

N313 FOCUS CONCEPTS Exam 6 F&E, Acid/Base

1. What is the most common cause of low potassium serum levels?

Diuretic therapy is the most common cause; most K⁺ loss via the renal system.

2. What is the relationship between calcium and Vitamin D?

Vitamin D allows your body to effectively absorb calcium

3. What are neurologic changes that occur with abnormal levels of calcium, sodium, and potassium?

Calcium: Hypocalcemia=increased neuromuscular excitability/spasms. Hypercalcemia=decreased neuromuscular excitability, weakness.

Sodium: Hyponatremia= Headache, confusion, muscle cramps/spasms. Hypernatremia= dehydration, thirst, tachycardia, oliguria, poor skin turgor, dry mucus membr.

Potassium: Hypokalemia= cardiac arrhythmias, leg cramps, vomiting, anorexia. Hyperkalemia= numbness, muscle cramps, mental confusion, diarrhea, can lead to cardiac arrest.

4. What is the definition of Osmotic pressure? Oncotic pressure?

Osmotic: pressure by solutes in solution

Oncotic: Force exerted specifically by albumin in blood; pulls fluid into blood stream

5. What are signs of overhydration (fluid overload) in body? Is serum albumin level high or low?

Edema is a sign; decreased osmotic forces in blood=hypoalbuminemia.

6. What are signs of dehydration in body? What is 3rd spacing?

Osmoreceptors stim. thirst; increased HR & decreased BP (tachycardia and hypotension)

3rd spacing: when fluid accumulates in body cavity that's normally free of fluids (pericardial sac, peritoneal cavity, pleural space); called effusion.

7. What does ADH do? What secretes it?

AKA vasopressin; synthesized by hypothalamus, released from post. pituitary. Stimulates kidneys to reabsorb and secrete more H₂O.

8. What are main signs/symptoms of hypernatremia? Hyponatremia?

Hypernatremia: dehydration, thirst, tachycardia, oliguria, dry mucus membr., poor turgor.

Hyponatremia: headache, confusion, muscle cramps/spasms.

9. What are main signs/symptoms of hyperkalemia? Hypokalemia?

Hyperkalemia: Numbness, muscle cramps, diarrhea, confusion.

Hypokalemia: Anorexia, vomit, arrhythmias, leg cramps.

10. What are main signs/symptoms of hypercalcemia? Hypocalcemia?

Hypercalcemia: decreased neuromuscular excitability, weakness, renal calculi, arrhythmias.

Hypocalcemia: increased neuromuscular excitability, spasms, paresthesia(tingling/prickling), hypotension, arrhythmias, bone pain.

11. What are numerical ranges for serum sodium? Potassium? Calcium?

Sodium:Hypo= less than 135 mEq/L; Hyper= greater than 145 mEq/L

Potassium:Hypo=less than 3.5 mEq/L; Hyper= greater than 5.2 mEq/L

Calcium: Hypo= less than 8.7 mg/dL; Hyper=greater than 10 mg/dL

12. What is the relationship between calcium blood levels and hormones

Parathyroid hormone and calcitonin control calcium levels in blood and bone; Hypercalcemia causes elevated parathyroid hormone (PTH) lvls.

13. Calcitonin and parathyroid hormone?

Hyperparathyroidism is one of the most common cause of hypercalcemia; PTH is overproduced and the hormone pulls an excessive amount of calcium out of bones and into the bloodstream.

Parathyroid hormone and calcitonin control calcium levels in blood and bone (ppt chapter 7, slide 36)

PTH acts on bone to mobilize calcium and raise blood levels. Calcitonin, a hormone produced by the thyroid, acts at the bone and kidneys to remove calcium from the circulation

14. What happens to phosphorus levels in blood the calcium level in blood is high? Low?

There's an inverse relationship betw. calcium and phosphate in the blood; hypocalcemia will cause hyperphosphatemia and vice versa.

