# Hemodynamic Support in cardiovascular failure Ionotropes and Vasopressors.

Cardiovascular failure, including cardiogenic shock, requires prompt hemodynamic support to maintain adequate cardiac output and organ perfusion. This is primarily achieved using **inotropic agents** and **vasopressors** .

## Inotropes

- **Definition:** Drugs that alter the force of cardiac muscle contraction.
- **Types:**
  - **Positive inotropes:** Increase myocardial contractility ? stronger heartbeats ? improved cardiac output.
  - **Negative inotropes:** Decrease contractility and heart rate ? used in conditions like hypertension, arrhythmias, and angina.

**Positive inotropes** are crucial in managing heart failure, cardiomyopathy, recent myocardial infarction, and cardiogenic shock.

### Vasopressors

- **Definition:** Drugs that cause vasoconstriction, increasing vascular tone and blood pressure.
- Used mainly in vasodilatory shock states (e.g., septic shock) and sometimes in cardiovascular failure when vascular tone is low.

## Common Inotropes in Cardiovascular Failure

| Drug | Mechanism | Notes/Adverse Effects |
|---|---|---|
| **Dobutamine** | ?1 agonist (? contractility & HR), mild ?2 (vasodilation) | May cause tachyarrhythmias; can worsen hypotension due to vasodilation |
| **Dopamine** | Dose-dependent stimulation: Dopaminergic ? ?1 ? ?1 | Versatile; can improve contractility and vascular tone; risk of arrhythmias |
| **Epinephrine** | Potent ? & ? agonist | Strong inotrope & vasopressor; increases myocardial O2 demand and tachyarrhythmias |
| **Phosphodiesterase inhibitors (e.g., milrinone)** | ? cAMP ? ? contractility & vasodilation | Less tachyarrhythmia risk than dobutamine; may cause hypotension |

## Common Vasopressors

| Drug | Mechanism | Clinical Use & Notes |
|---|---|---|
| **Norepinephrine** | Potent ?1 agonist (vasoconstriction), mild ?1 effect | First-line in vasodilatory shock (septic shock); increases BP with less tachycardia |
| **Phenylephrine** | Pure ?1 agonist | Useful for vasodilatory shock; may reduce stroke volume due to increased afterload; risk of tachyphylaxis |
| **Vasopressin** | Vasopressin receptor agonist | Adjunct in refractory septic shock; bypasses catecholamine receptors; may enhance sensitivity to catecholamines |

## Clinical Application

- **Cardiogenic Shock Management** :
    1. Optimize **volume status** (careful fluid management).
    2. Use **inotropes** to increase myocardial contractility and cardiac output.
    3. Vasopressors may be needed if hypotension persists due to vasodilation.
- Inotropes can increase myocardial oxygen consumption, potentially worsening ischemia, so titration and careful monitoring are critical.

| Drug | Primary Action | Key Clinical Point | Main Risk |
|---|---|---|---|
| Dobutamine | ? Contractility & HR | Good for cardiac failure; caution if hypotensive | Tachyarrhythmias, hypotension |
| Dopamine | Dose-dependent effects | Flexible dosing, useful in shock | Arrhythmias |
| Epinephrine | ? Contractility & Vasoconstriction | Useful in shock, potent | ? Myocardial O2 demand |
| Milrinone | ? Contractility + Vasodilation | Useful in heart failure | Hypotension, arrhythmias |
| Norepinephrine | Vasoconstriction + Mild ? HR | First-line vasopressor in septic shock | Excess vasoconstriction |
| Phenylephrine | Pure Vasoconstriction | Avoid if stroke volume low | Tachyphylaxis, decreased CO |
| Vasopressin | Vasoconstriction via vasopressin receptors | Adjunct in refractory shock | Hyponatremia, ischemia |