

# Basics of ED: Endocrine and metabolic emergencies

Sara Sabur (5th year)

[Srs29@student.le.ac.uk](mailto:Srs29@student.le.ac.uk)



L.W.E.M.S.

LEICESTER WILDERNESS AND  
EMERGENCY MEDICINE SOCIETY





## 2 big questions on everyone's minds...

YES this will be recorded

YES you will get the slides





# Disclaimer

- This lecture should not replace any other med school teaching/learning resources
- We will not be able to cover all endocrine and metabolic presentations/emergencies
- This lecture has been reviewed by the LWEMS society and myself but there may be some inaccuracies - if you spot one please let me know!



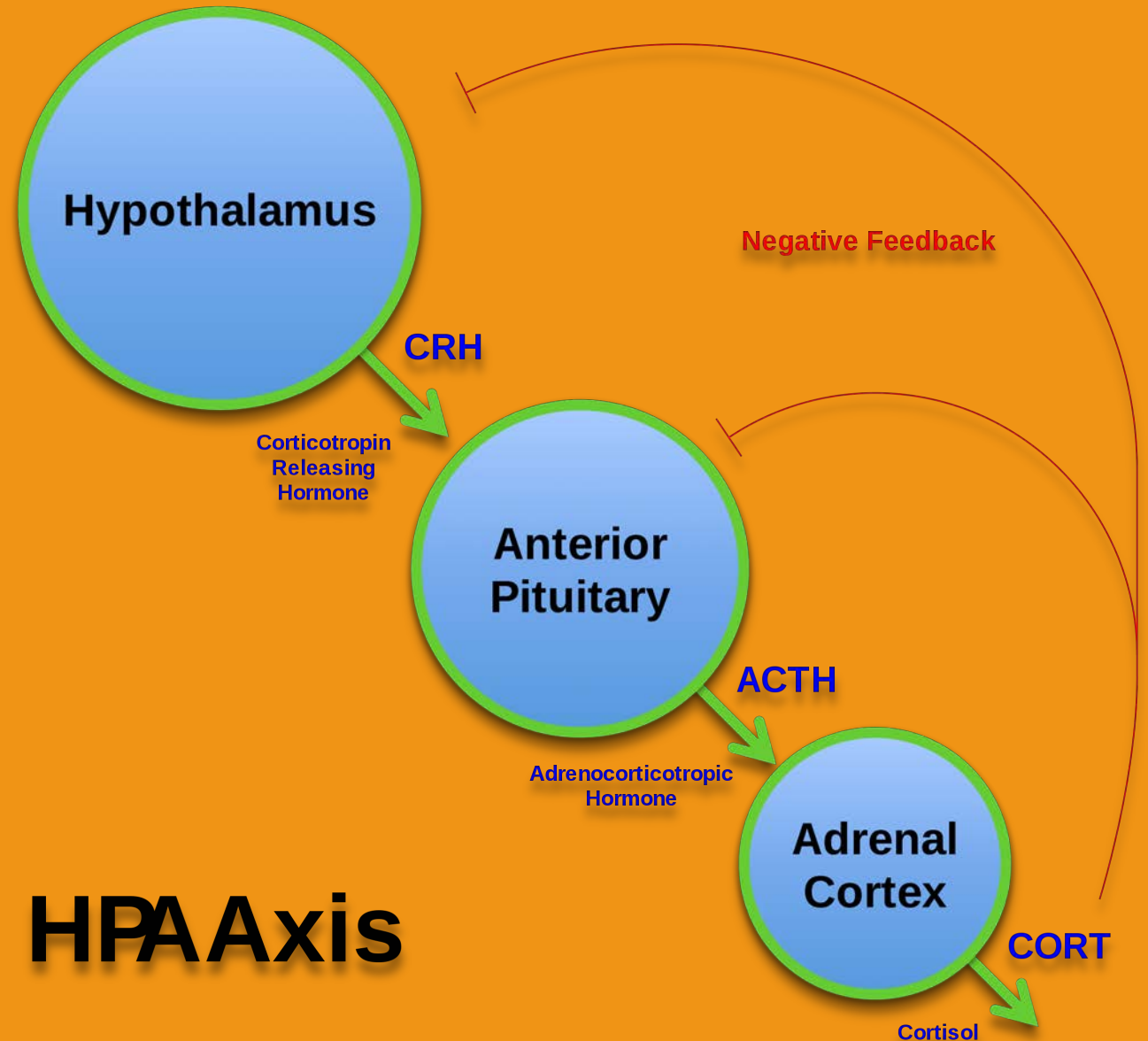
# We will cover:

