(A) Policy Statement

Registered Nurses (RN’s) may administer intravenous (IV) Medications in accordance with the following guidelines. It is the responsibility of the RN administering the medication to utilize unit resources and the Pharmacy Department for specific methods of administration or guidelines in giving specific drugs. Strict aseptic techniques and needleless systems will be utilized.

(B) Purpose of Policy

To provide guidelines for a safe and therapeutic administration of continuous IV infusions

(C) Procedure

1. The Nursing Service policies and procedures pertaining to the Administration of IV Therapy, Administration of Medications, specific policies regarding specialized types of vascular access devices (i.e. Broviac, Hickman, etc.), and any pertinent specialty area guidelines should be adhered to when administering IV medications.

2. When there are requests for variance from these guidelines, it is the responsibility of the RN to use discretion in each patient situation and to utilize all existing resources, i.e. Pharmacy and other specialty area personnel in the determination of whether the medication can be safely administered.

3. For adult patients, Pharmacy will indicate in Admin-Rx those medications requiring filters. These cues are also noted in the guardrails of the smart pumps for continuous infusions. Macro-filtered needles must be used to draw up medications from ampules which otherwise would not be filtered on administration.

4. IV medications requiring close observation, frequent monitoring of vital signs, or having high concentrations or pH extremes are only to be administered in areas that provide the availability of necessary monitoring equipment, and by RNs knowledgeable in administration of that specific drug. See attached chart.

5. The following IV medications require a second RN to double check administration: all blood products, chemotherapy, patient controlled analgesic medications, and investigational medications.

6. Appropriate precautionary measures should be taken when the specific medication or administration is unfamiliar or unusual. Clarification as needed should always be obtained from the Pharmacist or other existing resources.

7. RN’s may administer I.V. medications via peripheral, central and PICC lines. The RN is responsible for
assuring adequate patency and placement before administering IV medications.

A. IV medications may be administered peripherally via the following types of needles and catheters:
   1. Scalp vein or butterfly needles.
   2. Plastic or teflon over the catheter needles (Jelco-caths, angiocaths, etc.).
   3. Plastic through the needle catheters (intracaths).

B. IV medications may be administered via the following types of central lines:
   1. Single lumen catheters, multiple lumen and pulmonary artery catheters (i.e. Arrow triple
tenums, Hickmans and Broviacs, Groshong catheters, etc.).

8. The following methods of administration may be employed:
A. IV continuous infusion.
B. IV admixture (medication added to the primary IV).
C. IV piggyback and other secondary IV infusions connected to a primary IV solution.
D. IV push or bolus injection via the Y-site of an IV line or intermittent IV line (INT).
E. IV push chemotherapy or one-time dose medications such as Lasix and SoluMedrol (insert a syringe
   with the medication into a Y-site or INT, pushing the medication). Patency of the IV must first be
   established by flushing the line with 5ml’s of Normal Saline. After administration of medication,
   line must be flushed with 5 ml’s of normal saline unless a continuous IV fluid is running.
F. Push-pump method (mechanical syringe administration).

9. The following medications may be administered as primary infusions. These solutions may be
   administered by gravity drip with the RN’s discretion when ordered at a Keep Vein Open (KVO) rate
   post-procedure, and/or when precise fluid administration is not required.
A. Blood and blood products.
B. Dextrose, saline, and lactated Ringers solutions.

10. The following solutions may be administered as primary solutions using the assistance of a mechanical
    volume or rate controller. Intravenous caloric solutions:
    A. Hyperalimentation (All-In-One TPN) solutions (Dextrose solutions of greater than 20%
       concentration must be run via central lines whereas solutions of 10% or less may be run through
       a peripheral IV or midline PICC).
    B. Lipid or fat emulsion solutions.
    C. Glucose, fructose, or concentrated dextrose solutions.
    D. Amino acids (amino acid solutions ranging from 3.5 to 4.25% may be administered through
        peripheral lines).

11. The following medications may be administered as additives to primary IV infusions (500-1000 ml for
    adult patients).
    A. Electrolyte replacement solutions (in dilute solutions). Examples: KCL, calcium compounds,
       Magnesium Sulfate, NH3Cl, NaHCO3.
    B. Antibiotics or anti-infectives. Examples: Penicillin in a liter of solutions.
    C. Vitamin and mineral solutions. Examples: Vitamin C or B complex.

12. The following medications should be administered as a primary infusion only with the assistance of a
    mechanical volume or rate controller using the correct setting for the level of care (med-surg, pediatrics,
    critical care). Additionally, guardrails on the smart pumps should be used when available. These
    medications should not be administered as piggyback medications. These primary solutions should
    not be used to deliver a bolus of medication unless the bolus feature and guardrails of the smart pumps are
    utilized (exception: PCA).
    A. Vasopressive agents
    B. Aminophylline
    C. Anticoagulants/Thrombolytics Heparin
    D. Insulin
E. Morphine sulfate or other narcotics
F. Patient controlled analgesia (example: PCA)
G. Chemotherapy

