carried on the patient's cells—for instance, C and c or E and e. If this should happen, these antibodies would present as a panagglutinin, as apart from very few exceptions (-D-/-D-) (Race *et al.*, 1951) all cells contain one or both allelomorphs. A serological definition and separation of these antibodies might be extremely difficult (Race *et al.*, 1951). It would be of theoretical importance only, as from the practical point of view no blood would be found to be compatible. All blood transfused would be destroyed rapidly.

As compatible blood in A.H.A. will, of necessity, be non-homologous blood, antigens not found in the patient's cells will be introduced into his or her circulation. Patients suffering from A.H.A. are "good reactors" and often produce antibodies to even weak antigens. One therefore runs the risk of stimulating the formation of additional antibodies against the introduced antigen. This must have happened many times in the past after blood transfusion. These additional antibodies produced to the stimulus of introduced antigens may also make transfusion treatment quite impossible. It is conceivable that a patient, having developed an immunologically "idiopathic" anti-c antibody, may be stimulated to produce anti-C in addition. The same condition would then obtain which has been described above—that is, that, apart from a very few cells, no cell would be compatible. It is perhaps true that dramatic transfusion reactions do not occur very frequently in A.H.A. even if the eluate and/or the serum contains the homologous antibody against the antigen introduced. There is no doubt, however, that the blood is destroyed very rapidly in these cases, and often the only effect the transfusion has for the patient is to increase the haemosiderosis which is so marked a feature in the cases of A.H.A. that come to necropsy after prolonged transfusion treatment.

From the above it would appear to be imperative to use not only the serum but also the eluate for cross-matching. Loutit and Mollison (1946) have shown that the survival of normal cells in A.H.A. is shorter than in the congenital variety. The blood used was presumably selected after a cross-match, using serum for the test, had been performed. The short survival is no doubt due to the above-mentioned mechanism. Compatible cells should have the normal life expectancy even in cases of A.H.A.

For the reasons given we have refrained, once the diagnosis had been made and the serology clarified, from treating either of these patients with further transfusions. Though the first patient derived some benefit from the 2 pints (1,140 ml.) he received, the remission was produced by cortisone. Within the rhesus system no foreign antigen was introduced, but, of course, we cannot claim the same from antigens belonging to different systems. The second patient received blood containing a non-homologous C antigen. The latter is known to be rather poor in its antigenic properties. Neither of the two patients has so far produced evidence of the presence of an additional antibody due to the transfusion treatment.

Summary

Two patients suffering from acquired haemolytic anaemia are described. They presented with a variety of symptoms and signs. The occurrence of a lung lesion in one patient is discussed and its possible importance pointed out. The other patient showed the not unusual combination of A.H.A. and thrombocytopenic purpura. The serology showed that both patients had developed an anti-E antibody and one patient an anti-c in addition. The anti-E antibody was present in the sera and eluates of both patients, whereas the anti-c antibody could be recovered from the eluate only. The importance of these findings is discussed with particular reference to transfusion treatment. A revision of compatibility tests in these cases is suggested in view of these findings. It would appear to be essential that cross-matches for selecting blood for these patients be performed using not only the serum but also the eluate prepared from the cells of these patients. Cortisone treatment in both patients was effective in controlling the haemolysis, and both patients achieved a good remission.

The patients were admitted under the care of Dr. S. R. F. Whittaker and Dr. J. V. S. A. Davies, and we thank them for their most helpful attitude, for free access to notes, and for permission to investigate both patients so fully. We also thank Dr. A. P. Prior and Dr. J. C. Ford for their help. We are grateful to Professor S. P. Bedson for his advice on the virology. The staff of the Transfusion Service have generously contributed the "test cells," which involved numerous pricks in the literal sense of the word. We are indebted to all of them, as without the generous supply of these cells the tests could not have been performed. We also thank Miss D. A. Battey for rechecking donor No. 2, and Miss P. M. Young for the secretarial work.

