The Anesthetic Considerations for Skeletal Muscle Channelopathies
An Educational Initiative

Garrett Boone, BSN, RN; Lindsay Smart, BSN, RN
Beth Ann Clayton DNP, CRNA, FAAN, FAANA; William Harr, DNP, CRNA; Thomas L. Minges, DNP, CRNA
University of Cincinnati Nurse Anesthesia DNP Program

University of CINCINNATI

INTRODUCTION

Background

- Skeletal Muscle Channelopathies, formerly known as Familial Periodic Paralysis, are rare genetic defects of electrolyte channels within muscle cells that cause weakness, paralysis or rigidity (Statland et al., 2017)
    - Further research has led to the title “Familial Periodic Paralysis” expanding to “Skeletal Muscle Channelopathies” to accommodate additional subtypes of the condition (Harr, 2022)
- Incidence is 1:100,000 for Hypokalemic Periodic Paralysis (PP), 1: 2,000,000 for Andersen-Tawil, 1:200,000 for Hyperkalemic PP, and < 1: 100,000 for Paramyotonia and Myotonia Congenita (Harr, 2023)
- Neuromuscular junction and neurotransmitters are unaffected
- Triggers can include exercise, rest after exercise, stress, diet changes, electrolyte imbalances, and hypothermia
- Muscle weakness or rigidity has a gradual onset with spontaneous recovery
- Severe symptoms can involve respiratory muscles and impact ventilation (Raja, 2020)
- Direct correlation between Skeletal Muscle Channelopathies and anesthesia leading to exacerbations of the condition

Problem

- There are literature, education and experience gaps regarding anesthetic considerations and guidelines for patients with Skeletal Muscle Channelopathies

Purpose

- Deliver provider education surrounding anesthesia guidelines that have been approved for patients with hypokalemic periodic paralysis
- Increase anesthesia provider knowledge and confidence regarding anesthesia considerations for Skeletal Muscle Channelopathies
- Supply an evidence-based practice resource for anesthesia providers when encountering patients with Skeletal Muscle Channelopathies

PICO

"In nurse anesthetists and nurse anesthesia students, does a focused education session on practice guidelines for Skeletal Muscle Channelopathies affect knowledge and confidence on the topic?"

APPLICATION OF THE ACE STAR MODEL OF KNOWLEDGE TRANSFORMATION

- The ACE Star Model of Knowledge Transformation was developed to understand the cycle of knowledge growth and transformation. The model is commonly utilized with Evidence Based Practice development (Stevens, 2015)

Discovery/Research	Extensive review of literature. Strategic analysis of needs.
Summarizing the Evidence	Compile pertinent research to utilize in educational session.
Translation into Guidelines	Utilize approved anesthetic guidelines for Hypokalemic Periodic Paralysis. Utilize literature to develop anesthetic considerations for Familial Periodic Paralysis subtypes.
Practice Integration	Make educational materials accessible via anesthesia department website.
Process, Evaluation of Outcomes	Assess knowledge impact of anesthesia providers via a Pre-test and Post-test.

METHODS

Background and Review of Literature

- 9 literature/research materials were selected and categorized by the Johns Hopkins Evidence-Based Practice Model. According to the Model, 11% were Level II, 33% were Level III, 33% were Level IV, and 22% were Level V.

Methods

- Educational materials were developed utilizing literature on Skeletal Muscle Channelopathies from PubMed and CINAHL.

Intervention

- Education session presented to Certified Registered Nurse Anesthetists (CRNAs) and Student Registered Nurse Anesthetists (SRNAs) at the University of Cincinnati
    - Certified Registered Nurse Anesthetists (CRNAs): 18 Subjects
    - CRNA Students (SRNAs): 17 Subjects

Safe

- Versed
- Propofol
- Sevoflurane
- Isoflurane
- Rocuronium
- Sugammadex
- Ropivacaine
- NSAIDs
- Opioids
- Scopolamine

