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Fluid & Electrolyte

FE01 [Mar96] [Mar98] [Jul98] [Apr01] [Jul01] [Mar03] [Jul03] [Mar05] [Jul05] Effects of hypokalaemia:

A. Short PR interval
B. Ventricular extrasystoles
C. Elevated ST segments
D. Long QRS interval
E. Long QT interval
F. Q waves

FE01b Jul98 version: Hypokalaemia:

A. Hyperpolarises membrane ???
B. Peaked T waves
C. Prolonged QT
D. VEBs
E. ST elevation

Alt version: Hypokalaemia:

A. Hyperpolarizes the membrane???
B. Shortens the QRS
C. Shortens the PR interval
D. Depresses the ST segment
E. Prolongs the QT interval

Alt version: Hypokalemia

A. ST segment changes (it did read “changes”)
B. P wave flattening
C. Shortened QT
D. No Q wave

ECG changes with hypokalaemia

- prolongation of the PR interval
- ST segment depression

- T wave: decreased T wave amplitude, late inversion
- prominent U waves

If the T and U waves merge, the apparent QT interval is prolonged, but, if they are separated, the QT interval is seen to be normal.

In addition, hypokalaemia:

- hyperpolarise the membrane
- causes ventricular extrasystoles

Hypokalaemia does:

- NOT cause q waves
- NOT shorten QRS
- NOT prolong QT

FE02 [Mar97] [Jul04] For two solutions separated by a semi-permeable membrane (Solution A: saline solution AND solution B: H2O): Which of the following statements is true?

A. A hydrostatic pressure applied to A will stop osmotic pressure (?)
B. There will be bulk flow from A to B
C. The fluid level in B will go up
D. The NaCl concentration at A will remain the same
E. Water will move from A to B by diffusion

FE03 [Mar97] [Jul97] [Jul99] Rapid (?ingestion/?infusion) of 2 litres of normal saline causes:

A. Increased ECF, increased ICF, decreased [Na^+]
B. Increased ECF, unchanged ICF, increased [Na^+]
C. Unchanged ECF, increased ICF, increased [Na^+]
D. Increased ECF, unchanged ICF, unchanged [Na+]

FE04 [d] [Jul98] [Jul00] Hyperkalaemia:

A. Causes a prolonged QT interval
B. Prolongs the QRS duration
C. Causes ST segment elevation
D. Potentiates digoxin toxicity - hypoK
E. Causes loss of P wave

FE04b [Mar02] [Feb07] ECG changes in hyperkalaemia include:

A. ST depression

B. T wave inversion
C. P wave flattening
D. Sinus tachycardia
E. ?

FE05 [Mar98] [Apr01] [Jul04] Thoracic lymph contains:

A. Clotting factors - all but low fibrinogen
B. Higher protein content than plasma - always lower
C. Similar composition to ISF - hepatic lymph high protein conc
D. Rarely contains fat - from small bowel - high fat
E. ?

FE06 [Mar98] [Jul98] [Mar99] [Feb04] Gibbs-Donnan effect leads to:

A. Non-diffusible ions between 2 sides will be equal
B. Diffusible ions between 2 sides will be equal
C. Equal concentrations of ions on both sides
D. Equal passive diffusion
E. Osmotic gradient - = non diffusable ions contribute to gradient

by altering the concentrations of diffusible ions, resulting in a small net increase in ions present in the plasma and maintenance of the plasma oncotic pressure in the blood.
F. Important in the measurement of plasma oncotic pressure

FE07 [Jul98] [Mar05] [Jul05] With decreased osmolality and hypovolaemia, you would see:

A. (?Decreased/increased) urine output
B. Decreased ADH secretion
C. Decreased aldosterone
D. Increased permeability of collecting ducts to water
E. Decreased renin
So the knowledge this question is testing is whether you know that hypovolaemia over-rides the inhibition from the hypo-osmolality. Volume is maintained at the expense of a decreased osmolality.

