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HYPERTENSION—TREATED AND UNTREATED

A STUDY OF 400 CASES

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The present preoccupation of our profession with the lowering of blood pressure must inevitably defeat any future attempt to study the natural history of hypertensive disease, but in view of the attention this topic has already received this may not be counted altogether a misfortune. Nevertheless, as Simpson and Gilchrist (1958) point out, it is particularly during the next few years that there is likely to be felt the need for a satisfactory yardstick against which the long-term success of modern hypotensive treatment can be measured.

There are, of course, available to-day a number of admirable studies of untreated hypertension. Yet it is doubtful if any of these can be regarded as fully satisfying this requirement since they suffer in common the disadvantage of all retrospective studies that the picture presented is insufficiently detailed. It therefore seemed that this might be an appropriate moment to give a further report on the group of untreated hypertensive patients whose year-to-year progress from 1946 onwards was the subject of an earlier communication (Leishman, 1953). On this occasion, however, it was felt that the time had come to employ this "control" series of untreated cases for the purpose originally intended, since there were now available for comparison two further groups of patients treated respectively by lumbo-dorsal sympathectomy and by ganglion-blocking drugs.

Since regular observation of all three groups (a total of 402 patients) has been continuing simultaneously, it was hoped that comparison of their respective welfare or fate would by this stage provide a fair evaluation of these methods of treatment.

Untreated Hypertension

The decision taken in 1946 to follow by annual examination every hypertensive patient under the age of 60 who either declined or was considered unsuitable for sympathectomy (the only effective treatment then available) was prompted solely by the desire to learn more about the natural prognosis of this disease. Altogether 211 patients (87 men, 124 women) with diastolic pressure initially not less than 100 mm. Hg have now been followed in this way up to the present time or until their death. Since the object was to collect rather than select cases, all grades of hypertension are represented, and, as is later shown, this group does not appear to have been unduly weighted by cases of exceptional severity. One-half (106) of these patients

are now dead, and this number represents 66% of the men and 39% of the women who with the exception of 14 have all died before they were 60. The age and period of observation of every case is recorded in Figs. 1 to 5 together with the individual causes of death as accurately as these could be ascertained. It may, however, be noted that the use of the term C.V.A. (cerebral vascular accident) has been necessary on occasions when post-mortem evidence was lacking or the clinical details supplied were insufficient to justify a diagnosis of cerebral haemorrhage; also that when uraemia complicated terminal heart failure this has been recorded as a cardiac death.

Prognostic Considerations

When the behaviour of these patients was earlier studied the clinical features which then appeared to have been especially unfavourable were listed as male sex, high diastolic pressure, albuminuria, retinopathy, abnormal electrocardiograms, and possibly absence of obesity; and when revised to-day, after an opportunity of five years' further observation, this list appears to need only minor amendment. Certainly it requires only a glance at the mortality rates shown in Fig. 6 to appreciate the hazard both of being male and of having a high diastolic pressure, since not a single man survives to-day whose diastolic pressure initially exceeded 130

FIG. 1.—Malignant hypertension. (Criterion—papilloedema.) B.A.T.=Basilar artery thrombosis. C.F.=Congestive failure. C.H.=Cerebral haemorrhage. C.I.=Cardiac infarct. C.V.A.=Cerebral vascular accident. D.A.=Dissecting aneurysm. R.A.=Ruptured aorta. S.H.=Subarachnoid haemorrhage. U.=Uraemia.

demonstration of a higher death rate among hypertensive patients when electrocardiographic changes are present, and little or no attention has apparently been paid to the much more important influence on mortality of the individual blood-pressure levels in these cases (Perera, 1951; Simpson and Gilchrist, 1958).

In an earlier contribution (Leishman, 1951) it was suggested that "strain pattern" changes appeared in the electrocardiogram whenever the relationship between ventricular muscle bulk and coronary blood flow was disturbed, and it was noted on that occasion that there did not appear to be any close correlation between this finding and the severity of the hypertensive state.

