the hope of surgical cure of the hypertension. Before operation the precise renal pathology was in doubt, though renal shrinkage with a normal pelvis favoured ischaemia. The renal potassium loss with a low serum level suggested a diagnosis of primary hyperaldosteronism, but the presence of renal disease supported an alternative possibility that this disease was the primary cause of the failure to conserve potassium. The prompt reversal of the potassium-losing tendency after nephrectomy favoured the latter explanation.

There are three possible mechanisms whereby unilateral renal ischaemia might give rise to hypokalaemia. One of these is loss from the damaged tubules of the ischaemic kidney, and the prompt improvement after surgery would support this view. However, loss from the contralateral kidney, due either to the nephrosclerosis of malignant hypertension or to a humoral factor such as secondary hyperaldosteronism, cannot be excluded. Divided renal-function studies with ureteric catheters were attempted to resolve this point, but technical difficulties rendered these studies inconclusive. Whatever the explanation may be, both patients have maintained a normal serum potassium since nephrectomy, which rules out a diagnosis of primary hyperaldosteronism. The aldosterone output was normal in the second case but was not determined in the first. It is of interest that the aldosterone output was high in two similar cases, one described by Wrong (1957) and the other by FitzGerald *et al.* (1957).

Wrong's patient was cured of both hypertension and hypokalaemia after subtotal adrenalectomy and resection of an ischaemic kidney. In the case reported by FitzGerald *et al.* cure of the potassium-losing tendency followed unilateral adrenalectomy, but the blood-pressure remained high and the patient died in uraemia. These cases may be examples of secondary hyperaldosteronism, and this explanation was proposed by both authors. The case of Holten and Petersen (1956) could be interpreted in a similar way. It is possible that Wrong's case may have been similar to our own, because the adrenal tissue was found to be normal and the kidney proved to have an obstructed artery. Our cases do not resemble the others reported in important respects, notably in the apparently rapid onset, the heavy proteinuria, and cure without adrenalectomy. Both the resected kidneys showed the incomplete infarction (*Teilinfarzierung*) described by Fahr (1934): crowded glomeruli separated by shrunken tubules. There can be no doubt that the kidney lesions were the result of ischaemia. Doubt remains about the mechanism of the potassium loss, but, in our second case at least, it is unlikely that aldosterone played any part.

The possibility of similar cases deserves to be considered whenever malignant hypertension and severe hypokalaemia occur together, because of the dramatic cure that may follow nephrectomy.

Summary

Two patients have been studied who presented with malignant hypertension and hypokalaemia of rapid onset. They were found to have a continuing renal potassium loss despite a low serum level. Both proved to have unilateral obstruction of the renal artery, and hypertension was cured in one by nephrectomy, though in the other there was only slight reduction of pressure. The serum potassium level in both has remained normal since operation without supplements. The possible causes of the potassium loss have been discussed.

We should like to thank the Department of Pathology of the Postgraduate Medical School for the pathological reports and the photomicrographs; and Dr. A. H. Gowenlock, senior lecturer in chemical pathology at Manchester University, who kindly determined the aldosterone output in Case 2.

REFERENCES

- Aird, I., Milne, M. D., and Muehrcke, R. C. (1956). *Brit. med. J.*, **1**, 1042.
 Conn, J. W. (1955a). *J. Lab. clin. Med.*, **45**, 6.
 — (1955b). *Ibid.*, **45**, 661.
 Dawson, I. M. P. (1956). *J. Path. Bact.*, **72**, 393.
 Fahr, T. (1934). In F. Henke and O. Lubarsch's *Handbuch der speziellen pathologischen Anatomie und Histologie*, vol. 6, part. 2. Springer, Berlin.
 FitzGerald, M. G., Fourman, P., James, A. H., and Scarborough, H. (1957). *Scot. med. J.*, **2**, 473.
 Holten, C., and Petersen, V. P. (1956). *Lancet*, **2**, 918.
 Milne, M. D. (1955). *Proc. roy. Soc. Med.*, **48**, 780.
 — Muehrcke, R. C., and Heard, B. E. (1957). *Brit. med. Bull.*, **13**, 15.
 — Stanbury, S. W., and Thomson, A. E. (1952). *Quart. J. Med.*, **21**, 61.
 Prunty, F. T. G. (1957). *Ibid.*, **26**, 586.
 Wrong, O. (1957). *Ibid.*, **26**, 586.

