Endocrinology

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ST5 Anaesthetics
• Regarding thyroid gland
  A) iodide ions from plasma enter follicle cells by secondary active transport.-- T
  B) T4 & T3 bind to receptors in nucleus.-- T
  C) after synthesis thyroxine is coupled to thyroglobulin until released.-- T
  D) thyroid hormones increase number & affinity of beta receptors in myocardium.-- T
  E) foetus does not depend on transplacental transfer of thyroid hormones.-- T
**MCQ 2**

- **Thyroid hormones**
  - A] Iodine is essential for thyroid hormone synthesis. -- T
  - B] T3 is more potent than T4. -- T (3-5 times)
  - C] They are essential for normal menstruation/fertility - T
  - D] Are synthesized from tryptophan - F
  - E] Highly bound to plasma proteins. --- T

- >90% -T4; >99% bound to plasma proteins [albumin, TBG]
- Diffuse across cell membrane & act on I/C receptors [ steroids also]
Synthesis of thyroid hormones

• Dietary iodine – iodide transported to thyroid by secondary active transport.
• Iodide is oxidised to iodine & binds to tyrosine -- MIT & DIT
• T4 (90%) & T3 (more potent)
Following are the physiological effects of thyroid hormones –

A) Elevation of BMR.---T
B) Hepatic glycogenolysis.—T (all aspects of carbohydrate metabolism stimulated )
C) Mobilisation of free fatty acids.--T
D) Protein synthesis at low levels.--T
E) Protein catabolism at high levels.--T [In thyrotoxicosis]
Regarding adrenal gland –

A) Adrenal cortex develops from mesoderm. -- T
B) Medulla develops from neuroendocrine cells. -- T
C) Zona fasciculata secretes mineralocorticoids. -- F
D) Zona reticularis secretes androgens. -- T
E) Zona glomerulosa secretes glucocorticoids. -- F

--------G- Mineralocorticoids,
F- glucoCorticoids,
R- Androgens
Adrenal gland

• Cortex – 70% of gland
• Cortex & Medulla – 2 distinct endocrine glands
• Cholesterol – precursor of all CS
• G – mineralocorticoids (aldosterone)
• F – glucocorticoids (cortisol & corticosterone)
• R -- androgens
Aldosterone –

A) is responsible for 95% of mineralocorticoid activity.

B) does not influence sodium absorption from sweat & saliva. (also urine & gastric juice)

C) secretion is increased by increase in ECF volume & increase in potassium.

D) levels are mainly regulated by ACTH.

E) causes tubular secretion of H+ leading to metabolic alkalosis.

- Decrease ECFV & Increase in K+
Regulation of Aldosterone Secretion

- Decrease in extracellular fluid (ECF) volume, blood pressure (B.P.), plasma sodium detected by juxtaglomerular apparatus activates the renin-angiotensin system, leading to aldosterone secretion.
- Increase in plasma potassium (K) activates aldosterone secretion, maintaining normal K levels.
- Deficiency of ACTH does not cause hypoaldosteronism.
MCQ  6

• **Conn’s syndrome results in** –
  • A) *Hypotension.* - F
  • B) *Hyperkalemia.* - F
  • C) *Metabolic acidosis.* - F
  • D) Muscle weakness. - T
  • E) *Dehydration.* - F

• **Primary hyperaldosternism** - tumour of adrenal cortex --- hypertension, hypokalemia, met.alkalosis.
MCQ 7

• Catecholamines ---
• A] are synthesised from tryptophan.-- F
• B] dopamine is converted into norepinephrine by decarboxylase enzyme.---F [dopa to dopamine]
• C] norepinephrine is converted into epinephrine by N- methyl transferase.---T
• D] normal basal levels of norepinephrine are more than epinephrine.---F (epinephrine 80% )
• E] act via G protein coupled receptors.--T
Synthesis Of Catecholamines

Cytoplasm

Tyrosine

Tyrosine hydroxylase

Dopa

Decarboxylase

Dopamine

Dopamine beta-hydroxylase

Noradrenaline

Phenylalanine

Melanin in skin

Corpus striatum

Adrenaline

Granule
Catecholamine synthesis

- Phenylalanine – Tyrosine --- Dopa --- Dopamine---
  ---Norepinephrine --- Epinephrine
- Dopa – Dopamine ( decarboxylase)
- Norepinephrine --- Epinephrine ( N- methyl transferase)
- Hydroxylase – other steps
MCQ 8