13. The following medications may be administered as primary or secondary infusions with the assistance of a mechanical volume or rate controller using the correct setting for the level of care (med-surg, pediatrics, critical care). Additionally, guardrails on the smart pumps should be used when available.
   A. NaHCO₃, Antibiotics, antifungals, anti-infectives
   B. Steroids or other hormonal replacements
   C. Vitamin and mineral replacement solution
   D. Electrolytes
   E. Antihypertensive agents (secondary infusion)
   F. Uterine contractants
   G. Plasmanate
   H. Immunosuppressants
   I. Anticonvulsants
   J. Lasix may be administered by primary or secondary infusion but the preferred method is by IV bolus or IV push
   K. Antibiotics

14. The following medications may be administered by IV bolus or IV push:
   A. Digoxin as a maintenance dose for a patient who cannot be given liquid or tablet form.
   B. Diuretics
      Example: Mannitol, Lasix
   C. Steroids
      Example: Decadron, Solu-Medrol
   D. Narcotics
      Example: Morphine Sulfate, Demerol
   E. Antianxiety or sedatives
      Example: Ativan, Droperidol, Benadryl
   F. Antihypertensives
      Example: Hydralazine, Vasotec
   G. Sedation for procedures
      Example: Versed
   H. Narcotic antagonists
      Example: Narcan
   I. Benzodiazepine Reversal Antagonists
      Example: Romazicon
   J. Hypoglycemics and glycemics
      Example: Insulin, Dextrose 50% in 50ml syringe
   K. Anticoagulants/coagulation enhancers
      Example: Heparin, Vitamin K (adults only)
   L. Select antihypertensives for routine maintenance dosetherepy when oral therapy is not feasible.
      Example: Vasotec, Lopressor, Labetolol, Hydralazine

Telemetry monitoring is required when IV Betablockers (eg. Lopressor, Labetolol) are administered.

M. Antiarrythmics
   Example: Droperidol, Ativan
N. Antiemetics
   Example: Adriamycin
O. Chemotherapy
P. Diagnostic Agents
   Example: Methylene Blue

15. It is highly recommended that medications that are hypertonic, caustic or have a very high or low pH be administered via a central line, if clinically possible. Exceptions to this include chemotherapy and Amphotericin B. Medications demonstrating these properties that must be run via a peripheral line must be closely monitored for infiltration.

16. RN's may administer restricted I.V. medications in a life threatening code situation under the direct supervision of a licensed physician. If the patient cannot be immediately transferred, the Nursing Director or Administrative Coordinator should be called to obtain further assistance. In the event that the physician has requested that a patient be transferred to an intermediate or intensive care setting (due to change in condition or an increased need for monitoring), and a bed is not immediately available, the nurse, with adequate resources (assistance from an ICU or Intermediate Care trained nurse) will initiate and maintain
the required IV medications until a bed becomes available and the patient is transferred.

17. RN's working within a critical care area and who have proved competency may perform IV admixture in emergent or urgent situations. Any IV medications after the first bag must be provided by pharmacy.

<table>
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<th>Approved by:</th>
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<tr>
<td>Moneca Smith, MSN, RN</td>
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<td>Date: 3.27.15</td>
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1985 1993 4/2001 3.27.15