NEPHRECTOMY IN CASES OF HYPERTENSION

BY

J. G. YATES-BELL, F.R.C.S.

Urological Surgeon, King's College Hospital, London

The possibility that hypertension might be related to unilateral renal disease was first suggested by Ask-Upmark (1929). The first case in which hypertension was relieved by removal of a kidney, diseased in this case by chronic pyelonephritis, was published by Butler (1937), without apparent knowledge of Ask-Upmark's earlier paper.

Braasch (1942) claimed that hypertension had been relieved permanently in 65 (33%) of the 198 patients in his series, and gave as the criterion of a cure a minimum period of two years' reduction of blood-pressure following nephrectomy. Heritage (1943) presented a very thorough survey of the problem of hypertension and listed among the causes of the condition urinary obstruction and renal vascular disease. He concluded that investigation of a case of unexplained hypertension demands "a complete urological search" before such procedures as splachnicectomy are undertaken.

The ensuing 15 years produced many papers in the world literature, and certain important points of common accord became apparent. First, the incidence of unilateral renal disease as a cause for hypertension is low. Braasch (1942) gives the figure of 4% and Ratliff *et al.* (1947) 5.5%. Secondly, only a fraction of these patients will prove suitable for surgery. Thirdly,

it is unilateral renal vascular disease that will give the highest percentage of cures—as, indeed, is to be expected from the classic experimental work of Goldblatt *et al.* (1934) and of Wilson and Byrom (1939).

Many isolated cases of hypertension due to vascular occlusion have been separately reported. Adams and Newman (1958) report a cure with the interesting but temporary complication of hypotensive overswing. Gellman (1958) reports another successful case with renal artery occlusion, but states that success rates are too high and assumes that many unsuccessful cases are not reported.

The largest number of cures will, however, be provided by cases of chronic pyelonephritis owing to the higher incidence of this condition (Thompson, 1957).

Homer Smith (1956) has the most complete survey of the literature up to 1956; he, too, feels that failures may not be reported, that the 26% cure rate he extracts from 575 reported cases may be too high; and he is apprehensive of “undue optimism.” This fear appears unwarranted, as the figures of successful cases in individual series show remarkable similarity. It is hoped that the presentation of these cases will help to lighten the gloom of Homer Smith’s concluding paragraphs, where he suggests that urological examination should be carried out “only when strong suspicion is raised by history, physical examination and routine laboratory examination . . . and in the face of widespread, diverse, uncontrolled and sometimes uncontrollable therapeutic experimentation, he [the urologist] is urged to observe every conservative measure in its application and interpretation. Even in the presence of obvious unilateral disease, nephrectomy remains an experimental procedure and subject to experimental error.”

Thompson and Smithwick (1952) give 24.4% cure. Gershom Thompson (1957) gives 25% cure in 100 cases of assorted renal conditions; the figures of cure for atrophic pyelonephritis are much higher.

Selection of Patients

There is general agreement on criteria for the selection of patients for operation. Maitland (1952) lists them as follows: (1) The blood-pressure must be labile. (2) Intravenous pyelography should attach suspicion to one kidney. (3) Urine separation should reveal delay in indigocarmine excretion and lowered urea and sodium concentrations on the suspected side. Where the difference is slight these tests will need repeating more than once. The importance of comparing the volume of urinary secretion on the two sides has been emphasized recently; sometimes it is shown to be much reduced on the diseased side in spite of normal excretion urography pictures and normal chemical tests. (4) Aortography, even by the more modern femoral route, is not without risk in the older group of hypertensives. Poutasse and Dustan (1957) suggest the following three indications for aortography: (a) disparity in size or function of the kidneys at intravenous pyelography (I would add also irregularity in shape), (b) the presence of hypertension in young people with no family history, and (c) hypertension which has suddenly become worse.

Poutasse and Dustan performed aortography on 104 selected patients with hypertension and found that 30 of them had lesions of the renal artery.

Nephrectomy or corrective renal artery surgery was performed on 19 patients with good results. Corrective surgery to strictured or aneurysmal renal arteries is giving encouraging results and will certainly offer more hope for a patient with contralateral renal disease. Where the remaining kidney is healthy, however, nephrectomy may yet be preferred to vascular surgery owing to the risk of permanent damage in the diseased kidney or recurrence of the vascular lesion.

It is to be hoped that the work of Winter (1957) on the excretion rate of diodone ^{131}I will prove of great help in the diagnosis of vascular lesions of the kidney and provide a valuable guide to which patients merit further urological investigation in all cases of hypertension.