In the group of patients with non-malignant hypertension at present under review, "strain pattern" changes were seen in the electrocardiograms of 44 (54%) of the 81 fatal cases in which these were available and 45 (43%) of the 105 survivors. When one appreciates that the first group was composed largely of cases with exceptionally high blood pressure this difference appears unimpressive. In fact, among the minority of fatal cases in which diastolic pressure was less than 130 mm. Hg, the incidence of abnormal electrocardiograms was distinctly lower (29%) than among the survivors.

As might be expected, deaths from congestive heart failure were proportionately higher among patients with abnormal electrocardiograms, but this finding provided no forecast of subsequent cardiac infarction, only 6 of the 15 patients who died from this cause showing electrocardiographic changes before this event.

Although apparently neglected, an observation by Filley (1946) that "when other factors are eliminated, electrocardiographic changes become less and less ominous" appears to-day to summarize the position admirably, for, although these changes are seen more commonly in patients with high levels of diastolic pressure, it has become evident that their presence or absence in fact adds very little to the general assessment of a hypertensive patient. It is difficult, therefore, to share the enthusiasm of Evans (1957) for the electrocardiogram as a gauge of hypertensive severity.

The possibility that obesity is an asset to a hypertensive patient has also been reconsidered and it is now fairly evident that the preponderance of patients of normal weight among the fatal cases which was previously reported was biased by cases of malignant hypertension who are of course rarely overweight. When cases of malignant hypertension are excluded as in the present review the presence or absence of obesity seems much less important, since 38% of the patients who died appear to have been overweight compared with 48% of those still living.

Course of Untreated Hypertension

An advantage of the deliberately planned follow-up is the opportunity it affords of studying over a number of years the behaviour of the blood pressure itself. This has provided some surprises; it was, for example, unexpected that at the end of an average period of nearly eight years' observation it would be found that the diastolic pressure had increased by more than 10 mm. Hg in only 25 (20%) of the 128 patients who survived more than five years, and that in a further 37 cases the diastolic pressure would be appreciably lower than at the start of observation. (The behaviour of systolic pressure was closely similar.) Even among patients who failed to survive five years, a rise of

diastolic pressure even of this modest degree was seen in only 40% of the 48 cases in which re-examination was possible before death. In this group women outnumber men by 2 to 1, but in general the sexes behaved similarly in this respect, although it has been noticed that when the diastolic pressure exceeded 120 mm. Hg the men showed a rather greater tendency to rise in blood pressure.

Nevertheless in the case of 10 men and 10 women (from the total of 176 patients) the diastolic pressure increased by more than 20 mm. Hg, and in seven of these the pattern of malignant or accelerated hypertension developed fairly rapidly although the diastolic pressure in four cases was initially less than 120 mm. Hg. All of these patients died within one to three years,

FIG. 5.—Diastolic pressure 100–119 mm. Hg (untreated).

FIG. 6.—Mortality rate in treated and untreated groups of hypertensive patients.

and with only one exception either from stroke or from uraemia. A similar rate of blood-pressure rise was seen in two further cases, but here the hypertension retained its benign character although both of these patients died within three years from congestive failure. In the remaining 11 patients the increase in diastolic pressure was a slow and gradual process which occupied from 5 to 10 years, and it has been rather reassuring to find only four instances of the blood pressure increasing as a late development after a period in which it had remained static.

Even in retrospect, however, it is difficult to see how the few patients destined for an inexorably progressive course could have been identified on the first occasion, although the presence of albumin in the urine of five of the nine cases would, one hopes, to-day attract appropriately greater attention.

Of the original total of 211 patients, 105 (29 men and 76 women) are alive, but 37 of these are leading restricted lives. Sixteen have suffered strokes and a further 15 have had transient cerebral attacks of one kind or another. Six patients survived cardiac infarction, 12 are now anginal, and three have at some stage been in heart failure. In rather more than half the cases the heart has enlarged, and in an equal number the ability to concentrate urine has been lost, a finding which perhaps should be emphasized, since undue importance is often attached to this particular manifestation of renal inefficiency in a hypertensive patient.