Next Review Date: 3/2018

Policies Superseded by This Policy: 5-02
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<tr>
<th>MEDICATION</th>
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<th>MAXIMUM CONC. OR INFUSION INSTRUCTIONS</th>
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<th>PATIENT UNIT REQUIREMENT</th>
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<tr>
<td>Abciximab (Reopro®)</td>
<td>Binds to platelet-specific Glycoprotein lib/lla receptor producing inhibition of platelet function. After infusion stopped, platelet function recovery gradually over 48hrs</td>
<td>IV bolus: may be given undiluted (2 mg/mL via bolus) Infusion: 9 mg/250 ml in DSW (36 mcg/ml)</td>
<td>Must be filtered with a 0.2 µm filter before administering the bolus and the infusion. 12 hour expiration time. DSW or NS</td>
<td>Peripheral or Central</td>
<td>IV bolus: 0.15 mg/kg  Ci: 0.125 mcg/kg/min (weight adjusted) up to 10 mcg/min (non-weight adjusted) for 12-24 hours</td>
<td>INTERMEDIATE CARE</td>
<td>Minimum: TELEMETRY MONITORING HR, arrhythmias, PLTs, bleeding Patient may also be on heparin follow GP IIb/IIIa Protocol</td>
</tr>
<tr>
<td>Alprostadil</td>
<td>Naturally occurring prostaglandin, causing smooth muscle relaxation</td>
<td>Infusion: 500 mcg/500 ml (1 mcg/ml)</td>
<td>Various volumes may be used for final concentration of 2-20 mcg/mL DSW or NS 24 hour stability</td>
<td>Peripheral or Central</td>
<td>Ci: 0.05-0.4 mcg/kg/min</td>
<td>INTERMEDIATE CARE</td>
<td>Minimum: PORTABLE MONITOR BP, HR, flush</td>
</tr>
<tr>
<td>Alteplase (TPA, Activase®)</td>
<td>Recombinant tissue plasminogen activator. Binds to fibrin in a thrombus, converts plasminogen to plasmin, then plasmin digests the fibrin and dissolves the clot</td>
<td>0.1 mg/mL in NS for post thrombolysis (special procedures) 0.5-1 mg/mL in DSW or NS for AMI, PE or acute ischemic stroke</td>
<td>Various volumes used based on rate and anticipated infusion time (30 minutes-3 hours) Max Adult Dose = 100mg Must be used within 8 hours of dilution</td>
<td>Peripheral or Central</td>
<td>10.25-1 mg/hr x 6-24 hrs (post thrombolysis) AMI: 100mg over 30 min Stroke: 0.9mg/kg NTE 90mg PE: 100mg over 2 hours</td>
<td>ICU PREFERRED</td>
<td>Minimum: PORTABLE MONITOR- HR (arrhythmias: AV block, bradyarrhythmia, VT/VF, Torsades de Pointes), hypotension Significant drug interactions with both digoxin and warfarin, decrease doses of each, digoxin levels, PT/INR</td>
</tr>
<tr>
<td>Amiodarone (Cordarone®)</td>
<td>Antiarrhythmic possessing alpha and beta blocking properties. It depresses conduction velocity, slows AV node conduction and raises the threshold for VF. It possesses vasodilator effects which decrease cardiac workload and decrease myocardial O2 demand. Myocardial uptake of drug is rapid and anti-arrhythmic effects are clinically relevant within hours, but full effect may take days. Exceptionally long half-life of 53 days</td>
<td>Rapid loading infusion: 150 mg/100ml DSW bag (1.5 mg/ml) Cardiac arrest (unlabeled): 300 mg bolus, G2 to 50 ml with DSW in syringe (50 mg/ml amp) May repeat dose of 150mg IV push in 3 to 5 min Max cumulative dose = 2.46 mg IV/24 hr</td>
<td>1.6 mg/mL (320 mg/150 ml) PVC bags only suitable for rapid loading doses (24hrs) Glass containers used for solutions given over more than 2 hours Concentrations over 2 mg/mL for longer than 1 hour must infuse via central line Use filter set provided (0.2 micron) 360mg/200mL, (1.8 mg/mL) in premade bag</td>
<td>Peripheral or Central</td>
<td>IV load: 150mg/100ml over 10 minutes (not to exceed 30 mg/min) IV bolus (ACLs): up to 450mg/100 ml DSW bolus Ci: (360mg/200ml) 1 mg/min x 6 hrs after bolus, followed by 0.5 mg/min x 18 hrs Maintenance infusions range from 0.25-1 mg/min</td>
<td>INTERMEDIATE CARE</td>
<td>Minimum: PORTABLE MONITOR- HR (arrhythmias: AV block, bradyarrhythmia, VT/VF, Torsades de Pointes), hypotension Significant drug interactions with both digoxin and warfarin, decrease doses of each, digoxin levels, PT/INR</td>
</tr>
<tr>
<td>Argatroban (Argatroban ®)</td>
<td>For HIT (heparin-induced thrombocytopenia) Selective synthetic direct thrombin inhibitor</td>
<td>250 mg/250 ml in NS or DS 1 mg/mL Must be properly protected from light and freezing</td>
<td>1 mg/mL NS or DSW 86 hour stability protected from light</td>
<td>Peripheral or Central</td>
<td>Non Critical: 2 mcg/kg/min adjust to aPTT by 0.6 mcg/kg/min. Critical/Hepatic dysfunction: 0.15 mcg/kg/min, titrate 0.1 mcg/kg/min. MAX: 10 mcg/kg/min</td>
<td>DOSE DEPENDENT GENERAL TO ICU</td>
<td>Bleeding, monitor aPTT and adjust dose as needed LFTs</td>
</tr>
<tr>
<td>Bivalirudin (Angiomax®)</td>
<td>Anticoagulant used in conjunction with aspirin for patients with unstable angina undergoing percutaneous transluminal coronary angioplasty (PTCA)</td>
<td>Infusion: 250mg/50mL or 500mg/100ml in NS (5mg/ml) May be further diluted to 250mg/500ml (0.5mg/ml)</td>
<td>5 mg/ml</td>
<td>Boli: 1mg/kg  Ci: 2.5mg/kg/hour over 4 hours; if needed CI may be continued as 0.2 mg/kg/hour for up to 20 hours Dose reduced based on renal Function</td>
<td>ICU</td>
<td>Activated clotting time (ACT) especially with renal insufficiency Bleeding major adverse event</td>
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</table>
| Bumetanide  | Potent loop diuretic. Works in the Loop of Henle to excrete 
|            | H20, Na+, K+, Cl- |
|            | 0.25 mg/mL undiluted 
|            | drug (12 mg/48 mL, 24 
|            | mg/96 mL) Must be 
|            | properly protected 
|            | from light |
|            | May be further diluted per 
|            | request 
|            | D5W, NS or LR |
| CI: 0.25-1 mg/hr 
| 1:40 mg ratio (Bumex to 
| Lasix) |
| GENERAL | HR, BP, electrolytes, UOP |
| INTERMEDIATE | |

| Cisatracurium  | Nondepolarizing neuromuscular 
| (Nimbex®) | blocking agent with 
|            | intermediate onset and duration of 
|            | action |
|            | Initial IV bolus: may be 
|            | given undiluted 
|            | (10 mg/mL, vial) 
|            | Infusion: 100 mg/500 
|            | mL NS (200 mcg/mL) |
|            | 200 mcg/mL 
|            | NS or D5W |
|            | IV bolus: 0.15-0.2 mg/kg 
|            | CI: 1-2 mcg/kg/min, 
|            | adjust according to 
|            | response. Max 10 
|            | mcg/kg/min |
| VENT/ICU | Hardwire/PNS |
|            | Train-of-Four monitoring 
|            | Patient must be 
|            | sedated 
|            | No adjustments for 
|            | renal/hepatic dysfunction |

