

# **Fluids used in surgery**

## **Objectives**

**What are type of fluids**

**What are indications of iv fluid**

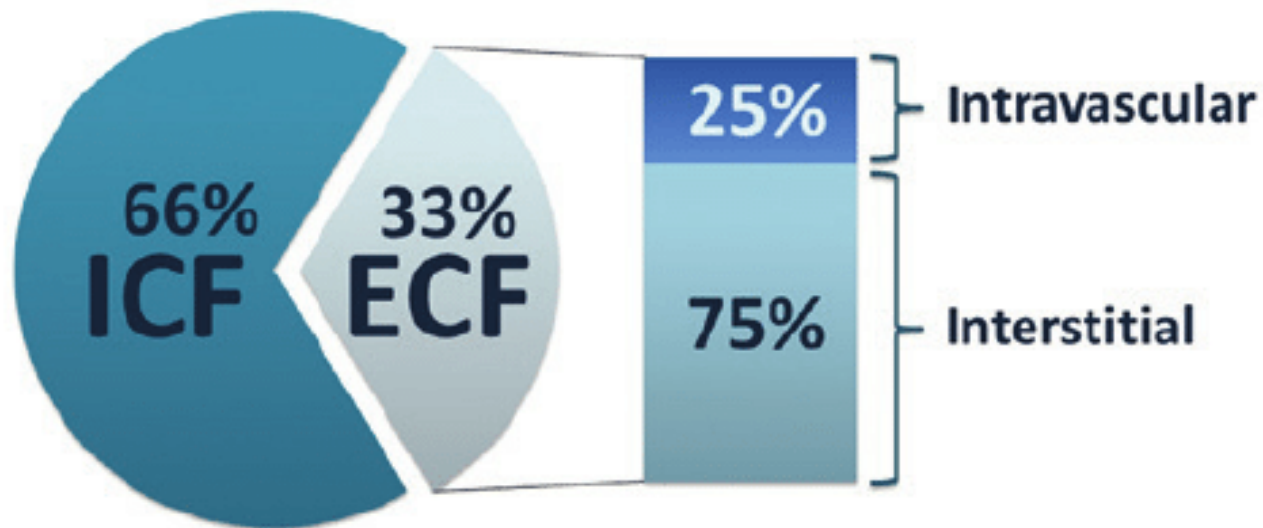
**Disadvantage and advantage of various types of fluids**

# **INTRODUCTION**

**Total body fluid accounts for approximately 60% of total body weight (this can be 70% or higher in newborn down to 50-55% in mature women).**

