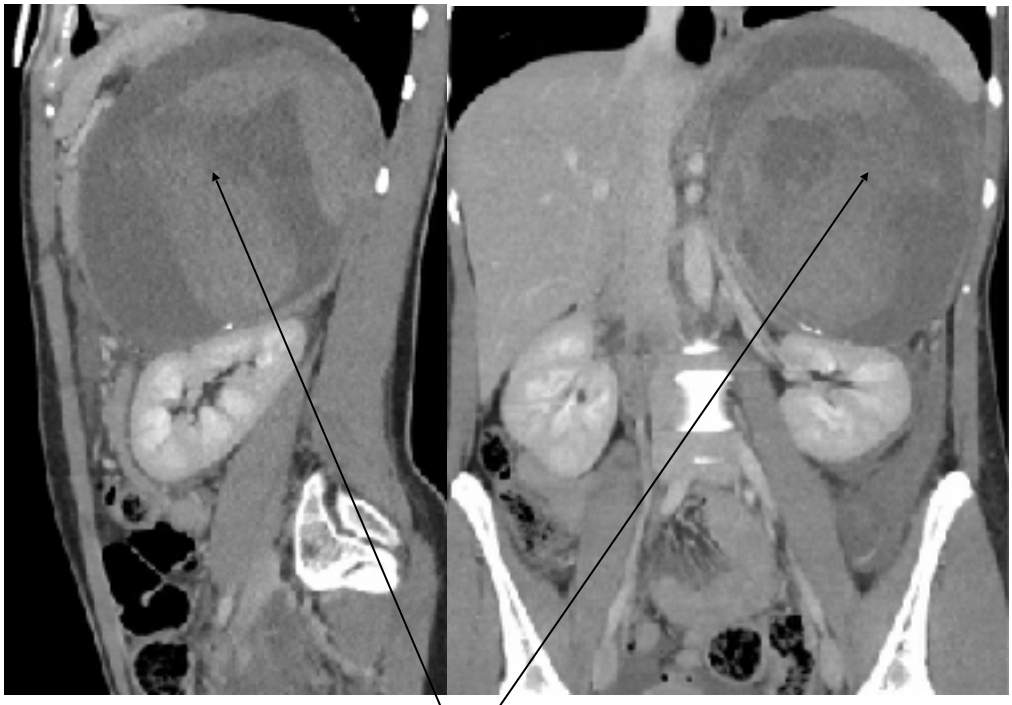
The Weekly Probe

3rd March February 2017 Volume 14 Issue 8

THIS WEEK

LAST WEEK'S CASE – ADRENAL HAEMORRHAGE

A 26yo previously well lady presents 3 days of atraumatic constant LUQ / left flank pain with colicky exacerbations. No other GIT, urinary or cardioresp symptoms. No meds or previous illnesses. Hb dropped over 3 days from 107 to 73. Below is a copy of her saggital and coronal CT reconstructions. What is going on?



The CT shows a large heterogenous collection consisient with recent haemorrhage superior to and compressing the left kidney. It was largely contained in the retroperitoneum (small intraperitoneal blood) and there was no evidence of a blush (ie evidence of active bleeding).
Due to it's location the bleed was thought to be a possible adrenal (or renal) haemorrhage (it looks seperate from the kidney and thus I suspect it is more likley to be the former Dx).
She was transfused and observed with discharge 2 days later.

What causes adrenal haemorrhage?

Causes:

- Infective / sepsis – meningococcaemia (Waterhouse-Friderichsen syndrome)., Strep Pn , E.coli, Pseudomonas , N. gono, H.influ, Staph aureus
- Coagulation problems- Anticoagulation, thrombocytopenia
- Hypercoaguable states
- Post trauma

This can be unilateral or bilateral.
The symptoms and signs include hypotension or shock, abdominal, back, flank, or lower chest pain; fever (66%); anorexia, nausea, or vomiting; confusion or disorientation; and abdominal rigidity or rebound.

