NK8EOa – INNOVATION

ADOPTION OF PUPILLOMETER TECHNOLOGY TO DETECT STROKE IN ECMO PATIENTS

Using the required empirical outcomes presentation format, provide one example of an improved outcome in a care setting associated with a clinical nurse(s) involvement in the adoption of technology.

Problem

COVID-19 patients in the MICU (4HN-605420) [MICU] at NewYork-Presbyterian/Columbia University Irving Medical Center (NYP/Columbia) required deep sedation levels and often neuromuscular blockers to tolerate mechanical ventilators and extracorporeal membrane oxygenation (ECMO) circuit for pulmonary support. ECMO puts patients at risk for thromboembolic events, including strokes. Deep sedation among COVID-19 patients on ECMO limited the nurses' ability to assess a patients' neurologic status leading to a delay in stroke detection. MICU nurses noted that strokes were detected after patients were weaned off sedation, resulting in delayed treatment, increased comorbidities, and prolonged the length of stay. These cases presented an opportunity for early stroke detection and improved patient outcomes, reducing the patient's average length of stay (ALOS).

Pre-Intervention

July 2020:

- The July 2020 ALOS in the MICU was 21.9 days.

- During a unit huddle, multiple MICU clinical nurses expressed concerns of the delayed stroke diagnosis in COVID-19 patients on ECMO to Oluneye Oladapo, BSN, RN, Clinical Nurse Manager (clinical nurse, at the time), MICU and Neuro ICU (8GS-605476). Mr. Oladapo suggested looking into implementing pupillometers, a technology routinely used in the Neuro ICU, to the MICU. Previously, nurses in the

MICU conducted manual pupil assessments using a penlight or flashlight. This practice was prone to inter-examiner variability.

- Mr. Oladapo conducted a literature review on the use of a pupillometer to detect stroke in deeply sedated patients on ECMO. He identified studies that supported the use of a pupillometer, a handheld automated medical technology intended to measure the size of the pupil of the eye by reflected light, as an evidence-based nursing intervention to detect potential stroke. Pupillary data obtained by pupillometer technology was found to correlate with horizontal intracranial midline shift in patients with ischemic and hemorrhagic strokes.

Goal

To decrease the average length of stay (ALOS) in days in the MICU

Participants

Name/Credentials	Discipline	Title	Department/Unit
Naomi Meulemans, MS, RN, CCRN	Nursing	Clinical Nurse	MICU
Guillermo Fabro, BSN, RN, CCRN	Nursing	Clinical Nurse	MICU
Maria Aguil Chumacera, MSN, RN, CCRN	Nursing	Clinical Nurse	MICU
Sara Schoon, BSN, RN	Nursing	Clinical Nurse	MICU
Winsome West, MSN, MBA, RN, CSRN	Nursing	Patient Care Director (Nurse Manager)	MICU
Oluneye Oladapo, BSN, RN	Nursing	Clinical Nurse Manager (clinical nurse, at the time)	MICU
Cris Perdomo, MSN-Ed, RN	Nursing	Program Administrator, Stroke Center	Administrative Neurology
Emily Jackson, MBOE, BSN, RN, NEA-BC	Nursing	Director of Nursing (at the time)	Medicine and Neurology Services
Cara Agerstrand, MD	Medicine	Director	Medical ECMO Program
Daniel Brodie, MD	Medicine	Attending Physician	Division of Pulmonary, Allergy, and Critical Care Medicine

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Natalie Yip, MD	Medicine	Attending Physician	Division of Pulmonary, Allergy, and Critical Care Medicine
Joshua Willey, MD	Medicine	Stroke Medical Director	Division of Neurology
Susan Tanzi Pfeifer, MBA	Cardiology	Administrator	Adult ECMO Program
Sitara Patel, MPH	Cardiology	ECMO Program Coordinator (at the time)	Medical ECMO Program

Intervention

August 2020:

- Sitara Patel, MPH, ECMO Program Coordinator (at the time), collaborated with Mr. Oladapo; Sara Schoon, BSN, RN, clinical nurse, MICU; Guillermo Fabro, BSN, RN, CCRN, clinical nurse, MICU; Winsome West, MSN, MBA, RN, CSRN, Patient Care Director (at the time), MICU; Susan Tanzi Pfeifer, MBA, Adult ECMO Program Administrator; Daniel Brodie, MD, and Natalie Yip, MD, attending physicians, Division of Pulmonary, Allergy, and Critical Care Medicine; Joshua Willey, MD, Stroke Medical Director, Division of Neurology, NYP/Columbia; and Cris Perdomo, MSN-Ed, RN, Stroke Center Program Administrator, to develop neuro-monitoring guidelines specifically for the MICU. The Guideline for Neurologic Monitoring of ECMO Patients in the MICU consisted of the following:

  The purpose of the guideline was to standardize neurologic monitoring of patients supported with ECMO.

