### VASODILATORS

<table>
<thead>
<tr>
<th>Drug</th>
<th>Enalaprilat</th>
<th>Hydralazine</th>
<th>Nitroglycerin</th>
<th>Nitroprusside</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Trade/Alternate Name</strong></td>
<td>VASOTEC</td>
<td>APRESOLINE</td>
<td>glyceryl trinitrate</td>
<td>NIPRIDE</td>
</tr>
<tr>
<td><strong>Suggested initial dose:</strong></td>
<td>1.25 mg IV q6h (0.625 mg if volume depleted or in renal failure)</td>
<td>10 mg IV q6h</td>
<td>5 to 10 mcg/min IV infusion</td>
<td>0.25 mcg/kg/min IV infusion</td>
</tr>
<tr>
<td><strong>Dose range:</strong></td>
<td>0.625 to 5 mg IV q6h</td>
<td>2.5 to 40 mg IV q4h to q12h</td>
<td>5 to 100 mcg/min IV infusion</td>
<td>0.25 to 10 mcg/kg/min</td>
</tr>
<tr>
<td><strong>Titrate:</strong></td>
<td>Every 3 to 5 min in 5 to 10 mcg/min increments</td>
<td></td>
<td></td>
<td>Every 5 min in 0.5 mcg/kg/min increments.</td>
</tr>
</tbody>
</table>

**Onset of Action**
- Less than 15 min
- Peak: 1 to 4 h
- 10 to 30 min
- 1 to 5 min
- Immediate

**Duration of Action**
- 4 to 12 hours
- 3 to 6 hours
- 3 to 5 min
- 1 to 2 min

**Adverse Effects**
- Renal failure, unpredictable abrupt hypotension in high-renin states, angioedema
- Flushing, headache, tachycardia, worsening angina
- Headache, nausea, vomiting, tachycardia, tachyphylaxis with prolonged use, raised ICP
- Thiocyanate or cyanide toxicity, raised ICP

**Considerations**
- Unpredictable and not readily titrated to target BP
- Unpredictable and not readily titrated to target BP.
- First dose and any IV push doses to be administered by physician only.
- Give q12h if CrCl less than 30 mL/min.
- Max infusion rate: 0.5 mg/min for
- Greater effect on SBP; larger doses are required to decrease DBP.
- Requires ECG monitoring.
- **Restricted:** see restricted nursing intravenous drug list for approved areas.
- Monitor methemoglobin.
- Monitor thiocyanate/cyanide levels in patients with renal dysfunction, on prolonged therapy (greater than 7 days), or on high doses (greater than 4 mcg/kg/min).
- May be started in non-ICU setting for hypertensive crisis but patient must be...
## Hypertension

### DRUGS FOR THE TREATMENT OF HYPERTENSIVE URGENCIES AND EMERGENCIES

<table>
<thead>
<tr>
<th>Drug</th>
<th>Enalaprilat</th>
<th>Hydralazine</th>
<th>Nitroglycerin</th>
<th>Nitroprusside</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>intermittent infusion.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Restricted:</strong></td>
<td>see restricted nursing intravenous drug list for approved areas</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| **Unit Cost** | 1.25 mg/mL | 20 mg/mL | 5 mg/mL | 25 mg/mL |
|---------------|           |          |         |         |
|               | 2 mL vial | 1 mL vial | 10 mL vial | 2 mL vial |
|               | $34.29    | $12.29   | $11.08  | $114.67 |

**Note:** Hypotension can occur with all the listed drugs.

### ADRENERGIC INHIBITORS

<table>
<thead>
<tr>
<th>Drug</th>
<th>Esmolol</th>
<th>Metoprolol</th>
<th>Labetalol</th>
<th>Phentolamine</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Trade Name</strong></td>
<td>BREVIBLOC</td>
<td>BETALOC</td>
<td>TRANDATE</td>
<td>ROGITINE</td>
</tr>
</tbody>
</table>

#### Dose

- **Esmolol**
  - Suggested initial dose: 0.5 to 1.5 mg/kg bolus over 1 min followed by 50 mcg/kg/min IV infusion
  - **Dose range:** 50 to 200 mcg/kg/min
  - **Bolus dose:** may give 0.5 mg/kg bolus over 1 minute prior to every rate increase

- **Metoprolol**
  - Suggested initial dose: 2.5 mg IV q6h
  - **Dose range:** 2.5 mg to 15 mg IV q4h to 8h

- **Labetalol**
  - Suggested initial dose: 0.5 mg/min IV infusion
  - **Dose range:** 0.5 to 3 mg/min IV infusion
  - **Bolus Dose (for MD administration):** 5 to 10 mg IV over 1 to 2 min

