# THE MANAGEMENT OF HYPERTENSION IN GENERAL PRACTICE*

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The reduction of blood pressure in the hypertensive patient is desirable in patients manifesting symptoms of giddiness, noises in the head and headaches, and in whom a small reduction in blood pressure will usually give relief. Mortality is highest when the diastolic level is above 130 mm. Hg and where gallop rhythm, left ventricular strain, considerable albuminuria and retinopathy are present. With such findings adequate lowering of the blood pressure is beneficial and, no matter what the aetiology, simple lowering of the blood pressure is attended by improvement.[1, 2]

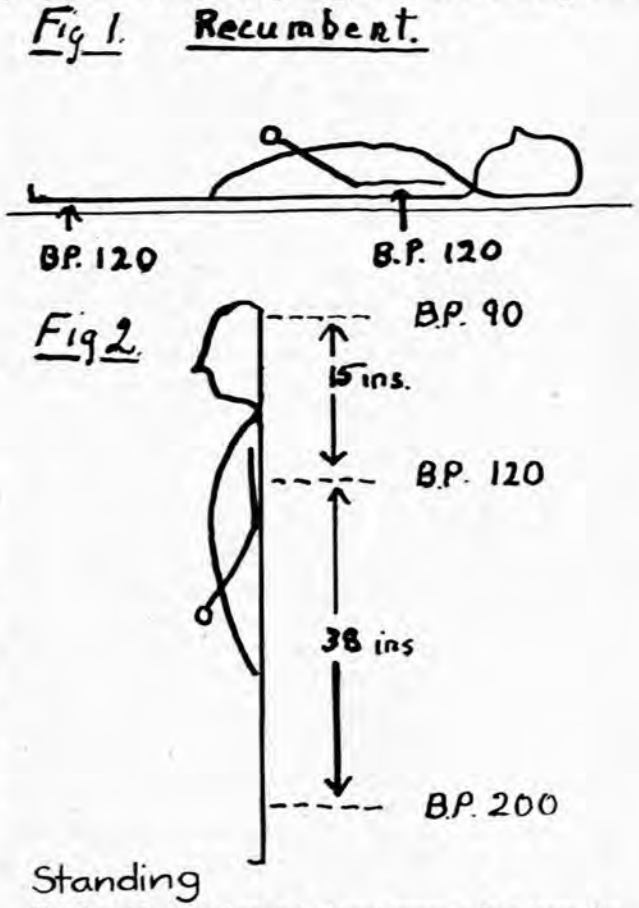
Cerebral oxygenation, reduced to a dangerous level in the erect position, is the factor which limits the extent to which the blood pressure may be lowered. At the same time the lower the blood pressure is reduced, provided it is not below the limits of safety, the greater the relief.

In the use of blood pressure reducing drugs, the measurement of the effect of the drugs by taking the blood pressure with the patient in the horizontal position only is unsatisfactory, because some patients who show little or no fall in blood pressure when horizontal, when erect, develop lassitude or giddiness, lose consciousness or develop cerebral thrombosis.

## BLOOD-PRESSURE READINGS IN NORMAL INDIVIDUALS

A case is presented here for taking the blood pressures in the lying position and in the standing position with the arm resting out laterally from the body at shoulder level, i.e. in 90° abduction so that the degree of hypotension can be better controlled, particularly in relation to cerebral blood-pressure. Blood pressures are measured by the method recommended by the Committee for the Standardization of Blood Pressure Readings.[3]

The hydrostatic effect of gravity on the column of blood above or below the heart causes a gradient of arterial pressure throughout the body. For every 15 inches of vertical height above the heart level there is a reduction of local blood pressure of about 30 mm. Hg, and below heart-level the pressure is raised by a similar amount. This effect of gravity influences the blood pressure in the brain in the erect position. At heart-level the blood pressure remains constant but elsewhere, unless the body is horizontal, there is a gradient of arterial pressure. Figs. 1 and 2 illustrate the changes in the blood pressure in a conscious man lying down and standing up.[4] In the normal individual, the diastolic pressure is nearly always higher in the standing than




*Figs.* 1 *and* 2. The changes in blood pressure in a conscious man recumbent and standing (Enderley).

