OBSERVATIONS ON THE MANAGEMENT OF HYPERTENSION*

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BLOOD pressure is considered to depend on three factors, the cardiac output, the volume of the blood and the peripheral resistance. The latter is regulated by suitable neurogenic impulses to the vasomotor system. Any alteration in the first two conditions is normally very quickly followed by changes in the vasomotor tone in an attempt to maintain a normal blood pressure. It seems obvious that in any marked and continuous variation of the blood pressure, such as is found in hypertension, the cause should be sought in the field of peripheral resistance.

Many authors have considered the increased peripheral resistance in hypertension to be in the arterioles. Ellis and Weiss,[9] by measurement of capillary pressure in normal subjects and in patients with hypertension, showed that the increased resistance was in the arterioles. Wagenmann,[28] as early as 1897, and in the following year Elschnig,[8] reported the observation of spasm of the retinal vessels in hypertensive states. Gipner[10] recently published a comprehensive report of retinal changes in which he stated "In mild benign hypertension the retinal arteries show uniform exaggeration of the arterial reflex and uniform constriction of the calibre of the arteries which have regular lumina." "As the fibrosis increases, there is added to the generalized reduction in calibre of the arteries, areas where still further reduction in calibre is present, so that there is a generalized irregularity in the calibre of the retinal arteries giving the picture of hypertensive sclerosis."

A review of the literature on the relation of hypertension to cardiovascular-renal change is beyond the scope of this paper. However, considerable evidence has been advanced to show that many cases of hypertension were primarily the so-called essential type, and that diseases of the kidneys and blood vessels, which were formerly considered a cause of hypertension, were in reality results of the increased blood pressure. This view was upheld by Moschcowitz.[23] O'Hare and Walker[25] have reported that in their experience all cases of retinal sclerosis had presented elevated blood pressure some time previously, and that patients whose blood pressure had been normal never developed sclerosis of the retinal vessels, even in the presence of sclerosis of the peripheral arteries. Kernohan, Anderson and Keith[19] have observed in biopsy specimens of voluntary muscle in patients with hypertension a hypertrophy of the media and proliferation of the intima of the arterioles in a large percentage of cases.

Clinical investigators have frequently noted that patients with hypertension showed stigmata of autonomic imbalance. Sigler[26] believed that the rise of blood pressure in these cases was due to an instability of the vegetative nervous system. Lian, Stoicesco and Vidrasco[21] have shown in their studies of the vegetative nervous system that in permanent arterial hypertension there was a vascular sympathetic hyperexcitability. The vaso-constrictors are innervated by the sympathetic and the vasodilators by the parasympathetic system. Thus it appeared logical to seek a cause of the increased peripheral resistance of the circulation in the autonomic nervous system.

The sodium ion has been considered for a number of years as a vascular constrictor, although there has been published little experimental evidence of such an effect. Macht,[22] while studying the action of potassium and sodium iodide on the heart and blood vessels, concluded that sodium was a vascular constrictor. Allen[3, 4, 5] has been an advocate of the theory that the retention of sodium chloride was a cause of hypertension. Bayer,[6] Houghton,[16] Calvert and Lane,[7] Higley and Field[15] have published results of clinical investigation to support this contention. Houghton[17, 18] demonstrated a low blood sodium chloride in many cases of hypotension. The work of

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Addison[1, 2] indicated that sodium was possibly the "toxic factor" in increased blood pressure. In the toxæmias of pregnancy Harding and Van Wyck[12] have noted a distinct rise of blood pressure following the administration of sodium salts.

Much experimental evidence has been published showing that potassium favours the irritability of the parasympathetic and the vaso-dilators. Titajew and Unik[27] demonstrated that in the complete absence of potassium in the perfusion fluid there was no action of the vaso-dilators. Kylin's experiments[20] indicated that with adrenin injection, calcium raised, while potassium lowered, the blood pressure. Thus the higher the relative amount of potassium, the more pronounced was the vagotonic effect of adrenin. Hering[14] has shown experimentally the vagotonic action of potassium on the heart, while Heinekamp[13] produced inhibition of the heart by the action of potassium on the cardio-inhibitory centre in the medulla oblongata. Macht investigated the action of potassium on the blood vessels and found that it caused vascular dilatation and lowered blood pressure. Goerner and Haley[11] demonstrated that the depressor substance of hepatic extract was monopotassium dihydrogen phosphate. Addison[2] observed, in several patients on a low sodium chloride diet, a fall of blood pressure following the administration of the various salts of potassium.

Our first observations in this field were made on cases with restriction of sodium chloride in their diet, accompanied by the use of the various bromide salts. It was noted that the blood pressure was much better controlled when the potassium salt was used. Sometimes following this the iodide and chloride of potassium were given, and more recently the citrate.

