SAWA UNIVERSITY

جامعة ساوة الاهلية
كلية التقنيات الصحية والطبية
قسم التخدير - اللجنة العلمية

مادة أسس التخدير 1 الكورس الاول

IV FLUIDS TYPE AND USAGE (part1)

جامعـــــــة ســـــــــاوة الاهلية — Sawa University

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المرحلـــــــــــــة .الثانية . — .Second .. Stage

نظـــــــري — Theoretical

محاضرة رقم 3. ... — Lecture No.3.....

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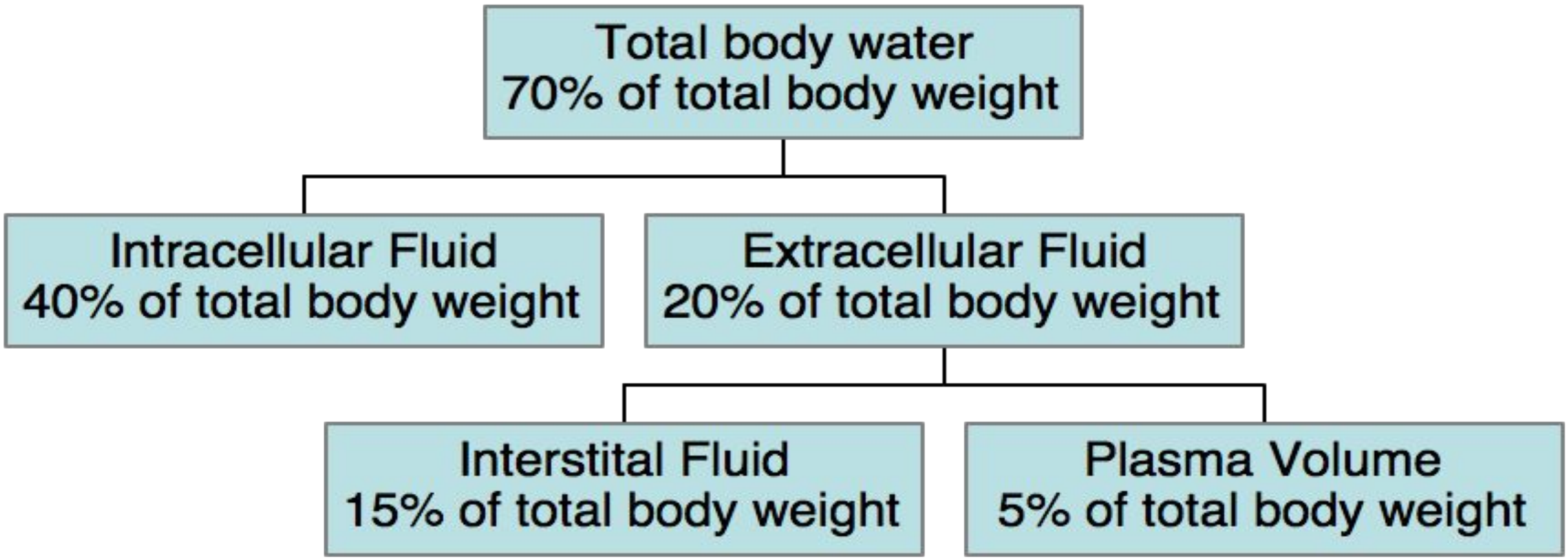
Distribution of Fluid



TOTAL BODY FLUID AND ITS DISTRIBUTION

- Intracellular compartment ICC forms 2/3 of TBF.
- Extracellular compartment ECC forms 1/3 of TBF.

Further more the ECC is subdivided by endothelium of capillary wall into:

a. Intravascular 1/4

b. Interstitial 3/4

ECF and ICF Composition

	ICF (mEq/L)	ECF (mEq/L)
Sodium	20	**135-145**
Potassium	**150**	3-5
Chloride	-----	**98-110**
Bicarbonate	10	20-25
Phosphate	110-115	5
Proteins	75	10

Osmolarity = Osmolarity

Key learning points
Sodium is the Principle electrolyte in ECF
Potassium is the Principle electrolyte in ICF

Fluid intake

Fluid intake is derived from two sources:

- (1) exogenous: is either drink or ingested in solid food.

