Validation of the Thai Version Critical Care Pain Observation Tool and Behavioral Pain Scale in Postoperative Mechanically Ventilated ICU Patients

Karuna Wongtangman MD*, Onuma Chaiwat MD*,
Suwannee Suraseranivongse MD*, Napat Thikom RN**,
Vimolluck Sanansilp MD*, Suratsawadee Wangnamthip MD*

** Department of Anesthesiology, Faculty of Medicine Siriraj Hospital, Mahidol University, Bangkok, Thailand*
*** Division of Nursing, Faculty of Medicine Siriraj Hospital, Mahidol University, Bangkok, Thailand*

Objective: *To translate critical care pain observation tool (CPOT) and behavioral pain scale (BPS) into Thai language, and to validate the Thai version of these pain assessment tools in postoperative mechanically ventilated adult intensive care unit (ICU) patients.*

Material and Method: *This is a prospective study. After translation, both pain scales were tested for concurrent validity, discriminant validity, criterion validity, and inter-rater reliability in patients who were intubated during the postoperative period. Opinions regarding practicality were elicited via questionnaires from nurses who had been using and were familiar with these two pain scales.*

Results: *Four hundred and eighty-four observations from 27 included patients were analyzed. Concurrent validity was supported by positive correlations between scales, which ranged from r = 0.74 to r = 0.78 (p<0.01). Both scales showed a trend toward agreement with routine clinical decisions to treat postoperative pain. Discriminant validity was demonstrated by high scores (BPS 5, CPOT 3) in higher pain situations before giving analgesics, and by lower pain scores (BPS 4, CPOT 2) in less painful situations after pain medication had been given. Both scales showed good inter-rater reliability (intraclass correlation coefficient = 0.72 to 0.90).*

Conclusion: *The Thai version BPS and CPOT are valid and reliable tools for assessment of pain in postoperative mechanically ventilated adult ICU patients. Further studies are needed to evaluate the value and utility of these scales for improving pain management in a critical care setting in Thailand.*

Keywords: *Thai version, Validated, Critical care pain observation tool, CPOT, Behavioral pain scale, BPS, Adult ICU patients*

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The International Association for the Study of Pain (IASP) defines pain as "an unpleasant sensory and emotional experience associated with actual or potential tissue damage"[1]. Adult critically ill medical, surgical, and trauma patients routinely experience pain, both at rest and during routine intensive care unit (ICU) care[2]. Pain in ICU patients can contribute to unfavorable outcomes. The stress response to pain may initiate hyperglycemia and increase catecholamine, cortisol, and antidiuretic hormone secretions[8,9]. In addition, pain-induced reflex responses may alter respiratory mechanics, increase cardiac demands, and cause contraction of skeletal muscles, muscle spasms, and rigidity. Moreover, pain does not allow patients to collaborate appropriately during care-related procedures, such as mobilization and respiratory therapy, leading to complications that may prolong hospital stay and increase health care costs[10,11]. The incidence of pain in previous studies ranged from 52% to 71% in surgical ICUs[3-5], and 50% to 54% in medical and mixed ICUs[3,6,7]. In some pain studies in critically ill patients, the majority of patients described their pain as moderate to severe[4,7,12]. Accordingly, timely and accurate pain assessment is the first step in proper pain management. Although self-report is the most valid indicator of pain assessment, many factors can compromise patient ability to communicate verbally,

Correspondence to:
Wongtangman K, Department of Anesthesiology, Faculty of Medicine Siriraj Hospital, Mahidol University, 2 Wanglang Road, Bangkoknoi, Bangkok 10700, Thailand.
Phone: +66-2-4197978; Fax: +66-2-4113256
E-mail: karuna.pha@gmail.com

including sedation, endotracheal intubation, and altered level of consciousness[9,13]. A lack of clinical scoring systems to objectively measure pain levels results in excessively deep states of sedation and a lack of analgesia during painful procedures[14]. Moreover, many studies found rates of pain assessment in critically ill patients to be significantly lower (40%) than the rates of use of analgesic drugs (60 to 90%)[14,15].

Although several tools (e.g., behavioral pain rating scale (BPRS), pain management algorithms, behavioral pain scale (BPS), nonverbal pain scale (NVPS), critical care pain observation tool (CPOT)) have been developed to identify and objectively measure pain; the 2013 clinical practice guidelines for the management of pain, Agitation, and Delirium in adult patients in the ICU recommend BPS and CPOT as the most valid and reliable behavioral pain scales for ICU patients that are unable to communicate[2].

BPS is composed of three behavioral domains including facial expression, movements of upper limbs, and compliance with ventilation. Each domain contains four descriptions of the patients state or behavior, with the first representing the mildest option with a score of 1, and the last representing the most extreme option with a score of 4. BPS scoring ranges from 3 (no pain) to 12 (most pain)[17] (Appendix 1). The validity and reliability of BPS in sedated, ventilated ICU patients has been evaluated in many studies[17-20].