- Adrenal crisis
- Diabetic ketoacidosis
- Hypoglycaemia
- Hyper/hypothyroidism
- Hypo/hyperkalaemia
- Hypo/hypercalcaemia



## Adrenal hormones and what goes wrong?

- The HPA axis is the mechanism by which our body is able to produce the hormone cortisol from the adrenal gland
- Cortisol has many actions in the body including: stimulating gluconeogenesis , activating anti-stress and anti-inflammatory pathways and repairing of tissues
- However...in some people the adrenal glands can be destroyed (most commonly thought to be by an autoimmune response)
- This means that they aren't able to produce their own cortisol and need medicinal replacement





# Addison's disease/primary adrenal insufficiency

- Most common in people between the ages of 30-50, more common in females
- Symptoms include: lack of energy, muscle weakness, low mood, loss of appetite and weight loss
- Treatment: Hydrocortisone (most similar to cortisol)
- Can also use prednisolone and dexamethasone - less common



# Adrenal crisis

- MEDICAL EMERGENCY
- Happens when level of cortisol in the body falls significantly
- If patient is suspected/at risk of having an adrenal crisis - treat first!
- Patient will not be put at harm if you give a hydrocortisone bolus and they ended up not having an adrenal crisis!
- Treatment: Hydrocortisone and rehydration with NaCl



# Type 1 diabetes

- Type one diabetes is an autoimmune disorder whereby the pancreas is attacked by the body's own immune system
- Leads to less/no insulin production by the pancreas
- This leads to diabetic ketoacidosis (or DKA) if not diagnosed/treated appropriately

## Symptoms of Type 1 diabetes in adults and children

 <p><b>Excessive thirst</b></p>	 <p><b>Excessive hunger</b></p>	 <p><b>Unexplained weight loss</b></p>
 <p><b>Blurred vision</b></p>	 <p><b>Slow healing of cuts and sores</b></p>	 <p><b>Fatigue</b></p>
 <p><b>Vaginal yeast infections</b></p>	 <p><b>Frequent urination, including frequent full diapers in infants and bedwetting in children</b></p>	

 Cleveland Clinic



# Diabetic ketoacidosis

- When the body's insulin supply runs low the body has to revert to other mechanisms for energy
- This could be due to the patient forgetting insulin or a first presentation of T1DM
- Also may be an infection - screen for this
- Body uses fat instead - this produces ketones which are the breakdown products
- Can use ketones to diagnose DKA - via urine or serum



# DKA Symptoms

- Increased work of breathing/SOB
- Flushed face
- Fruity smelling breath (ketones)
- Nausea and vomiting
- Tiredness
- Muscle stiffness



# DKA Diagnosis

- If left untreated - patient could go into a coma and this could even lead to death
- Rapid diagnosis and treatment is needed
- Diagnosed by three parameters:
  1. The patient has T1DM/blood glucose  $>11$
  2. Presence of ketonuria  $>2+$ , ketonaemia  $>3\text{mmol/L}$
  3. Venous pH  $<7.3$  or bicarbonate  $<15\text{mmol/L}$



