

5-1-1932

The management of hypertension with especial reference to dietary

Stanley. Drasky
University of Nebraska Medical Center

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THE MANAGEMENT OF HYPERTENSION

WITH ESPECIAL REFERENCE

TO DIETARY

by

S. DRASKY

C O N T E N T S

I.	INTRODUCTION	1
II.	THE QUESTION OF SALT-FREE DIET	4
III.	THE QUESTION OF DIETARY PROTEINS	18
IV.	ORGANOTHERAPY AND CALCIUM METABOLISM	24
V.	OBESITY AND HIGH CARBOHYDRATE DIET	30
VI.	INFECTION, FOCAL, AND AS A FORERUNNER	34
VII.	CONSTIPATION AND INTESTINAL TOXINS	41
VIII.	NERVOUS RELAXATION AND DIATHERMY	44
IX.	EXERCISE	48
X.	DRUGS	50
XI.	CASE REPORTS	54
XII.	CONCLUSION	57
	BIBLIOGRAPHY	61

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THE MANAGEMENT OF HYPERTENSION

I. INTRODUCTION

In the course of our limited experience we have had, on various occasions, the opportunity of seeing several people who were victims of arterial hypertension. We were much impressed with the variety in the types of management in all of these respective cases, especially with reference to their dietary regime. Some, although inconvenient for the patient seemed quite harmless insofar as the health of the patient was concerned. Others, it seemed to us, were decidedly deleterious to the essential general resistance and well being of the patient.

One elderly lady in particular, the mother of an intimate friend of ours, had had the idea of strict abstinence from salt and protein in her diet very forcefully inculcated by her family physician. This poor soul, between these two questionable desiderata, was not only unrelieved of her subjective and objective symptoms but, day by day, showed increasing signs of irritability and an unstable emotional state. Others we have seen have been admonished against the use of salt alone, the eating of proteins, the indulgence in exercise, or against the drinking of liberal quantities of water. It seems to us that even such a thing as rigid salt restriction works undue hardship on these people if it is not definitely indicated.

Because of the existence of such states as enumerated above it seems that a review of the literature, in an atten-

THE MANAGEMENT OF HYPERTENSION

It to gain an insight into the underlying malfunction in hypertension, and to formulate, if possible, a logical and rational regimen in its management, conducive to both well-being of the patient and to the establishment of a mutual rapport between the patient and his medical attendant, would not be amiss; and that the following paper is justified.

Because our clinical experience is limited the scope of this paper is, of necessity, largely confined to a review of the literature of the last decade or so, and because the literature is vast it is collated to approximate a digest.

The abstracts have been briefed as much as possible and have been arranged according to particular phase of management into general sections: The Question Of Salt Restriction, Protein Restriction, Focal Infection, et cetera.

Since any form of management hinges on an underlying probable disorder of metabolism, or etiology, this has been dealt with incidentally in the respective sections where it has been considered as tantamount to the management of the condition.

Where the trend of favor to any particular form of treatment has changed with the time, the abstracts appear in chronological sequence thus rendering such trend obvious.

Although not all the writers on the subject have been included in this symposium, it will be found that the references given are the outstanding contributions to the medical literature dealing with the subject.

THE MANAGEMENT OF HYPERTENSION

All references, wherever possible, are from the original source. However, where this has been impossible, for lack of available material or the inability to translate they have been requoted and the authority listed in the bibliography has been taken as final.

By the term "hypertension", as used in this paper, we refer to the condition termed by Sir Clifford Allbutt "Hyperpiesis", by which we understand a high blood pressure not obviously secondary to any demonstrable cause, and we distinguish it from high blood pressure that gradually develops in chronic nephritis or quickly develops in acute nephritis in an apparent close relationship to renal insufficiency, in this sense a secondary hypertension, while the essential vascular hypertension might be considered a primary (?) condition. As a clinical entity the condition is fairly definite¹.

THE MANAGEMENT OF HYPERTENSION

II. THE QUESTION OF SALT-FREE DIET

Hypertension has been studied intensively from all angles and written about profusely². The "Quarterly Cumulative Index Medicus" for the last three years lists over 150 articles on "High Blood Pressure". The more one reads, the more is one confused in the maze of conflicting theories as to the cause and treatment of hypertension.

The relation to sodium chloride has been urged for some time but was really brought to the forefront when Allen brought his work and reports before general notice in 1920. It is of interest to follow this subject in chronological sequence.³ In 1904 Ambard and Beaujard*⁴ claimed that there was a direct relation between retention of sodium chloride and the level of arterial tension. In 8 cases studied 6 cases conformed to their theory and 2 did not. Subsequently (1906)*⁵ Ambard reiterated his views and expressed the belief that all hypertension is due to retention of sodium chloride and that every case of permanently increased blood pressure is due to a nephritis. It is now established that a permanent rise in arterial tension is very often not associated with a nephritis. Mosenthal³ quotes an observation of Castagne, in 1905, that injections of sodium chloride may produce fatal uremia in "chronic atrophic nephritis". Mink (1918) made note of a similar instance after the administration of a rather large dose of salt. Mosenthal³ and Short had untoward symptoms occur in a case of nephritis with marked

*Are borrowed reference and found under item 3 in bibliography.

THE MANAGEMENT OF HYPERTENSION

impairment of renal function after a 10 gm. dose of sodium chloride, but not where the hypertension was "essential".

Loeb (1906), in regard to this problem, makes the statement*⁶ that the parenchymatous types of nephritis, characterized by the retention of sodium chloride, as a rule do not have a high blood pressure. Bergouignan and Fiesniger (1906)*⁷ reported a patient who retained salt without a parallel holding back of water, during which period the blood pressure rose. Bayer (1907)*⁸ reported 6 cases of arteriosclerosis some of which showed a marked increase in blood pressure on a high salt diet, whereas others gave evidence of little or none.

Brodzki (1908)*⁹ could produce no increase in blood pressure with salt in either the experimental uranium nephritis of dogs or the cantharidin nephritis of rabbits. Lowenstein (1907)*¹⁰ was unable to note any relation of sodium chloride to blood pressure in 4 carefully observed cases, as the result of the "Karlsbad Cure", in the course of which considerable saline water is taken. Ritter (1910)*¹¹ notes the following results: 57 cases, blood pressure lowered; 4 cases blood pressure constant; 17 cases blood pressure raised. Allbutt's opinion is as follows: " I have found that to cut out salt from the diet of healthy persons for a few days produces no changes of pressure "1²

Allen, after observations in 1918 and 1919, published a paper in 1920¹³ which he deemed as furnishing evidence in

THE MANAGEMENT OF HYPERTENSION

favor of sodium chloride restriction as a treatment for arterial hypertension. Records were given of 20 cases thus treated, with apparently a marked benefit in a large percentage of the cases. Also two experiments were listed to attempt to establish a general principle of the effects of sudden dosage with salt and water during the 24 hours. The first subject was given 2,750 cc. of water during this length of time and 10 gm. of sodium chloride were given at 11 a. m. Subject no. 2 was given 3,800 cc. of water within a period of four hours. A marked rise in blood pressure was noted in both cases. The author seems to conclude that the effects of salt are, in general, more powerful and obvious than the effects from water alone.

In 1922 there followed a rather voluminous paper by Allen and Sherril¹⁴ which, 'tho it may seem too optimistic, does show evidence of much careful work and the results seem to show that the salt free diet has great value in the management of hypertension.

The paper describes 180 cases of severe hypertension, treated by a close restriction of the sodium chloride intake, for a period from one month to three years. (The authors claim that the chief requirement for success is that a sufficiently strict salt privation be carried out for a sufficient length of time. In cases of marked severity diets were devised which kept the urinary excretion of sodium chloride below 0.5 gm. per 24 hours.)

THE MANAGEMENT OF HYPERTENSION

The series of patients was divided into groups. Those that had an initial plasma chloride above 580 mg. per 100cc., those whose chloride figure was below this and those with nephritic involvement as determined by impairment of excretion of nitrogenous substances; then those in the last group who were complicated by diabetes.

The results from the series were;- Fully normal blood pressure was restored in only 34 cases (18.9 per cent) . In 75 other cases (41.9 per cent) the relief of hypertension and other symptoms was sufficient to be regarded as a distinct therapeutic success. Transitory benefit, followed by relapse or death after several months, was obtained in 16 cases (8.9 per cent). Complete failure of treatment was encountered in 55 cases (30.5 per cent), the total mortality for the four years period being 25 (13.8 per cent). They found no appreciable difference between cases of long and short duration of the condition, success or failure being determined by the character of the case rather than by the time element. On the whole the uncomplicated hypertension cases with a high plasma chloride carried a better prognosis than those with low plasma chloride, the nephritic group, showed by far the highest proportion of failures and deaths. In the diabetics the response seemed to be rather good.