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in the recumbent position (with the reading taken in the antecubital fossa with the arm adducted), and the systolic pressure is usually higher in the standing position, but may be lower if the blood pressure in the recumbent position is already low.[5] By taking the blood pressure while standing, with the arm supported in 90° abduction, this initial confusion is eliminated, and an assessment is also obtained of the hydrostatic pressure-gradient in the body between the heart and the head, and so an indication of the cerebral blood-pressure. By actually holding aloft the arm of the erect patient, the blood pressure taken at the antecubital fossa is at the same level as the brain and so gives a reading approximating to that in the brain. The disadvantages of this position are its awkwardness, especially in the elderly, and the fact that the muscular stresses involved must affect the reading.

The average of the blood pressure taken in the horizontal position in 18 apparently normal individuals with the arm adducted, in 90° abduction, and in 180° abduction are shown in Table I. It is apparent that there is very little difference in the pressures. A comparison

TABLE I. BLOOD-PRESSURE (MM. HG) IN RECUMBENT POSITION IN NORMALS

| *With arm adducted* | *With arm in 90° abduction* | *With arm in 180° Abduction* |
|---|---|---|
| 139/82 | 144/83 | 139/81 |

TABLE II. BLOOD PRESSURE (MM. HG) IN RECUMBENT AND STANDING POSITIONS IN NORMALS

| *Recumbent* | *Standing* | | |
|---|---|---|---|
| | *Arm adducted* | *Arm in 90° abduction* | *Arm in 180° abduction* |
| 146/85 | 141/91 | 134/81 | 125/70 |

of the average blood-pressure taken in 30 apparently normal individuals recumbent; and standing with the arm adducted, in 90° abduction, and in 180° abduction, is shown in Table II, where the hydrostatic pressure-differences are apparent. Both the young and the old may show big differences between the lying and standing blood-pressures.

Vasomotor control is responsible for maintaining the lumen of the dependent small arterioles and veins against the dilating effect of gravity and, by combating the pooling effect of gravity in the dependent parts and splanchnic area, ensures an adequate venous return in all positions, and consequently ensures a sustained output and sustained arterial blood-pressure. The heart can thus deliver sufficient blood to the brain in the upright position, although the pressure will be about 30 mm. Hg lower than at heart-level. In the young untreated hypertensive the lying and standing blood-pressures are closer to each other than in normals, but in elderly hypertensives the differences may be great.

## BLOOD-PRESSURE READINGS AFTER ADMINISTRATION OF BLOOD-PRESSURE REDUCING DRUGS

A similar gradient of pressure exists after the administration of blood-pressure reducing drugs, with the difference that the vasomotor paralysis induced by the drug inhibits the compensating vasomotor reflexes with resultant pooling, diminished venous return, diminished cardiac output, and consequently a fall in blood pressure in all positions, but most pronounced in the erect above heart-level.

A reduced blood-pressure at heart-level may be adequate for the metabolic requirements of all organs when the body is horizontal, but may not necessarily be so when the body is erect. The erect posture may reduce local pressure in the elevated regions of the brain to such a level that the circulatory requirements cannot be met.

