An Evaluation of Potassium Usage in Ambulatory Hypertensive Patients

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Controversies surround the practice of prescribing potassium for ambulatory hypertensive patients who are being treated with diuretics. A chart review was conducted in a family medicine group practice to examine habits of potassium monitoring and supplement prescribing for patients receiving diuretic therapy for control of hypertension. Eighty-four percent of the 134 patients studied were monitored for serum potassium. For those with values obtained both before and after institution of diuretic therapy, mean potassium fell from 4.1 mEq/liter to 3.8 mEq/liter and 29 percent of patients had potassium levels fall to 3.5 mEq/liter or less. Almost half of patients received some type of potassium therapy, with diet enrichment and pharmacologic supplementation being the most common. When mean serum potassium values and percentage of patients with hypokalemia were compared for patients who were prescribed potassium therapy and for those who were not, there was little evidence that patients benefited from potassium prescribing.

Diuretic induced hypokalemia in ambulatory hypertensive patients is a major concern. It has been estimated that the incidence of hypokalemia in patients can increase from 2 percent to over 23 percent after treatment with diuretics.[1] Among clinical consequences of hypokalemia which include muscle weakness, polyuria, and fatigue, the most feared is the development of arrhythmias, especially in patients on concurrent digoxin therapy.[2-4]

There are no universally agreed upon values for determining a clinically important episode of hypokalemia. Kosman[4] advocates treatment in any patient having a serum level less than 3.0 mEq/liter and only in symptomatic patients when the level is between 3.0 mEq/liter and 3.5 mEq/liter. The report given by the American Medical Association (AMA) Committee on Hypertension[5] suggests initiating potassium treatment for values less than 3.0 mEq/liter. Morgan[6] rated the likelihood of important total body potassium depletion as follows: if serum potassium is greater than 3.5 mEq/liter, then it is unlikely; if potassium is between 3.2 and 3.5 mEq/liter, then prediction is difficult; and if less than 3.2 mEq/liter, depletion is likely. Gifford[7] maintains that any patient with a value less than 2.5 mEq/liter or any patient with myocardial or liver disease and hypokalemia symptoms has significant hypokalemia. Finnerty et al[8] define hypokalemia as less than 3.5 mEq/liter on two occasions, or less than 3.0 mEq/liter on one occasion. The recommendation of Ramsay and Ramsay[9] is to arbitrarily set a limit below which the physician will treat. All authors agree that patients on concurrent digoxin therapy constitute a subgroup in which serum potassium should be maintained at or above 3.5 mEq/liter.

In spite of recommendations to evaluate the serum potassium level in patients receiving diuretics, there is little to indicate how soon potassium should be checked after initiation of diuretic therapy. The reports that do mention this subject

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suggest that monitoring should be done within the first month or so after beginning diuretics.[4,6,9] Some studies suggest that hypokalemia is likely to occur more rapidly in the elderly because of decreased dietary potassium intake, and this group should be observed especially closely.[10,11]

The use of therapeutic potassium to protect against hypokalemia is controversial. Edmonds and Jasani[12] urge the use of prophylactic potassium for everyone beginning diuretic therapy. Morgan[6] states that prophylactic potassium has no place in management of uncomplicated hypertensive patients on diuretics. MacLeod[3] decries the use of prophylactic potassium saying that mortality in these patients is more often due to hyperkalemia than hypokalemia. He maintains that "preventive" potassium therapy should be reserved for patients at high risk (those with liver disease, taking digoxin, or on high-dose corticosteroids). Ramsay and Ramsay[9] conclude that physicians tend to prescribe potassium irrationally. They note that potassium is more often given to patients on loop diuretics where it is not needed than to those on thiazides or long acting diuretics for whom potassium loss is a threat. They found that the amount of potassium prescribed had no relation to the amount of diuretic the patient was taking.

This paper examines the problem of hypokalemia in ambulatory hypertensive patients. How common is diuretic induced hypokalemia? When do physicians monitor for hypokalemia, and is this influenced by the patient's age? How is potassium prescribed and what types of potassium therapy are used?