# DKA Treatment

- Fluid replacement is needed - normally in the form of a IVI rather than a bolus of 500ml
- Fixed rate insulin 0.1 units/kg/hr (if glucose is dropping then give glucose - do not stop the insulin!)
- Continue any long acting insulin the patient may be on
- Stop any short acting insulin the patient may be on
- Treatment of any electrolyte abnormalities (NB: K+)





# Hypoglycaemia

- Mainly manifests in diabetic patients (taken insulin but not eaten, on a sulphonylurea)
- Can also happen in non-diabetics - less food intake after surgery etc
- Three different severities of hypoglycaemia and treatment differs for each



# Mild vs moderate vs severe hypoglycaemia

- Mild - patient is conscious and able to swallow
- Moderate - patient is conscious and able to swallow, but confused, disoriented or aggressive
- Severe - patient is unconscious/aggressive/NBM or CBG less than 2.6
  
- In all cases - stop any IV insulin in situ



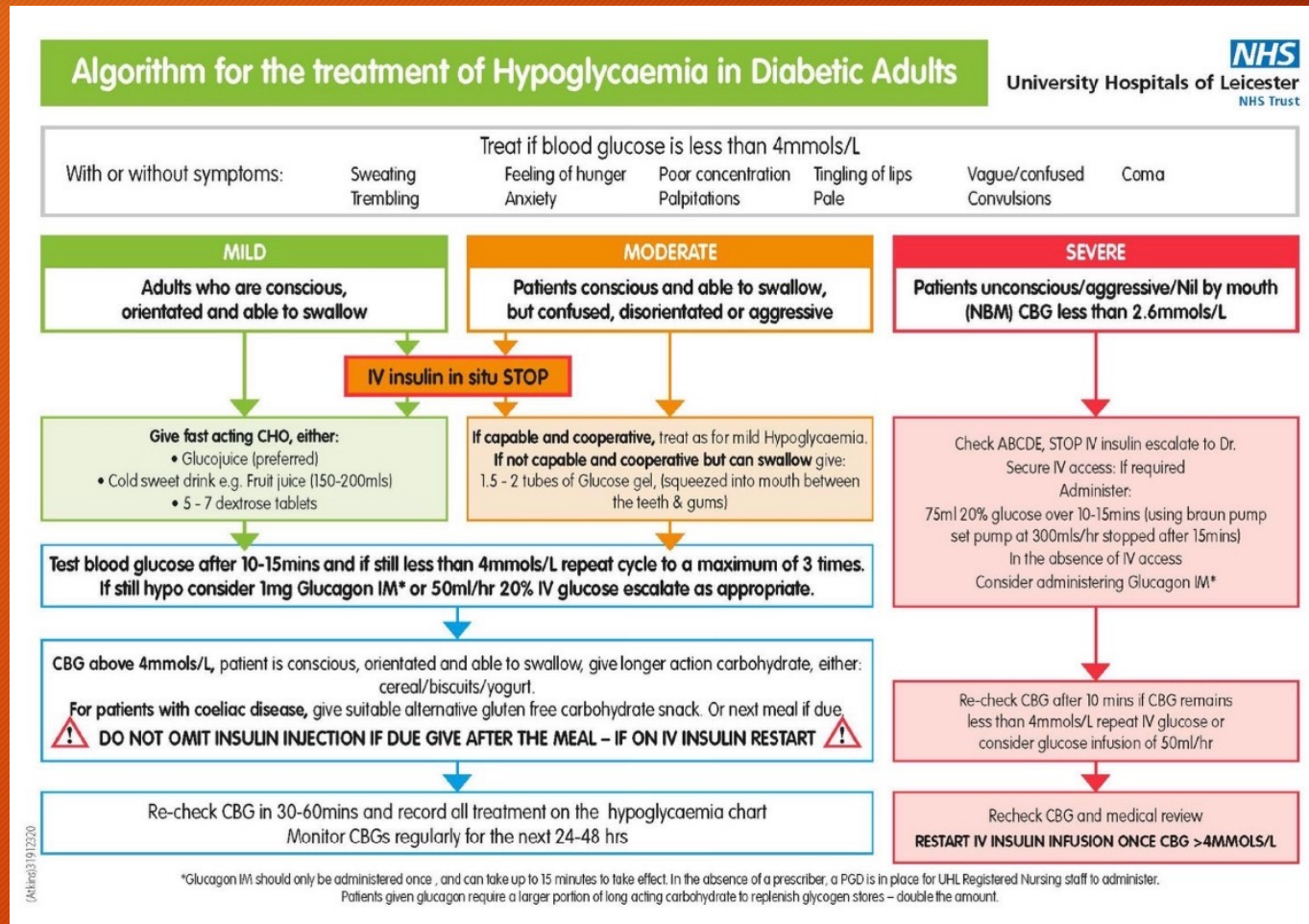
# Treatment

- Mild - give fast-acting carbohydrates such as glucojuice, fruit juice, 5-7 dextrose tablets
- Moderate - same as above if patient is do-operative, can also use glucose gel
- Severe - if they have IV access then give 100mls 20% dextrose IV in 15 mins, if no IV access then consider IM glucagon
- Escalate to senior in severe cases





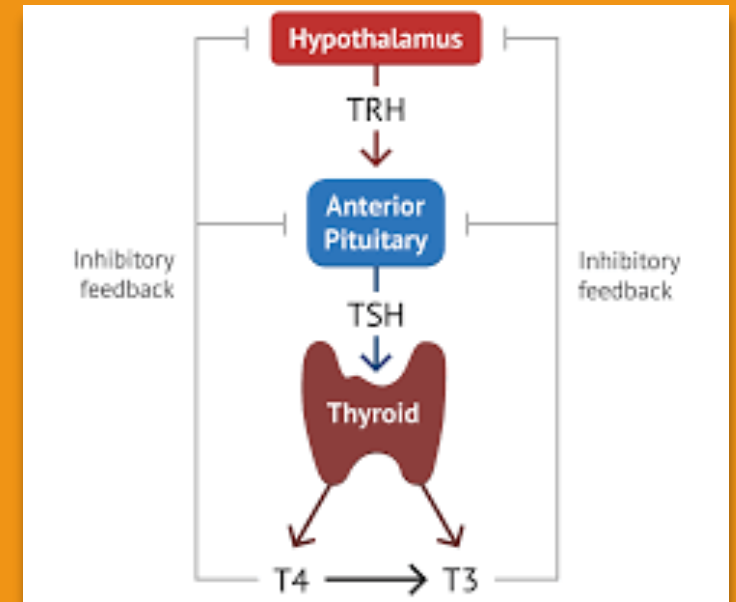
# UHL logarithm for hypoglycaemia





# Thyroid hormones

- Increases basal metabolic rate
- Heat production
- Stimulates certain enzymes in various pathways - including in the brain, spleen and testis
- Lipid metabolism
- Carbohydrate metabolism - increases gluconeogenesis and glycogenolysis
- Increase in CO, HR, vasodilation
- Myelination of nerves and development of neurons

