Basics of Fluid & Electrolyte Therapy

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Objectives

- Understand the physiology of fluid distribution & changes in fluid and electrolyte distribution in surgical patients
- Principles of management of these changes.

Objectives

- Be able to identify the clinical signs of dehydration & hypovolaemic shock.
- Describe the components of commonly used IV fluids in terms of their osmolality, electrolyte and energy content and macromolecules and how they relate to the use of these fluids.

Objectives

- Should be able to assess the fluid requirements of a patient.
- Plan a fluid regimen
- Describe how you monitor the effectiveness of your regimen

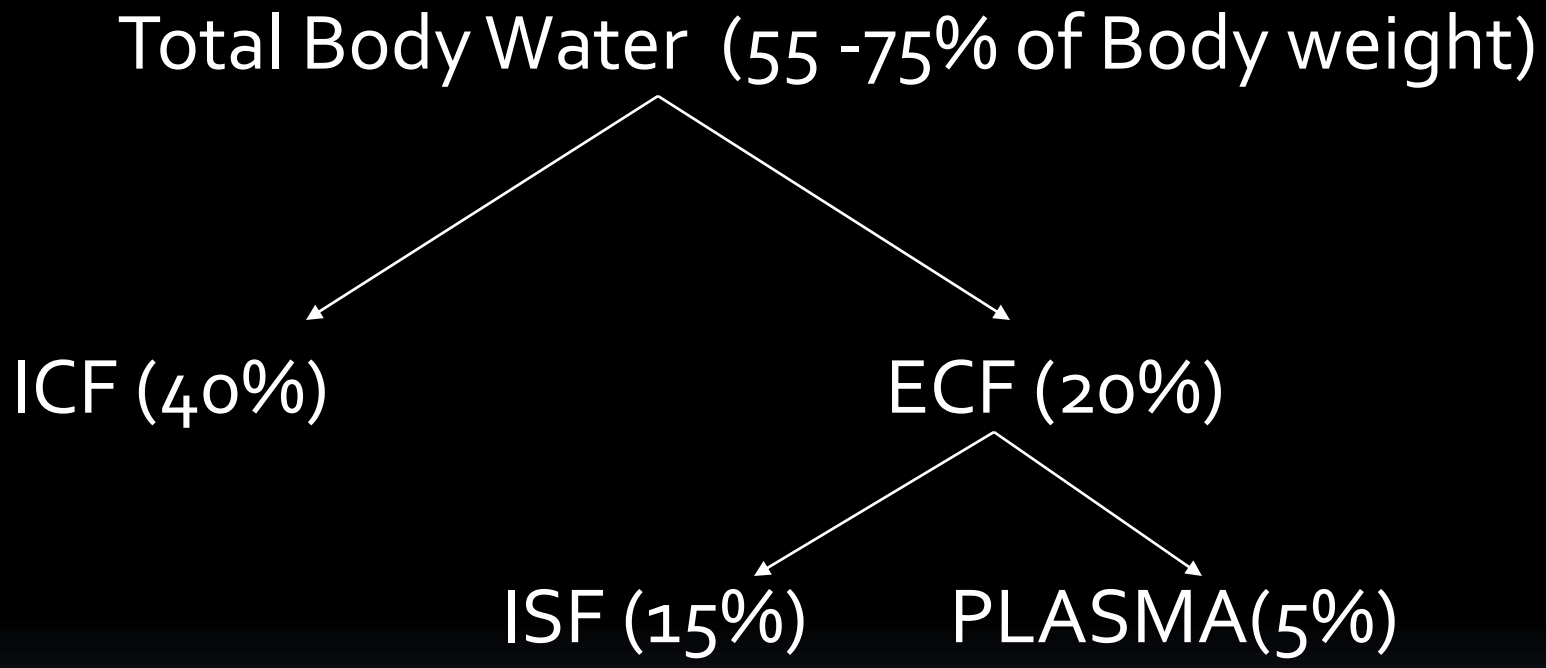
Case

25 year old man presents with vomiting for 3days.

Thirst, Resp. rate 25, pulse 90/min

a) Degree of dehydration?
b) What fluid will you use?
c) How do you assess the response to treatment?