CPOT is a unidimensional measure designed for use in intubated and non-intubated ICU patients. It evaluates four behavioral domains, including facial expressions, body movements, muscle tension, and compliance with ventilator for intubated patients or vocalization for non-intubated patients. Each of the four CPOT domains consists of three descriptions of the patients' state or behavior, with the first describing the mildest level with a score of 0, and the third describing the most severe level with a score of 2. CPOT score ranging from 0 (no pain) to 8 (most pain)[21] (Appendix 3). It was originally developed in French based on retrospective evaluation and analysis of patient medical records to identify common pain notations and findings; and the English version was validated in 2007 by Gelinas et al[15,22]. Since that time, many studies have evaluated the reliability and validity of CPOT[21-24].

Since pain response is affected by several psychological factors, including cultural differences, cognitive appraisal, and coping style[16]; cross-validation is needed to ensure that these pain assessment tools can be effectively and reliably used in Thai patients. Based on the literature's review, BPS and CPOT have not been translated into Thai language and validated. Accordingly, the aim of the study was to translate CPOT and BPS into Thai language and to validate the Thai version of two pain assessment tools in postoperative mechanically ventilated adult ICU patients. The secondary objective was to describe the content validity, concurrent validity, inter-rater reliability, and practicality of use of the Thai versions of BPS and CPOT.

Material and Method

This study design was approved by the Institutional Review Board (Si 553/2014). The study was conducted in the surgical ICUs (SICUs) of Siriraj Hospital Thailand's university-based national tertiary referral center. These ICUs are closed, 14-bed units that receive surgical patients, except cardiothoracic surgery, neurologic surgery, and trauma surgery patients. Care in these ICUs is managed by a critical care anesthesiologist. At the time this study was conducted, there were no protocols or guidelines in place for the management of pain, agitation, and delirium in the SICUs at our center. As such, all decisions relative to these patient management parameters were made according to the discretion of the attending physicians and staff.

Patients that were admitted to SICUs at Siriraj Hospital during the October 2015 to September 2016 study period were recruited. Patients meeting all of the following criteria were included: aged $\geq$18 years, be able to communicate in Thai, and intubated during postoperative period. Patients in whom physical responses to pain could not be reliably assessed (e.g., quadriplegia, patients with limb or facial injuries, patients receiving neuromuscular blockers, patients with limb mobility adversely affected by stroke, and patients with epidural catheter used for postoperative pain control) were excluded.Written informed consent was obtained from all patients (prior to operation) or relatives prior to inclusion in the study.

Phase 1: Translation

CPOT was translated with the permission of the American Association of Critical-Care Nurses (AACN) and the permission to translate BPS was granted by Prof. JF Payen. BPS and CPOT were translated from English into Thai by an anesthetist who is fluent in both languages. Then, another bilingual anesthetist who was not involved in the first English to Thai translation phase, translated the Thai version

back into English. Finally, the back-translated BPS and CPOT were rechecked against the original English language versions by a third translator who is a native English speaker to ensure translation accuracy.

Phase 2: Testing of concurrent validity, construct validity, discriminant validity, and inter-rater reliability in post-surgical pain

Patients' demographic data and perioperative data were recorded. All SICUs nurses were trained in how to score pain using the BPS and CPOT scales. Ten behaviors that patients demonstrate during painful procedures (e.g., suctioning and blood sampling) were shown on videotape to train nurses until the intra-class correlation coefficient (ICC) reached 0.8 or more. Serial assessments of each patient were conducted by three nurses every 1 hour until 24 hours after surgery or until patients were extubated. During each hourly assessment, two nurses independently evaluated the same patient using both pain scales. Subjective opinions about pain were made and objective physical variables, including mean arterial pressure, heart rate, and respiratory rate, were collected every hour by the third nurse who used that information to formulate routine clinical decisions to treat pain. The third nurse was the bedside nurse who was responsible for caring for that patient on the day of the study. Other etiologies of increased blood pressure, such as full bladder, were ruled out before analgesic was given. Concurrent validity was assessed using correlation data between BPS and CPOT at the same time point for all patients. In addition, the ability of each pain scale to differentiate high pain scores before giving analgesic and low pain scores after giving analgesic was tested to evaluate for discriminant validity. Kappa (κ) statistic was used to test for inter-rater reliability between BPS and CPOT by using the average high scores of the two pain scales before giving analgesics to determine the cut-off point. Agreement between the two pain scales was assessed by comparing the findings of the first and second nurses with the routine clinical decisions of the third nurse. Consistencies in scoring from each of the pain scales as evaluated by the first and second nurse were identified by inter-rater reliability.