Although headache was originally a complaint of 85 patients (80%) it has been interesting to see that in 32 cases this ceased spontaneously and in a further 15 cases became notably less troublesome with the passage of time. It is likely, of course, that in large measure this was due to the reassurance which could usually be given to these patients at their annual examination.

Comparability of Treated and Untreated Groups

From what has already been said it is clear that any inference drawn from the varying behaviour of groups of hypertensive patients will carry little weight unless the greatest care has been taken to compare only cases of equal severity. This means, in the first place, that malignant hypertension must be considered separately, the sexes segregated, and comparison permitted only between patients within a similar blood-pressure range.

Apart from these obvious precautions, however, it seemed likely that the best measure of their respective severity would be obtained by comparing in these three groups the incidence of retinopathy and albuminuria. In Table II this comparison is made; it will be seen that by the exclusion of survivors from the group of untreated cases this test has been made deliberately severe. Nevertheless by these criteria at least it may be judged that the two groups of patients whose hypertension was

treated were undoubtedly of more than average severity, and as an example of this it should be noted that the incidence of albuminuria even at its lowest is nearly twice as high as was found among patients who have survived without the aid of hypotensive treatment.

The possible influence on prognosis of difference in age also needs some consideration, since the patients selected for sympathectomy were younger than the rest, only five being over the age of 50 at the time of their operation. However, according to Smirk (1957) it is now generally agreed that younger hypertensive subjects have a worse outlook than their seniors, and even in our own limited experience the patients who presented with hypertension between the ages of 40 and 50 appeared to fare rather worse without treatment than did those in the next decade. So far as the sympathectomy cases are concerned, therefore, we can only assume that their relative youth was on the whole prejudicial to them rather than an advantage. It should also not be overlooked that to-day's survivors from sympathectomy have now been under observation almost twice as long as the average survival period of patients in the corresponding blood-pressure group who died without treatment.

On the other hand, there is little difference between the age distribution of the patients treated by ganglion-blocking drugs and of those who remained untreated. Here, of course, the main objection to comparison is the somewhat limited period of treatment. Nevertheless, at the time of reporting, the average duration of drug treatment in the 86 surviving patients was 3.7 years, and this may be compared with average survival periods among patients dying without hypotensive treatment of 2.2, 3.9, and 3.75 years according to their respective blood-pressure group (malignant hypertension excluded). Indeed, without treatment 70% of the patients with a diastolic pressure above 130 mm. Hg were dead within four years.

Thus, although the present mortality rate among drug-treated cases is scarcely acceptable for strict comparison without some correcting factor in mind, this should by now provide at least a fair indication of the extent to which ganglion-blocking drugs are varying the natural course of hypertensive disease.

Hypertension Treated by Lumbo-dorsal Sympathectomy

Although more than 100 patients have undergone lumbo-dorsal sympathectomy, the present study is limited for purposes of comparison to 82 cases with a minimum pre-operative diastolic pressure of 120 mm. Hg, observed for at least a year since their operation. As nine of these patients later required ganglion-blocking drugs and their progress has therefore been recorded under that heading, 73 sympathectomy cases are available for comparison with the other two groups. Except in two cases, Poppen's two-stage operation was always performed and the surgeon's objective in every case was to remove the sympathetic chains from at least the level of the fourth dorsal to the third lumbar ganglion together with the splanchnic nerves.