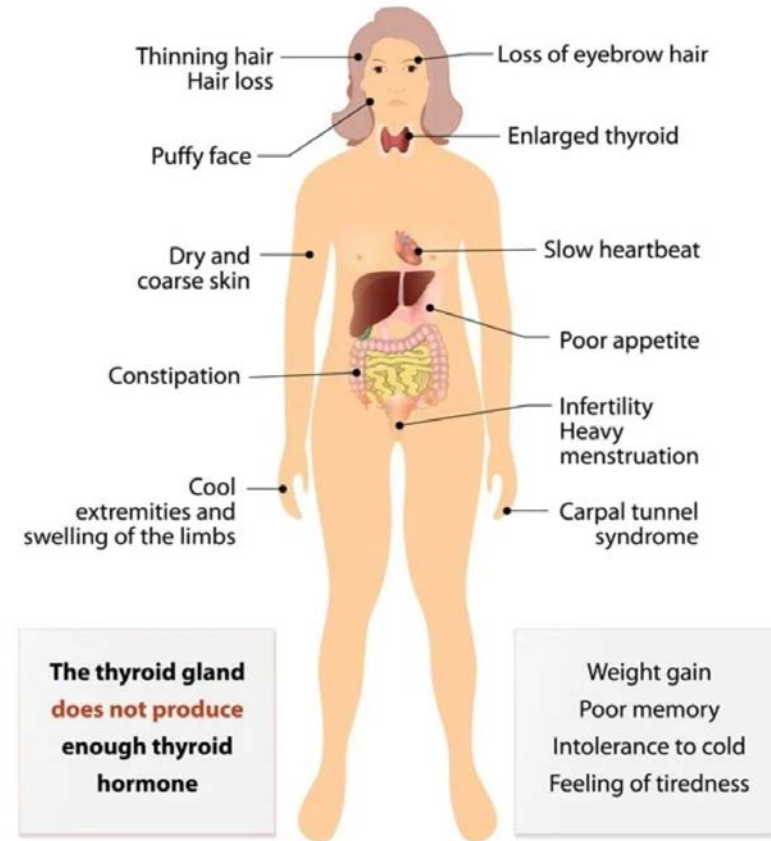




# Hyperthyroidism

- Overproduction of thyroid hormones (T4 +T3)
- Most common cause is Graves' disease
- Other causes include toxic nodular goitre, drugs including amiodarone, thyroid carcinoma
- Sx include - weight loss, heat intolerance, fatigue, sweating, tachycardia, weakness
- Anti-thyroid drugs such as Carbimazole is used (blocks formation of thyroid hormone by blocking certain enzymes)

## Symptoms of HYPOTHYROIDISM





# Thyrotoxic crisis

- Rare complication of hyperthyroidism
- Medical emergency and can be life-threatening
- Occurs when thyroid gland releases a large amount of thyroid hormone in a short amount of time
- Symptoms include pyrexia, tachycardia, cardiac failure, liver dysfunction
- Treatment of thyroid storm consists of supportive measures like IV fluids, oxygen, cooling blankets, as well as specific measures to treat hyperthyroidism
- After initial supportive measures, a beta-blocker should be started for any case of suspected thyroid storm



# Hypothyroidism

- Basically the opposite of hyperthyroidism - less/no thyroid hormone being produced
- Causes include - Hashimoto's thyroiditis, medications like amiodarone, damage caused by cancer or hyperthyroid treatments
- Symptoms - cold intolerance, weight gain, tiredness, depression, constipation, muscle aches
- Treatment - replace the hormone via medication such as levothyroxine



# Myxoedema coma

- Severe hypothyroidism, rare condition
- Usually in the elderly and in those with long-standing untreated hypothyroidism
- Usually occurs during winter
- Symptoms include hypothermia, bradycardia, periorbital puffiness, hypotension
- Pericardial effusion
- 50% mortality so requires HDU/ICU care
- May need IV thyroxine, warm the patient up



# Potassium

- Many roles in the body, one of the main electrolytes we have
- Normal level in blood - 3.5-5.3 mmol/L
- Helps to maintain normal fluid inside cells
- Muscle contraction
- Blood pressure
- **MOST IMPORTANT** - help to trigger action potentials to allow the heart to beat normally, activation of cardiac muscle cells