| Diltiazem  | Calcium channel blocker. 
| (Cardizem®) | Inhibits influx of Ca++ ions 
|            | during depolarization of 
|            | cardiac and 
|            | vascular smooth muscle. 
|            | Slows AV node conduction, 
|            | prolongs refractory period, 
|            | slows ventricular response, ↓ 
|            | HR, ↓ BP, ↓ SVR |
|            | IV bolus: may be 
|            | given undiluted 
|            | (5 mg/mL vial) 
|            | Infusion: 125 mg/125 
|            | mL D5W 
|            | (1 mg/mL) |
|            | 1 mg/mL 
|            | D5W or NS |
| Peripheral | IV bolus: 0.25 mg/kg 
|            | (up to 20 mg) over 2 min 
|            | CI: 5-15 mg/hr 
|            | (not recommended 
|            | >24hrs) |
| INTERMEDIATE | |
| Minimum: | PORTABLE |
| MONITOR- | ↓ HR, arrhythmias, 
|            | ↓ BP, flushing, edema, 
|            | Stored in refrigerator |

| Dexmedetomidine  | A relatively selective 
| (Precedex®) | alpha-2 adrenoceptor agonist with 
|            | sedative properties. Used for 
|            | the sedation of initially intubated 
|            | and mechanically ventilated 
|            | patients during treatment in an 
|            | intensive care setting. |
|            | 200 mcg/50 ml or 
|            | 400 mcg/100 ml NS, 
|            | (4 mcg/ml) 
|            | Must be diluted prior 
|            | to administration. 
|            | 4 mcg/mL Not indicated for infusions 
|            | lasting longer than 24 hours |
| Peripheral | Loading dose: Not 
|            | recommended at LITMC. 
|            | Maintenance: 0.2 to 0.7 
|            | mcg/kg/hr, Max dose, 
|            | 1.5 mcg/kg/min. Max 
|            | duration, 24 hours. |
| ICU | Hardwire: 
|            | Monitor with the use of a 
|            | sedation scale 
|            | Monitor for bradycardia, 
|            | hypotension, hypoxia, and 
|            | EKG changes |

| Dobutamine  | Synthetic sympathomimetic 
| (Dobutrex®) | catecholamine with β1 
|            | cardioselective activity. Positive 
|            | inotrope (↑ CO, ↓ contractility, 
|            | ↑ CI), with mild chronotropic 
|            | effects (↑ HR, ↑ BP) |
|            | 2mg/mL in D5W 
|            | (500 mg/250 mL pre-made 
|            | bag) |
|            | 1000mg/250 mL 
|            | D5W or NS |
| Peripheral | CI (ICU): 
|            | 2.5-20 mcg/kg/min 
|            | CI (Intermediate): 
|            | <10 mcg/kg/min |
| DOSE | DEPENDENT |
| INTERMEDIATE | CARE, or ICU |
| Minimum: | PORTABLE |
| MONITOR- | ↓ HR, ↓ BP, ↓ BP 
|            | arrhythmias, myocardial 
|            | ischemia, chest pain, 
|            | anxiety, NA, tremors |

| Dopamine  | Catecholamine precursor to 
|            | norepinephrine, possessing α, 
|            | β and dopaminergic actions. 
|            | Low DA vasoconstriction of 
|            | renal/mesenteric bed 
|            | Mid: stimulation, ↑ CO, ↓ 
|            | contractility 
|            | High: α effects, ↑ BP, 
|            | vasoconstriction |
|            | 1600 mcg/mL in D5W 
|            | (400 mg/250 mL pre-made 
|            | bag) Premade: 400 or 800 
|            | mg in 250 mL D5W |
|            | 3200 mcg/mL 
|            | (800 mg/250 mL) D5W 
|            | or NS |
| Central | CI (ICU): 
|            | 1-20 mcg/kg/min 
|            | CI (846, P46): 
|            | <8 mcg/kg/min |
| DOSE | DEPENDENT |
| LOW- INTERMEDIATE | >RENAL DOSE-ICU |
| Minimum: | PORTABLE |
| MONITOR- | ↓ HR, palpitations, 
|            | arrhythmias, ↓ BP |

