back pain and 73.5% in chronic pain participants.[27] Additionally, Verayachanku, *et al.* reported the efficacy and safety of poly-herbal formula Sahatsatara (SHT) in pain reduction in acute low back pain patients. The results show HT was not inferior to ibuprofen in pain relieving and disability in patients with acute LBP.[28]

To the best of our knowledge, this is the first study to investigate the prevalence and characteristics of NP, and the effect of NP on quality of life among CLBP patients in Thailand. The limitations of this study include its relatively small sample size and the fact that its study was conducted at a large urban national tertiary referral center. The later limitation suggests that our findings may not reflect and/or be generalizable to other care settings in Thailand. Lastly, as painDETECT is only a screening tool for NP, the positive screening is not the definite diagnosis of NP. The individual confirmation of NP by the standard guideline[29] is needed for a more definite result.

CONCLUSION

The prevalence of NP in Thai CLBP patients is high, especially in patients with back pain and pain radiating above or below the knee. Older age is an independent predictor of NP. NP is currently undertreated, especially axial pain and pain radiating above the knee.

ACKNOWLEDGMENTS

The authors would like to thank Miss Nunnapat Kangkano for assistance with statistical analysis, manuscript preparation, and journal submission process. And Miss Nattaya Bunwatsana for assistance with statistical analysis.

Competing interests:

This study was approved by the Institutional Review Board (Si 215/2013 [EC3]) and written informed consent was obtained from all participants.

All authors declare no personal or professional conflicts of interest relating to any aspect of this study.

TABLE 5. Show results of previous studies.

Author	Year	N	Tool/group	Prevalence (%)	Risk factors
Present study		371	PainDETECT >19 • Axial back pain • pain radiating proximal knee • pain radiating below the knee	50.1 28.3 58.21 59.50	advanced age
Kim et al.[9]	2017	1200	DN4 >4	41	• male • severe pain • had pain based on radiological and neurological findings
Sakai et al.[10]	2015	32	NePSQ PainDETECT ≥13	43.3 15.6	
Atta et al.[11]	2011	132	DN4 >4 • pain radiating proximal knee • pain radiating below the knee without neurologic signs • pain radiating towards the foot	 15 39 80	
El Sissi et al.[4]	2010	1134	LANSS ≥12	55	• advanced age • female • diabetes
Kaki et al.[7]	2005	1169	LANSS ≥12	54.7	• advanced age • female • increased height • white race • hypertension /Diabetes • smoking • previous back surgery • previous medications
Hassan et al.[12]	2005	100	LANSS >12	41	
Andrasinova et al.[22]	2016	63	painDETECT >19	1.6	
Spahr et al.[13]	2017	50	PainDETECT >19	48	
Sivas et al.[14]	2018	101	DN4 >4 LANSS >12	65.3 40.6	• female • occupation • VAS scores
Li et al.[23]	2018	2116	LANSS >12	2.8	• lumbar surgery • abdominal or pelvic surgery • drinking alcohol

Abbreviations: painDETECT; The painDETECT questionnaire, DN4; Self-completed douleur neuropathique 4 Questions, NePSQ; Neuropathic Pain Screening Questionnaire, LANSS; Self-completed Leeds Assessment of neuropathic Symptoms and Signs pain scale

Abbreviations

NP : Neuropathic Pain
QoL : Quality of Life
CLBP : Chronic Low Back Pain
LBP : Low Back Pain
ODI : Oswestry Disability Index
SF-36 : Short Form 36
LANSS : Leeds Assessment of Neuropathic Symptoms and Signs pain scale
DN4 : Douleur Neuropathique 4 Questions

