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## Research paper

# Content validation of behaviours and autonomic responses for the assessment of pain in critically ill adults with a brain injury

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## ABSTRACT

**Background:** The evidence shows that brain-injured patients express behaviours that are related to their level of consciousness (LOC), and different from other patients in the intensive care unit (ICU). Therefore, existing behavioural scales should be revised to enhance their content and validity for use in these patients.

**Objectives:** The aim was to evaluate the content relevance of behaviours and autonomic responses for pain assessment of brain-injured ICU patients from the perspective of critical care clinicians.

**Methods:** A total of 77 clinicians from four adult neuroscience ICUs (three from Canada and one from the United States) participated in this descriptive study. A physician/nurse ratio of 21% (13/61) was reached in this quota sample, and three physiotherapists also participated. They completed a content validation questionnaire of 19 items rated on clarity and relevance based on the patient's LOC. Item Content Validity Index (I-CVI), and modified kappa ( $\kappa^*$ ) were calculated. Values higher than 0.78 and 0.75 respectively were considered excellent.

**Results:** Regardless of the patient's LOC, brow lowering, grimacing, and trying to reach the pain site were rated as the most relevant behaviours by clinicians, with excellent values of I-CVI > 0.78 and  $\kappa^*$  > 0.75. Eyes tightly closed, moaning and verbal complaints of pain also obtained excellent values in altered LOC and conscious patients. Eye weeping obtained excellent values only in conscious patients. Other items showed fair (0.40–0.59) to good (0.60–0.74) values, while blinking and coughing showed poor values (<0.40) at various LOC.

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**Conclusions:** Facial expressions, movements towards the pain site, and vocalisation of pain were the most relevant pain-related behaviours rated by critical care clinicians. The relevance of some behaviours (e.g., moaning and verbal complaints of pain) varied across LOCs, thereby calling forth adaptations of behavioural pain scales to allow for interpretation in the context of a patient's LOC and ability to express specific behaviours.

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## 1. Introduction

Behavioural scales are a recommended measure for the assessment of pain in patients unable to self-report.<sup>1</sup> According to the practice guidelines of the Society of Critical Care Medicine (SCCM),<sup>2</sup> the Behavioural Pain Scale (BPS)<sup>3</sup> and the Critical-Care Pain Observation Tool (CPOT)<sup>4</sup> were identified as the most valid behavioural scales for assessing pain in medical, postoperative or trauma (except for brain injury) adult patients in the intensive care unit (ICU). One limitation of the guidelines at the time of their publication was a paucity of evidence available on the validity of these tools with brain-injured ICU patients. The aim of this study was to evaluate the content relevance of behaviours and autonomic responses for the assessment of pain of brain-injured ICU patients from the perspective of critical care clinicians.

## 2. Background of studies in pain behaviours in brain-injured patients

Since the SCCM Guidelines<sup>2</sup> were published, there has been only one validation study of the BPS with 50 ICU patients with a traumatic brain injury (TBI).<sup>5</sup> There have been three validation studies of the CPOT with a total sample of 153 brain-injured ICU patients. The samples included 43 with elective brain surgery,<sup>6</sup> and 110 with traumatic and non-traumatic brain injury.<sup>7–8</sup> Construct validity of the BPS and the CPOT was supported with higher scale scores reported during painful procedures (e.g., turning, endotracheal suctioning, and other procedures) compared with non-painful procedures (e.g., gentle touch, cuff inflation for blood pressure measurement, eye care) demonstrating their ability to discriminate between painful and non-painful procedures. However, no information was provided regarding appropriateness of behavioural scale item scores.

Levels of consciousness (LOC) are determinants of pain behaviours exhibited by patients with brain injuries. ICU patients with moderate brain injury (Glasgow Coma Scale or GCS 9–12) had higher CPOT scores compared with those with severe brain injury (GCS 3–8).<sup>8</sup> In addition, the use of behavioural pain scales may be more useful in non-elective brain-injured patients who are less likely to be able to self-report than elective brain surgery patients. Indeed, 95% of the elective brain surgery patients<sup>6</sup> versus 58% of the brain-injured conscious patients<sup>7</sup> could self-report their pain.

Specific pain-related behaviours of brain-injured ICU patients have been previously reported. Unconscious ICU patients (GCS ≤ 8) with a TBI (n = 43/257) have shown different behaviours during turning than those without brain injury.<sup>9</sup> Common behaviours in TBI patients were relaxed face, eye weeping, eye opening, and relaxed body muscles. In a more recent study,<sup>10</sup> more than 44% of TBI patients (n = 20/45) showed neutral behaviours (e.g., relaxed face, absence of body movements and relaxed body muscles) during turning. This finding was related to their LOC. In two groups, those with altered LOC (GCS 9–12) and those who were conscious (GCS 13–15), the TBI patients had higher frequencies of behaviours (brow lowering, eye opening, limb flexion, moaning) and autonomic responses (eye weeping, face flushing) than in the third

group, the unconscious patients (GCS 4–8). The unconscious TBI patients (n = 7/8) were more likely to show a relaxed face and to remain immobile.

Interestingly, in this same study, among the 13 patients able to self-report their pain, nine reported pain during turning, but only one exhibited a grimace and muscle rigidity.<sup>10</sup> Such findings are different from large multi-site studies, the Thunder Project II<sup>11</sup> and Europain<sup>®</sup>:<sup>12</sup> grimace and muscle rigidity were frequently observed in general ICU patients who were and were not able to self-report. Roulin and Ramelet<sup>13</sup> described pain behaviours in 116 ICU patients with a non-traumatic brain injury at different LOCs during turning. In patients with altered LOC (GCS 3–12) and unable to self-report, brow lowering, eye closure, and touching the pain site were less frequently observed than in patients able to self-report. Face flushing was more frequently identified in patients with the lowest LOC (GCS 3–8). Muscle rigidity was observed in more than 30% of brain-injured patients and in similar proportions (32–48%) in all patients regardless of their LOC. This differed from what was found in TBI patients<sup>10</sup> where muscle rigidity was observed in fewer than 20% of them. According to their LOC, muscle rigidity was observed in 12% of unconscious patient (GCS 4–8; n = 7/8), 14% of those with an altered LOC (GCS 9–12; n = 3/21), and 19% of those who were conscious (GCS 13–15; n = 3/16).<sup>10</sup>

The evidence so far shows that brain-injured ICU patients express behaviours that are related to their LOC, and typical pain-related behaviours such as grimacing and muscle rigidity are less frequently expressed by this patient group. Therefore, revisions to the content of existing scales are necessary to enhance their psychometric properties in this specific vulnerable population. Consultation of experts is a recommended step in scale development and revision process.<sup>14</sup> In this study, critical care clinicians of the ICU interprofessional team were invited to rate the relevance of behaviours and autonomic responses for the assessment of pain in brain-injured ICU patients at various LOC, and to suggest other indicators they find relevant and use in their practice.

## 3. Material and methods

### 3.1. Design

A descriptive design was used for this content validation study. Content validation or evaluation refers to examining the clarity, relevance, and comprehensiveness of items (in this case, pain indicators) for the development, revision or adaptation of a scale.<sup>14</sup>

### 3.2. Settings and sample

Critical care clinicians from four adult neuroscience ICUs (three from Canada and one from the United States) were invited to participate. A quota sample of critical care physicians and nurses (two physicians for 10 nurses in each ICU) were selected to reflect the proportion of these health care professionals in ICU teams. Other members of the inter-professional ICU team were also invited to participate. To be eligible, critical care clinicians had to work full or part time in the ICU setting and have a minimum of one year

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