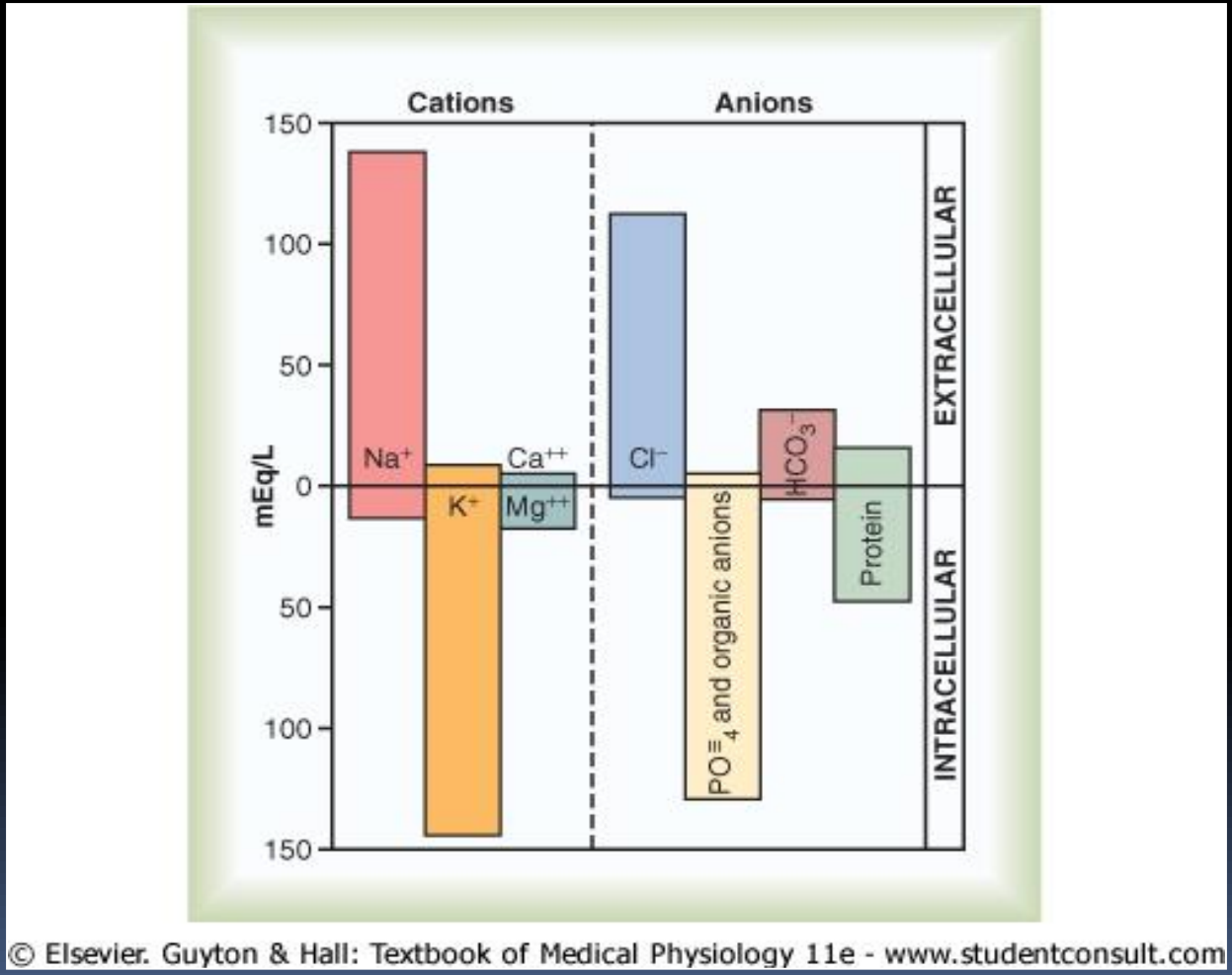
PHYSIOLOGY


Total Body Water (55 -75% of Body weight)
ICF (40%)
ECF (20%)
ISF (15%)
PLASMA(5%)