# Hypokalaemia

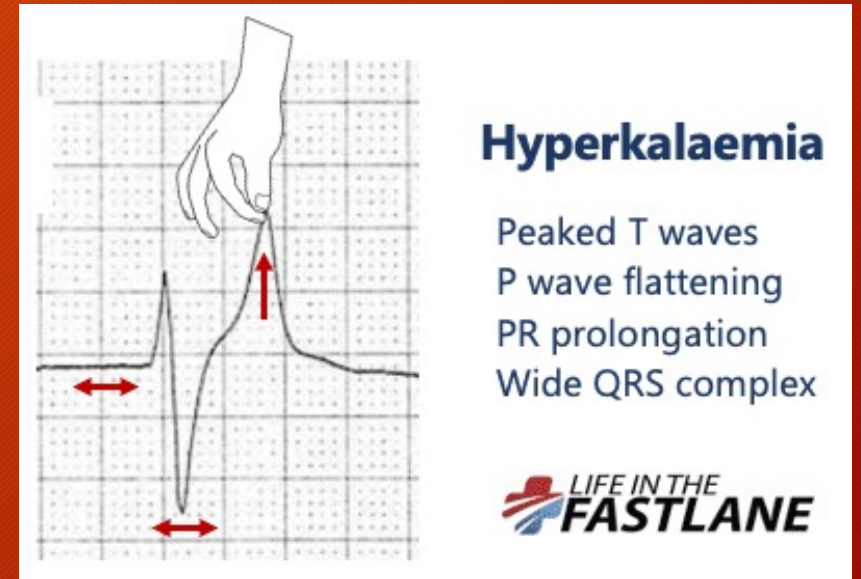
- Symptoms: Fatigue, constipation, muscle weakness, paralysis, cardiac arrhythmias, hypertension
- Causes: MANY! To name a few - vomiting, diarrhoea, laxatives, alpha blockers, refeeding syndrome, Conn's syndrome, diuretics
- ECG changes: Small T waves, U wave after T wave, increased PR interval
- Treatment: Replace mg (low mg can lead to K<sup>+</sup> secretion), oral K replacement, IV K replacement with 0.9% NaCl





# Hyperkalaemia

- Causes: CKD, drugs such as spironolactone, amiloride and NSAIDs, Addison's disease, tumour lysis syndrome
- ECG changes: Tented T waves, prolonged QRS, slurring of ST segment, loss of P waves, asystole





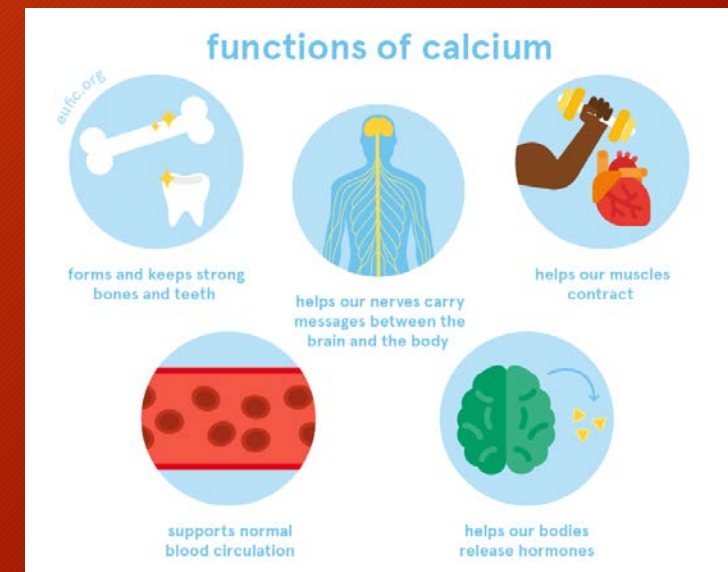
# Hyperkalaemia treatment

1. Stabilise the myocardium to prevent arrhythmias - 10mls 10% calcium gluconate over 5-10 mins
2. Shift potassium back into cells - 10 units actrapid and glucose 50% 50mls and/or salbutamol 5-10mg via nebuliser
3. Eliminate potassium from the body - calcium resonium, furosemide (depending on hydration status), dialysis (only if medical treatment is ineffective)



# Calcium

- Another electrolyte which is involved in many processes in the body
- Normal levels are 2.2-2.6 mmol/L
- Helps keep teeth and bones healthy
- Role in clotting
- Muscle contraction
- Regulation of normal heart rhythms
- Nerve function





