1986, 22 had their serum phosphate concentrations measured before any treatment was started. Four children aged 2-10 years and a pregnant woman were excluded from further analysis, which left 17 patients (11 men, six women; mean age 32 years, range 17-64).

The figure shows the serum phosphate concentration according to plasmodial species and day of admission. A total of 8885 consecutive measurements of phosphate concentration obtained with the same autoanalyser during March 1987 served as control values (mean 1.14 mmol/l); this control mean was significantly different from the mean in the patients with malaria on admission (0.75 mmol/l) (one sample, two tailed Student's t test: $t = -5.57$, $p < 0.001$). Serum phosphate concentrations increased in all patients for whom subsequent values were available. In case 1 the phosphate concentration initially rose but then fell over days 4-6 coincident with the administration of intravenous quinine during his relapse (he received no other intravenous fluids during this time). It then rose sharply (figure).

There was no obvious cause for the low serum phosphate concentrations; six patients vomited, but in only case 1 was vomiting severe. Only one patient (case 1) was particularly unwell, and there was no correlation between the duration of the patients' symptoms and the serum phosphate concentration observed.

The mean serum calcium concentration in the patients with malaria on admission was 2.30 mmol/l uncorrected, and 2.25 mmol/l when corrected to an albumin concentration of 40 g/l ; simple regression analysis showed a weak correlation with serum phosphate concentration, which was not significant ($r = 0.39$, $p = 0.13$). The mean albumin concentration was 38.4 g/l .

Comment

Acute severe hypophosphataemia (less than 0.32 mmol/l) in the absence of total body phosphate depletion results in cellular anoxia through depletion of intracellular adenosine triphosphate and may cause respiratory failure, encephalopathy, cardiac depression,² and haemolysis (by impaired red cell deformability).³ Hypophosphataemia is associated with fever, persistent vomiting, and diarrhoea² but has not been reported with malaria. Giving carbohydrate or insulin may cause profound hypophosphataemia because of the intracellular shift of phosphate essential for glycolysis, glycogenolysis, glycogenesis, and other anabolic processes.² Intravenous quinine releases endogenous insulin⁴ (which might account for the fall in serum phosphate concentration in case 1), but hypoglycaemia may occur before quinine is given. Furthermore, White *et al* reported hypoglycaemia in African children with malaria without hyperinsulinaemia and suggested that impaired gluconeogenesis and glycogenolysis were responsible.⁵

It is therefore not surprising that hypophosphataemia occurs in malaria—especially if quinine is administered—and theoretically it could aggravate the pathophysiological effects of the parasite. If these results are confirmed then serum phosphate concentration should be measured in all patients with malaria, especially those receiving intravenous quinine or carbohydrate, and hypophosphataemia should be rapidly corrected.

1 Cook GC. Plasmodium falciparum infection: problems in prophylaxis and treatment in 1986. *Q J Med* 1986;61:1091-115.

2 Berkelhammer C, Bear RA. A clinical approach to common electrolyte problems. 3. Hypophosphataemia. *Can Med Assoc J* 1984;130:17-23.

3 Jacob HS, Amsden T. Acute hemolytic anemia with rigid red cells in hypophosphatemia. *N Engl J Med* 1971;285:1446-50.

4 White NJ, Warrell DA, Chanthavanich P, *et al*. Severe hypoglycemia and hyperinsulinemia in falciparum malaria. *N Engl J Med* 1983;309:61-6.

5 White NJ, Miller KD, Marsh K, *et al*. Hypoglycaemia in African children with severe malaria. *Lancet* 1987;i:708-11.

(Accepted 3 June 1987)

Department of Medicine, University Hospital of Wales, Cardiff CF4 1ZZ

DAVID J M LEWIS, MB, MRCP, medical registrar

Correspondence to: 5 Caer Graig, Radyr, Cardiff CF4 8RD.

Plasma atrial natriuretic peptide in essential hypertension: effects of changes in dietary sodium

Plasma concentrations of atrial natriuretic peptides are raised in a substantial proportion of patients with essential hypertension,¹ but the relevance of these raised values, particularly in relation to changes in sodium intake and blood pressure, is not known. We have therefore studied the effect of changes in dietary sodium intake on plasma atrial peptides and on blood pressure in patients with untreated essential hypertension.

Patients, methods, and results

Twelve patients (seven men, five women; two black, 10 white) aged 39-68 years with uncomplicated essential hypertension and not receiving treatment were studied as outpatients. Plasma atrial peptide concentration, renin activity, and aldosterone and electrolyte concentrations, blood pressure, and 24 hour urinary sodium excretion (mean of two estimations) were measured with the patients having their usual sodium intake, on the fifth day of a low sodium diet (10 mmol/day), and on the fifth day of a high sodium diet (350 mmol/day), the sequence of low and high sodium intakes being allocated at random.²

