Physiology of blood donation and adverse donor reactions

Body Fluid compartment

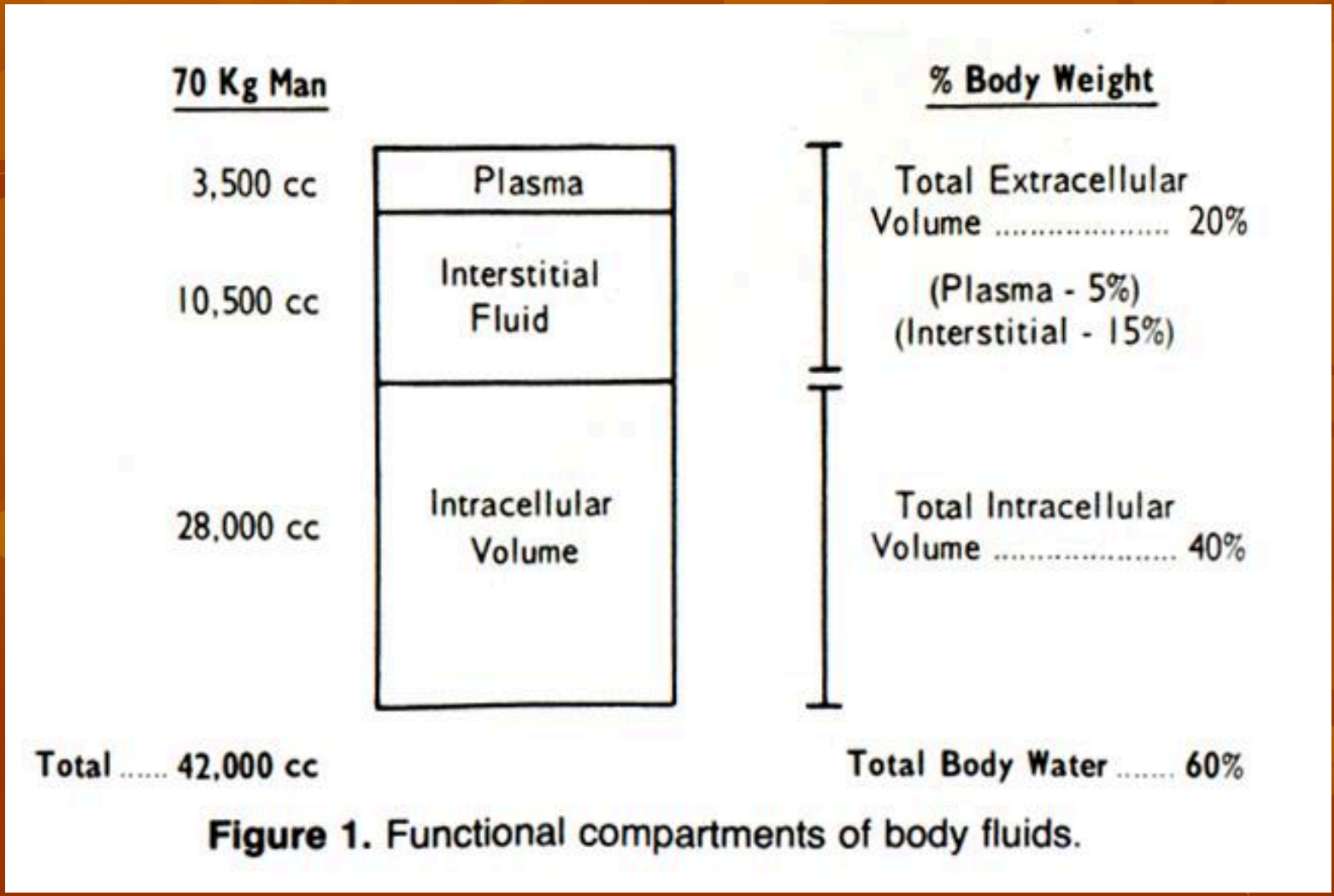


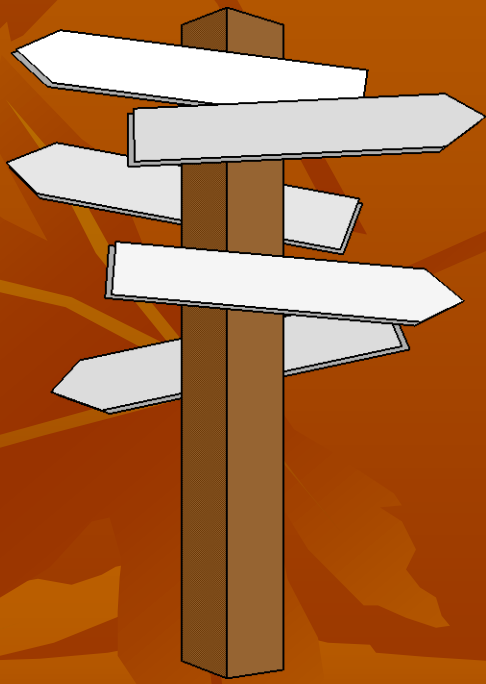
Figure 1. Functional compartments of body fluids.