15. What are normal Arterial Blood Gas of O₂, CO₂, and HCO₃?

o₂: 90 to 100 mm Hg

CO₂: 35 to 45 mm Hg

HCO₃: 22 to 26 mEq/L

16. What is the range of Blood pH? How does the pH show acidosis and alkalosis?

Range: 7.35 to 7.45

Acidosis (acidemia): blood pH less than 7.35; Retain HCO₃, excrete H

Alkalosis (alkalemia) blood pH more than 7.45; Retain H, excrete HCO₃

17. Why are levels of Carbon dioxide (CO₂) and Bicarbonate (HCO₃) harmful if too high or too low?

CO₂ high; greater than 45mm Hg(Respiratory Acidosis) - lungs unable to remove sufficient CO₂, restless, headache, rapid breathing, it can develop confusion, carbon dioxide narcosis, obstructive lung disease may be present, respiratory centers may become insensitive to chronically high CO₂

CO₂ low; less than 35mm Hg(Respiratory Alkalosis) - Tingling of extremities, tetany, dizziness, If patient hypoxic, cyanosis may be present

HCO₃ high; greater than 26(Metabolic Alkalosis) - Confusion, dizziness, weakness, diarrhea

HCO₃ low; lower than 22(Metabolic Acidosis) - Increased respirations, tachycardia, hypotension, confusion

18. What does a buffer system in the blood do?

Help prevent large changes in pH by donating H ion when too basic; absorbing H ion when too acidic.

19. Know the chemical equation of the Carbonic Acid buffer process.

CO₂+H₂O⇌H₂CO₃⇌HCO₃+H

20. Carbonic Acid buffer system has ability to change each acid H⁺ (pos ion) and alkaline HCO₃⁻ (neg ion) into H₂CO₃ (carbonic acid) which then can turn into H₂O and CO₂ or vice versa. So carbonic acid can capture free H⁺ and HCO₃⁻ ions to neutralize acids or alkalines (bases).

21. What are signs of too much or too little CO₂ in blood? How do we treat both?

(resp. acidosis) Hypercapnia: anxiety, SOB, fatigue, rapid breathing, cough, confusion, possible coma. Treat: improve gas exchange.

(resp. alkalosis) Hypocapnia: paresthesia (tingling of extremities), muscle cramps, tetany, dizziness, confusion, seizures, anxiety, coma. Treat: Slow respiration/paper bag.

22. What acid-base problem does hyperventilation or inadequate breaths per minute (hypoventilation) cause?

Respiratory alkalosis= hyperventilation. Respiratory acidosis= hypoventilation

23. What acid base problem does diabetic ketoacidosis cause?

Metabolic acidosis. Without insulin (DM1) ketone formation occurs, pH less than 7.3; HCO₃ less than 15 mEq/L

24. What acid base problem does over ingestion of alkaline medication like Tums cause?

Metabolic alkalosis

25. What acid base problem does over ingestion of aspirin cause?

Metabolic acidosis

26. Why would you encourage someone to breathe through a paper bag?

To slow respirations and treat respiratory alkalosis

27. What are numeric value ranges for pO₂, pCO₂, HCO₃, pH in a blood gas?

pO₂: 90-100

pCO₂: 35-45

HCO₃: 22-26

pH: 7.35-7.45

28. If CO₂ high in respiratory acidosis, kidneys do what to compensate?
(if respiratory system cannot fix?)

Kidneys retain bicarbonate and excrete hydrogen ions if lungs are unable to remove sufficient CO₂.

29. If CO₂ low, in respiratory alkalosis, kidneys do what to compensate (if respiratory system cannot fix?)

Caused by hyperventilation(anxiety); kidneys reabsorb hydrogen ions and excrete HCO₃. Treat w/ slow breathing and paper bag.

30. If HCO₃ low in metabolic acidosis, lungs do what to compensate?

Increase ventilation with Kussmauls breathing; kidneys secrete Hydrogen ions and reabsorb HCO₃.

31. If HCO₃ high in metabolic alkalosis, lungs do what to compensate?

Lungs decrease ventilation to increase CO₂; kidneys excrete HCO₃ and retain hydrogen ions.

32. What is cause in body for Diabetes in Type I and Type II ?

T1DM: autoimmune, no insulin production

T2DM: insulin resistance, sedentary behavior/obesity

33. What are signs, symptoms of both Type I and Type II ?

T1DM:Polyuria, polydipsia(excessive thirst), polyphagia(excessive hunger), DKA

T2DM:Polyuria, polydipsia, polyphagia, metabolic syndrome

34. What changes in blood and urine occur with Type I ? Type II ?

Osmotic diuresis: glucose,acetone, and ketones appears in urine. Increased glucose in the bloodstream.