Blood-pressure determinations in the erect position are not an exact indication of the degree of cerebral oxygenation, bedevilled as this is by variations in cerebral metabolism, cerebral oxygen extraction, arterial oxygen saturation and cerebral blood-flow, and the vascular supply of the brain has not been sufficiently explored in controlled hypotension to ensure that, without doubt, there is no alteration in vascular dynamics such as, for example, an arterial shunt mechanism.[6]

Cerebral function in conscious healthy adults is slightly impaired when the blood pressure in the erect posture falls to 60 mm. Hg,[7] and electro-encephalographic evidence supports the view that 55 mm. Hg systolic is the critical level.[8] Findings with the total oxygen consumption show that a net debt is incurred at pressures below 55-60 mm. Hg under light anaesthesia, and the debt is discharged when the pressure is restored to higher levels. We must insist that our limits of safety are on the high side, and as far as possible should be

TABLE III. SHOWING THAT THE DIFFERENCE BETWEEN LYING AND STANDING BLOOD-PRESSURES INCREASES AS THE PRESSURE IS REDUCED (ARM IN 90° ABDUCTION)

| | *Highest blood-pressures untreated* | | *Lowest blood-pressures treated* | |
|---|---|---|---|---|
| | *Lying* | *Standing* | *Lying* | *Standing* |
| B.A.I. .. | 240/160 | 260/160 | 154/120 | 120/86 |
| P.O.R. .. | 180/140 | 160/110 | 150/100 | 120/80 |
| J.A.M. .. | 240/130 | 240/120 | 174/100 | 204/100 |
| L.I.N. .. | 150/100 | 140/100 | 138/92 | 120/80 |
| F.E.A. .. | 198/94 | 180/80 | 185/110 | 120/80 |
| R.O.B. .. | 220/120 | 200/120 | 150/110 | 110/80 |
| B.E.R. .. | 195/105 | 180/110 | 170/90 | 110/70 |
| S.C.H. .. | 225/130 | 220/120 | 230/130 | 190/120 |
| C.A.R. .. | 200/110 | 220/110 | 180/100 | 160/100 |
| Average of the 9 patients .. | 205/121 | 200/114 | 170/106 | 139/88 |

based on experiments and not assumption.[9] The critical level of hypotension in each individual will vary with the amount of vasodilation of which he is capable, something which cannot be assessed until the drug has been used, although high pressures fall further from the use of hypotensive drugs in older than in younger people. In Table III are shown the highest blood-pressures in 9 hypertensives with the arm out at right angles to the body, not on hypotensive drugs, in the lying and standing positions, and the lowest blood-pressures in the same group under treatment.

The difference between lying and standing blood-pressures gives an assessment of the efficacy of the drug

in treatment, for the greater the reduction in pressure the greater the difference between the lying and standing blood-pressures. In patients taking effective doses of hypotensive drugs the alteration in blood pressures with change of position is rapid; and therefore the blood-pressure readings taken in quick succession afford a fair estimate of the effect the drug is having. One feels that it is unwise to reduce the systolic pressure to less than 150 mm. Hg standing. This allows a margin for any further fall which may occur, in rapid resumption of the upright position, in hot or stuffy atmospheres, on prolonged standing, and after alcohol. The patient should be warned that a combination of these circumstances may, while he is taking hypotensive drugs, reduce his labile blood-pressure to a dangerous level, and that should he experience symptoms he should sit, or if necessary lie down, immediately.

Griffiths[10] has pointed out the added danger of a fall in blood sugar with the administration of Methonium and, as the brain is intolerant of hypoglycaemia, it is unlikely to be able to withstand the combined action of extreme hypotension and hypoglycaemia at the same time without showing symptoms.

Because blood pressures are notoriously variable, the general practitioner is probably the person best placed to regulate the hypertensive's blood pressure and life. For, to know how effective drug treatment is, it is necessary to take many readings over many months, at different times of the day in the patient's own environment. As many patients with long-standing hypertension, have some degree of left ventricular failure, pulmonary oedema unrecognized clinically may be produced, and mercurial diuretics are valuable adjuncts to treatment. It is also necessary to know the factors producing stress in the patient's life; to be able to discuss them; to advise and, when appropriate, administer sedation, or temporarily increase the dosage of the hypotensive drug. His remaining life-time is in fact one of constant adjustment.

