Enhancement of Patient Safety - Reduction of Unplanned Extubation in Neonatal Intensive Care Unit (NICU)

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BACKGROUND
Unplanned Extubation (UE)

- Defined as **premature removal** of the endotracheal tube (ETT) either deliberately by the infant, or accidentally by staff during nursing and medical care
- **UE rate** is regarded as a **quality of care metric**
- Incidence reported in literature ranging from **0.14** to **5.3** UEs per 100 intubation days in neonatal intensive care settings

(Lucas da Silva et al, 2013)
Unplanned Extubation

Infant

Impact

Parents & Family

Staff

Organization
Distinct features in neonates

• Anatomical features
  – Small face
  – Short airway
  – Critical airway

• Function of skin
  – Immature
  – Fragile
  – Skin breakdown easily
In Searching for Evidence

- Poor fixation of ETT – the most frequently reported reason for UE (Veldman et al, 2006)
- Lack of evidence to support the use of one particular method over the others for securing ETT, and
- Quality improvement initiatives to identify the best technique for own settings (Lai et al, 2014)
OBJECTIVES – TO REDUCE THE INCIDENCE OF UNPLANNED EXTUBATION IN NICU
INTERVENTION – REVIEW AND REVISE TUBE FIXATION METHOD AND PROCEDURE
Anchor the tube with a stitch sutured to a tape placed above the upper lip. Further secure the tube with two H-shape tapes.

Hold the tube in place and apply stitches and tape.

Prepare stitches and tape.

Ventilate and monitor the infant.
**Stitch Method**

Anchor the tube with a stitch sutured to a tape placed above the upper lip

Further secure the tube with two H-shape tapes

**Hold the tube in place**

Apply stitches and tape

**Prepare stitches and tape**

Ventilate and monitor the infant
STITCH METHOD

Good tube security

- Difficult to revise the tape
- Risk of needle sticks injury
- High level of skills required
Initiating Change

- Change ETT fixation method
- Facilitate and support nurses to initiate ETT tape revision timely
- Goal: Reduction of Unplanned Extubation
New ETT Fixation Method

- Employ a simpler method
- Use two Y-shape tapes and one straight tape
- Standardize
  - the sizes and measurements of adhesive tapes
  - the method in applying the tapes
  - the procedure

A three-role procedure
Nurse Empowerment Strategies

• Conduct nursing education and training
• Encourage and facilitate nurses to revise any loosened ETT tapes timely
• Adopt team approach
• Listen to nurse’s concerns
• Provide feedbacks
• Instill value and meanings behind action
• Cultivate patient safety awareness
Implementation

started since January 2013
Evaluation

- **Staff survey**
  - Nurses’ acceptance to the new ETT securing method and their extended role

- **Workload statistics**
  - Frequency of the ETT tape revision procedure required after the change

- **UE Rates**
  - Monitoring the incidence of UE
RESULTS
Staff survey

Survey
• At three months after the implementation of the new ETT securing method

Response rate
• 100% (N = 60)

Respondents
• 93% had observed the procedure
• 80% had participated in the procedure
Nurse’s opinion on new method

- Easy to apply and renew
- Security of ETT
- Infant’s appearance and comfort level

Visualization of ETT marking – same as the old method
Doctor’s Role

Priority of nurse’s preference

1\textsuperscript{st} choice
- Hold the ETT in place (48%)
- Stand-by (22%)

2\textsuperscript{nd} choice
- Ventilate the infant (43%)
- Hold the ETT in place (18%)

Priority of nurse’s preference

1\textsuperscript{st} choice
- Hold the ETT in place (48%)
- Stand-by (22%)

2\textsuperscript{nd} choice
- Ventilate the infant (43%)
- Hold the ETT in place (18%)

Doctor’s Role

Infant with ETT

- Ventilate the infant
- Apply the tape
- Hold the ETT in place
- Doctor stand-by

Least preferred
Nurse’s perspective on their extended role

- Increased sense of nursing autonomy (78%)
- As good as doctor in applying tapes (87%)
- Satisfied with the team arrangement (95%)
Nurse’s level of confidence

No. of nurses

Level of Confidence

Not confident at all

Most confident
Workload statistics

- Collection of data
  - Episodes of tape renewal event
  - Reason of the event
- For all intubated infants
- For a period of 3 months
### Results