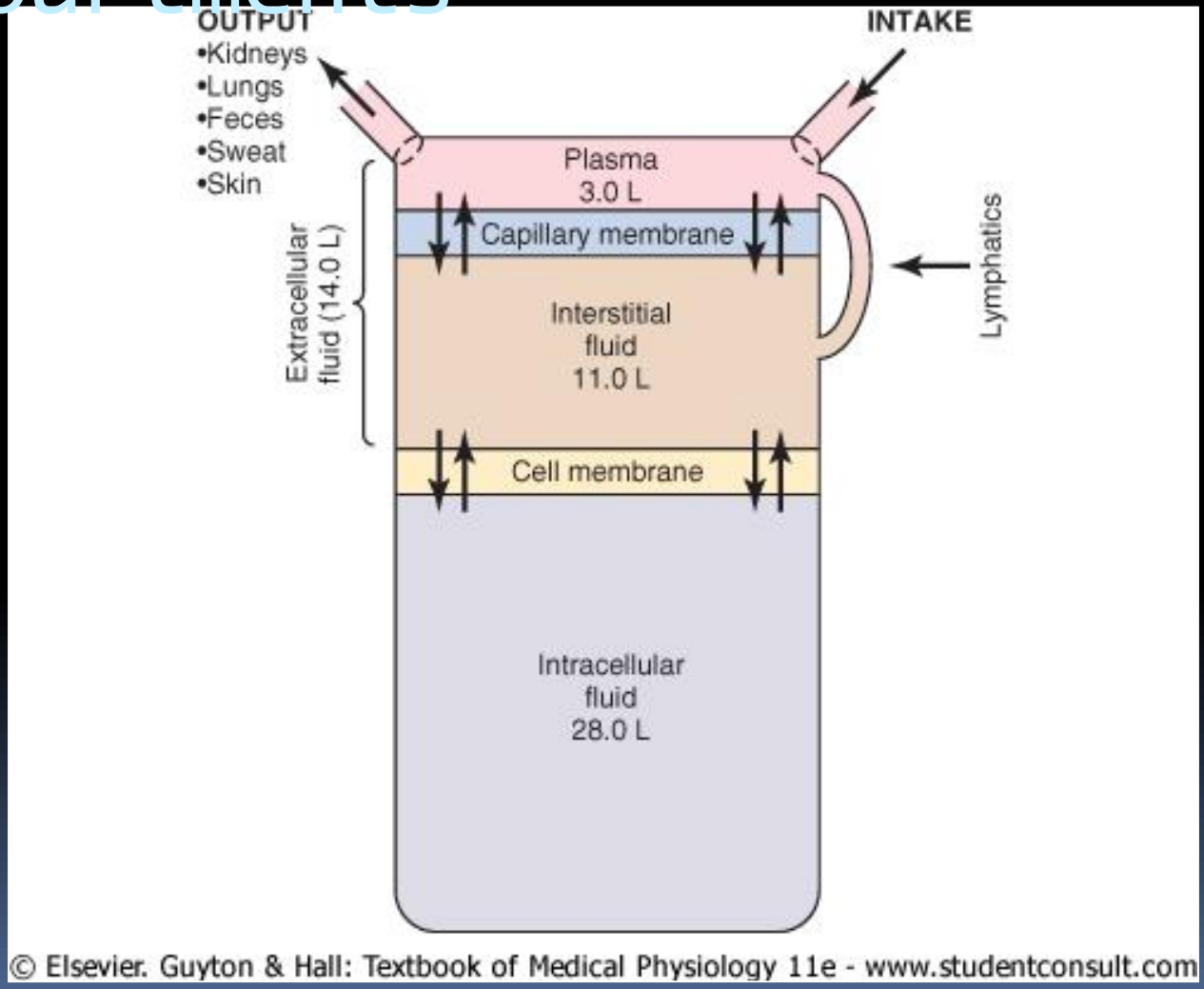
Distribution of Water & Electrolytes

ICF	ECF	Pl
40%	15%	5%
Na 10 K 150	Na 140 K 4 -5	Protein

Distribution of Ions

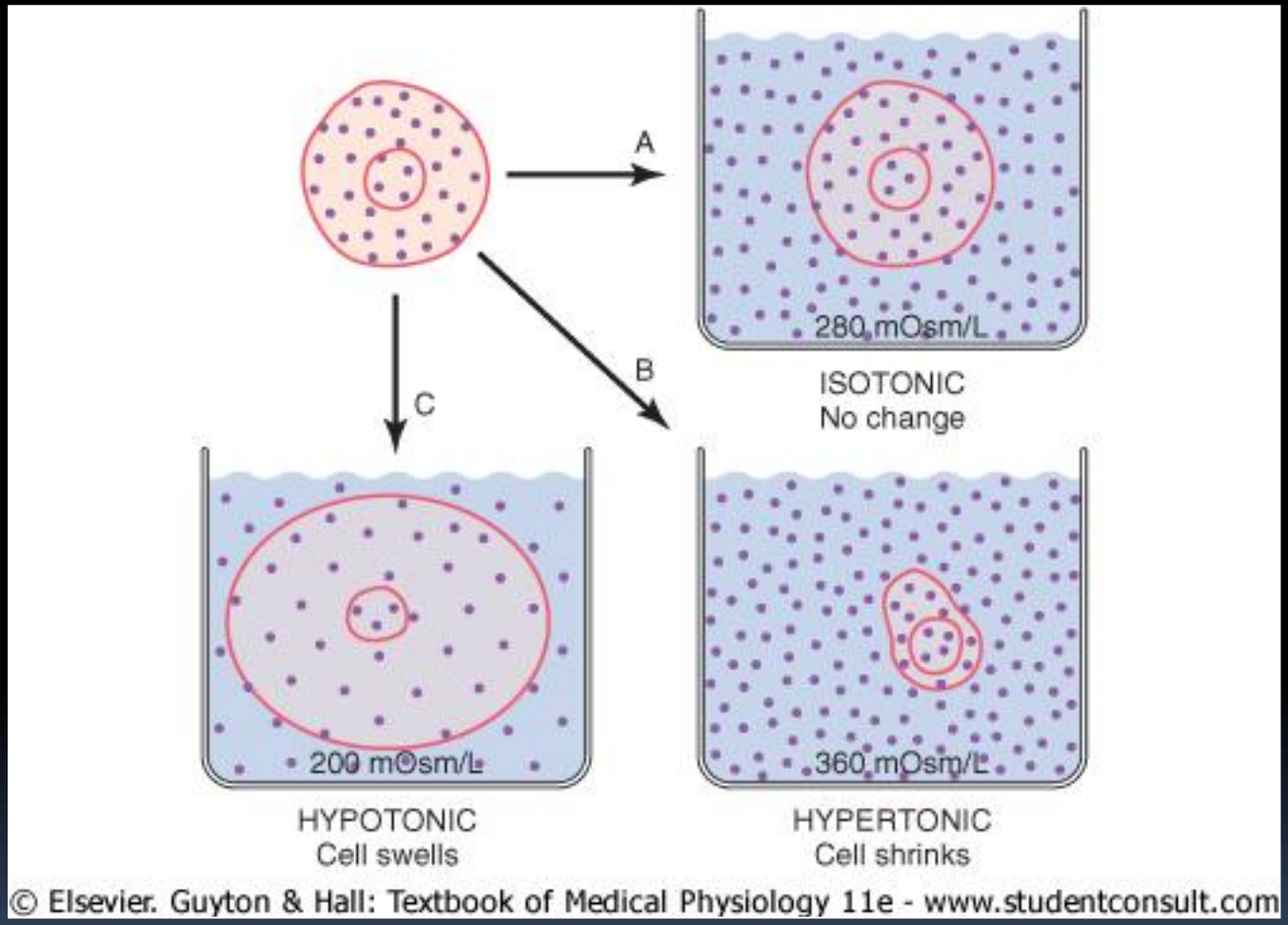


Composition of Body Fluid Compartments

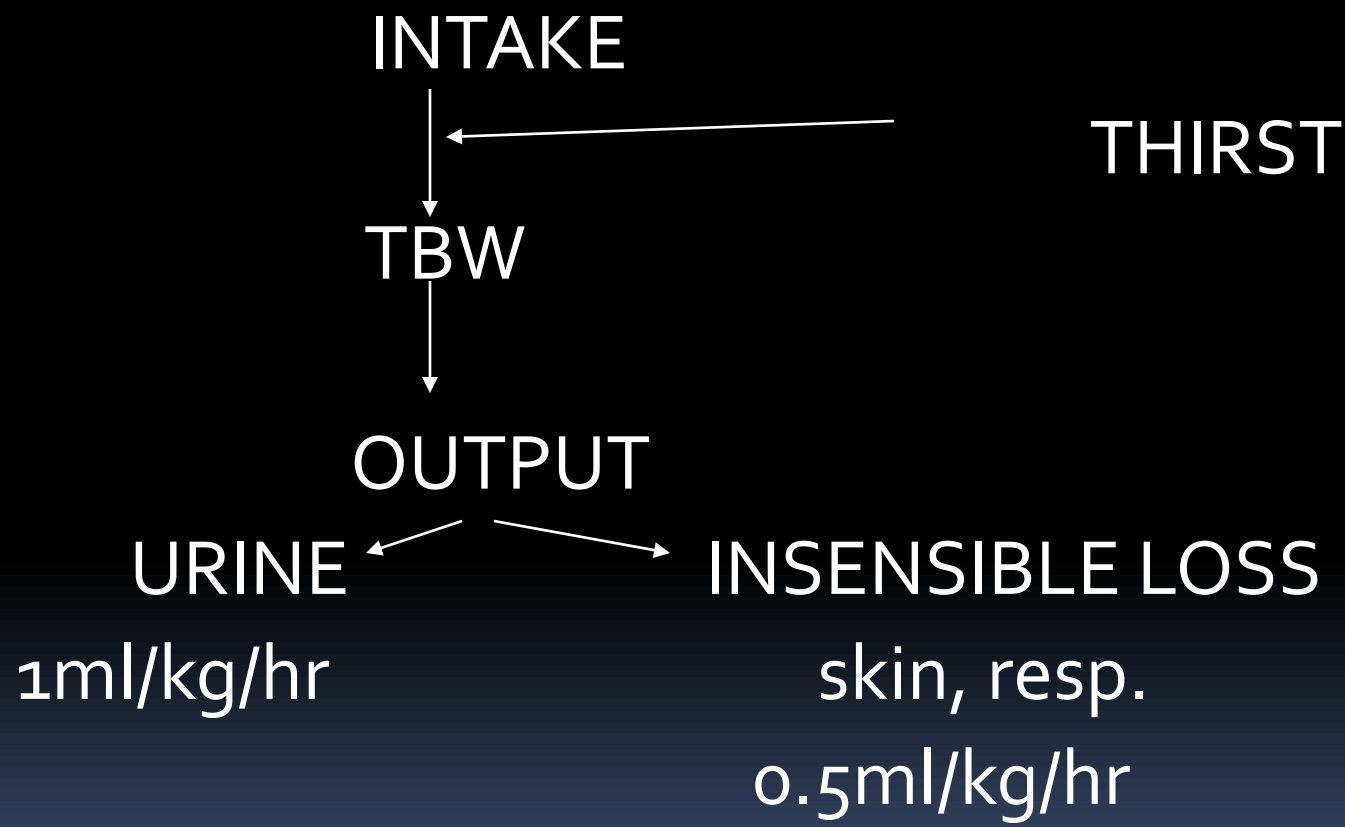


Important principles

- At equilibrium the compartments are isotonic to each other at an osmolarity of 290mosm/L
- Ionic concentrations differ



WATER BALANCE



Maintenance

- NORMAL WATER REQUIREMENT
  30 - 35 ml/ Kg/ day
- SODIUM REQUIREMENT
  1 mmol/ Kg / day
- POTASSIUM REQUIREMENT 1mmol/Kg/day

FLUID THERAPY
Estimating requirements

- NORMAL REQUIREMENTS
- EXISTING FLUID DEFECIT- Fasting, vomiting, dehydration
- ABNORMAL LOSSES - during and after surgery

ASSESSMENT OF DEHYDRATION-1

- History - Fasting, Vomiting

- Level of obstruction & loss of fluid / electrolytes

	Vol	Na	CL	K	HCO_3
Gastric	500-2500	60	80	10	
Biliary	500	140	100	5	40
Intestinal	3000	120	110	20	30

ASSESSMENT OF DEHYDRATION-2

- Severity of dehydration (percentage of Total body water)

	Mild (4%)	Mod (6%)	Severe (8%)
Thirst	+	++	+++
Tongue		Dry	V Dry
Skin and sunken eyes		+	++
UOP	N	<0.5ml/kg/hr	
Pulse	N	N	100-120
Deficit (70kg man)	1.7l	2.5l	3.4l