**Total body fluid can be divided into intracellular and extracellular.**

Total Body water = 60 % Body weight



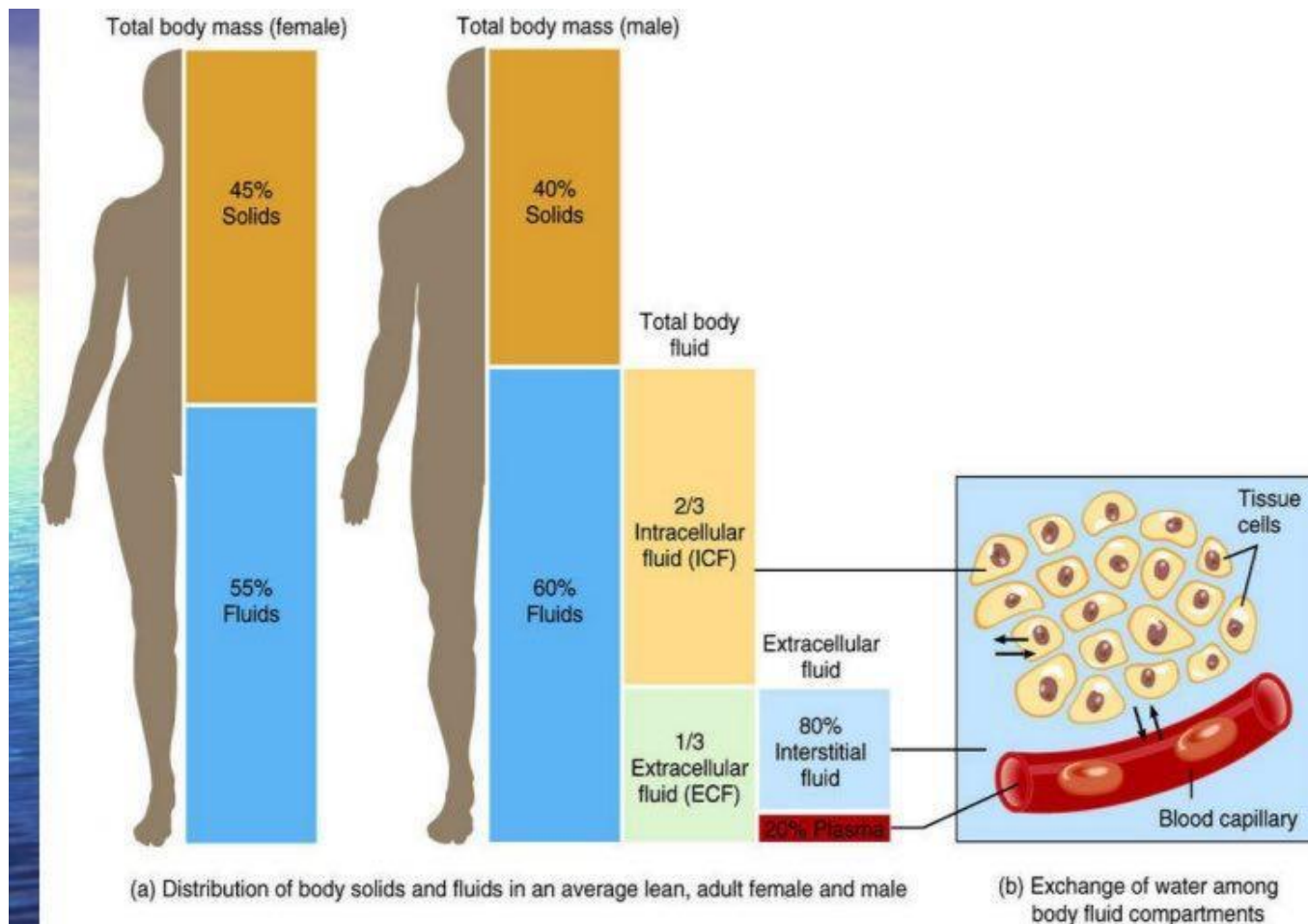
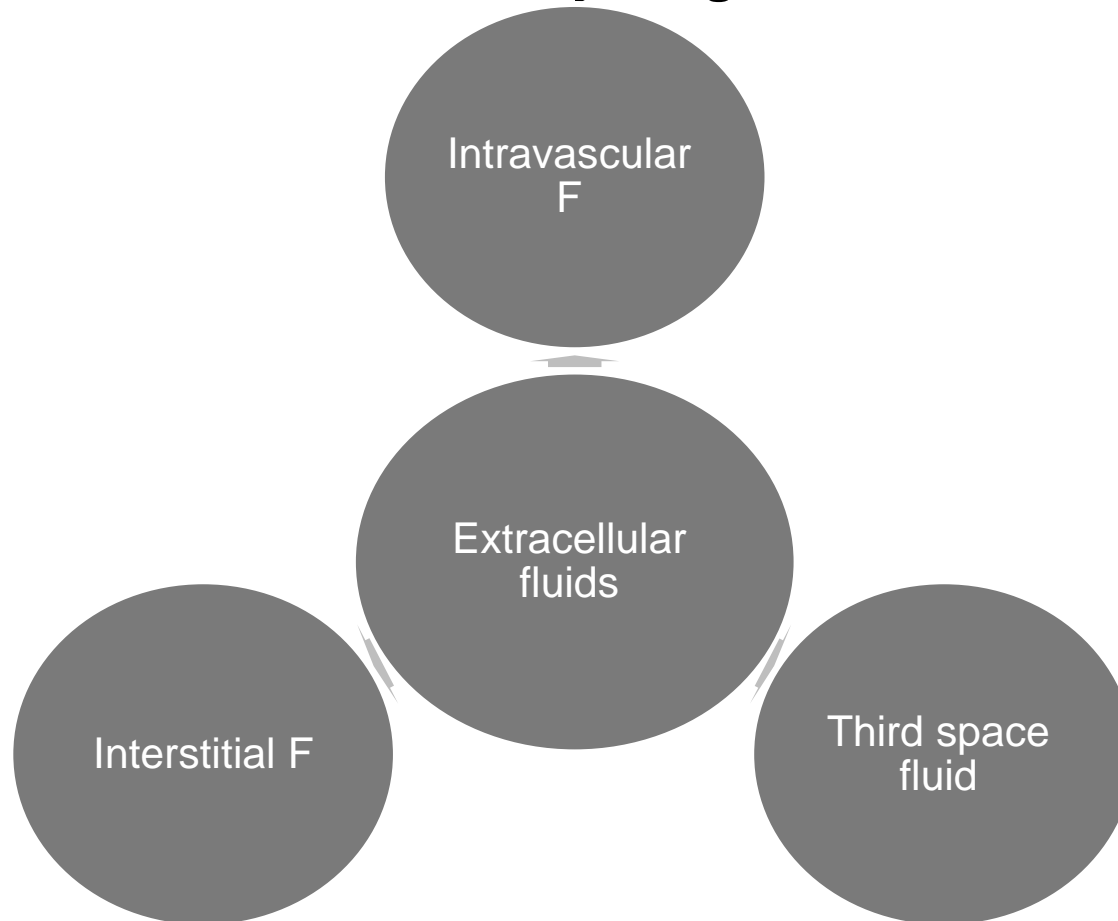