HYPOCALCEMIA

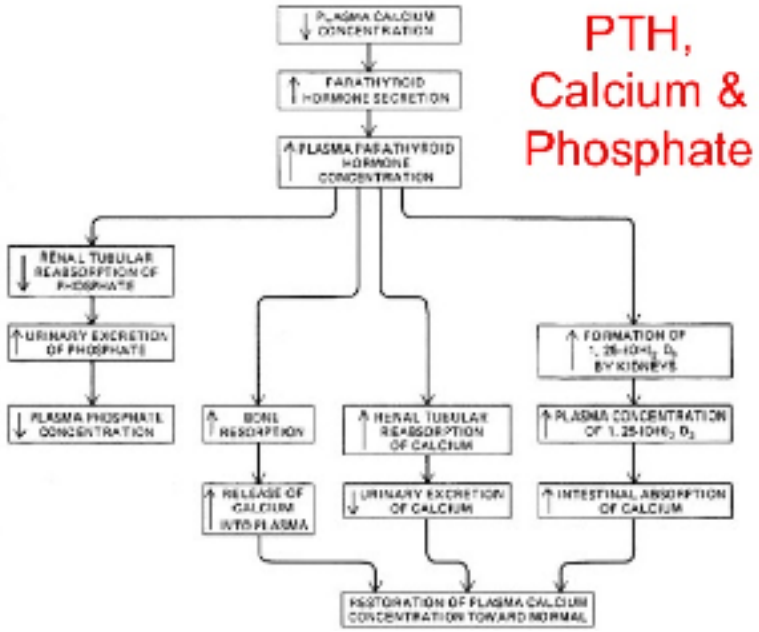
A 80 yo man with a HX of CRF , HT'n and hypertension presents with vomiting and dizziness. His corect ed Ca is 1.6 (lower limit of normal 2.1 mmol/L) (Cr 186) . What is the cause for this and how should this be treated?

Calcium regulation is critical for normal cell function, neural transmission, membrane stability, bone structure, blood coagulation, and intracellular calcium regulation of cAMP mediated messenger systems and many cell organelle functions.

Calcium regulation is maintained by parathyroid hormone (PTH), vitamin D, and calcitonin which act at bone, renal, and GI sites. Calcium is also affected by magnesium, phosphorus and the pH balance.

Approximately 99% of calcium is found in bone and 1% is found in extracellular fluid.
Of this ecf calcium, 50% is in the free (active) ionized form (1-1.15 mmol/L), 40% is bound to protein (predominantly albumin), and 10% is complexed with anions (eg, citrate).
Variations in extracellular calcium depend on serum pH, protein and anion levels, and the calcitonin, PTH and Vit D levels.

- PTH acts to increase serum calcium levels in 3 ways. It enhances the release of calcium from the large reservoir in the bones; it enhances reabsorption of calcium from renal tubules; and it enhances the absorption of calcium in the intestine by increasing the production of 1,25-hydroxyvitamin B.
- Vitamin D directly targets GI absorption of calcium to increase calcium levels. Calcitonin lowers calcium by targeting bone, renal, and GI losses.



Severe, symptomatic hypocalcemia may result in cardiovascular collapse, hypotension unresponsive to fluids and vasopressors, and dysrhythmias.
Neurological dysfunction with tetany and seizures may occur.

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History: ask about muscle cramping, tetany, numbness or tingling, particularly in the hands or feet. Carpopedal spasm is characteristic but in severe cases can progress to tetany, seizures, and cardiac dysrhythmias
Chronic manifestations include cataracts, dry skin, coarse hair, brittle nails, psoriasis, and poor dentition.
Acute hypocalcemia may lead to syncope or cardiovascular manifestations (long QT syndrome).
Ask about a past history of pancreatitis, anxiety disorders, renal or liver failure, hyperthyroidism or hyperparathyroidism. There may be a recent history of thyroid, parathyroid or bowel surgeries or recent neck trauma.
Ask about medications such as recent IV contrast, oestrogen, loop diuretics, bisphosphonates, calcium supplements, antibiotics and anti-epileptics.
Ask about the dietary intake eg anorexia nervosa or bulaemia.