# Hypocalcaemia

- Symptoms occur at levels  $<1.9\text{mmol/L}$
- Commonest cause is post-op after a thyroidectomy (due to accidental removal/damage to parathyroid glands)
- Vitamin D deficiency can also cause hypocalcaemia (also associated with low phosphate in this case)
- Hypomagnesaemia also causes hypoparathyroidism - which leads to low calcium



# Hypocalcaemia symptoms

- Acute severe - laryngospasm, prolonged QT interval, seizures - MEDICAL EMERGENCY
- Most commonly presents less acutely with - muscle cramps, carpo-pedal spasm, peri-oral and peripheral parasthesia
- Chvostek's sign - facial spasm when cheek tapped with finger
- Trousseau's sign - carpo-pedal spasm when blood pressure cuff inflated



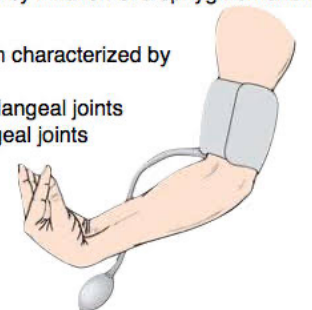
## Hypocalcemia

### Trousseau's Sign

Induction of carpopedal spasm by inflation of a sphygmomanometer above SBP for 3 minutes

**Response:** Carpopedal spasm characterized by

- Adduction of the thumb
- Flexion of the metacarpophalangeal joints
- Extension of the interphalangeal joints
- Flexion of the wrist



### Chvostek's sign

Contraction of the ipsilateral facial muscles elicited by tapping the facial nerve just anterior to the ear

**Response:** Twitching of the lip to spasm of all facial muscles



# Hypocalcaemia treatment

- Calcium replacement is mainstay of treatment
- Investigate underlying cause and treat
- Acute severe form - need treatment with IV calcium
- Vitamin D deficiency - loading dose cholecalciferol for 7 weeks followed by maintenance doses
- Hypoparathyroidism treated with calcitriol
- Oral calcium supplements (sandocal and adcal D3)
- Aim for calcium levels at lower end of reference range to avoid nephro-calcinosis



# Hypercalcaemia

- When serum calcium is 2.6mmol/L or above
- Commonest causes are primary hyperparathyroidism and malignancy
- Important to note: malignancy - will have hypercalcaemia and low PTH, primary hyperparathyroidism - will have hypercalcaemia with normal or raised PTH



# Hypercalcaemia with low PTH - malignancy until proven otherwise

- Must be excluded in this scenario
- Usually associated with squamous cell tumours due to the secretion of PTH-related peptide
- Mainly occurs in large or advanced cancers
- Bone mets may not be present
- Same occurs in TB and sarcoidosis



# Hypercalcaemia with non-suppressed PTH - primary hyperparathyroidism until proven otherwise

- If PTH is in the normal or upper range - malignancy is unlikely
- Usual cause is primary hyperparathyroidism most commonly due to a single parathyroid adenoma
- Rare - serum calcium above 3.5mmol/L may indicate parathyroid cancer



# Acute severe hypercalcaemia

- Medical emergency
- May present as profound dehydration
- Renal impairment
- Urgent treatment required - next slide
- Treat underlying cause



# Acute severe hypercalcaemia treatment

- Treat dehydration - 0.9% NaCl 1L over 4 hours
- Discontinue any offending drugs such as thiazides and vitamin D compounds
- Use of bisphosphonates - inhibit mobilisation of calcium from the skeleton
- Calcitonin can be used for treatment of hypercalcaemia associated with malignancy
- Find underlying cause - to prevent it from happening again



# References

- NICE CKS Guidelines
- BMJ Best Practice
- Teach Me Physiology
- Life in the fast lane
- MEH Lectures from first year
- Endocrine workbook from medicine block in third year



# Thank you for attending!

If anyone has any questions please don't hesitate to email me on [srs29@student.le.ac.uk](mailto:srs29@student.le.ac.uk)