*Vegolysen Retard*

Vegolysen Retard, given by subcutaneous injection, is a satisfactory drug. Given 8-hourly in a well-adjusted dose it produces a satisfactory fall in blood pressure over most of the 24 hours. Even the most stoic patients, however, seem to revolt against the injection regime sooner or later.

*Serpasil*

The action of Serpasil is central, on the sympathetic ganglia in the mid-brain, and it is its depressing of this centre which is responsible for the hypotensive action. Evidently, under certain conditions and in some patients, the hypotensive activity of Serpasil is potent. Many patients are resistant at dosages which produce no side-effects. The fall in blood pressure is frequently preceded by flushing, which is ancillary evidence of distinctive action on the vascular system. In the recommended daily doses of 0·75-1·5 mg., Serpasil frequently does not produce impressive falls in blood pressure, and often doses as great as 3 mg. a day do not produce a satisfactory fall. By the time these large doses are used most patients exhibit side-effects such as conspicuous conjunctival congestion, nasal blockage, sensation of fatigue and sleepiness, *depression*, shivering, restlessness, nausea, vomiting and diarrhoea, and a feeling of heat within one or two hours of the administration of Serpasil.[11] When, after the blood-pressure has been reduced by Serpasil, and the drug is discontinued, a significant fall in blood pressure often persists for 12 and sometimes 24 hours.

*Ansolysen*

Ansolysen (pentapyrrolidinium bitartrate, M. and B. 2050A) is usually effective in reducing blood pressure. An effective oral dose lies between 30 and 2100 mg. daily. It is recommended that the drug should be given thrice daily before meals. But many patients living active lives find it difficult to remember to take tablets before meals. I have found a satisfactory alternative regime is to take the oral dose with early morning tea, mid-morning tea, mid-afternoon tea and last thing at night.

Significant falls in blood pressure are obtained with as little as 5 mg. 4 times daily but, if the patient's resistance to the drug is high and as the tolerance to the drug (which eventually reaches a level) develops, doses as high as 700 mg. may be required for a single dose.

The advantage of Ansolysen over the other methonium drugs is the relative absence of side-reactions, particularly constipation, diarrhoea, mouth dryness and visual disturbances. The maximum effect of Ansolysen is at 1½-3 hours after oral administration, but it remains in the system for about 6-8 hours, and the duration of the fall in blood pressure depends largely on the dose and on capricious absorption from the alimentary canal. Even when the effect of Ansolysen has worn off, as judged by the blood pressure, some may still be retained in the system so that the subsequent doses during the day may have to be reduced.

In hospital practice it is probably good to give a subcutaneous dose of 4 mg. and measure the effect on the blood pressure over the first 4 hours, or do the same with an oral dose of 40 mg., but in general practice the facilities seldom exist for this assessment. It is practical, therefore, to start with a small dose of (if deemed necessary) 5 mg. daily, which can be increased by 10 mg. every few days. Frequent blood-pressure readings taken at the same time every few days will establish the effect of and required increase of dosage of the drug. The blood pressure should be taken at a time when the effect on the blood pressure is known to be maximum after the dose. After 10 minutes' rest, the lying blood pressure is taken and, after standing for 60 seconds, the blood pressure is again taken with the arm in 90° abduction. The standing test,[12] in which the dose is increased until the patient experiences hypotensive symptoms on standing for 60 seconds, has the objection of giving no information of how progress is being made between the hypertensive state and the hypotensive state where symptoms are experienced. The first symptom experienced may be a 'black-out' or vascular occlusion, and not the symptoms of faintness and languor. Although in most patients there is a comparatively narrow margin between the dose which has an inadequate effect and that which has an excessive one,[12] it is not so small that the progress from one to the other cannot be followed by

the method of taking the blood pressures as proposed above, and so making for better blood-pressure control.

Where patients are resistant to oral Ansolysen, subcutaneous Ansolysen should be used. A suitable initial dose is 4 mg., with an increase of 5 mg. every few days until the required level is reached. Some patients are resistant to this too.

Three illustrative case histories are tabulated.