REFERENCES

Dacie, J. V. (1953). *Fourth Congress of the European Society of Haematology*. Amsterdam.
—— and Cutbush, Marie (1954). *J. clin. Path.*, 7. 18.
Dameshek, W. (1953). *Blood*, **8**, 382.
Evans, R. S., Takahashi, K., Duane, R. T., Payne, R., and Liu, C. K. (1951). *Arch. intern. Med.*, **87**, 48.
Flückiger, P., Ricci, C., and Usteri, C. (1955). *Acta Haemat. (Basel)*, **13**, 53.
Höllander, L. (1953). *Experientia (Basel)*, **9**, 468.
Loghem, J. J. van, and Hart, M. van der (1954a). *Vox Sanguinis (Amst.)*, **4**, 2.
—— —— (1954b). Ibid., **4**, 98, 120.
Loutit, J. F., and Mollison, P. L. (1946). *J. Path. Bact.*, **58**, 711.
Race, R. R. (1944). *Nature (Lond.)*, **153**, 771.
—— Sanger, Ruth, and Selwyn, J. G. (1951). *Brit. J. exp. Path.*, **32**, 124.
Stefanini, M., and Dameshek, W. (1954). *Ann. Rev. Med.*, **5**, 87.
—— —— Chatterjea, J. B., Adelson, E., and Mednicoff, I. B. (1953). *Blood*, **8**, 26.
Weiner, W., Battey, D. A., Cleghorn, T. E., Marson, F. G. W., and Meynell, M. J. (1953). *British Medical Journal*, **2**, 125.
Wiener, A. S. (1944). *Proc. Soc. exp. Biol. (N.Y.)*, **56**, 173.

DISSECTING ANEURYSM DURING METHONIUM THERAPY

A REPORT ON NINE CASES TREATED FOR HYPERTENSION

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Nine out of a series of 44 hypertensive patients who came to necropsy after methonium or pentolinium therapy have had dissecting aneurysms. We think that this incidence is beyond chance expectation. Three of the cases have been mentioned elsewhere (Doniach *et al.*, 1954; Goldsmith *et al.*, 1955).

Of the 44 cases, 34 were suffering from malignant hypertension and 10 from "benign" hypertension, the latter with major complications or severe symptoms. While we now accept malignant hypertensives for treatment only when they are non-uraemic or have a blood urea of less than 110 mg. per 100 ml., eight cases with more severe uraemia than this were included in our earlier therapeutic trials.

Control data on untreated malignant hypertension were obtained from a study of such cases admitted to Hammersmith Hospital during the period 1935–50; data on benign hypertension were obtained from 200 consecutive post-mortem examinations on patients with benign essential hypertension, confirmed pathologically, and with a record of at least one blood-pressure reading of 190/110 mm. Hg or over during life.

Case 1

A male clerk aged 50 was admitted to Hammersmith Hospital on January 8, 1952, complaining of dyspnoea on exertion, and, recently, at night.

Examination revealed locomotor brachialis; blood pressure, 225/170 mm. Hg; harsh apical systolic murmur and thrill; and bilateral retinitis with haemorrhages and exudates, but no papilloedema or signs of congestive failure. *X*-ray examination and E.C.G. showed gross left ventricular enlargement. On January 21 subcutaneous hexamethonium was started, and eventually the patient was discharged on 300 mg. three times a day. This regularly lowered his standing blood pressure, one hour after injection, to about 150/110 mm. Hg. Though much improved by the drug, he stopped it one month later because of side-effects. Left ventricular failure recurred and he was readmitted. Subcutaneous hexamethonium again proved effective, and he was restabilized on 450 mg. three times a day. For a few weeks he was given a more powerful analogue, phenyldimethonium ("M. & B. 1950"), which was also effective but was available in small supplies only. In September he developed "methonium lung" (Doniach *et al.*, 1954), cortisone was started, and in place of hexamethonium he was given another trial hypotensive agent, "Ciba 7441," which had no effect on the blood pressure in the doses used. Ultimately, on November 11, he was changed back to hexamethonium, 420 mg. thrice daily subcutaneously, and remained on it thereafter.

On October 6 he had an attack of chest pain, which recurred periodically. At first its character was ill defined, but on December 18 he had a severe attack; his blood pressure was at that time 280/150 mm. Hg, and a tentative diagnosis of dissecting aneurysm of the aorta was made. Hexamethonium was not stopped, however, and he was discharged home on January 8, 1953. On January 19 he had a further attack of pain, lapsed into coma, and died on the following day.

