BIBLIOGRAPHY

- Bartels, E. C., and Cattell, R. D. (1950). *Ann. Surg.*, **131**, 903.
 Biskind, G. R., Meyer, M. A., and Beadner, S. A. (1941). *J. clin. Endocrinol.*, **1**, 113.
British Medical Journal (1949). **1**, 1131.
 Cole, Leslie (1950). *Brit. Heart J.*, **12**, 232.
 Goldenberg, M., Snyder, C. H., and Aranow, H. (1947). *J. Amer. med. Ass.*, **135**, 971.
 Haimovici, H. (1948). *Proc. Soc. exp. Biol., N.Y.*, **68**, 40.
 MacKeith, R. (1944). *Brit. Heart J.*, **6**, 1.
 Reid, T. M., and Salm, R. (1949). *British Medical Journal*, **1**, 1116.
 Spear, H. C., and Griswold, D. (1948). *New Engl. J. Med.*, **239**, 736.

A CASE OF ADRENAL PHAEOCHROMOCYTOMA

BY

J. F. PANTRIDGE, M.C., M.D., M.R.C.P.

AND

M. McC. BURROWS, M.B.

(From the Belfast City Hospital)

The first case of chromaffin tumour of the adrenal medulla correctly diagnosed and successfully removed was reported by Shipley (1929). Between 1929 and 1947 these tumours have been successfully removed in some 44 cases (Hatch *et al.*, 1949). The object of this communication is to record the occurrence of a phaeochromocytoma with somewhat unusual features and its successful removal.

Case Report

The patient, a widow aged 66, had suffered irregularly from "peculiar attacks" for at least seven years. Each attack began with epigastric discomfort associated with eructation of gas and sometimes with retching. These symptoms were quickly followed by a feeling like an electric shock in the limbs, back of the neck, and back of the head. The patient felt warm during the attacks, although she had noted that her hands became blue. The attacks

occurred in episodes, each lasting two to four months. There had been long free periods, the longest being nearly two years. During an episode there were four to seven attacks each week. For the past two years the attacks had been associated with "very rapid beating of the heart."

On examination the patient was found to be intelligent and co-operative. There was no cyanosis, oedema, or apparent rise in the jugular venous pressure. The pulse was 84 and regular, and the blood pressure 140/80 mm. Hg. There was clinical evidence of cardiac enlargement, the apex beat being in the sixth intercostal space in the anterior axillary line. The mitral first sound was split. Examination of the respiratory system revealed nothing abnormal. The liver edge was palpable 1 in. (2.5 cm.) below the right costal margin. A swelling, thought to be a palpable right kidney, was found in the right hypochondrium. Examination of her nervous system revealed nothing relevant.

The patient was seen during an attack on the day after admission. She appeared very apprehensive. The face was flushed, the limbs were trembling, and the hands were cold and cyanosed. The pulse was 150 and regular, and the blood pressure 270/170. Subjective symptoms lasted only 15 minutes. Within half an hour the blood pressure had fallen to 120/80, and the pulse rate had returned to normal. The variations in the blood pressure, spontaneous and induced, during the patient's pre-operative stay in hospital are shown in Fig. 1.

Investigations

An electrocardiogram obtained during her first attack in hospital showed sinus tachycardia, rate 150. The next day there was a sinus rhythm, rate 55. The standard unipolar limb and precordial leads were regarded as normal. The basal metabolic rate was -10%, and the blood cholesterol 190 mg. per 100 ml. Radiography and fluoroscopic examination of the chest revealed moderate enlargement of the left ventricle; the lung fields were clear. An intravenous pyelogram showed good excretion on both sides, with normal calices and pelves. The right kidney appeared to lie rather low. The blood urea was 44 mg. per 100 ml.; W.R. negative; fasting blood sugar was 91 mg. per 100 ml., 105 mg. during an attack.

Injection of histamine, 0.05 mg., caused a rise in blood pressure, but did not produce tachycardia or any

FIG. 1.—Blood-pressure readings and pulse rates before operation.

FIG. 2.—Blood-pressure readings during operation.

of the symptoms associated with a spontaneous attack. Palpation of the right renal region was on one occasion followed by a marked but symptom-free rise in blood pressure. The injection of histamine, 0.05 mg., following the intravenous infusion of "dibenamine," 270 mg., failed to cause a rise in blood pressure. (See Fig. 1.)

