

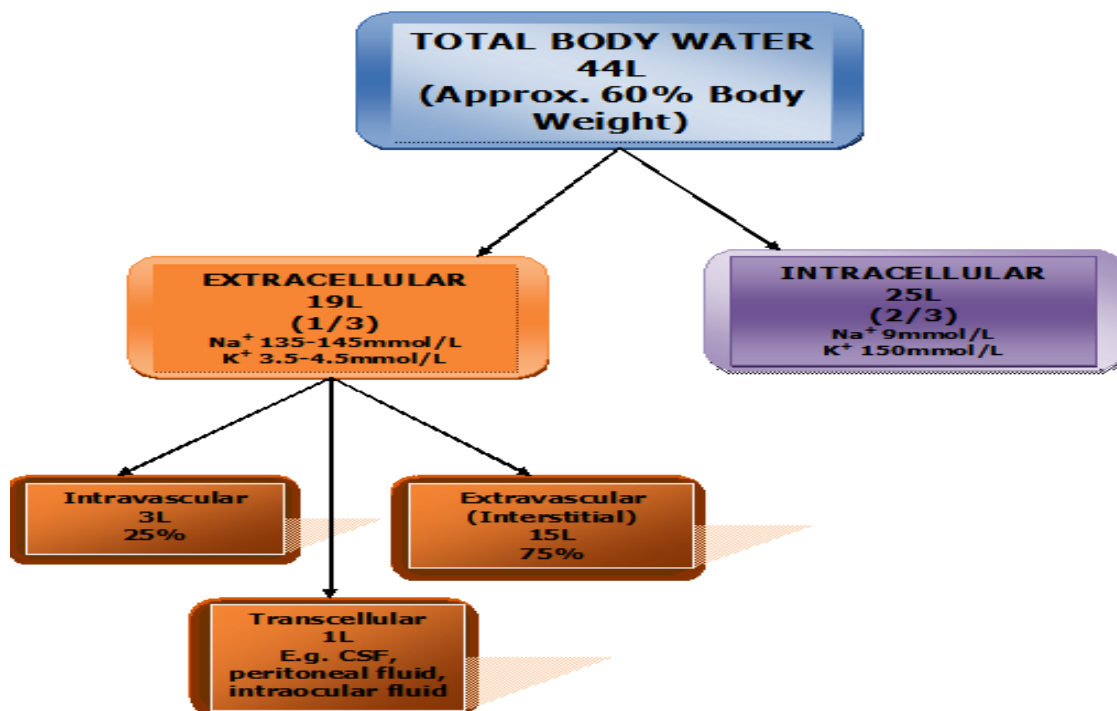
FLUID & ELECTROLYTE BALANCE

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OBJECTIVES

- To review the principles of fluid homeostasis
- To review fluid types
- To be able to prescribe fluids in the post-op patient

FLUID COMPARTMENTS (70kg Man)



NORMAL DAILY FLUID & ELECTROLYTE INPUT & OUTPUT

The average 70kg person needs approx. **2.5-3L fluid, 150mmol Na+ & 60mmol K+** per day to cover losses & maintain normal fluid-electrolyte balance.

<u>Intake</u>	
(approx. 2.5L)	
■ Water	
Diet	2.3l
Metabolism	0.2l
■ Na+	
150mmol/day	
■ K+	
100mmol/day	

<u>Output</u>	
(approx. 2.5L)	
■ Water	
Urine	0.5-1.4l
Stools	0.1l
Lungs	0.5l
Sweat	0.5l
■ Na+	
Stool	5mmol/day
Urine	140mmol/day
Skin Transpiration	5mmol/day
■ K+	
Stool	10mmol/day
Urine	85mmol/day
Skin	<5mmol/day