REFERENCES

1. Iizuka Y, Iizuka H, Mieda T, Tsunoda D, Sasaki T, Tajika T, et al. Prevalence of Chronic Nonspecific Low Back Pain and Its Associated Factors among Middle-Aged and Elderly People: An Analysis Based on Data from a Musculoskeletal Examination in Japan. Asian Spine J 2017;11:989-97.
2. Meucci RD, Fassa AG, Faria NM. Prevalence of chronic low back pain: systematic review. Rev Saude Publica 2015;49:1.
3. Qaseem A, Wilt TJ, McLean RM, Forciea MA, Clinical Guidelines Committee of the American College of Physicians, Denberg TD, et al. Noninvasive Treatments for Acute, Subacute, and Chronic Low Back Pain: A Clinical Practice Guideline From the American College of Physicians. Ann Intern Med 2017;166: 514-30.
4. El Sissi W, Arnaout A, Chaarani MW, Fouad M, Assuity EI W, Zalzala M, et al. Prevalence of neuropathic pain among patients with chronic low-back pain in the Arabian Gulf Region assessed using the leeds assessment of neuropathic symptoms and signs pain scale. J Int Med Res 2010;38:2135-45.
5. Mehra M, Hill K, Nicholl D, Schadrack J. The burden of chronic low back pain with and without a neuropathic component: a healthcare resource use and cost analysis. J Med Econ 2012;15(2): 245-52.
6. Gudala K, Bansal D, Vatte R, Ghai B, Schifano F, Boya C. High Prevalence of Neuropathic Pain Component in Patients with Low Back Pain: Evidence from Meta-Analysis. Pain Physician 2017; 20:343-52.
7. Kaki AM, El-Yaski AZ, Youseif E. Identifying neuropathic pain among patients with chronic low-back pain: use of the Leeds Assessment of Neuropathic Symptoms and Signs pain scale. Reg Anesth Pain Med 2005;30:422-8.
8. Freynhagen R, Baron R. The evaluation of neuropathic components in low back pain. Curr Pain Headache Rep 2009;13:185-90.
9. Kim JH, Hong JT, Lee CS, Kim KS, Suk KS, Kim JH, et al. Prevalence of Neuropathic Pain and Patient-Reported Outcomes in Korean Adults with Chronic Low Back Pain Resulting from Neuropathic Low Back Pain. Asian Spine J 2017;11:917-27.
10. Sakai Y, Ito K, Hida T, Ito S, Harada A. Neuropathic pain in elderly patients with chronic low back painand effects of pregabalin: a preliminary study. Asian Spine J 2015;9:254-62.
11. Attal N, Perrot S, Fermanian J, Bouhassira D. The neuropathic components of chronic low back pain: a prospective multicenter study using the DN4 Questionnaire. J Pain 2011;12:1080-7.
12. Hassan AE, Saleh HA, Baroudy YM, Abdul-Rahman KI, Najjar MW, Kazi MS, et al. Prevalence of neuropathic pain among patients suffering from chronic low back pain in Saudi Arabia. Neurosciences (Riyadh) 2005;10:51-5.
13. Spahr N, Hodkinson D, Jolly K, Williams S, Howard M, Thacker M. Distinguishing between nociceptive and neuropathic components in chronic low back pain using behavioural evaluation and sensory examination. Musculoskelet Sci Pract 2017;27: 40-48.
14. Sivas F, Uzun O, Baskan B, Bodur H. The neuropathic pain component among patients with chronic low back-radicular pain. J Back Musculoskelet Rehabil 2018;31:939-46.
15. Freynhagen R, Baron R, Gockel U, Tolle TR. painDETECT: a new screening questionnaire to identify neuropathic components in patients with back pain. Curr Med Res Opin 2006;22:1911-20.
16. Fairbank JC, Pynsent PB. The Oswestry Disability Index. Spine (Phila Pa 1976) 2000;25:2940-52.
17. Gatchel RJ, Mayer T, Dersh J, Robinson R, Polatin P. The association of the SF-36 health status survey with 1-year socioeconomic outcomes in a chronically disabled spinal disorder population. Spine (Phila Pa 1976) 1999;24:2162-70.
18. Sanjaroensuttikul N. The Oswestry low back pain disability questionnaire (version 1.0) Thai version. J Med Assoc Thai 2007; 90:1417-22.
19. Bennett M. The LANSS Pain Scale: the Leeds assessment of neuropathic symptoms and signs. Pain 2001;92:147-57.
20. Bouhassira D, Attal N, Alchaar H, Boureau F, Brochet B, Bruxelle J, et al. Comparison of pain syndromes associated with nervous or somatic lesions and development of a new neuropathic pain diagnostic questionnaire (DN4). Pain 2005;114(1-2):29-36.
21. Krittayaphong R, Bhuripanyo K, Raungratanaamporn O, Chotinaiwatarakul C, Chaowalit N, Punlee K, et al. Reliability of Thai version of SF-36 questionnaire for the evaluation of quality of life in cardiac patients. J Med Assoc Thai 2000;83 Suppl 2:S130-6.
22. Andrasinova T, Kalikova E, Kopacik R, Srotova I, Vlckova E, Dusek L, et al. Evaluation of the Neuropathic Component of Chronic Low Back Pain. Clin J Pain 2019;35:7-17.
23. Li J, He J, Li H, Fan BF, Liu BT, Mao P, et al. Proportion of neuropathic pain in the back region in chronic low back pain patients -a multicenter investigation. Sci Rep 2018;8:16537.
24. Djordjevic OC, Konstantinovic LM, Miljkovic N. Difference between subjects in early chronic phase of low back pain with and without neuropathic component: observational cross-sectional study. Eur J Phys Rehabil Med 2019;55:217-24.
25. Chaisewikul R, Saejong R, Tongsai S, Thamlikitkul V. Comparative Effectiveness and Safety of Original Gabapentin and Generic Gabapentin in Treating Patients with Neuropathic Pain at Siriraj Hospital, Bangkok, Thailand. Siriraj Med J 2020;64:172-77.
26. Chaiprateep T, Kolladarungkri T, Kumthornthip W, Hunnangkul S. Effectiveness of Back Exercise and Education for Lower Back Pain Prevention among Nurses at a Tertiary Hospital in Bangkok, Thailand. Siriraj Med J 2020;72:109-16.
27. Thepsongwat JJ, Supakul R, Panupattanapong S, Witthawaskul J, Cheewakongkiat P, Fongkum W, et al. Effectiveness of the Royal Thai Traditional Massage for Relief of Muscle Pain. Siriraj Med J 2006;58:702-04.
28. Chatsiricharoenkul S. Single-Blind Randomized Controlled Trial of Poly-Herbal Formula Sahatsatara for Acute Low Back Pain: A Pilot Study. Siriraj Med J 2016; 68:30-36.
29. Finnerup NB, Haroutounian S, Kamerman P, Baron R, Bennett DLH, Bouhassira D, et al. Neuropathic pain: an updated grading system for research and clinical practice. Pain 2016;157:1599-606.