Spécificité de la prise en charge de la spasticité chez le patient en état de conscience altérée

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Coma Science Group
Université de Liège

Symposium Prise en charge interdisciplinaire de la spasticité
18 octobre 2014
Consciousness
Consciousness: 2 components

- Coma
- General Anesthesia
- Unresponsive Wakefulness Syndrome (Laureys et al., 2010)

Level of Consciousness: Wakefulness

Content of Consciousness: Awareness

- Lucid Dreaming
-REM Sleep
-St I-II Sleep
-St III-IV Sleep

Conscious Wakefulness

Locked-in syndrome

Drowsiness

Minimally Responsive
- command following MCS+
- non-reflex movements MCS-

Vegetative State
Epilepsy
Sleepwalking

Unresponsive Wakefulness Syndrome
Laureys et al., 2010

"There’s nothing we can do... he’ll always be a vegetable."

Laureys, Trends in Cognitive Sciences, 2005

www.comascience.org
Chronic disorders of consciousness

1952, artificial respirator (Ibsen, Copenhagen)
Redefinition of death based on neurological criteria

1966
Plum & Posner (NY)

1972
Jennett (Glasgow) & Plum (NY)

Acute Brain Injury
Coma

Fast Recovery

Minimally Conscious State
Permanent Vegetative State
Permanent Minimally Conscious State?

Vegetative State
Locked-In Syndrome

>1 year (traumatic)
>3 months (non-traumatic; anoxic)

1994, Multi-Society Task Force on PVS

2002, Aspen Workgroup

Recovery of Consciousness

Consciousness | Pain in DOC | Spasticity in DOC | Conclusion

Laureys, Scientific American, 2007

www.comascience.org
Not all “coma”

Laureys, Owen and Schiff, Lancet Neurology, 2005
Vegetative state/Unresponsive

- No sign of consciousness
- No environment interaction
- No voluntary behavior in response to visual, auditive, tactile and painful stimuli
- No language comprehension – no language expression
- Wake-sleep cycle

Multi-Society Task Force on Persistent Vegetative State guidelines, 1994
Laureys et al., BMC Med, 2010
A new name for «vegetative»

Unresponsive wakefulness syndrome: a new name for the vegetative state or apallic syndrome

“There’s nothing we can do... he’ll always be a vegetable.”

Laureys et al, BMC Medicine 2011
Minimally conscious state

Limited but clearly discernible evidence of self or environmental awareness - one or more of the following behaviors:

- Following simple commands
- Intelligible verbalization.
- Purposeful behavior that occur in contingent relation to environmental stimuli:
  - appropriate smiling
  - appropriate vocalizations or gestures
  - reaching for objects
  - touching or holding objects
  - visual pursuit

Emergence from MCS:

- Functional interactive communication
- Functional use of two different objects

Aspen Workgroup, 2002; Bruno & Vanhaudenhuyse et al., 2011
Recovery

Behavioral diagnosis

- Coma
- VS/UWS
- MCS -
- MCS +
- Command following
- Signs of consciousness (non reflex behaviors)
- Arousal (eye opening)
- Functional communication

Cognitive function

- Consciousness
- Pain in DOC
- Spasticity in DOC
- Conclusion

Vanhaudenhuyse, Boly, Laureys. Scholarpedia (2009)
Diagnostic error

n=103 post-comatose patients
- 45 clinical consensus diagnosis ‘vegetative state’
- 18 signs of awareness (Coma Recovery Scale-Revised)

41% potential misdiagnosis

New studies ± 30%

Schnakers et al, BMC Neurology 2009
# JFK Coma Recovery Scale - Revised

**Record Form**

<table>
<thead>
<tr>
<th>Patient:</th>
<th>Date:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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## Auditory Function Scale

<table>
<thead>
<tr>
<th>4</th>
<th>Consistent Movement to Command *</th>
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<tbody>
<tr>
<td>3</td>
<td>Reproducible Movement to Command *</td>
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<tr>
<td>2</td>
<td>Localization to Sound</td>
</tr>
<tr>
<td>1</td>
<td>Auditory Startle</td>
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<tr>
<td>0</td>
<td>None</td>
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## Visual Function Scale

<table>
<thead>
<tr>
<th>5</th>
<th>Object Recognition *</th>
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<tbody>
<tr>
<td>4</td>
<td>Object Localization: Reaching *</td>
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<tr>
<td>3</td>
<td>Visual Pursuit *</td>
</tr>
<tr>
<td>2</td>
<td>Fixation *</td>
</tr>
<tr>
<td>1</td>
<td>Visual Startle</td>
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<tr>
<td>0</td>
<td>None</td>
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## Motor Function Scale

<table>
<thead>
<tr>
<th>6</th>
<th>Functional Object Use *</th>
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<tbody>
<tr>
<td>5</td>
<td>Automatic Motor Response *</td>
</tr>
<tr>
<td>4</td>
<td>Object Manipulation *</td>
</tr>
<tr>
<td>3</td>
<td>Localization to Noxious Stimulation *</td>
</tr>
<tr>
<td>2</td>
<td>Flexion Withdrawal</td>
</tr>
<tr>
<td>1</td>
<td>Abnormal Posturing</td>
</tr>
<tr>
<td>0</td>
<td>None/Flaccid</td>
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</table>

## Oromotor/Verbal Function Scale

<table>
<thead>
<tr>
<th>3</th>
<th>Intelligible Verbalization *</th>
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<tbody>
<tr>
<td>2</td>
<td>Vocalization/Oral Movement</td>
</tr>
<tr>
<td>1</td>
<td>Oral Reflexive Movement</td>
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<tr>
<td>0</td>
<td>None</td>
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</tbody>
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## Communication Scale

