Calcium emergencies at front door

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Topics covered

- Etiology, symptoms and management of calcium related emergencies

- Relevant physiology and pathophysicsology to understand the symptoms and treatment of hyper and hypocalcemia
Topics not covered

- Management of primary hyperparathyroidism
- Rare disorders of hyper and hypocalcemia which are primarily dealt in the endocrine OPD
- Detailed discussion on Calcium and Vitamin D metabolism
Basics of calcium metabolism

Vitamin D
- Bone resorption
- Ca absorption from gut/kidney

PTH
- Bone resorption
- Ca absorption from gut/kidney
- 1,25 DHCC

Mg

Ca absorption from gut/kidney

2% calcium

98% calcium

Calcium
Key Enzymes in Vitamin D Metabolism

Physiological state

25 Hydroxylase
Not tightly regulated
Induced by drugs

1alpha Hydroxylase
Very tightly regulated
PTH - activates
FGF-23, 1,25DHCC
Calcium - Inhibits

Pathological state

1alpha Hydroxylase
IFN, IL - 6 activates
Steroids - Inhibits
PTH - no effect
Common causes of Hypercalcemia in AMU

- Malignancy related (HHM/LOH)
- Incidental detection of PHPT
- Dehydration/AKI
- Drug induced
- Thyrotoxicosis/addison
- Sarcoidosis
Hypercalcemia- causes

- PTH dependent – normal to high (PHPT, FHH, Tertiary HPT)

- PTH Independent
  - PTHrP dependant-HHM, Lymphoma, Sarcoidosis, Myeloma etc
  - LOH
  - Drug induced (BZD, Vitamin D, Calcium)
  - Dehydration
  - Immobilisation
  - Endocrine – Thyrotoxicosis, Addison,
Hypercalcemia symptoms

- Arrhythmias, short QTc, systolic cardiac arrest
- Nephrolithiasis, nephrogenic DI
- Confusion, seizures
- Constipation, acid peptic symptoms
Grades Of Hypercalcemia

Total serum calcium level, mg/dL (mmol/L)

8 (2) 10 (2.5) 12 (3) 14 (3.5) 16 (4)

- Hypercalcemic crisis
- Moderate hypercalcemia
- Mild hypercalcemia
- Normocalcemia

Ionized serum calcium level, mg/dL (mmol/L)

4 (1) 5.6 (1.4) 8 (2) 10 (2.5) 12 (3)
Investigations

- PTH
- FBC, U&Es, Bone profile, TFT, Cortisol, Mg,
- Myeloma screen, ACE levels
- USS abdomen/ CXR/CTCAP
- ECG
Clinical assessment

- Volume status
- CVS - ECG, signs of heart failure
- assess the underlying cause
Principals of Treatment
Treatment

- Hydration
- Increase GFR (IV fluids)
- Increase distal delivery of sodium (NS, loop diuretics, stopping thiazide diuretics)
- Reduce osteocalst activity (Biphosphonates, Calcitonin)
- RANK-L inhibition – Denusomab
- Remove Calcium from the system – Dialysis
- Steroids – Cytokine dependant causes/Vitamin D intoxication
- Reduce PTH levels – Cinacalcept (calcimimetic)
- Surgery
Hypocalcemia- causes

- Low PTH (acquired, congenital)
- PTH resistance (PHP, low Mg)
- Hungry bone syndrome
- Vitamin D deficiency/enzyme inducers; Phenytoin etc
- Loop diuretics, PPI
- Rhabdomyolysis, TLS, pancreatitis
- Malabsorption (coeliac, ch. pancreatitis, Post GI surgery etc)
- CKD
- Magnesium wasting disorders
- Massive blood transfusion
Common causes of Hypocalcemia in AMU

- Post parathyroidectomy
- Drug induced/Vitamin D deficiency
- Rhabdomyolysis
Hypocalcemia symptoms

Cardiac- long QT, cardiomyopathy, CCF

Neurological symptoms- EPS, Confusion, psychosis, papilledema

Smooth muscle involvement- dysphagia, biliary colic

Neuromuscular irritability- chvostek’s sign, Trousseau’s sign, Paresthesias, Tetany, Seizures (lowers seizure threshold), Muscle cramps, Muscle weakness, Laryngospasm, Bronchospasm
Investigations

- PTH, bone profile, Mg, Vitamin D
- ECG
- Investigations for underlying cause
Treatment

- Calcium – in patients with tetany or seizures administer 20ml of 10%(w/v) Ca gluconate in 100ml of NS or 5% Dex and infuse over 10 min and repeat if necessary. For maintenance give a continuous infusion of 40 ml of 10% Ca gluconate in 1L of NS or 5%Dex over 24H. (Needs ECG monitoring). Correct hypo-magnesemia if present

- For less severe hypocalcaemia/maintenance treatment oral Calcium carbonate 1.5g (600mg elemental Ca) x2-3/day
other treatment options

- Vitamin D supplementation
- Mg replacement
- BZD
- intact PTH
Thank you