ECMO: The Role of the Bedside Nurse
Their Importance and their Education

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Objectives

• Increase nursing knowledge on how to provide safe and effective care for patients who require ECMO
• Enhance nursing skills to provide and maintain:
  – A high standard of care when caring for life threatening patient on ECMO
  – An organized approach in completing tasks in ECMO emergencies
• Identify and describe the importance of a comprehensive physical assessment for patient on ECMO
  – Increase and optimize early detection and intervention
  – Prevention or minimization of complications
• Improve caregiver/family support and education
ECMO: THE TEAM
ECMO: The Team

Requires **EXCELLENT**:

Communication
Coordination
Collaboration
Teamwork
ECMO: THE DETAILS
ECMO: Like No Other ICU Patient
Types of ECMO

**VV ECMO = Veno-Veno**
- For lung support

**VA ECMO = Veno-Arterial**
- For heart AND lung support
Types of ECMO

VA cannulation

VV cannulation

ECMO circuitry

Pump

O₂

Oxygenator

Heater-cooler
Purpose of ECMO

- Improvement of oxygenation
- Improvement of tissue perfusion
- Removal of carbon dioxide
- Restart aerobic metabolism
ECMO: Complex Nursing Care

• The Bedside Nurse
  – Is *CRITICAL THINKING* alone enough to care for these patients?

• The ECMO Specialist Nurse
  – Select group of highly-skilled and high-functioning ICU nurses
  – Receive extensive specialized training in the care of patients receiving ECMO
  – Increased and earlier recognition of changing patient assessment, as well as interpretation of these changes
  – Advanced understanding of the complexities of interventions and treatments required, including emergency situations
  – Receiving continuous evidence-based education and simulation labs
ECMO: Goals of Nursing Care

• **GOAL: Optimize patient outcomes**
• Achievement of goal is dependent on:
  – Assessment, planning, intervention, and evaluation
  – Stable oxygenation, hemodynamic function, and anticoagulation
  – Correct actions during an emergent situation
  – Prevent and/or minimizing number or severity of complications
  – Comfort and support during the healing process
    • For the patient
    • For the family and caregivers
ECMO: Goals of Nursing Care

- Assessment and Interventions: **Neurological**
  - Neurological injury is **COMMON** in ECMO patients
  - Risk of cerebral vascular injury from stroke (ischemic or hemorrhagic)
  - Pupillary reaction
  - Painful stimuli and response !!
  - Sedation Assessment:
    - SAS: Sedation-Agitation Scale
    - Bis: Bispectral Index
    - TOF: Train of Four
    - GCS not helpful as these patients are all sedated and non-responsive
  - NIRS: Near infrared spectroscopy
  - Imaging: Daily ultrasound
  - Seizure Monitoring
    - Continuous EEG monitoring
ECMO: Goals of Nursing Care

• Assessment and Interventions: Respiratory
  – Impaired gas exchange
    • Oxygen
    • Carbon dioxide
  – Auscultation: Ventilator on low setting
  – Monitoring:
    • ABGs: Patient and post-oxygenator
    • VBGs: Patient and post-oxygenator
    • SpO₂
    • SaO₂
    • SvO₂
    • EtCO₂
  – Lung recruitment, chest physio, suctioning
  – Imaging: Daily CXR
ECMO: Goals of Nursing Care

• Assessment and Interventions: **Hemodynamic**
  – VV ECMO = Does NOT affect hemodynamics
  – VA ECMO = Effect dependent on percentage of ECMO support
    • ECMO CO > 60% + Native circulation < 40%
    • Discernable pulse contour
  – Tissue Perfusion
    • Cardiac Function: ECG, HR, ABP, MAP, CVP, Arterial waves, CO, CI
    • Temperature: The lower the temperature, the higher SvO\(_2\), and the lower the oxygen consumption
    • Respiratory Function: SaO\(_2\), SvO\(_2\)
    • NIRS
    • Imaging: Echocardiogram
  – Observe for HYPOvolemia
    – CVP Monitoring: Low preload
    – Assess ECMO drainage line: Swinging or shaking
ECMO: Goals of Nursing Care

• Assessment and Interventions: Renal/Urinary
  – Decreased perfusion to the kidneys = Increased risk for acute renal failure
  – Assure and maintain patency of urinary catheter
  – Monitor HOURLY urine output and characteristics
  – Monitor HOURLY overall fluid balance
  – Diuretic(s) for any observable signs of edema or fluid retention/overload
  – Monitor labs and physical assessment for electrolytes imbalance
  – Peritoneal Dialysis or CRRT
ECMO: Goals of Nursing Care

- **Assessment and Interventions: Gastrointestinal**
  - If NPO with NGT, monitor NGT drainage color
  - Monitor bowel sounds and movement, assess stool color
  - Administer H2 blockers or PPI
  - Consult Dietician:
    - Monitor calorie count
    - Provide nutrition as soon as possible
      - NGT feeds
      - TPN
    - Monitor blood glucose: Insulin protocol
    - Weight daily if possible
ECMO: Goals of Nursing Care