Lowering of Blood Pressure

As with ganglion-blocking drugs, the effectiveness of operation depends largely on the production of postural hypotension, and the diastolic pressure of these patients as recently recorded in the standing position provides the best measure of a successful result. In each of the 82 cases this figure has therefore been compared with

TABLE II.—Incidence (Pre-treatment) of Retinopathy and Albuminuria in Patients Surviving After Hypotensive Treatment and in Fatal Untreated Cases. (Diastolic Pressure Exceeding 120 mm. Hg—Malignant Hypertension Excluded)

	64 Fatal Cases Untreated	80 Survivors Treated by Ganglion- blocking Drugs	59 Survivors Treated by Sympathectomy
Retinopathy (grade III) ..	21 (32.8%)	28 (35%)	16 (27.1%)
Albuminuria ..	54 (84.3%)	42 (52.5%)	28 (47.4%)

the preoperative pressure, and it will be seen (Fig. 7) that on this basis operation is judged to have been successful in 65 cases (79%) and an average reduction of diastolic pressure of 40 mm. Hg has been achieved in the case of 29 men and of 47 mm. Hg in the 36 women. (Had the preoperative pressure also been taken with the patients standing the figures would probably have been slightly greater.) Among 62 survivors from operation, the post-operative interval in 7 cases now exceeds 10 years, in 36 cases is between 5 and 10 years, and in 19 cases is less than 5 years.

Normally after this operation postural hypotension is severe enough to require the wearing of elastic stockings, and this was necessary in all except 4 of the 82 cases, whether they proved ultimately successful or not. This

FIG. 7.—82 Sympathectomy cases. Pre-operative and post-operative diastolic pressure. Unshaded=Pre-operative diastolic pressure (lying). Shaded=Diastolic pressure (standing) at last annual examination.

phase does not commonly last longer than six months, and in most of the cases postural hypotension continued to decrease slowly for a further two to four years. When followed beyond this stage, however, it has been surprising to find that in 75% of the cases postural hypotension increased again to an appreciable extent. Indeed, in this series of surgically treated cases there has been no tendency for postural hypotension to be lost in the later stages, and all the failures were apparent within two to three years of their operation.

In respect of their permanence at least, it may be agreed that these results are much better than those reported in previous reviews. To quote only representative examples of similar studies, it may be noted that Smithwick (1948), Evelyn Alexander, and Cooper (1949), Platt and Stanbury (1950), and Wells (1956) all reported dwindling success from operation with succeeding years.

The reputation of lumbo-dorsal sympathectomy, however, rested for many years on resections of the Smithwick type which stop short at the sixth dorsal ganglion, and it is not altogether surprising that this procedure aroused little enthusiasm in this country. In Great Britain, Morrissey, Brookes, and Cooke (1953)

alone seem to have realized that greater permanence of hypotensive effect could be achieved if the operation was extended to the level of the fourth dorsal ganglion, although earlier in the United States this had been claimed by Evans and Bartels (1949). This interesting finding seems certainly confirmed by the results reported here, and there can be little doubt that the surgeon responsible for the present series of operations was entirely justified in his insistence on an extensive dorsal denervation.

Post-operative Progress in Successfully Operated Cases

Of the 65 patients in whom reduction of diastolic pressure was considered satisfactory, 8 have since died, but this number includes two patients with malignant hypertension who lived for two years and eight years respectively, and one patient whose death was probably unrelated to hypertension. With only three exceptions, two of whom are psychoneurotic, all the survivors at the present time are leading virtually normal lives, the men earning their living and the women performing their normal household duties, and only in four cases has operation failed to relieve headache completely. Before operation five of these patients were anginal, and, although initially all appeared to have been relieved, this tendency reappeared later in two cases, and five additional patients have subsequently developed this symptom.

On the objective side retinal exudates and haemorrhages disappeared after operation in 11 cases out of 12, and papilloedema also cleared in each of the six cases where this was present, although it recurred in one patient who later died from uraemia. In one-third of the cases the heart size is less than before operation; but in an equal number the heart has enlarged, and it is therefore not surprising that only in 5 out of 17 cases has the "strain-pattern" electrocardiogram reverted to normal. However, only one patient with a previously normal electrocardiogram has post-operatively developed these changes.

Albumin, which was present in the urine of 27 patients before their operation and to a marked degree in 12 of these, failed only in four instances to clear completely, and it is significant that each of these patients subsequently died. In no case, however, has albumin appeared after a successful sympathectomy. On the other hand, lowering of blood pressure does not seem to have led to any improvement either in renal concentrating capacity or in urea clearance.

