Acute kidney injury after use of oral Fleet Phospho Soda as bowel preparation for colonoscopy

W. Jacobs, K. Stas, J.-L. Coenegrachts

University Hospitals KULeuven, campus Gasthuisberg, Leuven, Belgium.

Abstract

We present a case of a 64-year old woman who developed acute kidney injury (AKI) finally resulting in stage 4 chronic kidney disease after ingestion of a high phosphate containing solution (oral Fleet Phospho Soda) as bowel cleansing for colonoscopy. (Acta gastroenterol. belg., **2011**, 74, **77-78**).

Key words : phosphate nephropathy, colonoscopy, renal failure, Fleet Phospho Soda.

Introduction

Oral phosphate containing enemas are still routinely prescribed as bowel preparation for colonoscopy and barium study, often in an outpatient clinical setting. They act as an osmotic agent and can lead to dehydration and electrolyte disturbances like hypernatremia, hypocalcemia and hyperphosphatemia, the latter of which has been associated with potential serious side effects like acute and chronic kidney injury.

We report a case of severe acute kidney injury following the use of oral Fleet Phospho Soda.

In the US this kind of enemas cannot longer be obtained over-the-counter because of an FDA warning in 2008 (1).

Despite these warnings and despite the amount of lawsuits in the US, in Belgium Fleet Phospho Soda is still available without medical prescription. Considering the potential serious side effects and the availability of effective alternatives we think that the use of oral sodium phosphate solutions should be limited.

Case report

A 64-year-old woman with a history of hypercholesterolemia, arterial hypertension and type 2 diabetes mellitus was admitted to the consultation with a problem of bloody stools. She was taking oral antidiabetics (metformine, gliclazide), her hypertension was treated with a combination of an ace-inhibitor and a diuretic (quinapril 10 mg, hydrochloro-thiazide 12.5 mg), and she was taking a statin (atorvastatin). A rectal examination revealed grade 1-2 internal haemorrhoids which were treated with infrared therapy and a colonoscopy was planned. A bowel preparation with oral Fleet Phospho Soda 45 mL was prescribed the evening before and the morning of the colonoscopy. The examination was performed under sedation with 5 mg of midazolam and 50 mg of pethidinehydrochloride. The colonoscopy revealed an obstructing adenocarcinoma of the sigmoid. After the procedure the patient was in a good general condition and went home.

Two days later the patient was electively hospitalized for further staging and therapeutic planning. In the days after the colonoscopy she developed oliguria and she experienced some nausea. At admission clinical examination showed normal auscultation of heart and lungs. Blood pressure was 137/87 mmHg, heart rate was 64 beats per minute, central venous pressure was 6 cm water. Abdominal palpation didn't show abdominal masses.

A routine blood sample revealed a serum creatinine of 6.23 mg/dL (normal values 0.58-0.94) (being 0.57 mg/dL 2 months before hospital admission). Serum urea was 103 mg/dL (normal values 19-48), phosphate 11.4 mg/dL (normal values 2.5-4.5) and calcium 8.1 mg/dL (normal values 8.8-10.6). Blood haemoglobin level was 11.7 g/dL (normal values 11.6-15.5 g/dL).

A urine sample contained 43 red blood cells and 41 white blood cells/mm^3, protein dosage was 0.2 g/L.

An ultrasound examination of the urinary tract showed normal renal volumes and blood vessels and excluded postrenal causes of renal failure. We started an infusion of sodium chloride 0.9% and sodium bicarbonate 1.3% at 80 mL/min and a high dose of diuretics to promote excretion of the excess phosphate. The next day acute hemodialysis was started because of diuretics-resistant lung oedema.

In the following days there was a gradual decline in serum creatinine and with regaining spontaneous diuresis, dialysis could be stopped.

In the next six months of follow-up the renal insufficiency stabilized resulting in stage 4 chronic kidney disease.