Necropsy revealed medionecrosis of the aorta with three dissecting aneurysms in various stages of healing. There was an unexplained recent myocardial infarct without coronary occlusion. Microscopical examination of the kidneys revealed a severe benign essential hypertension.

Case 2

A general dealer aged 28 was admitted to Hammersmith Hospital on August 25, 1951. He presented with lower motor neurone facial palsy, but had been a known hypertensive for eight years. There was a history of psychiatric upset and he was rather uncooperative.

On examination there were no signs of congestive cardiac failure. Neither dorsalis pedis artery was palpable, but the peripheral vascular system appeared otherwise normal. Blood pressure was 230/170 mm. Hg. Bilateral papilloedema and retinitis were present. Triple rhythm was audible.

X-ray examination showed moderate cardiac enlargement, E.C.G. gross left ventricular strain. As a routine intravenous pyelogram showed no excretion of the dye on the left side, a laparotomy was performed through a posterior incision. No trace of kidney could be found. After a period of convalescence the patient was readmitted and started on hexamethonium on February 8, 1952, in doses of up to 50 mg. three times a day subcutaneously, which lowered his standing blood pressure to the order of 165/140 mm. Hg one hour after injection. A further exploratory operation through an anterior incision was planned, but the patient refused this and discharged himself, taking a supply of hexamethonium home with him. It is not certain, however, that he continued therapy outside hospital.

On March 30 he died; no details are available about his death. A coroner's post-mortem examination, performed by the late Dr. W. J. O'Donovan, revealed a haemopericardium from a ruptured dissecting aneurysm of the aorta, but unfortunately no histological examination of the kidney was performed.

Case 3

A chartered accountant aged 56 was admitted to Hammersmith Hospital on June 24, 1953. He was known to have had hypertension for over three years, and dermatomyositis, proved by biopsy in another hospital. His main complaints were failing memory, intermittent claudication, exertional dyspnoea, and failing vision.

Examination revealed tortuous palpable arteries; blood pressure 250/170 mm. Hg; incipient heart failure and a triple rhythm; bilateral papilloedema; and moderate retinitis. *X*-ray examination showed a large left ventricle with a greatly uncoiled aorta.

Pentolinium was started, and he was eventually stabilized on 22.5 mg. three times a day subcutaneously, which regularly reduced his standing blood pressure to 160/100 mm. Hg. On this regime his fundi returned to normal, his dyspnoea improved, and he returned to work. On February 26, 1954, at the out-patient clinic, an aortic diastolic murmur was heard for the first time, but there were no accompanying symptoms. *X*-ray examination at this time showed a considerable reduction in the heart size.

On July 16 his treatment was changed to 30 mg. of pentolinium subcutaneously at night, and 300 mg. orally at 11 a.m.

On September 12, while on holiday in France, he died suddenly. The body was brought back to England for necropsy, performed by Dr. David Haler. It revealed a haemopericardium due to a ruptured dissecting aneurysm of the aorta, but the tissues were too autolysed for histology.

Case 4

A housewife aged 55 was admitted to Hammersmith Hospital on September 14, 1952. She gave a history of "kidney trouble" following scarlet fever at the age of 5. She was known to have been hypertensive for five years. Her main complaints were headaches, vomiting, deteriorating vision, and nocturnal polyuria.

Examination revealed thickened arteries; blood pressure 220/145 mm. Hg; bilateral papilloedema and retinitis; no signs of congestive cardiac failure, but triple rhythm. *X*-ray examination showed slight left ventricular enlargement. Hexamethonium was started on October 6, at first by mouth, later (from October 20) by subcutaneous injection to a maximum of 80 mg. three times a day, which reduced her blood pressure, taken in the standing position, one hour after injection to about 145/105 mm. Hg. Her symptoms and fundi were much improved.

On November 31, following a purgative, she developed severe diarrhoea, and the following day, during her evening meal, developed central chest pain, radiating down into her arms and abdomen. On examination she was severely shocked. Blood pressure was 85/65 mm. Hg, with distended jugular veins. E.C.G. suggested myocardial infarction, and anticoagulants were started. On December 2 a further attack of pain occurred in the evening, and the patient died.