Mean (SEM) plasma atrial peptide concentration when patients were having their normal sodium intake was $15.9 (3.0) \text{ ng/l}$, with a 24 hour urinary sodium excretion of $123.4 (8.2) \text{ mmol}$ and an average supine blood pressure of $161 (6)/98 (2) \text{ mm Hg}$. Plasma atrial natriuretic peptide concentration increased to $30.1 (3.1) \text{ ng/l}$ on the fifth day of the high sodium intake, but there was no overall significant change in values between the normal and fifth day of the low sodium intake (figure). Mean blood pressure was reduced from $119 (3) \text{ mm Hg}$ during normal sodium intake to $110 (3) \text{ mm Hg}$ on the fifth day of the low sodium intake, but there was no difference in blood pressure between the period of normal sodium intake and the fifth day of the high sodium intake (figure). Plasma renin activity and aldosterone concentration increased with the reduction in sodium intake and were suppressed on the fifth day of the high sodium intake; throughout the study there were no significant changes in plasma sodium or potassium concentration or urinary potassium or creatinine excretion and volume (results not shown).

Plasma immunoreactive atrial peptide concentrations, supine mean blood pressure, and urinary sodium excretion in 12 patients with untreated essential hypertension on a normal and fifth day of a low or high sodium intake. Values are means and SEM (bars). Significance of differences assessed by Student's paired t test (two tailed).

Comment

These findings show that the plasma concentration of atrial peptides in patients with essential hypertension may be influenced by changes in dietary sodium, as occurs in normotensive subjects.² In patients with essential hypertension, however, the main change in plasma atrial peptide values occurred when transferring from the normal to the high sodium diet, and there was little change when sodium intake was restricted. We and others¹ have previously recorded in hypertensive patients a blunted response of the renin system to a reduction in sodium intake and shown that, at least in part, the fall in pressure with sodium restriction was due to the relative lack of rise in plasma renin activity with sodium restriction. The mechanism for this blunted renin response, however, is unresolved, but in view of the renin inhibitory action of the atrial peptides⁴ the absence of a fall in circulating

atrial peptide values with the reduction in sodium intake (figure) may provide one explanation.

The pronounced increase in plasma atrial peptide concentrations on changing from the normal to the high sodium diet but with no concomitant change in blood pressure, and given the potent vascular actions of the atrial peptides,⁵ may perhaps account for the lack of rise in blood pressure with the increase in sodium intake, possibly through a direct vasodilatory action on the arterial or venous system.

In conclusion, our study suggests that in hypertensive patients changes in circulating atrial peptide values with changes in sodium intake may not only contribute to the maintenance of sodium balance but may also contribute to the observed changes in blood pressure.

These studies were supported by the National Kidney Research Fund (United Kingdom).

- 1 MacGregor GA, Sagnella GA, Markandu ND, *et al*. Raised plasma levels of atrial natriuretic peptide in subjects with untreated essential hypertension. *Journal of Hypertension* 1986;4 (suppl 6):S567-9.
- 2 Sagnella GA, Markandu ND, Shore AC, Forsling ML, MacGregor GA. Plasma atrial natriuretic peptide: its relationship to changes in sodium intake, plasma renin activity and aldosterone in man. *Clin Sci* 1987;72:25-30.
- 3 Cappuccio FC, Markandu ND, Sagnella GA, MacGregor GA. Sodium restriction lowers high blood pressure through a decreased response of the renin system—direct evidence using saralasin. *Journal of Hypertension* 1985;3:243-7.
- 4 Anderson JV, Donckier J, Payne NN, *et al*. Atrial natriuretic peptide: evidence of action as a natriuretic hormone at physiological plasma concentrations in man. *Clin Sci* 1987;72:305-12.
- 5 Bolli P, Muller FB, Linder L, *et al*. The vasodilatory potency of atrial natriuretic peptide in man. *Circulation* 1987;75:221-8.

(Accepted 5 June 1987)

Blood Pressure Unit, Department of Medicine, Charing Cross and Westminster Medical School, London W6 8RF

GIUSEPPE A SAGNELLA, BSC, PHD, senior biochemist
NIRMALA D MARKANDU, SRN, research assistant
MARTIN G BUCKLEY, BSC, biochemist
DONALD R J SINGER, BMEDBIOL, MRCP, research fellow
A LOUISE SUGDEN, BSC, PHD, research assistant
ANGELA C SHORE, BSC, PHD, research assistant
GRAHAM A MACGREGOR, MA, MRCP, Wellcome Trust senior lecturer

Correspondence to: Dr Sagnella.

Sexually transmitted disease in potential semen donors

Artificial insemination with semen from a donor is a well established procedure for childless couples in whom the male partner is infertile. The serious consequences to the mother and fetus of the many bacterial and viral infections that can be transmitted in semen have recently been reviewed.¹ There are no data on the prevalence of sexually transmitted diseases in potential semen donors, but screening is now recommended.² We studied urethral and serological evidence of infection in a group of such men.

Subjects, methods, and results

Thirty six consecutive heterosexual men who had answered a university advertisement requesting semen donors consented to a genital examination. Two urethral smears were initially taken. One smear was Gram stained and the other examined for *Chlamydia trachomatis* with a monoclonal antibody labelled with fluorescein (Microtrak, Syva). Two further plain cotton urethral swabs were taken and one put in Amies and one in virus transport medium. The swab in Amies medium was cultured for *Neisseria gonorrhoeae*, *Mycoplasma hominis*, *Ureaplasma urealyticum*, *Staphylococcus aureus*, *Gardnerella vaginalis*, *Trichomonas vaginalis*, group B streptococci, and anaerobes. The other swab was cultured for herpes simplex virus.

