Opioid-induced Sedation: Its Relationship to Respiratory Depression

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El Dorado Hills, California

Opioid-induced Sedation

- Common opioid adverse effect
- Underlying mechanisms poorly understood
- No agreed-upon definition
- Lack of consistency in monitoring and reporting
- Highly sensitive indicator of impending respiratory depression

Consciousness

- Arousal domain
  - Fluctuations between awake and sleep states
  - Mediated by reticular formation in medulla
  - Thalamus responds to sensory input
- Content domain
  - Quality features, e.g., sensation, thought, speech, imagination

Opioid-induced Sedation: Suggested Mechanisms

- Opioids interfere with sleep/wake cycle
  - Disrupt REM sleep
  - Decrease responsiveness to sensory input induces sleep
  - Prolong sleep time

- Clinical presentation
  - Drowsy → Somnolence


References

Post-opioid Sedation Assessment Scales

Allison Nisbet, MSN, RN-BC, CPN, AOCNS
Clinical Nurse Specialist
Pediatric Hem/Onc & Adolescent Units
Inova Fairfax Hospital for Children

Continuum of Consciousness

- Maintains Airway Independently: Awake, baseline
- Does NOT maintain airway: Does NOT maintain airway
- Anxiolysis “Anti-Anxiety” precedes respiratory depression
- Advancing Sedation: Precedes respiratory depression
- General anesthesia
- Deep sedation

Why Post-opioid Sedation Assessment?

- System sedation assessment tool not previously validated (internally developed)
- Minimal use of a common “language of sedation” noted
  - Hand-off communications
  - Escalation of clinical issues
- Support clinical decision-making; appropriate and timely escalation of care
- Enhance patient safety
Why Post-opioid Sedation Assessment?

- Sedation assessment tools identified in the literature had not yet been studied for validity or reliability for use by non-critical care nurses with adult medical-surgical patients
  - Richmond Agitation & Sedation Scale (RASS)
  - Pasero Post-Opioid Sedation Assessment Scale (POSS)

Why Post-opioid Sedation Assessment?

- Sedation assessment tools validated in the literature were developed in critical care settings:
  - Measure agitation in addition to sedation in relation to the titration of sedative agents; not opioids (Sessler, 2002 & Ely, 2003)
  - Noted to be inappropriate to measure in post-opioid analgesic sedation assessment (Pasero & McCaffery, 2002; Quinn, 2006)

Goal of Post-opioid Sedation Assessments

**Identify advancing sedation** before it is compounded by continued opioid administration and results in clinically significant respiratory depression or apnea, **thereby enhancing patient safety** during pain management with opioid analgesics.
Outcomes

- Safely managed opioid analgesia
  - Early identification of developing problems
  - Responsive titration of therapy
  - Appropriate escalation of care
- Accuracy and clarity of communications
  - Across teams
  - Across departments
  - “speak the same language”

Study Methodology

- Online anonymous survey (Survey Monkey®)
  - 25 items – Evaluating responses to three sedation scales
    - Demographic Information (6 questions)
    - 6 questions/scale (18)
    - One knowledge question (1)
    - Open for 30 days on InovaNET
    - Incentive:
      - Certificate of participation
      - Candy (always a good idea!)
  - Pre-validated by panel of experts
    - 10 internal
    - 10 external
    - 15 responded to invitation (blinded)

Inova Sedation Assessment Scale

Inova Sedation Assessment Scale

1 - Alert
2 - Occasionaly drowsy, easy to rouse
3 - Drowsing intermittently
4 - Asleep, easy to awaken
5 - Difficult to awaken
6 - Unresponsive

(Inova Health System, 1991)
### Richmond Agitation & Sedation Scale (RASS)

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Alert &amp; calm</td>
<td>Acceptable; no action necessary; may increase opioid dose if needed</td>
</tr>
<tr>
<td>1</td>
<td>Drowsy</td>
<td>Not fully alert, but has sustained awakening to voice (eye opening &amp; contact &lt; 10 sec)</td>
</tr>
<tr>
<td>2</td>
<td>Light sedation</td>
<td>Briefly awakens to voice (eye opening &amp; contact &lt; 10 sec)</td>
</tr>
<tr>
<td>3</td>
<td>Moderate sedation</td>
<td>Movement or eye opening to voice (but no eye contact)</td>
</tr>
<tr>
<td>4</td>
<td>Sleep sedation</td>
<td>No response to voice, but movement or eye opening to physical stimulation</td>
</tr>
<tr>
<td>5</td>
<td>Unarousable</td>
<td>No response to voice or physical stimulation</td>
</tr>
</tbody>
</table>