FE08 [Mar99] [Jul00] [Apr01] [Jul04] Hartmann's solution contains:

A. Potassium 2 mmol/l
B. Calcium 3 mmol/l

C. Magnesium 2 mmol/l
D. Sodium 154 mmol/l
E. Chloride ?131 ?154 mmol/l
Hartmans: Na 130, K5, Ca 2, Cl 109, lac 29mmol/L, pH 6.5, osm 279mosm/L

FE08b [Apr01] [Mar05] Hartmann's solution contains no:

A. Na^{+}
B. Ca^{++}
C. Mg++
D. Lactate
E. Cl-
plasmalyte contains Mg but no Ca

plasmalyte Na 140, Hartmans 130

FE09 [Mar99] [Feb00] [Jul00] The total osmotic pressure of plasma is:

A. 25 mmHg
B. 285 mOsm/l (or ?308mOsm/l)
C. 5900 mmHg
D. 300 kPa
E. None of the above

FE10 [Mar99] [Jul05] Normal saline:

A. Osmolality of 300-308 mOsm/l
B. Has pH 7.35 to 7.45. pH 4-7
C. ?
D. ?

FE11 [Mar99] [Mar03] [Jul03] Obligatory water loss from body:

A. 400 mls in faeces 100ml
B. 300 mls from lung
C. Loss from skin & respiratory tract 700ml 900ml
D. ??Insensible water loss
E. 500 mls in urine

Alt version: Normal amount of daily water loss in a 70kg man:

A. 300mls faeces
B. 500mls from urine
C. 700mls from lungs and skin (?insensible)
D. ?
E. None of the above
All figures seemed slightly off from standard text

FE12 [Jul99] [Mar03] [Jul03] [Jul05] Which ONE of the following statements about intravenous crystalloid solutions is TRUE?

A. Rapid infusion of (?one litre) Hartmann's may cause lactic acidosis
B. Hartmann's 300-308 mosm/kg 274
C. 0.9% saline pH 7.35-7.45 4-7
D. N/saline osmol 300-308 mosm/kg. osmolarity = 300, osmolality = 285
E. 0.9% sodium chloride has a pH 6.5-7.5
F. One litre of Hartmann's solution contains 150 mmol of Na+

FE13 [Mar99] [Jul99] [Feb00] Water handling by the kidney (% reabsorption):

A. 93%
B. 94%
C. 99%
D. 99.4%
E. 99.9%
GFR 180l/day. UO 1L/day

FE14 [Jul00] [Jul04] [Mar05] [Jul05] [Feb06] The ion with lowest intracellular concentration is:

A. Na^+ 10
B. $HCO3^-$ 10
C. Ca++ 100nmol/L ie nano - rest are mmol/L
D. Mg^{++} 10
E. K^+ 150

FE15 [Apr01] Total plasma osmolality can be calculated via:

A. Van Halen's equation
B. Starling equation
C. P = nRT
D. (multiplying 19.2mmHg/mOsm/L by body Osm) (*it worked out in the exam!*)

E. None of the above

FE16 [Apr01] Which of the following will increase plasma potassium concentration

A. Beta adrenergic receptor AGONIST
B. Insulin
C. Aldosterone
D. haemolysis
E. None of the above

FE16b [Ju05]: Which will increase plasma [K^+]?

A. Hyperglycaemia
B. Aldosterone
C. Metabolic acidosis
D. ?
E. Carbonic anhydrase inhibitors

FE17 [Apr01] Osmotic pressure in plasma is usually 1.6 mosmol/L more than ISF. This is because of

A Plasma Proteins
B Plasma Oxygen Tension
C Plasma creatinine
D ?
E ?

FE18 [Apr01] [Mar03] [Jul03] [Feb04] [Jul04] (Responses to ?increased osmolarity)

A. ?Thirst and ADH from stimulation of osmoreceptors in posterior hypothalamus. ant hypothalamus
B. ?Thirst via stimulation of SFO and OVLT via Angiotensin II in hypovolaemia
C. Baroreceptors afferents to the Posterior Pituitary
D. Increased ADH levels but doenst effect thirst
E. Aldosterone - but doenst effect thirst

Alt version(Mar 03): Increases in plasma osmolarity in a healthy young person produce:

A. Production of ADH from posterior pituitary. produced in hypothalamus, secreted from pp
B. Thirst via ADH effect on paraventricular nuclei & supraoptic nuclei
C. ... angiotensin?