Phase 3: Practicality of use and testing for content validity

Questionnaires designed to elicit opinions regarding the practicality of use of BPS and CPOT were sent to participating SICU nurses. Both pain assessment scales were ranked from "0 = least" to "10 = most" for the following parameters: simplicity of use, time consumed, feasibility in routine clinical use, ability to differentiate pain severity, assistance in decision to give analgesic, and overall satisfaction with the scales. To evaluate content validity, the content of the Thai version BPS and CPOT was assessed by 8 senior nurses with at least 5 years of SICU work experience. Content assessment scoring was coded, as follows: 1 = agree; 0 = no idea; and, -1 = disagree.

Statistical analysis

The sample size calculation was based on a two-group Satterth waite t-test with a 0.05 two-sided significance level, 90% power to detect a difference in means of 1 (the difference between before and after analgesic given), and assuming a ratio of patients who did not receive treatment to patients who received treatment of 3:1. The sample size in the two groups was calculated to be 360 and 120, respectively.

Data were analyzed using PASW Statistics for Windows, 18.0 Chicago: SPSS Inc. Patient demographic and clinical data are described as mean $\pm$ standard deviation (SD), median and range, or number and percentage (%), as appropriate. Correlations between BPS and CPOT were analyzed using Spearman's rank correlation coefficient. Inter-rater reliability was analyzed by intraclass correlation coefficient (ICC) using a two-way random effect model. An ICC of 0.8 or more was considered acceptable. Differences in pain scores before and after analgesic given (used to determine discriminant validity) were analyzed using Wilcoxon matched-pairs signed-rank test. Agreement between pain scales from the independent evaluations of the first and second nurse at the cut-off points (corresponding to high pain before analgesic given) and the third nurse's routine decisions to treat pain were analyzed and reported as positive predictive value. Internal consistency, a measure of how the items within a scale are interrelated, was expressed using Cronbach's alpha (α). A high Cronbach's α value reflects high internal consistency. A value larger than 0.7 is generally regarded as satisfactory.

Results

A total of 27 patients were enrolled during the study period and 484 observations were included in the final analysis. The number of observations per patient varied depending on the duration of intubation. The mean number of assessments from ICU admission to discontinuation of ventilator support or until 24

hours after surgery was 18±6 times per patient. Among 484 observations, there were 115 observations that received treatment. A majority of patients underwent major abdominal surgery and were American Society of Anesthesiologists (ASA) physical status III (Table 1).

Concurrent validity

Concurrent validity was evaluated in terms of correlation between pain scales in all patients. The correlation between BPS and CPOT was moderate to strong correlations, which ranged from r = 0.74 to r = 0.76 (p<0.01).

Discriminant validity

In 65% of observations, patients received analgesic as a continuous infusion. Each patient was assessed every hour using both BPS and CPOT. Narcotic administration was also recorded. Discriminant validity was observed for both tools between before and after administration of analgesics (Table 2). In cases receiving continuous narcotic infusion, scores were recorded before and after additional bolus doses or increased doses of infusion. Median and interquartile range (IQR) BPS score was 5 (4, 6) before analgesic was given, and 4 (3, 5) after analgesic was given. Median and IQR (P_{25},P_{75}) CPOT score was 3 (1, 4) before analgesic was given, and 1-2 (0, 3) after analgesic was given.

Table 1. Patients demographic and clinical characteristic

Characteristics	(n = 27)
Age (yr)	64±15
Gender (female)	13 (48.10)
ASA class	
II	5 (18.50)
III	15 (55.60)
IV	7 (25.90)
Type of surgery	
Elective	19 (70.40)
Emergency	8 (29.60)
Site of surgery	
Abdomen	12 (44.40)
Vascular	6 (22.20)
Orthopedic	6 (22.20)
Others	3 (11.10)
Anesthetic duration (min)	332±145

Data presented as mean ± standard deviation ornumber and percentage.
ASA = American Society of Anesthesiologists

Reliability

Inter-rater agreement was excellent based on 484-paired assessments between nurse A and nurse B. ICC was 0.87 (95% CI 0.84 to 0.89) for BPS and ICC was 0.91 (95% CI 0.90 to 0.93) for CPOT. Both scales demonstrated a high level of internal consistency, with overall Cronbach's α of 0.79 to 0.81 for BPS and 0.79 to 0.81 for CPOT. Each item was found to contribute to the overall internal consistency of its respective pain assessment tool, given that the Cronbach's α did not improve with the removal of any indicator. Indicator 1 (facial expression) contributed most to the reliability of both the BPS and the CPOT, as the Cronbach's α decreased the most when facial expression was deleted from the analysis. In contrast, indicator 3 (compliance with ventilator) contributed least to BPS (Table 3), and indicator 3 (muscle tension) contributed least to CPOT (Table 4).

