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## Lesson of the week

# Fatal dysnatraemia caused by elective colonoscopy

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**Colonoscopy can cause fatal dysnatraemia, and plasma sodium should always be checked after the procedure**

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BMJ 2003;326:382-4

Recent data suggest that colonoscopy is superior to other screening procedures for the detection of colorectal cancer in people aged over 50.<sup>1</sup> The American College of Gastroenterology has recently recommended that individuals over 50 at average risk of colon cancer should have elective colonoscopy every 10 years, and those at higher risk more frequently.<sup>2</sup> In the United States, 239 000 inpatient colonoscopies were performed in 1995,<sup>3</sup> and this figure rose by 20% to 286 000 by 1999.<sup>4</sup> Yet complications of elective colonoscopy are reported to be infrequent: colon perforation or bleeding occurs in fewer than 1% of cases, and electrolyte disorders are not even mentioned.<sup>1-5-8</sup>

Preparation of the colon for colonoscopy involves a thorough cleansing of the large bowel by one of several different methods, in some of which large volumes of a liquid cleansing agent may be given: one method involves drinking 4 l polyethylene glycol solution; another involves taking 90 ml sodium phosphate solution.<sup>5-9</sup> Both methods can lead to diarrhoea with nausea, vomiting, and potential dehydration,<sup>9</sup> often resulting in raised plasma concentrations of anti-diuretic hormone.<sup>10</sup> Thus electrolyte imbalance may occur, either from increased oral water intake with abnormal fluid retention or from increased fluid losses into the gastrointestinal tract.

Furthermore, preparation for colonoscopy causes substantial release of anti-diuretic hormone,<sup>10</sup> and gastrointestinal fluid losses may cause excessive thirst, so increasing fluid intake. In patients with impaired ability to excrete water, the raised plasma anti-diuretic hormone concentrations can lead to hyponatraemia; if thirst is impaired, excessive fluid losses can lead to

hypernatraemia. In elderly patients in hospital, acute hypernatraemia and hyponatraemia may be fatal,<sup>11-12</sup> yet there are no reports of fatal electrolyte complications associated with elective colonoscopy. We recently saw three patients who developed symptoms of hypernatraemia or hyponatraemia (dysnatraemia) as a complication of elective colonoscopy.

## Case reports

Over a period of 28 months (December 1998 to March 2001), JAC and AIA advised elective colonoscopy for three patients: one for unexplained weight loss, one for bleeding, and one as routine screening. Their ages ranged from 51 to 73; two were men and one was a woman. All three patients developed symptoms of dysnatraemia, and the laboratory findings at the time this was noted are shown in the table. All three patients had been given 4 l of a standard bowel preparation solution containing an isosmotic solution of polyethylene glycol and balanced electrolytes (Golytely; Braintree Laboratories, Braintree, MA) to prepare the bowel.<sup>9-13</sup> Plasma sodium was measured at the time patients first showed symptoms of dysnatraemia.

In patients 1 and 2, taking the cleansing solution induced nausea, abdominal distension, and diarrhoea, and both patients reported then drinking substantially increased amounts of fluids. Patient 1 was concomitantly taking thiazides. Before preparation, her plasma sodium concentration was 138 mmol/l. After drinking all 4 l of the preparation solution, she continued to drink water and reported nausea, vomiting, and headache. The following morning she was found unconscious in bed; she had several tonic-clonic seizures on the way to hospital in the ambulance; and in hospital

Laboratory values and clinical findings for patients with dysnatraemia as a complication of elective colonoscopy

Characteristic or finding	Patient 1	Patient 2	Patient 3
Age	62	51	73
Sex	F	M	M
Illness	Hypertension, hyperlipidaemia	Diabetes, end stage renal disease	Diabetes, end stage renal disease
Prescription drugs	Thiazide	Amlodipine, atenolol, Lasix, Phoslo, Prilosec	Prozac, atenolol, tegretol, Prevacid, ramipril, Prandin
Sodium (mmol/l):			
24 hours before colonoscopy preparation	138	138	134
After colonoscopy preparation	116	134	Not done
After colonoscopy	Not done	122	156
Potassium (mmol/l)	3.9	5.1	3.2
Chloride (mmol/l)	79	94	82
Bicarbonate (mmol/l)	26	20	55
Urea (mmol/l)	2.5	24.3	15
Creatinine (mg/dl)	0.6	7.7	5.9
Glucose (mmol/l)	Not done	5.3	11.3
Blood pressure (mm Hg)	130/90	167/78	75/45
Temperature (°C)	36.7	38.1	36.1
Heart rate (beats/min)	90	103	152
Clinical presentation	Seizures	Emesis, idioventricular rhythm, cardiopulmonary arrest	Obtundation, shock
Computed tomography or magnetic resonance imaging of brain	Cerebral oedema, no neoplasm or bleeding	Not done	Not done
Treatment for dysnatraemia	Plasma sodium increased with 3% NaCl from 116 to 130 mmol/l in 24 hours	None	Plasma sodium decreased from 156 to 140 mmol/l with 0.45% NaCl in 24 hours
Outcome	Complete recovery	Died	Died

she developed status epilepticus. On admission her plasma sodium concentration was 116 mmol/l. She was immediately intubated and mechanically ventilated and treated with intravenous hypertonic sodium chloride solution (table). She recovered fully and was discharged from the hospital. Two months later she had no neurological abnormalities, and a magnetic resonance scan of the brain was normal.