Post-mortem examination revealed medionecrosis of the aorta and a dissecting aneurysm which, obstructing the coronary arteries, had produced a myocardial infarct. The kidneys exhibited a malignant nephrosclerosis with classical onion-skin hyperplasia of the intima in the arterioles, but no fibrinoid necrosis.

Case 5

A car-washer aged 60 was admitted to Hammersmith Hospital on November 24, 1952, in an attack of nocturnal dyspnoea. He gave a history of chronic bronchitis with, at times, retrosternal pain on coughing, but no angina pectoris.

On examination he was very dyspnoeic and pale, but was not sweating. There was gross venous engorgement and oedema; the liver was enlarged two to three fingerbreadths below the costal margin. Summation gallop was audible. Blood pressure was 270/140 mm. Hg. The left fundus was obscured by cataract, but the right eye, which was aphakic, showed retinitis and early papilloedema. E.C.G. showed gross left ventricular strain, and *x*-ray examination moderate cardiac enlargement. The blood urea was 94 mg. per 100 ml. blood.

Digitalis and mersalyl, with morphine and aminophylline, produced much benefit in the acute attack, but the blood pressure remained high (240/130 mm. Hg) and on December 27 he was started on hexamethonium, 25 mg. three times a day subcutaneously, later increased to 100 mg. three times a day but with no fall in blood pressure except in the early stages.

On January 7, 1953, just after his night dose of hexamethonium, he developed a sudden severe abdominal pain, with diarrhoea. Hexamethonium was stopped and chloramphenicol given as the diarrhoea was thought to be infective, but it failed to respond to either measure. On January 13 he "fell out of bed," became unconscious, and died seven hours later.

Post-mortem examination revealed an aneurysm dissecting throughout the length of the aorta which exhibited medionecrosis, a large right cerebral haemorrhage, and acute colitis. The kidneys were arteriosclerotic, the right being grossly atrophic. Microscopy showed evidence of an old pyelonephritis in the right kidney, and stigmata of malignant hypertension with cellular hyperplasia of the intima in the arterioles in the left.

Case 6

A tool-maker aged 48 was admitted to Hammersmith Hospital on July 7, 1951, giving a history of a recent attack of transient hemiparesis and dysphasia. He had no other symptoms or relevant history.

On examination his blood pressure was 230/130 mm. Hg. Arteriovenous nipping was the only abnormality in the retinae. *X*-ray examination showed slight left ventricular enlargement and the E.C.G. moderate enlargement.

Hexamethonium was started subcutaneously, reaching a maximum dose of 270 mg. three times a day. On this, his blood pressure was well controlled, standing figures one hour after injection being of the order of 150/100 mm. Hg; no further attacks of paresis occurred, and the fundi did not deteriorate. On June 9, 1953, his treatment was changed to pentolinium, at first three times and then twice daily (15 mg. at night, 7.5 mg. in the morning) without ill effects, and with a response of blood pressure similar to that on hexamethonium.

On January 6, 1955, he was admitted to Hillingdon Hospital with a history of sudden onset of chest pain, radiating downwards, coming on six hours after his last injection. On examination his blood pressure was 220/120 mm. Hg. All the major pulses were palpable. The pulse rate was 44. E.C.G. showed mild ischaemic changes. Dissecting aneurysm was considered as a possible diagnosis, but discarded in favour of one of coronary thrombosis, and anticoagulants were started. There was a progressive fall in blood pressure; however, the patient developed heart block and died on January 12.

Post-mortem examination showed a ruptured dissecting aneurysm of the aorta, which exhibited marked medionecrosis, a haemothorax, and a myocardial infarct in the presence of patent coronary arteries. No renal histology was done.

Case 7

A farmer aged 42 presented with an attack of left ventricular failure. On examination his blood pressure was 260/145 mm. Hg. Papilloedema and retinitis were present. The blood urea was normal. He was treated with hexamethonium to a maximum dose of 120 mg. three times a day which reduced his blood pressure to an average figure of 170/110 mm. Hg. He remained well for 11 months and then, while on holiday, died suddenly. Post-mortem examination revealed a dissecting aneurysm of the aorta, but unfortunately no further details are available.

Case 8

A male clerk aged 49 presented at Central Middlesex Hospital in August, 1952, with a nine-months history of recurrent left ventricular failure uncontrolled by the usual measures.

