Within-Visit Blood Pressure Changes in Outpatient Clinic

To the Editor:

Epidemiological blood pressure (BP) surveys suggest that BP determinations are often subject to considerable within-visit variation. For this reason, a memorandum from a WHO/ISH meeting published in 1983 stressed that BP should be measured at least three times over a period of at least 3 minutes at each visit and the lowest reading should be recorded. The same committee has now recommended that two or more measurements should be taken over the same interval and the mean value should be used. The scientific basis for this slight change in the recommendation has not been fully explained. The present study was performed to obtain information on the magnitude and time course of the variability in casual BP measurements recorded for individual patients during routine clinical practice that would be useful in determining the desirable number of BP readings in outpatient clinic settings.

Patients with a history of hypertension (systolic BP ≥ 160 mm Hg or diastolic BP ≥ 90 mm Hg, or both) were recruited consecutively from our outpatient clinic. The study subjects consisted of 63 patients (38 men and 25 women) aged 63 ± 11 (SD) years, 46 of whom were undergoing anti-hypertensive therapy. Seventy-eight percent of patients had end-organ damage, as evidenced by Grade II and III retinopathy or left ventricular hypertrophy, or both.

BP and heart rate (HR) were recorded in the sitting position by nurses using an automatic blood pressure recorder (Model BP103-N; Nippon Kohrin, Komaki, Japan) throughout to eliminate observer error. This device determines the systolic, mean, and diastolic BPs based on an orderly sequence of oscillations in cuff pressure. The device was set to inflate automatically every minute. Each patient had four consecutive BP measurements at each visit, and the examination was repeated four times in an identical manner at 2- or 4-week intervals.

Figure 1 shows the mean differences between the individual values and the average of four serial readings at each visit for a total of 252 (63 patients × 4 visits) BP and HR measurements. They were significantly different from each other when tested by one-way analysis of variance (p < 0.0001). As seen in Figure 1, systolic, mean, and diastolic BP levels progressively decreased during multiple readings. The mean value of the fourth reading was lower than that of the first by 4.3, 2.3, and 1.9 mm Hg, respectively. The differences between the mean values of the first two readings and those of the last two readings were statistically significant, while the differences between each of the last two readings were not significant. For systolic and mean, but not diastolic, BP the differences between each of the first two readings were also insignificant. Finally, the HR obtained in the first reading was significantly higher than that of successive readings. The mean value of the second reading was lower than that of the first one by 2.5 beats/min.

Thus, we may conclude that at least three, rather than two, BP readings over a short interval in an outpatient clinic practice are desirable, since even duplicate readings might lead to overestimated BP values. This conclusion is in accordance with 1983 WHO/ISH
guidelines. It cannot be inferred from the present study, however, which value — the average, the highest, or the lowest — of the serial readings should be used as the value for the visit.

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References

(Hypertension 10: 465–466, 1987)
Hydrochlorothiazide augments the antihypertensive effect of enalapril.

Enalapril tends to reverse the potassium loss often associated with hydrochlorothiazide.

Highly effective in adults, regardless of age or race.*

This fixed-dose combination is not indicated for initial therapy. Patients already receiving a diuretic when enalapril is initiated or given a diuretic and enalapril simultaneously can develop symptomatic hypotension. In the initial titration of the individual entities, it is important, if possible, to stop the diuretic for several days before starting enalapril or, if this is not possible, to begin enalapril at a low initial dose (2.5 mg; see DOSAGE AND ADMINISTRATION). This fixed-dose combination is not suitable for titration but may be substituted for the individual components if the titrated doses are the same as those in the combination.

VASERETIC, containing 10 mg enalapril maleate and 25 mg hydrochlorothiazide, is contraindicated in patients who are hypersensitive to any component of this product. Because of the hydrochlorothiazide component, this product is contraindicated in patients with anuria or hypersensitivity to other sulfonamide-derived drugs.

Evaluation of the hypertensive patient should always include assessment of renal function.