<table>
<thead>
<tr>
<th>2</th>
<th>Functional: Accurate</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Non-Functional: Intentional *</td>
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<tr>
<td>0</td>
<td>None</td>
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## Arousal Scale

<table>
<thead>
<tr>
<th>3</th>
<th>Attention</th>
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<tbody>
<tr>
<td>2</td>
<td>Eye Opening w/o Stimulation</td>
</tr>
<tr>
<td>1</td>
<td>Eye Opening with Stimulation</td>
</tr>
<tr>
<td>0</td>
<td>Unarousable</td>
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</table>

## Total Score

<p>| |</p>
<table>
<thead>
<tr>
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**coma@chu.ulg.ac.be**

[Univ. de Liège] [CHU de Liège] [JFK Medical Center]

[www.comascience.org](http://www.comascience.org)
Pronostic  (Belgium Federal Project)

VS/UWS (n=116)

MCS (n=84)

Bruno et al., 2011
Pain in disorders of consciousness

NO RESPONSE
AWAKENING
GRIMACING
Pain in brain death & VS/UWS

Noxious electrical stimulation

Laureys et al, Neuroimage, 2002
Laureys, Nature Reviews Neuroscience, 2005
Pain in minimally conscious state

Consciousness | Pain in DOC | Spasticity in DOC | Conclusion

### BUT...

<table>
<thead>
<tr>
<th>Subject number</th>
<th>Sex</th>
<th>Age</th>
<th>ACC</th>
<th>AI</th>
<th>S2</th>
<th>S1</th>
<th>Thalamus</th>
<th>PI</th>
<th>Cerebellum</th>
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</tbody>
</table>
Nociception and pain

Nociception Coma Scale - Revised

<table>
<thead>
<tr>
<th>Motor response</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 – Localization to noxious stimulation</td>
</tr>
<tr>
<td>2 – Flexion withdrawal</td>
</tr>
<tr>
<td>1 – Abnormal posturing</td>
</tr>
<tr>
<td>0 – None/flaccid</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Verbal response</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 – Verbalisation (intelligible)</td>
</tr>
<tr>
<td>2 – Vocalisation</td>
</tr>
<tr>
<td>1 – Groaning</td>
</tr>
<tr>
<td>0 – None</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Facial expression</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 – Cry</td>
</tr>
<tr>
<td>2 – Grimace</td>
</tr>
<tr>
<td>1 – Oral reflexive movement/startle response</td>
</tr>
<tr>
<td>0 – None</td>
</tr>
</tbody>
</table>

Score >3/9 = analgesic treatment

Chatelle et al, *JNNP*, 2012
Nociception Coma Scale - Revised

Correlation between brain metabolism in anterior cingulate cortex (ACC–pain matrix) and Nocicetion Coma Scale Revised

Chatelle, Thibaut et al. NNR, 2013
Spasticity in disorders of consciousness
Spasticity & upper motor neuron syndrome

- Exaggeration of myotatic reflex leading to an involuntary muscle contraction after muscle stretching or a permanent muscle contraction due to an alteration of 1st motoneuron (CNS) in the spinal cord or in the brain.

**Aggravating factors:** Velocity of stretching
Fatigue & stress
Infection & pain

**Side effects:** Muscle retraction (sarcomeres)
Irreversible stiffness of joints
Vicious positions and pain

Thibaut et al, *Brain Injury*, 2013
65 sub-acute & chronic VS/UWS and MCS patients

- **88%** (n=57) suffered from spasticity (MAS≥1) and **60%** (n=39) suffered from severe spasticity (MAS≥3)
- **Diagnosis**: no ≠ ; VS/UWS = MCS
- **Treatment**: treated > non-treated (p=0.03)
- **Joint fixation**: MAS higher if tendon retraction (p<0.001) or equinovarus feet (p<0.001)
Spasticity in DOC

- **Time since insult**: positively correlated with MAS scores (p=0.006)
- **Pain** (*Nociception Coma Scale Revised* - NCS-R): positively correlated with MAS scores (p=0.01)
- **Physical therapy** (frequency per week): negative correlation with MAS scores (p=0.01)

Thibaut et al, *under revision*
Study: soft braces

- **AIM:** Test the efficacy of soft braces on spastic upper limb to reduce spasticity in chronics VS/UWS & MCS

- **Brace:** polyurethane roll in the palm of the hand

- **3 technics:**
  1. soft braces
  2. stretching
  3. no treatment

- **Assessments:** 
  Modified Ashworth Scale (MAS)
  Tardieu scale
  Amplitudes (fingers/wrist/elbow)
  Length finger-palm

Thibaut et al, *under revision*
Results

Spasticity decreases after both treatments (fingers flexors)

Braces

Stretching

Braces increases hand opening (lenght finger-palm)

Thibaut et al, in prep
Advantages

Clinical benefits:
• Spasticity decrease on fingers flexors
• Increase of hand opening
• Better improvement for patients without tendon retraction

Avantages:
• Easy to apply
• Patient can be alone
• Soft
• Confortable
• Serveral hours per day
Brain metabolism

Positive correlation between MAS score and brain metabolism

Comparison between spastic and non-spastic patients

ACC ➔ pain?
Conclusion
Conclusion

Patients in MCS perceive pain like us!

- Use appropriate scales (CRS-R and NCS-R)

Spasticity is correlated with pain and over time
- Treat it as soon as possible

Soft splints seem to spasticity and hand opening
THANK YOU!