Serum samples were examined for antibodies to *Treponema pallidum*, cytomegalovirus (by haemagglutination and enzyme linked immunosorbent assay (ELISA)), human immunodeficiency virus (enzyme immunoassay, Abbott Laboratories), and *C trachomatis* (microimmunofluorescence, IgG to serotype L₂) and for hepatitis B surface antigen. Samples of semen were analysed for volume; pH; the density, motility, and morphology of sperm; and the presence of germinal cells, white cells, adenosine triphosphate, and antisperm antibodies (IgG).

The table shows demographic data on the men, most of whom were single students. The mean number of lifetime sexual partners was nine. Five men

admitted to having had episodes of sexually transmitted disease; none had current genital symptoms.

Pathogens were isolated from 12 men, in two of whom two types of urethral organism were found: *C trachomatis* was detected in three; *M hominis* in two; *U urealyticum* in five; and group B streptococci, anaerobes, *G vaginalis*, and *S aureus* each in one. Five men had signs of asymptomatic genitourinary infection, four had non-gonococcal urethritis, and one had penile warts. Serum was positive for antibody to *C trachomatis* in 10 men and for cytomegalovirus in nine. Only 12 men had no history, signs, or serological evidence of infection. No correlation was found between the different seminal characteristics, including the presence of leucocytes, and a positive urethral culture.

Demographic data on 36 potential semen donors

Age (years):	
Mean (SD)	22.9 (5.1)
Range	18-37
Occupation:	
Student	28
Employed	5
Unemployed	3
Marital state:	
Single	34
Married	2
No who were white	33
Median no (range) of sexual partners in three months	1 (0-3)
Median no (range) of sexual partners in lifetime	5 (1-40)
No with regular partner	17
No with previous episodes of sexually transmitted disease	5

Comment

Some of the semen donors in this study had asymptomatic sexually transmitted diseases and had had many sexual partners. Although some of the urethral organisms isolated seemed to be commensal in the donor, they may contaminate semen. Organisms such as *C trachomatis* are known risks for the mother and fetus; we found that serological tests for *C trachomatis* showed low antibody titres and were unhelpful in diagnosing active genital infections. The risk of men with genital warts transmitting genital human papillomavirus is unknown, although deoxyribonucleic acid from human papillomavirus 5 and human papillomavirus 2 has been isolated in semen.³ The detection of antibody to cytomegalovirus, however, is important as men who are seropositive may excrete the antigen in urogenital fluids,⁴ which is a potential hazard for a fetus whose mother is seronegative.

We routinely use frozen semen for insemination by donor and screen all regular donors for antibodies to human immunodeficiency virus, as recommended by the Department of Health and Social Security⁵; at present, however, other common sexually transmitted diseases pose a much greater risk from heterosexual donors.

All potential semen donors should be screened for genital infections. Ideally, the tests should be repeated whenever the men change their sexual partner. Further studies are necessary to compare urethral with seminal cultures and to determine the prevalence of sexually transmitted diseases and their complications in women who are treated by insemination by donor.

- 1 Mascola L, Guinan ME. Screening to reduce transmission of sexually transmitted diseases in semen used for artificial insemination. *N Engl J Med* 1986;314:1354-9.
- 2 American Fertility Society. New guidelines for the use of semen donor insemination: 1986. *Fertil Steril* 1986;46(suppl 2):95-110.
- 3 Ostrow RS, Zachow KR, Niimura A, *et al*. Detection of papillomavirus DNA in human semen. *Science* 1986;231:731-3.
- 4 Handsfield HH, Chandler SH, Caine UA, *et al*. Cytomegalovirus infection in sex partners: evidence for sexual transmission. *J Infect Dis* 1985;151:344-8.
- 5 Department of Health and Social Security. *Acquired immune deficiency syndrome (AIDS) and artificial insemination—guidance for doctors and AI clinics*. London: DHSS, 1986. (AIDS booklet 4.)

(Accepted 15 May 1987)

Departments of Genitourinary Medicine and Bacteriology, Royal Hallamshire Hospital, Sheffield S10 2JF

ERIC F MONTEIRO, MB, MRCP, senior registrar in genitourinary medicine
ROBERT C SPENCER, MB, MRCPATH, consultant in bacteriology
GEORGE R KINGHORN, MD, MRCP, consultant in genitourinary medicine

Harris Birthright Research Centre for Reproductive Medicine, Department of Obstetrics and Gynaecology, Jessop Hospital for Women, Sheffield

CHRISTOPHER L R BARRATT, PHD, research scientist
SHEILA COOKE, MB, DOBSTRCOG, clinical assistant
IAN D COOKE, MB, FRCOG, professor of obstetrics and gynaecology

Correspondence to: Dr Monteiro.