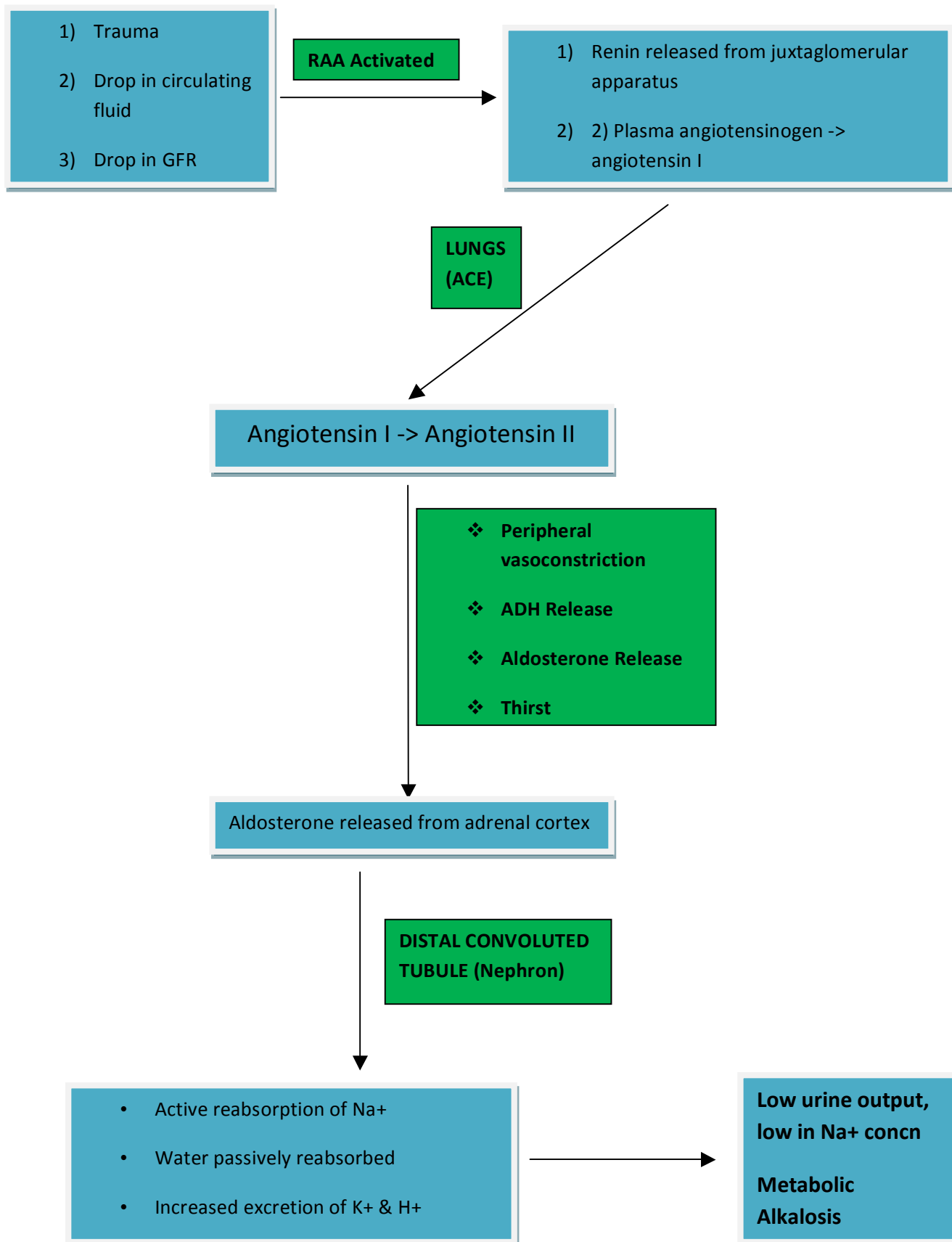
FLUID HOMEOSTASIS

- Water freely diffuses unlike ions & proteins
- Osmolality maintained within narrow range 285-295mosmol/L

■ Excess water loss -> Increased osmolality
■ ADH released
■ Thirst
■ ->WATER RETENTION

■ Excess water intake -> Decreased osmolality
■ ADH release inhibited
■ Thirst eliminated
■ ->DIURESIS

RENAL CONTROL (RENIN-ANGIOTENSIN-ALDOSTERONE SYSTEM)



RENAL CONTROL (ADH- Anti-Diuretic Hormone)

