

potassium concentration in individuals on diuretics seen to fluctuate within a band, and chance determines whether an individual measurement is taken from a peak or a trough. Thus all three-monthly measurements for all 169 patients were used to calculate the incidence of hypokalaemia.

Throughout the study 23 patients (13.6%) had moderate hypokalaemia (grade 2, <3.0 mmol(mEq/L)) at least once (average of 5.5 observations per patient), and two patients had moderate hypokalaemia once only; three were immediately given potassium supplements, but six continued without potassium and over 28 months there was no recurrence. Seven patients had moderate hypokalaemia twice only;

TABLE 1—Concentrations of plasma electrolytes, blood urea, and plasma creatinine in two groups of patients (n=169)

Table with 4 columns: No. of patients, Hypokalaemia (mmol/L), Alkalosis (mmol/L), High urea (mmol/L). Rows include normal and mild hypokalaemia, moderate hypokalaemia, and a comparison of potassium supplement groups.

*An imbalance of three electrolytes occurred simultaneously in 1 patient, of two electrolytes in 13 patients, and of one electrolyte in 65 further patients. No imbalance occurred in 66 patients in 292 tests. 74 simultaneous imbalances of two or three electrolytes occurred in 6 patients and in one test only. A plasma potassium concentration below 3.0 mmol(mEq/L) occurred in 12 patients. No imbalance occurred in 7 patients in 54 tests.

potassium supplements were then added in two cases, but the plasma potassium concentration never fell below 3.0 mmol(mEq/L) in the other five up to 13 months later. Six patients had persistent moderate hypokalaemia—that is, present on three or more occasions. All were eventually given potassium supplements. In two cases, however, this was done only after 18 and 20 months of persistent hypokalaemia, during which time they led normal lives without symptoms. In three

patients the results of alternate estimations showed moderate hypokalaemia despite potassium supplements for up to 24 months, but when diuretics were withdrawn from two patients plasma potassium concentrations rose to normal. None of these patients had ever had concentrations below 2.6 mmol(mEq/L). One patient had subarachnoid haemorrhage thought to be unconnected with her hypokalaemia. The patient who had a minor electrolyte imbalance was recalled. One week after starting bendroflumide the complaint of "funny feelings"; her plasma potassium concentration had fallen to 2.4 mmol(mEq/L). She was given potassium chloride but one week later her plasma potassium concentration was still 2.5 mmol(mEq/L) and her symptoms persisted. All diuretics were withdrawn; her plasma potassium rose rapidly to 3.6 mmol(mEq/L) and her symptoms disappeared.

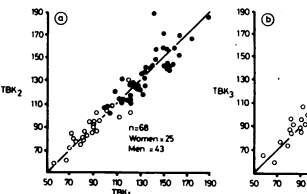
OTHER PLASMA ELECTROLYTES, UREA, AND CREATININE CONCENTRATIONS

No patient developed hyponatraemia, and hypochloreaemia or alkalosis occurred occasionally in some but rarely simultaneously. High plasma urea or creatinine concentrations occurred only in patients who had been at the start of the trial (table 1). To assess the association between moderate hypokalaemia and other electrolyte disturbances the combined group with normokalaemia and mild hypokalaemia (796 estimations on 146 patients) was compared with the group with moderate hypokalaemia (171 estimations on 23 patients) (table 1). In the latter group a higher proportion of patients developed hypochloreaemia or alkalosis, or both, but otherwise there was no excess of electrolyte disturbances. Only four of the 23 patients (17%) with moderate hypokalaemia had plasma urea or creatinine concentrations when plasma potassium concentrations were <3.0 mmol(mEq/L).

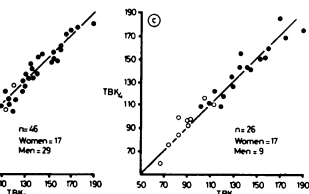
FLUCTUATIONS OF THE TOTAL BODY POTASSIUM CONCENTRATION

Data on 68 patients who have had up to four estimations of the total body potassium are shown in the figure. The interval between the two estimations was at least one year, and in some cases two years. There were no appreciable fluctuations. The results were given to the general practitioners, but because the fluctuations were slight compared with those of the plasma potassium concentrations they had little influence on treatment.

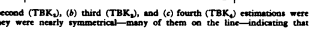
For ethical reasons we made these estimations. They confirmed the



Fluctuations of the total body potassium (—○— women, —●— men). (a) The second (TBK1), (b) third (TBK2), and (c) fourth (TBK3) estimations were plotted against the first (TBK1) around the "identity line" (45° slope). They were nearly symmetrical—many of them on the line—indicating that the fluctuations were minimal.



