

<b>Adult Critical Care Intravenous Infusions Titration Protocol</b>	
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Nursing staff to titrate drip to achieve goal ordered by provider in assigned time intervals.

**\*\*\*Any deviation from the titration protocol must be specified by the provider and reflected in the orders.\*\*\***

Please refer to Appendix 1 for provider-only titratable drips.

Medication	Standard Conc. (Maximum conc.)	Starting Rate	ICU Dose Range	Maximum Dose	Titration Increment	Titration Interval	Goal to be Selected by Provider
<b>Bumetanide (Bumex®)</b> <i>Loop diuretic</i>	0.25 mg/mL	0.5 mg/hr	0.5 – 3 mg/hr	3 mg/hour	0.25 mg/hr	2 hours	<ul style="list-style-type: none"> <li>Titrate to goal urine output of ___ mL/hr</li> <li>Contact provider for SBP below ___</li> </ul> <p><u>Order comment:</u> If goal urinary output not met after 6 hours or if rate reaches &gt; 1 mg/hr, contact provider.</p> <p>If net fluid balance &gt; 2 L in 24 hours, then notify provider.</p>

*Printed copies are for reference only. Please refer to the electronic copy for the latest version*

Pharmacy & Therapeutics (P&T) Committee Approval Date: 1/25/2022

Nurse Executive Council (NEC) Approval Date:

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Medication	Standard (Max) conc	Starting Rate	ICU Dose Range	Maximum Dose	Titration Increment	Titration Interval	Goal to be Selected by Provider
<b>Calcium gluconate</b> <i>Post renal parathyroidectomy</i>	20 mg/mL	10.8 mg/kg/hr	5.4 – 16.8 mg/kg/hr	16.8 mg/kg/hr	<u>Overnight:</u> 5.4 mg/kg/hr	<u>Overnight:</u> 4 hours	<p><u>Order Comment:</u> Provider titration only during daytime</p> <p><b>Overnight</b> Titration Parameters:</p> <ul style="list-style-type: none"> <li>• If repeat iCa is trending up (increasing) from previous result and is &gt; 4.5, decrease rate by 5.4 mg/kg/hr Ca gluconate (= 0.5 mg/kg/hr Elemental Calcium)</li> <li>• If repeat iCa 4.0-4.5, no rate adjustment</li> <li>• If repeat iCa is trending down (decreasing) from previous result and is &lt; 4.0, increase rate by 5.4 mg/kg/hr Ca gluconate (= 0.5 mg/kg/hr Elemental Calcium)</li> </ul> <p>Min rate = 5.4 mcg/kg/hr; max rate = 16.8 mg/kg/hr for nurse titration.</p> <p>If repeat iCa &lt; 3.5 at MAX rate or &gt; 4.5 at MIN rate, page nephrology at #1482.</p>
<b>Cisatracurium (Nimbex®)</b> <i>Nondepolarizing neuromuscular blocker</i>	2 mg/mL	0.5 mcg/kg/min	0.5 – 10 mcg/kg/min	10 mcg/kg/min	1 mcg/kg/min	30 min	<ul style="list-style-type: none"> <li>• Titrate to train of four goal ___ of 4</li> </ul> <p><u>Order comment:</u> Ensure RASS goal of -4 to -5 prior to initiation of cisatracurium. Do not wean analgesia/sedation during neuromuscular blockade.</p>
<b>Dexmedetomidine (Precedex®)</b> <i>Sedative</i>	4 mcg/mL	0.2 mcg/kg/hr	0.2 – 1.5 mcg/kg/hr	1.5 mcg/kg/hr	0.1 mcg/kg/hr	30 min	<ul style="list-style-type: none"> <li>• Titrate to goal RASS of ___</li> </ul> <p><u>Order comment:</u> Contact provider if HR &lt; 50 bpm or MAP &lt; 65 mmHg.</p>
<b>Diltiazem (Cardizem®)</b> <i>Calcium channel blocker</i>	1 mg/mL	5 mg/hr	5 – 15 mg/hr	15 mg/hr	5 mg/hr	15 min	<ul style="list-style-type: none"> <li>• Titrate to HR of ___</li> <li>• Hold for HR below ___</li> <li>• Hold for SBP below ___</li> </ul>