Sessler, 2002

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### Pasero Opioid-induced Sedation Scale (POSS)

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Sleep, easy to arouse</td>
<td>Acceptable; no action necessary; may increase opioid dose if needed</td>
</tr>
<tr>
<td>1</td>
<td>Awake and alert</td>
<td>Acceptable; no action necessary; may increase opioid dose if needed</td>
</tr>
<tr>
<td>2</td>
<td>Slightly drowsy, easily aroused</td>
<td>Acceptable; no action necessary; may increase opioid dose if needed</td>
</tr>
<tr>
<td>3</td>
<td>Frequently drowsy, arousable, drifts off to sleep during conversation</td>
<td>Unacceptable; monitor respiratory status and sedation level closely until sedation level is stable at less than 3 and respiratory status is satisfactory; decrease opioid dose 25% to 50% or notify prescriber or anesthesiologist for orders; consider administering a non-sedating, opioid-sparing nonopioid, such as acetaminophen or a NSAID, if not contraindicated.</td>
</tr>
<tr>
<td>4</td>
<td>Somnolent, minimal or no response to verbal and physical stimulation</td>
<td>Unacceptable; stop opioid; consider administering naloxone; notify prescriber or anesthesiologist; monitor respiratory status and sedation level closely until sedation level is stable at less than 3 and respiratory status is satisfactory.</td>
</tr>
</tbody>
</table>

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### Research Questions

1. What is the content validity and reliability of the three scales?
2. Is there a significant difference in scoring & clinical decision-making between scales?
3. Is there a significant difference in the nurse’s combined rating of each scale’s:
   - Ease of use
   - Confidence (in score & actions chosen)
   - Useful information provided to make clinical decisions

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Sample

- 10% sample of Medical-Surgical Nurses
  - Excluded: Peri-op; critical care; peds
  - Desired: 53
  - Obtained: 96

Sample: Clinical Area

- Med/Surg: 31%
- Ortho: 21%
- Unc: 14%
- Neuro: 13%
- GYN: 10%
- Card/Tele: 9%
- Pain: 5%
- Missing: 2%

Sample: Education

- AAS: 4%
- Diploma: 14%
- BSN: 21%
- RN/Other: 11%
- MS: 9%
- Other Adv: 4%
- Missing: 40%
Data Analysis

- Content Validity: established by Panel of Expert review of overall study tool & subscales relating to each sedation assessment scale
- Scale Reliability: Cronbach’s alpha: > 0.7 α acceptable internal consistency of the subscale (4 items rating scale)

Validity

- All tools have been used in practice and have face validity
- Content validity and established by Panel of 15 content experts
  - RASS
  - POSS
- ISS was felt by some panel members not to discriminate advancing sedation well enough to validate content.

Reliability

<table>
<thead>
<tr>
<th>Scale</th>
<th>Cronbach’s Alpha</th>
<th>% Correct Score</th>
<th>% Correct Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISS</td>
<td>.803*</td>
<td>46.9</td>
<td>67.7</td>
</tr>
<tr>
<td>RASS</td>
<td>.770*</td>
<td>76</td>
<td>68.8</td>
</tr>
<tr>
<td>POSS</td>
<td>.903*</td>
<td>79.2</td>
<td>80.2</td>
</tr>
</tbody>
</table>

* Indicates acceptable reliability
Data Analysis

- 2 Paired sample T Tests to measure significance of observed means ($p < 0.05$):
  - ISS:RASS and RASS:POSS

- Total Correct (RN: score & actions)
- Total Scale Rating (ease of use, information provides, confidence in score, confidence in actions)

Method of pairing accounts for rater learning as study questions progress.

