CCCF/QUEBEC – BRAINS
Neuro-ICU: Assessing Pain, Sedation and Delirium

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A recent review paper

Pain, Sedation, and Delirium Management in the Neurocritically Ill: Lessons Learned from Recent Research

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What is neuro-ICU?

Neurological
Neurosurgical
Neurotrauma
Patients with central or peripheral neurological injury or illness in all ICUs
Multiple challenges

Neuro injury (central or peripheral)
Altered LOC
Mechanical ventilation
Use of sedatives and other medications
Assessing pain in the neuro-ICU

Pain is a symptom

The patient self-report should always be attempted = Gold standard measure for pain

Some statistics...

69.6% of 439 assessments of 151 neurocritically ill patients (Yu et al., 2013)

37/43 (86.0%) elective brain surgery ICU patients (Kapoustina, Echegaray-Benites & Gélinas, under review)

19/26 (73.1%) conscious brain-injured ICU patients (Gélinas, Topolovec-Vranic et al., unpublished)

19/35 (54.3%) conscious TBI ICU patients (Gélinas, Topolovec-Vranic et al., unpublished)
How to assess pain in nonverbal neurocritically ill patients?

Behavioral pain scales are suggested for clinical use as an alternative measure with patient unable to self-report (Barr et al., 2013; Herr et al., 2011)

Behavioral Pain Scale (BPS: Payen et al., 2001)
Critical-Care Pain Observation Tool
(CPOT: Gélinas et al., 2006)
Behavioral Pain Scale (BPS) Training Poster

**BPS (intubated patients)**

- **Facial expression**
  - 1: Relaxed
  - 2: Partially tightened = bruxism
  - 3: Fully tightened = eyelid closure
  - 4: Grinning

- **Movements of upper limbs**
  - 1: No movement
  - 2: Partially bent
  - 3: Very bent with finger flexion
  - 4: Retracted, apparent to care

- **Compliance with ventilation**
  - 1: Tolerating ventilation
  - 2: Coughing but tolerating ventilation most of the time
  - 3: Fighting ventilation but possible sometimes
  - 4: Unable to control ventilation

**BPS-NI (non-intubated patients)**

- **Facial expression**
  - 1: Relaxed
  - 2: Partially tightened = bruxism
  - 3: Fully tightened = eyelid closure
  - 4: Grinning

- **Movements of upper limbs**
  - 1: No movement
  - 2: Partially bent
  - 3: Very bent with finger flexion
  - 4: Retracted, apparent to care

- **Vocalisation**
  - 1: No pain vocalisation
  - 2: Crying (at least 30 s)
  - 3: Crying (at least 10 s)
  - 4: Crying and breath-holding

**① + ② + ③ = Total BPS value**

From 3 (no) to 12 (maximum) pain behavior rated using the BPS

Chanques et al., 2009
Critical-Care Pain Observation Tool

**Facial Expressions**
- Relaxed: 0
- Tense: 1
- Grimacing: 2

**Body Movements**
- Absence of movements or normal position: 0
- Protection: 1
- Agitation: 2

**Muscle Tension**
- Relaxed: 0
- Tense, rigid: 1
- Very tense/rigid: 2

**Compliance with the Ventilator (intubated)**
- Tolerating ventilator or movements: 0
- Coughing but tolerating: 1
- Fighting ventilator: 2

**Vocalization (extubated)**
- Normal or silent: 0
- Sighing or moaning: 1
- Crying out or sobbing: 2

(CPOT; Gélinas et al. 2006)
What about their validity of use in neurocritically ill patients?

A Validated Approach to Evaluating Psychometric Properties of Pain Assessment Tools for Use in Nonverbal Critically Ill Adults

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8 pain scales were analyzed

About BPS and CPOT

Both were validated with more than 500 ICU patients but neurocritically ill patients were either absent or under-represented.

<table>
<thead>
<tr>
<th>Scale</th>
<th>Neuro ICU sample</th>
<th>Scale score</th>
</tr>
</thead>
<tbody>
<tr>
<td>BPS – Payen et al., 2001</td>
<td>16/30 with TBI (53%)</td>
<td>↑ 1.3 (vs 2) during nociceptive procedures</td>
</tr>
<tr>
<td>CPOT – Gélinas &amp; Arbour, 2009</td>
<td>43/257 with TBI (17%)</td>
<td>↑ 2.1 (vs &gt;3 in post-op pts) during nociceptive procedures</td>
</tr>
</tbody>
</table>

BPS-NI was validated with 30 ICU patients with a high proportion presenting delirium (84%) – patients with brain injury, post-anoxic coma or cognitive deficits were excluded (Chanques et al., 2009)
BPS was performed for 20.4% of the 439 assessments, with ICC of 0.83 for physician-nurse interrater reliability.
One CPOT study with brain-injured ICU patients

Patterns and Clinical Correlates of Pain Among Brain Injury Patients in Critical Care Assessed with the Critical Care Pain Observation Tool

KangIm Lee, MSN, RN,* HyunSoo Oh, PhD, RN,† YeonOk Sub, PhD, RN,‡ and WhaSook Seo, PhD, RN†

In press in Pain Management Nursing, available online
Their findings...