- **Phentolamine**
  - Suggested initial dose: 5 mg IV once or 1 mg/min IV infusion
  - **Dose range:** 5 to 10 mg IV with repeats every 30 min or 1 to 5 mg/min IV infusion

#### Onset of Action

- **Esmolol:** 1 to 2 min
- **Metoprolol:** 20 min
- **Labetalol:** Less than 5 min
- **Phentolamine:** 1 to 2 min

#### Duration of Action

- **Esmolol:** 10 to 20 min
- **Metoprolol:** 5 to 8 hours
- **Labetalol:** 4 to 6 hours
- **Phentolamine:** 10 to 30 min

#### Adverse Effects

- **Esmolol:** Bradycardia, bronchospasm
- **Metoprolol:** Bradycardia, bronchospasm
- **Labetalol:** Nasal congestion, dyspnea, bradycardia, heart block, bronchospasm
- **Phentolamine:** Flushing, headache, weakness, cardiac arrhythmia
Hypertension

DRUGS FOR THE TREATMENT OF HYPERTENSIVE URGENCIES AND EMERGENCIES

<table>
<thead>
<tr>
<th>Drug</th>
<th>Esmolol</th>
<th>Metoprolol</th>
<th>Labetalol</th>
<th>Phentolamine</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Considerations</strong></td>
<td>Physician must administer all boluses. If no bolus given, peak effect of rate increase may be delayed up to 30 minutes. Physician must order every rate increase (no titration by RN) no more frequently than every 4 minutes. Morphine increases esmolol concentrations by 50% → reduce dose. Delayed onset (30 min) of peak action after dose titration if no boluses given. ECG monitoring required. <strong>Restricted:</strong> see restricted nursing intravenous drug list for approved areas</td>
<td>ECG monitoring required. <strong>Restricted:</strong> see restricted nursing intravenous drug list for approved areas</td>
<td>Combined alpha and beta-adrenergic blockade. ECG monitoring required. <strong>For patients receiving thrombolysis:</strong> If BP greater than 185/110 mmHg, give labetalol bolus. May repeat one time. <strong>During or after thrombolysis:</strong> If BP greater than 180/105 mmHg, give labetalol bolus. May repeat every 10 to 20 minutes up to 300 mg or switch to infusion. <strong>Restricted:</strong> see restricted nursing intravenous drug list for approved areas</td>
<td>For catecholamine excess states. May require additional alpha-adrenergic blockade for BP control or the use of nitroprusside.</td>
</tr>
</tbody>
</table>

| Cost       | 10 mg/mL 250 mL bag $114.68 | 1 mg/mL 5 mL vial $7.21 | 5 mg/mL 20 mL vial $27.80 | 10 mg/mL 1 mL $38.29 |

**Note:** Hypotension can occur with all the listed drugs.
## Hypertension

### DRUGS FOR THE TREATMENT OF HYPERTENSIVE URGENCIES AND EMERGENCIES

#### CALCIUM CHANNEL BLOCKERS

<table>
<thead>
<tr>
<th>Drug</th>
<th>Diltiazem</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trade Name</td>
<td>CARDIZEM</td>
</tr>
</tbody>
</table>
| **Dose**  | **Suggested initial dose:** 0.25 mg/kg IV loading dose over 2 minutes followed by 5 mg/hr IV infusion  
**Dose range:** 5 to 15 mg/hr IV infusion |
| **Onset of Action** | 3 min |
| **Duration of Action** | 0.5 to 10 hours |
| **Adverse Effects** | Bradycardia, hypotension |
| **Considerations** | Dosing over 15 mg/hr or infusions longer than 24 hrs are not recommended due to non-linear kinetics  
2nd line when beta blockers cannot be used due to bronchospasm  
ECG monitoring required  
**Restricted:** see restricted nursing intravenous drug list for approved areas |
| **Cost** | 5 mg/mL  
5 mL  
$12.65 |