<table>
<thead>
<tr>
<th>Paired samples / Test</th>
<th>Mean (Std Dev)</th>
<th>Std. Error Mean</th>
<th>% Confidence Interval of the Difference</th>
<th>t</th>
<th>df</th>
<th>Sig. (2 tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Correct</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>INOVA:RASS</td>
<td>-0.292</td>
<td>0.300</td>
<td>[-0.426, -0.157]</td>
<td>-4.306</td>
<td>95</td>
<td>0.000*</td>
</tr>
<tr>
<td>RASS:POSS</td>
<td>-0.146</td>
<td>0.313</td>
<td>[-0.290, -0.002]</td>
<td>-2.011</td>
<td>95</td>
<td>0.047*</td>
</tr>
</tbody>
</table>

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<th>Std. Error Mean</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Total Rating</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>INOVA:RASS</td>
<td>-0.813</td>
<td>2.01</td>
<td>[-1.22, -0.405]</td>
<td>-3.96</td>
<td>95</td>
<td>0.000*</td>
</tr>
<tr>
<td>RASS:POSS</td>
<td>-0.750</td>
<td>2.05</td>
<td>[-1.17, -0.335]</td>
<td>-3.59</td>
<td>95</td>
<td>0.001*</td>
</tr>
</tbody>
</table>
Summary results

- **RASS & POSS content validity established**
  - ISS – not enough discrimination between scale items to indicate advancing sedation
  - All scales reliable in this sample:
    - POSS > Highest Reliability (0.903)
    - ISS Were results skewed by familiarity with the tool?
      - Not valid; Lowest consistency in correct score
  - POSS > Most frequently correct
    - Sedation score (.790; range 0-1)
    - Nursing Actions chosen (.802; range 0-1)
  - POSS > Nurses rated higher
    - rated more frequently as easy to use (2.49; range 0-3)
    - providing useful information to make clinical decisions (2.51)
    - resulting in confidence
      - score obtained (2.55)
      - actions chosen (2.56)

Take Home

- **ISS cannot be recommended for continued use**
  - Poor content validity; found reliable in this population?
    - Familiarity with the tool
  - Poor consistency in accurate score
  - Lowest consistency in correct actions
- **POSS/RASS can be recommended for use in non-critical care setting with adult patients**
  - POSS superior scale:
    - Better performance
    - Does not measure constructs other than sedation (agitation), which is desirable for post-opioid sedation assessment

Based on my understanding of opioid side effects, I know that...

A. Sedation follows respiratory depression
B. Sedation precedes respiratory depression
C. Sedation and respiratory depression are unrelated side effects
D. I am not sure.
Based on my understanding of opioid side effects, I know that…

A. Sedation follows respiratory depression (10.5%)
B. Sedation precedes respiratory depression (85.3% - correct)
C. Sedation and respiratory depression are unrelated side effects (2.1%)
D. I am not sure. (2.1%)

Survey Responses, 2008

Results Sharing/Process change
- Revisions to the Pain Flow Sheet
- Revisions to online documentation pages
- Share research results
  - Education
    - Internal Presentations
    - Online annual Safety Fair
    - Poster sessions, local, regional, national
    - In Press – September PMN
- Goal: Enhanced patient safety
  - Develop monitoring process to capture outcomes

Future Research
- Research in other non-critical care populations
  - Pediatric
  - Procedural sedation
    - Comparison: does reporting in this setting require agitation dimension?
References


Selection of a Sedation Assessment Scale for Clinical Practice: Inter-rater Reliability, Ease of Use and Applicability Testing of the RASS and POSS

Susan J. Dempsey, MN, RN-BC, CNS
Judy Davidson, DNP, RN, CNS
Donna Cahill, MSN, RN-BC, CNS
Donna Agan, EdD

Five Hospital Campuses

By the Numbers
- Two of San Diego’s six trauma centers
- 1,254 total licensed acute care beds
- 12,000 employees
- 2,600 physicians
- 131 residents and fellows
- 1,500 volunteers
- 1.5 million patient visits annually
- 118,000 visits a year to our emergency departments
Corporate Profile

- Private, Not-for-Profit Corporation
- Board of community volunteers
- 1,368 total licensed beds
- 2,600 Physicians & 136 residents/fellows
- Two of San Diego’s six trauma centers
- 12,500 employees, including 3,000 registered nurses
- Integrated Delivery System
- Other programs/services include:
  - Home Health
  - Chemical Dependency
  - Executive Health
  - Center for Integrative Medicine
  - Whittier Institute for Diabetes
  - Graduate Medical Education
  - Clinical Research
  - Scripps Health Foundation

Significance of the Problem

- All patients receiving opioids for pain management are at risk for sedation that may progress to oversedation and lead to clinically significant opioid-induced respiratory depression
  - *Sedation always precedes respiratory depression.*
- Sedation Scales that correlate behaviors to sedation level often are used to assess sedation regardless of desired patient outcome
- Assessment using a sedation scale which identifies changes in alertness and arousability is critical to prevention of opioid-induced respiratory depression