Encouraged by these findings and the work of Addison, it was decided to investigate further the management of patients with hypertension by this method. In view of the experimental evidence of the relation of the ionic salts to the autonomic nervous system, and to the control of blood pressure, the sodium was limited and the potassium increased in the intake. Due to

CHART I

Case No.	*Age*	*Duration of H.B.P.*	*Symptoms*	*Urine*	*Average B.P.*	*Potassium-Grains Daily: Blood Pressure, Readings by Weeks* 1	2	3	4	5	6	7	8	9	10	11	12	13	14	*Clinical Results*
10	50	5 yrs.	Dizziness Insomnia Dyspnœa Nervousness Headache Epistaxis	S.G. 1018 Alb.– Sug.–	190 120	96 200 108	96	96 180 105	128	128	128 160 98	128	128	128	128 150 98					Complete relief of symptoms.
21	48	2 yrs.	Œdema Pains in legs Nervousness Insomnia	S.G. 1020 Alb.– Sug.–	240 110	84 160 100	84	84 155 100	84	84	84 160 110	84	84 136 80	irregular	gu l ar s m o u n ts		m a ll		9 mos. 154 96	Marked improvement.
34	44	5 yrs.	Headache Shooting pains in head Dizziness Dyspnœa Insomnia	S.G. 1009 Alb. trace Sug.–	284 130	108 226 110	108 234 120	108 204 112	128 210 110	128	128	128	* 128 240 110	128	128 216 120	128	128 182 106	128	128 178 95	Much improved.
37	66	10 yrs.	Palpitation Precordial distress	S.G. 1010 Alb.++ Sug.–	258 130		96 210 116	96	96 246 110	96	96	96	96 200 90	96	96 200 88	96	96 200 88			Much improved.

* Increase of sodium intake due to error in diet.
H.B.P.—High blood pressure.
B.P.—Blood pressure measured in mm. of mercury.
S.G.—Specific gravity.
Alb.—Albumin.
Sug.—Sugar reducing Benedict's solution.

the action of calcium on the sympathetic, an excess of this ion has been excluded. It was thought best as a result of some clinical observations to limit also the intake of magnesium which was often taken in appreciable quantities by patients with increased blood pressure.

MANAGEMENT

The findings in a consecutive group of 45 cases coming under the care of the author have been analyzed for this report. Blood pressure readings were taken at least six times in the sitting position, under as nearly the same conditions as possible, and the average recorded. The usual activities of the patients were allowed. A low sodium diet with a limitation of calcium and magnesium was prescribed as a routine. In an attempt to gain the best cooperation of the patients, a departure from the usual method of diet regulation has been used. Instead of giving the patient a list of prohibited foods and drugs, the details of their diets have been discussed with them and a substitution suggested where elimination was necessary.

The dosage of potassium citrate prescribed varied from 26 to 128 grains daily. This was determined by the height of the blood pressure, the urgency of the patient's clinical condition and the response to treatment.

The accompanying chart has been compiled as a summary of the findings in four cases selected to illustrate various types of response to treatment. The rise of systolic and the lowering of diastolic pressure recorded in case No. 10 was noted on several occasions, and was concomitant with general improvement of the circulation. Case No. 21 represented a large group of patients whose blood pressure responded rapidly and remained nearly normal as long as treatment was continued. In contrast was case No. 37 in which the blood pressure remained considerably above normal, although the patient's clinical condition was much improved. This type of case usually had renal impairment secondary to the hypertension and demonstrable fibrosis and sclerosis in the arterioles of the retina. Another group, with markedly elevated blood pressure, of which case No. 34 was an example, responded slowly but steadily to strict dietary regulations and large doses of potassium. Dietetic errors proved most detrimental to the results with these patients.

All cases showed a decided fall of blood pressure under treatment. Eleven patients with a systolic blood pressure of 200 or over showed an average drop of 64 mm. over a period varying from one to eighteen weeks. An accompanying mean fall of 25 mm. of diastolic pressure was considered quite noteworthy.

More pronounced than the drop of blood pressure has been the improvement in the patient's clinical condition. Invariably such distressing symptoms as insomnia, nervousness, dizziness, frequent headaches and shooting pains in the head have disappeared. A decrease of nycturia was constantly experienced by the patients as they improved. In cases with signs of cardiac failure, such as dyspnœa and œdema, compensation was quickly restored as the treatment progressed. Patients who were missed from the clinic for some time, upon investigation stated that they felt so well they could see no need for returning. None of the untoward symptoms bordering on collapse, experienced in some other methods of lowering blood pressure, have been encountered.