The value of renal biopsy is by no means agreed upon by the various authors. In my opinion it is of most value where there is some doubt about the integrity of the supposedly healthy kidney, but is obviously not indicated for the healthy kidney when the diseased kidney has negligible function. Where, however, both kidneys function more or less equally but one is suspected, biopsy must be done on both. I prefer a small incision down to the kidney so that an adequate piece of tissue may be removed under vision with a glaucoma trephine or prostatic biopsy punch. The kidney is held steady with a sucker and the risk of accidental injury to neighbouring structures thereby avoided. The piece of tissue removed does not curl up when mounting for section, and is much preferred by pathologists to the pieces obtained from percutaneous biopsy.

Expected nephrectomy was contraindicated in two patients as a result of this method of biopsy. In Wilson’s (1957) case a patient with unilateral contracted kidney and hypertension was found to have a trace of albumin in the otherwise normally secreting kidney, and biopsy of this showed chronic pyelonephritis; nephrectomy was not then carried out.

The presence of hypertensive changes in the healthy kidney and the absence of changes in the diseased “protected” kidney make interpretation of findings very difficult. In addition the patchy distribution of chronic pyelonephritis throughout a kidney often makes the finding of this lesion a chancy affair at biopsy.

Criteria of Cure

When the question of the requirements for a claim of cure are considered the greatest disagreement is apparent in the literature. Thompson and Smithwick (1952) require a diastolic pressure maintained under 90 mm. Hg for one year; Maitland (1952) requires a diastolic pressure under 100 mm. Hg, though in subsequent writings he refers to a “normal” diastolic pressure maintained over 12 months. Homer Smith (1956) requires that the pressure remains below 140/90 for at least one year. He rejects Kreutzmann’s (1947) two cases, as their last recorded pressures were 156/94 and 170/100 respectively. Gershom Thompson (1957) also requires a level below 140/90 for more than a year to claim “good effect,” and classes as “poor effect” one of his own cases in which the level fell

from 230/140 to normal but which gradually increased after 10 years to 170/110.

The selection empirically of 140/90 as an indication of cure or good result is easy, and perhaps reasonable as a scientific optimum, but by adhering rigidly to it some good results are excluded. There is no doubt that benefit should be claimed in more than the 26% in 575 cases allowed by Homer Smith (1956). He fears the pendulum is swinging towards undue optimism, and deaths have been precipitated by unwarranted nephrectomy. No such case has come to our notice, and, as Gershom Thompson states, "unless specific contraindications to operation can be found, it would appear unwise to postpone nephrectomy for fear of not relieving the patient of the distressing symptoms caused by his severe hypertension."

Schaffer and Markowitz (1954) feel that resistance to the operation is even now encountered in fairly sophisticated medical circles, and express the belief that it is exceptional for the pressure, after remaining normal for five to six months, to rise again. This is undoubtedly true, and is admitted by Homer Smith; but, until more definitely established, it will be wise to follow these cases for 12 months and preferably longer.

Included in my own series is a case in point (No. 9). An old house-surgeon of mine developed acute hypertension (200/140) in 1942 at the age of 34 and was gravely ill with retinal changes, etc. He had previously had a von Lichtenberg plastic operation performed by Sir John Thomson-Walker. Investigations now showed poor function in this kidney. At a very difficult nephrectomy a much shrunken and adherent kidney was removed and the blood-pressure fell at once to 115/80; it remained stationary for 10 months, but rose to about 140/105 for the next 16 years. He is in full work as a pathologist and completely well. Must he be rejected as a cure? It is because of this type of case and many similar examples that I suggest a new criterion for cure.

In my earlier series (Yates-Bell, 1952) the figure of 100 mm. Hg diastolic pressure was taken as the maximum permissible to claim a cure. I now, however, require a diastolic pressure of 90 mm. Hg for one year and recommend a simple additional test to be applied to patients who have been much relieved of their symptoms—namely, that if there has been a 20% fall in the diastolic blood-pressure for three years they may be included in the category of a cure. This will, for example, allow a patient (Case 9) whose diastolic blood-pressure has been reduced from 140 to 105 mm. Hg for 17 years very reasonably to be included.