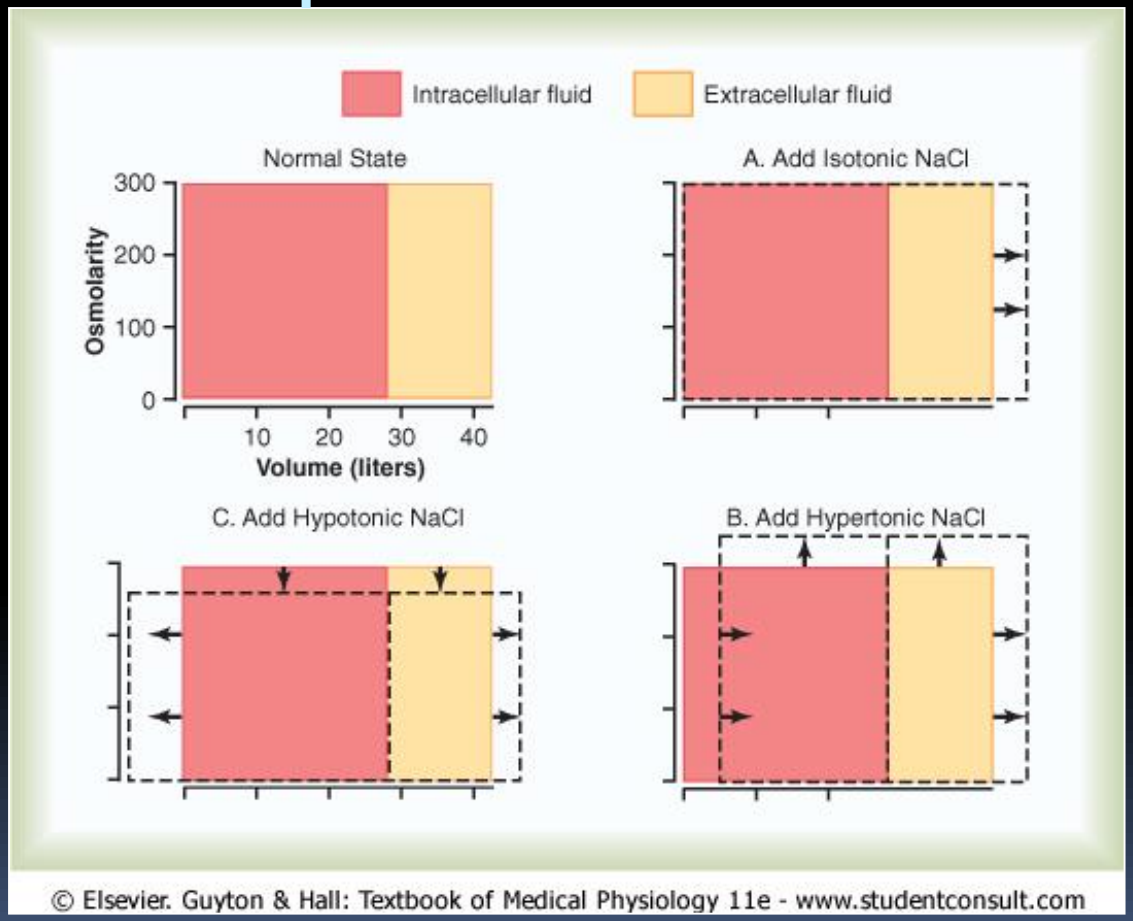
ABNORMAL LOSSES

- NG Aspirate
- Ascitic fluid
- Third space - 5 - 15ml/kg/hr of surgery
- Evaporation
- Drainage

What fluids do we have?

- 5% Dextrose
- Crystalloids – N Saline, Hartmanns
- Colloids – Gelatins, Starches, Dextrans

Effect of IV Fluids on Body Fluid Compartments



ICF	ECF	Plasma

5% Dextrose	400ml	150ml	50
N Saline		400ml	200
Colloid eg:Gelufundin,Starch			600

WHAT FLUID?

- Mild dehydration – ORS, K-C water, Hartmanns

  Which compartment is depleted?

- Severe - Colloid to restore intra-vascular volume.

- Guided by clinical assessment.

WHAT FLUID?

- Gastric loss & Intestinal loss - Hartmanns
- NG aspirate - Hartmanns
- Third Space - N Saline
- Evaporation - 250ml/hr of open abdomen 5% Dextrose

REPALCING THE DEFICIT: HOW FAST?

- Severe depletion- 20ml/ kg in 10-15 minutes
- Caution in the elderly or those with cardiac disease.(Monitor/ assess response)

MONITOR

	GOALS
Pulse	<100
UOP	1ml/kg/hr
CVP	6cmH_2o
Lung bases - no creps	
PCV	>30 < 45
Bl Urea	Normal

Goals

- Maintain Hb 8- 10g%. (PCV 30%)
- Maintain UOP 0.5 - 1 ml/kg/ hr
- A basic 1.5 - 2L / 24hrs in an adult to replace insensible loss and maintain an adequate UOP.