<table>
<thead>
<tr>
<th>Demographics</th>
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<tbody>
<tr>
<td>Duration</td>
<td>3 months (24th Jan 2013 – 23rd April 2013)</td>
</tr>
<tr>
<td>No. of intubated infants</td>
<td>20</td>
</tr>
<tr>
<td>Duration of intubation &lt; 7 days</td>
<td>17 infants</td>
</tr>
<tr>
<td>Duration of intubation ≥ 7 days</td>
<td>3 infants</td>
</tr>
<tr>
<td>Duration of intubation (range)</td>
<td>1 – 53 days</td>
</tr>
<tr>
<td>Total No. of intubation days</td>
<td>129 days</td>
</tr>
<tr>
<td>No. of episodes of ETT tape renewal</td>
<td>33</td>
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</tbody>
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Duration of intubation and Frequency of ETT tape renewal

<table>
<thead>
<tr>
<th>Duration of intubation (Total No. of days = 129)</th>
<th>No. of patients (N=20)</th>
<th>Episodes of ETT tape renewal (Total No. = 33)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 7 days</td>
<td>16</td>
<td>≤ 2</td>
</tr>
<tr>
<td>&lt; 7 days</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>12 days</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>27 days</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>53 days</td>
<td>1</td>
<td>9</td>
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\[ y = 0.1734x + 0.5314 \]

\[ R^2 = 0.805 \]
### Reasons for ETT tape renewal

<table>
<thead>
<tr>
<th>Reasons for ETT tape renewal</th>
<th>No. of Episodes</th>
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<tbody>
<tr>
<td>Tape loosened</td>
<td>14 (42%)</td>
</tr>
<tr>
<td>Adjustment of ETT position as per doctor’s prescription</td>
<td>13 (39%)</td>
</tr>
<tr>
<td>Change of ETT</td>
<td>3 (10%)</td>
</tr>
<tr>
<td>Dislodgement of ETT</td>
<td>2 (6%)</td>
</tr>
<tr>
<td>Others (Old securing method was used in DS and tape was loosened on admission)</td>
<td>1 (3%)</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>33</strong></td>
</tr>
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</table>
Estimation of Workload

33 episodes in 3 months = 2 – 3 episodes in a week
MONITORING OF UE RATES
Number of Intubation Days and Incidence of Unplanned Extubation in 2013

Total No. of Intubation Days: 663

Total No. of UE: 7

UE Rate: 1.05 per 100 intubation days
# Case Review

(N = 7)

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<thead>
<tr>
<th></th>
<th>Range</th>
<th>Average</th>
</tr>
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<tr>
<td><strong>Birth weight (kg)</strong></td>
<td>0.5 – 2.31</td>
<td>1.455</td>
</tr>
<tr>
<td><strong>Birth gestation (week)</strong></td>
<td>24.71 – 36.57</td>
<td>32.08</td>
</tr>
<tr>
<td><strong>Post-natal age</strong></td>
<td>Day 0 – Day 47</td>
<td>Day 19</td>
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ETT Tape was well secure in all cases.
Further Improvement Actions

• Share case review and findings among doctors and nurses
• Standardize infant’s position for CXR
• Define sub-optimal endotracheal tube position
• Review tube position regularly and adjust the tube position whenever indicated
• Precaution measures for high risk nursing procedures, such as turning and tube suctioning
Number of Intubation Days and Incidence of Unplanned Extubation in 2014

Total No. of Intubation Days: 697

Intubation Days

Unplanned Extubation

Total No. of UE: 2

UE Rate: 0.28 per 100 intubation days
UE Rates

1.05 per 100 intubation days in 2013

0.28 per 100 intubation days in 2014
In Summary

• Our experience confirms that reduction of unplanned extubation in NICU is possible with quality improvement initiatives.

• A team approach with nurse empowerment strategies and back up support from medical team, monitoring of UE rates and case review are the key factors for our success.

• Our reporting of UE rate serves a reference to inform doctors and nurses of our local data and hopefully, as a catalyst, for promoting more patient safety initiatives for the benefits of this vulnerable patient group.
References


Thank You