To arrive at the figure of 20% as an additional test all the cases have been reviewed under two headings—a diastolic pressure of 90 mm. Hg or below, and 20% reduction in the diastolic pressure. It was found that cures with a diastolic pressure of 90 or less corresponded almost exactly with the 20% fall required; this latter figure, however, very conveniently let in a few cases that have been cured for a very considerable period symptomatically but were excluded by what appeared to be excessively severe criteria.

Classification and Review of Cases

In 1952 I reported 39 cases of nephrectomy in patients with hypertension. These cases are included

in the present series, but with greater attention to follow-up and criteria for acceptance some have been rejected and 66 personal cases are now presented after a great deal of pruning.

I use the same classification as in 1952: group 1, nephrectomy for hypertension; group 2, nephrectomy for urinary diseases associated with hypertension; and group 3, urinary disease with definite slight hypertension in young people (under 40). Cases of hypernephroma are excluded, as this appears to be traditional, but several cures of hypertension associated with hypernephroma have been noted. The cases have been analysed with varying criteria for cure—a reduction of 25% and 20% in the diastolic pressure, and also for a fall of 100 mm. Hg and to 90 mm. Hg. For the sake of clarity figures of 90 mm. Hg for the diastolic pressure and a 20% fall only are included in the tables and subsequent discussion. The figure of 100 mm. Hg is too lenient and 25% too severe.

In group 1 (Table I) there are 36 cases, with 24 failures and 12 successes (33.3%) using the new combined scheme. Cases 9 and 13 would have been classed as failures by rigid adherence to the 90 mm. Hg diastolic pressure, but have been brought in as successes by the 20% reduction rule. These cases have remained well for 17 years and 6 years respectively. Cases 29

TABLE I.—Nephrectomy for Hypertension (Group 1)

Case No.	Age and Sex	B.P. Pre-op.	Latest B.P. Post-op.	No. of Years Cures Follow-up	Failed	90 mm. Hg Diastolic Pressure	20% Reduction in Diastolic Pressure	Disease
1	48 M	180/135	140/90	13		+	+	Hydronephrosis
2	31 F	230/150	140/90	7		+	+	"
3	47 M	260/150			+			Pyelonephritis
4	39 M	280/160			+			Hypoplastic kidney
5	32 F	225/120	145/100	5	+	0	0	Hydronephrosis
6	54 F	200/130	170/110	5	+			"
7	64 F	190/110			+			"
8	44 F	205/120	160/80	8		+	+	Hypoplastic kidney
9	34 M	200/140	140/105	17		0	+	Pyelonephritis
10	50 F	230/130			+			Hydronephrosis
11	19 F	250/170			+			Hypoplastic kidney
12	26 F	160/110	140/100	4	+	0	0	"
13	53 M	180/130	160/100	6		0	+	Stone
14	45 M	215/130	175/107	4		0	+	Radiation nephritis
15	45 F	235/130			+			Pyelonephritis
16	54 M	240/140	210/110	3	+	0	+	Stone
17	37 F	210/130			+			Hydronephrosis
18	54 F	205/125			+			"
19	49 M	225/125			+			Cysts of kidney
20	46 M	200/130			+			Pyelonephritis
21	54 F	280/150			+			"
22	55 M	240/140			+			Stone
23	50 M	180/120			+			Hydronephrosis
24	44 F	250/118			+			Hypoplasia
25	21 F	165/120	130/70	2		+	+	Pyelonephritis
26	8 M	220/150	115/70	1		+	+	Hypoplasia
27	46 M	220/120	150/105		+	0	0	Pyelonephritis
28	42 M	175/115	120/80	1		+	+	Arterial stricture
29	53 M	250/150	200/110	2	+	0	0	Hypoplasia
30	45 M	220/130	150/100	2	+	0	0	Hydronephrosis
31	72 M	230/120	150/80		+			Radiation nephritis
32	5 F	160/130	140/80	8		+	+	Pyelonephritis
33	7 F	160/110	95/60	2		+	+	"
34	48 M	210/130			+			"
35	23 F	160/115	130/102					"
36	41 F	135/110	126/90	1		+	+	"

Case 5: Relapsed after 10 years. 160/110. Case 6: 260/170 after 12 years, but had 12 years' symptomatic relief. Case 9: 1958 145/100. Previous operation for hydronephrosis. Case 14: Continued improvement after 4 years. Diastolic pressure, 85 mm. Hg. This case has already been recorded by Levitt and Oram (1956). Case 16: Late failure after three years. 230/130. Case 20: 210/110 after 2 years. Case 24: 200/120 after 2 years, but vast clinical improvement. Case 25: Upper element of double kidney. Cases 29 and 30: 20% reduction not claimed; follow-up under 3 years. Case 31: Has not been followed for a full year yet, but the temptation to include a second case of radiation nephritis was not to be resisted. 170/115 on discharge, with marked clinical benefit.

and 30 will be reviewed at the end of three years and may well be successes later (only two-year follow-up at present).

