Safe Use of Opioids in Hospitals:
Addressing The Joint Commission
Sentinel Event Alert

Physician-Patient Alliance
for Health & Safety (PPAHS)
www.ppahs.org
Panelists

Michael Wong, JD - Physician-Patient Alliance for Health & Safety
Dr. Jenifer R. Lightdale, MD, MPH - Boston Children’s Hospital
Dr. Frank J. Overdyk, MSEE, MD - Hofstra North Shore – LIJ School of Medicine
Debbie Fox, MBA, RRT-NPS, FAARC - Wesley Medical Center
“While opioid use is generally safe for most patients, opioid analgesics may be associated with adverse effects, the most serious effect being respiratory depression, which is generally preceded by sedation.”
Opioid Use Most Related with Adverse Drug Events

“Opioid analgesics rank among the drugs most frequently associated with adverse drug events”

Two studies:
• most adverse drug events were due to drug-drug interactions, most commonly involving opioids, benzodiazepines, or cardiac medications
• 16% of inpatient adverse drug reactions attributable to opioids

The Joint Commission
Sentinel Event Alert “Safe use of opioids in hospitals”
(Issue 49, August 8, 2012)
Lenore Alexander & Leah’s Law
Causes of Opioid-Related Respiratory Depression

• Lack of knowledge about potency differences among opioids.

• Improper prescribing and administration of multiple opioids and modalities of opioid administration (i.e., oral, parenteral and transdermal patches).

• Inadequate monitoring of patients on opioids.

The Joint Commission
Sentinel Event Alert “Safe use of opioids in hospitals”
(Issue 49, August 8, 2012)
Incidence of Opioid-Related Respiratory Depression

- average about 0.5 percent
- studies range from 0.16% to 5.2%

The Joint Commission
Sentinel Event Alert “Safe use of opioids in hospitals”
(Issue 49, August 8, 2012)
Incidence of Opioid-Related Respiratory Depression: Patient-Controlled Analgesia (PCA)

- 13 million patients receive PCA annually
- Respiratory depression averages about 0.5% = 65,000 patients:
  - low 0.16% = 20,800 patients
  - high 5.2% = 676,000 patients
- Estimated 5,200 potentially preventable episodes of respiratory failure
- As many as 50% of PCA adverse events could be prevented with effective monitoring

Dr. Robert Stoelting
President
Anesthesia Patient Safety Foundation
(slides presented at Patient Safety, Science & Technology Summit (Jan 2013)
Incidenece of Opioid-Related Respiratory Depression: Patient-Controlled Analgesia (PCA)

Dr Richard Dutton  
(Executive Director, Anesthesia Quality Institute):  
“PCA errors certainly occur, both in programming and in delivery, but any published estimate is likely to be only the tip of the iceberg.”
Objectives

- Link patient monitoring to patient safety
- Review routine monitoring
  - Strengths
  - Gaps
- Describe the difference between oxygenation and ventilation
Trip Down Memory Lane
Patient Monitoring During Procedural Sedation

- Before 1980’s - Nurse assessment only

- Late 1980’s - Pulse oximetry introduced
  - Revealed truths
    - e.g. “blue” patient = <80% O₂ saturation

- 1995 - Standard of Care: Pulse oximetry plus a dedicated nurse performing direct visual assessment
Today...

*Difficult to imagine clinical practice without pulse oximetry*
Important to recognize!

- Pulse oximetry:
  - Measures the concentration of $O_2$-bound hemoglobin
  - Reflects oxygenation, NOT ventilation
  - Late indicator of ventilatory problems

! Current standard monitoring may not detect apnea until $O_2$ desaturation has occurred.
What Is Capnography?

- A non-invasive, continuous measurement of exhaled carbon dioxide concentration
- Expired CO₂ is sampled via specialized nasal cannulae
- Measures ventilation, NOT oxygenation
Capnography
Capnography
What info does capnography provide?

ETCO2 display

- Numerical value for ETCO2
- Distinct waveform (tracing) for each respiratory cycle
Overall principles of capnography

- Accurately monitors respiratory rate
- Monitors ventilation in non-intubated patients
- Monitors hypoventilation more effectively than pulse oximetry
  - Early indicator of ventilation issues
  - Early warning of apnea
Ventilation and Oxygenation....

