Near-Infrared Spectroscopy’s Predictive Ability of Neurological Injury in ECMO Patients

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**Introduction**

ECMO and Cerebral Oximetry (NIRS)
- Support treatment for heart/lung failure
- Most common complication is neurological injury
- NIRS helps monitor cerebral oxygenation levels while on ECMO

ECMO + NIRS: Previous Studies
- NIRS detects regional changes in oxygen
- Mixing of oxygenated blood in circuit and deoxygenated in lungs is unpredictable
- Most research on NIRS have been done in acute settings or pediatric settings
- Recently used as a trend monitor for cerebral oxygenation levels in adults
- Both are relatively new technology not available to most hospitals

Currently, the neurological exam is the gold standard in prompting a CT scan
- NIRS may be more accurate

**Objectives**

Elucidate sensitivity and specificity of NIRS in detecting neurological injury

Determine magnitude of NIRS decline in ECMO patients with neurologic injury

Explore how effective cerebral O₂ monitoring is regionally and globally

**Methods**

**Inclusion criteria for study**
- VA orVV ECMO with head/brain CT
- NIRS monitoring documented
- At least 5 baseline readings
- At least 2 readings at time of CT

**Study period:** 2010-2017

**Total number of patients:** 73 (out of 204)

**Demographics of patients**
- 73 patients: 51M, 22F
- Mean Age: 49 ± 13 y/o
- Type of ECMO: VA: 56; VV: 17
- Days from ECMO to CT: 4.4 ± 4.6d.
- Cardiac – 75%; Respiratory – 25%

**NIRS Algorithm**

Patient Groups based on Neuro signs* and NIRS drop
- Group A: Neuro (+) / NIRS drop (+) n=14 (19%)
- Group B: Neuro (+) / NIRS drop (-) n=40 (55%)
- Group C: Neuro (-) / NIRS drop (+) n=0 (0%)
- Group D: Neuro (-) / NIRS drop (-) n=19 (26%)

**Results**

CT scans confirmed 28 (out of 73) patients had a neurological injury:
- Group A Neuro (+) / NIRS drop (+): 12 (86%)
- Group B Neuro (+) / NIRS drop (-): 14 (33%)
- Group D Neuro (-) / NIRS drop (-): 3 (16%)

**Neurological Injuries by CT scan**

- Intracranial bleed: 36%
- Ischemic stroke: 44%
- Anoxic injury: 20%

**Sensitivity and Specificity of Groups to identify CT confirmed Neurological injury**

<table>
<thead>
<tr>
<th></th>
<th>Group A (AN=12)</th>
<th>Group B (AN=13)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensitivity</td>
<td>43%</td>
<td>46%</td>
</tr>
<tr>
<td>Specificity</td>
<td>60%</td>
<td>60%</td>
</tr>
</tbody>
</table>

**Comatose Patients with CT confirmed Neurological Injury**

<table>
<thead>
<tr>
<th></th>
<th>Group A (AN=10)</th>
<th>Group B (AN=7)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensitivity</td>
<td>83%</td>
<td>96%</td>
</tr>
<tr>
<td>Specificity</td>
<td>21%</td>
<td>54%</td>
</tr>
</tbody>
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