Respiratory Chemosensitivity and Sleep as Risk Factors for Postop OIRD
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Background

Opioid induced respiratory depression (OIRD):

The frequency of significant respiratory depression among post-operative patients may be as high as 2% \(^1\)

OIRD Risk Factors?
Age, sex
Comorbidities
Opioid dependence \(^2\)


Background

Hypercapnic Ventilatory Response (HCVR)

Purpose

To provide data that will assess the role of respiratory chemosensitivity of patients receiving major surgery in determining postoperative respiratory depression due to opioids.

To determine whether respiratory events are more likely during sleep (and if so, what specific phases of sleep).
Methodology

• Patient Recruitment: Preoperative Screening Clinic
  ➢ 18 years or older
  ➢ Undergoing major, non-thoracic surgery
  ➢ Exclusion criteria: pregnancy, history of adverse reaction to remifentanil, chronic use of opioids, sickle cell disease, coronary artery disease, and history of a neurological injury or stroke

Methodology

• Pre-surgery Testing
  ➢ Respiratory chemosensitivity: Duffin’s modified rebreathing method
    ▪ HCVR in setting of hyperoxia (150 mmHg) and mild hypoxia (50 mmHg)
    ▪ Remifentanil effect site concentration: 2.0 vs. 0.7 ng/ml
  ➢ Pre-Operative Sleep Study

Methodology

- **Post-surgery Monitoring**
  - Opioid consumption and timing
  - PACU to Postop Morning 1
  - PACU to discharge

End points: “Respiratory Events”
1) RR < 80% of baseline
2) MV < 80% of expected MV (based on BMI)
3) SpO₂ < 90% (room air) or 92% (+ O₂)
4) P<sub>TCCO₂</sub> > 50 mmHg

Preliminary Results

<table>
<thead>
<tr>
<th>Age</th>
<th>Sex</th>
<th>Surgery</th>
<th>ΔAHI</th>
<th>Total opioid dose (MME)</th>
<th>Epidural opioid dose (MME)</th>
<th>Opioid intake frequency (MME/hr)</th>
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</thead>
<tbody>
<tr>
<td>68</td>
<td>M</td>
<td>Colectomy</td>
<td>-24.6</td>
<td>177.9</td>
<td>52.9</td>
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<td>294.4</td>
<td>66.4</td>
<td>6.2</td>
</tr>
</tbody>
</table>
Preliminary Results

Desaturation Events

Opioid Dose (morphine eq)

Event Frequency (Hz)

A/H (central) Events

Desaturation Events

RR Depression Events

Opioid Dose (morphine eq)

Event Frequency (Hz)

Patient ID

On epidural
Off epidural

Preliminary Results

HCVR (mill remi)

HCVR (no remi)

Hyperoxia (2.0 remi)
Hyperoxia (0.7 remi)
Hypoxia (2.0 remi)
Hypoxia (0.7 remi)

Desaturation Events

Event Frequency (Hz)

Desaturation

ΔAH1

ΔHCVR
Preliminary Results

- Establishment of methodology
  - Remifentanil site concentration of 0.7 ng/ml is adequate to measure opioid effect on respiratory chemosensitivity

- Preliminary findings:
  - Frequency of respiratory events generally have a positive correlation with total opioid dose and ΔHCVR
  - Respiratory events occur mostly during light sleep

Conclusions and Moving Forward
Questions?