Post-operative Progress in Unsuccessful Cases

Sympathectomy failed to achieve an adequate reduction in blood pressure in 17 cases, and 9 of these were later treated with ganglion-blocking drugs. In two cases these also proved a failure and both patients died, but the remainder appear to be satisfactorily controlled, although one is constantly in borderline heart failure. The remaining eight patients received no additional hypotensive treatment, and three of these have died from strokes while another is incapacitated on this account.

Except in a single instance where a limited operation was performed, no satisfactory explanation even in retrospect can be offered for these failures, and in the case of these unfortunate few the only credit that could be claimed for operation is that their headaches were generally relieved in spite of the poor blood-pressure response.

Hypertension Treated by Ganglion-blocking Drugs

Altogether 118 patients have received treatment with ganglion-blocking drugs, but 25 of these (8 women, 17 men) have since died, and a further 7 have as yet been under treatment for less than a year. There are therefore 86 patients whose progress can be reported. These have now been treated for periods ranging from one to six and a half years, and the average duration of treatment for the whole group is at the present time three years and nine months.

When this treatment first started hexamethonium bromide was the only drug employed and 16 patients who were particularly well stabilized have continued to use it. The remainder, however, have received pentolinium, and throughout this time, with scarcely an exception, both ganglion-blocking drugs have been given parenterally and the patients have injected themselves twice daily, usually at 8 a.m. and 4 p.m., while at the same time taking reserpine by mouth.

The employment of parenteral therapy to-day would doubtless be regarded as unenlightened, but, although from time to time, as new drugs became available, attempts were made to substitute oral treatment, these invariably proved far too troublesome to manage in a clinic of this size. The greater consistency and predictability of the effects of these drugs when injected, not to mention the fewer side-effects, are considerations which weigh heavily when the attendance of patients has to be kept to a minimum. Happily, with the advent recently of new drugs, oral therapy now seems to have become a really practical proposition.

In this series of cases the objective of hypotensive drug treatment has not been over-ambitious, and a standing diastolic pressure of the order 100–110 mm. Hg recorded within the period of maximum drug activity has usually been regarded as satisfactory. By these standards 58 patients (67%) are now regarded as well controlled, 23 are under fair control, and 5 are relative failures. On the other hand, an adequate hypotensive response was achieved in only 6 out of the 25 patients who died.

Progress of Drug-treated Cases

It has been disappointing to find as many as 25 (29%) of these patients apparently incapable of leading a fully normal life, and, in this respect at least, the operated cases are clearly at a considerable advantage. Their headaches also do not seem to have been as effectively relieved, for, of 64 patients thus afflicted, 24 are still aware of some headache, although it is admitted by half this number to be now less severe. (It may be recalled that headache ceased spontaneously in one-third of the cases who received no effective treatment.)

Albumin did not disappear from the urine so constantly after drug treatment (40%) as was seen after sympathectomy (85%), but in respect of clearance of papilloedema and retinopathy, reversal of changes in the electrocardiogram, and relief of angina, there seems to have been very little difference between the patients treated medically or surgically. Only exceptionally, however, has a heart appeared to become smaller as a result of treatment with ganglion-blocking drugs.

Side-effects during treatment have not been particularly troublesome, and here, of course, the relatively small dose of drug given parenterally is a big advantage. Three-quarters of the patients on pentolinium, for example, have needed less than 10 mg.

of this drug. Constipation, notoriously the worst obstacle to oral therapy, has scarcely been noticed, and usually the only complaint has been of postural faintness and disturbance in visual accommodation for a variable period after the injection. Patients normally became progressively less conscious of these effects, and in eight cases only were they at all seriously inconvenienced. Complaints of fatigue and lack of energy were, however, commonly made, but it was thought that reserpine was at least partly responsible for these.