D. ?

Alt version: In hypovolaemic shock, thirst is triggered via:

A. Angiotensin II acting on the circumventricular organs
B. ?

Feb 04 version Thirst is stimulated by:

A. Release of angiotensin II
B. Supraoptic nuclei
C. ?
July 04: Thirst in hypovolaemia from

A. Stimulation of baroreceptors which stimulate posterior pituitary
B. Angiotensin II stimulating SFO and OVLT
C. increased ADH levels
D. Aldosterone
(?), osmoreceptor stimulation not an option

FE19 [Apr01] [Feb04] Sweat in patients acclimatised to hot weather (as compared to patients in a temperate climate) contains less Na+ because:

A. Takes longer for Na^+ to be transported through sweat ducts
B. Aldosterone effect causing a reduction in Na+ in sweat
C. Increased intake of water causing a reduction in Na concentration
D. ?

FE20 [Jul01] Magnesium is required for:

A. To Depolarise excitable cell membranes
B. Na+-K+ ATPase cofactor
C. Coagulation
D. ?
E. ?

Mg Intracellular function

Catalysing Mg++ dependent enzymes

- all enzymes for phosphate transfer
- all enzymes requiring thiamine phosphorylase as a co-factor (therefore **Na+/K+ pump,** oxidative phosphorylation, all reactions involving ATP)

- acts as 'plug' in NMDA receptors ->voltage-dependent block of channel.

Mg Extracellular function

- Reduces nerve and membrane excitability (similar to but < Ca++)
- Inhibits transmitter release (cholinergic and adrenergic junctions)
- Inhibits excitation-contraction coupling in skeletal and cardiac muscle

FE21 [Jul01] Intracellular ?osmolality is greater than interstitial ?osmolality because:

A. Proteins in plasma

B. Cells producing intracellular proteins - gibbs donnan

C. ?

D. ?

E. ?

FE22 [Mar02] [Jul02] [Mar03] [Jul03] Sweating in strenuous exercise. Sweat contains Na+:

A. Less than plasma
B. Equal to plasma
C. More than plasma
D. ?
E. ?

FE23 [Mar03] [Jul03] [Feb04] [Jul05]

Acute onset (4 hours) diabetes insipidus in an otherwise healthy person produces these biochemical changes ("these numbers may not be exact"):

A. Na^+ 130, K^+ 3.0, Osm 260
B. Na^+ 130, K^+ 4.0, Osm 300
C. Na^+ 150, K^+ 3.0, Osm 260
D. Na^+ 150, K^+ 3.5, Osm 320
E. Na^+ 160, K^+ 3.0, Osm 320

Comment received July 03: "For the DI question there were a set of normal electrolytes as an option too - which is missing from the bank thus far (the problem with the discussion previously on the Bulletin Board ie the most 'normal' set of electrolytes were hyponatraemic/ hypoosmotic - if your thirst mechanism is intact and you have access to water you have

normal electrolytes but tend towards hypernatraemia/hyperosmolality. The actual numbers in the MCQ were Na 140 K 3.5 Osm 300. (One of the options also had a K of 6.0!)"

"I must admit I still answered normal electrolytes in spite of the 'untreated' bit in the Q since drinking is part of the normal physiology of DI (most DI's are not the head injured ventilated pt's we tend to see in ICU but rather the compensating DI's in renal clinics)... ie I regarded drinking lots as normal physiology for DI, not a treatment for it."

FE24 [Mar03] [Jul03] Colligative properties:

A. Increase BP, decrease freezing point, decrease SVP
B. Other combinations: increase/ decrease…boiling point/FP/SVP
C. ?
The Colligative properties of a solution are those properties that depend ONLY on the particle concentration (number of solute particles per unit volume) - and NOT on the chemical properties of the substance or size of the particles.

(as concentration of particles increases)
These properties are:

- Freezing Point Depression
- Boiling Point Elevation
- Vapour Pressure Depression – reduction of the solvent molecules ability to leave the solution
- Osmotic pressure

FE25 [Mar03] [Jul03] Organic ion necessary in Na-K ATPase

A. ?
B. ?
C. Mg+2
D. PO4
E. $SO4^{-2}$

FE26 [Jul04] A patient is given an infusion of 100 mL of 8.4% sodium bicarbonate solution. This represents an osmotic load of:

A. 42 mosmol
B 84 mosmol
C 100 mosmol

D 168 mosmol
E 200 mosmol

- Secondly: Sodium bicarbonate splits in two ions on dissolving: Na+ and HCO3-.