In group 2 (Table II) there were 20 patients, with 10 failures and 10 successes. Cases 206, 213, and 220 are brought in by the 20% reduction rule and have been symptomatically well for 4 years, 4 years, and 10 years

TABLE II.—*Nephrectomy for Urinary Disease with Hypertension (Group 2)*

Case No.	Age and Sex	B.P. Pre-op.	Latest B.P. Post-op.	No. of Years Cures Follow-up	Failed	90 mm. Hg Diastolic Pressure	20% Reduction in Diastolic Pressure	Disease
201	51 M	190/110	140/85	7		+	+	Hydronephrosis
202	61 M	190/100	165/80	7		+	+	Papilloma renal pelvis
203	55 M	210/100	140/70	6		+	+	Stone
204	59 F	185/105	180/70	14		+	+	Hydronephrosis
205	40 M	230/135	190/120		+			Stone
206	53 F	200/130	180/100	4		0	+	"
207	48 F	210/135			+			Aneurysm renal artery
208	48 M	210/135			+			Stone
209	50 F	200/110			+			Stone
210	58 M	240/130	164/90	7		+	+	Hydronephrosis
211	49 M	200/110	150/90	6		+	+	Stone
212	52 F	180/110			+			"
213	51 M	240/155	170/110	4		0	+	"
214	26 M	170/110	130/90	3		+	+	Hydronephrosis
215	46 M	180/120			+			Pyelonephritis
216	48 M	195/125	160/105	1	+			Stones
217	54 F	200/100			+			Tuberculosis
218	38 F	165/105	150/90	8	+			"
219	28 M	180/110			+			"
220	42 F	170/120	158/94	10		0	+	Hydronephrosis

Case 205: 220/150 after 10 years. Case 206: 180/105 after 13 years. Case 216: May be a success later. Some pre-operative readings 190/140. Case 218: Late failure 160/105 again.

respectively. One tuberculous patient (Case 218) had a late relapse after a five-year reduction of diastolic pressure from 105 to 90 mm. Hg and is classified as failure.

In group 3 (Table III) there are 10 cases with 8 cures, which include 5 children under 14 years. No additional

TABLE III.—*Nephrectomy for Slight Hypertension in Patients Under 40 (Group 3)*

Case No.	Age and Sex	B.P. Pre-op.	Latest B.P. Post-op.	No. of Years Cures Follow-up	Failed	90 mm. Hg Diastolic Pressure	20% Reduction in Diastolic Pressure	Disease
101	26 M	150/90	120/70	5		+	+	Hydronephrosis
102	28 M	165/110	165/90	12		+	+	Stone
103	37 M	170/105					0	Hydronephrosis
104	16 M	160/95			+			"
105	13 M	140/90	120/70	3		+	+	"
106	31 F	145/100	110/76	3		+	+	"
107	4 F	150/95	90/55	7		+	+	"
108	4 M	120/90	115/75	2		+	0	"
109	8 F	110/90	110/65	1		+	+	Failed plastic for hydro-nephrosis
110	11 M	135/100	118/78	5		+	+	Hydronephrosis

cures are brought in by the 20% rule, which if used alone would reclassify two successes as failures.

In all groups together, taking a diastolic requirement of 90 mm. Hg plus the 20% reduction cases, there were 30 successes in 66 cases, or 45.5%; in addition, Cases 5, 16, and 218, who had remained as cures for five, three, and eight years respectively, were rejected as late failures but obviously had received considerable benefit from the operation from the point of view of hypertension.

If, however, a diastolic pressure of 90 mm. Hg for one year is insisted on without the addition of 20% reduction cases, we must delete Cases 9, 13, 14, 206, 213, and 220, but would reinsert Cases 5, 16, and 218, which had late relapses. This gives 25 successes in 66 cases—that is, 40.9% benefit instead of 45.5%.

It is felt that the statistics of this combined scheme correspond more closely to the clinical picture. The final assessment, therefore, should be based on a reduction to 90 mm. Hg diastolic pressure with the addition of patients symptomatically cured with a 20% reduction in the diastolic pressure after a three-year follow-up.

