

Lesson of the week

A life threatening complication after ingestion of sodium phosphate bowel preparation

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Colonoscopy is a common procedure in modern health care. A prerequisite for good quality colonoscopy is adequate bowel preparation. Various methods are available, which are also used for diagnostic radiological and surgical procedures. One such agent, the oral sodium phosphate solution (Fleet Phospho-soda, C B Fleet, Lynchburg), has become increasingly popular as an alternative to gut lavage preparations since a report of its use in colonic cleansing in 1990.¹ This acceptance is largely due to the smaller volume required for ingestion, with a recommended dose of 45 ml of sodium phosphate diluted with water, given at two intervals 12 hours apart (www.phosphosoda.com). Numerous studies have documented its efficacy and higher patient preference and compliance.² Furthermore, it is cheaper than other forms of bowel preparation agents.

In a recent study of colonoscopy practice in the United Kingdom, a single policy on bowel preparation was used in 82% of the gastroenterology centres, and sodium phosphate was the preferred agent in 15% of these units.³ However, once incorporated as the standard lavage regimen in units' protocols, the blanket use of sodium phosphate may result in a greater chance of serious complications because pharmaceutical warnings may not be rigidly observed. We present the case of a life threatening complication after ingestion of sodium phosphate before colonoscopy.

Case report

A 64 year old man with Wegener's granulomatosis who attends for routine hospital haemodialysis presented for his routine dialysis with a 24 hour history of tetany, including locked jaw and carpopedal spasm. He also described skin paraesthesia "like something crawling under my skin."

Two days before, he had started bowel preparation with Fleet Phospho-soda, in preparation for upper and lower gastrointestinal endoscopies to investigate weight loss, persistent nausea, and vomiting and an episode of *Streptococcus bovis* bacteraemia. Endoscopic examinations on the day before admission identified significant global diverticulosis with multiple small polyps throughout the colon, all of which were snared and removed. Subsequent pathology showed all polyps to be benign. He also had gastritis and a single benign partially healed ulcer in the oesophagus. At the time of presentation, his corrected total serum calcium was 1.08 (normal range 2.2-2.6) mmol/l, serum magnesium 0.4 (0.7-1.1) mmol/l, and serum phosphate 3.64 (0.8-1.4) mmol/l. He was treated with urgent haemodialysis using 1.75 mmol/l ionised calcium dialysate, and his symptoms settled by the end of his 4.5 hour session. By the time he was transferred to the ward for admission, his corrected total serum calcium was 2.25 mmol/l. He received further treatment with oral calcium supplements. At discharge after 24 hours observation, his total serum calcium was 2.47 mmol/l

and his symptoms had resolved. His serum calcium after discharge was maintained within the normal range without further calcium supplementation.

Discussion

Sodium phosphate bowel preparations can lead to severe complications in patients with renal failure. These patients are unable to excrete the acute and excessive phosphate load. The main symptoms are due to the hypocalcaemia that results from the raised serum phosphate concentrations. Other reported symptoms include confusion, drowsiness, postural dizziness, and circulatory collapse. They are thought to be the additional effects of concomitant intravascular volume depletion, hypernatraemia, hypokalaemia, and metabolic acidosis.⁴ The timing of routine haemodialysis probably saved our patient because his electrolyte abnormalities were rapidly corrected by dialysis.

Sodium phosphate is a hypertonic solution with strong osmotic effects. It acts by retaining fluid in the bowel through osmosis. It contains 48 g (400 mmol) of monobasic sodium phosphate and 18 g (130 mmol) of dibasic sodium phosphate per 100 ml. (www.phosphosoda.com). The diluted preparation of sodium phosphate contains about 34 times the amount of sodium, 2000 times the phosphate, and has more than 30 times the osmolality of normal human plasma.⁴ Several studies have reported a rise in serum phosphate and a fall in serum calcium concentrations after ingestion of sodium phosphate.⁵⁻⁶ In one study, the lowest serum ionised calcium was 1.07 mmol/l, but none of the patients had symptoms of hypocalcaemia. The authors said that such transient electrolyte abnormalities have little clinical relevance.⁷ However, these studies excluded patients with comorbidities such as renal dysfunction, heart disease, liver disease, and patients with known electrolyte imbalances.