In this same connection, a similar paper appeared several years later (1928) by Vogel¹⁵, with similar results. In this paper the series of Allen's patients was enlarged

THE MANAGEMENT OF HYPERTENSION

by 212 cases subsequently treated in the same institute. The same empirical classification was employed as that used by Allen, namely, A. Cases of essential hypertension with initial plasma chloride concentration below 589 mg. per 100 cc. of blood. B. Cases with initial plasma chloride concentration above 580 mg. per 100 cc. of blood. C. Cases with renal impairment, shown by a lowered nitrogen excretion. D. Cases of hypertension with diabetes.

Only those patients who remained in the institute for at least two weeks were included, the average stay being about three weeks. Also only those cases were included which had shown persistent systolic blood pressure above 160 mm. Hg. and diastolic pressures above 200.

The treatment consisted essentially of the same routine as that used by Allen, namely; not mere removal of salt from the table but the most rigid elimination of salt from the diet by the use of food having a low chloride content and by special preparation of the food.

The following results were reported:- " Of these 212 cases, 156 improved during the initial treatment (usually 2 or 3 weeks in duration) in the institute, while 55 are classified as unimproved because there was no appreciable reduction of pressure during this time. Some cases in this latter group, however, showed subjective benefits or a fall of pressure after a considerable period of continued treatment at home.

THE MANAGEMENT OF HYPERTENSION

Both Allen and Vogel found that in some, after a few days of such rigid salt restriction there appeared symptoms of anorexia and weakness. In these cases it was necessary to determine the tolerance of each individual to insure a freedom of privation symptoms and a control of the hypertension at the same time. Two grams daily of salt, never more, seemed sufficient to offset any symptoms of privation.

No other form of treatment, unless especially indicated, was used. Bed rest was used in only occasional cases. Drugs such as digitalis, insulin, and nitrites were used when needed.

About this time various papers appeared of experiences rather favorable to the salt free diet. Musser¹⁶ published the following results with salt and water restriction:

Case	Blood pressure mm. Hg.	
	Before treat.	After treat.
I.	185/85	125/75
II.	215/105	170/85
III.	157/79	130/80
IV.	204/115	170/105
V.	205/120	160/100
VI.	174/80	145/75
VII.	230/110	210/100

Higley and Field¹⁷ have made laboratory observations, extending over periods of years, in numerous hypertension cases treated by various physicians with salt free diet. They say, "This group of physicians were evidently convinced of the

THE MANAGEMENT OF HYPERTENSION

benefit of the method. "

Houghton¹⁸ considers that sodium chloride excretion is generally the first renal function damaged, and that it is, especially in those with high pressure, often associated with excessive retention of water and possibly uric acid. He writes that his experience is long enough to warrant temporary conclusions. Records are given of ten hypertension cases treated with salt restriction, the pressure sometimes being reduced actually below normal. He advises treatment by gradual reduction of salt intake, and mentions the privation symptoms observed when the allowance is made less than 3 gm. daily. He says, "There is no department of medicine where attention to every detail is more necessary to achieve success". The mere order for a salt free diet is supposed to suffice for edema but not for hypertension. The writer concludes that arterial hypertension is a tertiary condition, of which the immediate cause is a larger sodium chloride intake than kidney output.

Konikow¹⁹ observing a pneumonia in a woman with habitual high blood pressure, noticed a marked fall of blood pressure. Since the fall of chlorides in blood and urine during this process is rapid he assumed that probably there might be some relationship. Subsequently this patient was tried on a salt free diet by Konikow and Smith²⁰. The case was a difficult one but with the diet there was a gradual fall of the systolic pressure from 235 to 170 mm. Hg., and of the diastolic

THE MANAGEMENT OF HYPERTENSION

pressure from 130 to 112 mm. Hg. There was also relief of the subjective symptoms, especially headache. Addition of salt to the diet raised the pressure to 222 systolic and 120 diastolic.

In 1923 Selman²¹ in a similar regimen, reports good results with this treatment. He says, "The indifferent results of those who have disagreed with Allen have been on account of them misunderstanding the term "salt-free" their restriction has been inadequate".

Dubray, in 1924, observes²² after using the salt poor diet after a period of two years, which contained approximately 2-3 gm. of salt per 24 hours, that in many cases, remarkable symptomatic results were noted, particularly in the alleviation of the characteristic morning headache so common in hypertension. No effect, however, was found on the blood pressure, even after prolonged periods. It was suggested that the reduction in fluid intake and food intake which follow salt restriction, is connected with the relief of symptoms.

Steiglitz²³ (1926), referring to his own instructions, says that the patients are told that boiled meats without the gravy are the least injurious, for the high salt and extractive content of meat broths, soups and gravies is felt to be a vascular and renal irritant.

Blaisdell²⁴ (1927) reports the result of the salt-free diet treatment on thirty-five cases. He used the same diet in these cases, that is advocated by Dr. Allen. After the

THE MANAGEMENT OF HYPERTENSION

initial elimination of salt, an attempt was made to keep the 24 hour urine chlorides at .5 gm., although they ranged from .3 gm. to .9 gm. A summary of his cases shows that the blood pressure was reduced to normal in only a small number of the cases, but there was a marked lowering of both systolic and diastolic pressures in nearly every case. There was a decided relief in symptoms in all cases. With some exceptions the results obtained were independent of the time the blood pressure was raised. The blood pressure remained reduced as long as the patients remained faithful to their diet. It was noted in cases under observation over one month, an increase of 1 gram in the 24 hour urine chloride was almost invariably accompanied, within a short time, by an increase in blood pressure.

He concludes, "The results obtained in the treatment of arterial hypertension, by the Allen method, have been, in the writer's experience, far superior to those obtained by low protein, salt-poor diets, rest and drug therapy.

Some Opposed Views

McLester (1921), after reading Allen's suggestions, makes studies of his own²⁵. He writes that almost total elimination of sodium chloride from the diet for a limited period failed, in most instances, to reduce materially the blood pressure or to influence definitely the course of the disease. He was led to believe that excessive use of salt

THE MANAGEMENT OF HYPERTENSION

does real harm and that its restriction does good, but such restriction as Allen advises, accomplishes no more than the benefits which follow the dietary limitations ordinarily imposed. He adds that the almost total restrictions of salt for a period of two weeks has in certain instances appeared to depress the patient to a dangerous degree. He concludes it sufficient to say to the patient that he must eat no food which contains an unusual amount of salt, and that he must add no salt to his food after it comes to the table. Thus his salt intake will be reduced to about 2 gm. per day, an amount which he believes well within the limits of safety.

A year later, following the suggestion of Allen, that his (McLester's) salt restriction in the past has not been rigid enough, he studied a small number (10) of hypertension cases over a limited period of time to determine the effects of almost absolute elimination from the diet, of all chlorides²⁶.

Note was made of the influence of this diet upon the patient's general condition, his blood-pressure, any possible eye changes and certain chemical bodies in his blood. The chloride content of the urine was used as a check upon the accuracy with which the dietary restriction was made.

Summarizing, the following results were noted:-

1. The patients found the food unappetizing and usually ate but little.
2. The blood urea instead of decreasing seemed to increase
3. The blood chlorides, irrespective of diet, varied

THE MANAGEMENT OF HYPERTENSION

but little; while the urine chloride fell to very low figures.

4. The systolic pressure as a rule showed a moderate fall, this fall was never marked.

5. In two patients there developed weakness and prostration to a distressing degree.

6. One of the patients suddenly experienced retinal hemorrhages and other fundus changes at the end of two weeks of this diet.

He seems of the same opinion in a paper²⁷ appearing a year later. He reiterates this opinion before a meeting²⁸ of the American Medical Association several years later.

In 1930 he²⁹ makes the statement that there is no objection to advising the patient that he must eat no unusually salty food and that he should add no salt to food at the table, but that there is abundant experimental and clinical evidence to show that no good whatever comes from unnecessarily rigid salt restriction such as is attempted in the so-called salt-free diet. He says, "I am convinced that such diet long continued is distinctly harmful".

O'Hare (1921)³⁰ states that his group of experiments are not yet complete, but that they seem to be in accord with Dr. McLester's conclusion that a diet containing less than 0.5 gm. of sodium chloride does not reduce the blood pressure more than less radical measures. And says, "Curiously enough those cases that showed the normal chlorides averaged the higher blood pressure", speaking of a series of 45 of his cases of hypertension.

In 1923 he appears with a study of 18 cases³¹. He enumerates various reasons for doubting the efficacy of the salt free regime as set forth by Allen but conducts studies

THE MANAGEMENT OF HYPERTENSION

along these lines. He states that at first this seemed a simple, straightforward piece of work but the difficulties were many. The patients were all kept in bed during the entire period of observation. All were given a fixed diet containing 60 gm. of protein, 3,000 calories, and 1,800 cc. of fluids. The salt intake was alternated from 0.5 gm. and 4 gm. over varying periods of time.

