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Inotropic Clinical Guideline for Home Intravenous Therapy

Section: Clinical Guideline
Compliance: ACHC Infusion Pharmacy
ACHC Standards: N/A
URAC Standards: N/A
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Approved by, Title and Date Approved: Kathleen Patrick, President, 3/10/2025

I. BACKGROUND

Inotropic agents, including Dobutamine, Dopamine, and Milrinone, are utilized in the management of end-stage congestive heart failure (CHF) when conventional treatments are no longer effective. These medications enhance myocardial contractility and stroke volume, leading to improved cardiac output while minimizing increases in heart rate and mean arterial pressure.

Additionally, inotropic therapy can provide hemodynamic support for patients awaiting cardiac transplantation, helping to stabilize their condition. The following guideline outlines the safe and effective use and administration of inotropic agents for home intravenous therapy.

II. PATIENT ACCEPTANCE CRITERIA

A. All candidates for home care service must be evaluated by the clinician(s) and deemed appropriate to receive home care based upon the dispensing pharmacy's admission criteria.

B. All patients will receive two teaching sessions in the hospital before starting service. The second session will include the hookup of the first inotropic bag.

C. Physician orders for inotropic therapy must include:

1. Patient weight
2. Drug and weight-based dosage
3. Route of administration
4. Frequency of administration
5. Emergency medications per protocol
6. Line care protocol
7. Routine lab monitoring, if applicable

D. Baseline labs or tests prior to starting therapy including but not limited to electrolytes, BUN, Cr, potassium, and magnesium.

III. PHARMACOLOGY OVERVIEW

Refer to manufacturer's full Prescribing Information for most up to date information

A. Indications

1. Short-term inotropic support in adults with cardiac decompensation.

B. Dosing

1. Milrinone - 0.125 to 0.75 mcg/kg/minute IV continuous infusion
2. Dobutamine - 2.5 to 20 mcg/kg/minute IV continuous infusion
3. Dopamine - 5 to 15 mcg/kg/minute; doses at lower end of this range are preferred as inotropic actions predominate at lower doses.

*Dosing is based off actual body weight. Inotropic agents have not been studied extensively in extremes of body weights

C. Dose Adjustment

1. Milrinone – Reduction in infusion rate may be necessary in patients with renal impairment. The suggested infusion rates are as follows:

Creatinine Clearance (mL/min/1.73 m(2))	Infusion Rate in mcg/kg/min
5	0.2
10	0.23
20	0.28
30	0.33
40	0.38
50	0.43
mL=milliliter; min=minute; m(2)=square meter; mcg=microgram; kg=kilogram	

2. Dobutamine
    a. No specific recommendations available
3. Dopamine
    a. No specific recommendations available

D. Duration

1. Duration of therapy is dependent on patient response, adverse reactions, and goals of therapy

E. Contraindications:

1. Milrinone – none
2. Dobutamine

    a. Hypersensitivity to corn products (D5W premix)
    b. Idiopathic hypertrophic subaortic stenosis

3. Dopamine

    a. Pheochromocytoma
    b. Uncorrected tachyarrhythmias or ventricular fibrillation

F. Warnings and Precautions:

1. All Inotropes

    a. Concerns Related to Adverse Effects:

        1) Arrhythmias: Ventricular arrhythmias, including non-sustained ventricular tachycardia and supraventricular arrhythmias, have been reported. Monitor closely in patients with decompensated heart failure, as sudden cardiac death has been observed. Ensure ventricular rate control in atrial fibrillation/flutter prior to initiation; therapy may increase ventricular response rate.
        2) Blood Pressure Effects: Increased blood pressure is more common due to augmented cardiac output; however, hypotension secondary to vasodilation may occur at higher doses.
        3) Heart Failure Complications: Prolonged use in patients with NYHA Class III/IV heart failure is associated with an increased risk of hospitalization and death.
        4) Tachycardia: May cause dose-related increases in heart rate.
        5) Ventricular Ectopy: May exacerbate ventricular ectopy in a dose-related manner.

    b. Disease-Related Concerns:

        1) Aortic Stenosis: Therapeutically ineffective for patients with severe aortic stenosis or other mechanical obstructions.
        2) Electrolyte Imbalance: Correct hypokalemia or hypomagnesemia prior to and during therapy to reduce the risk of arrhythmias.
        3) Myocardial Ischemia or Recent Myocardial Infarction: Use with caution, as therapy can increase myocardial oxygen demand.

    c. Pregnancy and Lactation

        1) Data on the use of inotropic agents in pregnant and lactating women are limited. Animal studies have not shown evidence of teratogenicity or fetal harm from in utero exposure, but no human studies have documented outcomes or adverse effects on offspring. Additionally, there are limited reports on the use of inotropic agents during

lactation, and their effects on nursing infants are unknown. Use with caution due to the lack of human data.

2. Milrinone

    a. Disease Related Concerns

        1) Kidney Impairment: Exercise caution in patients with kidney dysfunction; reduce infusion rates as needed, as hypotension may be prolonged in these patients.

3. Dobutamine

    a. Dosage Form-Specific Issues:

        1) Sodium Sulfite: Product may contain sodium sulfite, which may pose risks to sensitive individuals such as asthmatics.

4. Dopamine

    a. Allergic type reactions including anaphylactic symptoms and life-threatening asthmatic episodes in patients with sulfite sensitivity may occur; increased risk in asthmatic patients as compared with non-asthmatic patients.

G. Pharmacokinetics

1. Milrinone

    a. Absorption: Onset of Action: IV: 5 to 15 minutes.
    b. Distribution: Heart failure (continuous infusion): Vd: 0.45 L/kg. Protein Binding: ~70%.
    c. Metabolism: Predominantly excreted unchanged; minor hepatic metabolism.
    d. Half-Life Elimination: Heart failure: 2.3 to 2.4 hours. Primarily excreted via urine (83% as unchanged drug, 12% as O-glucuronide metabolite). Active tubular secretion is a major elimination pathway.

2. Dobutamine

    a. Absorption: Onset of action: IV: 1 to 10 minutes, peak effect: 10 to 20 minutes
    b. Distribution: Vd:0.2 L/kg
    c. Metabolism: In tissues and hepatically (via conjugation and methylation) to inactive metabolites.
    d. Half-life elimination: 2 minutes. Primarily excreted in urine inactive metabolites.

3. Dopamine

    a. Onset of action: Within 5 minutes.
    b. Distribution: 1.81 to 2.45 L/kg
    c. Metabolism: Renal, hepatic, plasma; 75% to inactive metabolites by monoamine oxidase and 25% to norepinephrine (active).
    d. Half-life elimination: ~2 minutes. Primarily excreted renally: 80% as metabolites, small portion excreted unchanged.

H. Adverse Reactions:

1. Milrinone

a. Cardiovascular Effects:

1) Angina pectoris: 1.2% incidence.
2) Postoperative atrial fibrillation: Increased incidence (58.2% in perioperative patient).
3) Hypotension: 2.9% incidence.
4) Supraventricular tachycardia: 3.8% incidence.
5) Torsades de pointes: Rare.
6) Ventricular arrhythmia: 12.1% incidence, including ventricular ectopy (8.5%) and non-sustained ventricular tachycardia (2.8%).

b. Endocrine/Metabolic Effects:

1) Hypokalemia: 0.6% incidence

c. Hematologic Effects:

1) Thrombocytopenia: 0.4% incidence

d. Hepatic Effects:

1) Abnormal liver function tests reported in post marketing studies.

e. Immunologic Effects:

1) Anaphylaxis and anaphylactic shock are reported in isolated cases.

f. Neurologic Effects:

1) Headache: 2.9% incidence.

g. Respiratory Effects:

1) Bronchospasm reported rarely in post marketing studies.