Avoid

Hypokalemic Periodic Paralysis:
- Hypokalemia
- Epinephrine
- Steroids/Dextrose

Hyperkalemic Periodic Paralysis:
- Hyperkalemia
- Acidosis
- Succinylcholine
- Anticholinesterases

Andersen-Tawil syndrome:
- Desflurane
- Ketamine
- Bupivacaine
- Zofran/Reglan/Promethazine

Myotonia Congenita:
- Hypothermia

Paramyotonia Congenita:
- Hypothermia
- IV potassium

Anesthesia Guidelines:

Adult

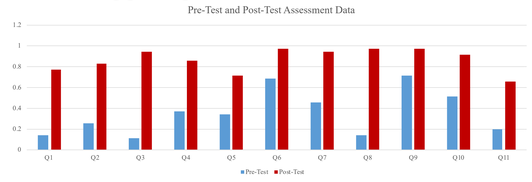
Pediatric

Evaluation

- Pre-test and post-test assessments provided to evaluate effectiveness of educational session (created through Microsoft Forms)
    - 15 multiple choice questions: 4 demographic and 11 content-based
    - Statistical analysis using Paired T-Test

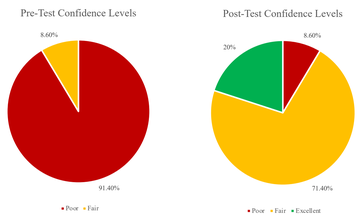
RESULTS

- **Knowledge Deficit Identified:** Improvement in Post-Test scores compared to Pre-Test scores following participation in the educational session



- **Average score of Pre-Test**
(only content-based questions graded):
    - CRNA mean score: 39.8%
    - SRNA mean score: 31.9%

- **Average score of Post-Test**
(only content-based questions graded):
    - CRNA mean score: 89%
    - SRNA mean score: 84.6%



- **Statistical Significance of Paired T-Test**
    - Average P-Value: 0.0005
    - Confidence Interval: 95%

DISCUSSION

Pre-Test and Post-Test: A total of 35 participants responded to the Pre-Test. (18 CRNAs and 17 SRNAs)

- **Data prior to the Education Session**
    - 91.4% of total participants stated a "Poor" rating on a self-reported confidence scale regarding knowledge on anesthetic considerations for patients with Skeletal Muscle Channelopathies.
    - 8.6% of total participants stated a "Fair" rating on a self-reported confidence scale regarding knowledge on anesthetic considerations for patients with Skeletal Muscle Channelopathies.
    - 2.9% of total participants have taken care of a patient with a Skeletal Muscle Channelopathy
- **Data following the Education Session**
    - 20% of total participants stated an "Excellent" rating on a self-reported confidence scale regarding knowledge on anesthetic considerations for patients with Skeletal Muscle Channelopathies.
    - 71.4% of total participants stated a "Fair" rating on a self-reported confidence scale regarding knowledge on anesthetic considerations for patients with Skeletal Muscle Channelopathies.
    - 8.6% total participants stated a "Poor" rating on a self-reported confidence scale regarding knowledge on anesthetic considerations for patients with Skeletal Muscle Channelopathies.
- **Limitations:**
    - Small sample size(n=35)
    - One site implementation

CONCLUSION

- Skeletal Muscle Channelopathies are a rare group of muscle cell electrolyte channel defects which can be directly triggered by aspects of anesthesia and cause weakness, paralysis or rigidity which can lead to chronic weakness and pain.
- Anesthesia providers should be knowledgeable about the anesthetic considerations for patients with Skeletal Muscle Channelopathies to maintain patient safety.
- There is a knowledge and confidence gap in anesthetic providers regarding the care of patients with Skeletal Muscle Channelopathies.
- An educational session focusing on the anesthetic guidelines for Skeletal Muscle Channelopathies increased both CRNA and SRNA self-reported confidence levels as well as content-based test scores.
- Future goals for implementation of the anesthetic considerations include:
    - Making the educational session and anesthetic guidelines available to providers for reference
    - Including the educational session into didactic lectures for SRNAs at the University of Cincinnati

REFERENCES

References