Examination: Look for chronic signs of dry skin and psoriasis, cataracts.
Acutely examine for perioral paraesthesia and laryngeal stridor.
Look for signs of CCF due to reduced myocardial contractility.
Perform an ECG and look for a prolonged QT interval, ventricular arrhythmias, U waves.
Look for tetany, numbness or muscle spasms.

The classic signs associated with hypocalcaemia are Chvostek's and Trousseau's sign.
Irritability, confusion, hallucinations, dementia, extrapyramidal manifestations, and seizures have been reported. Calcification of basal ganglia, cerebellum, and cerebrum may occur. Seizures often occur in individuals with pre existent epileptic foci when the excitation threshold is lowered.
Note that the development of neuromuscular excitability depends on both the absolute concentration of calcium and how rapidly it falls. Rapid falls in calcium—for example, after the removal of a parathyroid adenoma —are often associated with symptoms, whereas patients who develop hypocalcaemia gradually can be surprisingly free of symptoms, and the diagnosis may only become evident as an incidental biochemical finding. Longstanding hypocalcaemia, even without neuromuscular symptoms, is associated with the development of neuropsychiatric symptoms, cataract formation, and occasionally raised intracranial pressure.

Chvostek's sign: described as tapping on the face at a point anterior to the ear and just below the zygomatic bone. A positive response is ipsilateral twitching or spasms of any the facial muscles (circumoral or orbicularis oculi)as you tap over the facial nerve.
Chovstek –a point 0.5-1cm below the zygomatic process of the temporal bone and 2cm anterior to the ear lobe on a line with the mandible. Chovstek's sign has been reported in normal patient (up to 10%), in hypothyroidism, rickets, whooping cough and measles. May also be absent in hypocalcaemia – thus not a good discriminator.

Trousseau's sign: Inflation of a blood pressure cuff above the systolic pressure for several minutes carpopedal spasm due to ulnar and median nerve ischaemia. Patients may also experience numbness, fasiculations, a sense of cramping or stiffness. Trousseau's sign is relatively specific for hypocalcaemia—94% of hypocalcaemic patients display a positive sign, compared with 1% of normocalcaemic people. However a positive result has also been described with hypomagnesaemia (which may co-exist with hypocalcaemia).

Causes:
Artefactual: Collection in EDTA, citrate or oxalate anticoagulant will result in a spurious reduction in calcium.
Renal failure– chronic (impaired Vit D3 synthesis, secondary hyperparathyroidism)
Hypoparathyroidism (hereditary, acquired, ineffective PTH deficient PTH) pseudohypoparathyroidism
Post surgical: Parathyroidectomy, Thyroidectomy);
Vitamin D deficiency (osteomalacia); absent active Vit D (fat soluble vitamin, also known as calciferol).
-decreased dietary intake (inadequate milk or green vegetables);
-decreased sun exposure;
defective Vitamin D metabolism;
anticonvulsant therapy (barbiturates and phenobarbitone, phenytoin)
-vitamin-D dependent rickets

-Hypomagnesaemia : causes end organ resistance to PTH.
–Rhabdomyolysis – sequesters in the muscle
-Acute pancreatitis- sequesters in the pancreas
-anorexia nervosa
Hypoalbuminaemia (low total calcium, normal corrected and ionised calcium): a common cause of uncorrected hypocalcemia and is due to cirrhosis, nephrosis, malnutrition, burns, chronic illness, and sepsis.
-Hyperventilation (normal total and corrected calcium, low ionised calcium)