Materials and Methods

The study was a chart audit of patients at the Duke-Watts Family Medicine Center (DFMC) in Durham, North Carolina. The practice has 10,000 active patients who are cared for by 40 residents and 6 family medicine faculty physicians. Of the patients making visits to the center, 52 percent are between the ages of 18 and 39 years, 28 percent are 40 years or more, 77 percent are white, and 75 percent are female.

The medical records are problem oriented. Encounter data from these records are entered into computer files that are designed to allow easy retrieval of information. All DFMC patients who had the diagnosis of hypertension as of January 9, 1979, were eligible for study. Of these 569 patients, 150 (26 percent) were selected randomly for chart audit.

The charts were searched for information about the treatment of hypertension, date of initiation of therapy, type of diuretic and dosage, and any subsequent changes in type of drug or dosage. Chart entries problem coded for hypertension were read entirely to ascertain whether potassium therapy was employed as well as reasons for initiation. Acceptable therapies included use of dietary modification, potassium supplements, potassium sparing diuretics, diuretic combination tablets, salt substitutes, or any combination of the above. Serum potassium values were recorded either from the laboratory summary sheet or progress notes. Values obtained from non-DFMC (eg, Emergency Room) visits were recorded when available.

Hypokalemia was defined as a serum potassium less than 3.5 mEq/liter. Test determinations were performed by Biomedical Reference Laboratories, Inc, in Burlington, North Carolina. The laboratory utilizes Technicon SMA 660 flame photometry equipment for its measurements (range of normal: 3.5 to 5.5 mEq/liter).

Results

Demographics

Of 150 patients selected for audit, information was obtained for 134 hypertensives who were taking diuretics. Lost cases included three patients whose charts were never found, two patients treated with nondiuretic therapy (salt reducing diet), nine patients never treated (ie, labile hypertension), and two patients incorrectly entered into the computer as having hypertension without the diagnosis substantiated in the chart. Of these 134 patients, 64 percent were female, 63 percent were white, and 72 percent were aged 65 years or younger with a mean age of 54.3 years. Of the 134 patients, 92 were started on their initial diuretic at DFMC and 42 patients entered the practice on diuretic therapy. There were 113 patients (84 percent) who had at least one potassium evaluation. Of the 92 patients started on diuretic therapy at the DFMC, 59 (64 percent) had a prediuretic potassium value recorded, while there were 60 patients (65 percent) who had a postdiuretic potassium value recorded.

Distribution of Serum Potassium Values

For the 59 patients who had a prediuretic potassium recorded, the mean value was 4.16 mEq/liter (±0.38). The mean value for postdiuretic potassium level among the 60 patients was 3.82 (±0.57). Further subdivision of this group yielded 44 patients who were on no potassium therapy and had a mean potassium level of 3.80 mEq/liter and 16 patients who were on some form of potassium therapy and had a mean potassium level of 3.88 mEq/liter. The difference between these subgroups is not statistically significant ($P>.10$ by one-tailed t test) nor clinically important.

A total of 41 patients had paired potassium values for pre- and postdiuretic treatment. The prediuretic mean was found to be 4.11 mEq/liter while the postdiuretic mean was 3.84 ($P<.01$ by one-tailed t test). Of these 41 patients, 28 received no potassium therapy. This subgroup displayed a prediuretic mean of 4.10 and postdiuretic mean of 3.80. The 13 patients receiving potassium therapy had means of 4.10 mEq/liter and 3.90 mEq/liter, respectively.

Of all 41 patients with paired values, only 1 patient (2 percent) was hypokalemic before diuretic therapy as opposed to 12 (29 percent) who were hypokalemic on initial postdiuretic potassium evaluation. Of the patients on potassium therapy, 3 of 13 (23 percent) were hypokalemic following diuretic therapy compared to 9 of 28 (32 percent) of the untreated patients ($\chi^2=0.35$, $P>0.5$).

