Factors Associated With Postoperative Respiratory Depression: From the ASA Closed Claims Analysis

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Postoperative respiratory depression (RD) from opioids remains a significant cause of high-severity injuries for patients, often resulting in death or brain damage. The Joint Commission recently issued Sentinel Event Alert Issue 49 regarding the safe use of opioids after review of opioid-related events from the Joint Commission's Sentinel Event Database from 2004-11.[1] Wrong-dose medication errors were present in 47 percent of these sentinel events, improper monitoring occurred in 29 percent, and other factors such as excessive dosing, medication interactions and adverse drug effects were present in 11 percent.[1]

Over the past five to six years, both the Institute for Safe Medication Practices[2] and the Anesthesia Patient Safety Foundation[3] have advocated for increased monitoring (electronic and nursing assessments) of patients receiving opioids in the postoperative period. Together with the Joint Commission, these organizations emphasize the superiority of continuous electronic monitoring over spot checks with pulse oximetry and/or capnography for detection of respiratory depression. However, disagreement exists on whether to monitor all postoperative patients receiving opioids or only those patients perceived to be at high risk for respiratory depression from coexisting conditions such as obesity, obstructive sleep apnea, advanced age, organ system dysfunction, preoperative opioid tolerance or co-administration of non-opioid sedating medications.

We sought to analyze the associated factors for postoperative respiratory depression in the ASA Closed Claims Project Database and assess whether or not better monitoring might have prevented the respiratory depression event. These findings were presented in part at the ANESHESIOLOGY™ 2012 annual meeting in Washington, D.C., on October 13, 2012.[4]

ASA Closed Claims Project

The ASA Closed Claims Project Database is a structured collection of closed malpractice claims in anesthesia from participating professional liability companies across the country that currently insure more than one-third of practicing anesthesiologists. Specific topics are periodically reviewed to identify any recurring patterns of injury and associated factors to guide future research with more in-depth analysis.

Postoperative Respiratory Depression Claims

From the Closed Claims Database, we examined claims occurring between 1990 and 2009 and identified 341 acute pain claims. Details provided in the narrative summary were reviewed by three anesthesiologists using criteria such as naloxone reversal of RD, arterial carbon dioxide concentrations of 100 mm Hg or greater (in the absence of baseline carbon dioxide retention or cardiac arrest), presence of somnolence, pinpoint pupils, respiratory rate <8 breaths per minute, etc., to evaluate whether RD was present or not. Severity of injury and patient, physician and nursing factors associated with RD were examined and compared to other acute pain claims.

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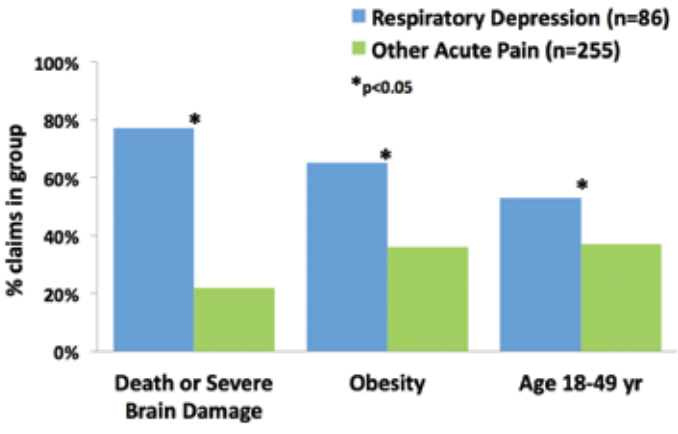
One-quarter (n=86) of the 341 acute pain claims were assessed as having RD, whereas more than half of the acute pain claims without RD were associated with regional anesthesia block-related injuries. No significant difference was found with respect to sex for RD versus other acute pain claims. Although advanced age has been identified as a risk factor for opioid-induced respiratory depression, there was a significantly higher proportion of RD claims in the 18-49 year-old age group compared to other acute pain claims (Figure 1). Less surprising was the finding of a higher proportion of RD claims with obesity compared to other acute pain claims, and the very high proportion of RD claims with death or severe brain damage (Figure 1).

Figure 1: Postoperative Respiratory Depression in Acute Pain Claims (N=341)



Modes of Pain Control and Prescriber Issues

Modes of pain control examined included neuraxial (epidural or intrathecal), patient-controlled analgesia (PCA), intramuscular, intravenous (intermittent or continuous infusion) and oral. Neuraxial and PCA pumps were the most common primary modes of pain control. Multiple modes of pain control were used in half of RD claims (Table 1). The most common multimodal therapies were PCA combined with other non-neuraxial analgesia (23 percent), non-neuraxial/non-PCA analgesia (15 percent), and then neuraxial combined with non-PCA analgesia (14 percent).