- (2) endogenous: by metabolism of food

1 gm of fat → 1 ml of fluid

1 gm of CHO → 0.6 ml of fluid

1 gm of protein → 0.4 ml of fluid

FLUID LOSS

Termed	From	As	ml/24 h
Insensible losses	Skin	Sweat	500
	Lungs	Moisture from humidified air	300
Measured losses	Renal	Urine	500-1200
	Gut	Faeces	500

Intravenous fluid

DIFFERENT TYPES OF IV FLUIDS

Which IV Fluids do we use and when?

ANYONE CAN KNOW

IN A VERY EASY LANGAUGE

TYPES /COMPOSITION

Introduction:

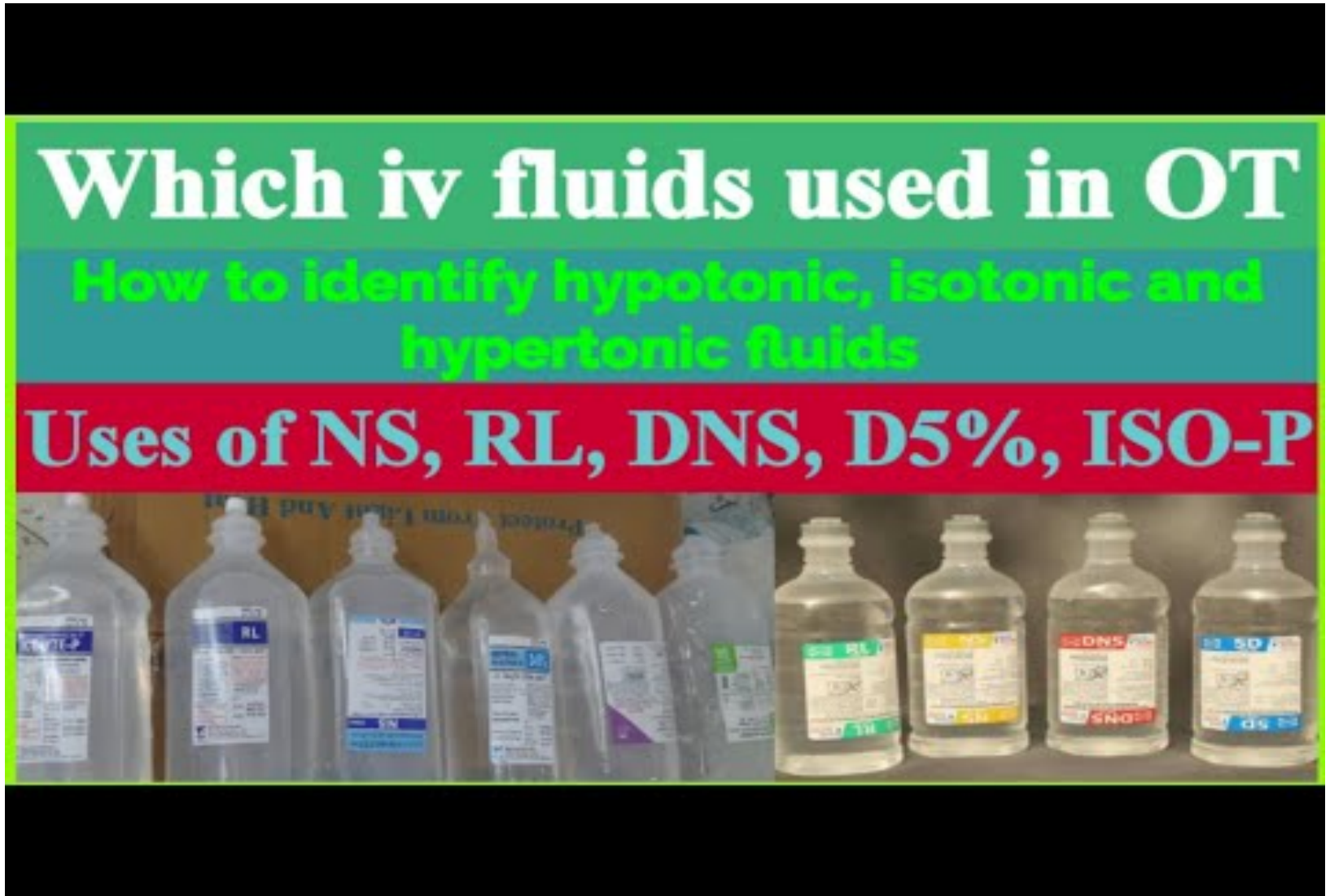
Intravenous fluid administration should be considered as any other pharmacological prescription.