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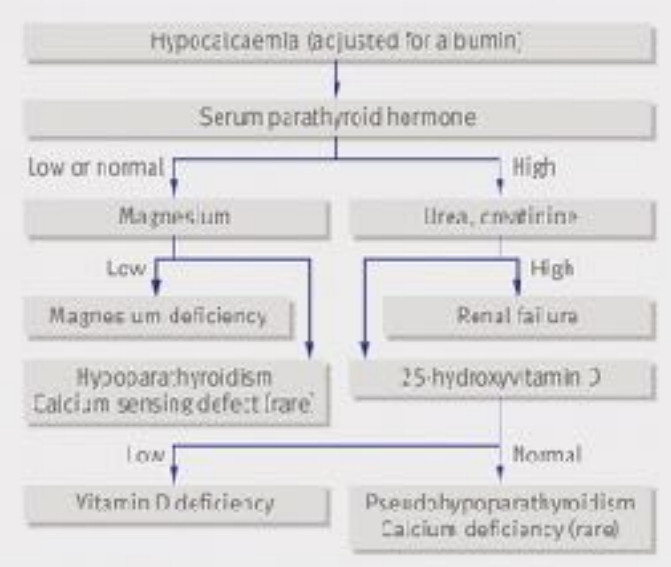
-Pseudohypoparathyroidism
-Fleet bowel prep for colonoscopy has been reported to cause fatal electrolyte disturbances including severe hyperphosphataemia and hypocalcaemia
-Cisplatin .
-Tumour lysis syndrome - massive cell death (eg newly diagnosed neoplasia) - results in hyperkalaemia, hyperphosphataemia, hypocalcaemia and hyperuricaemia
-Infiltrative disease: Sarcoidosis, TB, and hemochromatosis - infiltrate the parathyroids

Interpretation of values Interpret the serum calcium concentration in relation to serum albumin as serum calcium exists in an ionised form (50%) or is bound to albumin or other ions. Only ionised calcium is biologically important. Various factors alter the ratio of ionised calcium to bound calcium, but the most important factor is the albumin concentration and there are many medical conditions which decrease the serum albumin. Serum calcium concentrations are therefore “corrected” to a reference albumin concentration of 40 g/l, and for every 1 g/l of albumin above or below this value, the calcium is adjusted by decreasing or increasing by 0.02 mmol/l. For example, a calcium concentration of 2.05 mmol/l with an albumin concentration of 35 g/l would be corrected to 2.15 mmol/l, which would correct the hypocalcaemic value to normal. Note the ionised value can be checked directly such as with the istat machine.

Below is one algorithm for investigating hypocalcaemia.
In true hypocalcaemia, parathyroid hormone concentrations should be high if the parathyroids are appropriately responding to the reduced negative feedback of calcium or low if these glands are the cause of the problem.

- A high concentration of parathyroid hormone in the presence of normal renal function suggests deficiency of vitamin D or calcium malabsorption.
- A low concentration usually indicates hypoparathyroidism. Parathyroid hormone concentrations can be normal in hypoparathyroidism, but they are usually within the lower part of the reference range. Parathyroid hormone concentrations can also be inappropriately normal in hypomagnesaemia (see below) or when the extracellular calcium sensing receptor has increased sensitivity.

A raised serum alk phos (SAP) suggests osteomalacia as a result of vitamin D deficiency. The possibility of metastatic cancer, with sclerotic metastases causing rapid absorption of calcium into the skeleton, should also be excluded. Parathyroid hormone stimulates renal phosphate clearance, so serum phosphate should be low in non-parathyroid disease but high in parathyroid hormone deficiency. Measuring phosphate has limited value because it varies diurnally and is affected by food intake. Renal function should be measured because the kidney is central to several aspects of calcium homoeostasis.



Other tests may be needed in some situations. Serum 25-hydroxyvitamin D concentrations are useful in confirming vitamin D deficiency when it presents atypically, and it should be assessed in patients with possible pseudohypoparathyroidism.

