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Reliability and validity of the Chinese version of the behavioral pain scale in intubated and non-intubated critically ill patients: Two cross-sectional studies

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ABSTRACT

Background: Self-report pain assessment scales may be inappropriate when critically ill patients are incapable of adequate communication because of sedation or mechanical ventilation. The Behavioral Pain Scale (BPS, for intubated patients) and the BPS-non intubated (BPS-NI, for non-intubated patients) measure objective behavioral indicators of pain in non-communicating critically ill patients.
Objectives: To develop a Chinese version of the BPS combining the original version of the BPS and BPS-NI suitable for pain assessment among critically ill patients and to determine its reliability and validity.
Design: Two cross-sectional studies.
Settings: A 15-bed surgical intensive care unit (ICU) in a teaching hospital in Beijing, China.
Participants: In the first study, 129 patients (53 intubated and 76 non-intubated) were recruited; in the second study, 83 (43 intubated and 40 non-intubated) were recruited.
Methods: The Chinese version of the BPS (BPS-C) was developed via rigorous translation methods, including double back-translation and content validation involving 13 clinical experts. Internal consistency, discriminative validity, and criterion-related validity were established using the BPS-C and the Numeric Rating Scale (NRS). The BPS-C and NRS were used to assess pain in 53 intubated and 76 non-intubated post-abdominal surgery patients during low pain exposure and increased pain exposure in the first study. To establish interrater reliability, a researcher and a bedside nurse independently performed 172 paired assessments in 43 intubated patients and 160 paired assessments in 40 non-intubated patients with the BPS-C under the same conditions in the second study.
Results: The BPS-C achieved conceptual and semantic equivalence with the original tool. Internal consistency was established through Cronbach's alpha ($\alpha = 0.724–0.743$ in intubated patients, $\alpha = 0.701–0.762$ in non-intubated patients). Interrater reliability was confirmed through the intraclass correlation coefficients (ICCs), which ranged from 0.962 to 1.000 in both intubated and non-intubated patients with high agreement percentages (95.3–100.0% in intubated and 95.0–100.0% in non-intubated patients). BPS-C scores during increased exposure to pain were significantly higher than those obtained

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during low exposure to pain, indicating discriminative validity. Criterion-related validity was confirmed by strong positive correlations between BPS-C and NRS scores (*Pearson's correlations* $r = 0.815–0.937$ for intubated patients, *Pearson's correlations* $r = 0.755–0.899$ for non-intubated patients).

Conclusions: The Chinese version of the BPS (BPS-C) is appropriate for pain assessment among intubated and non-intubated ICU patients.

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What is already known about the topic?

- Intensive care unit (ICU) patients are at risk for unrelieved pain as self-report scales may be inappropriate when patients are incapable of adequate communication because of sedation or mechanical ventilation.
- The Behavioral Pain Scale (BPS) and the BPS-non intubated (BPS-NI) are valid for pain assessment in ICU patients unable to self-report.
- At present, a Chinese tool for objective pain assessment in non-communicating ICU patients is lacking.

What this paper adds

- A Chinese version of the BPS (BPS-C) combining the original version of the BPS and BPS-NI was developed via rigorous translation methods for assessing pain in intubated and non-intubated adult patients in the ICU.
- The BPS-C was demonstrated to be reliable and valid with appropriate internal consistency, interrater reliability, discriminative validity, and criterion-related validity.
- The BPS-C may help Chinese healthcare professionals improve decision making regarding pain management and monitoring pain treatment response in critically ill patients.

1. Introduction

Pain is the most unpleasant experience for intensive care unit (ICU) patients. Most patients experience pain when at rest, and some undergo painful procedures performed by nurses and clinicians (Barr et al., 2013a,b; Chanques et al., 2007; Payen et al., 2007). For example, routine ICU care, such as turning, airway suctioning, wound care, wound drain removal, and central venous catheter insertion, all cause pain to patients (Chen et al., 2011; Puntillo et al., 2014).

Previous studies demonstrated that pain in ICU patients is often inadequately assessed and treated; thus, ICU patients are at risk of unrelieved pain, which can lead to significant psychological adversity and emotional stress (Barr et al., 2013a,b; Gelinas, 2007). The individual and societal consequences of long-term inadequate pain management include sleep disturbances, decreased quality of life, and increased care cost (Barr et al., 2013a,b; Tembo and Parker, 2009).

Appropriate pain management in critically ill patients greatly depends on a clinician's ability to perform reliable and valid pain assessment (Gelinas et al., 2014). Subjective pain assessment tools, such as the Numeric Rating Scale (NRS), the Visual Analogue Scale (VAS), the Verbal Rating Scale (VRS), and the Faces Pain Scale-Revised (FPS-R), may be used by clinicians when patients are able to complete self-report tools (the "gold standard" of pain assessment). However, self-report scales may not be appropriate when patients are incapable of adequate communication because of sedation or mechanical ventilation (Flynn, 2013; Herr et al., 2011; Puntillo et al., 2009).

Owing to the aforementioned reasons, several systematic and standardized objective pain assessment instruments based on patients' behavior were developed for pain assessment in non-communicating, critically ill patients (Flynn, 2013; Herr et al., 2011; Pasero et al., 2009). The Behavioral Pain Scale (BPS) (Payen et al., 2001), the Critical-Care Pain Observation Tool (CPOT) (Gelinas et al., 2006), the Nonverbal Pain Assessment Tool (NPAT) (Klein et al., 2010), the Nonverbal Adult Pain Assessment Scale (NVPS) (Odhner et al., 2003), and the Pain Assessment and Intervention Notation algorithm (P.A.I.N.) (Puntillo et al., 1997) are available for use in non-communicating patients. Since the implementation of such objective pain assessment instruments in hospitals, consumption of analgesia has significantly decreased and patient satisfaction with pain management has increased (Payen et al., 2009; Gelinas et al., 2011). Additionally, efforts have been made toward earlier recognition of acute pain in critically ill patients via objective pain assessments (Rose et al., 2013). The timely identification of pain and implementation of pain management interventions have shown improvement in patient outcomes (Chanques et al., 2006).

The original BPS was the product of a rigorous research process in France aimed at pain assessment in nonverbal, mechanically ventilated patients (Payen et al., 2001). The BPS has demonstrated good construct validity and reliability in adult medical, postoperative, and trauma (except for brain injury) patients, indicating that the scale is valid for pain assessment in ICU patients unable to self-report (Chen et al., 2011; Pudas-Tahka et al., 2009; Young et al., 2006). While application of the initial BPS was limited to intubated ICU patients because of the "compliance with ventilation" domain, Chanques et al. (2009) adapted the BPS for use in non-intubated ICU patients (BPS-NI) by replacing the "compliance with ventilation" domain with a "vocalization" domain.

At present, a Chinese version of the BPS for intubated patients is available (Chen et al., 2011), while none exists for the BPS-NI, and there is no equivalent objective pain assessment tool for non-communicating ICU patients in mainland China. Therefore, we decided to adapt the English version of the BPS and BPS-NI to Chinese, and

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