The clinical history and the attack suggested the presence of a chromaffin-tissue tumour. It was thought that the tumour was arising from the right adrenal medulla, since palpation of the swelling in the right renal region on one occasion caused a rise in blood pressure. Surgical exploration was therefore advised, and the tumour was found and removed. The left adrenal gland was normal.

Progress

The variations in blood pressure during the operation are shown in Fig. 2. The alarming rise in pressure which occurred on handling the tumour was controlled by the intravenous injection of dibenamine 25 mg. It was considered that this amount of dibenamine would not interfere with the action of *noradrenaline*, should the latter be necessary to combat hypertension following removal of the tumour. A profound fall in pressure occurred immediately after clamping of the pedicle of the tumour. This was controlled by intravenous *noradrenaline* and intramuscular "methedrine" 20 mg. During the 19-minute period after clamping of the tumour pedicle 40 ml. of a solution containing 10 µg. of *noradrenaline* per ml. was given by intravenous injection.

A *noradrenaline* drip was started half an hour after operation. The rate of flow was varied so that the systolic blood pressure was not allowed to fall below approximately 90 mm. Hg. In the 30 hours following operation 30 mg. *noradrenaline* was required. After this period the pressure became stable at approximately 98/50, and remained at this level during the patient's stay in hospital.

Eight weeks after operation her blood pressure was 145/100. There were no signs of adrenal cortical insufficiency. Clinical and radiological examination at this time showed no change in the size of the heart.

Histologically the tumour was found to be a typical phaeochromocytoma. Assay showed that 1 g. of tumour tissue contained 8.3 mg. *L-noradrenaline* and 1.32 mg. *L-adrenaline*.

Discussion

Some features of the case require comment. The test substances, histamine (Roth and Kvale, 1945) and acetyl- β -methylcholine (Guarneri and Evans, 1948), failed to produce a typical paroxysm. The rise in blood pressure after injection of these substances and that following abdominal palpation were not associated with tachycardia, nor with any of the symptoms or other signs which characterize a spontaneously occurring attack. Symptomless paroxysmal rises in blood pressure have also been noted in patients with phaeochromocytoma (MacKeith, 1944).

The pressor effect of *noradrenaline* following intravenous injection is not associated with tachycardia or usually with distressing subjective symptoms (Swan, 1949). It might therefore be postulated that asymptomatic paroxysmal hypertension in the presence of a phaeochromocytoma is due to the release of *noradrenaline*, and that attacks with tachycardia and marked subjective symptoms follow the release of *adrenaline*. If this is so, the absence of hyper-

glycaemia during a spontaneous attack in this case is difficult to explain, since *adrenaline* is eight times more potent than *noradrenaline* in producing hyperglycaemia (West, 1947).

The dangers of operative removal are, first, the development of a fatal hypertensive paroxysm when the tumour is handled (Holst, 1938), and, secondly, the development of post-operative hypotension, which occurred in approximately half the reported cases. It has been suggested that *noradrenaline* rather than *adrenaline* should be used in its treatment (Walton, 1950), and its efficacy in our case is worthy of note, particularly since administration of the more commonly used pressor substances to an elderly patient with cardiac enlargement might carry considerable risk.

Summary

The successful removal of a phaeochromocytoma from an elderly woman is reported.

Certain unusual features of the case are briefly discussed, and the value of *noradrenaline* in the control of post-operative hypotension is noted.

The patient was under the care of Professor F. M. B. Allen, to whom we are indebted for co-operation and advice. We are indebted to Professor J. H. Biggart for the pathological study, and to Dr. T. B. B. Crawford, Edinburgh University, for the assay of the pressor activity of the tumour. The *noradrenaline* used was part of a gift to Professor Greenfield from Messrs. Bayer Products, Ltd.

REFERENCES

- Guarneri, V., and Evans, J. A. (1948). *Amer. J. Med.*, **4**, 806.
- Hatch, F. N., Richards, V., and Spiegl, R. J. (1949). *Ibid.*, **6**, 633.
- Holst, E. J. (1938). *Acta med. scand.*, **94**, 510.
- MacKeith, R. (1944). *Brit. Heart J.*, **6**, 1.
- Roth, G. M., and Kvale, W. F. (1945). *Amer. J. med. Sci.*, **210**, 653.
- Shipley, A. M. (1929). *Ann. Surg.*, **90**, 742.
- Swan, H. J. C. (1949). *Lancet*, **2**, 508.
- Walton, J. N. (1950). *Ibid.*, **1**, 438.
- West, G. B. (1947). *J. Physiol.*, **106**, 418.