Criterion validity

The threshold associated with maximization of the sums of sensitivity and specificity between CPOT and the pain medication given by nurses, and BPS and the pain medication given by nurses was found to be a score of >2 on the CPOT, and a score of >4 on the BPS. Specificity (0.847 for CPOT and 0.679 for BPS) was higher than sensitivity (0.643 for CPOT and 0.672 for BPS), which resulted in a positive predictive value of 82.9% for the CPOT, and 77.2% for the BPS.

Practicality and content validity

Practicality aspect was evaluated by 36 nurses with mean experience of 9.94±7.69 years (range: 1 to 25 years). BPS was rated superior to CPOT for all criteria (Table 5).The content of both BPS and CPOT were accepted by all nurses.

Discussion

The present study validated the Thai version of the CPOT and BPS in adult postoperative ICU patients who were unable to self-report the presence or absence of pain. The findings of this study also revealed good concurrent validity between Thai version CPOT and Thai version BPS.

Testing the validity of a new pain scale requires comparison with a standard criterion. However, comparison between behavioral pain scales and a reference standard was not possible in this study. Interviewing patients after discharge from the ICU

Table 2. Discriminant validity of pain scores from nurse A and B before and after giving analgesic during 484 observations

Pain scales	Observer	Pain scores		*p*-value
		Before given analgesic	After given analgesic	
Behavioral Pain Scale	A	5 (4, 6)	4 (3, 5)	<0.01
	B	5 (4, 6)	4 (3, 5)	<0.01
Critical-care Pain Observation Tool	A	3 (1, 4)	1 (0, 3)	<0.01
	B	3 (1, 4)	2 (1, 3)	<0.01

Data presented as median and interquartile range (P_{25},P_{75})
Comparison using Wilcoxon matched-pair signed-rank test

Table 3. Internal consistency of Behavioral Pain Scale

Item	Cronbach's alpha: Nurse A	Cronbach's alpha: Nurse B
Overall	0.78	0.80
Without indicator 1 (facial expression)	0.66	0.70
Without indicator 2 (upper limb)	0.71	0.72
Without indicator 3 (compliance with ventilator)	0.74	0.78

Table 4. Internal consistency of Critical-care Pain Observation Tool

Item	Cronbach's alpha: Nurse A	Cronbach's alpha: Nurse B
Overall	0.80	0.79
Without indicator 1 (facial expression)	0.74	0.73
Without indicator 2 (body movement)	0.74	0.72
Without indicator 3 (muscle tension)	0.77	0.74
Without indicator 4 (compliance with ventilator)	0.75	0.75

Table 5. Practicality; rating score 0 (least likely) to 10 (most likely)

Items of practicality	BPS	CPOT
Simple to use	7.97±1.50	7.08±1.56
Time wasting	9.13±1.62	7.05±1.31
Difficulty in assessing	7.86±1.72	6.97±1.50
Able to differentiate pain severity	8.25±1.40	7.89±1.37
Assisting in decision to give analgesic	8.16±1.46	7.78±1.42
Appropriate for routine practice	8.00±1.87	7.44±1.81
Global rating	8.00±1.74	7.47±1.66

Data presented as mean ± standard deviation

provides some sense of a patient's overall and retrospective pain[4,7], but this interview cannot assess the temporal nature of that patient's pain. The authors, therefore, evaluated the validity of the Thai version of the CPOT and BPS by indirect arguments, assessing whether these scales really measured a patient's level of pain. Patients were evaluated hourly with both pain measurements to compare the pain scores before and

after giving analgesics. Discriminant validity of both pain scales was confirmed by significantly higher pain behavior scores before administration of analgesics. Moreover and in response to the objective of the study, the results confirm that both scores can detect and discriminate pain, and that both pain assessment tools provide a valid measurement of pain in mechanically ventilated critically ill ICU patients.

Inter-rater reliability is essential for standardizing pain assessment in the ICU, which is a setting where clinicians often have to assess pain in non-communicative patients. The study's findings indicate that the inter-rater reliability of the CPOT and BPS between two nurses was excellent, as supported by high intra-class correlation coefficients and satisfactory internal consistency. These parameters indicate that both scores produce consistent scores from different assessors. These results were similar to those from previous validation studies of the BPS[17] and of the CPOT in both English[22] and French version[21].

Principal factor analysis revealed that the "facial expression" subscale was the most sensitive to change in both the BPS and the CPOT[18,20,25]. The value of facial expression has been proven in both acute and chronic pain not only in adults, but also in infants and children[20].