CASE 1

W.A.L., aged 50 years. Breathless in bed and on exertion, palpitations, retinal haemorrhages.

| Date | Drugs | Lying | Standing | | Remarks |
|---|---|---|---|---|---|
| | | | Arm adducted | Arm in 90° abduction | |
| 1953 | | | | | |
| October 2 | Veg. Ret.* 20 mg. and readings of blood pressure taken at 15-minute intervals | 260/130 | 252/115 | | |
| | | 230/126 | 222/130 | | |
| | | 260/130 | 260/122 | | |
| | | 260/146 | 256/122 | | |
| | | 260/148 | 256/110 | | |
| ,, 5 | Veg. Ret.* 40 mg. tds | 240/120 | 260/140 | | 2 ml. Theurin diuresis |
| ,, 7 | | 230/120 | 190/110 | | |
| ,, 10 | ,, ,, 50 ,, ,, | 210/110 | | 190/110 (1) (2) | |
| ,, 14 | ,, ,, 90 ,, ,, | 210/130 | | 190/105 204/106 | |
| ,, 17 | ,, ,, 100 ,, ,, | 200/120 | | 184/94 170/96 | tightness in chest |
| ,, 19 | ,, ,, 100 ,, ,, | 210/110 | | 170/80 175/95 | constipated |
| ,, 21 | ,, ,, 100 ,, ,, | 200/120 | | 160/80 160/80 | |
| ,, 24 | ,, ,, 120 ,, ,, | 210/120 | | 165/80 166/86 | diuresis |
| ,, 26 | ,, ,, 130 ,, ,, | 200/120 | | 175/90 200/120 | |
| ,, 28 | ,, ,, 140 ,, ,, | 200/125 | | 165/80 165/90 | |
| November 2 | ,, ,, 150 ,, ,, | 200/130 | | 165/100 165/90 | |
| ,, 4 | ,, ,, 160 ,, ,, | 210/120 | | 180/80 180/80 | diarrhoea |
| ,, 7 | ,, ,, 170 ,, ,, | 220/120 | | 120/70 140/85 | dizzy fatigue |
| ,, 9 | ,, ,, 160 ,, ,, | 220/110 | | 140/70 140/70 | diarrhoea |
| ,, 16 | ,, ,, 160 ,, ,, | 230/130 | | 185/115 165/90 | bowels troublesome |
| ,, 20 | ,, ,, 160 ,, ,, | 210/130 | | 160/85 140/80 | |
| 1954 | | | | | |
| January 15 | ,, ,, 160 ,, ,, | 260/120 | | 205/95 | giddy, weak |
| ,, 23 | Ser. 0·25 mg. tds | 240/130 | | 190/85 | 168¼ lb. (5'3") |
| February 6 | ,, | 260/125 | | 190/85 | 168½ lb. |
| ,, 27 | | | | | 171½ lb. Theurin 2 ml. |
| April 5 | ,, | 230/140 | | 210/130 | tired in morning |
| May 8 | ,, | 200/95 | | 110/70 | |
| June 6 | Ser. 4 tab. daily and Veg. Ret.* 70 mg. *nocte* | 230/120 | | 210/100 | 177½ lb. |
| July 24 | ,, | 180/80 | | 190/90 | Theurin 2 ml. (6 pints) |
| August 21 | ,, | 260/120 | | 220/90 | |
| ,, 28 | ,, | 180/100 | | 150/80 | |
| September 1 | ,, | 230/120 | | 178/90 | Theurin 2 ml. (4 pints) |
| September 11 | ,, | | | | Theurin 2 ml. (5 pints) |
| ,, 20 | Ser. 4 tab. daily and Ans. 4 tab. daily | 200/110 | | 146/85 | |
| ,, 25 | ,, | 210/110 | | 190/100 | |
| | Ans. 8 tab. daily | 220/100 | | 210/100 | Diamox 1 tab. daily |
| November 13 | Ans. 12 tab. daily | 220/120 | | 160/100 | Fatigue excessive |
| 1955 | | | | | |
| February 5 | Ans. 5 tab. daily | 220/140 | | 180/115 | |
| March 26 | ,, | 240/120 | | 190/110 | 176 lb. |
| April 13 | ,, | 230/120 | | 170/100 | 178½ lb. |
| ,, 27 | ,, | 230/140 | | 170/120 | 175¼ lb. |

* Vegolysen Retard given subcutaneously.

