Introducing a new pain monitoring system (PainMonitor™) to Neurocritical care

Danilo Jataas, Dr James Sheehan, Katalin Kovas, Kristi Godfrey Ward, Rachel Curwood, Rosanna Hopkins, Georgina Sellick, Rosie Tasker
Objectives...

1. Evaluate the feasibility of using a skin conductance monitor (PainMonitor™) in neurocritical care.

2. Investigate the relationship between the PainMonitor™ peaks per second and patient CPOT scores.
Background

- Assessing pain in critical care is challenging but important
- In neurocritical care it is even more challenging due to brain and spinal cord injury
- Vital signs should serve as a cue to initiate further assessment of pain using methods such as CPOT but such scales have limited validity and use in brain injured patients (Azevedo-Santos, 2018)
Pain assessment tools

- Numerical Pain rating score

- Critical Pain observation tool (CPOT) score > 2 has 86% sensitivity and 78% specificity in intubated patients for pain (but not tested in neurocritical care)
Why???

- The recent PADIS guidelines recommend research focus on development of objective measures of pain assessment (Devlin, 2018).
- Palmar skin conductance has been previously investigated as an objective indicator for pain in the intensive care setting with recent research suggesting it is more sensitive than other physiological markers (Aslandis, 2018), but this technique has not been validated in neurocritical care.
Measuring unit
Physiology
Pain index: intensive care
### Index for patients intensive care

<table>
<thead>
<tr>
<th>Color</th>
<th>Peak Rate/sec</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>White: 0</td>
<td>0.00-0.07</td>
<td>No pain</td>
</tr>
<tr>
<td>Light yellow: 1-3</td>
<td>0.13</td>
<td>No pain or VAS* less than 40</td>
</tr>
<tr>
<td>Yellow: 3-4</td>
<td>0.27</td>
<td>Patient is active, can be pain VAS* 40-50</td>
</tr>
<tr>
<td>Orange: 5-7</td>
<td>0.33</td>
<td>Patient is possibly in pain, VAS* 60-80 – go evaluate the situation</td>
</tr>
<tr>
<td>Red: 8-10</td>
<td>0.40 or more</td>
<td>Patient is probably in pain, VAS* 80-100 – go find out how to help the patient</td>
</tr>
</tbody>
</table>

*VAS – Visual Analogue pain Score*
Methods and results

Objective 1: Evaluate the feasibility of using a skin conductance monitor (PainMonitor™) in neurocritical care

- Questionnaire of experience using PainMonitor™ at end of shift

- 30 recording sessions (each over 3-5 hours approx.)
- 30 questionnaires completed
How easy was the device

To apply

To maintain
Did the skin electrodes need replacing?

Interfere with any other clinical equipment?
How often did you respond to the peaks per second?  

How easy was the device to remove?
General comments...

- “Difficulty with starting PainMonitor™ software”

- “Even though the monitor read 0 for the entire shift I liked being able to tell relatives that the monitoring did not suggest their loved one was in pain”

- “Electrodes needed replacing due to sweat on patients palms”

- “I preferred having something objective to assess for pain”
Closer inspection...

- 31/ 87 PainMonitor™ suggested patient was in pain but CPOT score did not...
Methods and results

- Objective 2: relationship between the PainMonitor™ peaks per second and patient CPOT scores
  - Retrospectively collected data from clinical notes
    - CPOT; peaks per second; RASS
    - Data analysis with R studio (version 1.1.463)

- 30 recording sessions (each over 3-5 hours approx.)
  - 25 patients
  - 116 ‘peaks per seconds’ values recorded
    - 87 with a simultaneous CPOT score
      - 79 with a corresponding Rass score
All data

Peaks.per.second  CPOT.total
1.0000000  0.5093087
0.5093087  1.0000000
Rass -1 = 0.3337119

Rass -2 = 0.06051569
Rass -3 = 0.6061087
Rass -4 = 0.5602522
Rass -5 = 0.5423261
Conclusions and future work...

- PainMonitor™ is a feasible pain monitoring device in neurocritical care

- PainMonitor™ peaks per second has a moderately strong association with CPOT scores
  - the strength of the association increases with increasing depth of sedation
  - further data is required to investigate this relationship and at different levels of sedation
  - PainMonitor™ peaks per second could be used as part of a multimodal approach to improve assessment of pain in non-communicative neurocritical care patients

- The sensitivity and specificity of the PainMonitor™ in critical care requires further evaluation
References


Any questions?