Physiologic changes in blood volume

- Blood volume and proportion of its various constituent are fairly constant in men but modified in females by menstural cycle & pregnancy
- In neonates it is determined by circumstances of birth

Factors affecting blood volume

- Water and food intake
- Sodium intake
- Postural changes: changing from lying down to sitting or standing result in ↓ BV due to passage of water from vascular to interstitial compartment & by the effect of gravity on capillary hemodynamics



Factors affecting blood volume

- Short term gentle exercise causes ↓ BV & ↑ in hematocrit but prolonged exercise has opposite effect
- During pregnancy PV ↑ up to 25 to 50% & red cell volume ↑ 15 to 20%
- Disproportionate ↑ in PV over red cell is called hydremia of pregnancy
- In second half of ovulatory cycle retention of salt & water causes ↑ in interstitial & PV

Changes during blood donation

- After blood loss refilling of vascular compartment starts & interstitial fluid re-enters in circulation from capillaries & lymphatics
- BV depletion refill at rate of 9-120 ml/hr in first 2 hours & 40-60 ml/hr in next 6-10 hours and refill will complete in 30-40 hours

Changes during blood donation

- Immediately following blood loss ↑ in aldosteron, ↑ in ADH & ↓ urinary Na excretion
- No change in catecholamine or cortisol conc. But it ↑ when loss is > 10-20%
- Since there is no change in osmotic gradient, no shift of water into or out of cell

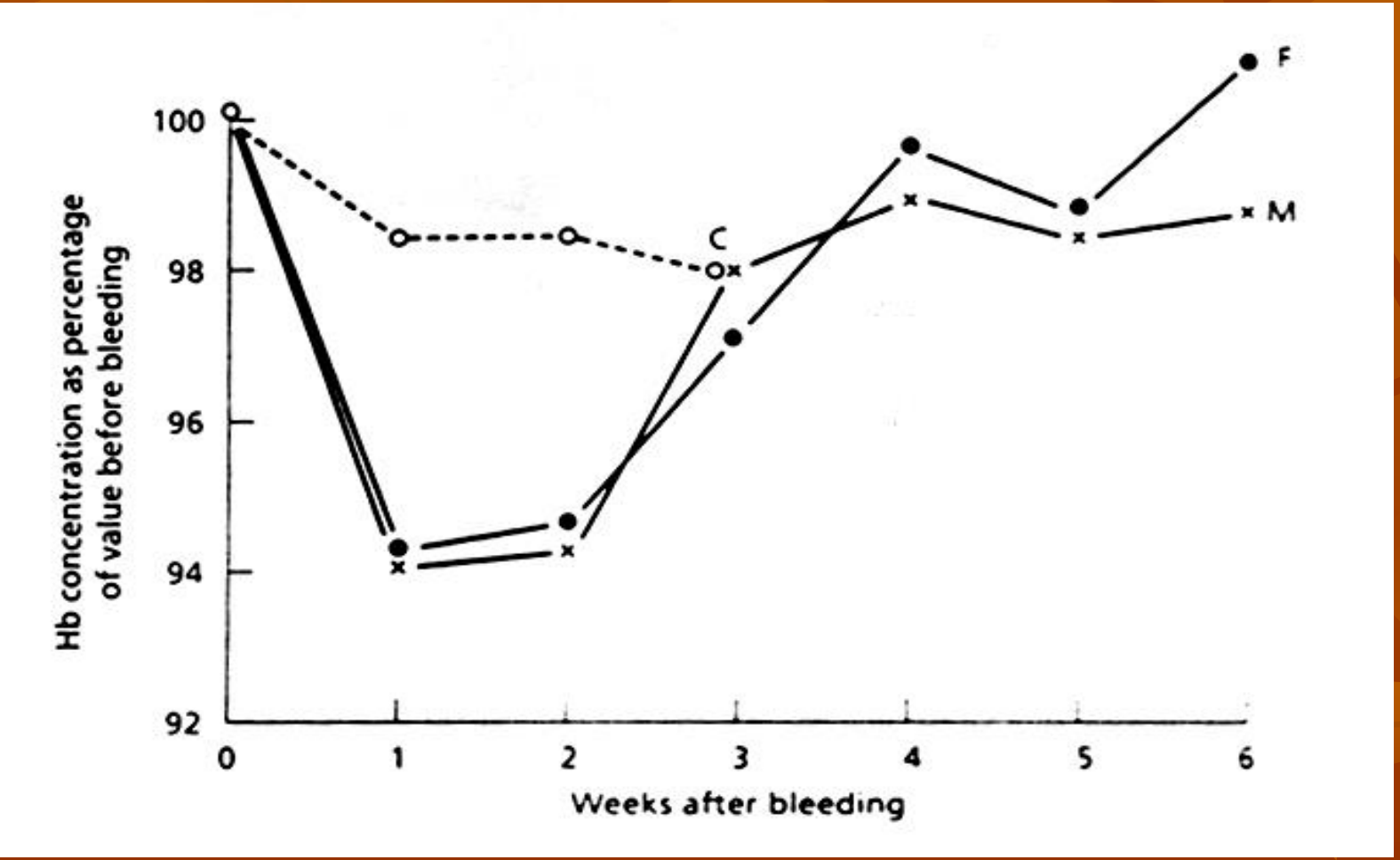
Changes during blood donation (3)