2. Dobutamine

a. Cardiovascular:

1) Angina pectoris (1% to 3%)
2) Chest pain (1% to 3%)
3) Increased heart rate (10%)
4) Increased systolic blood pressure (8%)
5) Palpitations (1% to 3%)
6) Premature ventricular contractions (5%)
7) Eosinophilic myocarditis (up to 7%)

b. Gastrointestinal

1) Nausea (1% to 3%)

c. Nervous system

1) Headache (1% to 3%)

d. Respiratory

1) Dyspnea (1% to 3%)

e. Frequency not defined: Decreased blood pressure, ventricular tachycardia, decreased serum potassium, localized phlebitis

f. Post marketing:

1) Atrial fibrillation
2) Bradycardia
3) Cardiomyopathy
4) Coronary artery vasospasm
5) Heart block
6) Left ventricular dysfunction
7) Torsade de pointes
8) Eosinophilia
9) Hypersensitivity reaction
10) Chills, shivering
11) Myoclonus

3. Dopamine

a. Post marketing:

1) Angina pectoris
2) Atrial fibrillation
3) Bradycardia
4) Cardiac conduction disorder
5) Ectopic beats
6) Hypertension
7) Hypotension
8) Palpitations
9) Tachycardia
10) Vasoconstriction
11) Ventricular arrhythmia
12) Widened QRS complex on ECG
13) Peripheral gangrene
14) Piloerection
15) Nausea, vomiting
16) Azotemia
17) Anxiety
18) Headache
19) Dyspnea

b. Drug Interactions: drug-drug interactions may exist. Consult interaction database for patient specific assessment.

4. Milrinone

    a. Anagrelide - may result in increased bleeding risk; additive vasodilation; increased risk of tachycardia, palpitations, and heart failure.

5. Dobutamine

    a. Monoamine Oxidase Inhibitors: Use with extreme caution in patients on monoamine oxidase inhibitors due to the risk of prolonged hypertension.
    b. COMT inhibitors: May result in increased risk of hypertensive reaction, including intracerebral hemorrhage.
    c. Beta-Blockers: May diminish the therapeutic effect of Dobutamine.

6. Dopamine

    a. Monoamine Oxidase Inhibitors: May enhance the hypertensive effect of Dopamine.
    b. COMT inhibitors: May result in increased risk of arrhythmias, increased heart rate, and excessive changes in blood pressure.
    c. Ergot Derivatives (Vasoconstrictive CYP3A4 Substrates): May enhance the vasoconstricting effect of Alpha-/Beta-Agonists.

I. Compatibility:

1. Milrinone

    a. Compatible with 0.45% NaCl, 0.9% NaCl, or D5W

2. Dobutamine

    a. Compatible with multiple solutions, however D5W is preferred due to extended stability.

3. Dopamine

    a. Compatible with 0.9% NaCl, D5W, D5-0.9%NaCl, D5-0.45%NaCl, D5LR, LR

J. How supplied:

1. Milrinone – Supplied as a clear, colorless to pale yellow intravenous solution available in both vials (to be further compounded) and premixes

2. Dobutamine - Dobutamine is a clear, practically colorless, sterile, nonpyrogenic solution available in both vials (to be further compounded) and premixes

3. Dopamine - Dopamine is a clear, practically colorless solution available in both vials (to be further compounded) and premixes.

***Note: Compounded sterile preparation (CSP) or premix product should be dispensed in final form from the compounding pharmacy to facilitate optimal BUD assessment per USP 797.**

K. Storage and Handling (commercially available, pre-manufactured inotropes):

1. Commercially available products: Store at 20°C to 25°C (68°F to 77°F)

2. Compounded sterile preparations: Storage of CSP is highly dependent on multiple factors. Refer to USP 797 for recommended storage.

IV. ADMINISTRATIVE GUIDELINES

A. For all inotropes, the dosing weight must be documented on the order. Do not adjust the infusion rate based on the patient's current weight. Always refer to the most recent order for the correct infusion rate.

B. For all inotropes, use a calibrated electronic infusion device when administering by continuous infusion. Additionally, a backup infusion device will be dispensed for all patients.

C. Do not administer bolus doses of inotropes. To prevent an inadvertent bolus when accessing the line or discontinuing the infusion, aspirate at least 5 mL of blood from the venous access device before flushing with normal saline and heparin.