There have been previous reports of fatal hyperphosphataemia in patients with renal dysfunction⁸ and in a kidney transplant recipient who had good transplant function.⁹ One review suggested that mortality may be as high as 33% when phosphate bowel preparation is used in patients with impaired renal function.⁸ Mortality seems to be dependent on the amount of phosphate absorbed, and the severity of the condition is determined by the patient's premorbid status.⁸ The mechanism of death is unknown. Precipitation of calcium phosphate in vital organs due to increased calcium-phosphate solubility product has been hypothesised, as seen with phosphate therapy.¹⁰ The presence of abundant tubular calcium phosphate deposits on renal biopsy has been noted in patients with acute renal failure after sodium phosphate ingestion, with some patients subsequently developing chronic renal failure.¹¹ Prolonged retention due to ileus, impaction, intestinal obstruction, or acute colitis may facilitate phosphate absorption.⁶ However, as in

Standard bowel preparations can cause life threatening complications in vulnerable patients, including people with renal disease

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our case, severe hyperphosphataemia can occur in the absence of intrinsic bowel disease. Other contributing factors are improper dose administration^{4 5 8} and concurrent administration of other purgatives, thus exposing the patient to a greater risk of fluid depletion.

Other vulnerable groups of patients include elderly and debilitated people, patients with hepatic and cardiac disease, people with delicate fluid and electrolyte balance and people taking drugs that prolong QT interval. The use of sodium phosphate is also contraindicated in children and in patients with gastrointestinal obstruction or megacolon (www.phosphosoda.com). Patients who are at risk should receive an alternative bowel preparation agent, such as polyethylene glycol. Ingestion of four litres of osmotically balanced polyethylene glycol solution has been shown to be safe and effective for colonic cleansing for special patient populations with cardiac, renal, or hepatic dysfunction and those with diabetic or hypertensive disease.^{5 12} Reduced volume (two litres) polyethylene glycol lavage with bisacodyl seems to have similar effectiveness.¹³

Patients taking sodium phosphate must be advised to maintain adequate hydration. If the patient cannot take fluids due to persistent vomiting or general debilitation, he or she should be advised to contact their doctor. Inpatients should be allowed easy access to oral fluids or receive intravenous supplements if unable to take orally. Patients taking diuretics, angiotensin converting enzyme inhibitors, angiotensin receptor antagonists, or other drugs known to affect electrolyte balance should have these drugs temporarily withheld before receiving sodium phosphate.¹⁴ Endoscopy units should be prepared to obtain baseline and post-treatment biochemical profiles to check patients who are at risk. Symptoms from electrolyte and metabolic derangement usually present between six and 12 hours after ingestion of sodium phosphate.⁴ Thus, inpatient facilities may be necessary for monitoring some patients.

Evidence shows that many endoscopists may not be aware of groups of patients who are at high risk and their potential for complications after ingestion of sodium phosphate.¹⁵ Although sodium phosphate preparations are safe and effective for most patients,

doctors who prescribe sodium phosphate for bowel preparation must be aware of the potential for life threatening complications, especially when drafting local protocols, and careful management of patients at risk should be emphasised.

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A memorable patient

The unconscious schoolgirl

I was the on-call paediatric senior house officer when I received a call from the accident and emergency department asking me to see a 5 year old girl who had been brought in by ambulance having been found unconscious in the school playground. Examination had failed to pin point the problem, so I came down to investigate. No one was available to give a collateral or eye witness account. My examination revealed non-response to pain but a level of tone in her limbs that belied this finding. I called my registrar. A third examination was performed, during which the patient remained totally immobile and unresponsive. There was a collective scratching of heads. By this time, the child's father had arrived.

"I think we should do some blood tests and keep her in overnight," my registrar suggested. While I went to collect the appropriate tools, my registrar discussed things with the father, during their exchange the word "needle" was used. Two minutes later, I returned to find the patient now sitting up in bed with a broad smile on her face eagerly telling everyone, "I'm alright

now." Her father looked a mixture of relieved and confused. As the patient was unable to elaborate on what had occurred, the decision was made to keep her in overnight for observation.

Later that evening I was called to the ward: the father wanted to see me. He was extremely embarrassed, and he explained that his daughter had "come clean" on the whole playground event. It seemed that she had been playing "mummies and daddies" with her friend and, as part of the game, had pretended to be asleep. Her friend, not realising this, had run off to tell the teacher that there was something wrong with her. Not wanting to risk getting her friend into trouble, she had decided it was best to remain "asleep." Such was her drive to be convincing that she had succeeded in fooling not only her teachers but also two paramedics and three doctors. The moral to the story? Never underestimate a child.

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