On examination he was in severe congestive failure. His blood pressure was 180/130 mm. Hg. There was no papilloedema or retinopathy. The blood urea was normal. He was treated for six months with hexamethonium, 75 mg. three times a day subcutaneously, then 200 mg. of hexamethonium in polyvidone three times a day subcutaneously. On these his blood pressure was only slightly reduced (average 175/115 mm. Hg), but his symptoms were much improved and he was able to return to work.

He was readmitted at the seventeenth month with severe chest and abdominal pain, and absence of the pulses in the right leg, and died.

Post-mortem examination showed a dissecting aneurysm of the aorta, extending from a point 1 cm. above the aortic valve to the right internal iliac artery. The upper end of the tear almost completely encircled the aorta. There was gross ulceration and calcification, but medionecrosis was slight and many elastic fibres were seen. No details of renal histology are available.

Case 9

A chauffeur aged 53 presented at Central Middlesex Hospital in April, 1953, complaining of palpitations. Examination revealed congestive cardiac failure, cardiac enlargement, and unilateral papilloedema. His blood pressure was 290/190 mm. Hg; blood urea, 90 mg. per 100 ml. The Wassermann reaction was positive.

He was discharged from hospital on digitalis, mersalyl, and 220 mg. of hexamethonium in polyvidone subcutaneously three times a day, which reduced his blood pressure to an average of 210/115 mm. Hg. He improved sufficiently to return to work, but eight months later he died.

Post-mortem examination revealed haemopericardium from a dissecting aneurysm, about 4 cm. in length, arising just above the aortic valve. The aorta showed large areas of cystic medionecrosis and moderate atheroma. There was evidence of a previous dissecting aneurysm with healing. The kidneys showed typical changes of malignant hypertension with necrotizing arteriolitis.

Results

Although these numbers are too small for adequate statistical analysis, it is interesting to compare the incidence of dissecting aneurysms in the treated and untreated groups (Table I).

TABLE I.—*The Incidence of Dissecting Aneurysms in Treated and Untreated Hypertensives*

	Treated Cases		Control Cases	
	Necropsies	Dissecting Aneurysms	Necropsies	Dissecting Aneurysms
Malignant:				
Initial blood urea under 110 mg. per 100 ml.	26	6 (23%)	34	1 (3%)
Initial blood urea over 110 mg. per 100 ml.	8	0	55	0
Total ..	34	6 (18%)	89	1 (1%)
Benign	10	3 (30%)	200	6 (3%)
Total ..	44	9 (20%)	289	7 (2%)

Males outnumber females by 8 to 1, compared with a preponderance of 2 to 1 in untreated cases (Shennan, 1934). The age of the nine treated patients who developed dissecting aneurysms averaged 49 years, between limits of 28 and 60 years, compared with an average of 59.3 years in 18 other cases collected from our own records (10 being known hypertensive patients). Two patients in the treated series showed evidence of previous dissecting aneurysms, partly healed; one patient had three such lesions. Similar observations were made in untreated patients. Crowell (1921) estimated that it occurred in 20% of cases; Shennan (1934) in 10%.

Discussion

Dissecting aneurysm of the aorta is more often than not associated with hypertension. Thus Gore and Seiwert

(1952) noted it in 58% of a series of 85 patients with dissecting aneurysms; Baer and Goldburgh (1948) in 58% of 44 such patients. On the other hand, dissecting aneurysm appears to be extraordinarily rare in malignant hypertension. Much of the published literature gives inadequate data about the appearance of the retinae and the histology of the kidneys. Between 1914 (when malignant hypertension was first defined by Volhard and Fahr) and 1955, over 1,400 cases of dissecting aneurysm of the aorta have been collected from 350 papers in the world's literature. Among these, only three were clearly shown to give both clinical and pathological evidence of malignant hypertension—those of Murphy and Grill (1930), Roques *et al.* (1944), and one described in a case conference in the Massachusetts General Hospital (1955). These, and a number of less adequately documented cases, are listed in Table II.

TABLE II.—*Cases of Dissecting Aneurysms in Malignant Hypertension*

Diagnosed on Clinical and Pathological Grounds (3 *cases*).—Murphy and Grill (1930, Case 12); Roques *et al.* (1944); Massachusetts General Hospital (1955), Case Conference No. 41031.

