Successful Use of a Prolonged Inspiratory Time on the Bunnell Life Pulse HFJV in Treating Pneumonia Refractory to Conventional and HFO Ventilation in a NICU Patient

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Successful Use of a Prolonged Inspiratory Time on the Bunnell Life Pulse HFJV in Treating Pneumonia Refractory to Conventional and HFO Ventilation in a NICU Patient

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Patient’s Pathology and Physiology
- 28 5/7 week pre-term infant
- Intubated and mechanically ventilated at birth
- Received surfactant
- Extubated on day of life three
- Maintained on high flow nasal cannula
- Developed a right upper lobe (RUL) pneumonia secondary to gram negative organisms on day of life (DOL) fifty-six and required intubation and mechanical ventilation

Clinical Course
- Within twenty-four hours developed a RUL consolidation requiring increased ventilatory support
- Capillary blood gas results revealed poor gas exchange noted by an increased PCO$_2$ and a reduced PaO$_2$
- Decision was made to place on High Frequency Oscillation (HFO)
- Minimal improvement noted in gas exchange
- Increased amplitude and mean airway pressure (Paw) via HFO
- Administered IV and inhaled antibiotics
- Performed aggressive pulmonary hygiene
- Gas exchange continued to deteriorate
- Decision was made on DOL #68 to place on High Frequency Jet Ventilation (HFJV)

Clinical Indications For HFJV Utilization
- Improve the distribution of inspired gas to the consolidated lung area
- Enhance secretion removal
- Allow for equilibration of time constants in non-homogenous lung while maintaining adequate expiratory time
- Reduce FiO$_2$ requirements and improve gas exchange

Clinical Course Via HFJV
- Increased I-time from 0.02 to 0.03 sec
- Clinical improvement noted within three hours of implementation
- Increased aeration seen on CXR
- Improved CBG results
- PIP, PEEP, and FiO$_2$ were reduced while maintaining a consistent $^*$P
- DOL #75 transition back to P-SIMV
- Adequate gas exchange was maintained until liberation

Table I: Capillary Results

<table>
<thead>
<tr>
<th></th>
<th>pH</th>
<th>PCO$_2$</th>
<th>PO$_2$</th>
<th>Settings</th>
</tr>
</thead>
<tbody>
<tr>
<td>P-SIMV DOL #57</td>
<td>7.21</td>
<td>90</td>
<td>34</td>
<td>140, PEEP 8 cm, IP 22 cm</td>
</tr>
<tr>
<td>HFOV #67 DOL</td>
<td>7.34</td>
<td>70</td>
<td>38</td>
<td>PAP 23 cm, Amp 33, Hertz 6</td>
</tr>
<tr>
<td>HFJV</td>
<td>7.30</td>
<td>75</td>
<td>37</td>
<td>45/25/1.40, 0.3 time</td>
</tr>
<tr>
<td>HFJV</td>
<td>7.32</td>
<td>70</td>
<td>30</td>
<td>45/25/1.40, 0.3 time</td>
</tr>
<tr>
<td>HFJV x 7 hrs.</td>
<td>7.35</td>
<td>62</td>
<td>37</td>
<td>44/24, 0.3 time</td>
</tr>
<tr>
<td>Transition x 8 days</td>
<td>7.42</td>
<td>55</td>
<td>58</td>
<td>33/6/1.40, 0.3 time</td>
</tr>
</tbody>
</table>

Discussion
- Utilizing an increased I-time promoted lung recruitment in the consolidated area
- Paw was maintained while allowing a reduction in the PEEP level
- HFJV helped facilitate secretion removal

Conclusions
- Our patient with refractory pneumonia improved by:
  - Changing ventilatory strategies from HFO to HFJV
  - Increasing I-time which optimized gas exchange
  - Maintaining delta pressure for CO2 removal

X-Rays

Table I: Capillary Results

- Pre HFJV
- Post HFJV Day 8