

Total serum $[Ca^{2+}] > \sim 2.55 \text{ mmol/L}$. $\sim 50\%$ as biologically active ionised $[Ca^{2+}]$.

Corrected $[Ca^{2+}] = [Ca^{2+}] + 0.02 \cdot (40 - [\text{albumin}]) \text{ mmol/L}$ for $[\text{albumin}]$ of $20-45 \text{ mmol/L}$

Causes

Spurious:

- Hyperalbuminaemia
- Sample after venous stasis (tourniquet)

PTH mediated:

- Primary hyperparathyroidism (usually adenoma)
- Tertiary hyperparathyroidism (after prolonged hypoCa secondary hyperparathyroidism)

Non-PTH mediated:

- Cancer - \uparrow PTH-related protein (lung, breast, renal, myeloma, leukaemia). \uparrow Vit D (lymphoma)
- Granulomatous conditions - e.g. sarcoidosis and tuberculosis
- Endocrine - thyrotoxicosis, pheochromocytoma, acromegaly and 1° adrenal insufficiency
- Drugs - e.g. thiazides, vitamin D and vitamin A supplements, Li, oestrogens
- Familial - e.g. familial hypocalciuric hypercalcaemia (rare A.Dom)
- Other - e.g. prolonged immobilisation, milk-alkali syndrome, AIDS

Presentation ("bones, moans, stones & (abdominal) groans")

General: anorexia, lethargy, dehydration, thirst/polydipsia, bone pain, calcinosis

GIT: nausea, vomiting, dyspepsia (gastrin), constipation, abdominal pain, pancreatitis

Neuromuscular: depression, muscle weakness, mild cognitive impairment, coma

Renal: polyuria, renal insufficiency, calculi, hyperK⁺

CVS: bradycardias, AV block, shortened QT interval, BBB, potentiates digoxin toxicity

Investigations

Urine: 24hr Ca²⁺

Bloods: CMP, UEC, PTH, Vit D, LFT (Albumin, ALP),

ECG:

Imaging: plain XR (primary Ca, mets, calculi), CT-KUB (calculi), USS/CT/Te scan parathyroids

Management

Supportive: Reduce dietary calcium, mobilise if possible

Rehydration: N.Saline (avoid Hartmann's or colloid as contain Ca²⁺)

Enhance elimination: Loop diuretics e.g. frusemide (avoid thiazides)

Oestrogen replacement in post-menopausal 1° hyperparathyroidism.

Bisphosphonates: e.g. **pamidronate** 15-90mg IV infusion over 2-24hrs. Osteoclastic inhibitor (\downarrow serum/urine Ca²⁺, serum PO₄⁻). **SE:** fever, local inflammation, thrombophlebitis, hypoCa²⁺

Corticosteroids: Haematologic malignancies (myeloma, lymphoma, leukaemia), TB, sarcoid

Salmon calcitonin: (\uparrow urine Ca²⁺). Not effective in up to 80% patients.

Others:

- Plicamycin is occasionally used (inhibits RNA synthesis and kills osteoclasts).
- Gallium nitrate rarely used (inhibits bone resorption) **SE:** nephrotoxic, anaemia, \downarrow PO₄⁻

Parathyroid surgery

Treat underlying condition