Bergstrom *et al*[7] reported the value of sequential ultrafiltration and haemodialysis in overcoming dialysis-induced hypotension. During isolated ultrafiltration peripheral vascular resistance increases, whereas in acetate dialysis no such increase occurs.[8] The symptoms of our two patients did not appear to improve during sequential treatment, though we have found this a most useful technique in many other patients.

Haemofiltration is a fairly new technique that uses highly permeable membranes to produce an ultrafiltrate of blood. This technique has been reported as producing a considerable decrease in symptomatic hypotensive episodes as well as providing a most satisfactory method of controlling severe hypertension in patients receiving dialysis.[9] Why haemofiltration should be so effective in controlling hypotension is not known, but it may be due to removal of some vasoactive "middle molecule" or to reduced production of cell-liberated materials such as prostacyclin. In the two patients reported on here satisfactory weight reduction and biochemical control of uraemia were achieved with haemofiltration with almost total abolition of their dialysis-induced symptoms.

Profound hypotension impairing consciousness during dialysis is unusual but may become more common with the increasing number of older patients entering dialysis programmes. We wish to draw attention to the value of haemofiltration in managing such patients. In addition, this method of removing sodium and water without affecting blood pressure may be of considerable advantage to patients overloaded with non-uraemic fluid in whom conventional diuretic treatment is ineffective or associated with unacceptable complications of volume depletion.

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Reprint requests should be sent to Dr A M Davison, St James's University Hospital, Beckett Street, Leeds LS9 7TF.

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Inappropriate secretion of antidiuretic hormone treated with frusemide

GUY DECAUX, YVES WATERLOT, FRANÇOISE GENETTE, ROGER HALLEMANS, JEAN CLAUDE DEMANET

Abstract

Seven out of nine patients with chronic inappropriate secretion of antidiuretic hormone were successfully treated with 40 mg frusemide daily. One patient needed 80 mg, and the remaining patient achieved only a small increase in diuresis after 40 mg frusemide; this was probably related to his low creatinine clearance. In order to maintain a salt intake high enough to compensate for the loss of urine electrolytes 3 to 6 g sodium chloride was added as tablets to the sodium-free diet in six patients. Hypokalaemia occurred in five patients but was easily corrected with either supplements of potassium chloride or a potassium-sparing diuretic.

These findings add further weight to evidence that frusemide is a good alternative for the treatment of patients with inappropriate secretion of antidiuretic hormone who cannot tolerate water restriction.

Department of Internal Medicine, Saint-Pierre University Hospital, 322 Rue Haute, Brussels 1000, Belgium, and Institute of Interdisciplinary Research, School of Medicine, Free University of Brussels, Brussels, Belgium

GUY DECAUX, MD, assistant
YVES WATERLOT, MD, assistant
FRANÇOISE GENETTE, MD, assistant
ROGER HALLEMANS, MD, assistant
JEAN CLAUDE DEMANET, MD, PHD, professor of internal medicine, University Department of Anaesthesia, Saint-Pierre University Hospital

Introduction

Water restriction is the cornerstone of treatment for the syndrome of inappropriate secretion of antidiuretic hormone.[1] When restriction must be drastic or is difficult for the patient to tolerate demeclocycline[2] or urea[3] may be tried. We successfully treated a patient with symptoms of inappropriate secretion of antidiuretic hormone using a single oral dose of 40 mg frusemide,[4] the principle being to induce a water diuresis while compensating for electrolyte losses by ensuring a sufficiently high salt intake. We have now extended the observations to nine patients.

Patients and methods

We treated nine patients with chronic inappropriate secretion of antidiuretic hormone due to organic brain disease (three cases) and inoperable oat-cell carcinoma of bronchus (six) who had continued to have serum sodium concentrations below 125 mmol(mEq)/l after five days of water restriction. All were given 40 mg frusemide by

Effect of frusemide in eight patients with syndrome of inappropriate secretion of antidiuretic hormone

Case No	Days of treatment	Before treatment			During treatment			Daily treatment
		Serum Na (mmol/l)	Serum K (mmol/l)	Creatinine clearance (ml/min)	Serum Na (mmol/l)	Serum K (mmol/l)	Lowest-highest urine volumes (ml)	
1	21	118	3·4	95	134	3·4	1500–3100	Frusemide 40 mg + 2 g salt tablets thrice daily
2	45	122	3·5	82	135	3·6	1100–2400	Frusemide 40 mg + KCl 40 mmol
3	63	119	4·4	75	139	4·3	900–1700	Frusemide 40 mg + 3 g salt tablet
4	150	122	3·7	85	138	3·6	1000–2500	Frusemide 40 mg
5	35	124	4·3	70	132	4·8	1300–2400	Frusemide 40 mg + 3 g salt tablet + triamterene 50 mg
6	25	124	3·6	80	136	3·8	1200–1800	Frusemide 80 mg + 3 g salt tablets twice daily + triamterene 50 mg
7	30	120	3·9	107	139	3·9	800–2000	Frusemide 40 mg + 3 g salt tablet + triamterene 50 mg
8	35	116	3·8	65	136	4·1	1000–1700	Frusemide 40 mg + 3 g salt tablet + triamterene 50 mg
Mean ± SD		120·6 ± 2·8	3·8 ± 0·4	82·3 ± 13·5	136·1 ± 2·4*	3·9 ± 0·5†		