Blood pressure readings were taken at the same time each day. The chloride in the urine quantitated daily to control the intake. The only way to view the results is to study the table of cases (see article). He concludes that the extremely low salt intake has no advantage over the older, less rigid, restrictions. He states that the very low salt diet is, furthermore, difficult to carry out at home and is very expensive. He also suggests that salt plays very little part in vascular hypertension.

In 1927 O'Hare again writes³² that extreme salt restriction in his hands has been of no value. He says, " It should be remembered that at all times when a remedy is tried which aims at a reduction in pressure that marked variations in pressure are the rule in this disease, and that the greatest conservatism in the interpretation of the effects of any given therapy should be exercised. "

Christian, in 1923, writes³³ that another, recently adduced, cause for hypertension is that it results from a disturbed salt metabolism and can be satisfactorily treated

THE MANAGEMENT OF HYPERTENSION

by eliminating salt from the diet. He states that his studies at the Peter Bent Brigham Hospital have not supported this view. He maintains that salt retention is dependent upon renal function and is accompaniment of some cases of hypertension and is not an important causative factor.

Mosenthal and Short³(1933) carried out experiments to determine the effect of moderate doses of salt on patients suffering from hypertension. The patients were kept in bed for a period of days and frequent blood-pressure readings were made. After the spontaneous variations characteristic of each case had been recorded 10 gm. of salt were given by mouth or through a stomach tube. The conclusions were as follows: "In a series of experimental observations the ingestion of 10 gm. of salt failed to raise the blood-pressure in cases of hypertension."

Berger and Fineberg³⁴ take up the study of salt-free diet in thirteen patients carefully observed in the hospital for a period of time ranging from 20 to 81 days. Salt was withdrawn from their diet to the extent that their output dropped to below 1 gm. per day. After being kept at this level from 2 to 3 weeks, salt was added to their diet in quantities from 10 to 30 gm., per day. They failed to see any unquestionable modification of the blood pressure curve which could be definitely attributed to variations in the salt intake.

Hayman(1930) from a study of several patients in the

THE MANAGEMENT OF HYPERTENSION

wards of the hospital of the university of Pennsylvania³⁵ decides that so far as his experience goes, he has not been able to recognize any reduction of high blood pressure which he could attribute, with confidence, to salt restriction, nor does a critical review of the literature persuade him of its value..

And so, especially more lately, most men do not agree with Allen. They conclude that hypertension is compatible with normal blood chloride and normal tension with with high blood chlorides. All seem agreed, however, that from clinical observations, salt should be moderately restricted.

THE MANAGEMENT OF HYPERTENSION

III. THE QUESTION OF DIETARY PROTEINS

There still seems to be a general impression abroad that proteins in the diet have a tendency to increase arterial tension. There is not much evidence to support this contention. Goodall (1913) found that³⁶ in cases of chronic interstitial nephritis the blood pressure dropped while the patients were taking low protein in their diet.

Sir Clifford Allbutt (1915) writes³⁷ that he has again and again placed high blood-pressure patients on purin-free diets, on vegetarian diets, and milk, cheese and egg diets, with no appreciable reduction of blood-pressure within such time limits of weeks as to satisfy the conditions of an experiment.

Mosenthal, in 1920, conducted a study, in 9 cases, on the effects of protein³⁸ on the blood pressure. The patients were kept in bed and were fed alternately on high and low protein diets. The results showed that it is exceptional for a low protein diet to diminish the blood pressure, one case only, however, seemed to show that this may occur. This was an extreme case bordering on uremia. A second period of low protein regime failed to give the same result. In short, the diminution of waste products in the blood, as indicated by lowering of the blood urea nitrogen, was without effect upon the blood pressure.

Webber (1923) believes³⁹ that the former idea that the retention of the end products of protein digestion act as

THE MANAGEMENT OF HYPERTENSION

irritants that stimulate the heart and arteries to increased activity and thus raise the blood-pressure, have never been proven. It is true that a secondary anaemia can be produced by restricting protein, which will diminish vitality and lower blood-pressure, but the patient pays the price in lessened efficiency. In cases of essential hypertension enough protein food should be allowed to maintain the body in efficient condition.

Squier and Newburgh⁴⁰ came to the conclusion that "high protein over a short period had no effect on blood pressure". Their study included cases of essential hypertension as well as of nephritis. The amounts of protein given these patients were high, well over 150 gm. per day. As the result of the forced protein diet, signs of renal irritation appeared but the blood pressure remained unchanged. Similar findings in regard to blood pressure have been reported by Strouse⁴¹.

Strouse and Kelman⁴² said that up until this time (1923) references to damage by protein were only expressions of opinions with little or no foundation. He refers to such men as Hamman, Meara, Bishop and Musser. Hence he conducts a study for the purpose of acquiring more experimental data than could be found in the literature, on the subject of relation of protein intake to high blood pressure, at that time. Ten patients were studied and they (the authors) were unable to convince themselves that the patients were harmed

THE MANAGEMENT OF HYPERTENSION

by protein. Excess of any kind of food seemed decidedly more injurious than a moderate amount of protein in a well balanced diet. They concluded that in patients with hypertension and with slight or no impairment of renal function, marked variations of blood pressure, but such variations bear no relation to protein intake.

Of interest on the question are the statistics of the Life Extension Institute at this time (1923). They are⁴³: 16% high protein feeders in the hypertensive group, and 29% high protein feeders in those with normal blood pressure. These figures were arrived at from an analysis of 1,021 cases of arterial hypertension, and 13,308 with normal blood pressure.

Mosenthal³ (1923) proclaims that the practice of modern blood chemistry has set aside the belief that retention of nitrogenous substances might be responsible for raised arterial tension. He says that the experience of everyone practicing this branch of medicine is that this idea is incorrect. Williams (1921) recalls attention⁴⁴ to the fact, "The height of blood pressure bears no relationship to the amount of non-protein-nitrogen substances in the blood."

Herric (1923) gives evidence along the same lines in his account⁴⁵ of six patients who consulted him for "high blood-pressure"; they had all been put on a non-protein diet, and as a consequence had made up the deficiency with carbohydrate, and all felt worse, their weight increased

THE MANAGEMENT OF HYPERTENSION

and their blood pressure was greater than before. He gave them a fairly liberal allowance of protein, but reduced their carbohydrate, and limited their total intake of food in calories to about three fourths of their normal requirement. They all showed prompt improvement in subjective symptoms, their weight decreased and their blood-pressure was markedly reduced.

For a time there seemed to be a swing of the pendulum toward the other view. Donaldson⁴⁶ working (1926) on a group of students to determine the influence of protein upon the blood pressure, found that proteins themselves (since milk did not cause a raise in blood-pressure) were not factors but he thought that probably extractives of meat have a very decided effect upon blood-pressure. He makes no definite conclusions but states that he believes that vegetarians run a consistently lower pressure than those who use flesh foods.

Nuzum et al (1925) in an experiment on rabbits,⁴⁷ placed on a high protein diet, were apparently able to produce an increase in blood-pressure without exception. Three different types of protein were used. There was evidence of renal irritation by the appearance and persistence of albumen and casts in the urine, and by a retention of non-protein-nitrogen and urea nitrogen in the blood. They suggest that diets containing excessive acid or alkali ash, necessitating excretion of excessively acid or alkaline urines over long periods of time, might, in themselves, be responsible for

THE MANAGEMENT OF HYPERTENSION

degenerative blood vessel and kidney changes. In 1926 Nuzum, with others,⁴⁸ again feeds rabbits on high protein diets and produces hypertension, after two years of such diet. The animals in which the most marked increase of blood-pressure was obtained presented extensive sclerosis of the aorta and often the coronary arteries. Later in the year (1926) he again reiterates his previous findings⁴⁹. To determine whether the medium of the urine or disturbance in the acid-base balance might be responsible for the increased blood-pressure and degenerative vessel changes he rendered the urine of rabbits highly acid and kept it there for a period of months, he found chemical evidence of kidney damage and an increase in blood-pressure, but no instance of arteriosclerosis.

On the other hand Lieb (1926) makes some observations on the arctic explorer Mr. Stefansson⁵⁰, who had lived for a number of days, totaling nine years, on an exclusive meat diet. He lived for nine successive months on an exclusive meat diet. Men in the various specialties have examined Stefansson and reports have been entirely negative. all laboratory tests and other findings were normal. Stefansson himself affirms that his observations on the health and longevity of Eskimos led him to the conclusion that the high protein diet has no deleterious effect on their circulation or kidneys.