D. Dobutamine

1. Do not administer simultaneously with other agents or diluents containing sodium bisulfate or ethanol, and do not mix with any other strongly alkaline solution or any other agents [5]

E. Dopamine

1. Do not use alkaline diluent solutions with Dopamine.

2. A large vein, such as the antecubital vein, should be utilized to reduce the risk of extravasation into surrounding tissues. The administration should be relocated to a large vein as necessary, monitoring recommended.

3. Maximum infusion rate is 50 mcg/kg/minute

4. Dopamine solution is light sensitive and should be stored protected from light.

V. NURSING PROCEDURE

A. Supplies may include but are not limited to:

1. Alcohol Swabs
2. Gloves
3. Tape
4. IV access supplies as applicable

B. Peripherally Inserted Central Catheter (PICC) or Central Venous Catheter (CVC)

1. Central line dressing change Kit

2. Securement Dressing

    a. Secondary securement device as appropriate)

3. Needless connector

    a. Extension set 12" as appropriate

4. Port access supplies for patients with a port

    a. Port needle (ex. 22 Gauge x ¾ to 1" safe step)
    b. Needless connector
    c. Central line dressing change kit

5. Supplies for ambulatory infusion pump (x2):

    a. Ambulatory pump tubing
    b. Pump pouch
    c. Electronic ambulatory pump
    d. Disposable batteries or AC charging cord for ambulatory pump)
    e. Battery change or charging procedure teaching sheet
    f. Continuous delivery mode teaching sheet
    g. Pump return box

C. Prescription items: (examples below)

1. Compounded inotrope
2. Standard flushes per protocol

D. Procedures:

1. Explain the reasoning for visit and use of inotropes for heart failure. Educate patients on disease process and medication.

2. Don gloves.

3. Assess line for signs and symptoms of infection and complete line dressing change. Notify the ordering physician and pharmacist if line infection suspected. Educate patient on IV-line complications, line access procedures, and what to do if any complications arise.

4. Obtain labs if ordered.

5. Complete head to toe assessment of patient and record weight. Remind patients to weigh themselves daily. Educate the patient on recognizing signs and symptoms of worsening heart failure and provide guidance on whom to contact in such cases.

6. Visually inspect CSP to ensure product integrity. Perform or teach inotrope bag change and line maintenance. Educate patients against stopping the infusion at any point unless instructed to do so

by a healthcare professional and the importance of alternating with 2nd backup pump to ensure both are always functional and programmed. IV line not to be flushed between bag or tubing changes.

7. Infusion Rates: Always refer to the most recent order for the correct infusion rate.

8. Post infusion flush: To prevent an inadvertent bolus when accessing the line or discontinuing the infusion, aspirate at least 5 mL of blood from the venous access device before flushing with normal saline and heparin.

VI. CLINICAL MONITORING

A. During therapy:

1. Monitoring (with each visit)

a. Cardiopulmonary status

1) Blood pressure: Notify physician of systolic BP decreases more than 10 mm Hg from baseline.
2) Apical pulse: Notify physician of pulse increases more than 10-15 beats per minute or if different in rhythm and/or quality from baseline.
3) Respiratory rate: Notify physician of an increase of more than 10 breaths/minute or if shortness of breath increases from baseline or if rales are present.
4) Weight: Notify physician of weight gain of more than 2 pounds in 24 hours or 4 pounds in a week from baseline.
5) Intake and Output: Notify physician of any deviation from normal urinary output.
6) Edema and/or jugular vein dilation: Notify physician of changes.

2. Review of systems per company protocol.

a. Status of venous access site.
b. Verify the quantity of compounded bags on hand to ensure uninterrupted continuity of care.

3. Patient Teaching (with each visit)

a. Patient understanding and compliance with treatment plan of care.
b. Signs and symptoms of pulmonary congestion, secondary to decreased cardiac output that require notification of the physician:

1) Increasing shortness of breath
2) Edema
3) Productive cough
4) Decreased urinary output
5) Fluttering of palpitations of the heart.
6) Cold extremities
7) Diaphoresis.

4. Operation, maintenance, and troubleshooting of infusion pump.

5. Labs

    a. CMP, CBC

Please refer to the package insert for the most up to date guidance on this medication.

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