N=31 brain-injured ICU patients (mainly hemorrhage) with GCS 6+2

Moderate (n=21) and severe (n=10) injury (GCS)

22 had brain surgery

<table>
<thead>
<tr>
<th>Period</th>
<th>Day 1</th>
<th>Day 3</th>
<th>Day 6</th>
<th>Day 9</th>
<th>Day 14</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean (SD)</td>
<td>1.00 (1.44)</td>
<td>0.29 (0.64)</td>
<td>0.29 (0.64)</td>
<td>0.65 (0.99)</td>
<td>0.55 (0.93)</td>
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<tr>
<td>RM-ANOVA*</td>
<td>3.23 (.04)</td>
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<tr>
<td>F (p)</td>
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<tr>
<td>Post hoc comparisons† (p value)</td>
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<tr>
<td>Day 1</td>
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<td>Day 3</td>
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<td>Day 6</td>
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<td>1.00</td>
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<td>Day 9</td>
<td>.28</td>
<td>.11</td>
<td>.05</td>
<td></td>
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<tr>
<td>Day 14</td>
<td>.14</td>
<td>.15</td>
<td>.15</td>
<td>.56</td>
<td></td>
</tr>
</tbody>
</table>

*Repeated-measures analysis of one-way variance.
†Bonferroni test.

Lee et al., in press
Their findings (con’t)...

![Graphs and tables showing pain scores before and after endotracheal suctioning.](#)

**Table 4.** Pain Before and After Endotracheal Suctioning (n = 31)

<table>
<thead>
<tr>
<th></th>
<th>Mean CPOT Score (SD)</th>
<th>t (p)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day 1</td>
<td>Before</td>
<td>1.00 (1.44)</td>
</tr>
<tr>
<td></td>
<td>Immediately after</td>
<td>3.26 (1.84)</td>
</tr>
<tr>
<td></td>
<td>20 min after</td>
<td>0.52 (1.06)</td>
</tr>
<tr>
<td>Day 3</td>
<td>Before</td>
<td>0.29 (0.64)</td>
</tr>
<tr>
<td></td>
<td>Immediately after</td>
<td>2.58 (1.46)</td>
</tr>
<tr>
<td></td>
<td>20 min after</td>
<td>0.45 (0.68)</td>
</tr>
<tr>
<td>Day 6</td>
<td>Before</td>
<td>0.29 (0.64)</td>
</tr>
<tr>
<td></td>
<td>Immediately after</td>
<td>2.42 (1.31)</td>
</tr>
<tr>
<td></td>
<td>20 min after</td>
<td>0.16 (0.45)</td>
</tr>
<tr>
<td>Day 9</td>
<td>Before</td>
<td>0.65 (0.98)</td>
</tr>
<tr>
<td></td>
<td>Immediately after</td>
<td>2.87 (1.67)</td>
</tr>
<tr>
<td></td>
<td>20 min after</td>
<td>0.55 (0.93)</td>
</tr>
<tr>
<td>Day 14</td>
<td>Before</td>
<td>0.55 (0.93)</td>
</tr>
<tr>
<td></td>
<td>Immediately after</td>
<td>2.87 (1.36)</td>
</tr>
<tr>
<td></td>
<td>20 min after</td>
<td>0.61 (0.99)</td>
</tr>
</tbody>
</table>

*Paired t test: before × immediately after endotracheal suctioning and before × 20 minutes after endotracheal suctioning.

Lee et al., in press
Patients (n=52) reported decreased retrospective pain ratings (p=0.04). ICU nurses reported increased confidence in assessing pain in nonverbal ICU patients, and pain was more frequently documented per day in the ICU (p=0.02).
Be cautious with vital signs!!!

