Reducing Hospital Acquired Infections with Non-Invasive Ventilation: Ending VAP!

Brian X Weaver MS, RRT-NPS, RPFT
Objectives

- Intubation
- Infection
- Weaning protocol
- NIV
- Before the Vent
- Summery
Intubation Problems

- Risk of intubation
- The mortality numbers are well documented
Risk of intubation

Design: Multiple-center observational study.
Setting: Seven intensive care units of two university hospitals.
Patients: We evaluated 253 occurrences of ETI in 220 patients.

Conclusions: ETI in ICU patients is associated with a high rate of immediate and severe life-threatening complications.

28% of ETI; at least one severe complication occurred

- Severe hypoxemia (26%)
- Hemodynamic collapse (25%)
- Cardiac arrest (2%)

The other complications with difficult intubation

- Cardiac arrhythmia (10%)
- Esophageal intubation (5%)
- Aspiration (2%)

Cost of doing business?

- Nosocomial infections affect > 2 million persons
- 5-35% of the ICU population develop NIs
- Cause 44,000-98,000 deaths annually

ONE-THIRD OF NOSOCOMIAL INFECTIONS ARE PREVENTABLE THROUGH INFECTION CONTROL PROGRAMS!

The Study on the Efficacy of Nosocomial Infection Control CDC
Figure 2. Correlation between prevalence rate of intensive care unit (ICU)-acquired infection and mortality rate

Prevalence of Nosocomial Infections in ICU

- Pneumonia: 46.9%
- Lower Respiratory Tract: 17.8%
- UTI: 17.6%
- Blood Stream Infection: 12%
Incidence of nosocomial infections in MICU patients was 17.7%

- urinary tract infection (UTI)
- pneumonia
- surgical site infection,
- Gastroenteritis
- blood stream infection and meningitis.
VAP

- VAP is the leading nosocomial infection
- The leading cause of death from nosocomial infection
- Prolongs time on the ventilator, ICU and hospital length of stay, increases mortality
- Adds $40,000 to cost of care

To prevent ventilator-associated pneumonia

- Keep the head of the patient’s bed raised between 30 and 45 degrees unless other medical conditions do not allow this to occur.
- Check the patient’s ability to breathe on his or her own every day so that the patient can be taken off of the ventilator as soon as possible.
- Clean their hands with soap and water or an alcohol-based hand rub before and after touching the patient or the ventilator.
- Clean the inside of the patient’s mouth on a regular basis.
- Clean or replace equipment between use on different patients.
The morbidity outcomes are equally dismal with long term intubation even when diligence is applied to cuff pressure monitoring.
n= 150

**Adverse consequences**

- **Endotracheal**
  - Excessive cuff pressure requirements **19%**
  - Self-extubation **13 %**
  - Inability to seal the airway **11 %**

- **Tracheal**
  - Stomal infection **36 %**
  - Stomal hemorrhage **36 %**
  - Excessive cuff pressure requirements **23 %**
  - Subcutaneous emphysema or pneumomediastinum **13 %**

High prevalence of tracheal stenosis after tracheotomy 65%

- Endotracheal intubation 19 % (p< 0.01).

T39 of 41 95 % patients with endotracheal intubation had laryngotracheal injury at autopsy.

Ulcers on the posterior aspect of the true vocal cords were found at autopsy in 51% of the patients who died after endotracheal intubation.

Weaning protocols are the most efficient way to do that.

Acute critical illness

Recover quickly

Die during acute illness

Require prolonged mechanical ventilation
Elective tracheotomy
Continued high levels of nursing care
Become chronically critically ill
Conclusions: Although local physicians were supportive in theory, introduction of protocolized weaning is likely to be difficult because of the breadth of information required for successful decision-making. Consultant views in this study were not consistent with American findings that physicians' caution may unnecessarily prolong weaning.

Modern Critical Care

- Patients who, in the past, would have died from their acute illnesses now survive

- Extensive and expensive care
Expression first used by Girard and Raffin, 1985

“Difficult to wean patients”

“Patients requiring prolonged mechanical ventilation”

“Patients with protracted critical illness”

“Patients with prolonged critical illness”
This population would normally be kept intubated or trached until the either became long term vent patients, extubated in the future or expired.
NIV vs. Intubation

- There is evidence of improved outcome with NIV over conventional ventilation.
- Noninvasive ventilation was as effective as conventional ventilation in improving gas exchange.
- Associated with fewer serious complications and shorter stays in the intensive care unit.


Reduced mortality at 14 days (16.2 vs.. 25.8%) Non-invasive vs. invasive strategy
Decreased organ failure (SOFA) at days 3, and 7
Decreased antibiotic use
More antibiotic free days at 28 days

- A significant increase in the rate of airway-related complications with increased intubation attempts
- Regurgitation of gastric contents
- Aspiration of gastric contents
- Bradycardia
- Cardiac arrest

Hamlet. Act III, Scene I.

Hamlet: To intubate or Not to intubate .... To extubate or not to extubate .... That is the question. Whether 'tis nobler in the mind to suffer ............... 

Ophelia: Oh hell no !!! get me off that vent.
New equipment has changed the game

New ventilators incorporated NIV features.
interfaces
### ED Pneumonia

**WHAT TO DO**

- **Intubate**
  - Weaned and required a NRM
  - Wean 7.19
  - pCO2 81
  - pO2 62
  - HCO3 31

- **Re-intubate**
  - Vent
  - PH 7.29
  - pCO2 63
  - pO2 94
  - HCO3 30

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### Previous gas from last visit

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**Resp Distress**: RR 30+

### New

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**WHAT TO DO**

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**DKA**

**WHAT TO DO**

**intubated**

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4 days - self extubates

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<tr>
<td>7.25</td>
<td>49</td>
<td>less than 32</td>
<td>incalculable</td>
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**WHAT TO DO**
4 days - self extubates

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<tr>
<td>pCO2</td>
<td>49</td>
</tr>
<tr>
<td>pO2</td>
<td>less than 32 incalculable</td>
</tr>
<tr>
<td>HCO3</td>
<td>21.5</td>
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Airvo

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<tr>
<td>pO2</td>
<td>175</td>
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<tr>
<td>HCO3</td>
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High-flow nasal cannula (HFNC)
- Air/oxygen blender
- Active humidifier
- Single heated circuit
- Nasal cannula.

It delivers adequately heated and humidified medical gas at up to 60 L/min of flow

Physiological effects:
- Reduction of anatomical dead space
- PEEP effect
- Constant fraction of inspired oxygen
- Good humidification

HFNC decreases breathing frequency and work of breathing and reduces needs of escalation of respiratory support in patients with diverse underlying diseases.

Mouth Piece

This an opion for the more functional and indepenant patient. This is not for everyone but the partients that use this system will not part with it. They do require a nasal set up for noctenanal support.
Intubation is a very dangerous business that should be avoided if possible.

The mortality and morbidity are excessively high with invasive procedures.

When intubated, the extubation should follow as soon as possible.

Wean protocols have proven their value.

There is a population that protocols do not help.

Extubation to NIV and NIV support can help germinate extubation.

Support the reintubation prone patient.

Provide support for as long as the patient needs.

New methods in NIV therapy and new equipment make this easier than ever.

NIV can help avoid intubation.

Never say never.