milrinone (mil-rin-one)

**Classification**: Inotropics

**Pregnancy Category**: C

**Indications**: Short-term treatment of HF unresponsive to conventional therapy with digoxin, diuretics, and vasodilators.

**Action**: Increases myocardial contractility. Decreases preload and afterload by a direct dilating effect on vascular smooth muscle. **Therapeutic Effect**: Increased cardiac output.

**Pharmacokinetics**

**Absorption**: IV administration results in complete bioavailability.

**Distribution**: Unknown.

**Metabolism and Excretion**: 80–90% excreted unchanged by the kidneys. 20% excreted as metabolites in urine.

**Half-life**: 2.3 hr (increased in renal impairment).

**TIME/ACTION PROFILE (hemodynamic effects)**

<table>
<thead>
<tr>
<th>ROUTE</th>
<th>ONSET</th>
<th>PEAK</th>
<th>DURATION</th>
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</thead>
<tbody>
<tr>
<td>IV</td>
<td>5–15 min</td>
<td>unknown</td>
<td>3–6 hr</td>
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</table>

**Contraindications/Precautions**

- **Contraindicated in**: Hypersensitivity; Severe aortic or pulmonic valvular heart disease; Hypertrophic subaortic stenosis (may cause outflow tract obstruction).

- **Use Cautiously in**: History of arrhythmias, electrolyte abnormalities, abnormal digoxin levels, or insertion of vascular catheters (risk of ventricular arrhythmias); Renal impairment; OB, Lactation: Pregnancy or lactation.

**Adverse Reactions/Side Effects**

- **CNS**: Headache, tremor.
- **CV**: Arrhythmias, angina pectoris, chest pain, hypotension, supraventricular arrhythmias.
- **GI**: Liver enzymes.
- **Musculoskeletal**: Myalgia.
- **Skin**: Rash.

**Interactions**

**Drug-Drug**: None significant.

**Route/Dosage**

**IV (Adults)**: Loading dose—50 mcg/kg followed by continuous infusion at 0.5 mcg/kg/min (range: 0.375–0.75 mcg/kg/min).

**IV (Infants and Children)**: Loading dose—50 mcg/kg over 10 min followed by continuous infusion at 0.5 mcg/kg/min (range: 0.25–0.75 mcg/kg/min).

**NURSING IMPLICATIONS**

**Assessment**

- Monitor heart rate and BP continuously during administration. Slow or discontinue if BP drops excessively.
- Monitor intake and output and daily weight. Assess patient for resolution of signs and symptoms of HF (peripheral edema, dyspnea, rales/crackles, weight gain) and improvement in hemodynamic parameters (increase in cardiac output and cardiac index, decrease in pulmonary capillary wedge pressure).
- Monitor ECG continuously during infusion. Arrhythmias are common and may be life threatening. The risk of ventricular arrhythmias is increased in patients with a history of arrhythmias, electrolyte abnormalities, abnormal digoxin levels, or insertion of vascular catheters.
- **Lab Test Considerations**: Monitor electrolytes and renal function frequently during administration. Correct hypokalemia prior to administration to decrease the risk of arrhythmias.
- Monitor platelet count during therapy.
- **Potential Nursing Diagnoses**: Decreased cardiac output (Indications)

**Implementation**

- **High Alert**: Accidental overdose of milrinone can cause patient harm or death. Have second practitioner independently check original order, dose calculations, and infusion pump settings.

**Interactions**

**Drug-Drug**: None significant.
IV Administration

- **pH:** 3.2–4.0
- **Direct IV:** Loading dose may be administered undiluted. May also be diluted in 0.9% NaCl, 0.45% NaCl, or DW for ease of administration. **Concentration:** 1 mg/mL. **Rate:** Administer the loading dose over 10 min.

- **Continuous Infusion:** Milrinone drawn from vials must be diluted. Dilute 10 mg (10 mL) of milrinone in 40 mL of diluent or 20 mg (20 mL) of milrinone in 80 mL of diluent. See manufacturer's instructions for further dilutions. Compatible diluents do not cause discoloration or contain particulate matter. **Concentration:** 200 mcg/mL. **Rate:** Based on patient's weight (see Route/Dosage section). Titrate according to hemodynamic and clinical response.

