Post-Operative Residual Paralysis Education Session for Post-Anesthesia Care Unit Nurses

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Background/Purpose

- **The post-anesthesia care unit (PACU) is a demanding, high-turnover unit that requires the delivery of different levels of patient care based on acuity**
  1. Patients with significant baseline co-morbidities and classification levels of ASA 3 or 4
  2. Patients recovering in the PACU have residual inhalational agents, opioids, and paralyzing agents
     - ❖ Alters respiratory, hemodynamic, and mental statuses
     - ❖ Most significantly, paralyzing agents can linger causing post-operative residual paralysis (PORP)
- **Surgical patients who require general anesthesia often need the administration of a non-depolarizing neuromuscular blocking agent (NMBA) in addition to any sedation medications**
  1. At induction to perform an intubation
  2. Intraoperatively to ensure the patient does not move or breath
  3. To provide ideal surgical conditions for the procedure by relaxing the muscles
- **Patients who receive a non-depolarizing NMBA, at any point during their surgery, require the administration of a reversal agent prior to extubation and recovery in the PACU**
  - ❖ Sugammadex -OR- Neostigmine + Glycopyrrolate
- **Ineffective reversal of paralysis can occur for multiple reasons such as insufficient reversal dosage administration, not allowing an adequate length of time for the reversal agent to exert its effect, or patient specific abnormalities. Ineffective reversal leads to PORP causing complications such as:**
  1. Short-term hypoxia requiring supplemental oxygen delivery
  2. Muscle weakness such as swallowing difficulty leading to aspiration
  3. Respiratory distress leading to emergent reintubation

(Belcher et al., 2017)

Problem Statement

Does an education session from an anesthesia team member on the occurrence of post-operative residual paralysis (PORP) **(I)** for post-anesthesia care unit (PACU) nurses **(P)** change PACU nurses' knowledge in identifying PORP in patients recovering in the PACU **(O)**?

Available Knowledge

PORP is officially defined as a Train-of-Four (TOF) ratio < 0.9 with incidence ranges estimated at 16.8% to 88% with as many as 112,000 patients annually in the United States at risk of adverse respiratory events associated with undetected neuromuscular blockade (Weigel et al., 2022; Saager et al., 2019; Naguib et al., 2018)

- 14%-30% of patients that develop respiratory complications such as atelectasis and aspiration pneumonitis will die within 30 days
- Morbidity also increases
  - Length of hospital stay increases by up to 17 days
  - Overall health care costs increase by greater than $25,000 per admission
- Additional costs to consider (Weigel & Thilen, 2021):
  - Prolonged PACU stay at approximately $15 per minute
  - ICU admission at $6,000 to $10,000 per day
  - Postoperative pulmonary complications at approximately $6,000 per occurrence
  - Prolonged hospital stay at approximately $2,500 per day

Stetler Model: Evidence-Based Practice Framework

(Stetler, 2001)

Phase 1
- **Preparation**
- Establishment of the problem, a desired outcome, and an initial team

Phase 2
- **Validation**
- Literature review conducted

Phase 3
- **Comparative Evaluation & Decision Making**
- Analysis and grading of the literature

Phase 4
- **Translation & Application**
- Development and implementation of the PORP Education Session for PACU Nurses

Phase 5
- **Evaluation**
- Analysis of the pre- and post-evaluation data and assessment of participant feedback

Methods

Intervention

- **Education session on PORP for University of Cincinnati Medical Center (UCMC) PACU Nurses**
  - Available as an in-person session or remotely via Microsoft Teams
  - PowerPoint presentation slides constructed from literature review
  - Handout of powerpoint slides distributed to all participants
  - Case scenario conducted at end of presentation with group participation
- **Pre- and Post-Session evaluations sent to all participants to complete via QR code**
  - Utilized Microsoft forms
  - Participants selected a 4-digit identifier to maintain anonymity

Measures

- **Pre-Education Session Evaluation**
  - Five demographic questions
  - Five knowledge-based questions
- **Post-Education Session Evaluation**
  - Five knowledge-based questions

Ethical Considerations

- **Submitted project to the University of Cincinnati College of Nursing IRB Review Board**
  - Determination concluded there was no intent to create generalizable knowledge and no identifiable data will be collected
  - Project is not research involving human subjects

Figures 1 & 2

Demographic and Knowledge-Based Questions for the Pre- and Post-Evaluations

4-Digit Identification #: _____

Demographic Questions

1. How long have you been practicing as a registered nurse?
a. Less than 1 year
b. 1 to 3 years
c. 4 to 6 years
d. 7 to 10 years
e. Greater than 10 years

2. How long have you been working as a registered nurse in the University of Cincinnati Medical Center post-anesthesia care unit?
a. Less than 1 year
b. 1 to 3 years
c. 4 to 6 years
d. 7 to 10 years
e. Greater than 10 years

3. Please select past and current units that you have worked on as a registered nurse (Select all that apply).
a. Medical-Surgical
b. Intermediate/Step-Down
c. Critical Care
d. Observation
e. Emergency
f. Pre-operative/Same-Day Surgery
g. Post-Anesthesia Recovery

4. Please select your staffing classification.
a. Permanent University of Cincinnati Medical Center Staff
b. Traveler/Short-term Contract Staff

5. How would you rate your current knowledge level on the topic of post-operative residual paralysis?
a. No knowledge
b. Limited/Minimal knowledge
c. Basic knowledge
d. Adequate knowledge
e. Superior knowledge