Medication	Standard (Max) conc	Starting Rate .	ICU Dose Range	Maximum Dose	Titration Increment	Titration Interval	Goal to be Selected by Provider
<b>Epinephrine</b> <i>Adrenergic agonist</i>	20 mcg/mL (40 mcg/mL)	0.1 mcg/kg/min	0.01 – 2 mcg/kg/min	2 mcg/kg/min*	0.02 mcg/kg/min	2 min	<ul style="list-style-type: none"> <li>• Titrate to goal MAP of ____ OR</li> <li>• For Neuro ICU patients with ICP monitoring: titrate to goal CPP of ____</li> </ul> <p><u>Order comment:</u> If rate &gt; 1 mcg/kg/min, contact provider.</p> <p>For sudden, life-threatening increase or decrease in MAP (CPP for Neuro ICU patients), titrate to maintain the goal MAP (CPP for Neuro ICU). Notify provider immediately.</p>
<b>Esmolol (BreviBloc®)</b> <i>Beta-blocker/ Antiarrhythmic</i>	10 mg/mL	50 mcg/kg/min	50 – 300 mcg/kg/min	200 mcg/kg/min (SVT/ tachycardia)  300 mcg/kg/min (post op HTN)	50 mcg/kg/min	2 min	<ul style="list-style-type: none"> <li>• Titrate to a goal HR below ____</li> <li>• Hold for HR less than ____</li> <li>• Hold for SBP less than ____</li> </ul> <p><u>Order comment:</u> Notify provider for doses ≥ 200 mcg/kg/min</p>
<b>Fentanyl</b> <i>Opioid analgesic</i>	20 mcg/mL (50 mcg/mL pure drug)	0.5 mcg/kg/hr	0.5 – 10 mcg/kg/hr	10 mcg/kg/hr	0.5 mcg/kg/hr	60 min	<ul style="list-style-type: none"> <li>• Titrate to goal RASS of ____</li> </ul>
<b>Furosemide (Lasix®)</b> <i>Loop diuretic</i>	10 mg/mL	10 mg/hr	5 – 80 mg/hr	80 mg/hr	5 mg/hr	2 hours	<ul style="list-style-type: none"> <li>• Titrate to goal urine output of ____ mL/hr</li> <li>• Contact provider for SBP below ____</li> </ul> <p><u>Order comment:</u> If goal urinary output not met after 6 hours or if rate reaches &gt; 20 mg/hr, contact provider.</p> <ul style="list-style-type: none"> <li>• If net fluid balance &gt; 2 L in 24 hours, then notify provider.</li> </ul>

\*If there is failure to maintain MAP goal with continued dose increase, contact provider to be available at bedside for further intervention (i.e. IV fluid therapy or additional agent). Both provider and nurse should leave documentation if responding to emergent situations.

Medication	Standard (Max) conc	Starting Rate	ICU Dose Range	Maximum Dose	Titration Increment	Titration Interval	Goal to be Selected by Provider
<b>Hydromorphone</b> <i>Opioid analgesic</i>	0.2 mg/mL	0.5 mg/hr	0.5 – 4 mg/hr	4 mg/hr	0.5 mg/hr	30 min	<ul style="list-style-type: none"> <li>• Titrate to goal RASS of ____</li> </ul>
<b>Ketamine</b> <i>Analgesic/sedative</i>	10 mg/mL	0.4 mg/kg/hr	0.4 – 3 mg/kg/hr	3 mg/kg/hr	0.2 mg/kg/hr	15 min	<ul style="list-style-type: none"> <li>• Titrate to RASS of ____</li> <li>• Titrate to CPOT of ____</li> </ul>
<b>Labetalol</b> <i>Alpha/beta blocker Antihypertensive Hypertensive Emergency</i>	2 mg/mL	0.5 mg/min	0.5 – 10 mg/min	6 mg/min per protocol  10 mg/min provider titration only	0.5 mg/min	15 min	<ul style="list-style-type: none"> <li>• Over the first hour, titrate to goal SBP of ____</li> <li>• Hold for SBP less than ____</li> <li>• Hold for HR less than ____</li> </ul> <p><u>Order comment:</u> For hypertensive emergency, titrate to the specified SBP goal over the 1<sup>st</sup> hour. After the 1<sup>st</sup> hour, decrease to 160/100 mmHg over the next 2-6 hours.</p> <p>Contact provider if rate &gt; 6 mg/min (provider max 10 mg/min).</p>
<b>Labetalol</b> <i>Alpha/beta blocker Aortic Dissection</i>	2 mg/mL	0.5 mg/min	0.5 – 10 mg/min	6 mg/min per protocol  10 mg/min provider titration only	0.5 mg/min	15 min	<ul style="list-style-type: none"> <li>• Titrate to a goal HR of below ____</li> <li>• Hold for SBP less than ____</li> <li>• Hold for HR less than ____</li> </ul> <p><u>Order comment:</u> Contact provider if rate &gt; 6 mg/min (provider max 10 mg/min).</p>
<b>Midazolam (Versed®)</b> <i>Sedative</i>	1 mg/mL	1 mg/hr	1 – 20 mg/hr	20 mg/hr	0.5 mg/hr	30 min	<ul style="list-style-type: none"> <li>• Titrate to goal RASS of ____</li> <li>• Contact provider if adequate sedation not reached at 10 mg/hr</li> </ul>
<b>Morphine</b> <i>Opioid analgesic</i>	1 mg/mL	2 mg/hr	2 – 30 mg/hr	30 mg/hr	1 mg/hr	30 min	<ul style="list-style-type: none"> <li>• Titrate to goal RASS of ____</li> </ul> <p><u>Order comment:</u></p> <ul style="list-style-type: none"> <li>• Notify provider if greater than 3 titrations made within 6 hours. If patient becomes unresponsive (RASS ≤ -4) when RASS goal -2 to 0, notify provider immediately</li> </ul>