Figure 27.01 Tortora - PAP 12/e  
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# EXTRACELLULAR FLUID

Accounts for 1/3 of the total body weight



# Types of IV fluid

```
graph TD; A[Types of IV fluid] --> B[crystalloids]; A --> C[colloids]; A --> D[Blood products]; B --> E["Solutions that contain small molecules that flow easily through cell membranes. This will increase fluid volume in both the interstitial and intravascular space"]; C --> F["Solutions that contain large molecules that do not pass the cell membranes. They remain in the intravascular compartment and expand the intravascular volume by drawing fluids from extravascular space."];
```

crystalloids

Solutions that contain **small molecules** that flow easily through cell membranes. This will **increase fluid volume** in both the **interstitial and intravascular space**

colloids

Solutions that contain **large molecules** that do not pass the cell membranes. They **remain in the intravascular compartment** and expand the intravascular volume by **drawing fluids from extravascular space**.

Blood products

crystalloid

```
graph TD; A[crystalloid] --> B[isotonic]; A --> C[hypotonic]; A --> D[hypertonic]; B --> B1["0.9 sodium chloride.  
Lactate ringer solution.  
5% dextrose water(D5W).  
Ringers solution."]; C --> C1["0.45 sodium chloride  
0.33 sodium chloride  
0.2 sodium chloride  
2.5 dextrose water"]; D --> D1["3% sodium chloride  
5% dextrose with  
normal saline (D5NS)"];
```

isotonic

0.9 sodium chloride.  
Lactate ringer solution.  
5% dextrose water(D5W).  
Ringers solution.

hypotonic

0.45 sodium chloride  
0.33 sodium chloride  
0.2 sodium chloride  
2.5 dextrose water

hypertonic

3% sodium chloride  
5% dextrose with  
normal saline (D5NS)



# 0.9 SODIUM CHLORIDE(NORMAL SALINE)

## Indication:

1- to treat volume deficit from hemorrhage, severe vomiting or diarrhea, heavy drainage from GIT suction, fistulas or wounds.

2- shock.

3- mild hyponatremia.

4- metabolic acidosis(DKA).

5- resuscitation.

6- it's the only fluid used with administration of blood products.



# **CAUTION**

**Because normal saline replaces extracellular fluid, it should be used cautiously in certain patients(those with cardiac or renal disease ) for fear of fluid volume overload.**

# DEXTROSE 5%

It's considered an isotonic solution, but when dextrose is metabolized, the solution actually become hypotonic and causes fluid shift into cells.



# CAUTION.

D5W is not good for patients with **renal failure or cardiac problems** since it could cause fluid overload.

Patients at risk **for intracranial pressure should** not received D5W since it could increase cerebral edema.

It should not be used in isolation to treat volume deficit because it dilutes plasma electrolyte concentrations.

**Never mix dextrose with blood** as it causes blood to hemolyze.

Not used for **resuscitation**, because the solution will not remain in the intravascular space.

Not used in early post operative period, because the body's reaction to the surgical stress may cause an increase in antidiuretic hormone secretion.

# RINGER LACTATE(HARTMANN SOLUTION)

Is the most physiologically adaptable fluid because its electrolyte content is most closely related to the composition of the body's blood serum and plasma.

Another choice for first –line fluid resuscitation for certain patients, such as those with burn injury.



# INDICATION

To replace GIT fluid losses.

Fistula drainage.

Fluid losses due to **burns and trauma**.

Patient experiencing acute blood loss or hypovolemia due to third- space fluid shift.

# CAUTION

Don't give ringer lactate to patient with **liver disease** as they can't metabolize lactate.

Used cautiously in patients with **severe renal impairment** because it contains some potassium.

Should not be given to a patient whose **pH is greater than 7.5**.

# RINGER SOLUTION

Used in a similar fashion as LR, but doesn't have the contraindications related to lactate





# HYPOTONIC FLUIDS

Hypotonic fluids have a **lower concentration** of solutes, and osmolarity less than **250 mOsm/L**.