In the study, predictive validity was tested in terms of sensitivity, specificity, and for predicting the routine clinical decision to treat pain after surgery. Nurse assessments and their decision to treat pain are not a perfect gold standard, but they were the best standard of treatment available in our routine practice. The predictive validity of all measures of postoperative pain yielded fair agreement, with positive predictive value of 82.9% on the CPOT and 77.2% on the BPS. In other words, 82.9% of patients in whom pain was detected with a CPOT score >2, and 77.2% of patients in whom pain was detected with a BPS score >4 received treatment for pain. Many different CPOT cut-off points were reported from previous studies. Gelinas et al reported a CPOT cut-off point of 3 with 66.7% sensitivity and 83.3% specificity in critically ill, non-communicative adults[22]. In another study, the same investigator reported a CPOT cut-off score of >2 with higher sensitivity (86.1%) in 99 cardiac surgery ICU patients[24]. Determining a definitive cut-off score for this type of clinical tool may be difficult.

Concerning practicality of use, BPS, when compared to CPOT, was found to be a more practical pain scale for use in a real-life clinical setting, most notably for the fact that it takes less time to use. For content validity, some nurses expressed confusion about how to grade 'body movement' on CPOT and 'upper limbs' on BPS. They reported that some patients moved their body or upper limbs because they could not tolerate the endotracheal tube, not because of pain. Some nurses have questioned the 'compliance with ventilation' parameter on both scales, that debate centering on whether ventilator compliance is indicative of pain or patient's lung pathology.

The study has some mentionable limitations. Given that pain is both complex and subjective, patient self-report of pain remains the gold standard. However, there are many factors that can compromise and complicate this process in ICU patients, as mentioned earlier in this report. In the absence of alternative gold standard when patients are not able to self-report pain, the usual measures of accuracy, including sensitivity and specificity, do not apply. Alternatively, discriminant validity was used to assess the efficacy of both pain assessment tools. A second potential limitation to the study design is that, in our practice, most of the postoperative patients that were intubated and ventilated received a fentanyl infusion. Although BPS can range from 3 to 12 and CPOT can range from 0 to 8, it is not surprising that most of our evaluations were clustered in the 3 to 6 range in 92% of observations when using the BPS, and clustered in the 0 to 4 range in 92% of observations when the CPOT was used. Fentanyl infusion may lead to drug accumulation and oversedation, which essentially results in preemptive treatment of pain. As a result, there were few evaluation scores at the far end of both pain scales [BPS >7, (n = 13); CPOT >5, (n = 15)]. As such, assessment of the validity of these scales at the high pain severity end of these scales may be difficult. Third, we did not routinely record delirium and depth of sedation in our patients. Although behavioral changes in patients may be due to delirium or sedation and not pain, Kanji et al reported that CPOT is a valid and reliable tool for detection of pain in delirious adult ICU patients[25]. Fourth and finally, we collected pain scores from postoperative ICU patients who were assumed to have pain at rest. Ideally, when comparing different pain scoring systems in the ICU, pain scores in the absence and presence of an unavoidable painful stimulus should be collected and analyzed in order to be able to study the sensitivity for a change of each pain scale. In further study, basal pain scores should be obtained together with intervention pain scores in order to evaluate and judge the use of specific pain scales in different settings and

for different purposes.

Conclusion

The use of a valid pain assessment tool is important for pain management in all critically ill patients. Clinical practice guidelines recommend the routine assessment of pain in all critically ill patients with a validated pain assessment tool. BPS and CPOT have both been validated and are recommended for pain assessment in this patient population. The results of the study demonstrate the reliability and validity of the Thai version of the BPS and CPOT for the detection and assessment of pain in postoperative mechanically ventilated adult ICU patients. Further studies are needed to evaluate the value and utility of these scales for improving pain management in a critical care setting in Thailand.

What is already known on this topic?

Adult critically ill patients routinely experience pain, both at rest and during routine ICU care, and the prevalence of inadequate pain relief remains high in the range of 50 to 70%. Appropriate pain assessment and adequate pain relief are extremely important in reducing complications from stress response.

Postoperative patients with disorders of consciousness are not able to communicate or appropriately report or describe their pain. To date, there is no Thai version of validated pain scale.

What this study adds?

This study demonstrates the reliability and validity of the Thai version of the BPS and CPOT for the detection and assessment of pain in postoperative mechanically ventilated adult ICU patients. BPS was rated as being more practical assessment in a busy routine clinical practice.

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Registration

ClinicalTrials.govNCT03164525.

Potential conflicts of interest

None.