• Regarding chromaffin cell tumours –
  • A] most common site is adrenal medulla.---T
  • B] extra adrenal sites are sympathetic ganglia &
    carotid body.---T
  • C] presents with cardiac arrhythmias.--T
  • D] associated with hypertension.---T
  • E] careful preop. control of BP usually with beta
    blockers is required.----T

  • Phaeochromocytoma secrete epinephrine & norepinephrine,--- hypertension, headache
    sweating, arrhythmias, angina, MI
MCQ  9

• Addison’s disease –
  • A) caused by tuberculosis infection--T
  • B) presents with pigmentation of skin or buccal mucosa.---T
  • C) can be autoimmune.---T
  • D) *presents with hypertension.*---F
  • E) *associated with hyperglycemia.*---F

• Hypoadrenalism--- dehydration, hypotension, increase in K+, metab acidosis, loss of wt, muscle weakness, hypoglycemia, decrease resistance to trauma & infection.
MCQ 10

- Insulin
  A) is secreted by beta cells of pancreas.--T
  B) promotes glycogenesis in liver & muscle.--T
  C) is essential for glucose uptake in RBC.--F
  D) increases protein & lipid synthesis.--T
  E) not essential for glucose uptake in CNS.--T

- Insulin is not essential for glucose uptake in RBC & brain.
MCQ 11

- Insulin release is
  A) increased by biguanides type of oral hypoglycaemics - F (act by increasing sensitivity of target cells to insulin)
  B) not affected by sulphonylureas - F (augment insulin secretion from existing beta cells)

- C) inhibited by diazoxide, thiazide & volatile agents - T
- D) stimulated by glucagon - T
- E) normally secreted at a rate of 40-50 U / day - T

- Biguanides – metformin
- Sulphonylureas – chlorpropamide, glibenclamide, gliclazide, glipizide, tolbutamide
MCQ 12

- Growth hormone and insulin have opposite effects on:
  - A) carbohydrate uptake by muscle -- T
  - B) catabolism of fat -- T
  - C) synthesis of fat - T
  - D) synthesis of protein - F
  - E) somatic growth - F
Glucagon (catabolic hormone)

A) is synthesized by delta cells.---F
B) secretion is stimulated by beta agonists.---T
C) increases glycogenolysis.---T
D) secretion is inhibited by high serum glucose.---T
E) has positive inotropic action.---T

Glucagon is a catabolic hormone.

Secretion is increased by stress, sepsis, trauma, hypoglycemia, beta agonists.
Secretion is inhibited by hyperglycemia, somatostatin, insulin, FFA, alpha agonists.
Increase plasma levels of fatty acids & glycerol [activates lipase].
MCQ 14

- Anterior pituitary secretes following hormones
  - A) growth hormone
  - B) ACTH
  - C) ADH – F (oxytocin – posterior pituitary)
  - D) TSH
  - E) prolactin

- Anterior pituitary & hypothalamus – vascular connection
MCQ 15

- Regarding structure of pancreas
  - A) acinus is secretory unit - T
  - B) 80% of pancreas comprise of islets of langerhans - F
  - C) exocrine part occupies 2% of pancreas - F
  - D) F cells secrete pancreatic polypeptide - T
  - E) has huge functional reserve - T

- 80% of pancreas can be removed without any effect on function.
MCQ 16

- Regarding pancreatic secretion
  - A) pH is 7 - F (8)
  - B) bicarbonate secretion is increased by CCK - F [secretin]
  - C) enzymatic secretion is increased by secretin - F [cck]
  - D) intestinal fats & proteins are main stimuli for pancreatic secretion – T (Ca & Mg also stimulate)
  - E) alcohol stimulates pancreatic secretion - T
Pancreas

- B(insulin), A(glucagon), D(somatostatin) & F cells (pancreatic polypeptide)
- Stimulation of insulin – hyperglycemia, β agonists, acetyl choline, glucagon.
- Inhibition of insulin – hypoglycemia, β blockers, alpha- agonists, somatostatin, diazoxide, thiazides, volatile agents.
Somatostatin

