Reduction of hypocarbia in extremely low birth weight infants

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Background / introduction

- The traditional use of a pressure controlled ventilating system in the NICU increases the risk of hypocarbia (low PaCO2) in babies

- This is due to difficulty in regulating the pressure required to ventilate in the face of ever changing lung compliance

- Hypocarbia increases the risk for periventricular leukomalacia (PVL) in premature babies, which in turn increases the risk for cerebral palsy and poor neurodevelopmental outcomes


Extremely low birth weight (ELBW) babies are at highest risk from the effects of hypocarbia.

The use of volume targeted ventilation could decrease hypocarbia by automatically regulating ventilator pressures.

Our QI initiative may improve this problem by:

- Increasing awareness of problem by education.
- Introducing the use of volume targeted ventilation in the highest risk population.


Collaborative team members

- Uduak Akpan, Neonatologist
- Sunny Patel, Fellow
- Lauren Jones, Neonatal nurse practitioner
- Darian Brewington, Respiratory therapist
- Paige Driver, Medical Student

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AIM statement

By March 2017, the use of volume targeted ventilation will decrease the incidence of hypocarbia (CO2 <40mmHg) in ELBW babies during the first week of life by 50%
Methods

- Based on literature review, we decided that the use of VTV would help decrease the incidence of hypocarbia due to the automatic vent. pressure wean

- We designed our QI to increase the use of VTV with the aim of decreasing the incidence of hypocarbia

- We selected ‘prevalence of hypocarbia in the first week‘ as our outcome measure and ‘use of VTV’ as our process measure
How will we know this change is an improvement?

- We determined the baseline incidence of hypocarbia (<40mmHg)
- Then we determined the use of VTV vs. pressure controlled ventilation
- Our change will be an improvement if over the months, with increasing VTV use, we also see a corresponding decrease in the incidence of hypocarbia
## Baseline data

<table>
<thead>
<tr>
<th>Variable</th>
<th>Median /%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gestational age (wks)</td>
<td>25</td>
</tr>
<tr>
<td>Birth weight (g)</td>
<td>730</td>
</tr>
<tr>
<td>Apgar at 1 min</td>
<td>2</td>
</tr>
<tr>
<td>Apgar at 5 mins</td>
<td>7</td>
</tr>
<tr>
<td>Number intubated</td>
<td>97%</td>
</tr>
<tr>
<td>DOL at intubation</td>
<td>0</td>
</tr>
<tr>
<td>Number with hypocarbia</td>
<td>85%</td>
</tr>
<tr>
<td>Number with hypocarbia &lt;35mmHg</td>
<td>68%</td>
</tr>
<tr>
<td>Initial ventilator type</td>
<td>VTV (42%)</td>
</tr>
<tr>
<td></td>
<td>HFV (39%)</td>
</tr>
<tr>
<td></td>
<td>SIMV (18%)</td>
</tr>
</tbody>
</table>
Improvement strategies employed

PDSA cycle 1

Plan

• Determination of problem
• Literature review
• Proposal for change i.e. use of VTV
• Determination of data to be collected, by who etc.

Do

• Presentation of proposal to neonatology group
• Collection of baseline data
• Education of group by vent. company rep
• Initiation of project in October 2016
Improvement strategies employed

Study

• Monthly data collection and analysis

Act

• Discuss strategies to encourage the use of VTV for initial ventilation
  • Ensure awareness of problem
  • Reserve VTV capable vent. for highest risk babies
Improvement strategies employed

PDSA cycle 2

Plan

• Meetings to discuss progress and problems
• Development of survey
• Development of vent. policy

Do

• Distribution of survey
Improvement strategies employed

Study

• Monthly data collection and analysis
• Analysis of survey

Act

• Repeat education session by vent. company rep
• Discuss results so far with group
• Continue to work on development of vent. policy
Outcomes

Prevalence of Hypocarbia in ELBW infants
(first week of life)

- Baseline (May-Aug)
- All Infants
- VTV
- Other ventilators

Oct  Nov  Dec  Jan
Outcomes

VTV use in ELBW}s

%  

Baseline (May-Aug)  Oct  Nov  Dec  Jan
Challenges encountered in QI process

- Lack of awareness of incidence of hypocarbia
  - Presentation of QI proposal with baseline data

- Inadequate knowledge of the proper use of VTV ventilators
  - In-service training with ventilator company rep.

- Inadequate number of VTV ventilators for the anticipated number of ELBW
  - Plan to reserve at least one VTV capable vent to be used for ELBW if possible

- Lack of ventilator policy to regulate use
  - Develop and institute policy
Lessons learned through QI efforts

- Team spirit makes the difference
- Education is key
- Resistance to change plays a big role in suboptimal outcomes
- Institution of guidelines helpful
Next steps

- Institution of ventilator policy
- Review of survey results and implementation of new ideas
- Request the purchase of more VTV capable ventilators
- Presentation of results so far to group to elicit suggestions
THANK YOU

Questions?