| Drotrecogin Alfa  | Inhibits factors Va and Villa, 
| (Xigris®) | limiting thrombotic effects. 
|            | Complex mechanism of action 
|            | not completely understood. 
|            | Given for severe sepsis |
|            | Standard concentration is 150 
|            | mcg/mL, given as a 96 
|            | hour continuous 
|            | infusion. The bag size 
|            | varies based on the 
|            | patient's weight. 
|            | Mixture is stable for 
|            | 14 hours at room 
|            | temperature or 24 
|            | hours in the fridge. 
|            | Most drips will be 
|            | mixed to deliver 
|            | between 8-11 
|            | hours of drug. |
|            | Standard concentration of 
|            | 150 mcg/mL. 
|            | Bag size will vary |
|            | ? |
| ICU | Drug should be held 2 hours 
|            | before surgery and restarted 
|            | 2 hours after minor surgery 
<p>|            | or 12 hours after major surgery. |
| <strong>Epinephrine</strong> | <strong>Natural sympathomimetic catecholamine, both an α and β agonist. Can cause SVR, ↑ SBP, ↓ DBP (vasoconstriction), is a potent cardiac stimulant (↑ HR, ↑ contraction) and dilates bronchi.</strong> | <strong>16 mcg/mL in D5W (4 mg/250 mL)</strong> | <strong>0.01-2 mcg/kg/min. ACLS: 30 mcg/250 mL (11,000)</strong> | <strong>Max, 2 mcg/kg/min</strong> | <strong>Central</strong> | <strong>IV bolus: 1mg/10 ml 1:10,000 syringe q3-5 min (ACLS)</strong> | <strong>CI: 0.06-1 mcg/kg/min (inotropic/pressor dose)</strong> | <strong>ICU</strong> | <strong>Hardwire</strong> |
| | <strong>Peripheral</strong> | | <strong>Minimum flow rate for CADD pump is 45 mL/day. Maximum recommended flow rate is 90 mL/day. Concentrations of bags individualized based on weight and effective dose. Expressed in ng/ml</strong> | | | <strong>Peripheral</strong> | <strong>CI: 1 to 2 ng/kg/min. Based on body size 0.5 mg/100 mL should be the starting cassette size for most patients. Stability: Cassette designed to last 24 hrs if ice bags are changed q8h. 8hrs at room temp, 48hrs if refrigerated</strong> | <strong>INTERMEDIATE-ICU</strong> | <strong>Hardwire</strong> | Administration limited to epoprostenol competency-certified nurses. Flush, HA, NIV, I BP, chest pain, anxiety, dizziness, bradycardia, and dyspnea. jaw pain Double-check calculations and settings! Do NOT let bag run dry sudden death can occur |
| <strong>Epoprostenol (Flolan®)</strong> | <strong>Natural prostaglandin, directly vasodilates pulmonary and systemic arterial vascular beds and inhibits platelet aggregation. ↑ CO, ↓ afterload and produces dose-related ↓ in pulmonary vascular resistance. Onset of action is immediate.</strong> | <strong>Infusion: Administered via CADD pump, dilution based on patient weight and dose.</strong> | | | | | | | <strong>Minimum: TELEMETRY MONITORING HR, PLT, TS, bleeding. Patient may also be on heparin- follow GPIIb/IIIa Protocol</strong> |
| <strong>Eptifibatide (Integrilin®)</strong> | <strong>Binds to platelet-specific Glycoprotein IIb/IIIa receptor, producing inhibition of platelet function. After infusion stopped, recovery of platelet function occurs quickly.</strong> | <strong>IV bolus: may be given undiluted (2 mg/mL, vial) Infusion: 75 mcg/100 mL bottle (0.75mg/mL) premade</strong> | | | | | | | <strong>Minimum: PORTABLE MONITOR- ↓ HR, ↓ BP, ↓ arrhythmias, CHF, bronchospasm, inflammation at infusion site</strong> |
| <strong>Esmolol (Brevibloc®)</strong> | <strong>Short acting, β-1 selective adrenergic blocker. Has antiarrhythmic properties and acts to ↓ HR, ↓ BP and ↓ contractility in a doserelated manner. Onset of action is within minutes to control SVT with rapid ventricular rate or hypertension.</strong> | <strong>IV bolus: may be given undiluted only use 10 mcg/mL vial for this</strong> Infusion: 5000 mcg/500 mL NS (10 mg/mL) pre-made bag | | | | | | | <strong>Challenge at 48hrs (turn infusion off for 4 hrs)</strong> |
| <strong>Fenoldopam (Corlopam®)</strong> | **Peripherally acting rapid vasodilator. D1 agonist, moderate ↓ 2 affinity. Dose dependent ↓ renal blood flow, ↓ GFR and ↓ BP. <strong>Must meet guideline criteria for use.</strong> | <strong>Infusion: 10 mcg/250 mL NS (40 mcg/mL) hypertensive crisis</strong> | <strong>20 mcg/100 mL in NS or D5W (20 mg/mL)</strong> | | | | | | | <strong>Dose/Site Dependent General</strong> |
| <strong>Fentanyl (Sublimaze®, Duragesic®)</strong> | <strong>Opium-derived, narcotic analgesic. Rapid onset, short duration of action. CNS depressant, respiratory depressant, minimal cardiovascular effects.</strong> | <strong>Infusion or PCA: 1000 mcg/100 mL (10 mcg/mL) pre-made bag Epidural: 2.5, 5 or 10 mcg/mL, with bupivacaine 0.1% in 250 mL NS</strong> | | | | | | | <strong>Minimum: SPO2 or ETCO2 (preferred)</strong> | <strong>↓ BP, ↓ RR, HR, GI effects, and CNS effects. Pain scale assessment for Analgesia. If given for procedures (with midazolam), requires Level II conscious sedation certification</strong> |</p>
<table>
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<th>Drug</th>
<th>Action/Effects</th>
<th>Dosage/Route</th>
<th>Administration Description</th>
<th>Monitoring/ACUITY Level</th>
<th>Minimum:</th>
</tr>
</thead>
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<tr>
<td>Furosemide (Lasix®)</td>
<td>Potent loop diuretic. Works in the Loop of Henle to excrete H₂O, Na⁺, K⁺, Cl⁻.</td>
<td>10 mg/mL undiluted drug  (1000 mg/100 mL) Must be properly protected from light</td>
<td>Titrated to effect, infusion rate should not exceed 240 mg/hr (not to exceed 2000 mg/24 hr)</td>
<td>GENERAL</td>
<td>PORTABLE</td>
</tr>
<tr>
<td>Heparin</td>
<td>Anticoagulant which acts to inhibit conversion of prothrombin to thrombin and fibrinogen to fibrin, and reduce platelet adhesiveness. Established clot is not dissolved.</td>