Pasero C & McCaffery M. AJN. 2002;102(2): 67-69

Purpose of the Study

- Answer the Question
  - Is the Richmond-Agitation-Sedation Scale (RASS) or the Pasero Opioid-Induced Sedation Scale (POSS) more appropriate for sedation assessment in patients receiving opioids for pain management?
- Select a Sedation Scale for clinical practice and inclusion in the electronic medical record system (EMR)
- Conduct psychometric testing of the POSS
- Conduct ease of use and applicability testing of the RASS and POSS
Richmond Agitation-Sedation-Scale

<table>
<thead>
<tr>
<th>Score</th>
<th>Term</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>+4</td>
<td>Combative</td>
<td>Violently combative or violent; immediate danger to staff</td>
</tr>
<tr>
<td>+3</td>
<td>Very agitated</td>
<td>Pulls or removes tube(s) or catheter(s) or has aggressive behavior toward staff</td>
</tr>
<tr>
<td>+2</td>
<td>Agitated</td>
<td>Frequent nonpurposeful movement or patient-ventilator dysynchrony</td>
</tr>
<tr>
<td>+1</td>
<td>Restless</td>
<td>Anxious or apprehensive but movements not aggressive or vigorous</td>
</tr>
<tr>
<td>0</td>
<td>Alert and calm</td>
<td></td>
</tr>
<tr>
<td>-1</td>
<td>Drowsy</td>
<td>Not fully alert, but has sustained (more than 10 seconds) awakening, with eye contact to voice</td>
</tr>
<tr>
<td>-2</td>
<td>Light Sedation</td>
<td>Briefly (less than 10 seconds) awakens with eye contact to voice</td>
</tr>
<tr>
<td>-3</td>
<td>Moderate Sedation</td>
<td>Any movement (but no eye contact) to voice</td>
</tr>
<tr>
<td>-4</td>
<td>Deep Sedation</td>
<td>No response to voice, but any movement to physical stimulation</td>
</tr>
<tr>
<td>-5</td>
<td>Unarousable</td>
<td>No response to voice or physical stimulation</td>
</tr>
</tbody>
</table>


Pasero Opioid-Induced Sedation Scale

- **S** = Sleep, easy to arouse
  - Acceptable, no action necessary, may increase opioid dose if needed
- **1** = Awake and alert
  - Acceptable, no action necessary, may increase opioid dose if needed
- **2** = Slightly drowsy, easily aroused
  - Acceptable, no action necessary, may increase opioid dose if needed
- **3** = Frequently drowsy, arousable, drifts off to sleep during conversation
  - Unacceptable; monitor respiratory status and sedation level closely until sedation level is stable at less than 3 and respiratory status is satisfactory, decrease opioid dose 25-50%, notify prescriber for orders, consider addition of a nonsedating, opioid-sparing analgesic
- **4** = Somnolent, minimal or no response to physical stimulation
  - Unacceptable; monitor respiratory status and sedation level closely until sedation level is stable at less than 3 and respiratory status is satisfactory, decrease opioid dose 25-50%, notify prescriber for orders, consider addition of a nonsedating, opioid-sparing analgesic


Description of the Study

- IRB approval as exempt
- Authors of both scales were contacted to verify content validity of scales modified for inclusion in the EMR system
- Design
  - Exploratory descriptive to determine ease of use and applicability
  - Psychometrics to determine inter-rater reliability
- Sample
  - Convenience sample (84 patients)
- Patient Population
  - All inpatients located in Critical Care and Medical-Surgical Units during the selected study days
Description of the Study

- Brief explanation was provided to patient’s RN to simulate “real-time” inservice during clinical practice
- 3 Researchers performed sedation assessment using the RASS and POSS.
  - Expert: Clinical nurse specialist
  - Reference rater: RN from pain committee
  - Clinical Nurse: RN caring for the patient
- Every RN who participated in the study completed an ease of use and applicability survey

Results

- Reliability of both scales was very high
  - POSS .909; RASS .949
- 76% rated the POSS as easiest to use
- 49% rated the POSS and 51% rated the RASS as applicable to the majority of their patients
- 49% requested POSS be available for patients receiving opioids for pain management and RASS be available for goal-directed sedation
- Other options were split much lower
  - POSS only 19%; RASS only 23%
  - POSS in Med-Surg and RASS in ICU 8%