What’s the Difference?
Oxygenation and Ventilation

- Respiratory Cycle = two-phase
  - related, *but separate* physiologic processes

- Oxygenation

- Ventilation
Physiology of Oxygenation and Ventilation

Oxygen → lungs → alveoli

EtCO₂

CO₂

breath

lungs

O₂ + Hgb

muscles & organs

SpO₂

energy

CO₂

lungs

energy

O₂

Glucose

cells
Oxygenation vs. Ventilation

**Oxygenation**
- Measured by pulse oximetry
  - $O_2$ attached to hemoglobin
- Influenced by supplemental O2
- May remain normal even after patient stops breathing

**Ventilation**
- Measured by capnography
  - Expired and inspired levels of ETCO$_2$
- Not affected by O2 delivery
- Does not appear normal if patient is not breathing
Oxygenation and Ventilation

- Oxygen reading
- $\text{CO}_2$ waveform flatline
Normal Waveform

- A-B: Baseline = no CO₂ in breath
- B-C: Rapid rise in CO₂
- C-D: Alveolar plateau
- D: End expiration (EtCO₂)
- D-E: Inhalation
Hypoventilation

\[ RR = \uparrow \text{CO}_2 \]

Hypoventilation

\[
\begin{array}{c}
\text{CO}_2 \\
(\text{mmHg})
\end{array}
\]

\[
\begin{array}{c}
0 \\
40 \\
\text{Time}
\end{array}
\]
Hyperventilation
How do you know when breathing is abnormal???

- Changes from baseline
- Change in ETCO2 value >10 mmHg
- Significant waveform change
- Flatlines
Keep it simple…

“Hey, c’mon. This isn’t brain surgery.”

ALL RIGHTS RESERVED
http://www.cartoonbank.com
Normal capnogram

Hypoventilation

Apnea
Indications for Capnography*

- Deep sedation
- Difficult-to-sedate patients
- Difficult-to-monitor patients
- Patients at risk for apnea (i.e. Obese)
- Patients who cannot be adequately assessed via typical means (e.g. visually)
- Patients receiving supplemental oxygen
- Elderly, More complex patients??

* Cohen, 2007
Putting It All Together...

- Capnograms can provide immediate information about:
  - Airway obstruction
  - Hypoventilation
  - Total lack of breathing

- Ventilatory abnormalities on capnography *precede* oxygen desaturation, as noted on oximetry.
Putting It All Together...

Early detection

+ Early intervention

= ! Improved patient safety
Thank You!
Wesley Medical Center
Wichita, KS

Licensed for 760 Beds
HCA Facility

700 physicians
3,000 employees

28,000 Inpatient Admissions
18,000 Surgeries
150-225 pts/mo PCA therapy
Wesley’s Experience: Previous Strategies Implemented

2002-2007
- Increased emphasis on pain management
- Increase in Opioid related ADRs

Strategies
- Preprinted PCA Order sets;
- Eliminated basal rates; Established dosing ranges; Eliminated Meperidine

Strategies
- PCA by Proxy education
- eMAR documentation for bolus and shift totals
### Wesley’s Results

<table>
<thead>
<tr>
<th>Opioid ADRs by Severity</th>
<th>2007</th>
<th>2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>%Mild</td>
<td>47.80%</td>
<td>36.4%</td>
</tr>
<tr>
<td>%Mod</td>
<td>32.60%</td>
<td>49%</td>
</tr>
<tr>
<td>%Severe</td>
<td>19.60%</td>
<td>14.60%</td>
</tr>
<tr>
<td>%Code Mod/Severe (All Opioids)</td>
<td>37.50%</td>
<td>31.40%</td>
</tr>
<tr>
<td>% Code Mod/Severe (PCA Only)</td>
<td>16.70%</td>
<td>11.4%</td>
</tr>
</tbody>
</table>
May 2009
• Conversion to “Smart” Pump system
  • Included Capnography
  • Policy/Procedures to monitor all PCA pts and all High Risk patients receiving IV opioids for first 48 hours

2009
• Expanded Multidisciplinary Implementation Team
• Identification of High Risk Patients
• All patients screened on admission
• Modified STOP BANG score