<td>40 units/mL in DSW (20,000 units/500 mL pre-made bag)</td>
<td>Various concentrations given for IV use. Maximum infusion concentration 200 units/mL DSW or NS</td>
<td>GENERAL</td>
<td>aPTT, PT, ACT, PLTS, bleeding</td>
</tr>
<tr>
<td>Hydromorphone (Dilaudid®)</td>
<td>Opium-derived, narcotic analgesic. CNS depressant, respiratory depressant, some cardiovascular effects.</td>
<td>PCA: 40 mg/200 mL NS (0.2 mg/mL infusion: Individualized per patient)</td>
<td>10 mg/mL undiluted drug may be diluted per request to yield various concentrations for PCA or continuous infusion, DSW or NS</td>
<td>GENERAL</td>
<td>SPO2 or ETOCO2 (preferred)</td>
</tr>
<tr>
<td>Insulin, regular (Humulin R ®)</td>
<td>Pancreatic hormone responsible for storage, metabolism and uptake of carbohydrates, fats, and protein.</td>
<td>1 unit/mL in NS (150 units/150 mL)</td>
<td>0.1-1 unit/mL in NS or %NS</td>
<td>INTERMEDIATE-ICU &amp; RENAL TRANSPLANTS</td>
<td>Hypoglycemia (FSBS) ONLY Regular insulin can be given IV &amp; MONITORING/ACUITY LEVEL</td>
</tr>
<tr>
<td>Isoproterenol (Isuprel®)</td>
<td>Synthetic sympathomimetic with β₁ and β₂ effects. Positive inotropic/chronotrope, HR. Improves AV conduction, also potent bronchodilator and Δ SVR by relaxing arterial smooth muscle.</td>
<td>1 mg/500 mL in DSW (2 mcg/ml) Max: 4 mg/250 mL in DSW (16 mcg/ml)</td>
<td>Central: 2.10 mcg/min (caution with higher doses)</td>
<td>HARDWARE</td>
<td>1 HR, arrhythmias, ΔBP, flushing, HA, pulmonary edema</td>
</tr>
<tr>
<td>Labetalol (Trandate®)</td>
<td>An α-β₁-β₂ adrenergic blocking agent. Causes dose-related ΔBP without significant ΔHR or reflex tachycardia.</td>
<td>IV bolus: May be given undiluted (5 mg/mL) infusion: 500 mg/250 mL DSW or NS (2 mg/mL)</td>
<td>Central: IV bolus: 20 mg over 2 min (may repeat q10 min until goal BP met, up to 300 mg)</td>
<td>INTERMEDIATE-ICU</td>
<td>PORTABLE</td>
</tr>
<tr>
<td>Lepirudin (Refludan®)</td>
<td>For HIT (heparin-induced thrombocytopenia) Recombinant hirudin anticoagulant, highly specific direct thrombin inhibitor. Inhibits both free and clot-bound thrombin.</td>
<td>IV bolus: 5 mg/mL in NS prepared in syringe infusion: 100 mg/500 mL NS (0.2 mg/ml) 100 mg/250 mL NS (0.4 mg/ml)</td>
<td>Peripheral: IV bolus: 0.4 mg/kg (up to 110 kg) over 1 min ΔTitrated to BP response</td>
<td>INTERMEDIATE-ICU</td>
<td>MONITORING</td>
</tr>
<tr>
<td>Lidocaine (Xylocaine®)</td>
<td>Local anesthetic and Class I antiarrhythmic. Decreases ventricular excitability and automatically by increasing the stimulation threshold of the ventricle, without depressing the force of contractions. Undergoes high first-pass metabolism, causes CNS stimulation.</td>
<td>IV bolus: 100 mg/5 mL syringe (2%) infusion: 2 mg/250 mL DSW (8 mg/ml) pre-made bag</td>
<td>Peripheral Titrated to effect 8 mg/mL in DSW</td>
<td>INTERMEDIATE-ICU</td>
<td>HARDWARE</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>IV bolus: 0.5-1.5 mg/kg (50-100 mg) ΔTitrated to effect 8 mg/mL in DSW (8 mg/ml) pre-made bag</td>
<td></td>
<td>1 HR, ΔBP, CNS effects (confusion, nervousness, seizure), cardiovascular collapse, arrhythmias, Lidocaine levels</td>
</tr>
<tr>
<td>Drug</td>
<td>Description</td>
<td>Concentration</td>
<td>Route</td>
<td>Effect/ Concentration</td>
<td>Toxicity/ Hazard</td>
</tr>
<tr>
<td>--------------</td>
<td>------------------------------------------------------------------------------</td>
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</tr>
<tr>
<td>Lorazepam</td>
<td>Longer-acting benzodiazepine with sedative, anxiolytic, amnestic and anticonvulsant properties.</td>
<td>0.1 mg/mL in D5W glass bottle only (20mg/200ml)</td>
<td>Peripheral</td>
<td>Titrated to effect, start infusion @ 1mg/hr</td>
<td>DOSE DEPENDENT</td>
</tr>
<tr>
<td>Methadone</td>
<td>Opioid analgesic, CNS depressant, respiratory depressant, some cardiovascular effects</td>
<td>1 mg/mL in NS</td>
<td>Peripheral</td>
<td>Titrated to effect Decrease in dose may be needed after 2-5 days due to accumulation</td>
<td>INTERMEDIATE-ICU</td>
</tr>
<tr>
<td>Midazolam</td>
<td>Short-acting benzodiazepine with sedative, anxiolytic and amnestic properties.</td>
<td>1 mg/mL in NS 50mg/50ml</td>
<td>Peripheral</td>
<td>Cl: Start at 1mg/hr Titrated to effect by increasing 1mg q20 min to desired effect.</td>
<td>ICU</td>
</tr>
<tr>
<td>Milrinone</td>
<td>Phosphodiesterase inhibitor with positive inotropic and vasodilatory properties. 1 CO without significant ↑ HR or ↑ myocardial O2 demand. ↓ SVR, preload and afterload.</td>
<td>Load: May be given undiluted (1 mg/mL vial) IV infusion: 20 mg/100 mL D5W (0.2 mg/mL pre-made)</td>
<td>Peripheral</td>
<td>IV load: 50 mcg over 10 minutes Cl: 0.25-1 mcg/kg/min</td>
<td>DOSE DEPENDENT</td>
</tr>
<tr>
<td>Morphine</td>
<td>Opium-derived, narcotic analgesic, CNS depressant, respiratory depressant. Histamine release may ↓ BP, ↑ myocardial O2 demand.</td>
<td>Infusion/PCA: 100 mg/100 mL D5W (1mg/mL pre-made)</td>
<td>Peripheral</td>
<td>Titrated to effect</td>
<td>DOSE DEPENDENT</td>
</tr>
<tr>
<td>Nesiritide</td>
<td>Arterial and venous vasodilator that possesses a dose dependent ability to reduce PCWP.</td>
<td>1.5 mg/250 mL (6 mcg/mL in D5W)</td>
<td>Central</td>
<td>Initial bolus dose of 2mcg/kg (withdraw bolus from the prepared infusion bag and administer over 60 seconds) followed by a Cl of 0.01 mcg/kg/min. At intervals ≥ 3 hours: 0.026 mcg/kg/min (preceded by a bolus of 1 mcg/kg) up to a maximum dose of 0.03 mcg/kg/min.</td>
<td>DOSE DEPENDENT</td>
</tr>
<tr>
<td>Nicardipine</td>
<td>Dihydropyridine calcium channel blocker. ↓ BP, ↓ SVR (coronary and peripheral vasodilation), ↑ CO</td>
<td>40mg/200ml (0.2mg/ml)</td>
<td>Central Line ONLY</td>
<td>Cl: 5-15 mg/hr Reduce to lowest required dose when BP is controlled</td>
<td>ICU</td>
</tr>
</tbody>
</table>