Fluctuations of the total body potassium (—○— women, —●— men). (b) The second (TBK1), (b) third (TBK2), and (c) fourth (TBK3) estimations were plotted against the first (TBK1) around the "identity line" (45° slope). They were nearly symmetrical—many of them on the line—indicating that the fluctuations were minimal.



Fluctuations of the total body potassium (—○— women, —●— men). (c) The second (TBK1), (b) third (TBK2), and (c) fourth (TBK3) estimations were plotted against the first (TBK1) around the "identity line" (45° slope). They were nearly symmetrical—many of them on the line—indicating that the fluctuations were minimal.

generally held view that no appreciable changes in the total body potassium concentration result from this treatment.^{1,2} We conclude that there is no need to have this estimation done in general practice.

Discussion

This study of variations in plasma potassium concentrations in patients taking diuretics for hypertension can be reproduced in most practices in Britain. It confirms the reassuring results reported in studies done in hospital.¹⁻³ The results of total body potassium measurements, which will be reported elsewhere, were given to general practitioners to use in deciding the most appropriate treatment for their patients. Our results, however, confirmed the results of others in showing that total body potassium concentrations seldom become depleted under the circumstances of a study like this. Despite this and the careful standardisation of collection and separation of blood, plasma potassium concentrations fluctuated widely and unpredictably.

When we assessed patients as they entered the trial we found, as did Ramsey,¹ that those who had been taking diuretics without potassium supplements had lower plasma potassium concentrations than those who had been taking potassium supplements as well, and when potassium supplements were withdrawn the plasma potassium concentration fell initially. We later modified our view of the value of potassium supplements, however.¹⁴

The plasma potassium concentration was not progressive, and the lowest point has occurred at one week,¹ one month,³ 33 days,⁴ and 4 months.⁵ Since we measured plasma potassium only at three-monthly intervals we cannot locate the lowest point accurately, but our lowest mean concentration was at three months.

Plasma potassium concentrations fluctuate within a band in each patient and chance determines whether hypokalaemia is diagnosed on a single estimation, this perhaps accounting for hypokalaemia being first diagnosed at 18 months in one of our patients. Thus the proportion of patients who showed mild hypokalaemia at any time increased with the number of estimations, rising from 6 to 17% of the total between 0 and three months, and then rising slowly to 29% at two years. The proportion with moderate (grade 2) hypokalaemia was constant at 8% but the total incidence was higher at 14%. In several patients the plasma potassium concentration apparently fluctuated across the arbitrary line dividing mild from moderate hypokalaemia (<3.0 mmol(mEq/L)), and again chance determined whether or not hypokalaemia would be picked up on a single measurement.

We recommend that every patient about to start diuretic treatment for hypertension should have an initial plasma potassium estimation. If this is normal and the patient is active, under age 65, and eating a normal diet, no potassium supplement should be given. The plasma potassium concentration should be measured again at three months and thereafter at six or twelve-monthly intervals to detect the few patients who will develop moderate hypokalaemia (2.6-2.9 mmol(mEq/L)) and the larger number (about 25%) who will at some time have mild hypokalaemia (3.0-3.3 mmol(mEq/L)). Whether these abnormalities call for a change in treatment is a matter of clinical judgment. In our patients the potassium supplement had deleterious effects from intermittent or persistent mild to moderate hypokalaemia. This was, however, only a two-year study and the results cannot be extrapolated to the decades of treatment that many hypertensive patients have received; longer studies are needed. Moreover, mild hypokalaemia may be an added risk for those who develop myocardial infarction,¹⁵ a disease to which hypertensive patients are prone. There has been no prospective study of potassium supplementation on this risk. Thus it would be prudent to avoid prescribing diuretics without potassium supplements for patients with angina or a history of myocardial infarction, and to monitor plasma potassium concentrations more often than we recommended.

Conclusions

One hundred and sixty-nine patients with hypertension who were eating an unrestricted diet were enrolled in a prospective study of diuretic treatment without potassium supplements. Plasma potassium concentrations were measured under strictly controlled conditions every three months. The mean concentration fell during the first three months but rose slowly thereafter. In individuals plasma potassium concentrations fluctuated between the arbitrary dividing lines between normokalaemia (3.4 mmol(mEq/L)), mild hypokalaemia (3.0-3.3 mmol(mEq/L)), and moderate hypokalaemia (2.6-2.9 mmol(mEq/L)). Thus the cumulative incidence of mild (29%) and moderate hypokalaemia (13%) over the two-year study was substantial and higher than reported. In only one patient, however, did the plasma potassium concentration fall below 2.6 mmol(mEq/L), and no other patient had symptoms that could be attributed to hypokalaemia; none showed an appreciable decline in renal function, judged by measuring plasma urea and creatinine concentrations.