References

1. Williams AC, Craig KD. Updating the definition of pain. Pain 2016; 157: 2420-3.
2. Barr J, Fraser GL, Puntillo K, Ely EW, Gelinas C, Dasta JF, et al. Clinical practice guidelines for the management of pain, agitation, and delirium in adult patients in the intensive care unit. Crit Care Med 2013; 41: 263-306.
3. Chanques G, Sebbane M, Barbotte E, Viel E, Eledjam JJ, Jaber S. A prospective study of pain at rest: incidence and characteristics of an unrecognized symptom in surgical and trauma versus medical intensive care unit patients. Anesthesiology 2007; 107: 858-60.
4. Puntillo KA. Pain experiences of intensive care unit patients. Heart Lung 1990; 19: 526-33.
5. Klein DG, Dumpe M, Katz E, Bena J. Pain assessment in the intensive care unit: development and psychometric testing of the nonverbal pain assessment tool. Heart Lung 2010; 39: 521-8.
6. van de Leur JP, van der Schans CP, Loef BG, Deelman BG, Geertzen JH, Zwaveling JH. Discomfort and factual recollection in intensive care unit patients. Crit Care 2004; 8: R467-73.
7. Desbiens NA, Wu AW, Broste SK, Wenger NS, Connors AFJr, Lynn J, et al. Pain and satisfaction with pain control in seriously ill hospitalized adults: findings from the SUPPORT research investigations. For the SUPPORT investigators. Study to Understand Prognoses and Preferences for Outcomes and Risks of Treatment. Crit Care Med 1996; 24: 1953-61.
8. Kehlet H. Does analgesia benefit post-injury outcome? In: Parker MM, Shapero MJ, Porembka DT, editors. Critical care: state of the art. Vol. 5. Anaheim, CA: Society of Critical Care Medicine; 1995: 213-29.
9. Hamill-Ruth RJ, Marohn ML. Evaluation of pain in the critically ill patient. Crit Care Clin 1999; 15: 35-54, v-vi.
10. Acute pain management guideline panel. Acute pain management: operative or medical procedures and trauma. Clinical practice guideline. AHCPR Pub. No. 92-0032. Rockville, MD: Agency for Health Care Policy and Research, Public Health Service, U.S. Department of Health and Human Services; 1992: 15-26.
11. Kwekkeboom KL, Herr K. Assessment of pain in

the critically ill. Crit Care Nurs Clin North Am 2001; 13: 181-94.
12. Whipple JK, Lewis KS, Quebbeman EJ, Wolff M, Gottlieb MS, Medicus-Bringa M, et al. Analysis of pain management in critically ill patients. Pharmacotherapy 1995; 15: 592-9.
13. Shannon K, Bucknall T. Pain assessment in critical care: what have we learnt from research. Intensive Crit Care Nurs 2003; 19: 154-62.
14. Payen JF, Chanques G, Mantz J, Hercule C, Auriant I, Leguillou JL, et al. Current practices in sedation and analgesia for mechanically ventilated critically ill patients: a prospective multicenter patient-based study. Anesthesiology 2007; 106: 687-95.
15. Gelinas C, Fortier M, Viens C, Fillion L, Puntillo K. Pain assessment and management in critically ill intubated patients: a retrospective study. Am J Crit Care 2004; 13: 126-35.
16. Cousins M. Acute and postoperative pain. In: Wall PD, Melzack R, editors. Textbook of pain. 3rd ed. Edinburgh: Churchill Livingstone; 1994: 357-85.
17. Payen JF, Bru O, Bosson JL, Lagrasta A, Novel E, Deschaux I, et al. Assessing pain in critically ill sedated patients by using a behavioral pain scale. Crit Care Med 2001; 29: 2258-63.
18. Aissaoui Y, Zeggwagh AA, Zekraoui A, Abidi K, Abouqal R. Validation of a behavioral pain scale in critically ill, sedated, and mechanically ventilated patients. Anesth Analg 2005; 101: 1470-6.
19. Young J, Siffleet J, Nikoletti S, Shaw T. Use of a Behavioural Pain Scale to assess pain in ventilated, unconscious and/or sedated patients. Intensive Crit Care Nurs 2006; 22: 32-9.
20. Ahlers SJ, van der Veen AM, van Dijk M, Tibboel D, Knibbe CA. The use of the Behavioral Pain Scale to assess pain in conscious sedated patients. AnesthAnalg 2010; 110: 127-33.
21. Gelinas C, Fillion L, Puntillo KA, Viens C, Fortier M. Validation of the critical-care pain observation tool in adult patients. Am J Crit Care 2006; 15: 420-7.
22. Gelinas C, Johnston C. Pain assessment in the critically ill ventilated adult: validation of the Critical-Care Pain Observation Tool and physiologic indicators. Clin J Pain 2007; 23: 497-505.
23. Marmo L, Fowler S. Pain assessment tool in the critically ill post-open heart surgery patient population. Pain Manag Nurs 2010; 11: 134-40.
24. Gelinas C, Harel F, Fillion L, Puntillo KA, Johnston CC. Sensitivity and specificity of the critical-care pain observation tool for the detection of pain in intubated adults after cardiac surgery. J Pain Symptom Manage 2009; 37: 58-67.
25. Kanji S, MacPhee H, Singh A, Johanson C, Fairbairn J, Lloyd T, et al. Validation of the Critical Care Pain Observation Tool in Critically Ill Patients With Delirium: A Prospective Cohort Study. Crit Care Med 2016; 44: 943-7.

