

Intensive Care Nursery House Staff Manual

Neonatal Shock

DEFINITION AND PATHOPHYSIOLOGY: Shock is an acute state in which circulatory function is inadequate to supply sufficient amounts of O₂ and other nutrients to tissues to meet metabolic demands. In most cases, cardiac output is low. In early shock, compensatory regional vasoconstriction (skin, skeletal muscle, splanchnic circulation) may temporarily maintain normal blood pressure and adequate blood flow to vital organs. As shock progresses, compensatory mechanisms fail and widespread cellular damage occurs. Insufficient O₂ delivery to tissues causes anaerobic metabolism and lactic acidosis. If shock persists, irreversible injury to vital organs occurs; death ensues despite vigorous therapy that may temporarily return cardiovascular measurements to normal.

ETIOLOGY: A variety of factors, often in combination, may cause shock:

Hypovolemia (*e.g.*, blood loss, inadequate placental transfusion, fetomaternal transfusion, severe dehydration)

Asphyxia (*e.g.*, antepartum or intrapartum, respiratory failure, impaired oxygen transport due to severe anemia or hemoglobinopathy)

Cardiogenic causes (*e.g.*, cardiomyopathy, dysrhythmia, congenital malformation, hypocalcemia, severe hypoglycemia)

Obstruction of venous return due to tension pneumothorax, excessive ventilator pressures, cardiac tamponade

Sepsis (especially early onset group B beta-hemolytic Streptococcal infection)

Drugs (especially when hypovolemic infants, in whom blood pressure has been maintained by vasoconstriction, are given vasodilators such as PGE₁, isoproterenol or magnesium)

Hypocarbica (severe)

CLINICAL EVALUATION: There are no clinical or laboratory findings specific to shock. The diagnosis is based on presence of several indicators of inadequate circulatory function. Various clinical and laboratory findings associated with shock include:

Cardiovascular findings:

Systemic arterial hypotension (see graphs on P. 36)

Narrow pulse pressure

Central venous hypotension: with myocardial failure, central venous pressure is ↑

Tachycardia (In early asphyxia, bradycardia is present.)

Respiratory findings:

Tachypnea

Grunting respirations

Retractions

Apnea

Other findings:

Prolonged capillary filling time

Hypothermia

Oliguria

Metabolic Acidemia

TREATMENT: Specific therapy depends upon the cause of shock. Rapid recognition of shock and identification of underlying cause(s) are essential to prevent irreversible changes. With hypovolemia, intravascular volume must be increased, but cautiously.

Volume replacement with blood or plasma expander should be in aliquots of 5 mL/kg every few minutes until circulatory function is adequate. Carefully assess the effects of volume replacement on heart rate, blood pressure, respiratory function, acid-base status and perfusion. After an adequate circulating blood volume has been achieved, replacement of other fluid deficits should be done more slowly, over several hours.

With **asphyxial shock**, treatment of respiratory failure with oxygen and assisted ventilation may be the only therapy needed. **Do not give blood volume expanders during asphyxia as that will aggravate hypoxic myocardial failure.** Alkali should be given only when there is significant metabolic acidemia (base deficit ≥ 10 mEq/L), the infant is receiving adequate assisted ventilation and PaCO₂ is in the normal range. NaHCO₃, given when ventilation is inadequate, leads to respiratory acidosis and may worsen the patient's condition. THAM™ may cause apnea because of its effect of rapidly lowering PaCO₂.

During resuscitation of an infant in shock, certain drugs are useful; these drugs, their indications, and their usual starting doses are listed in the table below. **Dopamine** is useful for treatment of infants in early shock as it is effective in raising systemic arterial blood pressure and often increases urinary output. Newborns in shock may require a dopamine dose of 30 mcg/kg/min or higher to obtain a pressor response. In contrast to older patients, such high doses of dopamine do not have adverse effects on urinary output in newborn infants. Dobutamine is less effective in newborns and often lowers blood pressure because of its vasodilating effects.

Drugs useful in resuscitation of infants in severe shock

<i>Drug</i>	<i>Dose</i>	<i>Route</i>	<i>Indication</i>
Atropine	0.01 mg/kg	IV	Sinus bradycardia
Calcium chloride 10%	0.25 mL/kg (25 mg/kg)	IV	Hypocalcemia
Calcium gluconate 10%	1.0 mL/kg (100 mg/kg)	IV	Hypocalcemia
Dopamine*	5.0 mcg/kg/min	INF	Hypotension, low CO
Epinephrine (1:10,000)	0.1 mL/kg	IV	Asystole, bradycardia
Glucose 10%*	1-3 mL/kg over 2-5 min	IV	Hypoglycemia
Isoproterenol*	0.1 mcg/kg/min	INF	Bradycardia with low CO

IV, intravenous; INF, continuous IV infusion; CO, cardiac output.

*Doses listed for these drugs are usual starting doses. The dose should be increased as needed until a therapeutic effect is achieved.