There are three main indications :

1. **Resuscitation**
2. **Replacement**
3. **Maintenance**

For maximizing benefits and minimizing harms intravenous fluid administration should follow the four Ds :

- ✔ Drug
- ✔ Dosing
- ✔ Duration
- ✔ De-escalation.



Concept of ‘four Ds’ when prescribing fluids:

- ✔ Drug consider **the indication** for the fluid and what effect is being sought.
- ✔ Duration of therapy consider **when to start** and **when to stop therapy.**
- ✔ Dosing consider **how much fluid to give**.
- ✔ De-escalation consider when the **fluid therapy is no longer effective or required.**

Osmolarity, **Osmolality,** Tonicity of a solution:

- **Osmolarity is a number of osmoles per liter of solution.**
- **Osmolality** is the number of solute particles **in 1 kg of solvent**.

For dilute solutions, the difference between osmolarity and osmolality **is insignificant**

- **Tonicity: (The effect a solution has on cell volume).**

a term used interchangeably with osmolarity,

- **Isotonic solution** has **no effect** on cell volume.
- **Hypotonic solutions increase** cell volume.
- **Hypertonic solutions decrease** cell volume.

Tonicity describes the effective osmolality of a fluid.

Fluids classification

I.V fluids are classified as:

1**. Crystalloids**

2.**Colloids**

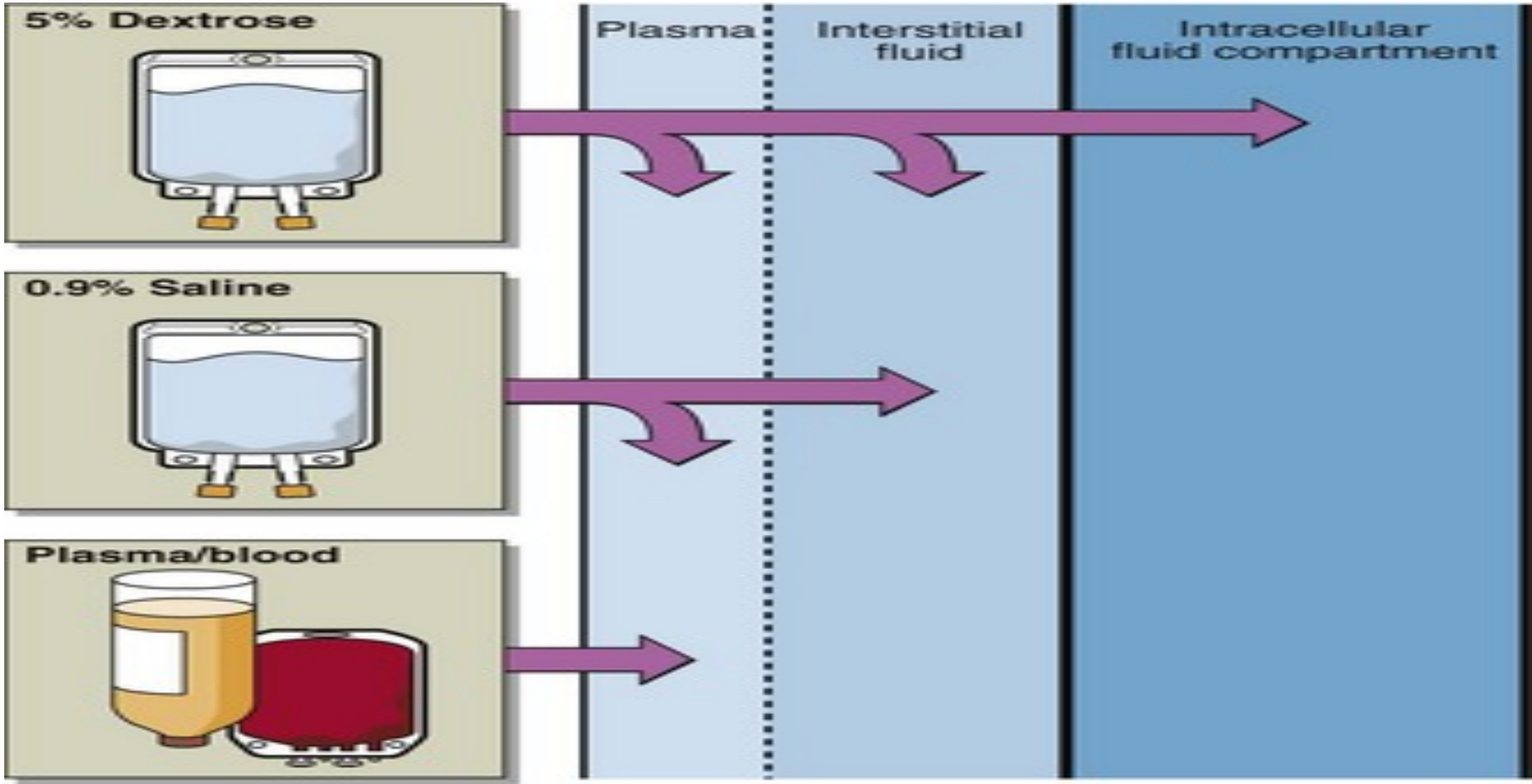
based on their ability to diffuse through barriers separating body fluid compartments, i.e intravascular and extravascular (interstitial) fluid compartments.