Appendix 1. Behavioral Pain Scale (BPS)[18]

Item	Description	Score
Facial expression	Relaxed	1
	Partially tightened (e.g., brow lowering)	2
	Fully tightened (e.g., eyelid closing)	3
	Grimacing	4
Upper limbs	No movement	1
	Partially bent	2
	Fully bent with finger flexion	3
	Permanently retracted	4
Compliance with ventilation	Tolerating movement	1
	Coughing, but tolerating ventilation most of the time	2
	Fighting ventilator	3
	Unable to control ventilation	4

Appendix 2. Behavioral Pain Scale (Thai version)

รายการ	*ลักษณะพฤติกรรม*	*คะแนน*
สีหน้า	*ผ่อนคลาย*	*1*
	บึ้งตึงบางส่วน (เช่น ขมวดคิ้ว)	*2*
	บึ้งเต็มที่ (เช่น ปิดตาแน่น)	*3*
	แสยะ หน้าเบะ	*4*
แขน	*ไม่ขยับ*	*1*
	งอบ้าง	*2*
	งอเต็มที่และเกร็งงอนิ้ว	*3*
	หดแขนตลอดเวลา	*4*
การเข้าได้กับเครื่องช่วยหายใจ	*เข้ากันได้ดี*	*1*
	มีไอบ้างแต่ยังหายใจเข้ากับเครื่องได้เป็นส่วนใหญ่	*2*
	หายใจสู้กับเครื่อง	*3*
	ไม่สามารถช่วยหายใจได้เลย	*4*

Appendix 3. Critical-Care Pain Observation Tool (CPOT)[26]

Indicator	Description	Score	
Facial expression	No muscular tension observed	Relaxed, neutral	0
	Presence of frowning, brow lowering, orbit tightening, and levator contraction	Tense	1
	All of the above facial movements plus eyelid tightly closed	Grimacing	2
Body movements	Does not move at all (does not necessarily mean absence of pain)	Absence of movements	0
	Slow, cautious movements, touching or rubbing the pain site, seeking attention through movements	Protection	1
	Pulling tube, attempting to sit up, moving limbs/ thrashing, not following commands, striking at staff, trying to climb out of bed	Restlessness	2
Muscle tension to passive movements	No resistance	Relaxed	0
	Resistance to passive movements	Tense, rigid	1
Evaluation by passive flexion and extension of upper extremities	Strong resistance to passive movements, inability to complete them	Very tense or rigid	2
Compliance with the ventilator (intubated patients)orVocalization (extubated patients)	Alarms not activated, easy ventilation	Tolerating ventilator or movement	0
	Alarms stop spontaneously	Coughing but tolerating	1
	Asynchrony: blocking ventilation, alarms frequently Activated	Fighting ventilator	2
	Talking in normal tone or no sound	Talking in normal tone or no sound	0
	Sighing, moaning	Sighing, moaning	1
	Crying out, sobbing	Crying out, sobbing	2
Total, range			0-8

Appendix 4. Critical-Care Pain Observation Tool (Thai version)

ตัวชี้วัด	ลักษณะพฤติกรรม		คะแนน
สีหน้า	ไม่พบการเกร็งของกล้ามเนื้อ	ผ่อนคลาย, เฉยๆ	0
	หน้านิ่วคิ้วขมวด	หน้าบึ้งตึง	1
	มีสีหน้าข้างต้น ร่วมกับปิดตาแน่น	แสยะ หน้าเบะ	2
การเคลื่อนไหวร่างกาย	ไม่ขยับเลย (แต่ไม่ได้หมายความว่าไม่ปวด)	ไม่มีการขยับ	0
	ขยับช้าๆ อย่างระมัดระวัง	แสดงการปกป้อง	1
	แตะหรือดูตำแหน่งที่ปวด เป็นการขยับ		
	ในลักษณะที่เรียกร้องความสนใจ		
	ดึงสายหรือท่อ ผุดลุกผุดนั่ง ขยับหรือฟาด	กระสับกระส่าย	2
	แขนขาไปมา ไม่ยอมทำตามคำสั่ง ทุบตีเจ้าหน้าที่		
	พยายามปีนออกจากเตียง		
การเกร็งของกล้ามเนื้อ	ไม่ต่อต้านเมื่อจับให้ขยับเคลื่อนไหว	ผ่อนคลาย	0
ประเมินโดยการขยับแขน	ต่อต้านการจับให้ขยับเคลื่อนไหว	ตึง แข็งเกร็ง	1
ให้งอและเหยียด	ต่อต้านแรงมาก ไม่ยอมให้จับขยับ	ตึงมาก แข็งเกร็ง	2
	ไม่สามารถทำให้ขยับได้		
การเข้าได้กับเครื่องช่วยหายใจ	ช่วยหายใจได้ง่าย ไม่เกิดเสียงสัญญาณเตือน	เข้ากันได้ดี	0
(ในรายที่คาท่อหายใจ) หรือ	เสียงสัญญาณเตือนหยุดได้เอง	ไอ แต่ยังเข้ากับเครื่องได้	1
การส่งเสียง	ไม่เข้ากันเลย: หายใจติดขัด	หายใจสู้กับเครื่อง	2
(ในรายที่ไม่ได้ใส่ท่อหายใจ)	มีเสียงสัญญาณเตือนเกิดขึ้นบ่อย		
	พูดคุยด้วยน้ำเสียงปกติหรือไม่มีเสียง	พูดคุยด้วยน้ำเสียงปกติ	0
		หรือไม่มีเสียง	
	ถอนหายใจ ร้องคราง	ถอนหายใจ ร้องคราง	1
	ร้องเสียงดัง สะอึกสะอื้น	ร้องเสียงดัง สะอึกสะอื้น	2
คะแนนรวม (พิสัย)			0-8