- Identical to growth hormone releasing inhibiting hormone.
- Slows down gastointestinal function & protects against rapid increase in plasma nutrients.
- Inhibits release of both insulin & glucagon.
• Following statements are correct regarding pituitary hormones

• A prolactin secretion is under control of prolactin inhibiting hormone [probably dopamine] - T

• B ACTH mainly regulates secretion of adrenal medulla – F
cortisol mainly (CA secretion is stimulated neurologically by sym.
Nervous sys)

• C GH increases protein synthesis - T

• D somatomedins mediate effects of GH on target tissue - T (ILGF-1& 2)

• E activity of anterior pituitary regulated by hormones secreted from hypothalamus & transported down axons in pituitary stalk - F
MCQ 18

• Regarding posterior pituitary

• A vasopressin is produced in supraoptic nucleus of hypothalamus - T

  B \text{ADH release is triggered by increase osmolarity of ICF} - F

  C \text{ADH acts on vasopressin 1 receptors to absorb water from DT \\ & CD} - F \quad \text{(vasopressin 2 receptors; vasopressin 1 receptors – arteriolar constriction increasing peripheral resistance)}

• D in absence of ADH, water reabsorption from proximal tubule & LOH remain unchanged - T

• E oxytocin causes milk ejection & uterine contraction – T

• ADH is released when osmolarity of ECF vol. rises / decrease in BP, blood volume
MCQ 19

• Administration of GH results in increase of

• A erythropoiesis - T
• B 2,3 DPG - T
• C Ca absorption from GIT - T
• D free fatty acid utilisation - T
• E insulin release from pancreas - F
MCQ 20

- Cushing’s syndrome (excess glucocorticoid secretion) results in
  - A hypertension -- T
  - B hyperglycemia -- T
  - C increase in protein breakdown – T (ms wasting, osteoporosis, striae)
  - D moon face & buffalo hump.-- T
  - E hirsuitism.-- T
MCQ 21

• Excessive pituitary hormone secretion results in –
  A cushing’s syndrome.--T
  B infertility -- T [hyperprolactenimia]
  C gigantism.--T (children) acromegaly after epiphysial fusion
  D fluid retention.--T
  \textit{E increase in plasma osmolarity}.-- F

• Excess of ADH causes fluid retention--decrease in plasma osmolarity, hyponatraemia
MCQ 22

- Aldosterone
  A. increases amount of Na K ATPase in target cells. --T
  B. reduces sodium content of sweat. --T (saliva, urine, gastric juice)
  C. increases acidity of urine. -- T (increased H secretion in tubules)
  D. decreases potassium content of urine. -F
    *increases; causes active secretion from distal tubular cells into urine*
  E. basal secretion decreases after hypophysectomy -F (ACTH not important)
• Following statements are correct regarding calcium homeostasis --
A  active vitamin D causes increase absorption of Ca from GIT.--T
B  active vitamin D causes increase bone deposition.--T
C hypocalcaemia stimulates parathyroid hormone secretion.-- T
D  parathyroid hormone causes calcium reabsorption from kidneys.--T
E  serum calcium is approximately 50% bound to albumin.--T
• Parathyroid glands
• A are 2 glands in human body.— F
• B contain chief cells & oxyphil cells.— T (chief cells secrete PTH; oxyphil cells – degenerated chief cells)
• C ionised Ca exhibit negative feedback on the gland.— T
• D are inhibited by plasma Mg++.— T (directly)
• E high phosphate conc stimulate PTH release.— T
MCQ 25

- Regarding vitamin D
- A *diet is the only source.* – F (uv radiation from sunlight stimulate vit D3 – cholecalciferol in skin)
- B cholecalciferol is converted into 25 OH cholecalciferol in liver.--T
- C 25 OH cholecalciferol is converted into 1, 25 di OH cholecalciferol in kidneys.--T
- D increases plasma Ca++ levels.--T
- E *decreases plasma phosphate levels.*—F
- Active metabolite of vit D is stimulated by PTH, low plasma Ca / PO4 levels.
**Figure 1. Vitamin D Synthesis**