- When refilling is completed, red cell mass & globulin fraction ↓ in direct proportion to volume of blood shed
- Albumin fraction is slightly reduced due to considerable reserve of albumin in interstitial fluid & capacity of liver to manufacture
- 60% (180 mg) of albumin is in extravascular compartment & 40% (140 mg) is in plasma

Changes during blood donation (4)

- Restoration of red cell mass is much slower
- Immediate rise in reticulocyte count which reached peak in 10 days
- Hb remains lowest in second week after donation & restored to pre-donation levels after 4 weeks
- Rate of restoration of red cell mass varies with degree of depletion

Changes during blood donation (5)

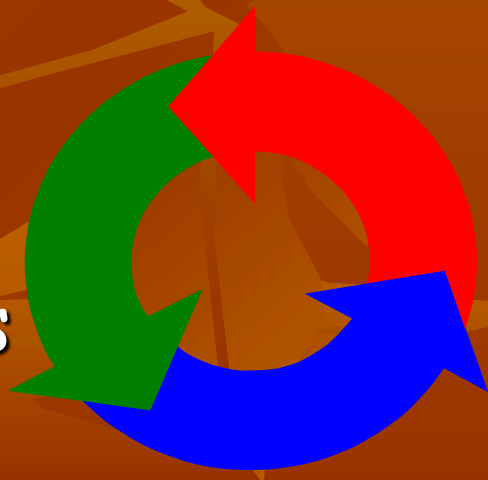


Adverse donor reaction

- Most donor tolerate giving blood very well but adverse donor reaction occur occasionally
- Staff & equipment should always be ready to handle any emergency situation
- Donor can tolerate up to 8ml/kg blood donation very well
- Volume of donated blood should not be >15% of estimated blood volume

Adverse donor reaction : vasovagal syndrome (1)

- Syncope or fainting may be caused by sight of blood, by watching others to donate blood or by excitement (psychological or neurophysiological response)
- Symptoms include weakness, sweating, dizziness , pallor, loss of consciousness, convulsion & involuntary passage of urine or feces



Adverse donor reaction: vasovagal syndrome (2)

- Skin feels cold & B.P. falls as low as systolic 50 mmHg
- Pulse rate slows significantly
- Distinguished by cardiogenic or hypovolemic shock (P.R.↑)
- Remove tourniquet & withdraw needle if sign of reaction occurs during phlebotomy

Adverse donor reaction: vasovagal syndrome (3)

- Apply cold compresses to forehead & back of neck
- Administer aromatic spirits of ammonia by inhalation, donor respond by coughing which elevates B.P.
- Head low & leg raised position
- Monitor B.P., pulse & respiration

Adverse donor reaction: Nausea & vomiting

- Make donor comfortable & instruct to breath slowly & deeply
- Provide suitable receptacle if donor vomits
- Head is turned to side due to danger of aspiration

Adverse donor reaction: muscular spasms

- Donor may hyperventilate causing faint muscular twitching or tetanic spasm of hands & face
- Engage donor in conversation to interrupt hyperventilation
- Manifestation are carpopedal spasm, laryngospasm & chvostek sign (signs of hypocalcemia)

Adverse donor reaction: Hematoma

- Bruising or hematoma mainly restricted to antecubital area
- Remove tourniqet & needle
- Place 3 or 4 sterile gauze over venipuncture site & apply digital pressure
- Apply ice if desired

Adverse donor reaction: Arterial puncture

- Suspect when blood bright red in color, flows very fast, unexplained pain
- Immediately withdraw needle, apply firm pressure and check for radial pulse
- If it is not palpable or weak, referred to vascular specialist

Adverse donor reaction: Convulsion

- Prevent donor from injuring himself or herself
- Be sure that donor has adequate airway
- Prevent tongue bite by placing tongue depressor
- Give him a lateral position to prevent aspiration

Adverse donor reaction: Cardiac difficulties

- Call for medical aid or emergency care unit immediately
- If donor has cardiac arrest, begin C.P.R. immediately & continue till emergency help arrives

Adverse donor reaction: other rare reactions

- No possibility of air embolism with plastic bags but is occasionally encountered where glass bottles are still used
- Arteriovenous fistula causing aneurysm in anticubital fossa causing aneurysm & needed operative repair (one reported case but unpublished)

Thank You