*Although enalapril was antihypertensive in all races studied, black hypertensive patients (usually a low-renin hypertensive population) had a smaller average response to enalapril maleate monotherapy than non-black patients. In contrast, hydrochlorothiazide was more effective in black patients than enalapril. Concomitant administration of enalapril maleate and hydrochlorothiazide was equally effective in black and non-black patients.
Excessive hypotension was rarely seen in uncomplicated patients with anuria or hypersensitivity to other sulfonamide-derived thiazide diuretics, including enalapril. In such cases, VASERETIC should be discontinued, and the patient observed. If hypotension occurs, the patient should be placed in a supine position and if necessary hospitalized. Treatment of hypotensive episodes usually includes intravenous fluid administration with or without concomitant administration of vasopressor agents. If vasopressor agents are used, it is important to recognize that a concomitant administration of clonidine, which can be administered by the intravenous route or as a transdermal patch, may enhance the hypotensive response to norepinephrine or epinephrine.

Hypokalemia

Hypokalemia may occur, especially when diuretics are used concomitantly with VASERETIC. Hypokalemia may cause cardiac arrhythmias or may aggravate hypocalcemia and hypomagnesemia. Hypokalemia has been observed in association with increased serum aldosterone levels. Clinical manifestations of hypokalemia depend on the degree and duration of the potassium deficit. For example, hypokalemia may cause muscle weakness and myalgia, or may lead to an excessive fall in blood pressure because of reduction in vascular resistance. In such cases, VASERETIC should be discontinued and the patient observed. If hypokalemia occurs, the patient should be placed in a supine position and if necessary hospitalized. In severe cases, intravenous potassium chloride may be administered.

Hyperkalemia

Hyperkalemia may occur, especially when diuretics are used concomitantly with VASERETIC. Hyperkalemia has been observed in association with increased serum aldosterone levels. Clinical manifestations of hyperkalemia depend on the degree and duration of the potassium excess. For example, hyperkalemia may cause muscle weakness and myalgia, or may lead to an excessive fall in blood pressure because of reduction in vascular resistance. In such cases, VASERETIC should be discontinued and the patient observed. If hyperkalemia occurs, the patient should be placed in a supine position and if necessary hospitalized. In severe cases, intravenous potassium chloride may be administered.

Hypocalcemia

Hypocalcemia may occur, especially when diuretics are used concomitantly with VASERETIC. Hypocalcemia has been observed in association with increased serum parathyroid hormone levels. Clinical manifestations of hypocalcemia depend on the degree and duration of the calcium deficit. For example, hypocalcemia may cause muscle weakness and myalgia, or may lead to an excessive fall in blood pressure because of reduction in vascular resistance. In such cases, VASERETIC should be discontinued and the patient observed. If hypocalcemia occurs, the patient should be placed in a supine position and if necessary hospitalized. In severe cases, intravenous calcium chloride may be administered.

Hypomagnesemia

Hypomagnesemia may occur, especially when diuretics are used concomitantly with VASERETIC. Hypomagnesemia has been observed in association with increased serum parathyroid hormone levels. Clinical manifestations of hypomagnesemia depend on the degree and duration of the magnesium deficit. For example, hypomagnesemia may cause muscle weakness and myalgia, or may lead to an excessive fall in blood pressure because of reduction in vascular resistance. In such cases, VASERETIC should be discontinued and the patient observed. If hypomagnesemia occurs, the patient should be placed in a supine position and if necessary hospitalized. In severe cases, intravenous magnesium sulfate may be administered.

Hypomagnesemia may cause or aggravate hyperkalemia, hypocalcemia, and hypophosphatemia. Hypomagnesemia has been observed in association with increased serum parathyroid hormone levels. Clinical manifestations of hypomagnesemia depend on the degree and duration of the magnesium deficit. For example, hypomagnesemia may cause muscle weakness and myalgia, or may lead to an excessive fall in blood pressure because of reduction in vascular resistance. In such cases, VASERETIC should be discontinued and the patient observed. If hypomagnesemia occurs, the patient should be placed in a supine position and if necessary hospitalized. In severe cases, intravenous magnesium sulfate may be administered.

Hypophosphatemia

Hypophosphatemia may occur, especially when diuretics are used concomitantly with VASERETIC. Hypophosphatemia has been observed in association with increased serum parathyroid hormone levels. Clinical manifestations of hypophosphatemia depend on the degree and duration of the phosphorus deficit. For example, hypophosphatemia may cause muscle weakness and myalgia, or may lead to an excessive fall in blood pressure because of reduction in vascular resistance. In such cases, VASERETIC should be discontinued and the patient observed. If hypophosphatemia occurs, the patient should be placed in a supine position and if necessary hospitalized. In severe cases, intravenous phosphoric acid or sodium phosphate may be administered.
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