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The Thistle QA CEU No is: **MT00025**.

Each attendee should claim **THREE** CEU points for completing this Quality Control Journal Club exercise, and retain a copy of the relevant Thistle QA Participation Certificate as proof of registration on a Thistle QA EQA.

## March 2008

### Hypocalcaemia

#### Case presentation

A 40-year-old woman, grossly overweight, presented with the complaint of cramps and 'spasms' of both hands. Six months prior to admission she had a gastric-bypass operation in an attempt to resolve her weight problem, and ten years earlier she had a thyroidectomy for Grave's disease. The pertinent admission biochemical findings were:

#### Plasma

|                 |             |             |
|-----------------|-------------|-------------|
| Creat           | 0.08 mmol/L | (0.06-0.12) |
| Ca              | 1.28 mmol/L | (2.15-2.55) |
| PO <sub>4</sub> | 1.75 mmol/L | (0.65-1.25) |
| ALP             | 65 U/L      | (30-120)    |
| Alb             | 39 g/L      | (30-50)     |

#### Blood gases

|                  |           |             |
|------------------|-----------|-------------|
| pH               | 7.39      | (7.35-7.45) |
| Po <sub>2</sub>  | 110 mm Hg | (80-110)    |
| Pco <sub>2</sub> | 42 mm Hg  | (35-45)     |
| HCO <sub>3</sub> | 25 mmol/L | (23-33)     |

#### Differential diagnosis

*vitamin D deficiency, hypoparathyroidism*

#### Evaluation of hypocalcaemia

The commonest cause of hypocalcaemia is hypoalbuminaemia closely followed by renal failure.

The Laboratory investigations fall into two groups:

1. routine laboratory tests: plasma albumin, phosphate, alkaline phosphatase, and electrolytes
2. special tests: plasma PTH, magnesium, and vitamin D studies

## Routine laboratory tests

*Plasma albumin:* Some 50% of the circulating calcium is bound to albumin; thus, hypoalbuminaemia may result in low levels of the plasma total calcium, but not necessarily a low concentration of the biologically active ionized fraction.

*Plasma phosphate:* Hypocalcaemia associated with a high plasma phosphate concentration occurs in renal failure and the hypoparathyroid syndromes.

*Plasma alkaline phosphatase:* A high plasma alkaline phosphatase within the context of disordered calcium metabolism usually indicates increased osteoblastic activity. Thus the hypocalcaemia of vitamin D deficiency is associated with a high plasma alkaline phosphatase level.

*Plasma electrolytes:* Renal failure is a common cause of hypocalcaemia – both a high plasma creatinine concentration as well as a high plasma phosphate level are found in such patients.

## Special tests

*Plasma PTH:* The plasma PTH is increased in secondary hyperparathyroidism (e.g. vitamin D deficiency syndromes with low plasma calcium and low plasma phosphate) and in pseudohypoparathyroidism (with low plasma calcium and high plasma phosphate). It is also increased in renal failure, with or without hypercalcaemia.

Low (or normal) levels of PTH are seen in primary hypoparathyroidism and in the hypocalcaemia of severe magnesium deficiency.

*Plasma magnesium:* Magnesium deficiency may cause hypocalcaemia by decreasing PTH secretion, or by inactivating its activity at the bone level.

*Vitamin D studies:* In vitamin D deficiency, due to malnutrition or malabsorption, the plasma levels of 25-hydroxycholecalciferol are usually decreased. On the other hand the vitamin D deficiency syndromes associated with anticonvulsant or barbiturate therapy often have normal levels of this analyte, although the 1,25-dihydroxycholecalciferol level is usually low.

## Case discussion

The commonest causes of neuromuscular hyper-excitability are alkalaemia (particularly respiratory alkalosis) and hypocalcaemia. In this patient alkalaemia was excluded by the normal blood gas results and the hypocalcaemia was confirmed by the normal plasma albumin concentration.

Further laboratory investigations revealed:

- plasma 25-hydroxycholecalciferol: 43 nmol/l (40-160);
- plasma magnesium: 0.90 mmol/L (0.75-1.00);
- plasma PTH: <2 U/L (less than 6)

### Final diagnosis

Vitamin D deficiency and renal failure were excluded by the normal plasma creatinine and vitamin D levels and thus hypoparathyroidism is the most likely cause (hypocalcaemia, hyperphosphataemia, a normal plasma alkaline phosphatase, and a low, or normal, PTH level in the presence of the hypocalcaemia). A common feature of hypoparathyroidism is the severe hypocalcaemia (often <1.50 mmol/L) associated with hyperphosphataemia. The plasma calcium concentrations found in patients with renal failure (also associated with hyperphosphataemia) are rarely less than 1.80 mmol/L and are not usually associated with clinical symptoms specific for hypocalcaemia (tetany, etc.).

Post-thyroidectomy hypoparathyroidism usually becomes apparent immediately after the operation, but in a number of cases the disease may not manifest itself until up to 20 to 30 years later, the reason for this being unclear.

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### **CPD Questions:**

1. Consider and explain this clinical investigation in terms of the admission (plasma) calcium and albumin.
  2. The final diagnosis was "post-thyroidectomy hypoparathyroidism". Explain the connection between thyroidectomy and hypoparathyroidism.
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