Goal
• Effective pain management
• Reduce Severe Adverse Drug Events
• Improve Patient Safety

Wesley’s Experience:
Implementation of Smart Pump Technology
Wesley’s Experience:
PCA volumes and Risk Scoring

<table>
<thead>
<tr>
<th></th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PCA Stats</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total PCA Orders</td>
<td>4122</td>
<td>3531</td>
<td>2268</td>
</tr>
<tr>
<td>Total PCA Patients</td>
<td>3580</td>
<td>3114</td>
<td>2037</td>
</tr>
<tr>
<td>Orders Using Order Set</td>
<td>4037</td>
<td>3472</td>
<td>2267</td>
</tr>
<tr>
<td>% PCA Ord Using OS</td>
<td>97.94%</td>
<td>98.33%</td>
<td>99.96%</td>
</tr>
<tr>
<td><strong>Patient Risk Scoring</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total PCA Pat w/ RS</td>
<td>3118</td>
<td>2961</td>
<td>1923</td>
</tr>
<tr>
<td>High Risk</td>
<td>178</td>
<td>156</td>
<td>170</td>
</tr>
<tr>
<td>Low Risk</td>
<td>2645</td>
<td>2428</td>
<td>1551</td>
</tr>
<tr>
<td>Missing</td>
<td>488</td>
<td>265</td>
<td>114</td>
</tr>
<tr>
<td>Diagnosed</td>
<td>274</td>
<td>251</td>
<td>202</td>
</tr>
<tr>
<td>Not Eval</td>
<td>0</td>
<td>14</td>
<td>0</td>
</tr>
<tr>
<td>% Pats w/PCA Ord w/RS</td>
<td>87.09%</td>
<td>95.09%</td>
<td>94.40%</td>
</tr>
</tbody>
</table>
### Wesley’s Experience: Results

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>%Mild</td>
<td>47.80%</td>
<td>36.4%</td>
<td>35.1%</td>
<td>27.6%</td>
<td>54.2%</td>
<td>45.9%</td>
<td>60.2%</td>
</tr>
<tr>
<td>%Mod</td>
<td>32.60%</td>
<td>49%</td>
<td>51.4%</td>
<td>41.4%</td>
<td>39.0%</td>
<td>50.5%</td>
<td>35.6%</td>
</tr>
<tr>
<td>%Severe</td>
<td>19.60%</td>
<td>14.60%</td>
<td>13.50%</td>
<td>31.0%</td>
<td>6.80%</td>
<td>3.6%</td>
<td>1.4%</td>
</tr>
<tr>
<td>%Code Mod/Severe (All Opioids)</td>
<td>37.50%</td>
<td>31.40%</td>
<td>20.80%</td>
<td>42.8%</td>
<td>11.1%</td>
<td>10.0%</td>
<td>10.3%</td>
</tr>
<tr>
<td>% Code Mod/Severe (PCA Only)</td>
<td>16.70%</td>
<td>11.4%</td>
<td>12.5%</td>
<td>14.3%</td>
<td>3.70%</td>
<td>1.7%</td>
<td>3.4%</td>
</tr>
</tbody>
</table>
Wesley’s Experience:
Transfer to ICU

% PCA ADRs Transfer to ICU

- pre-2010
- post 2010
- 2011
- 2012
Wesley’s Experience:
ADRs by Severity

Opioid Adverse Drug Reactions By Severity

- %Mild
- %Mod
- %Severe
Wesley’s Experience:
Code Prevalence

Code Prevalence in Moderate and Severe Opioid Adverse Drug Reactions
Wesley’s Experience: On-going Performance Improvement

Reduce Severity in Non-PCA ADRs

Dec. ’12: Monitor all Post-op pts receiving IV opioids for 1st 24 hrs

Methodology to identify other risk factors for respiratory depression?

Medical patients receiving IV opioids?
Wesley’s Experience: Lessons Learned

- Staff Education: ETCO2 Pulse Oximetry
- Patient Education
- Management of Alarms
- Team Collaboration
- ETCO2 an effective tool for early detection of Respiratory Depression
In recognition for our efforts to improve patient-controlled analgesia (PCA) outcomes, Wesley Medical Center was honored by the Institute of Safe Medication Practice with the Cheers Award in 2012.