Systemic Hypotension

Are there signs of shock?

No → Observe if Postnatal age < 4 hours AND hypotension mild

- No improvement by 4 hours of age OR
- Worsening hypotension OR
- Developing signs of shock

Yes → ***Signs of shock***

- Prolonged CRT (>3-4 seconds)
- Poor peripheral pulses
- Arterial lactate > 2
- Significant metabolic acidosis (base deficit > 8)
- Oliguria/anuria

Define type of hypotension

Systolic BP < 3rd centile

Pathophysiology:
↓ LV stroke output

Possible causes	Therapeutic Approach (mechanism)
PPHN	1.Reduce PVR e.g. iNO, milrinone (may have positive inotropy) 2. Improve atrial filling pressure (preload) e.g. fluid bolus, vasopressin (may ↓ PVR) 3. Enhance myocardial systolic performance e.g. dobutamine, epinephrine 4. Consider PGE_1 infusion if RV dysfunction and PDA closed
Septic (Cold) shock	1. Improve myocardial systolic performance e.g. dobutamine, epinephrine (may ↑ preload) 2. Optimize treatment of sepsis
Cardiogenic shock	1. Check heart rhythm (r/o arrhythmia) 2. Improve myocardial systolic performance e.g. dobutamine, epinephrine

Diastolic BP < 3rd centile

Pathophysiology:
↓ SVR

Possible causes	Therapeutic Approach (mechanism)
Systemic hypovolemia	1.Optimize filling pressures (preload) - fluid boluses (max 2 of 10mls/kg each) ± colloid 2. Increase SVR once adequate volume given e.g. vasopressin, dopamine
Warm shock	1.Optimize filling pressures (preload) - fluid boluses (max 2 of 10mls/kg each) 2.Increase SVR e.g. dopamine, norepinephrine, vasopressin (may increase atrial filling pressure)
PDA	1. Ductal closure strategies e.g. NSAID, acetaminophen, surgery 2. Flow limitation strategies e.g. permissive hypercapnea, ↑PEEP 3. Enhance LV systolic function e.g. dobutamine

Systolic < 3rd centile AND Diastolic < 3rd centile

Pathophysiology:
± cardiac systolic dysfunction

Cause	Physiology	Therapeutic algorithm
A. Progression of severity after an initial period of low systolic BP		
PPHN	LV dysfunction &/or Loss of vascular tone	1. Improve atrial filling pressure (preload) e.g. fluid bolus, vasopressin (unless LV dysfunction on TNE) 2. Enhance myocardial systolic performance e.g. dobutamine, epinephrine
Cardiogenic shock	Worsening LV function (? impending arrest)	Enhance myocardial systolic performance e.g. dobutamine, epinephrine
B. Progression of severity after an initial period of low diastolic BP		
Hypovolemia or warm shock	Myocardium unable to compensate or progression to cardiac dysfunction	1.Optimize filling pressures (preload) – fluid boluses (max 2 of 10mls/kg each) 2.Increase SVR e.g. dopamine, norepinephrine, vasopressin (if no LV dysfunction)
PDA	Large volume shunt + myocardium unable to compensate	1. Flow limitation strategies e.g. permissive hypercapnea, ↑PEEP 2. Enhance LV systolic function e.g. dobutamine, dopamine (if critical DAP)
C. Both systolic & diastolic low at presentation (profound hypotension)		
Manage as severe warm shock with LV dysfunction if no echo available **(rule out adrenal insufficiency)**		See above + **early hydrocortisone**

Special Considerations

- *Wean mean airway pressure to lowest needed provided no worsening of oxygenation*
- *Consider hydrocortisone if hypotension unresponsive to 2 therapeutic agents*
- *Early TnECHO consult is advisable for refractory hypotension*
- *Carefully evaluate infant and investigate/treat underlying cause of hypotension (e.g. acute blood loss, sepsis, SIRS, adrenal insufficiency, arrhythmia, electrolyte disturbances)*
- *Avoid use of cardiovascular agents which have chronotropic or inotropic effects in IDM patients*
- *Caution with use of milrinone in neonates with HIE or where borderline mean or diastolic BP*

On behalf of Targeted Neonatal Echocardiography and Neonatal Hemodynamics Program:
Reference:
Chapter 29: Hemodynamics. Patrick McNamara, Dany Weisz, Regan Giesinger, Amish Jain. Avery's Neonatology: Pathophysiology and Management of the Newborn, 7th Edition (2016), Wolters Kluwer.