Cerebral Oxygenation monitored by Near Infrared Spectroscopy (NIRS)
Relation $r\text{ScO}_2$ and Brain Damage

1) *Hou et al* (*Newborn Piglets)*:
   - $r\text{ScO}_2 < 40\%$:
     - Mitochondrial/hippocampal (CA1) damage

2) *Kurth et al* (*Newborn Piglets)*:
   - $r\text{ScO}_2 < 33-44\%$:
     - Functional impairment (low ATP levels)

3) *Kusaka et al* (*Newborn Piglets)*:
   - $r\text{ScO}_2 < 40\%$:
     - Decrease in $[\text{PCr}]/[\text{Pi}]$ ratio (MRS)

4) *Dent et al* (*Open Heart, Newborns)*:
   - $r\text{ScO}_2 < 40-45\%$:
     - (new) Ischemic Regions on MRI

What could be done?

*When cerebral rScO₂ is low (<55%), consider:*

- Low pCO₂ (Increase pCO₂)
- *hsPDA (Close)*
- Hypotension (treat)
- Anemia (Erytrocyte transfusion)
- Low arterial saturation (Increase FiO₂)

*When cerebral rScO₂ is high (>85%), please consider:*

- Supranormal Art Sat (Decrease FiO₂ if possible)
- Too high pCO₂ (Decrease pCO₂)
- Low glucose (Treat low blood glucose)
Artificial Ventilation can influence cerebral Oxygenation

♀ 26 4/7 wks; 925 g; SMIV; chorioamnionitis; Day 1;
Artificial Ventilation (HFO) can influence Systemic Hemodynamics

26 1/7 wks; 780 g; day 1; HFO for RDS

Van Bel et al, Neonatology 2009

60 minutes
Infants enrolled in:
- Lyon
- Madrid
- Copenhagen
- Cork
- Utrecht
- Graz
- Milan
- Cambridge

SafeBoosC II: Phase 2 Study (Randomized)

NIRS-monitored

Avoid:
- Hyperoxia: \( r\text{ScO}_2 > 85\% \)
- Hypoxia: \( r\text{ScO}_2 < 55\% \)

Standard Treatment

Sample Size: \( n=86/80 \)

(SafeboosC II Group, BMJ 2015)
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SafeBoosC II

Hyperoxia: $r\text{ScO}_2 > 85\%$
Hypoxia: $r\text{ScO}_2 < 55\%$

$p<0.001$

N = 80
GA = 26.8 wks

N = 86
GA = 26.6 wks

(SafeboosC II Group, BMJ 2015)
### SafeBoosC II

#### Infants enrolled in:
- Lyon
- Madrid
- Copenhagen
- Cork
- Utrecht
- Graz
- Milan
- Cambridge

#### Important Patient Characteristics

<table>
<thead>
<tr>
<th></th>
<th>Monitored</th>
<th>Blinded</th>
<th>p-value</th>
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<tbody>
<tr>
<td>Brain injury (%)</td>
<td></td>
<td></td>
<td>0.12</td>
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<tr>
<td>Mild-moderate</td>
<td>(61)</td>
<td>(43)</td>
<td></td>
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<tr>
<td>Severe</td>
<td>(12.5)</td>
<td>(21)</td>
<td></td>
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<tr>
<td>Death (n)</td>
<td>12</td>
<td>20</td>
<td>0.10</td>
</tr>
<tr>
<td>NEC, n (%)</td>
<td>9 (10.6)</td>
<td>10 (12.5)</td>
<td>0.70</td>
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<tr>
<td>BPD, n (%)</td>
<td>41 (50.0)</td>
<td>28 (37.3)</td>
<td>0.091</td>
</tr>
<tr>
<td>ROP, n (%)</td>
<td>14 (16.5)</td>
<td>8 (10.0)</td>
<td>0.18</td>
</tr>
</tbody>
</table>

(Source: SafeboosC II Group, BMJ 2015)
Take Home Messages

• Current results of our studies in (premature) infants strongly suggest that \( Sa(p)O_2 \) does not always reflect oxygenation (and perfusion) of the immature brain.

• Thus apart from monitoring \( SaO_2 \) and blood pressure, monitoring \( rScO_2 \) can help to prevent brain damage.

• Combining \( rScO_2 \) with aEEG provides us with additional information.