Clinical Diagnosis Without Pathological Confirmation (8 *cases*).—Dumas *et al.* (1929) (optic atrophy—no papilloedema); McGeachy and Paullin (1937, Case 3); Hamburger and Ferris (1938); Paliard and Plauchu (1938); Zimmerman (1943); Palmer and Mathisen (1946, Case 2); Schottstaedt and Sokolow (1953); Thomson and Marson (1955) (malignant hypertension developed after the first non-fatal dissection).

Pathological But Not Clinical Evidence (6 *cases*).—Massachusetts General Hospital (1935, Case Conference No. 21041); Massachusetts General Hospital (1940, Case Conference No. 26341); Palmer and Mathisen (1946, Case 11); Levinson *et al.* (1950, Case 15); Oram and Holt (1950); Wyngaarden *et al.* (1954).

Diagnosed on Unspecified Grounds (3 *cases*).—McGeachy and Paullin (1937, Case 1); Bay (1944, Case 3); Bechgaard (1946).

In all, 20 cases are listed, with complete proof of the presence of malignant hypertension in three, compared with our series of six treated cases with both clinical and pathological proof of malignant hypertension in three. It would be hard to believe that this frequent occurrence in treated cases is entirely due to chance. It seems to us that three possible explanations might account for this association.

1. Treatment Prolongs Life and Allows this Complication to Develop.—The facts lend little support to this view. Thus the survival time in the 34 control cases without severe initial uraemia was 6.5 months from the time of diagnosis; in the six treated cases it was 7.5 months. Adequate control figures for the benign hypertensives are not available, but the survival time in the three treated patients (42, 17, and 12.5 months respectively) does not seem inordinately long.

2. The Fluctuation in the Blood Pressure Encourages the Development of Dissecting Aneurysm.—This seems to be a much more plausible explanation. Many writers have suggested that this may be an important factor in precipitating dissection (Shennan, 1934; Gore and Seiwert, 1952). McGeachy and Paullin (1937) were able to elicit a history of exertion immediately prior to the onset in 33 out of 127 cases. Other factors which have been inculpated are violent emotion and straining at stool, as in the case of George II (Nicholls, 1761). Cherry and Cherry (1941), however, think that fluctuations in blood pressure are of little importance. Two of our cases of dissecting aneurysm occurred on treatment with the polyvidone solution, which leads to a slower rate of fall and rise in blood pressure. This may argue slightly against the importance of violent fluctuations of pressure as a precipitating factor.

3. These Hypotensive Agents Have a Specific Biochemical Effect on the Aorta.—This possibility cannot be ruled out, though the amount and duration of dosage varied considerably, lasting as little as 11 days in Case 5. The characteristic pathology of medionecrosis varied in severity, and in Case 8 atheroma was a more conspicuous lesion. It may be worth recalling that tyramine has been shown to produce lesions of medionecrosis and necrotizing arteriolitis in experimental animals (Duff *et al.*, 1939).

We feel that it is important that these cases should be recorded because: (1) Physicians using these drugs may mistake this complication for a myocardial infarct (White *et al.*, 1934; Bourne and Mills, 1946), withhold hypotensive therapy which may be of value (Pyke, 1953), and administer anticoagulants which further reduce the remote chance of survival. (2) Our experience may throw light on the pathogenesis of dissecting aneurysm. In this connexion it would be of value to hear any further evidence from pathologists on the incidence of dissecting aneurysm in malignant hypertension, and to know whether other clinicians using methonium compounds and allied drugs have had experience of this complication.

Summary

Nine patients with hypertension, malignant in six, who came to necropsy after parenteral hexamethonium or pentolinium therapy were found to have died of dissecting aneurysm of the aorta. It is thought that treatment may be causally related to this complication. Attention is called to the great rarity of reports of dissecting aneurysm in malignant hypertension, and a plea is put forward for such experience to be reported.

The possible mechanism of production of the complication is discussed, and the clinical and theoretical implications are mentioned.