Thomas (1927) makes a rather extensive study⁵¹ of the incidence of renal and vascular disease in the Eskimo, a

THE MANAGEMENT OF HYPERTENSION

race of people subsisting on a total meat diet, and finds that they exhibit no increased tendency to vascular and renal disease. While the Labrador Eskimo, whose diet includes many prepared, dried and canned articles, is very subject to both these maladies.

THE MANAGEMENT OF HYPERTENSION

IV. THE QUESTION OF ORGANOOTHERAPY AND CALCIUM METABOLISM

A review of the question of protein gradually merges into the problem of certain metabolites, the detoxifying function of the liver, and parathyroid function; thence to organotherapy and calcium administration and its metabolism, concomittantly, the relation of calcium to vaso-motor equilibrium mechanism.

In 1924 Major⁵², beginning with the assumption that some protein body, a product of metabolism, had a pressor effect, investigated the properties of some of the better known metabolites. Urea, uric acid, creatin etc., had no constant effect on the blood-pressure, but another group of experiments showed that the guanidine bases have a very powerful pressor effect. All the compounds of guanidine show a striking ability to raise blood-pressure and maintain it at a high level, often for 5 to 6 hours from a single small dose. Following this (1925) he observed two patients⁵³ who with a fall of blood-pressure, under treatment, also show an accompanying output of dimethyl guanidine in the urine. The output for several days after the fall of blood-pressure was quite high, suggesting the previous retention of an excess in the body. He suggests that this may be in relationship to the hypertension.

A month later he states⁵⁴ that the injected guanidine compounds disappear from the circulation very rapidly, to be clear five minutes after the injection, although the

THE MANAGEMENT OF HYPERTENSION

blood-pressure remained high for 4 or 5 hours. He says that calcium chloride injections produce an immediate fall with a cardiac irregularity, but when equal amounts of potassium chloride are added no irregularity occurs. If injected before the guanidine, no rise in pressure occurs. Liver extract has a very profound effect on this hypertension due to guanidine, reducing the pressure to normal in a few minutes and keeping it so. When added to methyl guanidine in proper amounts and injected, no rise in blood-pressure occurs. He states a desire to try this in arterial hypertension.

Later⁵⁵ he states that in cases with hypertension, while the blood calcium was low the blood-pressure was high, and as the calcium rose the pressure fell. He reiterates his statement concerning the liver extracts. Apparently thinking there might be some relationship to the calcium metabolism he uses parathyroid extract⁵⁶ with a drop in the experimental hypertension. Both this and liver extract produced a hypotension in normal dogs but the effects were evanescent.

James⁵⁷ (1924) began experiments with liver extracts, in rabbits rendered hypertensive with epinephrine. Here the blood-pressure was also reduced by the use of the substance. The degree of effect on blood-pressure seemed to be dependent on the dosage and the strength of the extract. He was able to reduce the blood-pressure in normal rabbits and sustain it at about one half its usual tension, by the use of this substance.

THE MANAGEMENT OF HYPERTENSION

Macdonald (1925) while conducting experiments with liver extract in an attempt to produce a control for cancer⁵⁸ noticed that in his subjects there was a reduction of blood-pressure. This led him to make a clinical test on a case of hypertension on December 18, 1924. He then observed 33 clinical cases of hypertension and obtained the following results: The average systolic pressure was reduced from 204 mm. Hg. to 142 mm., an average fall of 62 mm. Hg. He does not say how many cases did or did not respond, individually.

James et al (1926) declare that their results with liver extracts up to this date have been gratifying.⁵⁹ In some patients the depression in blood-pressure was very gradual, and the lowest point was reached many hours after the injection. In other cases the effect was immediate and persistent. They say that the clinical data accumulated at the present time is not exhaustive, and that, unfortunately, the instability of the depressor principle under the most favorable conditions is such that the extracts have to be administered freshly prepared to insure the best results.

In 1926, Major with others⁶⁰ again reports with results similar to his previous ones. Several months later he shows⁶¹ that the action of the guanidine acts as a vaso-constrictor on the arterioles and capillaries and that the action of the liver extract consists in abolishing this constriction. He says that the liver extract has no effect upon the blood-pressure of normal animals.

THE MANAGEMENT OF HYPERTENSION

Harrower⁶² reports (1926) a preparation of liver extract which may be given by mouth. He reports very good results. He admits some failures but these he attributes to "sclerotic processes which accompany the hypertension. He believes the active substance is some unknown catalytic agent which aids the liver in its detoxifying functions.

Willis (1930) mentions⁶³ the case of a woman aged 52 in whom he had to resort to repeated blood letting to relieve her hypertension. He can now maintain her blood-pressure at a satisfactory level by 4 or 5 injections of liver extract (anabolin) per year. His own father aged 72 years, has had his blood-pressure reduced by the use of the substance from 190/120 to 140/90, after ten daily injections. He still maintains this pressure one year later.

All the above evidence tends to betray some pressor substance present in the blood, however, Curtis and others⁶⁴, by injecting the blood of hypertensives into the blood stream of experimental animals (cats), were unable to find any evidence of a pressor substance present.

Above, we have Major's evidence⁵⁵ of a low blood calcium during the highest tension, and its reduction by the administration of parathyroid extract. Reid⁶⁵ writes (1925) a masterly article setting forth the theory that hypertension may be on the basis of an aberrant calcium metabolism; that a reduction of calcium in the body removes or seakens the inhibitory influence of the vagus nerve and then the sympath-

THE MANAGEMENT OF HYPERTENSION

etic nerve stimuli which are known to augment or increase blood-pressure are unopposed.

Similarly Pratt⁶⁶ writes (1925) that calcium is supposed to, pharmacologically, to have a beneficial effect on the autonomic nervous system, making the balance between the sympathetic and para-sympathetic more even. An irritable or unopposed sympathetic system may respond under certain conditions to various stimuli, either toxic or reflex, to produce a vaso-constriction, especially of the smaller arterioles and an elevation of the blood-pressure.

In 1924 Addison reported the results obtained by calcium therapy in 14 cases of hypertension. In 1925 he does further work⁶⁷ on a group of 45 consecutive cases. They were given from 90 to 180 gr. of calcium chloride per day, depending on their weight. Blood-pressure readings were taken weekly. If at the end of a month's time no fall in pressure was noted, potassium chloride was substituted for the calcium salt, in the same doses. All cases had an initial systolic of 170 mm. Hg. or over. Only those cases were considered as reacting in whom the systolic pressure was reduced 30 mm. Hg. or more. Of the forty-five cases 26 or 57.7% reacted with calcium and 13% with potassium chloride making in all 70%. Not only was the blood-pressure reduced but the patients felt decidedly better. He summarizes by saying that these two chemicals will produce a decided fall in blood-pressure in a large percentage of the cases with hypertension, with con-

THE MANAGEMENT OF HYPERTENSION

siderable improvement of the patients symptoms. The treatment must be persisted in for 3 or 4 weeks to get results. The only serious objection is the possibility of producing symptoms of an inorganic acidosis, since some of his patients experienced gastrointestinal upsets.

Davis (1931) decides⁶⁸ that his patients, when kept on calcium lactate, 8gm. in water, taken one-half hour before meals, plus a low salt, low protein diet, experience considerable subjective improvement but objectively is of little value. His patients maintained that they felt much better on the calcium regimen. He believes that hypertension, like fever may be intermittent, remittent, continuous or pernicious.

Then we have the report of Altnow and O'Hare⁶⁹ (1928) who, after reviewing the literature, gave calcium and parathyroid preparations in adequate doses with little or no results. They conclude that the question of calcium and guanidine metabolism are not an answer to the problem of hypertension.

THE MANAGEMENT OF HYPERTENSION

V. OBESITY AND HIGH CARBOHYDRATE DIET

When proteins are unduly excluded from the diet, it is obvious that the caloric deficiency must be gotten from some other source. The tendency is to derive this from the foods of high carbohydrate content. The carbohydrates have always been considered as innocuous⁷⁰, however, if the combination of obesity and increased tension does exist, a restriction of the starchy foods may bring relief. The same may be said of fats in this class of cases.

Herric's work⁷¹ (1923), pointing to the syndrome of obesity, hyperglycemia and hypertension, has done a great deal to indicate the ill-effects of the conventional low protein, high carbohydrate diets that have been prescribed for these patients, and as showing the good effects that come from reducing their weights. Mosenthal³ (1923) states that one of the present food fads is to avoid meats and eat starch ad libitum. When these precepts are followed without discrimination hypertension, as well as obesity, appear to be among the penalties entailed. He cites a patient 56 years old, weighing 215 pounds, with a blood sugar of 0.160 who ate a great deal more than his share, the blood pressure dropped from 146/88 to 112/72 when carbohydrate foods were curtailed. The weight at the same time diminished by 25 pounds. Dr. Herric⁷¹ was able to lower the blood-pressure in an obese woman from 200 to normal through regulating her starchy foods and thus her weight. Gibbes⁷² (1923) noted

THE MANAGEMENT OF HYPERTENSION

that 55% of his 100 patients were above their optimum weights.

