Lesson of the week

Danger of salt substitutes that contain potassium in patients with renal failure

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Salt substitutes may cause severe hyperkalaemia in patients with impaired renal potassium handling

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In extolling the benefits of potassium an editorial in the *BMJ* recently advocated that people should increase their intake of potassium.[1] Its benefits include lowering blood pressure in both hypertensive and normotensive people. A high potassium intake reduces the risk of stroke, and in rats it prevents renal vascular, glomerular, and tubular damage. Increasing potassium concentrations also reduces the risk of ventricular arrhythmias in patients with heart disease, heart failure, and left ventricular hypertrophy.[1] Using a salt substitute that contains potassium combines the advantages of reducing sodium intake and increasing potassium intake.

However, in the high risk population that may benefit most from an increased consumption of potassium, several medical conditions predispose to the development of hyperkalaemia through impairing renal excretion of potassium. These conditions include renal failure, diabetes mellitus with hyporeninaemic hypoaldosteronism, and obstructive uropathy. The risk of hyperkalaemia is further increased by the frequent prescription in these patients of angiotensin converting enzyme inhibitors, angiotensin II receptor blockers, and potassium sparing diuretics.[2] Elderly patients with osteoarthritis may also use non-steroidal anti-inflammatory drugs, which also may contribute to increased plasma potassium values.[2]

Salt substitutes that contain potassium may cause hyperkalaemia with life threatening consequences in susceptible patients, as the following case report illustrates.

Case report

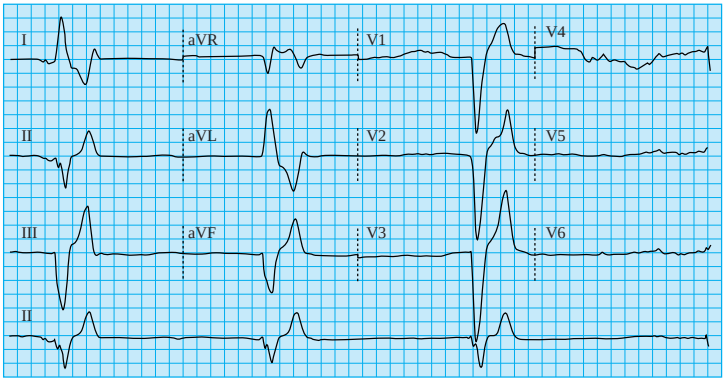
A 74 year old woman had developed end stage renal disease due to nephrolithiasis, hypertension, and renal vascular disease. She also had chronic obstructive pulmonary disease after 30 years of smoking. In November 2000 chronic intermittent haemodialysis was started three times weekly.

In March 2001 she was admitted urgently to our hospital on the day after dialysis because of malaise and abdominal pain. She had bradycardia (40 beats/min) in the ambulance, which responded to atropine infusion. On arrival in the emergency room an electrocardiogram showed bradycardia, absence of P waves, severely widened QRS complexes to 240 milliseconds, and tall peaked T waves (figure). She developed asystole, and cardiopulmonary resuscitation was performed for 20 minutes. Her serum potassium concentration was 9.2 mmol/l and she was given calcium levulinate 10 ml 10% twice, glucose 50% and insulin and sodium bicarbonate 8.4% 100 ml intravenously, and sodium polystyrene sulphonate 30 g orally. Her serum potassium concentration fell to 7.2 mmol/l and subsequently she underwent emergency haemodialysis. Her recovery was rapid and without sequelae. The cause of her unexpected life threatening hyperkalaemia was not established. The predialysis plasma potassium concentration in previous months had increased slowly from 4.1 to 6.4 mmol/l on the day before the incident. She was not taking angiotensin converting enzyme inhibitors, angiotensin II receptor blockers, potassium sparing diuretics, or non-steroidal anti-inflammatory drugs. A dietician repeated the recommendation to reduce the potassium intake to 2400 mg/day.

In May 2001, the night before a scheduled dialysis treatment, she was again urgently transferred by ambulance to our hospital because of a paresis of her arms and legs. She developed asystole and was treated with cardiopulmonary resuscitation for several minutes. Hyperkalaemia was suspected and immediately treated with calcium levulinate, sodium bicarbonate, glucose-insulin, and salbutamol inhalation. Her serum potassium was later reported to be 9.7 mmol/l, and it declined to 7.9 mmol/l with the measures taken. She received emergency haemodialysis and again recovered without sequelae. She admitted to the consumption of some grapes, and the dietary advice was repeated. On further questioning it turned out she had used the salt substitute LoSalt, which contains at least two thirds potassium chloride and less than one third sodium chloride. She handed the LoSalt over and was advised strongly never to take a salt substitute again. Since then no further episodes of severe hyperkalaemia have occurred.