- **Y-Site Compatibility:** acyclovir, alfentanil, allopurinol, amifostine, amikacin, aminophylline, amiodarone, amphotericin B liposome, ampicillin, anidulafungin, argatroban, atracurium, aztreonam, bleomycin, bivalirudin, bumetanide, buprenorphine, busulfan, butorphanol, calcium chloride, calcium gluconate, carboplatin, carmustine, caspofungin, cefazolin, cefepime, cefotaxime, cefotetan, cefoxitin, ceftaroline, ceftazidime, chloramphenicol, chlorpromazine, ciprofloxacin, cisatracurium, cisplatin, clindamycin, cyclophosphamide, cyclosporine, cyclosporine, dactinomycin, daptomycin, dexamethasone sodium phosphate, dexmedetomidine, doxorubicin, doxycycline, droperidol, enalaprilat, ephedrine, epinephrine, epirubicin, eptifibatide, ertapenem, erythromycin, etoposide, etoposide phosphate, fenoldopam, fentanyl, fluconazole, fludarabine, fluorouracil, ganciclovir, gemcitabine, gentamicin, glycopyrrolate, granisetron, haloperidol, heparin, hetastarch, hydralazine, hydrocortisone, hydromorphone, idarubicin, ifosfamide, insulin, irinotecan, isoproterenol, ketamine, ketorolac, labetalol, levofloxacin, magnesium sulfate, mannitol, mecobalamin, melphalan, meperidine, mercaptopurine, mesna, methotrexate, methyldopate, methylprednisolone sodium succinate, metoclopramide, metoprolol, meropenem, mepron, methyldopa, meropenem, metronidazole, milrinone, mitoxantrone, morphine, morphine, moricizine, mexitilene, nitroglycerin, norepinephrine, ondansetron, oxacillin, oxaliplatin, oxaliplatin, pazopanib, penicillin, penicillin, piperacillin, potassium acetate, potassium chloride, potassium phosphates, propranolol, propofol, propylthiouracil, quinupristin/dalfopristin, ranibizumab, ranitidine, remifentanil, rocuronium, sodium acetate, sodium bicarbonate, sodium phosphate, streptomycin, succinylcholine, suvorexant, sucrose, sulfamethoxazole, sulfadiazine, tacrolimus, telavancin, teniposide, theophylline, thiotepa, thranarinil, tienilic acid, timolol, tobramycin, tocopherol, tolanol, tirofiban, torsemide, vancomycin, vecuronium, vesceratine, vincristine, vinorelbine, voriconazole, zidovudine, zoledronic acid.

- **Y-Site Incompatibility:** amphotericin B colloidal, amphotericin B lipid complex, dantrolene, dexamethasone, dicoumarol, dexamethasone, dextrose, dopamine, dopamine, dexamethasone, dexamethasone, dexmedetomidine, dobutamine, droperidol, enalaprilat, ephedrine, epinephrine, epirubicin, eptifibatide, ertapenem, erythromycin, etoposide, etoposide phosphate, fenoldopam, fentanyl, fluconazole, fludarabine, fluorouracil, ganciclovir, gemcitabine, gentamicin, glycopyrrolate, granisetron, haloperidol, heparin, hetastarch, hydralazine, hydrocortisone, hydromorphone, idarubicin, ifosfamide, insulin, irinotecan, isoproterenol, ketamine, ketorolac, labetalol, levofloxacin, magnesium sulfate, mannitol, mecobalamin, melphalan, meperidine, mercaptopurine, methotrexate, methyldopate, methylprednisolone sodium succinate, metoclopramide, metoprolol, meropenem, mepron, methyldopa, meropenem, mitoxantrone, morphine, morphine, moricizine, mexitilene, nitroglycerin, norepinephrine, ondansetron, oxacillin, oxaliplatin, oxaliplatin, pazopanib, penicillin, penicillin, piperacillin, potassium acetate, potassium chloride, potassium phosphates, propranolol, propofol, propylthiouracil, quinupristin/dalfopristin, ranibizumab, ranitidine, remifentanil, rocuronium, sodium acetate, sodium bicarbonate, sodium phosphate, streptomycin, succinylcholine, suvorexant, sucrose, sulfamethoxazole, sulfadiazine, tacrolimus, telavancin, teniposide, theophylline, thiotepa, thranarinil, tienilic acid, timolol, tobramycin, tocopherol, tolanol, tirofiban, torsemide, vancomycin, vecuronium, vesceratine, vincristine, vinorelbine, voriconazole, zidovudine, zoledronic acid.

Patient/Family Teaching

- **Inform patient and family of reasons for administration. Milrinone is not a cure but is a temporary measure to control the symptoms of HF.**

Evaluation/Desired Outcomes

- **Decrease in the signs and symptoms of HF.**
- **Improvement in hemodynamic parameters.**

Why was this drug prescribed for your patient?