  Increase water intake if there is a temperature
- Replace K from second post op day
- If IV fluid prolonged consider parenteral nutrition

POTASSIUM

- Principle intracellular cation
- Responsible for the resting membrane potential. Imp for N and M function.
- Total body K - 35 - 50mEq/kg
- S K - 3.5 - 4.5 mEq /kg
- 1mmol/l drop = 100mmol TBK loss
- Kidney not good at conserving K
- Obligatory loss of 10 -20 mmol/d

HYPOKALAEMIA

Causes

- Reduced intake - Nil orally with prolonged IV Fluids
- Tissue redistribution - Insulin, B sympathomimetics, Dopamine
- Increased losses- GIT-fistulae, NG

  Renal - diuretic therapy

HYPOKALAEMIA

- No urgency to treat unless S K < 3MEq/L

confirmed by ECG changes.

- T wave flattened
- Prominent U wave
- Prolonged PR interval
- ST depression

HYPOKALAEMIA

Treatment

- Best as oral KCl
- If IV give slowly to allow time for equilibration with the intracellular compartment.
- Normal 10 mEq/hr to a max 20mEq/hr
- Ensure a good urine output
- Commence 2nd day post op. if not on orals unless already hypokalaemic.

Post operative Fluid requirements for adults

- Maintenance fluid requirement – 30 -35ml/kg/d or 1.5 ml/kg /hr
- During IV fluid therapy the 24 hour UOP should be monitored.
- UOP should be measured hourly

1st Day

- Maintenance 30-35ml/kg as 500 -1000ml of N Saline to ensure sodium requirement and the rest as 5% dextrose.
- 1.5 ml / kg / hr (alternate N Saline / dextrose)
- Evaluate hourly UOP to assess adequacy of replacement.
- If UOP < 0.5ml/hr for > 2 hours inform and take action
- In the presence of large fluid shifts balance the fluid every 4 hours.

2 nd Day

- Assess the balance of the previous 24 hours.
- Output = UOP + insensible loss of 15/ml kg + other losses (drains)
- If UOP 1ml/kg/h consider increasing input.
- If UOP > 1 ml/kg /h do not include a volume in excess of 1500 as output for balancing, since this is possibly due to excess input except if diuretics have been given
- Caution – except if in high output renal failure (CVP as guide)

3rd Day

- Diuresis occurs due to fluid shift from ECF from third space.
- Do not replace the UOP as the body is trying to get rid of excess.

What to do if UOP is low < 0.5 ml /kg/hr?

- Assess fluid balance
- Fluid challenge 200 – 500ml over ½ hr – 1 hr.
- Reassess UOP
- Consider CVP line insertion
- (Do not use diuretics or inotropes as the first option)

Fluid challenge

- CVP – normal 2 – 6
- In ventilated patient's 5 – 10
- In sepsis
  - Unventilated 10
  - Ventilated 15
- CVP meant for fine tuning
- Elderly, IHD, Sepsis, Large fluid shifts
- 50 – 250 ml in 10 min and look for response

BLOOD TRANSFUSION

- Whole blood
- Packed cells
- Fresh frozen Plasma
- Platelets.
- Cryoprecipitate

Risks of Blood Transfusion

- Reactions – Haemolytic, febrile, allergic, vaso-vagal
- Disease – malaria, HBV, HBC, HIV
- Immonological
- Overload
- Depletion – Platelets, 2,3 DPG, coagulation factors
- Storage - microaggregates

Methods of avoiding blood transfusion

- Improve Hb level
- Minimize bleeding-
- Ensure good cardiac output
- Accept lowest transfusion guidelines
  - Young healthy – 7g /l
  - Av health 8g
  - Elderly and poor health 10g

Massive blood transfusion

- One blood volume within 24 hours
- 70 ml/kg

- ½ blood volume within a few hours

- 5 units of blood

Problems of massive blood transfusion

- Hypothermia
- Dilutional coagulopathy
  - Platelets
  - Labile clotting factors
- Blood borne infections
- Hypersensitivity reactions
- Hyper K
- Hypo Ca

Transfusion of blood components

- FFP –Replacement of coagulation factors
  - INR >1.5 with bleeding or before surgery
  - Massive blood transfusion
  - Plasma exchange
- Platelets - <10,000
  - <20,000 with bleeding
  - < 50,000 pre op
  - <Inherited or acquired platelet dysfunction