Medication	Standard (Max) conc	Starting Rate	ICU Dose Range	Maximum Dose	Titration Increment	Titration Interval	Goal to be Selected by Provider
<b>Naloxone (Narcan®)</b> <i>Opioid antagonist</i>	20 mcg/mL	0.5 mg/hr	0.25 – 6.25 mg/hr	6.25 mg/hr	0.25 mg/hr	2 min	<ul style="list-style-type: none"> <li>Titrate to a respiratory rate of ____</li> <li>Hold for respiratory rate less than ____</li> </ul> <p><u>Order comment:</u> Notify provider if RASS ≤ -3 after 1 hour or any time when RASS ≥ 2</p> <p>For providers: Initial rate = 2/3<sup>rd</sup> of the total bolus doses given per hour</p>
<b>Nicardipine (Cardene®)</b> <i>Antihypertensive</i> <b>Hypertensive Emergency</b>	0.1 mg/mL (0.2 mg/mL)	5 mg/hr	5 – 15 mg/hr	15 mg/hr	2.5 mg/hr	15 min	<ul style="list-style-type: none"> <li>Over the first hour, titrate to goal SBP of ____</li> <li>Hold for SBP less than ____</li> </ul> <p><u>Order comment:</u> For hypertensive emergency, titrate to the specified SBP goal over the 1<sup>st</sup> hour. After the 1<sup>st</sup> hour, decrease to 160/100 mmHg over the next 2-6 hours.</p>
<b>Nicardipine (Cardene®)</b> <i>Antihypertensive</i> <b>NEURO ICU ONLY</b>	0.1 mg/mL (0.2 mg/mL)	5 mg/hr	5 – 15 mg/hr	15 mg/hr	2.5 mg/hr	15 min	<ul style="list-style-type: none"> <li>Titrate to goal SBP ____</li> <li>Hold for SBP less than ____</li> </ul>
<b>Nitroglycerin</b> <i>Vasodilator</i> <b>Antihypertensive</b>	200 mcg/mL	10 mcg/min	5 – 400 mcg/min	200 mcg/min per protocol 400 mcg/min provider titration only	10 mcg/min	2 min	<ul style="list-style-type: none"> <li>Over the first hour, titrate to goal SBP of ____</li> <li>Hold for SBP less than ____</li> </ul> <p><u>Order comment:</u> For hypertensive emergency, titrate to the specified SBP goal over the 1<sup>st</sup> hour. After the first hour, decrease to 160/100 mmHg over the next 2-6 hours.</p> <p>Contact provider if rate &gt; 200 mcg/min (provider max 400 mcg/min).</p> <ul style="list-style-type: none"> <li>If order written in mcg/kg/min, provider to titrate.</li> </ul>