4-Digit Identification #: _____

PACU Post-Operative Residual Paralysis Education Session
Pre/Post-Education Session Evaluation Survey

1. What is NOT a sign or symptom of post-operative residual paralysis?
a – Shortness of breath
b – Increased oxygen requirements
c – Inability to lift head off the pillow
d – Nausea and vomiting
e – Aspiration and Coughing

2. True or False: If a patient has received a reversal agent in the operating room prior to extubation, they are not at risk for post-operative residual paralysis in the PACU?
a – True
b – False

3. What are two drugs that an anesthesia provider can administer to a patient to reverse medication-induced paralysis?
a – Neostigmine and Glycopyrrolate
b – Sugammadex and Glycopyrrolate
c – Neostigmine and Sugammadex
d – Neostigmine and Reglan
e – Sugammadex and Zofran

4. What are two neuromuscular blocking agents administered during induction or intra-operatively that can be reversed with sugammadex?
a – Rocuronium and Vecuronium
b – Succinylcholine and Ciastracurium
c – Succinylcholine and Rocuronium
d – Succinylcholine and Vecuronium
e – Pancuronium and Ciastracurium

5. What is a significant side effect of sugammadex?
a – Refractory tachycardia
b – Nausea and vomiting
c – Myalgias
d – Inactivation of oral contraceptives
e – Burning sensation in the IV

Outcomes

Limitations of the Education Session

- *Attendance*
  - Six UCMC PACU nurses attended
  - Higher than normal number of patients boarded in the PACU requiring bedside care thus limiting the number of nurses that could attend the education session
- *Completion of Pre- and Post-Education Surveys*
  - Six PACU nurses completed the pre-survey
  - Three PACU nurses completed the post-survey
- *Location*
  - Staff meeting held in an unoccupied section of the PACU without access to projector and screen
    - Navigated several unanticipated interruptions

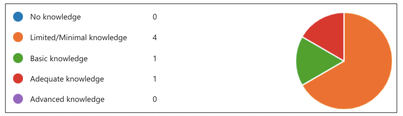
Anecdotal Evidence

- UCMC CRNA reported that a PACU nurse asked what paralyzing medication and reversal agent was used during the patient's case during a hand-off report citing information from the PORP education session

Note. From *Post-operative residual paralysis education session pre-education session evaluation survey* [Photograph], by Alderman, 2023a, (https://forms.office.com/Pages/ResponsePage.aspx?id=bC4i9c2f60PA3PbGCA7YzESlwPWKf5JugVlmBEPhzVUR ERHS1VGV1pSWFBOV1NTTkEzV1RWWk1HWi4u)

Figure 3

Knowledge Level of PORP Prior to Education Session



Note. From *Post-operative residual paralysis education session pre-education session evaluation survey* [Photograph], by Alderman, 2023a, (https://forms.office.com/Pages/ResponsePage.aspx?id=bC4i9c2f60PA3PbGCA7YzESlwPWKf5JugVlmBEPhzVUR ERHS1VGV1pSWFBOV1NTTkEzV1RWWk1HWi4u)

- **Pre-Education Session Evaluation Mean**
  - 79.99%
- **Post-Education Session Evaluation Mean**
  - 93.33%

Discussion

Barriers to Preventing Post-Operative Residual Paralysis at UCMC

1. Quantitative peripheral nerve stimulators, which are the gold standard for objectively monitoring TOF levels, are not available
   - ❖ Qualitative peripheral nerve stimulators are available, however the results of the TOF level are subjectively interpreted by the anesthesia provider, leaving opportunity for error
2. UCMC Surgical Pharmacy Team limits the use of sugammadex, which is the gold standard for reversing neuromuscular blockade, to three reasons with a goal of overall cost reduction:
   i. Ineffective reversal by neostigmine and glycopyrrolate
   ii. Short-length case requiring the use of non-depolarizing NMBAs
   iii. High risk of neuromuscular blockade
   - ❖ **Neostigmine + Glycopyrrolate = $6.49 *-OR-* Sugammadex = $107**
3. Lack of Training for UCMC PACU Nurses on the topic of PORP leading to limited knowledge on:
   a. What PORP is and what can cause it
   b. Signs and Symptoms
   c. How to effectively and quickly intervene when PORP is suspected

Next Steps

1. Increase educational opportunities for UCMC PACU nurses on the topic of PORP
   a. Construct voiceover powerpoint from the presentation given in-person
      i. Include five knowledge-based questions from the pre- and post-session evaluation survey for individuals to test their learning and understanding
   b. Upload to UCMCs ONETouch LMS site
   c. Current employees not able to attend the education session and future hires can review at any point
2. Improve anesthesia hand-off reports in the PACU to include what NMBA and reversal agent the patient received during their general anesthetic

Conclusions

1. Provide continuing educational opportunities for PACU nurses from the anesthesia team on best practices for monitoring PORP and how to effectively intervene when PORP is suspected
2. Improve communicative collaboration between PACU nurse and anesthesia provider during hand-off
   a. Discuss if the general anesthetic required a paralytic
   b. If a non-depolarizing NMBA was administered, provide details on what reversal agent was also administered
   c. Provide details on any concerns after extubation, such as weakness or increased oxygen requirements
3. Advocate for quantitative TOF equipment in the OR and uninhibited access to sugammadex

References

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Additional references can be found by scanning the QR code