Approach to Hypokalemic Values

In response to a hypokalemic value (<3.5 mEq/liter), a physician's decision to treat was defined as initiation of potassium therapy within three months of the low value or a recheck of a serum potassium within three months of the hypokalemic result.

Of all 134 patients on diuretics, there were 26 patients who became hypokalemic following diuretic therapy and who were not on any form of potassium therapy at the time. Of these, 7 of 14 (50 percent) with hypokalemic values above 3.2 mEq/liter were subsequently treated compared to 10 of 12 (83 percent) with values of 3.2 mEq/liter and below.

Time Interval to Initial Postdiuretic Potassium Evaluation

Most patients (70 percent) had at least one postdiuretic potassium level recorded. Twenty-eight percent of patients over 65 years of age had their postdiuretic potassium evaluation within one month of initiating therapy compared to only seven percent of the nongeriatric patients. The trend toward early monitoring of potassium in the elderly appeared to be a policy of the practice rather than a chance finding ($P<.05$, chi-square test).

Digitalis Patients

Only 6 of 134 patients (4 percent) were on digitalis therapy concurrently with diuretics. Two of these patients entered the DFMC on digoxin and potassium therapy. Of four other patients started on digoxin at the DFMC, three were on potassium therapy concurrently with their digoxin. The one patient who was not on prophylactic potassium subsequently became hypokalemic three months after concurrent therapy had begun, and was then placed on potassium supplementation.

Potassium Therapy

Potassium therapy was employed in 61 out of 134 patients (46 percent). Types of potassium therapy prescribed can be seen in Table 1. In only 1.5 percent of patients was potassium used to treat symptoms alone. Approximately 54 percent of the patients on potassium were treated prophylactically. Dietary potassium therapy was the method of prophylaxis most often used.

Discussion

Diuretic induced hypokalemia was a rather common event, occurring in 29 percent of the patients with paired pre- and postdiuretic values. As stated earlier, however, the literature provides no universally accepted value for determining a *clinically* important episode of hypokalemia. It appears that physicians in this practice do respond (either by re-evaluating serum potassium or instituting potassium therapy) to laboratory evidence of hypokalemia, especially when potassium falls below 3.2 mEq/liter.

With respect to the problem of when to obtain the initial potassium evaluation after diuretic therapy has begun, there was a broad range of time intervals. However, a trend toward early monitoring of geriatric patients was seen.

Most striking was the similarity in serum potassium levels for patients who were receiving potassium therapy and for those who were not. Kosman[4] states that, "although it is generally as-

Table 1. Potassium Therapy Prescribed for 61 Hypertensive Patients

Type	Total	Patients			
		Treated for Symptoms	Treated Prior to DFMC	Treated for Low Serum Potassium	Treated Prophy-lactically
Potassium supplement	19	1	5	8	5
Potassium enriched diet	20	1	1	2	16
Potassium sparing diuretic	1	0	1	0	0
Diuretic combination	6	0	3	0	3
Salt substitute	1	0	0	0	1
Various combinations of above	14	0	0	6	8
Totals	61	2	10	16	33

DFMC=Duke-Watts Family Medicine Center

sumed that potassium chloride supplements will maintain the serum potassium concentration during diuretic therapy, clinical studies have yielded equivocal results." In this practice there was no important difference between the mean potassium values (postdiuretic therapy) regardless of whether or not the patient was placed on potassium therapy.

Several factors may explain this finding. Since the number of observations in this sample is small, it is possible that a real difference between the average potassium levels of patients receiving and not receiving supplements exists but was not recognized. (The probability of making this "Type II" error was 0.24.) There are also problems in potassium administration that must be considered. There has been no attempt in the practice to standardize dosage of potassium supplements and it is possible that patients were receiving inadequate supplementation. It is also very likely that many patients prescribed potassium were not following physician advice. In any event, without better supporting guidelines for use of potassium and without clear evidence for efficacy of supplementation as it is practiced, the widespread, routine use of potassium supplements for uncomplicated hypertensive patients does not appear to be warranted.

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