We conclude that active young and middle-aged patients with hypertension without known ischaemic heart disease do not need routine potassium supplements when taking thiazide and similar diuretics. Plasma potassium concentrations should be estimated before treatment, at three months, and at six to 12-month intervals thereafter to detect the few who may require supplements or alternative treatment.

We are very grateful to Professor David Kerr, University of Newcastle upon Tyne, for guidance and help throughout this study and in preparing this article; to Dr Harvey McTaggart and Dr Ake Luuqander, consultant pathologists, and the whole staff of the laboratory of the General Hospital, Hartlepool, for their enthusiastic help in taking blood samples and carrying out the estimations; to Mr T Hawkins, senior physicist, Regional Medical Physics Department, for carrying out the whole-body potassium estimations; to the physicians who allowed patients under their care to remain in this study; to all general practitioners who referred their patients and co-operated with this study; to Dr Duncan Kerr, general practitioner, for help in the statistical assessment; to Miss Wendy Holmes, whose expert secretarial services were a great help in the complex administration of this project; and to Mrs M K Beatty, V Walton, M Johnson, and W Walker for their help.

This study was sponsored by the Hartlepool Postgraduate Medical Association, and carried out with a grant from the Regional Scientific and Research Committee, Newcastle upon Tyne.

Requests for reprints should be addressed to Dr Francis F Sandoz, 18 Parklands Way, Hartlepool TS26 0AR.

References

1 Healy JI, McKenna TJ, Canning BSJ, Brien G, Duffy FP, Muldowney FP. Body composition in hypertensive subjects in long term diuretic therapy. Br Med J 1970;3:718.
2 Downes PA, Pak A, Rao R, Mead JA. Fate of potassium supplements in six outpatients receiving long-term diuretics for oedematous disease. Lancet 1971;ii:1151.
3 Dargatzis HI, Boddy K, Kennedy AC, King PC, Reid PR, DVM DM. Total body potassium in long-term frusemide therapy: is potassium supplementation necessary? Br Med J 1974;iv:316-9.
4 Wilkinson PR, Isler H, Hesp R, Rafferty BE. Total body and serum potassium during prolonged diuretic therapy for essential hypertension. Lancet 1975;ii:759-62.
5 Lennquist MP, Danneberg KJ, Struyvenberg A. Effects of chlorothalidone on serum and total body potassium in hypertensive patients. Acta Med Scand 1970;200:37-45.
6 Davidson C, Burkhardt L, McLachlan MSF, Morgan DB. Effect of long-term diuretic treatment on body-potassium in heart-disease. Lancet 1970;ii:1047.
7 Kassirer JP, Harrison JT. Diuretics and potassium metabolism: a reassessment of the need, effectiveness and safety of potassium therapy. Kidney 1971;11:509-15.
8 Burchell HB. Dilemma in K therapy. Circulation 1974;47:1144-5.
9 Lawson DH. Adverse reactions to potassium chloride. Q J Med 1974;46:433-40.
10 Bacon CJ. Death from accidental potassium poisoning in childhood. Br Med J 1974;3:389.

- 11 Hulgren HN, Swanson R, Wetzach G. Cardiac arrest due to oral potassium administration. Am J Med 1975;58:138-9.
12 Judge TG. Potassium in the elderly. Medicine 1979;58:7.
13 Davidson C. Hypokalaemia. Br Med J 1979;3:1167-71.
14 Ramsay LE, Boyle P, Ramsay MH. Factors influencing serum potassium in treated hypertension. Q J Med 1977;48:101-10.
15 Landmann-Suter E, Struyvenberg A. Initial potassium loss and hypokalaemia during chlorothalidone administration in patients with essential hypertension: the influence of potassium restriction. Eur J Clin Invest 1978;8:153-64.
16 Lennquist MP, Struyvenberg A. Significance of hypokalaemia due to diuretics. Nephrol 1973;11:18-28.
17 Lawson DH. Clinical aspects of hypokalaemia. Medicine 1979;58:7.