Medication	Standard (Max) conc	Starting Rate	ICU Dose Range	Maximum Dose	Titration Increment	Titration Interval	Goal to be Selected by Provider
<b>Nitroglycerin</b> <i>Vasodilator</i> <b>Chest pain</b>	200 mcg/mL	10 mcg/min	5 – 100 mcg/min	100 mcg/min	10 mcg/min	10 min	<ul style="list-style-type: none"> <li>Titrate to chest pain of 0 on numeric pain score</li> <li>Hold for SBP less than ____</li> </ul> <p><u>Order comments:</u> For chest pain. DO NOT USE FOR HYPERTENSION</p>
<b>Nitroprusside (Nipride®)</b> <i>Vasodilator</i>	200 mcg/mL	0.3 mcg/kg/min	0.3 – 3 mcg/kg/min	3 mcg/kg/min	0.5 mcg/kg/min	2 min	<ul style="list-style-type: none"> <li>Over the first hour, titrate to goal SBP of ____</li> <li>Hold for SBP less than ____</li> </ul> <p><u>Order comment:</u> For hypertensive emergency, titrate to the specified SBP goal over the 1<sup>st</sup> hour. After the 1<sup>st</sup> hour, decrease to 160/100 mmHg over the next 2-6 hours.</p>
<b>Norepinephrine (Levophed®)</b> <i>Alpha/beta agonist</i>	32 mcg/mL (128 mcg/mL)	0.1 mcg/kg/min	0.01 – 3 mcg/kg/min	3 mcg/kg/min*	0.02 mcg/kg/min	2 min	<ul style="list-style-type: none"> <li>Titrate to goal MAP of ____ OR</li> <li>For Neuro ICU patients with ICP monitoring: titrate to goal CPP of ____</li> </ul> <p><u>Order comment:</u> If rate &gt; 1 mcg/kg/min, contact provider.</p> <p>For sudden, life-threatening increase or decrease in MAP (CPP for Neuro ICU patients), titrate to maintain the goal MAP (CPP for Neuro ICU). Notify provider immediately.</p>

Medication	Standard (Max) conc	Starting Rate	ICU Dose Range	Maximum Dose	Titration Increment	Titration Interval	Goal to be Selected by Provider
<b>Phenylephrine (Neosynephrine®)</b> <i>Alpha agonist</i>	160 mcg/mL (320 mcg/mL)	0.1 mcg/kg/min	0.1 – 10 mcg/kg/min	10 mcg/kg/min*	0.1 mcg/kg/min	2 min	<ul style="list-style-type: none"> <li>Titrate to goal MAP of ____ OR</li> <li>For Neuro ICU patients with ICP monitoring: titrate to goal CPP of ____</li> </ul> <p><u>Order comment:</u> If rate &gt; 6 mcg/kg/min, contact provider.</p> <p>For sudden, life-threatening increase or decrease in MAP (CPP for Neuro ICU patients), titrate to maintain the goal MAP (CPP for Neuro ICU). Notify provider immediately.</p>
<b>Propofol (Diprivan®)</b> <i>Sedative</i>	10 mg/mL	5 mcg/kg/min	5 – 80 mcg/kg/min	80 mcg/kg/min	5 mcg/kg/min	30 min	<ul style="list-style-type: none"> <li>Titrate to goal RASS of ____</li> </ul>
<b>Rocuronium</b> <i>Nondepolarizing neuromuscular blocker</i>	5 mg/mL	8 mcg/kg/min	8 – 12 mcg/kg/min	12 mcg/kg/min	0.5 mcg/kg/min	30 min	<ul style="list-style-type: none"> <li>Use ideal body weight</li> <li>Titrate to train of four goal ____ of 4</li> <li>Ensure RASS goal of -4 to -5 prior to initiation of rocuronium. Do not wean analgesia/sedation during neuromuscular blockade.</li> </ul>
<b>Vasopressin (Vasopressin®)</b> <i>Vasopressin (V1) agonist</i> <b>Non-sepsis indications including cardiac vasoplegia &amp; organ donation</b>	0.2 unit/mL	1 unit/hr	1 – 4 unit/hr	4 unit/hr	0.5 unit/hr	2 min	<ul style="list-style-type: none"> <li>Titrate to goal MAP of ____</li> </ul>

\*If there is failure to maintain MAP goal with continued dose increase, contact provider to be available at bedside for further intervention (i.e. IV fluid therapy or additional agent). Both provider and nurse should leave documentation if responding to emergent situations.

**APPENDIX 1: Provider-Only Titratable Drips**

The following drips should only be titrated by the providers. Each titration change must be reflected in the order. The following is a general guide for providers.