They are **NOT SPECIFIC** and **NOT VALID** pain indicators

In neurocritically ill patients:

HR and RR ↑ during a painful procedure but were NOT correlated with elective brain surgery ICU patients’ self-reports (Kapoustina, Echegaray-Benites & Gélinas, under review)

Only RR was found to ↑ specifically during a painful procedure and was correlated with TBI patients’ self-reports (Arbour et al., accepted)

Therefore, **vital signs should only be used as cues to begin further assessment of pain** (Herr et al, 2011)
Questions remain...

Are available behavioral pain scales valid for use with neurocritically ill patients?

Do brain-injured ICU patients with altered LOC present similar behavioral pain responses to other ICU patients?

SYMPTOMS IN PATIENTS & FAMILIES

Pain without words:
Are reactions comparable among patients?

Tuesday, November 12th, 2013
15h30 in Osgoode W

Picture reproduced with permission
Assessing sedation in the neuro-ICU

Indications unique to neurocritically ill patients

Two standard sedation scales suggested for clinical use in SCCM practice guidelines (Barr et al., 2013)

Richmond Agitation Sedation Scale (RASS: Sessler et al., 2002)

Sedation Agitation Scale (SAS: Riker et al., 1999)

Up to 11 sedation scales have been validated (Robinson et al., 2013)

Again, little validation of use with neurocritically ill patients
Assessing sedation in the neuro-ICU

Processed EEG monitors including the Bispectral Index (BIS) are suggested for ICU patients receiving neuromuscular blocking agents (Barr et al., 2013)

Little research with neurocritically ill patients (Olson et al., 2009)
The BIS in pain assessment?

↑ of 10-30% in BIS index value in medical-surgical-trauma ICU patients (no brain injury) during nociceptive procedures were found (Gélinas et al., 2011; Li et al., 2009)

Bilateral BIS was explored for the first time with critically ill TBI patients (n=25) (Arbour et al., under review)

Significant ↑ during turning but more pronounced in BIS-R of left-sided TBI patients (+17%)

BIS-R highly correlated with the number of observed behaviors (0.98) but 19 (76%) of them showed muscle activity (i.e. eye opening, frowning)
What is delirium?

A symptomatic temporary condition

The core diagnostic symptom of delirium is a problem with attention/awareness

Controversies about disturbances of consciousness as a core symptom (Blazer & van Nieuwenhuisen, 2012), especially in the ICU where it can be altered by the use of sedation (Bergeron, Skrobik & Dubois, 2005; Devlin, Fraser, Joffe, Riker & Skrobik, 2013; Frontera, 2011)
Assessing delirium in the neuro-ICU

Sedation use as an important confounder (on LOC and mental status)

Cognitive or language deficits secondary to neurological injury

Worsening of or new acute neurological injury to be determined as well

Devlin et al., 2013; Frontera, 2011
ICU delirium assessment tools

Routine delirium monitoring is recommended in ICU patients, and suggested scales include (Barr et al., 2013)

**CAM-ICU** (Ely et al., 2001)

**ICDSC** (Bergeron et al., 2001)
Delirium assessment tools

**CAM-ICU** (Ely et al., 2001)
- Acute onset and fluctuating course (in mental status or behavior) AND
- Inattention AND
- Disorganized thinking OR
- Altered LOC (RASS)

**ICDSC** (Bergeron et al., 2001)
- Altered LOC (if no response or only response to intense and repeated stimulation, do NOT ASSESS)
- Inattention
- Disorientation
- Hallucination-delusion-psychosis
- Psychomotor or retardation
- Inappropriate speech or mood
- Sleep/wake cycle disturbance
- Symptom fluctuation
Can the puzzle related to ICU delirium assessment be resolved?

The accurate recognition of delirium in the ICU: the emperor’s new clothes?

Delirium and Sedation in the ICU

Abstract Delirium is defined by a fluctuating level of attentiveness and has been associated with increased ICU mortality and poor cognitive outcomes in both general ICU and neurocritical care populations. Sedation use in the ICU can contribute to delirium. Limiting ICU sedation allows for the diagnosis of underlying acute neurological insults associated with delirium and leads to shorter mechanical ventilation time, shorter length of stay, and improved 1 year mortality rates. Identifying the underlying etiology of delirium is critical to developing treatment paradigms.
Key aspects for tool selection

- Purpose of Use
- Patient Population
- Context

Streiner & Norman, 2008
Conclusions

Validation of tool use in neurocritically ill patients is lacking and urgently needed.

Pain and delirium scales should be considered as screening tools only, and score interpretation made along with other clinical findings (e.g. physical examination, lab tests, cerebral monitoring).

Content adaptation of existing scales for the neurocritically ill population should be explored and tested.
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