Discussion

With the growing trend to set up major screening colonoscopy programs, safety remains one of the most

Correspondence to : Dr. Wim Jacobs, assistant in gastro-enterology, Engsbergseweg 74, 3980 Tessenderlo, Belgium. E-mail : wimjacobs@hotmail.com

Submission date : 26/10/2009
Acceptance date : 18/03/2010

important procedure-related concerns (2). This ultimately starts with a safe preparation for the procedure. Producers of oral phosphate containing enemas have always warranted the precautious use of these preparations in the elderly and patients with kidney and cardiac function impairment. Despite the fact that a recent review and meta-analysis of 7 studies could not discern whether there is an association between the receipt of an oral sodium phosphate solution and kidney injury (which could at least in part be explained by the fact that it is a small series, of which only one was a randomised control trial, and a lot of heterogeneity), some recent cases and series suggest a strong association particularly in certain high risk populations (3-10). Estimates from recent series have shown an incidence of up to 1-4%. Biopsy studies show that all cases involve tubular damage caused by deposition of calciumphosphate crystals in the distal tubuli and collecting ducts (11-13).

Phosphate homeostasis is regulated by oral intake (intestinal absorption) and renal excretion. All patients who get a standard dose of oral sodium phosphate (OSP) (= 2 × 45 mL of Fleet Phospho Soda in Belgium, which means more than 30 times the normal daily dietary intake of phosphate) develop transient hyperphosphatemia to some extent (14-16), but this will not lead to kidney injury in all cases.

Hyperphosphatemia will lead to high urinary (PTH-regulated) phosphate-excretion which can lead to crystal formation in case of oversaturation of the urine and in case of alterations in pH, citrate and pyrophosphate concentrations. These crystals attach to the tubular epithelium causing reactive oxygen stress damage, which in turn can lead to significant and potentially irreversible renal failure. Several factors can predispose to a higher risk of developing this condition, which is termed acute phosphate nephropathy (APN). Volume depletion (caused by the oral sodium phosphate, diuretics or pre-existing like in patients with severe colitis), leading to renal hypoperfusion, which can be aggravated by several other factors like medications (ACE-inhibitors, angiotensin receptor blockers, non-steroidal anti-inflammatory drugs) or arterial hypertension, ultimately leads to the rise of urinary calcium-phosphate product with a greater risk of crystal deposition. Also increasing age and female gender are recognised as potential risk factors for developing APN, probably in part explained by the higher risk for volume depletion (6,17).

In our case we did not obtain a kidney biopsy to prove the diagnosis. According to the temporal relation with the intake of a high phosphate solution, laboratory findings and the evolution of kidney injury, we assumed phosphate-nephropathy as the most probable diagnosis. Proving it by biopsy would not have altered therapy at that point. The stabilization of serum creatinine in the days after normalization of serum phosphate and after stopping dialysis are again in favor of our diagnosis. In our opinion the possible advantages did not outweigh the risk of a kidney biopsy in an obese patient in this clinical setting.

Retrospectively our 64-year old female patient with a history of hypertension, who was treated with a diuretic and an ACE-inhibitor, had a high risk of developing this complication. Cases like this should make physicians more aware of the potential serious risks of oral sodium phosphate containing laxatives and stress the importance of pre-procedure risk stratification. Regarding these data and the availability of safe and good alternatives for OSP, it could even be argued not to use these solutions at all.