35. If hyperglycemia progresses to Diabetic Ketoacidosis, what fluid, electrolyte, glucose, protein, changes occur in serum blood and urine? What carbon dioxide, bicarbonate, and pH changes occur in arterial blood gas ?

Without insulin, ketone formation occurs, no insulin to carry glucose into cells & prevents the breakdown of fat, leading to ketone formation. BG greater than 250 mEq/L, pH less than 7.3 mEq/L, HCO₃ less than 15 mEq/L, ketonuria, ketonemia. Lungs attempt to rid body of acid by hyperventilation to release CO₂, this in turn decreases CO₂ lvls, and lessens Hydrogen ion concentration in blood stream.

36. What does insulin do? What organ secretes it?

Insulin: hormone produced by beta cells of the islets of Langerhans in the pancreas; insulin assists in glucose uptake, storage, and usage.

37. What are the ranges of normal glucose level and diabetes levels?

Normal A1C:5.7

Normal fasting lvl: 70-100 mg/dL

DM A1C: 6.5 or greater

DM fasting lvl: 200 mg/dL or greater

38. Sign, symptoms, and treatment of hyperglycemia and hypoglycemia?

Hyperglycemia: BG greater than 200 mg/dL, due to no insulin (T1DM), or insulin resistance (T2DM). S&S polyuria, polyphagia, polydipsia, metabolic syndrome, DKA, blurred vision, electrolyte imbalance. Treat: strict glycemic control, ideal body weight, exercise, insulin therapy.

Hypoglycemia: BG less than 70mg/dL. SNS activation: sweating, hunger, dizziness, headache, heart palpitations, confusion. Treat: fast acting carbs, glucagon, IV glucose.

39. In severe hypoglycemia, what happens to cause ketoacidosis? How do ketones get into urine?

In severe hyperglycemia,ketone formation is a consequence of lipolysis (break down fat), which occurs in the absence of endogenous insulin; therefore, it mainly occurs in T1DM. Ketones accumulate in the bloodstream, as well as in other body fluids such as urine, saliva, and sweat.

40. What 3 signs/symptoms of hyperglycemia are classic?

Polydipsia: cellular dehydration; increased thirst

Polyuria: increased urine output

Polyphagia: weight loss with increased appetite

41. What are long-term complications of diabetes?

Arteriosclerosis, peripheral angiopathy (lack of circulation), diabetic retinopathy, neuropathy, nephropathy, poor wound healing, immunosuppression.

42. What percent of a diabetic patient's diet be carbohydrates? Fats?

Carbs: 40-50%

Fats: 25-30%

43. What is metabolic syndrome? **Cluster of conditions w/ increased risk of heart disease, stroke, DM**

What are the criteria to have metabolic syndrome? 3 of 5 signs must be present: abdominal obesity, hypertension >130/85, hyperglycemia >100, triglyceride lvl >150, or HDL cholesterol <40.

44. What is insulin resistance?

When blood glucose concentration increases 2-3 times normal lvl and remains here for a prolonged period of time; cells fail to respond appropriately to normal lvls of insulin, in turn increasing the amount of insulin needed for normal function.

45. What is Hyperosmolar Hyperglycemic Syndrome (HHS)? Signs and symptoms? Acidosis present or not?

Occurs in T2DM, cells resist insulin causing severe hyperglycemia, hyperosmolarity (osmotic diuresis: glucose in blood pull fluid from cells; excess fluid secreted thru kidneys & out body). Ketones not present as some insulin is present; no acidosis.

46. What is role of ADH Secretion? What secretes ADH?

ADH controls water retention in kidneys; posterior pituitary secretes ADH (antidiuretic hormone/vasopressin)

47. What imbalance in fluid and sodium occurs with HHS?

Electrolyte imbalance/hyponatremia, hyperosmolarity, and dehydration.

48. Which gland close to the brain is the "master gland"?

Pituitary gland

49. What hormones does the posterior pituitary gland secrete?

Anterior pituitary: Growth hormone, Adrenocorticotrophic (stims. adrenal gland), thyroid stimulating hormone, (follicle stimulating hormone & luteinizing hormone SHE SAID NOT IMPORTANT TO KNOW)

Posterior pituitary: Antidiuretic hormone (retain h₂O), oxytocin.

50. What endocrine glands does the pituitary stimulate or suppress by secreting its hormones?

Thyroid, adrenals, parathyroid, pancreas.