More than one-third of RD claims involved a mix of non-opioid sedating medications (butyrophenones, antihistamines, benzodiazepines and sleep aids) and opioids, and one-third of claims had more than one physician prescribing opioid or non-opioid sedating medications postoperatively (Table 1). Poor communication between prescribing physicians and nursing personnel is a common theme in opioid-induced respiratory depression claims. Moreover, many physicians and nurses do not fully appreciate the synergistic effects that opioids, benzodiazepines, some antiemetics and sleep aids may have on the respiratory drive. These findings indicate a need for improved education of perioperative health care providers, and development and adherence to institutional policies on administration of opioids in the postoperative period.

Table 1: Perioperative Characteristics of Respiratory Depression Claims

Factor	Respiratory Depression Claims (n=86)
Primary Mode of Pain Therapy	
Neuraxial	42%
PCA	42%
Other*	15%
Multimodal Pain Therapy**	51%
Non-opioid Sedating Medications Administered***	38%
>1 Physician Prescribing Opioids/Non-Opioid Sedating Medications***	34%
Evidence of Sleep Apnea	40%
Snoring Observed	16%
Somnolence	60%
Timing of Respiratory Depression Event	
Day or Night of Surgery	87%
Postoperative Day 1 or Later	12%
Unknown	1%

*"Other" modes of pain therapy refer to intramuscular, intravenous (intermittent or continuous infusion) and oral analgesics. All claims had opioids as part of their analgesia regimen.

**The most common multimodal therapies were PCA combined with other non-neuraxial analgesia (23%), non-neuraxial/non-PCA analgesia (15%) and neuraxial combined with non-PCA analgesia (14%).

***Non-opioid-sedating medications include butyrophenones, antihistamines, benzodiazepines and sleep aids.

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In addition, it highlights the lack of predictability in patient response when administering opioids in combination with other non-opioid sedating medications.

Less than half of the 86 RD claims had any evidence of sleep apnea (Table 1), though sleep apnea is notoriously underdiagnosed in patients. Snoring was observed in less than one-fifth of RD claims. Somnolence was noted in more than half of RD claims (Table 1), demonstrating the critical role nursing assessments of level of sedation can play in prevention of RD if appropriate interventions are made.

"Poor communication between prescribing physicians and nursing personnel is a common theme in opioid-induced respiratory depression claims. Moreover, many physicians and nurses do not fully appreciate the synergistic effects that opioids, benzodiazepines, some antiemetics and sleep aids may have on the respiratory drive."

Timing of Respiratory Depression Events

The most consistent associated factor in RD claims was the timing of occurrence of RD. The large majority occurred on the day or night of surgery, indicating the time period where increased monitoring may provide the most benefit (Table 1). Several claims had RD occur shortly after transfer from a stimulating recovery room environment to a quiet room on the floor. Reviewers thought that better monitoring may have prevented the complication in almost all of the 86 RD claims.

Summary

Postoperative respiratory depression is a significant cause of death and brain damage in the ASA Closed Claims Database, primarily associated with neuraxial and/or PCA use and multimodal pain therapy. Improved education of perioperative health care providers regarding opioid-induced respiratory depression particularly, when combined with non-opioid-sedating medications, better monitoring, more frequent bedside assessment with better management of somnolence, and better coordination of multiple modes of pain therapy may be useful interventions for reducing this high-severity complication. These improvements may be particularly helpful in the first 24 hours after surgery. Focusing on a high-risk postoperative period for better monitoring of *all* patients, rather than a high-risk patient profile, may provide better outcomes. Interventions aimed at reducing this devastating complication should be studied for efficacy, as many barriers may exist with increased monitoring such as alarm fatigue, patient compliance and interruption of sleep cycles. Early studies suggest that monitoring all patients in the postoperative period may improve outcomes and reduce ICU transfers for all causes.[5]

References

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For a recent ASA perspective on the topic of postoperative respiratory depression and efforts to improve the safety of patients receiving opioids via PCA, visit **www.asahq.org/For-Members/Practice-Management.aspx** and click on the link **"ASA Responds to Proposed CMS Measure to Provide Appropriate Monitoring to Patients Using Opioids via Patient Controlled Analgesia."** There you will find a letter from ASA President John Zerwas, M.D. to Terry Moore, Vice President of Health Policy at Abt Associates, which is the steward of Proposed CMS Measure to Provide Appropriate Monitoring to Patients Using Opioids via Patient Controlled Analgesia (PCA) – 3040.