- 18 Morgan DB, Davidson C. Hypokalaemia and diuretics: an analysis of Publications. Am J Med 1980;200:95-8.
19 Dyckner T, Wester PO. Ventricular arrhythmias and intracellular electrolytes in hypokalaemia before and after correction of hypokalaemia. Acta Med Scand 1978;204:375-9.
20 Dyckner T, Wester PO. Ventricular arrhythmias and intracellular electrolytes before and after potassium and magnesium infusions in patients on diuretic treatment. Am Heart J 1979;97:12-8.
21 Davidson C, Struyvenberg A. Hypokalaemia and electrocardiographic conduction disturbances in patients with hypokalaemia. Acta Intern Med 1967;120:285.
(Accepted 30 November 1981)

Women in General Practice

JANE E EVERETT

We live in a very different economic and social climate from that in which the National Health Service was founded. Until three or four years ago job mobility was easy, most professions there was a reasonable chance of finding an acceptable vacancy in the geographical location of choice, and a few years before that British graduates were always in demand overseas. Thus a woman in the same predicament that I was in a few years ago is living in very different circumstances from those that I experienced.

The past is often seen through rose-tinted spectacles. Painful experiences are forgotten and pleasant ones remembered. Writing this article has reminded me of the distress at the time and has made me realise that much of that pain has been pushed into the limbo of forgetfulness. The reader could be forgiven for thinking that I was lucky. It is true that I was, but living on luck is a tremendous psychological drain, particularly when you are aware that only one slip is needed for disaster to occur.

In retrospect I realise that I was naive. It had never occurred to me that my marriage would suddenly end in divorce and that I should find myself bringing up three children on my own. My elder son, with the mental clarity of a five year old, identified the central problem immediately with the question "Who is going to earn the money now?" It rapidly became clear that my contribution over and above my own earnings was going to be marginal, and the progress of inflation has accentuated this fact.

Learning to cope

After graduation in 1957 and pre-registration appointments in surgery and paediatrics I was senior house officer in obstetrics and gynaecology for a year in a small hospital near my home. I married a local solicitor, and apart from an occasional part-time locum in general practice I gave up medicine for five years to devote my time to husband and family. I shall always be grateful that when the break came our general practitioner gave me confidence by telling me quite bluntly that his concern was for the children, not for me, as I would cope. An unexpected invitation arrived from friends in Malawi, offering free hospitality indefinitely to me and my children, then aged five, four, and two years. This generous gesture was accompanied by equal kindness

from my parents and those of my former husband, who together paid for our return tickets to Africa. A close personal friendship was continued, without breach before the correction of hypokalaemia. Three months in Malawi gave me time for thought and for voluntary work at the hospital nearby, staffed by the Medical Missionaries of Mary. The nun in charge was only five before and after potassium and magnesium infusions in patients on diuretic treatment. Am Heart J 1979;97:12-8.
21 Davidson C, Struyvenberg A. Hypokalaemia and electrocardiographic conduction disturbances in patients with hypokalaemia. Acta Intern Med 1967;120:285.
(Accepted 30 November 1981)

On returning home I was fortunate: I was known in the area and work was offered to me. My first two appointments, in casualty and geriatrics, were arranged to enable me to work a five-day week, with free evenings and weekends to be with the children. Our large house had been sold, but my new bungalow was not ready. My parents and parents-in-law lived in the area so we were able to live with them for the next few months—weekdays in the town and weekends in the country. Fortunately they were all active and could drive the two older children to and from school in the village where we subsequently would live, and without their help I could not have worked the hours that I did. During these months I was able to complete my training in family planning and after the geriatric post to start child welfare and geriatric screening clinics.

Four months after our return to England we were settled in our new home. About this time the medical officer at the university several miles away invited me to work morning sessions during university terms from the start of the session in October 1967. This was an ideal arrangement as my youngest child was able to attend the university day nursery and I could be home before the other children returned to school. I also did two evening family planning clinics a week, made possible only by the offer from two friends to baby-sit regularly, and being the only doctor at this clinic gave me a very real sense of responsibility for my patients in this field, which I found satisfying.

During these four years I lived very much from day to day and had given little thought to my future career. A friend working in student health made me realise that I had not thought about pension rights. I considered joining two general practices in the area, but this did not seem possible so I applied for a full-time post in another university health service 60 miles away. This was my most difficult decision, but with the help of the National Health Service list so evenings and weekends were free, but I should have to work during university vacations. I would be eligible to join a pension scheme, which would give me financial security, but I would have to send the children to boarding schools. My

Leeds LS18 7DJ
JANE E EVERETT, MA, BA, general practitioner

younger son was only seven years old. I was offered the job and I decided to accept it, knowing that the time would come when the children would want to lead their own lives and, if I did not find a satisfying occupation, a full-time job longer than that which would be a possessive parent. With the motorway door to my door I commuted almost daily. Sometimes I stayed several nights each week with a relative in the new location to avoid the hour and a quarter journey each way. In school holidays I always travelled home at night and was dependent on grandparents and kind neighbours to help with the children during working hours.