Crystalloids **passed readily** through the membrane, whereas colloids **did not** (Greek word-glue).

Crystalloids and Colloids:

A Crystalloid solution is an **agueous solution** composed of **water** and **small solutes** such as electrolytes and glucose Crystalloid solutions can be further categorized as:

- ✔ **Hypotonic**
- ✔ **Isotonic**
- ✔ **Hypertonic.**



Colloid solution:

contains **large molecular weight** particles such as **proteins or hydroxyethyl starches** (HES) suspended in a crystalloid solution.

The intravascular half-life of a crystalloid solution is 20-30 min,

Most colloid solutions have intravascular half-lives between 3 and 6 h

Colloids vs Crystalloids

Colloids	Crystalloids
Includes **Albumin, Dextran, Hydroxyethyl starches (HES), Gelatin**	Includes **Hypotonic, Hypertonic, Isotonic** solutions
Large molecules that **stay** in intravascular space longer	**Small molecules** that **don't stay** too long in intravascular space
Fast at **expanding** intravascular space & amount administered equal to amount lost	**High amount** of **fluids needed** to equal amount lost **(overload: edema)**
Risks: allergic reaction, coagulation problems	**No** allergic reactions or coagulation problems
Cost More	**Cost Less** and easier to access

Crystalloids when given in sufficient amounts:

1. Are just as effective as colloids in restoring intravascular volume
2. **Replacing an intravascular** volume deficit with **three to four times** the volume needed when using colloid
3. **Severe intravascular fluid deficits** can be more rapidly corrected using **colloid solutions**
4. **The rapid administration** of **large amounts of crystalloids** (>4-5L) is more frequently associated with **tissue edema**.

Some evidence suggests that marked tissue edema can impair oxygen transport, tissue healing, and return of bowel function following major surgery.

Crystalloid Fluids

Fluid	Na^+ mEq/L	Cl^- mEq/L	K^+ mEq/L	Ca^{2+} mEq/L	Glucose g/L	Buffer	Osmolarity mOsm/L	Tonicity	Typical Indication
Normal plasma	~ 140	~ 100	~ 4	~ 2.4	~ 0.85	HCO_3^- ~ 24 mEq/L	~ 290	N/A	N/A
0.9% saline (a.k.a. "normal saline" or NS)	154	154	0	0	0	0	308	"Isotonic"	Resuscitation
0.45% saline (a.k.a. ½ NS)	77	77	0	0	0	0	154	Hypotonic	Maintenance
3% saline	513	513	0	0	0	0	1026	Hypertonic	Severe Hyponatremia
D5 ½NS + 20 meq KCL	77	97	20	0	50	0	446	Hypertonic → Hypotonic	Maintenance
D5W	0	0	0	0	50	0	252	Hypotonic	Hypernatremia Hypoglycemia
Lactated Ringer's (LR) / Hartmann's solution*	130	109	4	3	0	Lactate 28 mEq/L	273	Isotonic	Resuscitation

* Most, but not all, sources imply the terms lactated Ringer's and Hartmann's solutions are interchangeable. Also, there is small variability in the reported electrolyte concentrations between sources.