Twenty-three cases originally included have been rejected for various reasons, inadequate follow-up, inconclusive pre-operative blood-pressure readings, etc. Lest it be felt that these rejections might lower the beneficial result, these cases have been analysed and a beneficial result could be claimed in over 50%.

During the period (1942 to 1958) covered by this paper, one death from nephrectomy occurred (pulmonary embolus) out of 450 nephrectomies, again excluding nephrectomy for hypernephroma. No patient who had nephrectomy for hypertension died, nor was any such case made worse by the operation so far as can be ascertained by the clinical picture.

Analysis of the cases (Table IV) reveals that hydronephrosis provides the largest number of cases and by far the highest percentage cure, 54%. It is, however,

TABLE IV.—*Analysis of Results*

Disease	No. of Cases	Failed	Good Result
Hydronephrosis	24	10	14
Stone	13	7	6
Pyelonephritis	13	8	5
Hypoplasia	7	5	2
Tuberculosis	3	3	0
Radiation nephritis	2	1	1
Arterial disease	2	1	1
Other causes	2	1	1
	66	36	30

likely that pyelonephritis existed in at least some of these hydronephrosis cases, but they are classified with the pre-operative and operative diagnosis of hydronephrosis. Hypoplasia was disappointing in providing five failures out of seven cases (though another may be claimed as a good result later); it may be that the lesion, being congenital, leads to a long duration of hypertension allowing compensatory changes to develop in the healthy kidney to maintain the blood-pressure. It may be significant that the average age of the 14 successful hydronephrosis cases is 29 and the ten failures is 44. The average age of the successful pyelonephritis cases is 18 and that of the failures 44.

In the whole series, the average age of the 30 successes is 34 and the average age of the 36 failures is 44. Braasch (1942) pointed out that patients over 50 seldom benefit unless the hypertension is recent. Stone is the disease where a successful fall in blood pressure is most likely in patients over 40 years of age. This is opposed to my earlier opinion. Thirty-seven cases were in males, with 18 successes, and 29 were in females, with 12 successes.

The most striking finding is that all the 8 children under 14 years of age were cured, 5 nephrectomies being for hydronephrosis, 2 for pyelonephritis, and 1 for hypoplasia.

Delayed Cure

Case 216 is classed as a failure though his blood pressure was reduced from 195/125 to 160/105 for one year, and he actually had some pre-operative readings of 190/140. The reason for this is the relatively short follow-up period. If he remains well at the present level for three years he might be reviewed later as a possible cure. This also applies to Cases 29 and 30. Case 14 is claimed under the 20% reduction as a success in view of vast clinical benefit maintained for four years; actually the diastolic pressure has continued to fall and is now 85 mm. Hg, and he could be regarded as a cure by any standards; a further justification of the 20% allowance. Case 218 is a late failure after eight years' relief. Case 16 is the only one that would not justify the 20% reduction, for though the diastolic pressure fell from 140 to 110 mm. Hg for three years, it then relapsed to 130 mm. Hg. He is therefore classified as a failure.

The 20% reduction in diastolic pressure seems to be justified as an additional claim for cure if there is marked clinical benefit and the follow-up is extended for three years. Also it would be better if "good result" or "good effect" were claimed rather than "cure."

Summary and Conclusion

The literature on the subject of nephrectomy for hypertension is discussed and reasons for a more optimistic approach to this problem are advanced. Agreement is noted on the investigations required.

Eighty-nine personal cases of nephrectomy for unilateral renal disease in hypertension are reviewed and 66 accepted for analysis.

Criteria for a claim of success are discussed and a new standard is suggested.

The 66 nephrectomies have been analysed and a 45.5% cure is claimed, for which a diastolic pressure of 90 mm. Hg for one year is required. In addition, a few patients symptomatically cured for three years with a 20% fall in the diastolic pressure (even if remaining above 90 mm. Hg) are included.

If the additional claim of those with a 20% fall in diastolic pressure is rejected, the claim for cure is 37.9%.

The younger the patient the better the result.

Patients over 50 seldom benefit unless the hypertension is recent.

While every patient must be considered and assessed as an individual problem it is hoped that a more optimistic approach may be made to these cases. Certainly hypertension in young people must be investigated for a renal cause, and early nephrectomy of a suspected kidney will offer these patients a 50% chance of cure. The number of patients who have been adversely affected by such treatment must be very small; I have not encountered any.