51. What disorders or effects does Hyperpituitarism and Hypopituitarism have on the thyroid and adrenal glands?

Hypopituitarism: adrenal insufficiency, hypothyroidism.

Hyperpituitarism: hyper adrenal secretion and thyroid secretion.

52. What does over-stimulation (hyper secretion) OR under-stimulation (suppression) of 1)thyroid, 2) parathyroids, 3) adrenal cortex and 4)adrenal medulla cause? What abnormalities are caused? What are the names of the disorders caused?

Hypothyroidism: (Hashimoto's thyroiditis/autoimmune) Decreased TSH from pituitary gland. S&S: cold intolerance, weight gain, fatigue/lethargy, poor attention span, cramps, decreased fertility, puffy face, hair loss. Systemic effects: hyperlipidemia, yellow/orange skin, anemia, decreased kidney function. MYXEDEMA CRISIS=EMERGENCY

Hyperthyroidism: (Graves disease/autoimmune stimulation) Excessive TSH from pituitary. S&S: Anxiety, tachycardia, sensitive to heat, enlarged thyroid, exophthalmos(enlarged/wide eye stare), weight loss, A-fib. THYROID TOXICITY=EMERGENCY

Hypoparathyroidism: insufficient PTH secretion=hypocalcemia. S&S: Trousseau's sign, Cvoستeks sign, tetany, muscle cramps, seizures.

Hyperparathyroidism: excess PTH secretion=hypercalcemia. S&S: muscle weakness, neuropathies, kidney stones, osteopenia, fractures, poor concentration.

Adrenal cortex insufficiency: Secondary= decreased ACTH from pituitary. Primary= Addison's disease(autoimmune destruction of adrenal cortex). S&S: Hypotension, emotional instability, hypoglycemia, hyponatremia, hyperkalemia, tanned appearance.

Hyperadrenalism (cortex): Cushing's disease= elevated ACTH(adenicotropic from pituitary; tumor in pituitary. Cushing's syndrome= elevated cortisol secretion; hyperfunction of adrenal cortex. S&S: weight gain, body fat in face/trunk/abdomen, puffy/moon face, buffalo hump on cervicothoracic area, increased waist to hip ratio, easy bruising.

Adrenal medulla: Stress response causes secretion on epinephrine and norepinephrine; Over stimulation from tumor pheochromocytoma: hypertension, tremors, tachycardia, etc.

53. --What are the names of the hormones secreted by each?

Thyroid: Triiodothyronine (T3), Thyroxine (T4)

Parathyroid: Parathyroid hormone (PTH)

Adrenal Cortex: Glucocorticoids, mineralcorticoids, androgens

Adrenal Medulla:Epinephrine, Norepinephrine

--What are the signs and symptoms of disorders caused?

54. --What is Grave's Disease?

Autoimmune stim of the thyroid; hyperthyroidism/continual synthesis of thyroid hormones. S&S: sensitive to heat, nervousness, enlarged thyroid, tachycardia, exophthalmos (bulging eyes), insomnia, wt loss, a fib, increased SNS sensitivity.

55. --Addison's Disease?

Adrenal insufficiency(hypoadrenalism), autoimmune destruction of adrenal cortex, antibodies to adrenal cortex, antibodies to steroid enzymes. Can be due to overuse of steroids.

56. --Thyroid toxicosis?

Overstimulation of thyroid hormones. Stimulates metabolism: fever, tachycardia, psychosis. Cause may be surgery or trauma. EMERGENCY.

57. --Myxedema?

Severe lvl of hypothyroidism: non pitting edema, thickened leg skin. Will progress to coma EMERGENCY.

58. --Diabetes Insipidous?

Lack of ADH from post. pituitary. Large volume of diluted urine excreted by kidneys; extra sodium not excreted (plasma sodium increases).

Central DI: lack of ADH from post. pituitary.

Nephrogenic DI: kidneys dont respond to ADH and doesnt reabsorb water.

S&S: oliguria, thirst, dehydration, seizures. High osmolarity and hypernatremia and low urine osmolarity and specific gravity. Treat w/ ADH.

59. What happens in the adrenal cortex if a person takes long term steroids?

Hypoadrenalism from too much (exogenous) steroids. Adrenal gland downregulates receptors. Steroid usage shouldnt be abruptly stopped.

60. What is relationship of serum blood and bone levels of calcium to thyroid and parathyroid glands?

hyperthyroidism- high T3 T4, low TSH