1. Decreased BP
2. Reduced plasma sodium osmolality
3. Osmoreceptors stimulated in hypothalamus; stretch receptors stimulated in heart and large arteries
4. ADH released from post. Pituitary
5. ADH binds to distal convoluted tubule receptors
6. Water Retention

TYPES OF IV FLUIDS

COLLOIDS	CRYSTALLOIDS
<ul style="list-style-type: none"> ■ Osmotically-active particles in soln. ■ Larger molecules, remain in intravascular compartment longer ■ Maintenance of plasma vol. & Acute replacement of plasma vol. deficit ■ For Example: <ul style="list-style-type: none"> ■ Albumin ■ Gelofusin/Volplex ■ Haemaccel 	<ul style="list-style-type: none"> ■ Salt ions in water ■ Provides daily requirements for water & electrolytes ■ 1/3 stays in intravascular compartment, 2/3 pass to interstitial & transcellular compartments ■ High risk of oedema, but advantageous that ECF deficit can be replaced in shock

CRYSTALLOIDS

MMOL/L	NORMAL SALINE	HARTMANN'S	4% DEXTROSE; 0.18% NACL	5% DEXTROSE
Na+	155	131	30	0
K+	0	5	0	0
Ca ²⁺	0	2	0	0
Cl-	151	111	30	0
HCO ₃ ⁻	0	29	0	0
	ISOTONIC WITH PLASMA	PHYSIOLOGICAL	ISOTONIC WITH PLASMA	LIKE GIVING WATER

FLUID & ELECTROLYTE CHANGES IN RESPONSE TO SURGERY & TRAUMA

- Na^+ & Water retention -> Reduced Urine Vol. + Urine Na^+ Conc. because:
 - Catecholamines released; hypothalamus-pituitary-adrenal axis stimulated
 - Cortisol & Aldosterone released.
 - Reduced renal perfusion (Haemorrhage/fluid loss into other spaces)
 - RAA System activated
 - ADH Secretion
- Serum K^+ Increases
 - K^+ lost in urine
 - But increased release of K^+ from tissue damage by surgery/trauma

CAUSES OF FLUID LOSSES IN SURGICAL PATIENTS

❖ Blood

- Trauma
- Surgery

❖ Plasma

- Burns

❖ GI

- Nasogastric aspiration
- D&V
- Intestinal obstruction & paralytic ileus
- Fistulae
- Stomas

❖ Exudate in Peritoneal Cavity

- Peritonitis
- Acute Pancreatitis
- Septicaemia

❖ Excess Insensible Loss

- Fever
- Sweating
- Hyperventilation

COMMON FLUID & ELECTROLYTE PROBLEMS IN SURGICAL PATIENTS

1) BLOOD & PLASMA

- Loss $\geq 1\text{L}$ -> Hypotension & Shock
- Best replacement therapy = blood
- Colloids, eg. Gelofusin used until x-matched blood available
- In burns: 2-4ml of Hartmanns/kg body weight/% 2nd or 3rd degree body surface burns in 24hrs (50% in first 8hrs, Next 50% to be given over remaining 16hrs)

2) EXCESSIVE INSENSIBLE LOSSES

- Increased in ill & post-op patients, mainly from lungs (hyperventilation)
- Every $^{\circ}\text{C}$ temp. rise increases insensible losses by 10%
- Excessive sweating causes loss of Na^{+} -rich fluid

3) GI LOSSES

- 6-10L electrolyte-rich fluid secreted in upper GI daily
- Replace with normal saline with addition of K^{+} as necessary
- Check U&Es regularly

4) INTRAPERITONEAL FLUID LOSSES

- E.g. peritonitis & acute pancreatitis
- Fluid loss into peritoneal cavity & retroperitoneum
- Fluid replacement is key
- Plasma substitutes & Normal Saline

5) SEPSIS

- Peripheral vasodilatation
- Large increase in capillary permeability
- Loss of protein & electrolytes into extracellular space
- Replace with colloids & normal saline
- Monitor fluid loss by:
 - **URINE OUTPUT!**
 - BP
 - CVP
 - Pulmonary wedge pressure monitoring