Medication	Standard Conc. (Maximum conc.)	Starting Rate	ICU Dose Range	Maximum Dose	Titration Increment	Titration Interval	Goal to be Selected and Titrated by Provider
<b>3% Sodium Chloride</b> <i>Increased intracranial pressure</i>	3% NaCl	10 mL/hr	Infusion: 10-50 mL/hr Bolus: 250-500 mL	Peripheral 50 mL/hr	10-20 mL/hr	N/A	<u>Maximum rate for peripheral administration is 50 mL/hr.</u> Physician driven titration.
<b>Dobutamine</b> <i>Adrenergic agonist</i>	2 mg/mL	2.5 mcg/kg/min	2.5 – 40 mcg/kg/min	40 mcg/kg/min	N/A	N/A	<u>Order comment:</u> PROVIDER TITRATION ONLY. Contact provider for HR > 120 bpm, SBP < 85 or > 180 mmHg or development of ventricular arrhythmias.  <u>Notes:</u> <b>Suggested</b> Titration Parameter for providers: Titration increment 2.5 mcg/kg/min; Titration interval 10 min
<b>Dopamine</b> <i>Adrenergic agonist</i>	1.6 mg/mL (3.2 mg/mL)	5 mcg/kg/min	1 – 20 mcg/kg/min	20 mcg/kg/min	N/A	N/A	<u>Order comment:</u> PROVIDER TITRATION ONLY. Contact provider for HR > 120 bpm, SBP < 85 or > 180 mmHg or development of ventricular arrhythmias.  <u>Notes:</u> <b>Suggested</b> Titration Parameter for providers: Titration increment 2 mcg/kg/min; Titration interval 5 min
<b>Ketamine</b> <i>Status epilepticus Non-ventilated</i>	2 mg/mL	2 mcg/kg/min	2 – 15 mcg/kg/min	15 mcg/kg/min	1 mcg/kg/min	15 min	Physician driven titration
<b>Ketamine</b> <i>Status epilepticus Ventilated</i>	2 mg/mL	10 mcg/kg/min	10 – 150 mcg/kg/min	150 mcg/kg/min	10 mcg/kg/min	15 min	Physician driven titration
<b>Midazolam (Versed®)</b> <i>Status epilepticus</i>	1 mg/mL	1 mg/hr	1 – 100 mg/hr	100 mg/hr	N/A	N/A	PROVIDER TITRATION ONLY



Medication	Standard Conc. (Maximum conc.)	Starting Rate	ICU Dose Range	Maximum Dose	Titration Increment	Titration Interval	Goal to be Selected and Titrated by Provider
<b>Milrinone (Primacor®)</b> <i>PDE inhibitor/inotrope</i>	200 mcg/mL	0.25 mcg/kg/min	0.25 – 0.75 mcg/kg/min	0.75 mcg/kg/min	N/A	N/A	<p><u>Order comment:</u> PROVIDER TITRATION ONLY. Contact provider for HR &gt; 120 bpm, SBP &lt; 85 or &gt; 180 mmHg or development of ventricular arrhythmias.</p> <p><u>Notes:</u> <b>Suggested</b> Titration Parameter for providers: Titration increment 0.125 mcg/kg/min; Titration interval 2 hours</p>
<b>Pentobarbital</b> <i>Status epilepticus</i>	8 mg/mL	Loading dose: 5-15 mg/kg Maintenance dose: 0.5 mg/kg/hr	0.5-5 mg/kg/hr	5 mg/kg/hr	0.5-1 mg/kg/hr	12 hours	<u>Physician driven titration</u>
<b>Pentobarbital</b> <i>Increased intracranial pressure</i>	8 mg/mL	Bolus: 10 mg/kg/hr x 1 hour; then 5 mg/kg/hr x 3 hours Maintenance : 1 mg/kg/hr	0.5-5 mg/kg/hr	5 mg/kg/hr	0.1-1 mg/kg/hr	1 hour	<u>Physician driven titration.</u> <u>Use actual body weight (do not cap dose).</u>
<b>Propofol</b> <i>Status epilepticus</i>	10 mg/mL	5 mcg/kg/min	5-80 mcg/kg/min	80 mcg/kg/min	5 mcg/kg/min	30 min	<u>Physician driven titration</u>
<b>Vasopressin (Vasopressin®)</b> <i>Vasopressin (V1) agonist</i> <b>Septic shock</b>	0.2 unit/mL	1.8 unit/hr	1.8 – 2.4 unit/hr	2.4 unit/hr	N/A	N/A	<ul style="list-style-type: none"> <li>• Continuous infusion</li> <li>• Do not titrate</li> </ul> Physician may authorize nurse to increase rate to a maximum of 2.4 unit/hour if MAP not at goal after 4 hours