Advanced Care

April 16, 2020 1419
Spectrum Health contact: Megan Roth
Advanced Care

The module will provide the following education:

Critical Care Medications and Assessment
- Vasopressors
- Paralytics
- Peripheral Nerve Stimulator (Train of Four)
- BIS Monitor

Management of the Prone Patient

Invasive Monitoring
Critical Care Medications and Assessment

Outline of Topics
- Vasopressors
- Paralytics
- Peripheral Nerve Stimulator
- BIS Monitor
Vasopressors

Global Considerations:

- Must monitor BP closely – typically with arterial line
- What you wean up, you wean down. We very rarely “stop” a vasoactive infusion.
- All dose adjustments should be done in partnership with critical care RN
- Be very aware of remaining infusion volume and proactively order additional infusions. A brief pause in the infusion could result in a sudden drop in blood pressure!
Vasopressors

Warning:

- There is a risk of tissue necrosis if the medication extravasates and infuses subQ
- If infusing at a low dose, a peripheral IV may be utilized, however a central line is GREATLY preferred – especially if dose increases
- Hourly site assessments must be performed if infusing through a peripheral IV
Vasopressors

Norepinephrine (Levophed)

Action: alpha stimulation - arterial vasoconstriction

Typical dosing:
- Start at 0.1 mcg/kg/minute
- Titrate every 2-5 minutes by 0.02 mcg/kg/min to response, typically MAP >65 mmHg.
- “Max” dose 3 mcg/kg/minute – this is a general guideline, however at times infusion rate may be higher
Vasopressors

Vasopressin

Action: direct action on arterial vessels to cause vasoconstriction

Typical dosing: depends on indication / order. Dosed either in units/min or units/hr.

Considerations: Typically not titrated, usually administered at a standard dose.

Often ordered as a supplemental treatment option when patient is requiring high doses of vasopressors.
Vasopressors

For more information, please view the video below:

Vasopressor Video
Paralytics / Neuromuscular Blocking Agents

Neuromuscular Blocking (NMB) medications may be used in patients with severe acute respiratory failure.

Common NMBs used for medical paralysis: Vecuronium (Norcuron), Cisatracurium (Nimbex), Rocuronium (Zemuron) or Atracurium (Tracrium)

Effects: Paralyze all skeletal muscles preventing skeletal muscle contraction. Smooth muscles and cardiac muscles are not affected by NMBs.
Paralytics / Neuromuscular Blocking Agents

Purpose: Prevent patient from initiating ventilations for the purpose of:

- Preventing the dyssynchrony of patient breaths with ventilator breaths (coughing, trying to exhale when vent delivering a breath)
- Improving ventilation: no muscle resistance to the ventilator
- Improving oxygenation: by reducing the work of breathing and because the patient is unable to move any skeletal muscles, there is less oxygen demand by the muscles and more oxygen available for other essential tissues.
Paralytics / Neuromuscular Blocking Agents

Considerations:

Patients are unable to breathe if the ventilator becomes disconnected. RNs and RTs must listen for ventilator alarms and respond immediately.

Patients MUST have adequate sedation and analgesia when receiving NMBs, they are unable to indicate if they are experiencing pain or anxiety, assume they are and proactively manage patient discomfort.

Patients are unable to respond to any stimulation, they are unable to open eyes, to respond to questions, to swallow or to move.
Paralytics / Neuromuscular Blocking Agents

Considerations – Nursing Care:

The only neuro assessment that can be done while medically paralyzed is pupil response to light. This is usually assessed every 2 hours. If a full neuro assessment is required, the NMB will have to be stopped.

Patients are unable to blink and are at risk for corneal abrasions, eye lubricant should be ordered. Eyes may need to be taped shut to fully cover the sclera.

Patients are at high risk for pressure injury, reposition every 2 hours and assess skin closely.

Support joints when repositioning patients to prevent dislocation

Assign a staff member to observe the ETT and ventilator tubing to prevent dislodgement or disconnection.
Paralytics / Neuromuscular Blocking Agents

Considerations – Nursing Care:

Use heel boots to prevent foot drop and pressure injury.

Patients should be suctioned every 2-4 hours, but they will be unable to cough and secretions are often minimal.

Patients should have thromboprophylaxis as they are at high risk for VTE.

Head of bed should be elevated to 30° unless contraindicated for specific patient.

Assure orders for bowel medications are present. The goal is to have at least one bowel movement every 3 days.