It is recommended that a diastolic pressure of 90 mm. Hg be required for one year to claim a good result, but that patients who have been symptomatically cured for three years with a 20% fall in the diastolic pressure should also be included as good results.

I thank Mr. P. Holmes, Mr. C. Q. Henriques, Miss Gadsby, and Miss Henriksen for help in tracing the follow-up of cases.

REFERENCES

- Adams, J. C. L., and Newman, M. J. D. (1958). *Brit. med. J.*, **1**, 562.
 Ask-Upmark, E. (1929). *Acta path. microbiol. scand.*, **6**, 383.
 Braasch, W. F. (1942). *Canad. med. Ass. J.*, **46**, 9.
 Butler, A. M. (1937). *J. clin. Invest.*, **16**, 889.
 Gellman, D. D. (1958). *Quart. J. Med.*, **27**, 103.
 Goldblatt, H., Lynch, J., Hanzal, R. F., and Summerville, W. V. (1934). *J. exp. Med.*, **59**, 347.
 Heritage, K. (1943). *Proc. roy. Soc. Med.*, **36**, 551.
 Kreutzmann, H. A. R. (1947). *J. Urol. (Baltimore)*, **57**, 467.
 Levitt, W. M., and Oram, S. (1956). *Brit. med. J.*, **2**, 910.
 Maitland, A. I. L. (1952). *Proc. roy. Soc. Med.*, **45**, 731.
 Poutasse, E. F., and Dustan, H. P. (1957). *J. Amer. med. Ass.*, **165**, 1521.
 Ratliff, R. K., Nesbit, R. M., Plumb, R. T., and Bohne, W. (1947). *Ibid.*, **133**, 296.
 Schaffer, A. J., and Markowitz, M. (1954). *Amer. J. med. Sci.*, **227**, 417.
 Smith, H. W. (1956). *J. Urol. (Baltimore)*, **76**, 685.
 Thompson, G. J. (1957). *Ibid.*, **77**, 358.
 Thompson, J. E., and Smithwick, R. H. (1952). *Angiology*, **3**, 493.
 Wilson, C. (1957). *Brit. J. Urol.*, **29**, 348.
 — and Byrom, F. B. (1939). *Lancet*, **1**, 136.
 Winter, C. C. (1957). *J. Urol. (Baltimore)*, **78**, 107.
 Yates-Bell, J. G. (1952). *Proc. roy. Soc. Med.*, **45**, 737.

TUBERCULOSIS OCCURRING DURING STEROID THERAPY

BY

JOHN MACKINNON, M.D., M.R.C.P.

*Lecturer in Cardiology in the University of Manchester;
 Honorary Consultant Physician, Manchester Royal
 Infirmary; Formerly Senior Medical Registrar,
 Crumpsall Hospital*

There is much evidence that steroids facilitate the spread of tuberculosis in susceptible animals (Hart and Rees, 1950; Spain and Molomut, 1950; Karlson and Gainer, 1951). Dissemination from a tuberculous lesion during steroid therapy in man has been reported (Popp *et al.*, 1951), and also its appearance during or soon after treatment in individuals previously presumed to be unaffected (King *et al.*, 1951; Kleinschmidt and Johnston, 1951; Fred *et al.*, 1951; Harris-Jones and Pein, 1952; Davidson *et al.*, 1953; Hill and Kirshbaum, 1956).

In view of the increasing use of more powerful steroids it is thought justifiable to report the cases of three more patients who developed tuberculosis during treatment. In two the disease was widely disseminated, and none were suspected of having tuberculosis before treatment started.

Case 1

A housewife aged 58 was referred to Dr. E. G. Wade in April, 1956. In 1937 she had had a cervico-dorsal sympathectomy performed for Raynaud's disease, which had begun two years previously. Soon afterwards she developed dysphagia which became increasingly severe, and investigation by Mr. Gordon Jack in 1953 revealed a benign oesophageal stricture associated with ulceration and a small hiatus hernia. The dysphagia was not relieved by dilatation, and on January 22, 1954, the hiatus hernia was repaired, the stricture was dilated, and some enlarged paraesophageal glands were excised. Histological examination of these glands was not helpful and there was nothing to suggest tuberculosis.

For a time normal swallowing was restored, then dysphagia recurred, requiring frequent dilatation without much improvement. In January, 1956, she developed painless oedema of both feet and was referred to hospital