(1) Standing before lying blood-pressure taken.

(2) Standing after lying blood-pressure taken.

CASE 2

B.E.V., aged 42 years. Dizziness.

| Date | Drugs | Lying | Standing | | | Remarks |
|---|---|---|---|---|---|---|
| | | | *Arm adducted* | *Arm in 90° abduction* | *Arm in 180° abduction* | |
| 1952 | | | | | | |
| May 29 | .. | 210/30 | | | | Albumin and hypertensive |
| June 12 | .. | 230/134 | | | | Weight 183 |
| „ 19 | .. | 224/140 | | | | Blood urea 36 mg.% |
| August 23 | .. Lumbodorsal sympathectomy | | | | | |
| December 9 | .. | 176/114 | 184/126 | | | |
| 1953 | | | | | | |
| February 17 | .. | 224/132 | 210/140 | | | no albuminuria |
| March 11 | .. | 220/120 | 170/116 | | | shivering |
| April 18 | .. | 206/128 | 190/126 | | | looks and feels better |
| 1954 | | | | | | |
| March 12 | .. | 208/138 | 208/140 | | | |
| May 14 | .. | 214/142 | 212/146 | | | |
| June 25 | .. | 216/144 | 216/146 | | | |
| August 6 | .. | 196/124 | 202/128 | | | |
| „ 30 | .. Ser. 2 tabs. daily | 204/126 | 210/124 | | | |
| September 22 | .. Ser. 5 „ „ | 192/120 | 168/104 | | | |
| October 13 | .. Ser. 5 „ „ | 194/116 | 140/112 | | | |
| „ 22 | .. Ser. 4 „ „ | 180/108 | 134/86 | | | |
| | Ans. 3 „ „ | | | | | |
| November 10 | .. Ser. 6 „ „ | 166/100 | 128/92 | | | |
| | Ans.3 | | | | | |
| „ 24 | .. Ser. 6 „ „ | 210/116 | 116/80 | | | Giddy when standing for any length of time |
| | Ans.3 „ „ | | | | | |
| December 10 | .. Ser. 5 „ „ | 224/126 | 152/114 | | | |
| | Ans.2 „ „ | | | | | |
| December 24 | .. Ser. 3 „ „ | 194/116 | 156/110 | | | |
| | Ans.2 „ „ | | | | | |
| 1955 | | | | | | |
| January 21 | .. Ser. 6 „ „ | 192/116 | 132/106 | | | |
| | Ans.2 „ „ | | | | | |
| February 18 | .. Ser. 6 „ „ | 204/114 | 168/114 | | | |
| | Ans.2 „ „ | | | | | |
| June 13 | .. Ser. 6 „ „ | 240/130 | 150/110 | | | |
| | Ans.2 „ „ | | | | | |
| July 18 | .. Ser. 2 „ „ | 185/115 | 145/100 | 140/90 | 125/75 | |
| | .. Ans.2 „ „ | | | | | |
| August 25 | .. Ser. 4 „ „ | 210/120 | 150/100 | 150/90 | 150/90 | Had stress |
| | Ans.4 „ „ | | | | | |
| September 13 | .. Ser. 4 „ „ | 160/100 | | 50/40 | | |
| | Ans.5 „ „ | | | | | |
| September 16 | .. Ans.4 „ „ | 190/110 | | 110/75 | | |
| October 7 | .. Ans.4 „ „ | 190/130 | | 140/105 | | |
| November 28 | .. Ans.4½ „ „ | 208/130 | | 170/102 | | |
| 1956 | | | | | | |
| January 25 | .. Ans.4½ „ „ | 176/120 | | 114/70 | | |

Serpasil tablets—·25 mg.
Ansolysen tablets—40 mg.