Tube feeding will generally be started / continued, post pyloric feeding is preferred.
Paralytics / Neuromuscular Blocking Agents

How do you assess the level of paralysis and level of sedation?

- Peripheral Nerve Stimulator
- BIS Monitor (Bispectral Index) if available at your site

Patient MUST be completely sedated, no paralytic without sedation. If weaning paralytic and sedation, wean paralytic first.

Remember: patient is unable to move any skeletal muscles and therefore unable to breathe without the ventilator.

If the ventilator alarms, assess patient.
Paralytics / Neuromuscular Blocking Agents

Policy References:

- Neuromuscular Blocking Agents Drug Quick Reference (Ref: 22538)
- Neuromuscular Blockade Therapy Nomogram: Cisatracurium (Ref 21250)
- Neuromuscular Blockade Therapy Nomogram: Vecuronium (Ref 21251)
Peripheral Nerve Stimulator

A peripheral nerve stimulator (sometimes called a Train of Four) is utilized when a patient is receiving paralytic (neuromuscular blocking) medications.

It allows for an objective method to determine how many neuromuscular junctions are blocked by the paralytic medication.

It is performed by applying an electrical stimulus to a nerve; you then observe for a specific skeletal muscle contraction.

Common PNS locations:

- **Ulnar Nerve**
  - Twitch of the thumb

- **Facial Nerve**
  - Twitch (wink) of the Cheek
Peripheral Nerve Stimulator

Apply ECG electrodes to the desired site.

Apply lead wires the positive wire is usually proximal.

Administer TOF at the patient’s usual stimulation level (ideally established before the initiation of NMB)

The usual stimulation threshold for the patient is established by starting at a low level and working up to a higher level until the desired response is obtained. However, multiple attempts in short periods of time can deplete acetylcholine and affect the result.

Evaluate the response with tactile and/or visual observation.

- 2/4 and 3/4 indicates 70% - 90% of receptors are blocked.
- 1/4 indicates 90% of receptors are blocked.
- 0/4 indicates >90% or receptors are blocked.
Peripheral Nerve Stimulator

The goal is to administer the smallest dose of paralytic possible while still achieving oxygenation and ventilation outcomes.

Reasons why test results are 0 twitches for 4 stimulations:
- Patient has received too much paralytic.
- Issues with user technique.
- Patient factors

<table>
<thead>
<tr>
<th>Inaccurate Responses User Technique</th>
<th>Inaccurate Responses Patient Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Misplaced electrodes</td>
<td>Edema</td>
</tr>
<tr>
<td>Inadequate skin preparation</td>
<td>Obesity</td>
</tr>
<tr>
<td>Dried out electrodes</td>
<td>Skin thickness/scarring</td>
</tr>
<tr>
<td>Dead/weak battery</td>
<td>Neuromuscular disease</td>
</tr>
<tr>
<td>Broken lead wires</td>
<td>Hypothyroid</td>
</tr>
<tr>
<td></td>
<td>Hypothermia</td>
</tr>
<tr>
<td></td>
<td>Peripheral neuropathies</td>
</tr>
</tbody>
</table>
Peripheral Nerve Stimulator

Troubleshooting

Pretest prior to administering paralytic to establish stimulation level

Check the battery, lead wires, electrode integrity and electrode placement.

Increase the stimulation level to 10 to see if there is a response.

Switch electrode wires so positive is distal and negative is proximal.

Follow medication order for titration instructions.
Peripheral Nerve Stimulator

Factors that affect amount of neuromuscular blockade

<table>
<thead>
<tr>
<th>NMB Potentiation</th>
<th>NMB Resistance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dilantin</td>
<td>Lidocaine</td>
</tr>
<tr>
<td>Anesthetics</td>
<td>Corticosteroids</td>
</tr>
<tr>
<td>Aminoglycosides</td>
<td>Calcium Channel Blockers</td>
</tr>
<tr>
<td>Magnesium</td>
<td>Propanolol</td>
</tr>
<tr>
<td>Procainamide</td>
<td>Hypermagnesemia</td>
</tr>
<tr>
<td>Hypothermia</td>
<td>Hypocalcemia</td>
</tr>
<tr>
<td>Bretbylium</td>
<td></td>
</tr>
<tr>
<td>Neuromuscular disease</td>
<td></td>
</tr>
</tbody>
</table>

- Dilantin
- Anesthetics
- Aminoglycosides
- Magnesium
- Procainamide
- Hypothermia
- Bretbylium
- Neuromuscular disease
- Lidocaine
- Corticosteroids
- Calcium Channel Blockers
- Propanolol
- Hypermagnesemia
- Hypocalcemia
- Hemiplegia / Paraplegia
- Burn injury
Peripheral Nerve Stimulator

For additional details and information, please refer to the policy:
Peripheral Nerve Stimulation (PNS) Testing (Ref. # 8181)
BIS Monitor (Bispectral Index)

A sensor on the patient's forehead translates brain electrical activity into a single BIS value, ranging from 0 to 100, with 100 signifying full awareness and 0 indicating no brain activity.