On the whole the morale of these patients remains high and there has been little difficulty in securing their full co-operation with a form of treatment which has undoubtedly been burdensome. It has, however, been very noticeable that the continued supervision which this involves has at least had the merit of relieving them of much of their anxiety.

Discussion

It is of course evident from this record that there have been far fewer deaths among the patients whose hypertension has been treated either by surgery or by drugs, and when these comparisons are made on a percentage basis (Fig. 6) the differences in mortality rate become very impressive. It must, however, be emphasized that the use of percentages is in fact numerically justified only in the case of the two largest groups, consisting of cases of non-malignant hypertension with diastolic pressure of 130 mm. Hg and upwards.

Despite some measure of success our treatment of malignant hypertension has proved rather a disappointment and our results seem to compare unfavourably with those reported by McMichael (1956). Although the blood pressure was usually effectively controlled in these cases, too often this seems to have done little more than delay for a year or two the inevitable onset of uraemia. Success here is, of course, ultimately dependent upon renal changes being still reversible, and it is clear that in this type of case the real need is for earlier diagnosis.

In all other categories of hypertension, however, the respective mortality rates speak for themselves. Even if the figures need to be slightly modified in the case of the drug-treated cases in view of their shorter period of observation, a mortality rate which at its highest is scarcely more than one-third of that found when hypertension was untreated is capable of only one interpretation. No one, indeed, would doubt that lives have been prolonged by both these forms of hypotensive treatment.

It was previously suggested (Leishman, 1957) that fatal cerebral haemorrhage ought to occur less often when hypotensive treatment is employed, since it is probable that cerebral arteriolar necrosis, a condition potentially reversible, is responsible for many of these episodes. Happily this hope seems to have been realized, for when the causes of death among treated and untreated hypertensive cases are analysed it is found that, while there were 37 deaths from stroke among 124 untreated cases, only 13 patients died from this cause among 191 cases treated by sympathectomy or ganglion-blocking drugs. Since at the same time the incidence of uraemic death also has fallen from 25 to 10 in these respective groups, we must conclude that in severe cases a modest and even intermittent reduction of blood pressure may be sufficient to check the tendency

of hypertensive disease to "accelerate" and will restore a more static and benign state of affairs.

It would scarcely be opportune to-day to argue the respective merits of these two forms of hypotensive treatment, but it may be agreed that in general the operated cases have shown slightly the better record, and they are certainly more fortunate in their present mode of life.

Obviously lumbo-dorsal sympathectomy has now a very limited future, but in retrospect it seems a little unfortunate that in this country the potentialities of this operation have been largely discounted. No one would deny that the extensive denervation necessary for a satisfactory result is a gruelling experience and not without risk. Within our own experience 10 patients from a total of 114 did not survive the operation, but in fairness to those principally concerned it must be said that most of these deaths occurred in the early days when selection was often at fault. For a relatively young hypertensive subject, however, the operative risk is small, and even to-day in such circumstances operation may be regarded as a reasonable alternative to a lifetime spent on ganglion-blocking drugs.

The male who undergoes this operation must almost inevitably accept loss of fertility, though libido and potency have usually been retained. In women, however, reproduction is unaffected, and indeed on more than one occasion operation has been advised with the specific object (successfully achieved) of safeguarding future pregnancy.

On the other hand, there is no doubt that by employing ganglion-blocking drugs results can be obtained which are at least the equivalent of a successful sympathectomy operation. The surprise, however, has been that so much success has followed a method of treatment which secures effective postural hypotension only twice in each day for a period which seldom exceeds three hours. As it now seems possible to achieve a sustained reduction of blood pressure without undue discomfort to the patient, we may reasonably expect even better results in the future.

Nevertheless the possession of such potent drugs makes it especially important that we should be discriminate in their use, but if the fate of the untreated patients reported here has been followed it should be easy now to identify those who would have been likely to benefit from hypotensive treatment, had this been available to them. Certainly no case of malignant hypertension will be abandoned without attempting treatment, although ganglion-blocking drugs have to be used with caution in cases in which urea retention is already established. Our own experience in this situation seems to have been less reassuring than that of Abrahams and Wilson (1957), for more often than not the drug had to be stopped on account of a rapidly rising blood urea.