It lowers the serum osmolarity within the vascular space, causing fluid to shift from the intravascular space to both the intracellular and interstitial spaces.

These solutions will hydrate cells, although their use may deplete fluid within the circular system.

# INDICATIONS

**Hypotonic fluids are used to treat patients with conditions causing intracellular dehydration, such as:**

- 1- hyponatremia.**
- 2- DKA.**
- 3- Hyperosmolar hyperglycemic state.**

# CAUTIONS

**Never** give hypotonic solution in patients who are at risk for **increased ICP** because it may exacerbate **cerebral edema**.

Don't use hypotonic solutions in patients with liver disease, trauma, or burns due to the potential for depletion of intravascular fluid volume.

# HYPERTONIC SOLUTIONS

Solutions that have higher tonicity or solutes concentration, they have osmolarity of **375 mOsm/L** or higher.

The osmotic pressure gradient draws water out the intracellular space, increasing extracellular fluid volume, so they are used as volume expanders.



# INDICATIONS

- 1- patients with severe hyponatremia.
- 2- patients with cerebral edema.

# CAUTION

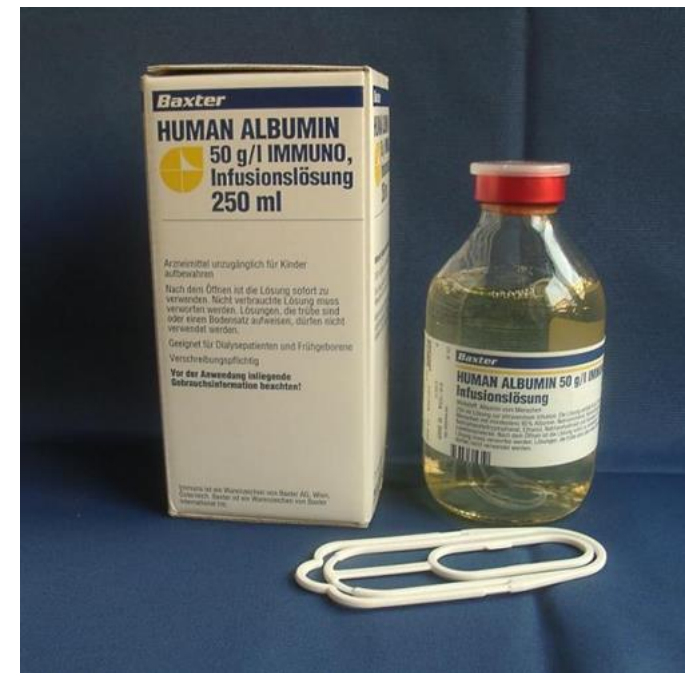
Be alert when administering hypertonic solutions because of their potential for causing intravascular **fluid volume** overload and pulmonary edema.

Should not be given for **indefinite period of time.**

# COLLOID SOLUTIONS

It expand the intravascular volume by drawing fluid from the interstitial space into the intravascular compartment through their higher oncotic pressure.

The same effect as hypertonic crystalloids solutions but it requires administration of less total volume and have a longer duration of action because the molecules remain within the intravascular space longer.



# **COLLOID**

## **5% albumin(human albumin solution).**

**The most commonly utilized colloid solutions.**

**It contains plasma protein fractions obtained from human plasma and works to rapidly expand the plasma volume.**

**Used for:**

**Volume expansion.**

**Moderate protein replacement.**

**Achievement of hemodynamic stability in shock states.**



# CONTRAINDICATIONS

1- severe anemia.

2- heart failure.

3-Known sensitivity to albumin.

4-**ACEI should be withheld** for at least 42 hours before administering albumin because of the risk of atypical reactions, such as **flushing and hypotension**.

# **TRANSFUSION REACTION**

**Signs of transfusion reactions:**

**Fever, flank pain, vital sign changes, nausea, headache, urticaria, dyspnea and bronchospasm.**

**Rx:**

**1- stop the transfusion.**

**2- keep the I.V line open with normal saline solution.**

**3- notify the physician and blood bank.**

**4-intervene for signs and symptoms as appropriate.**

**Monitor the vital signs.**

# OTHER COLLOIDS

## Hydroxyethylstarches

Another form of hypertonic synthetic colloids used for volume expansion.