This was far from ideal. The family saw little of me, and I felt professionally frustrated without a National Health Service commitment to my patients. After 15 months I was fortunate to become a principal in a National Health Service practice at another university. I had to move home, and there were no longer family and friends in the locality to help with the children. At the outset it was made clear to me that I should not receive any special consideration because of my family commitments, and I would not have wanted it otherwise. I have always felt that a woman wants to be a general practitioner, and I would be treated any differently from her male colleagues. It was up to me to organise my family commitments in the best possible way.

In my new post I had to share night and weekend duties. The fact that all requests made for the day were met by my sister was a major attraction of the job, as my house telephone did not have to be attended in my absence. When I was called out at night in school holidays the children had to be left alone. They had the telephone number of the university health service, which was manned round the clock, in case a crisis arose. We lived on a new housing estate and soon made friends. Neighbours with children who appreciated my problems gave what help they could. The two boys were at a boarding school near to their grandparents, and my daughter was at school in a city near to our new home. Among the five partners in the practice there has always been some flexibility in arranging weekend duties to fit in with parental commitments, so I could arrange to be free when the children had weekends at home.

On my first day at the university I was introduced to a member of the staff whom I was to marry two years later. Just before my marriage I developed glandular fever with jaundice and had to

take five weeks off work. Fortunately my fiancé was able to help with the children, and my neighbours said to him at the time that they had wondered when my health would break. Although I had joined the Family Emergency Association, which would have enabled me to obtain help in a crisis, I did not have to call upon them.

What observations can be drawn from my experience? It is almost impossible to generalise, but there are several points worth making. Any marriage can end suddenly, whether by death or breakdown. Irrespective of sex, serious illness of one partner can result in the other being required to combine a full-time job and bring up the family virtually single-handed with the added complication of caring for the sick spouse. The possibility of having to do this should be recognised. Coping is considerably easier if you are in the right place at the right time. This is a matter of chance, but with forethought the odds can be made less unfavourable. To be known in medical circles in the area is a great advantage, and family connections locally do help to relieve initial anxieties. In retrospect, I wish I had not given up medical work completely when the family were young. Reading journals is no substitute, and the longer you are out of touch with clinical practice the more difficult it is to resume it. Confidence is regained slowly, and in the economic climate of today someone who has kept in touch is a more attractive employee or partner than someone who has not practised medicine for several years. With hindsight I would wish to work part-time even if most of my earnings had to be used to pay a nanny.

Balancing priorities is difficult. There is a division of loyalty between the family and the practice. It is vital to both to remain healthy. On many occasions the job has to come first and the family may suffer. I am deeply grateful to my children for their patience and loyalty. Although the children received less of my time than I should have liked, I think my interests outside the home enabled me to bring something into it, but I can only surmise what the psychological cost has been to them. Trying to earn a living and bring up a family single-handed leaves little time or energy for anything else. Contact with friends must be maintained for they can easily be forgotten when time is short. It is important for the family to grow up and leave home without creating an unacceptable bond.

CAUSES.—Every thing that tends to relax or weaken the body, dipslops it to nervous diseases, as indolence, excessive vigour, drinking too much tea, or other weak watery liquors, frequent bleeding, purging, vomiting, &c. Whatever hinders the digestion, or prevents the proper assimilation of the food, has likewise this effect; as long fasting, excess in eating or drinking, the use of windy, crude, or unwholesome aliments, an unfavourable posture of the body, &c.

Nervous disorders often proceed from intense application to study. Indeed few studious persons are entirely free from them. Nor is this at all to be wondered at; intense thinking not only preys upon the spirits, but prevents the perform from taking proper exercise, by which means the digestion is impaired, the nourishment prevented, and the fluids relaxed, and the whole system vitiated. Grief and disappointment likewise produce the same effects. I have known more nervous patients, who dated the commencement of their disorders from the loss of a husband, a favoured child, or from some disappointment in life, than from any other cause. In a word, whatever weakens the body, or depresses the spirits, may occasion nervous disorders, as unwholesome air, want of sleep, great fatigue, disagreeable apprehensions, anxiety, vexation, &c.

(Buchan's Domestic Medicine, 1786.)

Correction
Do patients cash prescriptions?

In the paper by Mr Aylis Rankin (2 January, pp 24-6) in the first sentence under "Results" p. 95, not 90/95.

Br Med J (Clin Res Ed): first published as 10.1136/bmj.284.6317.716 on 6 March 1982. Downloaded from http://www.bmj.com/ on 27 April 2024 by guest. Protected by copyright.