Serum magnesium is important for the synthesis and release of parathyroid hormone. In hypomagnesaemia, the release of parathyroid hormone is inhibited, leading to (potentially severe) hypocalcaemia. Poor nutrition associated with chronic alcohol use, prolonged diarrhoea, and treatment with diuretics and certain chemotherapeutics (such as cisplatin) causes hypomagnesaemia.

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Recognition of hypomagnesaemia is important because in this setting it is difficult to reverse hypocalcaemia without magnesium repletion.

Treatment -The approach to treatment depends on speed of onset, biochemical severity, and clinical features.

Neuromuscular irritability with hypocalcaemia requires prompt management and treatment with IV calcium. Asymptomatic patients with corrected serum calcium less than 1.9 mmol/l may develop serious complications and admission should be considered.
An ampoule of Calcium chloride 10% in 10 mls = CaCl2 [100mg/ml] = Calcium [27.2 mg/ml] = Ca2+ 6.8 mmol [10ml]
An ampoule of Calcium gluconate 10% in 10 ml = 2.25 mmol Ca2+
ie Ca chloride has 3 times as such calcium as Ca gluconate
So if you have a life threatening situation where you need extra Ca eg severe hyper K – then use Calcium chloride yet note this can cause local phlebitis / pain. Another approach is to use 1-2 10 ml ampoules of 10% calcium gluconate diluted in 50–100 ml of 5% dextrose or saline and infused slowly over 10 minutes.

ECG monitoring is recommended because dysrhythmias can occur if correction is too rapid.
Treatment can be repeated until symptoms have cleared. Often this offers only temporary relief, and continuous administration of a dilute solution of calcium may be needed to prevent recurrence of hypocalcaemia.
Oral calcium supplements should be given concurrently, and if parathyroid hormone is deficient or non-functional then calcitriol (1,25 dihydroxy vit D) should be given (for example, 1 µg/day).
Mild hypocalcaemia should be referred for outpatient follow up.
Hypocalcaemia resulting in physical signs or ecg abnormalities should be managed as an inpatient.

Evaluation of the vit D and PTH levels will be required unless another cause is clear.
Correct hypomagnesaemia
Note most available vitamin D preparations include calcium, and two tablets of calcium with vitamin D, each containing 400 IU vitamin D, are usually given daily. In patients with hypoparathyroidism, smaller doses of vitamin D are ineffective because parathyroid hormone is needed for conversion to 1,25-dihydroxy-vitamin D. Thus calcitriol is needed. In hypocalcaemia caused by malabsorption, the underlying problem should be treated if possible

This case – the patient had previously elevated PTH levels suggestive of renal failure. He was treated with calcitriol and calcium orally after initial correction with calcium gluconate.

Ref- Diagnosis and management of hypocalcaemia, Cooper M BMJ Volume 336(7656), 7 June 2008, pp 1298-1302

NEXT WEEK'S CASE

An 80yo lady presents with lower abdominal and pelvic / left groin pain post fall .
Below is her pelvic Xray film with magnified section below.