References

1. www.fda.gov/Drugs/DrugSafety
2. MACKEN E., MOREELS T., PELCKMANS P., PEETERS M., BAERT D., REYNAERT H., DELOOZE D., VANNOOTE J., HIELE M., COENEGRACHTS J.L., HOSTE P., VAN CUTSEM E., D'HAENS G. Flemish Society of Gastroenterology VVGE. Quality assurance and recommendations for quality assessment of screening colonoscopy in Belgium. *Acta Gastroenterol. Belg.*, 2009, **72** : 17-25.
3. BRUNELLI S.M. Association between oral sodium phosphate bowel preparations and kidney injury : a systematic review and meta-analysis. *Am. J. Kidney Dis.*, 2009, **53** : 448-456.
4. ABASKHAROUN R., DEPEW W., VANNER S. Changes in renal function following administration of oral sodium phosphate or polyethylene glycol for colon cleansing before colonoscopy. *Can. J. Gastroenterol.*, 2007, **21** : 227-231.
5. BRUNELLI S.M., LEWIS J.D., GUPTA M., LATIF S.M., WEINER M.G., FELDMAN H.I. Risk of kidney injury following oral phosphosoda bowel preparations. *J. Am. Soc. Nephrol.*, 2007, **18** : 3199-3205.
6. HURST F.P., BOHEN E.M., OSGARD E.M., OLIVER D.K., DAS N.P, GAO S.W, ABBOTT K.C. Association of oral sodium phosphate purgative use with acute kidney injury. *J. Am. Soc. Nephrol.*, 2007, **18** : 3192-3198.
7. JOHANSON J.F., POPP J.W., COHEN L.B., LOTTES S.R., FORBES W.P., WALKER K., CARTER E., ZHANG B., ROSE M. A randomized, multicenter study comparing the safety and efficacy of sodium phosphate tablets with 2L polyethylene glycol solution plus bisacodyl tablets for colon cleansing. *Am. J. Gastroenterol.*, 2007, **102** : 2238-2246.
8. KHURANA A., MCLEAN L., ATKINSON S., FOULKES C.J. The effect of oral sodium phosphate drug products on renal function in adults undergoing bowel endoscopy. *Arch. Intern. Med.*, 2008, **168** : 593-597.
9. RUSSMANN S., LAMERATO L., MARFATIA A., MOTSKO S.P., PEZZULLO J.C., OLDS G., JONES J.K. Risk of impaired renal function after colonoscopy : a cohort study of patients receiving either oral sodium phosphate or polyethylene glycol. *Am. J. Gastroenterol.*, 2007, **102** : 2655-2663.
10. SINGAL A.K., ROSMAN A.S., POST J.B., BAUMAN W.A., SPUNGEN A.M., KORSTEN M.A. The renal safety of bowel preparations for colonoscopy : a comparative study of oral sodium phosphate solution and polyethylene glycol. *Aliment. Pharmacol. Ther.*, 2008, **27** : 41-47.
11. MARKOWITZ G.S., NASR S.H., KLEIN P., ANDERSON H., STACK J.I., ALTERMAN L., PRICE B., RADHAKRISHNAN J., D'AGATI V.D. Renal failure due to acute nephrocalcinosis following oral sodium phosphate bowel cleansing. *Hum. Pathol.*, 2004, **35** : 675-684.
12. GONLUSEN G. Renal failure and nephrocalcinosis associated with oral with oral sodium phosphate bowel cleansing : clinical patterns and renal biopsy findings. *Arch. Pathol. Lab. Med.*, 2006, **130** : 101-106.
13. AASEBO W. Kidney biopsy taken before and after oral sodium phosphate bowel cleansing. *Nephrol. Dial. Transplant.*, 2007, **22** : 920-922.
14. TAN J.J., TJANDRA J.J. Which is the optimal bowel preparation for colonoscopy – a meta-analysis. *Colorectal Dis.*, 2006, **8** : 247-258.
15. BELOOSESKY Y., GRINBLAT J., KATZ M., HENDEL D., SOMMER R. Electrolyte disorders following oral sodium phosphate administration for bowel cleansing in elderly patients. *Arch. Intern. Med.*, 2003, **163** : 803-808.
16. CASWELL M. The time course and effect on serum electrolytes of oral sodium phosphates solution in healthy male and female volunteers. *Can. J. Clin. Pharmacol.*, 2007, **14** : 260-274.
17. MARKOWITZ G.S., STOKES M.B., RADHAKRISHNAN J., D'AGATI V.D. Acute phosphate nephropathy following oral sodium phosphate bowel purgative : an underrecognized cause of chronic renal failure. *J. Am. Nephrol.*, 2005, **16** : 3389-3396.