- **7-dehydrocholesterol in skin**
  - Sun exposure
  - **Cholecalciferol (D$_3$)**
  - 25-hydroxylase in liver
  - **25-hydroxyvitamin D**
  - 1-alpha-hydroxylase in kidney
  - **1,25-dihydroxyvitamin D** (1,25-dihydroxycholecalciferol or calcitriol—active)
  - Binding to vitamin D receptors
  - **Biological actions**

- **Food**
  - **Ergocalciferol (D$_2$)**
Calcium homeostasis

- **Vitamin D** – increases plasma levels of calcium & phosphate.
  - It increases Ca absorption from intestine & kidney.
  - In bone Ca & PO4 are mobilised by increasing the number of mature osteoclasts & stimulating osteoblasts.
- **Calcitonin** – decreases plasma calcium
- **PTH** – increases plasma calcium & decreases phosphate.
MCQ 26

- PTH
- A secretion is stimulated by fall in plasma Ca++ .- T
- B causes Ca++ release from bone.-- T
- C causes Ca++ reabsorption from renal tubule.--T
- D increases urinary phosphate excretion.--T
- E converts vitamin D into active form in kidneys.T
• Calcitonin
  
  A  is secreted from parathyroid gland.---F
  
  B  increases phosphate levels.-- F [ no effect]
  
  C  acts on bone & increase plasma Ca++ levels.--
      F[decr]
  
  D  acts on kidney & decreases Ca++ absorption.---T
  
  E  is secreted by thyroid follicles.--- F [C cells]

• Inhibits release of calcium from bone & increase excretion in urine—
decreases plasma calcium level.

• Exact physiological role is uncertain ( as after thyroidectomy – no
  problem in calcium balance); skeletal development & maturation ( large amount secreted in children)
• Deficiency of parathyroid hormone
  • A occurs due to autoimmune disease. --T
  • B can occur after thyroid surgery.-- T
  • C results in hypocalcemia.-- T
  • \textit{D results in hypophosphatemia.--- F (hyper)}
  • E causes tetany & laryngeal spasm.--- T (even convulsions)
  • PTH increases Ca & decreases PO4 level.
Low concentration of calcium in blood

Release of parathyroid hormone

Vitamin D

Efflux of calcium from bone
Decreased loss of calcium in urine
Enhanced absorption of calcium from intestine

Increased concentration of calcium in blood
Low concentration of calcium in blood

Release of parathyroid hormone

Efflux of calcium from bone

Decreased loss of calcium in urine

Enhanced absorption of calcium from intestine

Increased concentration of calcium in blood
Parathyroid Hormone (PTH)

Drop in Serum Calcium

Increase in Production and Secretion of PTH

Enzymatic Reaction in Liver

Activated Parathyroid Hormone

Presence of Parathyroid receptors on target cells

Activity limited by Liver breakdown and Kidney excretion

Increase Bone Resorption

Increase Calcium Reabsorption From Kidneys

Increase activation of Vitamin-D by kidney

Release of Calcium into bloodstream

Reabsorption of calcium into bloodstream

Increase of calcium absorption from intestine

Increase of calcium in bloodstream
• Regarding corticosteroids
  • A 1mg dexamethasone = 25 mg hydrocortisone - T
  • B 1 mg methyl prednisolone = 25 mg hydrocortisone - F (5 times)
  • C 1mg prednisolone = 4mg hydrocortisone - T
  • D Mineralocorticoids do not have any glucocorticoid activity - F
  • E Dexamethasone does not have any mineralocorticoid activity - T
MCQ 30

- ADH secretion is decreased by
- A Alcohol – T
- B **Angiotensine II** - F
- C **Increase in Intracellular volume** - F
- D **Decrease in extracellular volume** - F
- E Decrease in effective osmotic pressure of plasma - T
• Pituitary gland
• A anterior pituitary secretes FSH--T
• B ADH is produced by posterior pituitary.--F
• C A vascular connection exist between posterior pituitary & hypothalamus.--F
• D ACTH secreted by anterior pituitary significantly affects aldosterone secretion.---F
• E growth hormone is a glycoprotein.- F polypeptide
All the best