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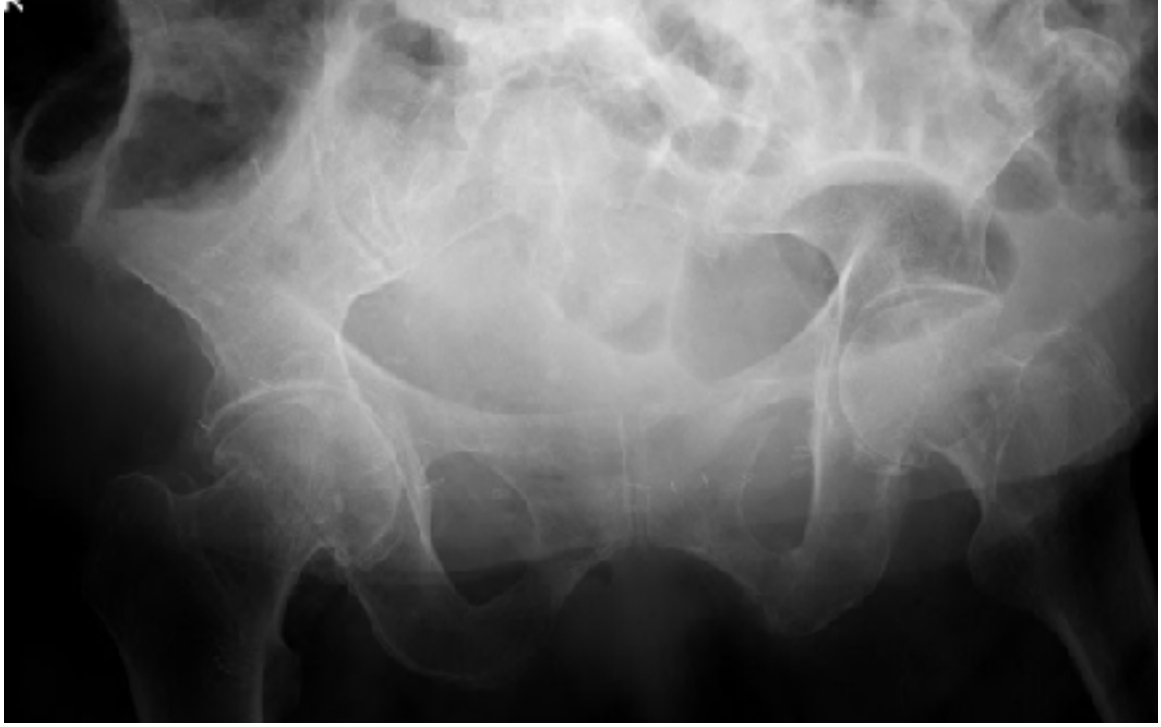

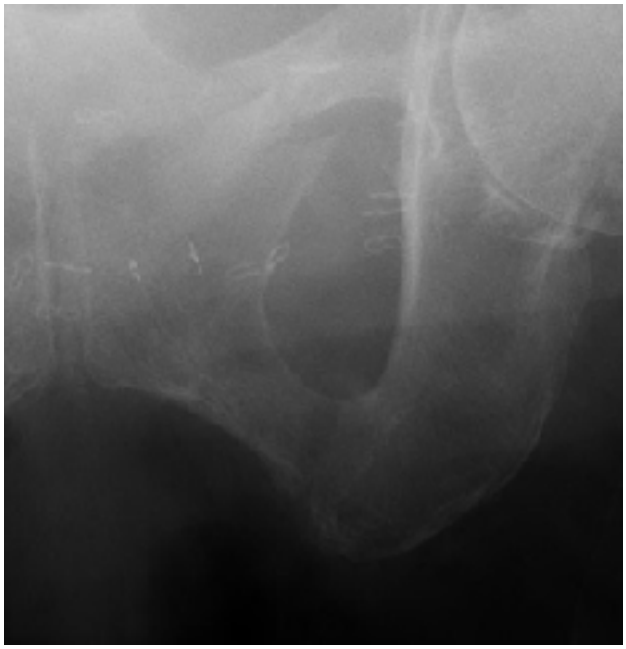

What are the issues that make your approach to the geriatric “trauma” patient such as this one different to that of the younger patient?

Is this potentially going to lead to significant morbidity or mortality?

Editor: Peter Wyllie

JOKE / QUOTE OF THE WEEK

Please forward any funny and litigious quotes you may hear on the floor (happy to publish names if you want)

THE WEEK AHEAD
Tuesdays - 14:30 – 15:30 Intern & JMO teaching -Thomas & Rachel Moore
Wednesday- 0800-0900 Critical Care Journal Club. ICU Conf Room / 14:30 – 15:30 Intern & JMO teaching -Thomas & Rachel Moore
Thursday 0730-0800 Trauma Audit. Education Centre / 0800-0830 MET Review Education centre / 1300-1400 Medical Grand Rounds. Auditorium.

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