การทดสอบความน่าเชื่อถือของ Critical Care Pain Observation Tool และ Behavioral Pain Scale ฉบับภาษาไทย ในผู้ป่วยที่ใช้เครื่องช่วยหายใจหลังผ่าตัด

กรุณา วงษ์ตั้งมั่น, อรอุมา ชัยวัฒน์, สุวรรณี สุรเศรณีวงศ์, ณภัทร ธิคม, วิมลลักษณ์ สนั่นศิลป์, สุรัสวดี วังน้ำทิพย์

วัตถุประสงค์: เพื่อแปล Critical Care Pain Observation Tool (CPOT) และ Behavioral Pain Scale (BPS) เป็นภาษาไทยและทดสอบความน่าเชื่อถือในผู้ป่วยหลังผ่าตัดที่ต้องใช้เครื่องช่วยหายใจในหออภิบาล

วัสดุและวิธีการ: เป็นการศึกษาแบบไปข้างหน้าโดยหลังจากแปล CPOT และ BPS เป็นภาษาไทยแล้วเครื่องมือทั้งสองจะถูกนำไปทดสอบความเที่ยงตรงตามสภาพ (concurrent validity), ความเที่ยงตรงเชิงจำแนก (discriminant validity), ความเที่ยงตรงเมื่อเทียบกับเกณฑ์ (criterion validity) และความเชื่อมั่นระหว่างผู้ประเมิน (interrater reliability) ในผู้ป่วยที่ใส่ท่อช่วยหายใจภายใน 24 ชั่วโมง หลังการผ่าตัดและตรวจสอบการใช้งานง่าย โดยใช้แบบสอบถามพยาบาลที่เคยใช้เครื่องมือดังกล่าว

ผลการศึกษา: ทำการศึกษาในผู้ป่วย 27 คน รวม 484 สังเกตการณ์ พบว่าเครื่องมือวัดระดับความปวดทั้ง 2 ชนิด มีความเที่ยงตรงตามสภาพ คือมีความสัมพันธ์เชิงบวก (positive correlation) ระหว่างกัน [ค่า r อยู่ระหว่าง 0.74 ถึง 0.78 ($p<0.01$)] เครื่องมือทั้ง 2 ชนิดมีแนวโน้มที่จะมีความสอดคล้องกับการตัดสินใจให้ยาแก้ปวดโดยการประเมิน อาการและอาการแสดงทางคลินิกที่ใช้อยู่เป็นประจำสำหรับการทดสอบความเที่ยงตรงเชิงจำแนก พบว่า คะแนน ความปวดในช่วงที่มีความปวดมาก ก่อนได้รับยาแก้ปวด (BPS 5, CPOT 3) มีค่าสูงกว่าคะแนนความปวดในช่วงที่มีความปวดน้อย หลังได้รับยาแก้ปวด (BPS 4, CPOT 2) เครื่องมือทั้งสองชนิดมีความเชื่อมั่นระหว่างผู้ประเมินอยู่ในเกณฑ์ดี (intraclass correlation = 0.72 ถึง 0.90)

สรุป: เครื่องมือวัดระดับความปวด CPOT และ BPS ฉบับภาษาไทย มีความเที่ยงตรงและน่าเชื่อถือในผู้ป่วยผู้ใหญ่ หลังผ่าตัดที่ต้องใช้เครื่องช่วยหายใจในหออภิบาล ยังมีความจำเป็นต้องทำการศึกษาต่อไปในแง่ของคุณค่าและการนำไปใช้ของเครื่องมือนี้ในการเพิ่มประสิทธิภาพการดูแลความเจ็บปวดในผู้ป่วยวิกฤตในประเทศไทย