*Note: BP = blood pressure, HR = heart rate, CO = cardiac output, SVR = systemic vascular resistance, SPO2 = arterial oxygen saturation, ETCO2 = end-tidal carbon dioxide, Cl = clearance.*
<table>
<thead>
<tr>
<th><strong>Nitroglycerin</strong></th>
<th>Vascular smooth muscle relaxer and vasodilator, iBP, preload and afterload, myocardial G2 demand, i pulmonary and systemic vascular resistance.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Nitroprusside (Nitropress®)</strong></td>
<td>Potent, rapid-acting antihypertensive. Produces peripheral vasodilation through direct action on venous and arterial smooth muscles. Metabolized in RBCs to cyanide, then in the liver to thiocyanate. Excreted 98% by kidneys. Liver or kidney dysfunction can affect metabolism and elimination.</td>
</tr>
<tr>
<td><strong>Norepinephrine (Levophed®)</strong></td>
<td>Natural sympathomimetic catecholamine, 1 agonist. Causes peripheral vasoconstriction, stimulates cardiac contractility and dilates coronary arteries. iHR, iSVR.</td>
</tr>
<tr>
<td><strong>Octreotide (Sandostatin®)</strong></td>
<td>Somatostatin analog, suppresses release of growth hormone, and other gastro-pancreatic peptides (insulin, gastrin, glucagon, etc). Stimulates fluid and electrolyte absorption from the GI tract and prolongs transit time.</td>
</tr>
<tr>
<td><strong>Phenylephrine (NeoSyneprine®)</strong></td>
<td>Synthetic sympathomimetic acting primarily on 1 adrenergic receptors. Causes potent vasoconstriction, lacks chronotropic or inotropic properties, iHR.</td>
</tr>
<tr>
<td><strong>Procainamide (Pronestyl®)</strong></td>
<td>Class 1 antiarrhythmic which i HR, slowing conduction velocity and prolonging the refractory period. Metabolized in the liver to an active NAPA metabolite.</td>
</tr>
<tr>
<td><strong>Propofol (Diprivan®)</strong></td>
<td>Potent, emulsified, sedative-hypnotic agent. Can provide conscious or unconscious sedation, depending on dose. Onset of action is rapid, as is recovery after discontinuation. Minimal impact on cardiac parameters.</td>
</tr>
</tbody>
</table>

