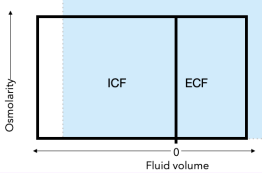
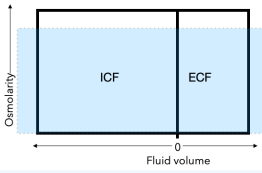


CRYSTALLOID FLUIDS

Crystalloid	Solution	Effect on fluid compartments	Indications	Risks	
Isotonic	Normal Saline (0.9% NaCl) Na ⁺ 154 Cl ⁻ 154 Osmolarity: 308	↑↑ Na ⁺ ↑↑ Cl ⁻ pH ~5.5	<ul style="list-style-type: none"> • Water flow: none • ↔ Intracellular volume • ↑ Extracellular volume 	<ul style="list-style-type: none"> • Fluid resuscitation • Maintenance fluid therapy • Hyponatremia • Co-administration of blood products 	<ul style="list-style-type: none"> • Hyperchloremic metabolic acidosis • Precipitate AKI in the critically ill
	Ringers Lactate Na ⁺ 130 Cl ⁻ 109 K ⁺ 4 Ca ²⁺ 3 Lactate 28 Osmolarity: 273	<ul style="list-style-type: none"> ↓ Na⁺ ↑ Cl⁻ ↓ Albumin pH ~6.2	<ul style="list-style-type: none"> • Water flow: none • ↔ Intracellular volume • ↑ Extracellular volume 	<ul style="list-style-type: none"> • Fluid resuscitation • Maintenance fluid therapy 	<ul style="list-style-type: none"> • Metabolic alkalosis (lactate converted to HCO₃⁻ in the liver) • Co-administration with blood products → RBC clumping (citrate in blood product binding with Ca⁺²)
	Plasmalyte/Isolyte Na ⁺ 140 Cl ⁻ 98 K ⁺ 5 Mg 3 Osmolarity: 294	<ul style="list-style-type: none"> ↔ Na⁺ ↔ Cl⁻ pH ~7.4	<ul style="list-style-type: none"> • Water flow: none • ↔ Intracellular volume • ↔ Extracellular volume 	<ul style="list-style-type: none"> • Fluid resuscitation • Maintenance fluid therapy 	<ul style="list-style-type: none"> • Fluid overload • Pulmonary edema
	D ₅ W (5% dextrose) Glucose: 50 g/L Osmolarity: 253	<ul style="list-style-type: none"> ↓ Na⁺ ↓ Cl⁻ pH ~4 <i>Sodium-free water is evenly distributed among both fluid compartments</i>	<ul style="list-style-type: none"> • Water flow: none • ↑ Intracellular volume • ↑ Extracellular volume 	<ul style="list-style-type: none"> • Maintenance fluid therapy • Replacing free water deficit • Total parental nutrition 	<ul style="list-style-type: none"> • Hyperglycemia in diabetic patients • Co-administration with blood products → RBC hemolysis
Hypertonic	3% NaCl Na ⁺ 513 Cl ⁻ 513 Osmolarity: 1026	 <ul style="list-style-type: none"> • Water flow: ICF → ECF • ↑ Osmolarity • ↓ Intracellular volume • ↑ Extracellular volume 	<ul style="list-style-type: none"> • Hyponatremia • Hyperosmolar therapy for ↑ ICP 	<ul style="list-style-type: none"> • Osmotic Demyelination Syndrome • Fluid overload & pulmonary edema 	
Hypotonic	½ Normal Saline (0.45% NaCl) Na ⁺ 77 Cl ⁻ 77 Osmolarity: 154	 <ul style="list-style-type: none"> • Water flow: ECF → ICF • ↓ Osmolarity • ↑ Intracellular volume • ↑ Extracellular volume 	<ul style="list-style-type: none"> • Replacing free water deficit • Maintenance fluid therapy 	<ul style="list-style-type: none"> • Cerebral edema • Pulmonary edema 	

Signs and symptoms of hypovolemia: Urine output < 0.5 mL/kg/hour, hypotension, tachycardia, poor capillary refill, weak thready pulse

4/2/1 Therapy of Maintenance Therapy

- 4 mL/kg/hr for the first 10 kg (= 40 mL/hr)
- 2 mL/kg/hr for the next 10 kg (= 20 mL/hr)
- 1 mL/kg/hr for each kg over 20 kg

Shortcut: Maintenance IV fluid rate (mL/hour) = Weight (kg) + 40