Judged from the mortality risk alone, the employment of a ganglion-blocking drug appears fully justified also in any male hypertensive patient with a diastolic pressure consistently above 120 mm. Hg, but in a woman it seems doubtful if in ordinary circumstances this is really needed unless the diastolic pressure is at least of the order of 130 mm. Hg.

There still remains, however, the problem of the man with relatively mild hypertension, for we can scarcely ignore the fact that even in the group with the lowest blood pressure in the present study (diastolic pressure

100–119 mm. Hg) one-third of the men died before they were 60 (Fig. 5). Yet it is difficult to see how these could have been helped by hypotensive treatment, since most of them died from cardiac infarction. According to Master (1953) the causal relationship between hypertension and coronary thrombosis is much less important in men than in women, and if this is accepted there seems little guarantee that, even if the blood pressure were lowered for a number of years, the risk of coronary thrombosis would necessarily be reduced. Although this possibility may nevertheless be regarded as a suitable objective for a future controlled experiment, the routine use of ganglion-blocking agents in this class of hypertensive patient seems as yet scarcely justified, but the presence of albumin in the urine might well call for revision of this policy.

Summary

The progress of 211 untreated hypertensive patients regularly followed since 1946 is compared with that of 73 patients treated by lumbo-dorsal sympathectomy and 118 patients treated with ganglion-blocking drugs.

Half of the untreated patients are dead, and study of these cases has confirmed that high diastolic pressure, male sex, and the presence of albuminuria or retinopathy are particularly unfavourable features. Changes in the electrocardiogram have not appeared to influence prognosis.

Rise of blood pressure in untreated cases was uncommon, but in 20 out of 176 cases diastolic pressure increased by 20 mm. Hg. Seven of these patients developed malignant or accelerated hypertension. This could not have been foreseen when they were originally examined.

A satisfactory fall in blood pressure was achieved in 80% of the patients who underwent lumbo-dorsal sympathectomy. The unusual permanence of these results is attributed to extensive dorsal denervation.

Ganglion-blocking drugs were given parenterally. Of the patients at present on treatment, 67% are regarded as well controlled.

The treated and untreated groups of cases are judged to have been of equivalent severity, and comparison of their respective mortality rates has been made in eight separate categories of hypertension.

Except in malignant hypertension the mortality rate among treated patients was in no instance appreciably higher than one-third that of the untreated cases.

Although the length of observation of drug-treated cases is not yet adequate for strict comparison, these figures leave no doubt that lives have been extended by both forms of hypotensive treatment. Reduction in the number of fatal strokes has been a notable feature.

Judged from the fate of untreated patients, the employment of ganglion-blocking drugs seems justified in any man whose diastolic pressure is consistently above 120 mm. Hg, and in the presence of albuminuria may be advisable when blood pressure is below this level. Hypertensive women, however, do not normally require this treatment unless the diastolic pressure is at least 130 mm. Hg.

It is a pleasure to express my appreciation of the surgical skill and unfailing co-operation of my colleague, Mr. J. Hardman, who performed all the sympathectomy operations. I am grateful to many registrars and house-physicians for their help throughout these years in the comprehensive

re-examination of these patients, and in particular I would like to thank Dr. R. S. Weetch, Dr. D. H. Isaac, and Dr. R. W. Meikle for their individual contributions to this work. I also thank Professor C. H. Stuart-Harris for valued criticism.