We are indebted to the physicians to the Central Middlesex and Hillingdon Hospitals for permission to describe three of their cases; to Dr. David Haler and the late Dr. W. J. O'Donovan for reports on post-mortem examinations on two of the patients; and to the senior members of the Departments of Medicine and Pathology of the Postgraduate Medical School for permission to publish five of their cases. A research grant from Messrs. May and Baker Ltd. supported this work.

REFERENCES

Baer, S., and Goldburgh, H. L. (1948). *Amer. Heart J.*, **35**, 198.
Bay, E. B. (1944). *Med. Clin. N. Amer.*, **28**, 112.
Bechgaard, P. (1946). *Acta med. scand.*, Suppl. 172, p. 211.
Bourne, G., and Mills, P. J. W. (1946). *Brit. Heart J.*, **8**, 181.
Cherry, C. B., and Cherry, K. T. (1941). *Industr. Med.*, **10**, 525.
Crowell, P. D. (1921). *J. Amer. med. Ass.*, **77**, 2114.
Doniach, I., Morrison, B., and Steiner, R. E. (1954). *Brit. Heart J.*, **16**, 101.
Duff, G. L., Hamilton, J. D., and Magner, D. (1939). *Proc. Soc. exp. Biol. (N.Y.)*, **41**, 295.
Dumas, A., Croizat, P., and Lyonnet, R. (1929). *Lyon méd.*, **143**, 394.
Goldsmith, H. J., Beaven, D. W., and Lambert, H. P. (1955). *Lancet*, **1**, 371.
Gore, I., and Seiwert, V. J. (1952). *Arch. Path. (Chicago)*, **53**, 121.
Hamburger, M., and Ferris, E. B. (1938). *Amer. Heart J.*, **16**, 1.
Levinson, D. C., Edmeades, D. T., and Griffith, G. C. (1950). *Circulation*, **1**, 360.
McGeachy, T. E., and Paullin, J. E. (1937). *J. Amer. med. Ass.*, **108**, 1690.
Massachusetts General Hospital (1935). *New Engl. J. Med.*, **212**, 162 (Case 21041).
—— (1940). Ibid., **223**, 294 (Case 26341).
—— (1955). Ibid., **252**, 104 (Case 41031).
Murphy, F. D., and Grill, J. (1930). *Arch. intern. Med.*, **46**, 75.
Nicholls, F. (1761). *Phil. Trans.*, **52**, 265.
Oram, S., and Holt, M. C. (1950). *Brit. Heart J.*, **12**, 10.
Paliard, F., and Plauchu, M. (1938). *Lyon méd.*, **162**, 641.
Palmer, J. D., and Mathisen, A. K. (1946). *Canad. med. Ass. J.*, **55**, 585.
Pyke, D. A. (1953). *Lancet*, **2**, 1189.
Roques, E., de Brux, J., and Bollinelli (1944). *Sem. Hôp. Paris*, **20**, 239.
Schottstaedt, M. F., and Sokolow, M. (1953). *Amer. Heart J.*, **45**, 334.
Shennan, T. (1934). *Spec. Rep. Ser. med. Res. Coun. (Lond.)*, No. 193.
Thomson, A. P., and Marson, F. G. W. (1955). *Lancet*, **1**, 482
Volhard, F., and Fahr, T. (1914). *Die Brightsche Nierenkrankheit*. Berlin.
White, P. D., Badger, T. L., and Castleman, B. (1934). *J. Amer. med. Ass.*, **103**, 1135.
Wyngaarden, J. B., Keitel, H. G., and Isselbacher, K. (1954). *New Engl. J. Med.*, **250**, 597.
Zimmerman, S. L. (1943). *J. Lab. clin. Med.*, **28**, 1799.

A scheme to aid in the rehabilitation of hospital patients has been put into operation by the Swindon and District Hospital Management Committee. After discharge from hospital suitable patients are admitted to a flat which is attached to the department of physical medicine at the hospital, and there the patients are trained to make the best use of limited powers by a resident warden, who is herself a paraplegic. Describing this scheme in the *Sunday Times* (December 18, 1955), the chairman of the Hospital Management Committee stated that it had been made possible by the generous financial help of the Nuffield Provincial Hospitals Trust. The local health authorities and their welfare workers co-operate closely with the hospital in this scheme, so that when patients are discharged from the flat they can continue to have supervision at home.