So an 8.4% solution of sodium bicarbonate contains 1,000mmols of Na+ and 1,000mmoles of HCO3-. The osmolality is this 2 Osm/litre (or 2,000 mOsm/litre).

A 100mls of this solution is an osmotic load of 200 Mosmoles

FE27 [Mar05] Regarding the ECF concentrations of K^+ and H^+:

A. K^+ rise causes pH rise
B. They move in the same direction??
C. ?
D. Hypokalaemia inhibits renal H^+ excretion
E. ?

FE28 [Jul05] Hyperkalemia caused by:

A. Metabolic acidosis
B. Aldosterone excess
C. ?
D. ?

FE29 [Feb06] Diffusion across semipermeable membrane:

A. is inversely proportional to thickness
B. is proportional to molecular weight
C. ?
D. ?

FE30 [Jul07] [Feb08] Infusion of 40ml/kg of 0.9% saline solution will cause:

A. Hypochloraemic metabolic acidosis.
B. Hypochloraemic metabolic alkalosis.
C. Hyperchloraemic metabolic acidosis.
D. Hyperchloraemic metabolic alkalosis.
E. No acid base disturbance.

FE31 [Jul07] Lymph flow:

A. greatest when skeletal muscle contracting
B. when interstitial pressure 1-2mmHg above atmospheric
C. approx. 1000ml per hour via thoracic duct 120ml/hr lymph flow (100ml throacic duct)
D. ?
E. ?

FE32 [Jul07] Post-thoracotomy the drain is leaking fluid with protein, fat, lymphocytes etc. What could be the cause?

A. Bleeding
B. Thoracic duct injury
C. sympathectomy
D. Pleural fluid
E. ?? "something like CHF or pulmonary oedema"
Alt stem: "Post-thoracotomy the drain is leaking fluid that contains protein, coagulation factors, with a high fat & lymphocyte count"

FE33 [Feb08] Hyponatraemia is usually due to:

A. Excess lipids
B. Excess glucose
C. Free water deficit
D. Excess protein
E. Free water excess

FE34 Hypertonic fluid is used in resuscitation for:

A. increase in total body sodium
B. reduction in viscosity
C. improve coagulation
D. reduce intracellular oedema
E. rapid expansion of intravascular volume

FE35 Feb12 Chronic hypokalaemia (3.0 mM) will cause which ECG changes?

A. Flat p waves
B. Flat T waves
C. Cardiac arrest in diastole - occurs in ↑K

D. More prone to arrhythmia than acute hypokalaemia
E. Resting membrane potential will be higher? - ↑excitability

FE36 Feb12 With regards to chloride:

A. Hyperchloraemia leads to decreased plasma HCO3
B. Intracellular concentration is less than 20mM =9
C. ?
D. ?
E. ?

With regards to chloride:
A. ? changes in direct proportion to bicarboate
B. it is the major cation extracellularly. is an anion. but is the major extracellular anion
C. is a weak base = strong base
D. ?
E. Intracellular concentration < 20 mMol/L

FE37 Feb12 A person with undiagnosed adrenocortical insufficiency will have the following electrolyte profile:

A. Na 122 K 6.2 Cl 72 HCO3 40 ??
B. Low Na, High K, Low Cl, Low HCO3
C. Low Na, High K, Low Cl, Normal HCO3 Cl move with Na
D. Low Na, High K, Low Cl, Raised HCO3
E. High Na, Low K ... ??

- Not clear whether this MCQ had example values, or was just *high, low & normal* options

FE38 Feb12 Long PR interval, ST depression, T wave inversion and U wave is caused by which electrolyte abnormality?

A. Hypokalaemia
B. Ca++
C. Na+
D. ?

FE39 [Mar10] Which is true regarding colloids?

A. dextrans stay in the circulation for 6-8hrs

B. gelatins have a higher rate of anaphylaxis than starches
C. ?? has greater effect on coagulation than ??
D. do not depend on renal clearance for excretion
E. ?
FE39b [Feb13] *Probably a different MCQ on the same topic as one above*

Colloids:
A. ?
B. ?
C. HES is completely excreted by the kidney
D. Dextran 40 is used to improve micro-circulatory flow
E. ?