Terry⁷³ in a study of 63 cases of obese women found that although patients were referred to his clinic for obesity 58% of them had hypertension. This was so common that it became usual in that institution to use the term in diagnosis "obesity and hypertension". The most striking individual case was a drop from 275/150 to 205/125 after a weight reduction of 13 pounds. He concludes that the majority of fat women who seek medical attention have hypertension. This hypertension is usually without findings suggestive of nephritis, diabetes or syphilis. On a high protein diet of low caloric content there is a lowering of weight together with a lowering of blood-pressure and this frequently relieves the chief complaint. He spoke only of the group and average results so we do not know in how many he effected a blood-pressure reduction.

Foster⁷⁴ (1923) remarks that it is a well known clinical fact that with the reduction of body weight and the lowering of the red cell count in over nourished cases, hypertension is benefited. The physician is the sole judge of the degree of reduction of food and liquids and body weight which may be permissible in a given case.

Fisk et al⁷⁵ (1925) found that in the ages of 45 to 54 those persons 20% or more overweight showed, as compared to those of normal weight, approximately two and one half times as many with systolic blood-pressure 20 to 60 mm. Hg. above

THE MANAGEMENT OF HYPERTENSION

normal and five times as many with 60 mm. Hg. or more above normal.

Barksdale⁷⁶ (1925) in a metropolitan insurance company's survey of 17,000 cases, showed that 50% of the overweights carried an increased blood-pressure (more than 20 mm. Hg. above normal). It would seem from the above and general clinical experience, that a gradual reduction in weight should be accomplished, probably two pounds per week is a safe rate. Fischer has shown that persons 20% or more in excess of their normal weight average a blood-pressure higher than those of normal weight.

Rose's⁷⁷ first observation was made (1926) while reducing the weight for a very stout woman. He noticed that her blood-pressure was reduced along with her weight reduction. The point was followed and he found it to be the rule that reducing weight also reduces blood-pressure. He reports results that have remained up to seven years, as long as they have been under his observation. Only those patients with distinct organic lesions failed to respond. He presents a table of 35 cases starting with an average pressure of 190/109 and these were reduced to 151/89, average. Others began higher with more remarkable results.

Master and Oppenheimer⁷⁸ show 28 cases in which continuous histories were taken, and in which the average loss of weight was more than 30 pounds. A distinct improvement was seen in some or all complaints, in all the cases. Further

THE MANAGEMENT OF HYPERTENSION

study of 97 obese patients revealed that 67% showed a condition of hypertension, a systolic of 150 mm. Hg. or more in persons over 30 years of age. With a reduction of weight there was a fall of both systolic and diastolic pressures, usually more marked in the systolic. In 53 patients whose average reduction of weight was 25 to 30 pounds the systolic was reduced on the average of from 25 to 30 mm. Hg. In one the blood-pressure again raised with gain in weight. Their clinical and laboratory studies show definitely that in obese persons a distinct circulatory embarrassment, as proved by the abnormalities of blood-pressure, pulse rate, roentgenogram, and electrocardiogram, exist. Riley⁷⁹ (1929) reports very gratifying results in the treatment of hypertensives by weight reduction.

Rose⁸⁰ after continuing his observations teaches (1930) that the diastolic and systolic pressures can be reduced approximately 50% of the amount by which they exceed 80 and 120 mm. Hg. respectively. By means of rational feeding, patients with hypertension may be carried along for years on lowered pressure, reducing the number of deaths from heart and arterial causes.

THE MANAGEMENT OF HYPERTENSION

VI. INFECTION, FOCAL, AND AS A FORERUNNER

Quite early attention was turned to the possibility of vascular damage, as a sequel to typhoid fever and other acute febrile conditions, having a direct relationship to hypertension. Later, by the same token, the question of focal infection was invoked. As early as 1905 Thayer⁸¹ reported the results of his examinations of 183 individuals who had previously had typhoid fever. He found that 54 had a systolic pressure of 160 mm. Hg. Twenty-seven had blood pressure over 180mm. Hg. and ten of these 27 had a blood pressure of 200 or over. Of 276, supposedly normal, controls, ten had pressure over 160. One of the 276 controls had a blood-pressure of 180. To make his data more accurate he removed from this group those that gave a history of previous serious illness that might have been responsible for the production of hypertension.

Walker⁸² says (1924) that heretofore with the exception of Thayer most of the references to the relationship between infection and hypertension are casual statements. He conducted a study of 400 patients with a previous history of measles, mumps, scarlet fever, diphtheria, teeth infections, small pox, etc. In none of these groups except the "typhoid fever" group does he find any higher incidence of the hypertensive disease than in his 400 controls. he concludes that there is no great that infect-

THE MANAGEMENT OF HYPERTENSION

tions play a very important part in the causation of hypertension. He says, however, that the relatively high incidence of typhoid fever in his, Thayer's and Barach's cases is noteworthy and may be of some significance in this respect. Hughton⁸³ while trying to prove that salt retention is the direct cause lays stress on the fact that all these cases give a history of some infection such as scarlet fever, tonsillitis, chorea, etc.

Foster⁸⁴ (1922) says that while there is not a vestige of evidence pointing to a causal relation of infections to hypertension, yet, on the other hand, foci of infection should not be ignored, because they predispose to vascular and renal degeneration, which are so commonly sequels to hypertension of long standing. Then, too, foci of infection whether in the tonsil or the gall bladder, are obstacles to the return of full health. From this point of view, then, infections, of whatever origin, should be given every possible attention.

Barach⁸⁵ believes in the diseased tonsil as being intimately associated with hypertension. In the female he describes a picture which he calls the "tonsil thyroid syndrome." In both sexes with tonsillar infection he describes a potential obese and sluggish type of individual. He speaks of several cases where he firmly believes that previous history of tonsillar disease was a very great factor in the producing of the condition. He says of these, "This is the type of in-

THE MANAGEMENT OF HYPERTENSION

dividual who has been described as a candidate for hypertension. He is in reality not a candidate, but he has long been elected to that group. After senescence begins, he will sooner or later show an established hypertension."

Powers cites two cases, one with very bad teeth and one with large "juicy" tonsils. After months of no response to dietary treatment the respective focii of infection were removed with a return of blood-pressure to normal in a few weeks. One was seen 6 months later and the other 18 months later, both with a persistence of normal blood-pressure.

Dubray⁸⁶ says (1934) that in the preliminary survey of cases of hypertension, local focii of infection in all regions should be noted. Although no direct relationship has been established between focal infection and vascular hypertension, nevertheless, they should be gradually and carefully eradicated. He is of the opinion for two reasons; in the first place, it is urgent to maintain the general resistance of the patients; and in the second place, it is important to protect the cardio-vascular-renal from added strains or damage from infection.

Philips (1925) cites⁸⁷ the case of a man, age 36, who was refused life insurance. His blood-pressure was 160/75. He had been under a severe nervous strain, had not been careful about his diet, had smoked to excess and was harboring a pair of infected tonsils. He was given careful instructions as to diet, rest and exercise and was advised to stop

THE MANAGEMENT OF HYPERTENSION

smoking and to have his tonsils removed. These instructions were carried out and within a year his systolic blood-pressure was 125, and, up to five years later had not been observed to be above 130 at anytime.

Gibbes (1926) found in 100 hypertensive cases studied by him⁸⁸ that in 82% of them that improved, focal infections were found and removed, in 30% of the unimproved cases this was done, and in only 11% of the deceased cases were focal infections eliminated. He suggests that the practical omnipresence of focal infection, and the improvement associated with their elimination, suggests a contributing responsibility of these infections, to hypertension.

Post (1926) makes a study of 110 cases of hypertension⁸⁹ and finds that 91% have some focus of infection. The most frequent being somewhere about the head, particularly, dental tonsillar, or chronic nasal infections. He (and Steiglitz) summarizes: " The etiology of vascular disease with so called hypertension is not uniform, varying with different cases. Past and present infections, particularly those which tend to become chronic and focalize are the most conspicuous causative factors * * * * *. In any one given case a combination of factors may usually be found after careful study of the situation."

Boston⁹⁰ reports a series of 45 cases of hypertension (1927) with a systolic pressure persistently above 200 mm. Hg. He finds cure or relief in an overwhelming percentage

THE MANAGEMENT OF HYPERTENSION

of these cases upon the removal of foci of infection, usually the teeth, less often the tonsils.