**DOSE/AQUITY DEPENDENT**

- **INTERMEDIATE-ICU**
  - **Nitroglycerin**
    - CI: 5-200 mcg/min, or 0.25-3 mcg/kg/min ↑ by 5 mcg/min every 5 minutes (or 1 by 0.1-0.25 mcg/kg/min every 3-5 min)
    - MAX DOSE: 200 mcg/min.
  - **Nitroprusside (Nitropress®)**
    - CI: 0.3-0.5 mcg/kg/min (1 by 0.5 mcg/kg/min q3-5min) Not to exceed 10 mcg/kg/min
  - **Norepinephrine (Levophed®)**
    - CI: 0.01-0.2 mcg/kg/min ↑ by 0.01-0.1 mcg/kg/min. MAX: 2 mcg/kg/min
  - **Octreotide (Sandostatin®)**
    - IV bolus: 25-50 mcg over 3 minutes, followed by CI. 25-50 mcg/hr (up to 250 mcg/hr may be used in high-output fistulas)
  - **Phenylephrine (NeoSyneprine®)**
    - CI: 1-3 mcg/kg/min. ↑ by 0.5-1 mcg/kg/min. MAX: 5 mcg/kg/min
  - **Procainamide (Pronestyl®)**
    - IV Load: 200-1000 mg diluted in DSW. Not to exceed 20 mg/kg/min. Max initial dose 17 mg/kg or 1gm
    - CI: 1-6 mcg/min
  - **Propofol (Diprivan®)**
    - CI: start at 10 mcg/kg/min. Titrate slowly q6-10 min by 5-10 mcg/kg/min increments to desired sedation

**Minimum:**

- **TELEMETRY MONITORING**
  - Dose dependent. iHR, iBP, HA, Flashing Tolerance may develop if continued >24 hrs
- **PORTABLE MONITOR-**
  - iBP, iSVR, may slightly ↓ HR or CO. Flashing. HA. Renal function, hepatic function. Cyanide, thiocyanate or Methemoglobin levels for prolonged use or suspected toxicity.
  - **HARDWIRE**
    - HR, arrhythmias, iBP, HA \& CO
    - Infuse via central line to avoid extravasation.
- **Blood sugars, GI effects, HA, LFTs**
- **Minimum:**
  - **PORTABLE MONITOR-**
    - iBP, HA, arrhythmias. Infuse via central line to avoid extravasation.
<table>
<thead>
<tr>
<th>Medication</th>
<th>Information</th>
<th>Available in four different via concentrations</th>
<th>CADD: Most patients will start at 1 mg/kg/min. Each patient has a unique way of mixing CADD. CADD cassettes are stable for 86 hours (first 48 hours in fridge then last 48 hours being infused into patient) SQ: The syringe will be undiluted drug</th>
<th>ICU: Administration limited to treprostinil competency certified nurse. Flushing, HA, NV, I BP, chest pain, anxiety, dizziness, bradycardia, and dyspnea, jaw pain. Pain at SQ site. Double check calculations and settings! Do NOT let bag run dry sudden death can occur</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treprostinil (Remodulin®)</td>
<td>Direct dilator of both pulmonary and systemic arterial vascular beds, also inhibit platelet aggregation. Half life of 2-4 hours. Infusion: Administered via CADD Pump. Dilution based on Patient's weight and dose. (Ask patient for current dilution, dosing weight &amp; rate from home when readmitted.) Normal rate administered 25-45 mL/day SQ: 3 ml syringe changed q72 hours</td>
<td>1 mg/ml 2.5 mg/ml 5 mg/ml 10 mg/ml</td>
<td>Verify concentration used to make CADD or Syringe with patient</td>
<td></td>
</tr>
<tr>
<td>Vasopressin (Pitressin®)</td>
<td>Most commonly used to replenish vasopressin deficiencies in septic shock or after cardiopulmonary bypass. Among many complex physiologic action, vasopressin most notably ↑ SVR, ↑ responsiveness of catecholamines and ↑ free water retention. 100 units/500 mL in either D5W or NS (0.2units/mL)</td>
<td>1 unit/mL in NS or D5W (Gl bleed concentration) CAUTION WITH INFUSION UNITS ORDERED (i.e. units/min versus units/hour) 5ICU: When ordering &quot;units/min&quot; is preferred</td>
<td>Sepsis &amp; Hypotension: Ct: 0.01-0.04 units/min DO NOT TITRATE CT Surgery: 0.035-0.07 units/min; MAX: 0.1 units/min Variceal Hemorrhage: 0.2-0.4 units/min MAX: 0.8 units/min</td>
<td>ICU: HARDWIRE ↑ BP, ↑ sodium, at higher doses (e.g. &gt; 0.04 units/min) coronary and mesenteric artery vasocostriction has been reported</td>
</tr>
<tr>
<td>Vecuronium (Norcuron®)</td>
<td>Nondepolarizing neuromuscular blocking agent with rapid onset and intermediate duration of action. IV Bolus: dilute to 2 mg/mL with SW Infusion: 50 mg/50 mL NS (1 mg/mL)</td>
<td>0.1-1 mg/mL in NS or D5W</td>
<td>Central</td>
<td>IV bolus: 80-100 mcg/kg Ct: 0.6-1.7 mcg/kg/min Titrates to effect (TCP)</td>
</tr>
</tbody>
</table>