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SOME ASPECTS OF PROGNOSIS IN TREATED HYPERTENSION

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Hypotensive drugs are now well established in the treatment of arterial hypertension. In the malignant phase their value has been clearly demonstrated (Morrison, 1953; Harington and Rosenheim, 1954; McMichael and Murphy, 1955; Smirk, 1957), and knowledge of this condition in its treated form is steadily accumulating. In hypertensive heart failure the beneficial effect of these drugs has been described (Shirley Smith and Fowler, 1955; Hamilton, 1956; Smirk, 1957). Severe impairment of renal function commonly prevents adequate treatment (McMichael, 1956), but sometimes deterioration may be stayed (Abrahams and Wilson, 1957), and there are reports of improvement in renal function apparently as a result of hypotensive therapy (Wilson, 1956; Hood, 1956). Both Hood (1956) and Smirk (1957) have the impression that cerebrovascular accidents in patients of all grades have been reduced by therapy, but it may be that in some instances cerebral thrombosis is precipitated by lowering the blood pressure (Locket *et al.*, 1951), and transient cerebral ischaemic episodes as a consequence of excessive pressure reduction are well recognized (McMichael, 1956; Hood, 1956; Smirk, 1956). Similarly, when hypertension is complicated by ischaemic heart disease, appropriate blood-pressure reduction may improve exercise tolerance (Doyle and Kilpatrick, 1954; Shirley Smith and Fowler, 1955), while an excessive fall appears sometimes to precipitate angina (Smirk and Alstad, 1951) or myocardial infarction (Hood, 1956).

Symptomless, uncomplicated hypertension presents a difficult problem. The statistics provided by life assurance companies (Dublin *et al.*, 1949) and Bechgaard's (1946) follow-up study of over 1,000 patients with hypertension have shown clearly that life expectancy diminishes with even small increments of blood pressure, and that the excess mortality is due mainly to cardiovascular and renal diseases. From such data it has been argued (Stewart, 1957) that hypotensive therapy should be given to symptomless patients: "Perhaps one of the best of the new prospects in hypertension awaits patients of this type." Stewart contemplates an extension of the use of ganglion-blocking drugs to most forms of "established hypertension." However, the fact that raised arterial pressure is associated with a poor prognosis does not permit the conclusion that reduction in that pressure will necessarily improve the prognosis. Further, Evans (1957) has argued forcibly that in the whole group with raised blood pressure there are included individuals whose prognosis is extremely good and whom he terms "hypertonics." His attitude is the antithesis of that of Stewart. According to Evans, "Even in the case of true arterial hypertension . . . neither product of test-tube or crucible halts, nor delays materially, the unfavourable course of the disease." [*Sic.*]

Most authorities, impressed on the one hand by the favourable results of treatment in the malignant phase and in hypertensive heart failure, and on the other by the troublesome side-effects which occur even with recent preparations, would be more selective. Many would agree with Turner (1956), who would not treat patients without objective evidence of hypertensive disease in the retina, heart, or kidney, with the exception of the young male with a high basal pressure.

Present Investigation

With such considerations in mind, we examined the results of treatment of 104 patients with high blood pressure attending the medical unit clinic at St. Mary's Hospital in the period 1950-7. We concerned ourselves only with those patients whose diastolic pressure before treatment was persistently at or above 120 mm. Hg. This excluded from consideration a number of cases treated for high blood pressure, but we feel that all the present cases may fairly be regarded as hypertensive. The blood pressures were measured in the ordinary way with a mercury sphygmomanometer, the point of abrupt fading of the arterial sounds being taken as the diastolic level. The figures have not been corrected for age, sex, or arm circumference.

Several patients began treatment before 1950, and, in them, the whole period of treatment is considered. Eighty-nine were treated with ganglion-blocking drugs, alone or in combination. Six were treated initially by sympathectomy; five of these were subsequently given ganglion-blocking drugs, and one reserpine alone. Six had other operations (nephrectomy, adrenalectomy, or removal of a pheochromocytoma), and four of these were subsequently treated with ganglion-blocking agents. Four were treated only with reserpine or hydrallazine, and eight had no specific therapy.

Though most of the patients were known personally to us, great reliance has had to be placed on case-notes compiled by several different doctors. The initial blood pressure has been taken as the mean of all readings in hospital before the start of treatment, while