Results

- With brief clinical practice inservice, RNs were able to discern the difference between the intended use of both scales and selected both for practice based on desired patient outcome
- Study results and clinical nurse recommendations determined sedation scale selection
- RN feedback was used in a scientific method to identify how to construct the EMR
Significance

- Both the POSS and RASS were included in the EMR system
- POSS is used when the desired patient outcome is prevention of sedation
- RASS is used when the desired patient outcome is goal-directed sedation
- Both sedation scales were incorporated in the Scripps Healthcare Pain Policy
- All nurses in every patient care area perform sedation assessment as determined by desired patient outcome
Recommendations for Practice

- Perform routine sedation assessment for all patients receiving opioids for pain management to identify oversedation and prevent opioid-induced respiratory depression
- Select sedation assessment scales based on desired patient outcome
- Conduct psychometric testing of scales when modified for EMR systems
- Consult authors of scales when considering scale modification to ensure that content validity is maintained
- Involve clinical nurses in research and decisions which impact clinical practice
Expert Consensus Panel for Monitoring of Opioid-induced Sedation and Respiratory Depression:

Summary of Findings from a Practice Analysis on Sedation and Respiratory Monitoring Practices
Donna Jarzyna RN-C, MS, CNS-BC
University Medical Center
Tucson, Arizona

Background
- The ASPMN Expert Consensus Panel values the opinions and experience of its members in understanding the state of current practice
- An internet-based practice survey of ASPMN members and nurses who are part of the ASPMN listserv was conducted using Survey Monkey from January to February 2009
- Potential respondents received notification of the survey by e-mail and postings on the ASPMN web site and in the Pathways newsletter
- Respondents (N=147) provided a data source for evaluating sedation and respiratory depression monitoring practices

Specific Aims
- Examine current sedation and respiratory monitoring practices for non-critical care, adult, hospitalized patients
- Identify populations at high-risk for sedation and respiratory depression with pain therapies
- Investigate policies, procedures and guidelines, and accountability for quality improvement activities related to sedation and respiratory depression outcomes
Percentage of Respondents Indicating Sedation Scale(s) Used at Their Institutions (N=92)

- Percentage of respondents using the Aldrete Scale: 31.3%
- Percentage of respondents using the Pasero Opioid-induced Sedation Scale (POSS): 45.5%
- Percentage of respondents using the Ramsay Scale: 31.3%
- Percentage of respondents using the Modified Ramsay Scale: 31.1%
- Percentage of respondents using the Richmond Agitation–Sedation Scale (RASS): 29.3%
- Percentage of respondents using the Riker Scale: 19.3%

Percentage of Respondents Identifying High-risk Populations (N=104)

- Percentage of respondents identifying OSA: Obstructive sleep apnea (OSA) as a high-risk population: 55.6%
- Percentage of respondents defining respiratory depression as less than 8 respirations per minute: 61.5%
- Percentage of respondents defining respiratory depression as less than 10 respirations per minute: 45.6%
- Percentage of respondents identifying other high-risk populations such as pre-existing cardiopulmonary disease and documented OSA as high-risk populations: 79.2% and 63.5%, respectively

Practice Policies and Guidelines

- 45.6% of respondents (n=49) indicated high-risk populations are identified in practice policies for epidural and PCA therapy.
- 42.4% (n=53) define respiratory depression as less than 8 respirations per minute, and 31.2% (n=39) less than 10 respirations per minute.
- Examples were provided for guidelines or protocols to decrease the risk of respiratory depression.
Quality Improvement Activities: Accountability for Tracking Naloxone Use

Percentage of Respondents (N=64)

<table>
<thead>
<tr>
<th>Activity</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pharmacists as part of ADEs</td>
<td>64.1%</td>
</tr>
<tr>
<td>Nurses as part of QI activities</td>
<td>45.3%</td>
</tr>
<tr>
<td>Pain Service</td>
<td>35.9%</td>
</tr>
<tr>
<td>Rapid Response Team</td>
<td>31.3%</td>
</tr>
<tr>
<td>Other</td>
<td>23.4%</td>
</tr>
</tbody>
</table>

Summary

- Findings from this survey will be used to support guidelines and recommendations for practice
- Plans are underway to prepare a full report and publish results for the ASPMN membership
- The ASPMN Expert Consensus Panel for Monitoring of Opioid-induced Sedation and Respiratory Depression wishes to thank those who responded to this survey