CASE 3

B.A.I. Age 65 years. Chronic Nephritis with Hypertension. Original B.P., 8 October 1953. 220/160

| Date | Drugs | Lying | Standing | Remarks |
|---|---|---|---|---|
| | | | *Arm in 90° abduction* | |
| 1953 | | | | |
| October 8 | .. Veg. Ret. | 220/160 | | |
| „ 26 | .. „ 90 mg. tds. | 117/115 | 180/150 | Vomited |
| „ 28 | .. „ 90 „ „ | 190/130 | 165/115 | Blood urea 81 mg. % |
| „ 30 | .. „ 80 „ „ | 180/130 | 180/126 | Work not a hardship |
| November 2 | .. „ 90 „ „ | 154/120 | 120/86 | |
| „ 9 | .. „ 90 „ „ | 175/125 | 144/110 | Muzzy head |
| „ 16 | .. „ 80 „ „ | 170/118 | 120/95 | No energy, diarrhoea, nausea. |
| „ 19 | .. „ 60 „ „ | 200/130 | 180/120 | Feeling well |
| „ 25 | .. „ 60 „ „ | 180/140 | 126/95 | Alternating constipation and diarrhoea. |

| Date | Drugs | Lying | Standing | Remarks |
|---|---|---|---|---|
| | | | Arm in 90° abduction | |
| December 21 | .. „ 40 „ „ | 204/140 | 180/130 | |
| „ 28 | .. „ 60 „ „ | 200/140 | 140/110 | |
| 1954 | | | | |
| January 4 | .. „ 50 „ „ | 180/120 | 158/115 | |
| „ 11 | .. „ 50 „ „ | 185/130 | 145/96 | |
| „ 18 | .. „ 50 „ „ | 200/120 | 160/110 | |
| „ 25 | .. Ser. 3 tab. bd. | 215/120 | 175/120 | |
| February 1 | .. Veg. Ret. 50 mg. bd. and Ser. 3 tab. bd. | 200/120 | 140/100 | Constricting chest pain |
| „ 2 | .. Veg. Ret. 50 mg. bd. and Ser. 3 tab. daily | 230/130 | 155/105 | |
| March 5 | .. „ | 210/120 | 175/115 | Cholecystitis |
| „ 22 | .. „ | 195/100 | 135/100 | Diarrhoea. |
| April 22 | .. „ | 210/130 | 160/100 | |
| September 21 | .. „ | 210/140 | 170/125 | From this date onwards touring in Europe |
| „ 28 | .. Ans. 4 tab. daily | 210/140 | 200/140 | |
| | .. Ser. 2 „ „ | | | |
| November 2 | .. Ans. 4 „ „ | 190/140 | 190/130 | |
| | Ser. 2 „ „ | | | |
| November 16 | .. Ans. 4 „ „ | 230/150 | 170/130 | |
| | Ser. 1 „ „ | | | |
| November 22 | .. Ans. 4 „ „ | 210/140 | 190/130 | |
| December 6 | .. Ans. 4 „ „ | 210/160 | 190/140 | |
| December 28 | .. Ans. 4 „ „ | 210/150 | 190/150 | |
| 1955 | | | | |
| January 4 | .. Off Ansolysen | 240/160 | 260/160 | |
| „ 11 | .. „ „ | 190/130 | 150/115 | |
| „ 18 | .. Ans. 4 tab. daily | 160/120 | 140/100 | |
| February 1 | .. dosage unreliable | 190/120 | 210/140 | |
| „ 23 | .. „ „ | 220/140 | 210/130 | Vomiting, no appetite. |

Serpasil tablets — ·25 mg.
Ansolysen tablets — 40 mg.

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