**Note:** Hypotension can occur with all the listed drugs.

#### ORAL DRUGS FOR THE TREATMENT OF HYPERTENSIVE URGENCIES

<table>
<thead>
<tr>
<th>Drug</th>
<th>Captopril</th>
<th>Clonidine</th>
<th>Labetalol</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Trade/Alternate Name</strong></td>
<td>CAPOTEN</td>
<td>CATAPRES</td>
<td>TRANDATE</td>
</tr>
</tbody>
</table>
| **Dose**  | Initial 12.5 to 25 mg PO. May repeat as needed, then q8h.  
**Dose range:** 6.25 to 50 mg PO q8h |
| **Onset of Action** | 5 to 15 min  
Peak: 1 hour |
| **Duration of Action** | 6 to 12 hours |
| **Dose**  | 0.1 to 0.2 mg PO once then 0.05 to 0.1 mg q1h to a maximum of 0.7 mg  
Then 0.1 mg PO q12h up to 0.8 mg/day |
| **Onset of Action** | 30 to 60 min  
Peak: 2 to 4 hours |
| **Duration of Action** | 6 to 10 hours |
| **Dose**  | 200 mg PO once then may repeat every hour to a max of 1200 mg.  
Then 200 to 400 mg PO q6h to q8h |
| **Onset of Action** | 30 to 120 min  
Peak: 2 hours |
| **Duration of Action** | 4 to 12 hours |
# Hypertension

## Drugs for the Treatment of Hypertensive Urgencies and Emergencies

<table>
<thead>
<tr>
<th>Drug</th>
<th>Captopril</th>
<th>Clonidine</th>
<th>Labetalol</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Adverse Effects</strong></td>
<td>Abrupt hypotension in high renin states, acute renal failure, angioedema, hyperkalemia</td>
<td>Drowsiness, sedation, dry mouth, orthostatic hypotension, rebound hypertension with withdrawal</td>
<td>Dizziness, scalp tingling, headache, nasal congestion, dyspnea, bradycardia, heart block, precipitates asthma</td>
</tr>
<tr>
<td><strong>Special Considerations</strong></td>
<td>Often chosen after using IV labetalol. Avoid in patients with second or third degree heart block, severe bradycardia, severe bronchospastic disease or decompensated heart failure</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Unit Cost</strong></td>
<td>$0.12/ 6.25 mg</td>
<td>$0.26/ 0.025 mg</td>
<td>$0.33/ 100 mg</td>
</tr>
<tr>
<td></td>
<td>$0.21/ 12.5 mg</td>
<td>$0.16/ 0.1 mg</td>
<td>$0.58/ 200 mg</td>
</tr>
<tr>
<td></td>
<td>$0.30/ 25 mg</td>
<td>$0.29/ 0.2 mg</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$0.56/ 50 mg</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>30 Day Patient cost</strong></td>
<td>$11.66 (6.25 mg tid)</td>
<td>For 0.1 mg bid</td>
<td>$21.40 (100 mg bid)</td>
</tr>
<tr>
<td></td>
<td>$20.40 (12.5 mg tid)</td>
<td>$67.40 (0.025 mg tabs)</td>
<td>$37.60 (200 mg bid)</td>
</tr>
<tr>
<td></td>
<td>$29.20 (25 mg tid)</td>
<td>$10.40 (0.1 mg tabs)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$54.40 (50 mg tid)</td>
<td>$9.40 (0.2 mg tab)</td>
<td></td>
</tr>
</tbody>
</table>

* List prices from the Ontario Drug Benefit (ODB) Formulary, Ontario Ministry of Health. Last Updated: 01/04/2011 Version 2.2. All prices represent the generic medication option. IV prices come from distributor database. 
# 30 day patient costs represented by ODB generic price + 8% markup. These prices do not include a dispensing fee, which can range from 4.99 – 11.99. Pricing is based on a typical dosing regimen.

**Note:** Nifedipine regular release should NOT be used, as it is associated with fatal cerebral, renal and myocardial ischemic events.

**REFERENCES**
1. Compendium of Pharmaceuticals and Specialties online version (e-CPS) 
2. Lexicomp Online Lexi-Drugs 
Hypertension

DRUGS FOR THE TREATMENT OF HYPERTENSIVE URGENCIES AND EMERGENCIES

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Reviewed by: Dr. del Campo, Neurologist, Dr R. Richardson, Nephrologist, Dr. S. Logan, Nephrologist, Marisa Battisella PharmD – March 2014
Updated by: Caitlin Meyer, BScPhm, ACPR – January 2015
Approved by CV Subcommittee – May 2014
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1. **Purpose of the Pharmacotherapy Handbook.**

Notice to Healthcare Providers:

The Pharmacotherapy Handbook is intended to be used as a tool to aid in the appropriate prescribing and administration of cardiovascular formulary agents.

This information in this Handbook is intended for use by and with experienced physicians and pharmacists. The information is not intended to replace sound professional judgment in individual situations, and should be used in conjunction with other reliable sources of information. Decisions about particular medical treatments should always be made in consultation with a qualified medical practitioner knowledgeable about Cardiovascular Illness and the treatments in question.

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Your comments on the usefulness of the resources contained in the Handbook are welcomed and may be forwarded to Amita Woods, Department of Pharmacy Services (amita.woods@uhn.ca).