  Applicability: Patients receiving ECMO in the Medical ICU

  I. Establish baseline at the time of cannulation:
      - Obtain and document neurologic exam, including:
        o Routine neurologic exam (all patients)
        o Pupillary reaction (pupillometer [preferred, must be ordered] or flashlight)
        o Corneal reflex
        o Response to pain in all extremities

  II. Escalation procedure: Any neurological changes should be escalated by RN to the ICU MD/NP who should immediately evaluate the patient, including:

- Any new asymmetry in the neurological examination
- Unexpected change in level of consciousness
- 10 percent change in the pupil size or NPI < 3 per policy

Impact Statement: Having neuro-monitoring guidelines for use of technology aids nurses in accurately integrating technology into their practice as an assessment tool to determine neurological status in patients thereby detecting strokes earlier and implementing urgent treatment, decreasing the patient's average length of stay through early detection.

September 2020:

- Borrowing the pupillometers from the Neuro ICU, Mr. Oladapo coordinated pupillometer education for MICU clinical nurses with the pupillometer vendor, NeurOptics®. NeurOptics conducted onsite training as well as provided the team with educational resources, including product information, instructional videos, webinar recordings, and clinical publications. By September 24, 2020, 80 percent of MICU nurses completed the education.

  Impact Statement: Validating RN competency in the use of a pupillometer resulted in improved confidence, knowledge, and skills to facilitate early detection and treatment of strokes, therefore reducing the ALOS in the MICU.

- Ms. West collaborated with the ECMO and Neurology providers on a process for neurological exam monitoring and an escalation procedure. If the nurses noted an abnormal finding from their pupillometers assessment, the nurses escalated to the providers in the MICU. The nurses and providers were responsible for calling a stroke code based on their assessment. The stroke team responded and determined a treatment plan, which included a stat CT head scan.

  Impact Statement: This cascade of interventions would ensure timely treatment of stroke, reducing MICU ALOS.

October 2020 - December 2020:

- Ms. West purchased two NPi- 300 pupillometers for the MICU after submitting a capital request detailing the necessity of the device. An NPi-300 pupillometer is a state-of-the-art pupillometer providing objective pupillary size measurement and reactivity. The request was reviewed and approved by Emily Jackson, MBOE, BSN, RN, NEA-BC, Director of Nursing for Medicine and Neurology Services (at the time).

Impact Statement: Securing an adequate number of pupillometers for use would make certain that clinical nurses have technology resources to rapidly detect strokes and urgently escalate for treatment, thereby reducing MICU ALOS.

January 2021 - February 2021:

- Naomi Meulemans, MS, RN, CCRN, and Maria Aguil Chumacera, MSN, RN, CCRN, clinical nurses, MICU, and Mr. Fabro attended the Critical Care Practice Council meetings (NYP enterprise-wide) to recommend changes to the NYP Policy PROC 855 Pupillometers that would include pupillometer use in the MICU. At that time, pupillometers were only used in the Neuro ICU.

  Impact Statement: Providing authorization for pupillometer use in the MICU to the policy supports nursing adopting the technology, which aids in early stroke detection and decreased ALOS.

March 2021:

- The neuro-monitoring guide for nurses, which included the use of a pupillometer, was finalized and approved for use in the MICU. The guideline was established with input from the MICU Unit Council, Ms. West, Dr. Wiley, Dr. Brodie, Ms. Perdomo, Ms. Tanzi Pfeifer, and Ms. Patel.

- The Nursing Practice Council (NYP enterprise-wide) approved the revisions for NYP Policy PROC 855 Pupillometers to include the MICU and all critical care areas.

- The clinical nurses in the MICU adopted the pupillometers technology on March 31, 2021.

  Impact Statement: Nurses and interprofessionals follow policies and procedures to guide standards of care and evidence-based practices. Gaining approval and accessing written information supported the MICU clinical nurses to fully adopt pupillometer technology for improving patient outcomes and decreasing the ALOS in the MICU.

o **Key references**

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Osman, M., Stutzman, S. E., Atem, F., Olson, D., Hicks, A. D., Ortega-Perez, S., Aoun, S. G., Salem, A., & Aiyagari, V. (2019). Correlation of Objective Pupillometry to Midline Shift in Acute Stroke Patients. *Journal of stroke and cerebrovascular diseases : the official journal of National Stroke Association*, *28*(7), 1902-1910. https://doi.org/10.1016/j.jstrokecerebrovasdis.2019.03.055

Outcome

NK8EOa MICU ALOS in Days

	Jul 2020	Aug 2020-Mar 2021	Apr 2021	May 2021	Jun 2021
MICU ALOS in days	21.9		18.7	19.0	11.5