*Compared with before treatment $p < 0.001$.
†Compared with before treatment $p > 0.05$ (NS).
Conversion: SI to traditional units—Serum Na, serum K: 1 mmol/l = 1 mEq/l.

mouth, usually at noon. They were allowed unlimited fluids, but salt tablets were given if salt intake was considered to be too low as judged by urinary sodium excretion. Estimations of electrolytes, creatinine, urea, and osmolality were made on daily blood samples and 24-hour urine collections. Statistical analysis was by Student's *t* test and the two-tailed test.

Results

Eight of the nine patients given frusemide responded satisfactorily (table). Two patients with a high salt intake were treated by a single oral dose without added salt; of the others, four were given 3 g salt daily and two 6 g salt daily. Only one patient needed 80 mg frusemide and 6 g salt a day to maintain a normal serum sodium value. Hypokalaemia occurred in five patients and was corrected with potassium supplements or triamterene.

Symptoms of water intoxication, such as anorexia, headache, confusion, and somnolence, disappeared completely during treatment, and the overall condition of the patients improved. Individual serum sodium concentrations fluctuated between 130 and 143 mmol/l over a long period of observation, but despite this all patients remained symptom free.

Comment

The principle of treatment is to restore normal water balance with a loop diuretic which inhibits reabsorption of free water while correcting for electrolyte loss by ensuring a sufficiently high salt intake. Water was not restricted and hypernatraemic dehydration did not occur. The treatment cannot absolutely prevent water intoxication, since retention might still occur with a large fluid intake; nevertheless, 3000 ml/day was tolerated by some patients. Electrolyte losses were easily corrected with a relatively high salt intake (± 150 mmol/day) and, when necessary, by adding potassium or a potassium-sparing diuretic.

One patient deteriorated with frusemide despite a normal sodium balance. This was due to failure of diuresis, probably resulting from a relatively low creatinine clearance (45-55 ml/min) and a high fluid intake. He achieved good control with urea.

If the primary lesion inducing inappropriate secretion of antidiuretic hormone cannot be treated the first choice remains water restriction. Demeclocycline, urea, or frusemide is usually effective whatever the aetiology. If urine osmolality is very high (over 900 mmol(mosmol)/kg H_2O) and creatinine clearance satisfactory frusemide is preferable to urea, as a high dose of urea would be needed to produce a sufficient osmotic diuresis. On the other hand, if creatinine clearance and urine osmolality are low, urea is more likely to induce a satisfactory diuresis. Demeclocycline is best used as a second choice because of the incidence of nephrotoxicity and risk of superinfection, especially in immunosuppressed patients. Also demeclocycline takes a few days to act, whereas frusemide and urea act immediately.[4 5] The few patients with high urine osmolality who cannot restrict water intake to less than 2500 ml a day are probably best treated with demeclocycline.

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ONE HUNDRED YEARS AGO With the complaints of professional grumblers, all medical officers, whether civilian or military, are unhappily too conversant; the man who out of hospital lives willingly on a shilling a day, in hospital finds the cooking never good enough, the beef-tea never strong enough, the wine not in sufficient abundance, the beds hard, the nurses inefficient. The value of the complaints made by such grumblers, and the unreasonableness of giving public importance to them, may be partly judged by the following incident, which falls within my personal knowledge. One of the returned invalids, on being asked how he got on at Ismailia, and if he received any medical comforts, replied, "No, none whatever; only just our rations." Struck with the peculiarity of the circumstance, and thinking the man must have been mistaken, in the course of the day he was asked the questions, "Did you get no arrowroot or port wine?" "O, yes," he replied, "I had plenty of arrowroot, and port wine, egg flip, and all those sort of things." "But," said his interrogator, "you told me this morning you had no medical comforts?" "O!" he replied, "I do not call those medical comforts." And in answer to the question, "What do you call medical comforts?" he replied, "O! grapes, jellies and such." Even field hospitals and medical officers cannot be expected to work miracles, or to provide grapes in the desert and jellies in the wilderness. (*British Medical Journal*, 1882).