Special Note: In the regional hospitals, if a BIS monitor is ordered, an advanced practice provider will assist you with the setup and troubleshooting. This information is shared for your awareness.
BIS Monitor (Bispectral Index)

We may use a bispectral index (BIS) monitor to assure patient is not awake and aware while receiving paralytics.

A BIS monitor provides depth of consciousness and sedation monitoring for use in the OR, ICU, and other clinical settings.

If a BIS monitor is not available, observe patient for elevations in vital signs suggesting patient is not sedated properly.
Management of the Prone Patient

Why would we put a patient in the prone position?

- Improves oxygenation by shifting blood flow to the regions of the lungs that are less injured
  - Moves abdominal organs/diaphragm ‘out of the way’
  - Goal – 17-20 hours prone, 6-8 hours supine
  - Patients will be usually heavily sedated and if necessary, paralyzed
Management of the Prone Patient

Please watch the videos below on the prone position.

Prone Video #1
Prone Video #2
Management of the Prone Patient

How do we put someone into the prone position?

Please view the video below for details and a demonstration.

Link to Prone Video

Additionally, please view the policy:

Guideline - Prone Positioning - Adult (Ref. # 24737)
Invasive Monitoring

Your patient may have an arterial line in place. This serves two main purposes:

- Continuous monitoring of arterial blood pressure (this is especially important if the patient is requiring vasoactive medications for BP control)
- Provides ease of access for arterial blood sampling – the patient may need frequent lab draws and arterial blood gases (ABGs)
- The following slides give a brief overview of setting up the equipment needed for invasive monitoring
Invasive Monitoring

Equipment
Pressure Tubing Systems
Tubing systems
- Single: used for art line or CVP
- Double or bifurcated: used for art line with CVP
- Triple or trifurcated: used for PA catheters
Color coded:
- Red = Arterial
- Blue = CVP
- Yellow = PA
Invasive Monitoring

Equipment

- Pressurized system (make sure the pressure pack is always inflated to 300 mmHg)
- Gravity primed with sterile Normal Saline
- Fluid filled, air-free system EXCEPT the drip chamber
- Please refer to institutional policy/communications regarding pressure pack tubing change guidelines
Invasive Monitoring

Equipment

Transducer

Transducer senses waves of pressure and converts the information into a waveform

Transducer automatically allows 5 ml/hr flush through system to keep line patent as long as the pressure pack is inflated to 300 mmHg

What will make the signal inaccurate?

- Kink in the tubing / catheter
- Additional tubing length
- Air in the tubing
- Clot in catheter
Invasive Monitoring

For more information, please view the video below:

Pressure Tubing Monitoring System Video
Invasive Monitoring

Ensuring Accurate Readings
Level system at phlebostatic axis (right atrial level) – 4th ICS, mid-chest
- Level stopcock to that point
- Mark spot with a marker

Zero system to atmospheric pressure
- Beginning of every shift
- If readings are questionable
- Change of atmospheric pressure

Perform square wave test
Normal Arterial Waveform:
Invasive Monitoring

Management of Complications
Catheter malfunction
- Decrease amount of movement at site
- Maintain pressure system

Inaccurate data
- Maintain pressure system
- Zero and level transducer
- Validate waveform appearance
- Correlate to cuff BP
Invasive Monitoring

Management of Complications

Decreased distal circulation
- Monitor color, temperature, sensation, pain, pulse

Bleeding / Hematoma
- Assess site visually and by palpation
- Monitor coagulation status
- If bleeding / hematoma – direct manual pressure!!

Infection
- Monitor site, temperature
- Decrease amount of movement at site
- Collaborate regarding need to change catheter/site if suspicious
Invasive Monitoring

For additional information:

Arterial Line Waveform Video

Arterial Line: Insertion, Maintenance, Obtaining Samples and Removal – Adult Policy (Ref. # 7605):