Contain sodium and chloride used for hemodynamic volume replacement following major surgery and to **treat major burns.**

Less expensive than albumin and their effect can last **24 to 36 hours.**



# CRYSTALLOIDS VS. COLLOIDS

Crystalloids		Colloids	
Advantages	Disadvantages	Advantages	Disadvantages
<ul style="list-style-type: none"><li>• Cheap</li><li>• Non allergic</li><li>• No transmission of infection</li><li>• No interference with coagulation</li></ul>	<ul style="list-style-type: none"><li>• Higher volume needed</li><li>• Relatively short amount of time remaining intravascularly</li></ul>	<ul style="list-style-type: none"><li>• Expansion plasma volume far superior</li><li>• May be salt sparing</li></ul>	<ul style="list-style-type: none"><li>• Expensive</li><li>• Risk of allergy</li><li>• Coagulopathy</li><li>• Itch</li><li>• May exacerbate tissue edema</li></ul>

# Fluid therapy in surgeries

fluid therapy is needed **pre-operatively, intraoperatively and postoperatively**.

## Pre-operative fluid therapy

The administration of maintenance fluids should be all that is required in an otherwise healthy individual who is under orders of receiving nothing by mouth for some time before the time of surgery. This does not, however, include replenishment of pre-existing deficit or ongoing losses.

# Maintenance therapy calculation

For the first 10kg	give 100ml/kg per day
For the second 10kg	give an additional 50ml/kg per day
For weight above 20kg	give an additional 25ml/kg per day

The appropriate choice of fluid would be **5% dextrose** in **0.45% sodium chloride** at **100ml/h** as initial therapy, with potassium added for patients with normal renal function.

# Fluid deficit in surgical patients

many surgical patients have volume and/or electrolyte abnormalities associated with their surgical disease so it must be evaluated as it is a vital step in the pre-operative assessment and care.

Volume deficit should be considered in patients who have obvious GI losses, such as through emesis or diarrhoea, as well as patient with poor oral intake secondary to their disease.

Less obvious cases are those with third space or non functional ECF losses, that occur with GI obstruction, peritoneal or bowel inflammation, ascites, crush injuries, burns, and severe soft tissue infection such as necrotizing fasciitis.

# So how do we assess hydration status?

the assessment acute volume loss is primarily clinical through the following:

1. Patients level of consciousness
2. Thirst
3. Eye glistening
4. Sunken eyes
5. Floor of mouth and mucous membrane
6. Tongue
7. Skin turgor
8. Pulse (rate, rhythm and volume)
9. Blood pressure
10. Urine output

Acute volume deficits should be corrected as much as possible before the time of operation, so once its diagnosed prompt fluid replacement should be started with usually **isotonic crystalloid** depending on the measured serum electrolyte values.



# Intraoperative fluid therapy

with the induction of anaesthesia, hypotension will develop and this hemodynamic instability is best avoided by correcting known fluid losses, ongoing losses, and providing adequate maintenance fluid therapy preoperatively.

Intra operative fluid losses beside measured blood loss especially in major abdominal surgeries are associated with continued extracellular losses in the form of bowel wall edema, peritoneal fluid and wound edema during surgery. And not to forget third space or parasitic losses such as in burns cases, so the intraoperative fluid therapy should **aim at maintaining base line requirements correcting known fluid losses and replacing ongoing losses.**

So saline administration is necessary to restore the obligate fluid losses mentioned earlier, although no accurate formula can predict intraoperative fluid needs, replacement of fluid during surgery often requires **500 to 1000ml/h** balanced solution to support homeostasis.

# Postoperatively fluid therapy

Postoperative fluid therapy should be based on the patient's current estimated volume status and projected ongoing losses.

Criteria of fluid given postoperatively:

**1. Isotonic solution**

**2. Contains energy**

**3. does not contain electrolyte**

so according to this criteria the fluid of choice is **Dextrose 5%**

## Postoperative fluids replacement

1- first day: 2L Dextrose 5% is given

2- second day: 2L of dextrose with 1L of normal saline.

3- third day :-fluid is given as 2<sup>nd</sup> day with potassium 60 mmol/ 24 hr.

# **IV LINE COMMON PROBLEMS**

**1- infiltration.**

**When the catheter is introduced into the tissue surrounding the blood vessels.**

**2- phlebitis.**

**3- hypothermia**

**When large amounts of cold fluids are infused rapidly.**

**4- local infection(abscess)**

Thank you

The image features the words "Thank you" in a large, bold, sans-serif font. Each letter is filled with a vertical rainbow gradient, transitioning from purple at the top to red, orange, yellow, green, and blue at the bottom. The text is presented in a 3D perspective, with each letter casting a soft, grey shadow onto the white background. The entire phrase is slanted upwards from left to right. On the far right edge of the image, there is a vertical bar with a red top section and a black bottom section.