Jenkins⁹¹ offers the opinion that bacterial toxins primarily derived from acute infections, remaining present and acting over long periods of time, or from focal infections, concealed or obvious, constantly feeding toxins into the circulation, would probably, by popular vote, head the list as causative factors in the condition under consideration. He states that there can be no doubt about this whatever. The connection is too direct and convincing. The majority of our doctors who have practised medicine for twenty-five years can recall a number of cases in which every phase, every step, every symptom and every detail could be distinctly traced; a good part of the process, perhaps, having enacted itself under the direct observation of the family doctor.

It may seem a little aside here but we will make brief mention of other possible sources of toxins and perhaps irritants (reflexly) to the vaso-motor equilibrium mechanism. O'Conner, Monakow, and Mayer⁹² show that prostatic hypertrophy with its mechanical interference with urinary elimination may result in hypertension, which condition returns to normal after the use of catheter and operation.

Owens⁹³ says according to Prof. F. Muller (Munich), hypertension and uterine fibroid so frequently occur together that some casual relationship must be assumed. He states that Rontgen rays may reduce the fibroid but do not influence

THE MANAGEMENT OF HYPERTENSION

the hypertension, whereas the blood pressure may become normal after operative removal of the fibroid. He cites a case of hemorrhage from the uterus where examination elicited a uterine fibroid about the size of an orange. In view of her condition it was deemed best to use radium on her instead of surgery for eradication of the tumor. All hemorrhage stopped and within two weeks the systolic blood-pressure had dropped from 200 to 170 mm. Hg. and within one month to 150 mm. It has since remained within normal limits.

Not all men agree, however, as to the status of foci of infection in relation to hypertension. Barksdale⁹⁴ gives the opinion (1925) that the matter of focal infection has been so much discussed, both pro and con, that one can take one stand only and that is removal of proved sources of sepsis, purely on general principles, as per se their place in hypertension has been markedly exaggerated as proved by observation of the Metropolitan Life Insurance Company, the Life Extension Institute and others. They were unable to establish any definite connection between focal infection, in general, and hypertension.

Lewis⁹⁵ remarks (1926), "Focal infection has here, as in every branch of medicine, been seized upon with gusto; and teeth, tonsils, and gall-bladders have been disappearing with alarming rapidity from our middle aged clientele. There is much in this matter of focal infection but it is about time that we take account of stock and show a little common

THE MANAGEMENT OF HYPERTENSION

sense in the matter. * * * * * In the early case, with or without other known etiology, I am heartily in accord with the extirpation of all known focii of infection but with the advanced case presenting a high diastolic pressure, particularly where heart and kidneys are involved, routine removal of teeth and tonsils offers no relief."

Brown et al⁹⁶ assume the following attitude; "In a small group of cases the removal of infected teeth or tonsils was advised for various reasons, although hypertension was not necessarily included. As a result of an examination of such patients from time to time we have found that removal of infected teeth and tonsils does not influence the level of blood-pressure and we would not recommend such a procedure solely for its effect on essential hypertension."

THE MANAGEMENT OF HYPERTENSION

VII. CONSTIPATION AND INTESTINAL TOXINS

The question of dealing with constipation and colonic irrigation has been much exploited, especially by the manufacturers of physical therapy equipment. It seems that many sincere practitioners are firmly convinced of its value. Davis⁹⁷ cites the presence of chronic intestinal trouble in 50 of 55 patients with arterial hypertension, which symptoms were present for from twenty to thirty years before the hypertension was discovered, together with the fact that the most effective treatment of hypertension is the diet that will correct such intestinal trouble, make these observations of interest.

Bicak⁹⁸ believing that hypertension may be caused by toxins emanated by the colon bacillus, treated twenty-four cases by subcutaneous injections of a sensitized vaccine of the colon bacillus, 2,000,000,000 to the cubic centimeter. The cases were taken without any selection whatever. The injections varied from one-half to five minims, the first was usually two, and were given every two to seven days. He gets a response in all of these cases, in some very marked. He remarks:- "The belief, that hypertension is caused by the toxins of the colon bacillus seems to be justified by the following reasons : The hypertension was improved in all the cases cited, by the injection of sensitized colon vaccine. When the pressure reaches normal, further treatment with the vaccine does not reduce it anymore. Dizziness is a common symptom of hypertension, as well as such conditions as constipation, indigestion, etc., in which

THE MANAGEMENT OF HYPERTENSION

one would expect more of the toxins of the colon bacillus to be absorbed from the bowel.

Davis⁹⁹ states that it is quite generally admitted (1927) that dissemination of bacteria may take place from the intestinal tract. Indican in the blood and urine is indicative of intestinal putrefaction and is disseminated from the intestinal tract indicating that other split products resulting from bacterial growth may be so disseminated. The frequency with which intestinal stasis (referring to his previous paper) of many years duration is found in patients with pathological blood pressure, makes it seem probable that dissemination of pressor or depressor substances from the intestinal tract may be an important etiological factor.

Some of the authorities in this field however, do not agree that there is any direct relationship between the condition of hypertension and constipation or other intestinal disorders. Alvarez¹⁰⁰ (1926) says, "It is commonly assumed by the practicing physicians that 'intesntinal autointoxication' has something to do with the production of hypertension. The more thoughtful writers on the subject, knowing that there is no mass of statistics to which they can turn for enlightenment, are guarded in their statements, but those who live by washing colons, and those who have for sale laxative drugs and foods and patented syringes, have no such inhibitions. They proclaim from the housetops, that one of the dire consequences of constipation is high blood pressure, and to a large extent their propaganda is believed."

THE MANAGEMENT OF HYPERTENSION

He makes a statistical study and analyzes the records of 410 men and 585 women. Of these, 436 were classed as normal, 414 as habitually constipated, and 110 as having occasional or recent constipation, and 35 as having diarrhea. He compiles his work into lucid tables and deduces that in men constipation has absolutely no effect on the blood pressure, in women, there is a pretty definite connection between constipation and a slightly lower mean blood pressure.

THE MANAGEMENT OF HYPERTENSION

VIII. THE QUESTION OF NERVOUS RELAXATION AND DIATHERMY

Much has been said in regard to the relationship of unstable emotional states to the problem of hypertension. O'Hare¹⁰¹ has shown (1921) that conversing about worrisome topics will raise arterial pressure to an amazing degree; Mosenthal relates an incident of an elderly methodical gentleman, who was in the habit of visiting him once a month, to have his blood pressure determined. His blood pressure fluctuated between 170 and 190 mm. Hg. over a period of several years. At one time it reached 240, to return to the usual level a few weeks later and remain there. Investigation showed that his brother had been the subject of an exploratory laparotomy for a tentative diagnosis of carcinoma; the tumor proved benign and recovery of the brother was assured. With the favorable turn of events the blood pressure of the former dropped, to the original level.

Foster¹⁰² speaks (1922) of the over busy driving type of successful man of affairs. He says that nothing can be accomplished by diet or exercise if the incentive to drive be left unmolested, and advocates treatment in special sanatoriums. He advocates outdoor pursuits with a sort of re-education and a corrected philosophy of life.

Greene¹⁰³ writes (1923) that possibly no phase of the work of the Neuro-psychiatrist is more frequently encountered than the matter of dealing with the impressionable person who has been stigmatized as a high blood pressure case. The pronunciation of a diagnosis of high blood pressure, given with an attitude of

THE MANAGEMENT OF HYPERTENSION

a well-meant but misdirected concern, has the effect of thrusting apprehension into conscious mentality of nervous, irritable, exhaustible people, who are combating ill-defined subconscious mental conflicts. Dr. M. A. Mortensen, (1922) in the bulletin of the Battle Creek Saniterium, invites attention to fluctuations in blood pressure readings, and offers as an opinion that the systolic reading changes range as high as 40 mm. Hg., due, he believes, to apprehension, worry, emotional disturbances and nervous tension. O'Hare and Boas have recently shown that nervous influences cause blood pressure to rise and fall in a most bizarre way.

Jenkins¹⁰⁴ (1924), however, believes that it would be difficult to conceive of any primary or direct method or way, by means of which worry, overwork, or stress could produce the condition in question. At most they could act as a contributory factor by paving the way for the real underlying or exciting cause.

Since deep heat seems to be essentially a method of bring-about a nervous relaxation, we will give some of the views held in regard to the place that diathermy holds in the management of hypertension.

Foster¹⁰⁵ (1923) opines that electrical high frequency in the form of the Tesla or D'Arsonval Current, given in the form of auto-condensation with the patient reclining, is rewarded with a state of mental and physical relaxation during the application of the current. This treatment is the application of heat resulting in stabilizing, in an indefinite manner, pressure and re-

THE MANAGEMENT OF HYPERTENSION

sistance with consequent lowering of the blood pressure. The electrical treatment at least has the effect of bringing the nervous over-active hypertension case to one's treatment room for a period of twenty minutes of absolute rest and relaxation in the midst of a business day, and is rewarded by giving more satisfactory results and more lasting effect than is usually observed following the administration of drugs alone.

