

Symptomatic hypercalcaemia following the use of calcium sulfate beads in periprosthetic joint infections

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ABSTRACT

Calcium sulfate beads (CSBs) are used as a method of delivery of antibiotics in periprosthetic joint infections, non-union and chronic osteomyelitis¹⁻³ Symptomatic hypercalcaemia can occur as a complication following the insertion of CSBs however it is rare and few cases have been reported⁴⁻⁷ The cause of hypercalcaemia is poorly understood.

We present the case of a 76-year-old woman who developed symptomatic hypercalcaemia following the insertion of CSBs for a periprosthetic joint infection.

A 76-year-old woman was admitted with a right periprosthetic hip fracture and underwent revision arthroplasty the following day. One week later she developed a complicated infected right hip wound. *Corynebacterium tuberculostrictum*, *Enterococcus faecalis* and *Staphylococcus epidermidis* were isolated. She underwent a washout of her hip and placement of 20mls of CSBs impregnated with vancomycin and gentamicin. She was commenced on intravenous vancomycin two days following her operation.

Six days following the placement of CSBs she developed a delirium with poor oral intake, polyuria and hypovolaemia.

Laboratory analysis determined that she was hypercalcaemic with a calcium level of 3.1 mmol/L, a corrected calcium of 3.3mmol/L and an albumin of 20g/L. Of note prior to the insertion of CSBs her corrected calcium was 2.4mmol/L. Her creatinine preoperatively was 56umol/L and eGFR 85 mL/min, but subsequently deteriorated with a creatinine of 137umol/L and eGFR 32 mL/min. Plasma parathyroid hormone was suppressed at 1.2pmol/L (1.6–7.0 pmol/L). Thyroid function tests demonstrated a T4(free) of 13pmol/L (8–16pmol/L), and a TSH which was slightly elevated at 6.7mIU/L (0.4–5.3 mIU/L). Serum vitamin D was normal at 97nmol/L (50–150nmol/L). Serum immunoglobulins, serum free light chains and serum protein electrophoresis did not show any evidence to suggest multiple myeloma. A CAT scan of her chest, abdomen and pelvis did not show any evidence of malignancy or granulomatous disease.

She had no prior history of hypercalcaemia, cal-

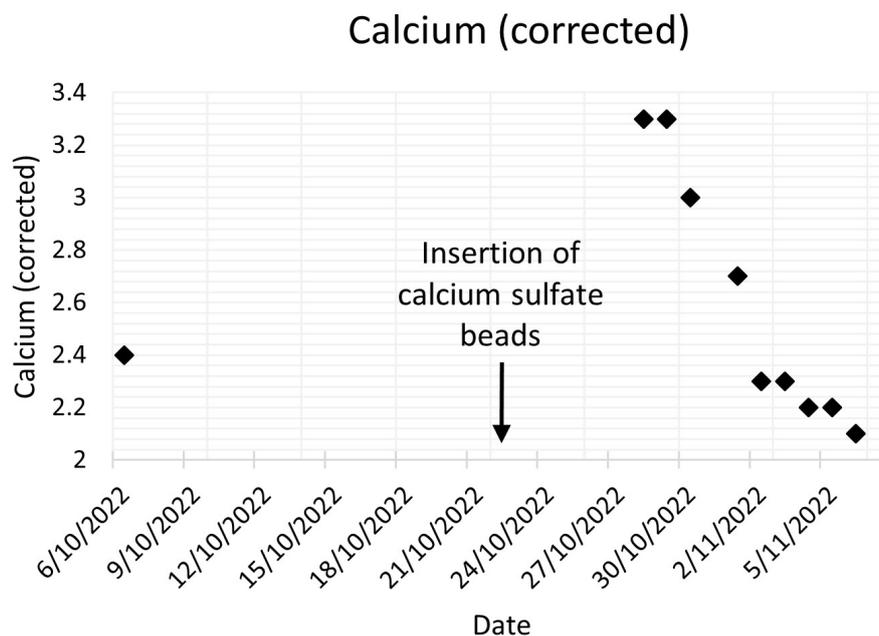
cium disorders, parathyroid disease or kidney disease. She was not on any medications known to induce hypercalcaemia. She was receiving annual zoledronic acid for osteoporosis, her last dose having been given 11 months prior to her hip fracture.

Her acute kidney injury was thought due to hypovolaemia and hypercalcaemia. Intravenous vancomycin was started four days prior to the diagnosis of hypercalcaemia. Daily vancomycin levels were at the lower end or below the target vancomycin concentration range. Vancomycin was not thought to have contributed to her kidney injury. She was not on any other nephrotoxins. She had an indwelling catheter throughout her post-operative period. Her CT abdomen did not show any significant renal tract lesion nor obstruction.

She was initially managed with large volume intravenous normal saline. Her hypercalcaemia improved only slightly and she was therefore given intravenous zoledronic acid. Her calcium subsequently normalised over several days (see Figure 1). Her renal function returned to normal.

Discussion

The use of CSBs is increasing, particularly as a method for delivery of high doses of antibiotics locally in orthopaedic surgery.² In our centre (serving a population of 550,000), CSBs are used in operations 25–30 times per year. They are advantageous in that they do not need subsequent removal as they are completely resorbed.³ Symptomatic hypercalcaemia has been reported as a rare complication of CSBs. A recent literature review in 2021 by Tarar et al⁸ identified a total of 1,049 patients who underwent CSBs implantation, of which 44 patients

Figure 1: Changes in corrected calcium levels pre- and post-surgery.

developed hypercalcaemia. Of those, three patients developed symptomatic hypercalcaemia requiring management. Our patient developed symptomatic hypercalcaemia following the insertion of antibiotic impregnated CSBs, requiring treatment with aggressive fluid replacement and zoledronic acid.

There is very limited data to fully elucidate the cause of hypercalcaemia following the placement of CSBs. Possibilities include premature breakdown of the CSBs, location of the bead placement near increased vasculature, or more rapid absorption of calcium from the beads.⁹ A 2018 study by Kallala et al⁶ indicates a possible dose dependent relationship between CSBs and the development of hypercalcaemia, and recommended a maximum dose of 40mls per operation. Our patient received only 20mls being half this recommended maximum dose for CSBs.

In conclusion, hypercalcaemia following placement of antibiotic eluting CSBs is a rare and poorly understood complication of this treatment. In a very few cases such as ours, symptomatic hypercalcaemia requiring treatment can occur. For best practice, patients should be informed of the possible complication of hypercalcaemia following the placement of CSBs, and serum calcium and renal function should be monitored pre and post-operatively. In patients at high risk for hypercalcaemia, such as those with primary hyperparathyroidism, kidney disease, critical illness, or prolonged periods of immobilisation, other methods should be considered for treatment of orthopaedic infections. Given the increasing use of CSBs in orthopaedic practice and increased potential for complications following their use, further investigation and studies are required.

COMPETING INTERESTS

Nil.

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