

Vasopressors

Receptors:

| Receptor | Location | Action |
|------------------------|---|---|
| Beta 1 (β_1) | Heart | Positive Inotrope (Increased Contractility), Positive Chronotrope Increased Automaticity Increased rate of conduction |
| Beta 2 (β_2) | Lungs Blood Vessels Coronary Arteries | Vasodilation Bronchodilation Relaxation of GI and uterine smooth muscle |
| Alpha 1 (α_1) | Heart Blood Vessels | Vasoconstriction Positive Inotrope (very weak) Negative Chronotrope |
| Alpha 2 (α_2) | Central Nervous System | Vasodilation Decreased HR and BP by limiting norepinephrine release and inhibiting sympathetic activity |
| Dopaminergic | Blood Vessels | DA1: Vasodilation of renal, cerebral, coronary, mesenteric, skeletal, skin |
| | | DA2: Vasodilation by inhibiting the release of norepinephrine |

Terms:

Inotrope: Increases contractility of the heart

Chronotrope: Increases HR by affecting electrical conduction system via SA node

Dromotrope: Speeds up conduction of electrical impulse through the tissue of the heart

Medications:

| Medication | Receptor | Action | Common Uses | Cautions |
|---------------------------|---|--|--|--|
| Phenylephrine | Pure α_1 | Pure vasoconstrictor with minimal cardiac effects Increased SVR \rightarrow Increases MAP | Used frequently in OR Low potency pressor | |
| Norepinephrine (Levophed) | Potent α_1 Some β_1 | Vasoconstriction \uparrow SVR Inotrope (\uparrow contractility) Chronotrope (some \uparrow HR) Some coronary artery dilation | *First line agent for Sepsis Hypotension | With high doses for long periods of time: Peripheral vasoconstriction leading to ischemic digits Ischemic bowel |
| Epinephrine | Low dose (used for CHF): β_1 and β_2 High Dose: α_1 , β_1 , and β_2 | \uparrow : HR, BP, SVR, automaticity, cerebral and coronary blood flow Inotrope (\uparrow contractility) Chronotrope Dromotrope | Severe Hypotension Bradycardia Cardiogenic shock Anaphylaxis/Bronchospasm | Arrhythmias Tachycardia |

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| | | Vasoconstriction ↑ myocardial oxygen demand | | |
| Dopamine | DA1 and DA2 Low Dose (2-4mcg/kg/min): Mostly DA1 (dilation of renal vessels) Medium Dose (4-8mcg/kg/min): β_1 (CHF) High Dose (8-20mcg/kg/min): α_1 (increases SVR) | Vasoconstriction (high dose only) Inotrope (↑ contractility) Dromotrope Chronotrope | Second line agent for symptomatic bradycardia Hypotension | Tachycardia Arrhythmias Use with caution in cardiogenic shock |
| Dobutamine | Primarily β_1 with some β_2 (3:1 ratio) | Inotrope (↑ contractility) May increased myocardial oxygen demands | Cardiogenic Shock CHF exacerbation | Hypotension Arrhythmias |
| Milrinone | Phosphodiesterase Inhibitor (Phosphodiesterase inhibits cAMP, cAMP is responsible for contractility → Milrinone increases cAMP levels → Increased contractility) | Inotrope (↑ contractility) Vasodilation ↓ Preload and Afterload | Works synergistically with β_1 agonists Works best for right sided heart failure through increased vasodilation in pulmonary vasculature | Arrhythmias Hypotension *Long half-life so titrate slowly Renal excretion (caution in patient with AKI/ESRD) |
| Vasopressin (Antidiuretic Hormone) | V1 | Binds to vasopressin receptors in vascular smooth muscle and renal cells causing vasoconstriction and fluid retention ↑ SVR and preload Low dose increases sensitivity to other α_1 pressors | Second choice agent for hypotension to be used in conjunction with another pressor Brain death and organ donation Diabetes Insipidus | Peripheral vasoconstriction leading to ischemic digits *Non-titratable medication* |

Resources:

1. FOAMcast: an Emergency Medicine Podcast, Episode 31-Vasopressors (<http://foamcast.org/tag/peripheral-vasopressors/>)
2. Internet Book of Critical Care, Vasopressors (<https://emcrit.org/ibcc/pressors/>)