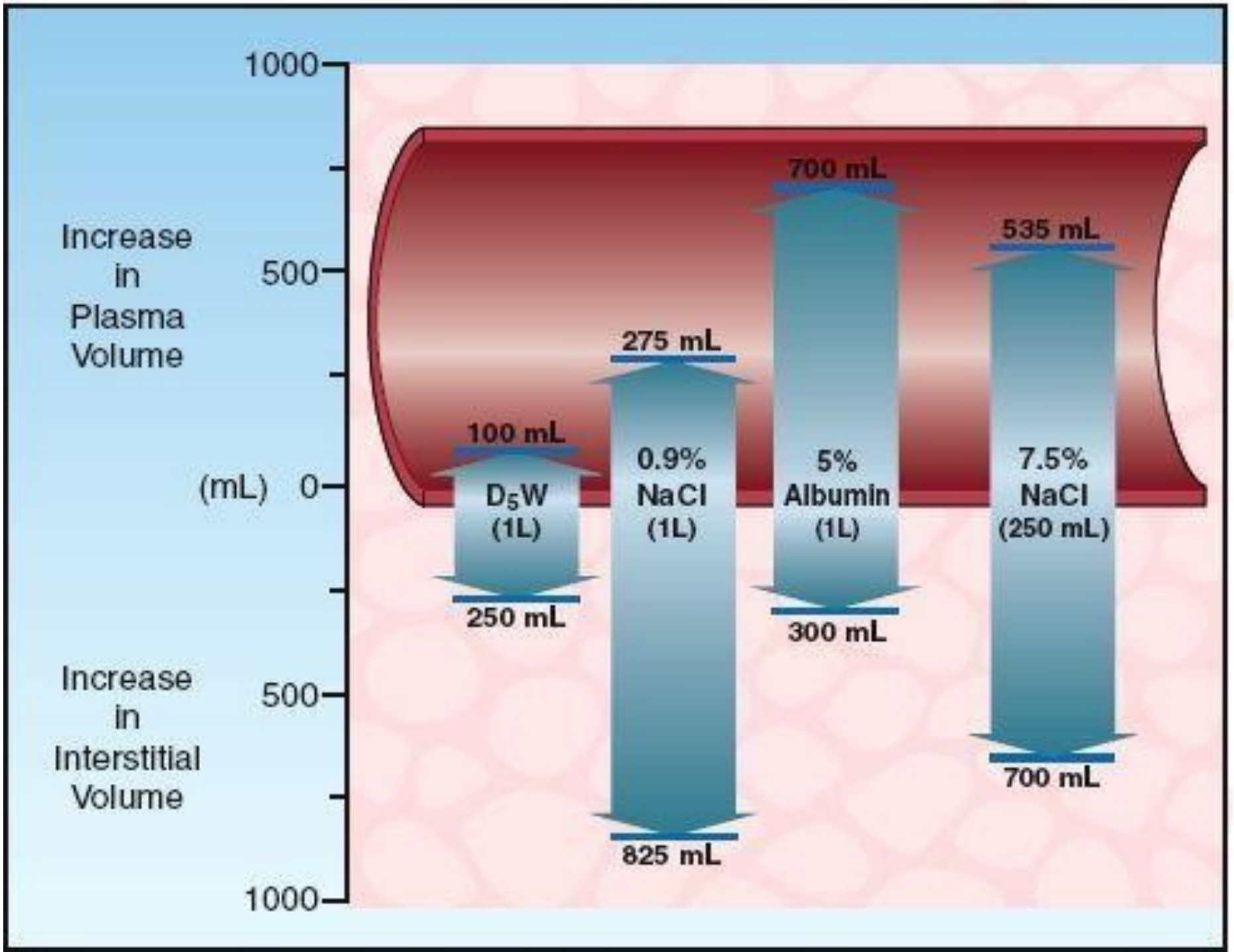
Infusion of common fluids

Infusion of 1 L of 0.9% NACL adds 275 mL to the plasma volume and 825 mL to the interstitial volume

Note: the total volume expansion (1100 mL) slightly greater than the infused volume.

This is the result of a fluid shift from the ICF to extracellular space, because isotonic saline is slightly hypertonic to the Plasma

Volume Effects



1.0.9% Sodium Chloride (Normal Saline(

Indications for the use of normal saline infusion that have been approved by the FDA:

- **Extracellular fluid replacement (e.g):**

(Dehydration,hypovolemia, hemorrhage, sepsis).

- **Treatment of metabolic alkalosis** in the presence of fluid loss.
- **Mild sodium depletion**.
- **Additionally: diluents for the infusion of compatible drug additives**

Other indications:

- Used also in **traumatic brain injury** or **any brain edema.**
- **Replacement fluid in hyperkalemia**.
- It is the preferred solution for **diluting packed red blood cells prior to transfusion**.
- It is used in **DKA** (diabetic ketoacidosis)when there is severe hypovolemia and when **serum sodium less than 140meq/L.**

Any questions?