Patient 2 had end stage renal failure and was receiving regular haemodialysis. Before colonoscopy his plasma sodium concentration was normal (table). After taking the cleansing solution, he had nausea and vomiting with diarrhoea, and he increased his oral water intake. After the colonoscopy was completed, he developed grand mal seizures followed by fatal cardiopulmonary arrest. Measurement of his electrolytes showed hyponatraemia.

Patient 3 was also in end stage renal failure, receiving regular haemodialysis; he also had diabetes. He developed massive diarrhoea after taking the preparatory solution, with fluid losses up to 3.5 l/day; in addition, he vomited as much as 4 l of fluid a day. The massive vomiting suggested gastric obstruction, but endoscopy showed the gastric outlet was patent. This patient did not have increased fluid intake after taking the preparation. He underwent colonoscopy, and electrolytes measured after colonoscopy showed development of hypernatraemia with metabolic alkalosis (table). He developed shock and clouding of consciousness, and then respiratory arrest.

An additional male patient, not detailed here because permission to do so could not be obtained, had a similar clinical course to that of patient 3, with massive diarrhoea and vomiting which progressed to hypernatraemia, followed by seizures, aspiration, and fatal cardiopulmonary arrest.

## Discussion

The present study shows that preparation for elective colonoscopy can cause fatal acute overt dysnatraemia. The electrolyte abnormalities we observed resulted from ingestion of large volumes of bowel preparation solution in patients prone to developing alterations of water handling. Oral ingestion of the isotonic cleansing solution does not by itself affect the plasma sodium concentration,<sup>9,13</sup> but in patients with potentially impaired renal handling of water,<sup>14</sup> or in elderly patients who have decreased thirst,<sup>15</sup> there is an increased risk of dysnatraemia. The cleansing solution tends to induce nausea and vomiting, which are strong stimuli for increased secretion.<sup>10</sup> The ensuing reduction in plasma volume and consequent rise in plasma antidiuretic hormone concentration can lead to increased thirst, with the potential for hyponatraemia,<sup>16</sup> as occurred in patients 1 and 2, whose ability to excrete water was impaired by taking diuretics and by pre-existing renal failure. By contrast, patient 3 had decreased fluid intake at the time when he was losing substantial amounts of water from the upper and lower gastrointestinal tract, and as a result he developed severe hypernatraemia.

In the two patients who died, dysnatraemia was not suspected before the actual colonoscopy and was most probably present at that time. Most patients routinely receive sedation during the procedure, which in the case of a patient with dysnatraemia can temporarily mask any symptoms, with fatal consequences.

Chronic renal failure presents special problems with respect to water handling. Uraemic patients are frequently subject to gastroparesis, as well as colonic bleeding.<sup>17</sup> The presence of uraemic and diabetic gastritis in patient 3 may have played a role in the

massive upper gastrointestinal loss of fluid after colonoscopy.

This report does not deal with the incidence of dysnatraemia associated with elective colonoscopy. Under the current recommendation that colonoscopy be done routinely every 10 years from age 50 onwards, many elderly people will be candidates for this procedure and therefore at risk of dysnatraemia. Patients with impaired ability to excrete free water include those with renal insufficiency, hypothyroidism, mineralocorticoid deficiency, liver cirrhosis, or heart failure, as well as those taking drugs which impair free excretion of water, including thiazide diuretics, non-steroidal anti-inflammatory drugs, and angiotensin converting enzyme inhibitors.<sup>16</sup> Such individuals will require increased surveillance, which should include routine measurement of plasma sodium after colonoscopy.

**Contributors:** The authors jointly provided the patients; JCA and AIA drafted the original paper, revised it, and approved the final version; RL helped with the revision and approval of the final version. JCA is guarantor.

**Funding:** None.

**Competing interests:** None declared.

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(Accepted 7 August 2002)

## *My most unfortunate mistake*

### Sociable medicine

Umpteen years ago, I worked as a locum for an unwell general practitioner in another part of the country. Ahead of his times, he traded on equal terms with his patients—neither kept a record of consultations. To add to the challenge, the labels on medicine bottles did not specify their content. I spent many happy hours writing repeat prescriptions for elderly patients: they all asked that, in addition to the specific drugs for their condition, I should replenish their supply of Dr A's "green and yellow pills." None had any idea what these were, or what they did. Not wanting to undermine the existing doctor-patient relationship, I complied, albeit hesitantly, by prescribing Librium 5 mg, the green and yellow capsule familiar to me in hospital practice. I continued for a few months with patients who seemed content with me and my treatment.

Much later, I worked for a distinguished but temperamental surgeon. Fortunately our paths rarely crossed in the NHS wards or clinics, but I became a skilled flak catcher when caring for his private patients. One of them asked me for a supply of "Mr B's green and yellow bombs," but was I sure I knew what they were?

"Of course," I said, and wrote the familiar prescription. Shortly after I was summoned urgently to the private patients' wing. Sister was smirking, and Mr B was apoplectic. "What do you mean by prescribing tranquilisers for the duchess?" he demanded.

"She asked me to, Sir."

"What? She asked you for Librium?"

"No, Sir, your green and yellow capsules."

He boiled over: "Stupid boy—they're vitamin B supplements."

(Inaudible) "Oh shit."

Anxious inquiry with the now recovered general practitioner settled my mind: no harm had befallen his patients. He thought the story hilarious and thought he might even follow my practice since, in his view, neither preparation added materially to the sum of human happiness. Respect and tact prevented me from suggesting that he prescribed neither.

Not only did this episode subvert my youthful faith in the effectiveness of medicines: more importantly, it was an early and sharp lesson on the sins of medical presumption and omniscience, but, regrettably, one that my patients continue to teach me.

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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.