Humphris¹⁰⁶ believes that the therapeutics of this current in lowering blood pressure are twofold. One, the general or constitutional effect as affecting metabolism; and the local effect on the vaso-motor system. Clinically there is gain in physical and mental strength and general improvement in health and the symptoms involved. The insomnia, palpitation, anxious fears, or whatever may be the subjective trouble, disappear. Chemically, there is an increase of solids in the urine, and a similar increase has been found on analysis of perspiration.

Dubray¹⁰⁷ (1924) says it is generally accepted that high frequency current will produce temporary reduction in the blood pressure with an accompanying relief of symptoms. I have had no experience with its use, but see no objection to its employment for the symptomatic benefit it may afford provided its administration is carried out by physicians with the special knowledge which is necessary.

We quote Allbutt¹⁰⁸, "D'Arsonvalism is the one means known which does influence high pressure, and is the most valuable aid we have in hyperpiesia; even if the lowering of the pressure is

THE MANAGEMENT OF HYPERTENSION

temporary, something has been gained."

Brown et al ¹¹⁰ cannot agree as to the value of diathermy in this condition. They state that it has proved absolutely worthless, in their hands as a means for reduction of elevated blood pressure.

THE MANAGEMENT OF HYPERTENSION

IX. EXERCISE

Certainly exercise has a place in the management of hypertension. Crampton¹¹¹ states that exercise has been little used because of ignorance in application to circulatory diseases which made it safer to limit the patients exercise than to venture into a dangerous unknown. These dangers exist. Most evident risk lies in the increase in tension resulting from most common forms of exercise. A greater danger lies in the damage resulting from coincident fatigue or excitement. This damage is sometimes merely excess wear and tear which has gone beyond all power of the tissues to rebuild. Exercise is always a destructive process, though by exercise we desire to arouse a repair stimulus which effectively reconstructs the tissues, and makes them stronger. He says, "Muscular activity can be safely used in circulatory diseases, as a ship can sail a sea where the rocks and dangers are fully known and marked." Not only is it necessary to know the dangers of exercise, but its benefits and uses." He confines his whole paper to the varieties that may be used. He summarizes by saying that it has a place in the therapeutic program and its omission should be considered the exception and not the rule.

The question of exercise¹¹² should be reviewed. Extremes of exertion are contraindicated. These patients should not do heavy work, should not hurry, should not run upstairs or after street cars, should not indulge in competitive athletics, tennis, baseball, track etc.,. Most essential hypertensives lead too sed-

THE MANAGEMENT OF HYPERTENSION

entary lives. They should take moderate exercise, walking and golf, which should be carried to a point below the threshold of fatigue and dyspnea. Experience shows that many cases feel better for exercise, the explanation being that blood pressure frequently falls after exercise.

In this connection, Rapport¹¹³, in conjunction with exercise, judiciously graduated, is a strong advocate of hyper-ventilation in the treatment of hypertension. He has for some time, in a few cases, been able to maintain marked reductions in blood pressure by deep breathing exercise. He notices that the victims of this condition are "notoriously poor breathers". His theory for the explanation of these results is essentially that the lesser circulation has a depot function which is the principal factor in regulation of pressure conditions in the systemic circulation. Reduction of this depot function, as caused by reduced respiratory function is probably the most important factor in the pathogenesis of chronic hypertensive disease.

This is not the first time such ideas in relation to the cause of hypertension have been propounded. Several foreign writers have done work along these lines, Lintz, Weinstein, and Mirtl being among the more important.¹¹³

THE MANAGEMENT OF HYPERTENSION

X. DRUGS

Merely a review of the titles of the articles appearing within the last five years on the treatment of hypertension suggests the use of 28 drugs, organic and inorganic. A review of the articles themselves show that this number must be doubled or trebled. This carries with it the inference that none of the various preparations suggested has been quite satisfactory. We will mention only some that have met with, apparent, general favor for a short time at least.

Potassium thiocyanate enjoyed considerable favor for a time. Pauli¹¹⁴ in 1903 first describes its use therapeutically. In 1925, Nicholas¹¹⁵ reported that he had used the drug in doses up to 15 gr. daily with success in reducing arterial hypertension, but had not noticed any marked sedative effect. Westphal¹¹⁶ in 1926 reports good results and explains its action as a relaxing agent on the increased arterial tonus, which he regards as chiefly responsible for essential hypertension.

Gager¹¹⁷ popularized the drug by reporting (1928) a series of cases in which thirty-five patients with hypertension were treated with potassium thiocyanate (Rhodan), with only three failures. He reports a sedative action in a great variety of neurotic patients and also a reduction of elevated blood pressure with relief of vertigo and other subjective symptoms. The dosage used by Gager was $1\frac{1}{2}$ gr. of the salt three times daily for the first week, twice daily for the second week, once daily for the third week, and thereafter a dose daily or every other

THE MANAGEMENT OF HYPERTENSION

day. Smith and Rudolf¹¹⁸ report successful with the use of from five to 15 gr. per day. Using the same doses as Gager, Palmer¹¹⁹ et al report a series of 59 cases of essential hypertension, in which 43% of the patients showed a reduction in the systolic pressure of 30 mm. Hg., or more. Logefeil¹²⁰ used the salt in an 8% solution which he gave in teaspoonful doses three times per day and reported good results. Finebergh¹²¹ (1930) gave the drug in 1½ gr. doses, three times per day for ninety days and in only one of twelve patients did he secure a fall of 30 mm. or more. However, upon suggestion he used rhodan in an 8% solution given in doses of a teaspoonful three times a day and this procedure was carried out successfully. Thirty-seven percent showed a drop of at least 30 mm. Hg. All of these patients and many who did not show a drop were subjectively improved. The other sedatives did more, however, in the way of subjective improvement.

Adams¹²² tried the drug in a few cases and found that it produced nausea even when given in doses of not more than five grains per day. He did not notice any remarkable effects in in cases of benign hypertension, and no effect whatever in in the malignant form. Ayman reports unfavorably¹²³ (1932) toward the drug. Where small (usual) doses are given he finds no response. Where large doses are given he reports a fall in the blood pressure in 20 cases out of a total of 31, but he found that the toxic symptoms from the drug were so severe as to preclude its use as a rational therapeutic measure in the

THE MANAGEMENT OF HYPERTENSION

management of the disease. This was true in nineteen out of the twenty cases. He concludes that the toxicity and the degree of blood pressure reduction go hand in hand.

Benzyl benzoate and benzyl acetate enjoyed popularity for a time. Macht¹²⁴ first introduced it as possessing blood pressure reducing qualities in 1918. Laubry and Mougeott¹²⁵ and Gunston¹²⁶ are enthusiastic as to its merits. Musser¹²⁷, Mason and Preck,¹²⁸ and Gruber and Shakelford¹²⁹ deny that it has any value in the management of hypertension and produce experimental evidence as well as clinical.

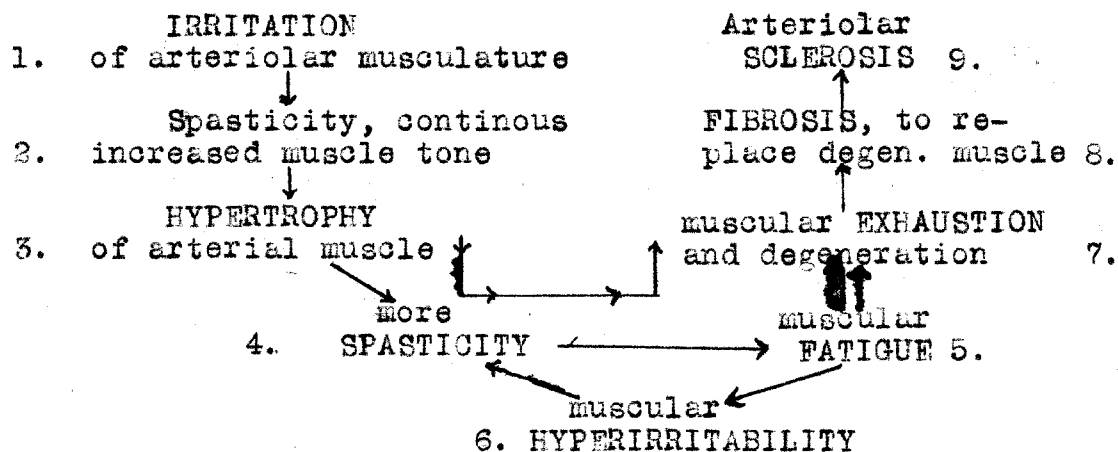
An extract of watermelon seed (cucurbita) was introduced by Barksdale¹³⁰. It has its supporters who report remarkable results, among these are Wilkinson¹³¹, Murray¹³² and Althausen¹³³. Gargill and Rudy¹³⁴ are not convinced of its value as a therapeutic agent.