Comment

A patient on maintenance haemodialysis developed cardiopulmonary arrest due to severe hyperkalaemia on two occasions, probably because of her use of a potassium-containing salt substitute. Fortunately, she responded well to appropriate treatment.[3]



Electrocardiogram showing bradycardia, absence of P waves in leads II and V1, severely widened QRS complexes in all leads, and tall peaked T waves in the inferior and precordial leads, caused by severe hyperkalaemia

The beneficial effects of potassium and the harmful effects of sodium have recently received attention.[1] Consumption of fruit and vegetables is the preferred source of potassium, but the use of a salt substitute also increases the intake of potassium at the same time as reducing the use of sodium. A similar case of cardiac arrest due to hyperkalaemia in a patient with mild renal insufficiency treated with nabumetone and also taking LoSalt has been reported previously.[4] The label of LoSalt does state that it is not suitable for people who must follow a salt restricted diet.

Patients are often not aware that their medical condition may reduce potassium excretion or of the potassium content of the salt substitute they may use to reduce their sodium intake. Carers may not always know of a patient's use of a salt substitute. Our patient initially denied the use of LoSalt, and its use was established only after we questioned her family after the second episode. Because of the increasing prevalence of diabetes, renal failure, and the use of drugs that increase potassium concentration, the number of patients at risk of developing life threatening hyperkalaemia is likely to increase.

We recommend that patients with impaired renal potassium excretion due to renal disease, especially those taking angiotensin converting enzyme inhibitors, angiotensin II receptor blockers, potassium sparing diuretics, or non-steroidal anti-inflammatory drugs, should be warned by their doctors and dieticians about the danger of hyperkalaemia. Prescribers of these drugs to such patients should inquire about their use of potassium-containing salt substitutes. The product information of salt substitutes containing potassium should also include clearer warnings.

Contributors: CGV managed the first episode of severe hyperkalaemia and CJD the second. CJD came up with the idea of writing the paper and undertook the literature review. The paper was written jointly by both authors. Both are guarantors.
Competing interests: None declared.

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A lesson in prescribing

On a recent visit to KwaZulu Natal, South Africa, I took doxycycline capsules for malaria prophylaxis. For three weeks, while we were on holiday, all went well. We then moved on to Mseleni Mission Hospital, 60 km south of the Mozambique border on the east coast, where I had worked for 21 months before my general practitioner registrar year.

The night before I was due to begin five weeks' work there, I started feeling some discomfort in my throat. We arrived at Mseleni Mission Hospital at midday, and I went straight to the outpatients and casualty department before spending most of the night in labour ward and theatre. By morning I was feeling quite unwell with retrosternal chest pain, odynophagia, and mild dysphagia. I am ashamed to say that it was my non-medical wife who first suggested the possibility of a link between the doxycycline and my unpleasant symptoms. I stopped the treatment, and the symptoms gradually resolved over a fairly miserable week. I took no further doxycycline, and I did not get malaria.

I learnt two lessons from this experience. Firstly, being in a low risk area in the dry season, I could have weighed up the pros and cons of taking antimalarial prophylaxis more carefully. It seems to be assumed in Britain that one should always take drug prophylaxis in a malarial area. There was one recorded case at the hospital in the five weeks I was there (in an area serving 70 000 patients).

Secondly, I learnt a little about tetracyclines. The symptoms I experienced were most likely because of oesophageal ulceration, which, although unproved in my case, is a recognised side effect of doxycycline. Most doctors will mention the potential for photosensitivity problems when prescribing doxycycline, but I have come across only one other who knew of its potential for causing oesophageal ulcers. The doctor in question knew of this only because a relative had experienced dysphagia while taking doxycycline in Mozambique.

The side effects are, of course, mentioned in the *British National Formulary*, and a search on Medline revealed some interesting abstracts reporting many similar cases. One paper, based on notifications to the French regional pharmacovigilance centre, cited 81 cases of oesophageal injuries associated with tetracycline ingestion between 1985 and 1992. It was mentioned that capsules caused 22 times more problems than tablets because of their adhesion to the oesophageal surface. Doxycycline was responsible for 96% of these cases, probably explained by its cytotoxic and irritant properties.[1]

The *British National Formulary* gives the following advice for counselling when prescribing doxycycline: "Capsules should be swallowed whole with plenty of fluids during meals while sitting or standing." The article cited above added they should be taken not less than one hour before bedtime.

I now check the *British National Formulary* for drug side effects more carefully than I used to. I counsel patients more appropriately when prescribing tetracyclines, and I am better at helping patients weigh up risks and benefits of prophylactic treatments. My side effects were not an experience I would have chosen, but equally, they were not an experience wasted.

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1 Champel V, Jonville-Bera AP, Bera F, Autret E. Oesophageal involvement after tetracycline ingestion. *Therapie* 1997;52:587-9.

We welcome articles up to 600 words on topics such as *A memorable patient, A paper that changed my practice, My most unfortunate mistake*, or any other piece conveying instruction, pathos, or humour. If possible the article should be supplied on a disk. Permission is needed from the patient or a relative if an identifiable patient is referred to. We also welcome contributions for "Endpieces," consisting of quotations of up to 80 words (but most are considerably shorter) from any source, ancient or modern, which have appealed to the reader.