- **Assessment and Interventions:**
  - Dermatological
    - Assess skin for redness, blisters, or breakdown
    - Keep skin clean and dry
    - Change body position **AT LEAST** every two hours
    - Use of pressure relief devices and/or mattress
    - Keep sheets dry and wrinkle-free
    - Float heels and elbows
    - Careful PRONE position = Stabilized line and cannula, check ECMO flow
COMPLICATIONS OF ECMO
ECMO: Complications

- Ischemia and Thrombosis
- Bleeding
- Air Embolism
- Infection
- Emergencies
ECMO: Complications

- Ischemia and Thrombosis
  - Low perfusion
  - Check pulses and capillary refill
  - Monitor oxygen saturation on the affected limb
  - ACT and coagulation profile
  - Doppler study
ECMO: Complications

• Bleeding
  – Be aware of current ACT and coagulation profile
  – Be aware about heparin level adjustment by ECMO specialist
  – NEVER do IM, SQ, or ID injection
  – Remove faulty IV access or mark ”DO NOT USE”
  – Only withdraw blood only from lines
  – Avoid new lines insertion
  – Prevent pressure ulcers
ECMO: Complications

• Bleeding
  – Mucosal bleeding = Difficult to compress
    • Nasopharyngeal: Suction
    • Oropharyngeal: Suction
    • Tracheobronchial: Suction
    • Rectal: Rectal thermometer
    • Urinary: Urinary catheter
    • Conjunctival: Cleaning
  – NO SUCTIONING = Try to use soft gauze, sponge or syringe
    • No suction if ACT or aPTT high
    • If suction is REQUIRED
      – Low suction level
      – Do not suction routinely
      – No deep suctioning, only shallow
      – If blood appears, stop IMMEDIATELY
ECMO: Complications

• Air Embolism
  - Prevention is EVERYONE’S responsibility
  - Avoid entry from any connections and infusions
    • ECMO circuit
    • IV tubing and infusion pumps
ECMO: Complications

- Infection
  - BSI
  - VAP
  - CAUTI
  - SSI
ECMO: Complications

• Infection
  – Antibiotic administration during cannulation and decannulation
  – Pan-cultures twice/week
  – Standard precautions and frequent handwashing
  – Maintain sterility for all procedures
ECMO: Complications

- **Emergencies:** *How to Improve Emergency Response*
  - Coordinate emergency roles at start of each shift
  - Bedside nurse: Monitor and maintain patient
  - ECMO specialist nurse: Monitor and maintain ECMO circuit
  - Frequent training and practice: Mock codes and scenarios
  - Availability of the team
- **Emergency Equipment:**
  - Another console
  - Manual pump
  - Clamps at the bedside
  - Emergency medications
  - Ambu bag
  - Return ventilator to normal setting
ECMO: Complications

- **Emergencies: Line Cracking**
  - Crack and Bleeding from the **RETURN** line
    - Put on STERILE gloves and cover/hold the crack to block it
  - Crack and Bleeding from the **DRAINAGE** line
    - Clamp the return line
    - De-air

- **PREVENTION:**
  - Check line position in hourly checks
  - Check length and sutures
  - Loosen but secure dressing
  - Support weight of all of the lines, ensure that they free of tension
ECMO: Complications

- Emergencies: **Air Bubbles**
  - Clamp the return line
  - Placement in Trendelenburg and initiation of CPR
  - Remove air from the nearest port
  - Consider replacement of the circuit
ECMO: Complications

- Emergencies: **Accidental Decannulation**
  - Partial Decannulation
    - Hemodynamics will be low or maintained
    - Secure and wait for review
  - Complete Decannulation
    - Hemodynamics will fail/collapse
    - Clamp the circuit and control bleeding
    - Initiate CPR

- PREVENTION:
  - Ensure lines are free of tension and off from the floor

- GOAL: Recannulation
CONSIDERATION OF THE FAMILY AND CAREGIVERS OF THE PATIENT REQUIRING ECMO
Family and Caregivers

Anxiety

- scared
- chest pain
- panic attacks
- trembling
- tension
- angst
- jumpy
- stress
- fear
- sweating
- feelings
- worry
- emotional
- disorder
- symptoms
- restless

ECMO & Nursing
Family and Caregivers

- Do not let care of the patient busyness outweigh the importance of family and caregiver support, GET HELP
- Provide comfortable environment
- Begin teaching ONLY when there is an indication of readiness to learn
- Explain ALL procedures in simple, concise, and reassuring manner. Repeat as many times as necessary.
- Provide constant updates, especially with any new changes
- Maximize opportunities for them to be with patient
- Maximize opportunities for parents to make choices for their child
- Provide opportunities for them to help in care of the patient
References

- Nitasha joyner. (2014), ECMO: the Ultimate support for the Cardiopulmonary system, AACN, webinar.
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