For many years French, German and other workers have been writing about the action of Mistletoe (*Viscum album*, Gui) in various conditions, especially as a vasodilator. O'Hare¹³⁵ gives it a trial and finds it of value as an aid in the management of hypertension. His findings are upheld by Barrow¹³⁶ who reports his observations two years later (1930) than O'Hare.

Steiglitz¹³⁷ works up an enthusiasm in favor of bismuth subnitrate. He reports the treatment of 200 unselected cases of hypertension, treated at Rush Medical College Central Free Dispensary, with 10 gr. doses of bismuth subnitrate thrice daily. He reports remarkable results. By way of explanation he main-

THE MANAGEMENT OF HYPERTENSION

tains that it has long been known that nitrites (NO_2) cause vascular relaxation, but the action is violent and fleeting in character. The course of events following the oral administration of bismuth subnitrate are outlined as follows: In the bowel the bismuth subnitrate is slowly decomposed, liberating nitrate ions (NO_3). The nitrate is reduced by *Bacillus coli* to nitrous acid. Thus minute quantities of nitrite ions are continuously absorbed. The process is equivalent to the oral administration of minute doses of glycerol trinitrate at 10 or 15 minute intervals throughout the day and night. He says that one can thus break into a vicious circle of fatigue represented ingeniously thus;



The process up to step seven (muscle degeneration) is reversible.

On the other hand Zeiss and Brams¹³⁸ find no effect on hypertension (1930) by direct administration of nitro glycerin, amyl nitrite and acetylcholine. This seems contrary to most experience.

THE MANAGEMENT OF HYPERTENSION

THE FOLLOWING SECTION IS FOUR CASE REPORTS OF CASES
OBSERVED BY US. TWO FROM EXPERIENCE AT THE UNIVER-
SITY OF NEBRASKA DISPENSARY AND TWO FROM THE PRIVA-
TE PRACTICE OF B. W. DRASKY OF LINWOOD NEBRASKA.

THE MANAGEMENT OF HYPERTENSION

XI. CASE REPORTS

CASE I, Sara N., A Negress house wife, aged 60, seen on out call for the first time. She complained of headaches with occasional dizziness over a period of about two years, which culminated in a "stroke," upon awaking the morning when first seen, with numbness in the left upper and lower extremities, and an inability to walk.

Physical examination revealed a marked weakness of the left upper and lower extremities and a blood-pressure of 190 systolic and 110 mm. Hg. diastolic.

Diagnosis was made of "premonitory symptoms" because of a hypertension and patient was put to bed at complete rest with the exhibition of bismuth subnitrate, 15 gr. three times per day. At the end of two weeks the blood pressure readings were 175/105 and there was a gradual return of strength in the extremities with the ability to get about. At this time there was a change in services and patient felt that she needed no more attention so she was not followed further.

CASE II. J.D., white, veterinary surgeon, aged 68, male. First came in, because of headaches and shortness of breath on exertion, for a general physical examination.

The findings were essentially negative with the exception of a marked of both the heart sounds, over the entire precordium, and a blood-pressure of 230 systolic over 110 mm. Hg. diastolic.

The family history revealed that the father had died of

THE MANAGEMENT OF HYPERTENSION

apoplexy at the age of 70.

The patient was informed of his condition and was advised to retire from his practise and to limit his protein to about 80 or 90 gm. per day, likewise to limit his salt intake to the extent that he put no salt into his food while at the table and that he avoid unduly salty foods.

The patient did as instructed and took things "easy". There was no marked change in blood pressure at any time and the patient made his exodus after a sudden stroke of apoplexy, about a year later.

CASE III. F. B., male, hardware dealer, white, age 48. He came in for an insurance examination.

Physical findings were essentially negative with the exception that his blood pressure readings were 185/85 mm. Hg., and his tonsils were red, enlarged, and showed evidence of chronic infection. His teeth were sadly in need of attention.

This patient was informed of his condition but nothing was done. He was rejected by the insurance company and so later returned for medical attention. His tonsils were removed and his teeth given attention by a competent dentist. Following this procedure his blood pressure gradually reduced until at the end of five months it was 125/80. It has remained in this neighborhood, with minor fluctuations, ever since (three years later).

CASE IV. Mr. B., white, male laborer, aged 45. First seen in the dispensary, on the service of Dr. Wigton in neurology. He had not worked for two years because of his tiredness and

THE MANAGEMENT OF HYPERTENSION

and feeling of fatigue.

His blood-pressure readings were consistently in the neighborhood of 250/130 mm. Hg. and his urine showed a trace of albumen.

This patient was referred to the Douglas County Hospital for complete bed rest and later, perhaps a trial of liver extract therapy. It is yet too early to determine the results of his management.

THE MANAGEMENT OF HYPERTENSION

XII. CONCLUSION

This review leaves us with the feeling that our knowledge is lacking in exactness, that a mass of observation is before us, but that our experimental approach to the matter has been checked on all sides. Practically everything that happens to an individual, from his conception to middle life has been mentioned as the cause of hypertension. Heredity is unquestionably of great importance. Probably all of the factors mentioned contribute a portion to its production. Hypertension, as we know it clinically, is almost certainly a state which results from long continued causes and which is associated with tissue changes of a gradually developing character, hence the importance of recognizing the condition early. Blood-pressure is dependent upon six factors: heart force, end resistance, elasticity of the vessel walls, amount of blood, viscosity of the blood, and vasomotor control. These essentials vary widely in the part they play, but observance of them may help toward an early diagnosis. In arriving at a diagnosis one should search through daily life and habits, diet, rest, exercise, work, worry and sex influences.

The management of the condition begins even before the patient is made aware of his condition. It is not an infrequent experience, according to Foster, for a patient who presents himself for an examination to walk into one's consultation room, apparently in excellent general health and relapse suddenly

THE MANAGEMENT OF HYPERTENSION

into a state of emotional instability and in a sobbing lacrimose manner announce, " Doctor I have high blood pressure ".¹⁰² We should first endeavor to have the patient adjust his mental attitude toward the condition. The importance of lowering the blood pressure to reasonable levels cannot be overestimated. In the very early case an attempt should even be made to reduce it to and maintain it at normal level, since in these it entails no great dangers. In the extreme cases with a long history too radical a lowering is dangerous as the sclerotic cerebral vessels require an increased pressure to maintain their circulation. In these it is well to remember that a certain level above normal is really a physiological process of a pathological condition; the effort of nature to supply the system with its adequate amount of blood.

The treatment should be directed first to a patient himself as a human being who has physical and mental processes other than hypertension. Attention should be directed to associated diseases as of kidneys, heart, nervous system etc. and these should be properly ruled out. Possible sources of infections, poisons, strains and disharmonies should be traced. Proper treatment lies in planning a program of living, rather than writing a prescription. If in a hypertension case, after careful examination, it is found that the heart and kidneys are not seriously involved, the matter of focal infection should be properly managed. Stieglitz feels that this is often the most neglected part of the

THE MANAGEMENT OF HYPERTENSION

therapy¹³⁷.

The dictates of common sense should be our best guide. In the matter of dietetics one must consider the individual. The obese patient should gradually have his weight reduced by total caloric reduction, a pound or two per week probably being about proper. proteins, as yet, have not been incriminated so it is senseless to institute marked restrictions. since, however, the work of eliminating nitrogenous waste falls on the kidneys it is well to limit their total intake to the necessary bodily requirements. This also applies to sodium chloride. Rest is important. Rest for even fifteen minutes under favorable conditions reduces systolic pressure and to a lesser degree the diastolic¹⁰². The patient should not, however, be reduced to the state of the bed fast invalid. Exercise, judiciously indulged in, is of great value. This should never be violent because of the dangers of vascular accident, but should be mild and kept well below the threshold of fatigue. Drugs may be used when indicated, some of the anti pressor substances mentioned above may prove of value but the sedatives in the "high strung" individual are unquestionably of aid. Digitalis should be used whenever myocardial failure threatens.

We quote Dr. Pratt: " Until we have more definite information as to the causes, let your treatment be: First, the protection of the heart by correct physical exercise and mental attitude; second, the protection of the kidneys by reducing protein to the necessary requirement and gradually eliminating salt from the

THE MANAGEMENT OF HYPERTENSION

diet; third, the care of the nervous system where calcium and bromides may be used to advantage; fourth, the elimination of toxemia from the bowels absorption or from focal infections; and lastly, treatment of all important general conditions of the patient." 66

This excerpt impresses us with its succinctness, we are unable to add any opinion that may enhance its value.

THE END

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