DISCUSSION

No reason has been observed for separating cases with chronic renal involvement from the so-called essential hypertensive group, when considering the advisability or results of treatment. Patients with definite kidney impairment, associated with elevated blood pressure, apparently had marked improvement of their clinical condition.

A knowledge of the mineral content of the various foods and the commercial preparation of foods is essential for the proper application of the diet. However, where the method outlined is not convenient the following instructions are suggested.

1. Avoid salts of sodium in the preparation, cooking or serving of foods.
2. Avoid chile sauce, catsup, salted olives, prepared salad dressings and prepared extractives.
3. Avoid bread, butter, caviar, cheese, clams, crackers, gluten feed, okra, oysters and wheat germ.
4. Avoid saline cathartics.

5. Avoid baking soda, stomach powders and any medicine containing salts of magnesium, sodium or calcium.

Until patients have been observed under treatment for a prolonged period of time no definite conclusions as to the success of this method of management are warranted. However, the results have been so uniformly successful over this period of the investigation that it was decided to publish these data as a preliminary communication. It is believed it will be necessary for all cases with well established hypertension to continue indefinitely their diet regulations, and in many, the high intake of potassium as well. If further cardiovascular-renal change can be prevented or postponed, there is justification for such management of patients with high blood pressure. Further observations on the results of treatment and an attempt to record the arteriolar calibre during the course of treatment will form the subjects of future communications.

SUMMARY

1. The sodium ion appears to be a factor in the increase of, and the potassium ion in the decrease of, blood pressure.

2. The restriction of sodium, calcium and magnesium, and the increase of potassium intake in patients with hypertension has resulted in uniform clinical improvement and lowering of blood pressure.

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LIPIODOL INJECTIONS IN NEURALGIA AND RHEUMATIC PAINS.—Following Sicard in using local injections of lipiodol for the relief of pain, F. Coste finds that this drug is harmless to the tissues, and tends to produce circulatory changes modifying pathological processes; although it lacks the immediate anæsthetic effect of novocain the relief induced is more permanent. In some cases the subperiosteal injection of lipiodol, at the point where the sciatic nerve crosses the ischial ramus, appears to cause the rapid breaking down of adhesions. When the seat of trouble is high the paravertebral injection of novocain at the level of the fifth lumbar vertebra often gives good immediate results, which may be maintained by immediately introducing a solution of sodium iodide. Coste tries novocain first, and if the improvement lasts several days he repeats the injection. If it is fleeting, he follows up with 15 c.cm. of lipiodol, given by the low epidural route. Another class of cases well treated by local injection is the "dry arthritis" group, especially mono-arthritic conditions such as the "lipo-arthritis" of Weinenbach and Francon, common in women at the menopause and affecting the knee-joint. Sicard injects lipiodol subperiosteally at the inner aspect of the upper tibial surface to infiltrate the peri-articular tissues; intra-articular injection is to be avoided, since it does no good, and often causes painful inflammatory reactions. Coste remarks that this method has proved less successful in "morbus coxæ senilis," in which condition radiant heat is still the treatment of choice. In lipo-arthritis of the knee, however, the injection of lipiodol has given far better results.—*Bull. et Mém. Soc. Méd. des Hôp. de Paris*, Feb. 2, 1931; p. 103.

THE PHYSIOLOGICAL ASPECTS OF OPIUM ADDICTION.—One of the first objectives in the studies of Arthur B. Light on the various phases of the opium addiction problem was to find out definitely, if possible, the existence of any physiological or struetural changes in patients with addiction of long standing. In all the studies reported, the drug used was morphine and was administered hypodermically. Sufficient morphine was always administered to prevent withdrawal symptoms and to produce drug comfort. In practically every instance, this procedure with a well balanced diet, rich in calories, was followed by marked gains in weight. Selecting 100 cases at random, a careful physical examination resulted in absolutely negative returns except for scars of previous abscesses, the result of infection from hypodermic punctures, found in about 70 per cent. Not a single sign or symptom suggestive of drug action was detected. In many of the patients the pupils were contracted; a few, however, failed to show this condition. Careful measurements of the height and weights showed an average of 0.2 per cent above the normal compared to the average normal weight accepted by life insurance companies. Studies of vital capacities, efficiency tests, heart and circulation, the blood metabolism, endocrine functions, kidney and liver function, gastro-intestinal tract, water balance, in fact, all the modern clinical tests to determine changes in physiological function, were carried out in a sufficient number of cases to lead to the conclusion that addiction to opium or its derivatives does not produce any abnormal or harmful changes in physiological mechanisms.—*J. Am. M. Ass.*, 1931, **96**: 823.