CARDIAC ARRHYTHMIAS AND SERIAL CHANGES OF
VARIOUS SERUM ENZYMES IN A PATIENT WITH
PHEOCHROMOCYTOMAS OF BOTH ADRENALS

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VARIOUS electrocardiographic abnormalities occurring during hypertensive crises in patients with pheochromocytoma have been reported by many investigators!¹⁻³

We observed electrocardiographic signs of myocardial damage, nodal rhythm in response to the histamine test, and supraventricular tachycardia during surgery, attributable to hypertension in a patient with pheochromocytomas of both adrenals and paroxysmal episodes of hypertension.

The clinical data, the serial changes of various serum enzymes and the electrocardiographic findings in this patient are presented and discussed in this report.

CASE REPORT

The patient (S. U.), a 26-year-old man, was well until June 21, 1970, when he developed abdominal cramps and headaches. This was follow-

ed by pounding in the chest and the sensation that his heart was racing.

Physical examination revealed a regular pulse of 100, blood pressure of 212/112 mmHg and temperature of 37.5°C. His skin was smooth, moist, and pale. The pupils were normal in size and reaction, and fundoscopy showed Scheie S₁H₀. The lungs were clear, and the heart was normal in size. A grade 2 systolic murmur was heard over the entire anterior chest.

An ECG taken during a recurrence of symptoms showed ST depression in leads II, III, aVF, and V3 through V6, ST elevation in leads aVR and aVL, and tall sharp T waves in leads V1 through V4, as shown in Fig.1.

At the time of admission, the WBC was 14,800, ESR 15 mm/hr., SCPK 92 mU/ml, SGOT 97 RF-U, SLDH 775 W-U, and SLDH isoenzymes H-type. Serial changes of the various serum enzymes and the electrophoretic pattern of SLDH isoenzymes (fractions were designated LD5, LD4, LD3, LD2, and LD1, and the pattern with an LD5/LD4 ratio of more than 0.81 was referred to as H-type) were similar to those seen in typical fresh myocardial infarction, (Fig.2)⁴ So both electrocardiographic findings and serial

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Fig.1. Serial changes of electrocardiograms taken during and after a hypertensive crisis.

Fig. 2. Serial changes of various serum enzymes and electrophoretic pattern of SLDH isoenzymes (SLDH isoenzyme fractions were designated LD5, LD4, LD3, LD2, and LD1. The pattern with an LD5/LD4 ratio of more than 0.81 was referred to as H-type).

changes of various serum enzymes resembled those of active myocardial damage. Serum K and Na level were normal. The FBS and glucose tolerance curve were within the normal range. Renal function tests showed a slightly decreased RBF. Urinary excretion of catecholamine was elevated.

During hospitalization he felt well, blood pressure ranged between 110/60 and 130/80 mmHg, and no other paroxysms occurred.

After the intra-venous injection of histamine hydrochloride the blood pressure rose to 240/120 mmHg., and he complained of chest pain. Phentolamine was injected intravenously, and the blood pressure fell towards normal. An ECG taken during the histamine test showed nodal rhythm as the blood pressure rose and restoration of sinus rhythm as the blood pressure fell towards normal, as seen in Fig. 3.

Pneumoretroperitoneum-tomograms and selective renal arteriograms showed tissue masses in both adrenal areas (Fig. 4). So the diagnosis of pheochromocytomas of both adrenals was made.

On Aug. 12, 1970, pheochromocytomas of

both adrenals were removed. During manipulation of the right tumor the blood pressure rose, the ECG showed supraventricular tachycardia (Fig. 5), and the blood pressure dropped. After resuscitation the blood pressure returned to normal, and the supraventricular tachycardia changed to sinus rhythm.

By the end of the operative procedure, the patient's heart rate, rhythm, and blood pressure, controlled by the intra-venous administration of phentolamine, were normal.

After surgery the blood pressure and urinary excretion of catecholamine were within the normal range, and the histamine test was negative.

A well-encapsulated 18g. pheochromocytoma was excised from the right adrenal (Fig. 6-A), and a 36g. pheochromocytoma from the left adrenal (Fig. 6-B). Both tumors contained bloody fluid. The catecholamine content of the tumor tissue was very high (Table I).

The microscopic findings of the tumors were typical of pheochromocytoma.

Electron micrographic analysis⁵⁻⁶ showed the following; within the cytoplasm there were vary-

Fig.3. Electrocardiogram during histamine test showing nodal rhythm.

TABLE I CATECHOLAMINE CONTENT OF TUMORS

Weight of Tumor (g)		Catecholamine Content of Tumor Tissue ¹ (mcg/g)		
		Adrenaline	Noradrenaline	Total Catecholamine
R	18	12,579	2,256	14,835
L	36	5,348	146	5,494
		Catecholamine Content of Fluid in Tumor ² (mcg/cc)		
		Adrenaline	Noradrenaline	Total Catecholamine
L		70.2	109.3	179.5

1) THI METHOD (GROUT)

2) THI METHOD (EULER-FLODING)

ing numbers of vesicles of different sizes, most of which had a single-layered membrane enclosing small amounts of osmiophilic material, catecholamine granules (Fig.7).

COMMENT

The effect of catecholamine on the myocardium has been described by many investi-

Fig.4. Pneumoretroperitoneum-tomogram showing soft tissue masses in both adrenal areas.

gators⁷⁻⁸

In this case, the serial changes of the various serum enzymes, especially a prolonged H-type pattern of SLDH isoenzymes, were similar to

those seen in typical fresh myocardial infarction.

The electrocardiographic findings on admission and serial changes of various serum enzymes presumably indicated catecholamine-induced

Fig.5. During manipulation of right tumor at time of surgery, electrocardiogram shows supra-ventricular tachycardia (paper speed of electrocardiogram 12.5 mm/sec.).

myocardial damage.

Various types of cardiac arrhythmias have been recorded in patients with pheochromocytoma¹⁻³ and in animal experiments,⁹ suggesting sympathetic hyperactivity induced by increase of circulating catecholamine or reflex vagal response in most cases.

In this case, electrocardiograms showed cardiac arrhythmias, nodal rhythm during the histamine test and supraventricular tachycardia during a hypertensive crisis at the time of surgery.

These findings indicate that the occurrence of cardiac arrhythmia and acute myocardial damage at the time of hypertensive crisis must be considered in the management of patients with pheochromocytoma.

SUMMARY

A patient with pheochromocytomas of both adrenals showed electrocardiographic abnormalities during a hypertensive crisis.

Serial changes of various serum enzymes, es-

Fig.6. Well-encapsulated 18g. pheochromocytoma excised from the right adrenal (A), and 36g. pheochromocytoma from the left adrenal (B).

Fig.7. Electron micrograph of tumor cells ($\times 13,570$).

pecially the electrophoretic pattern of SLDH isoenzymes were similar to those seen in typical fresh myocardial infarction.

In the management of this patient, the significance of catecholamine-induced arrhythmias and myocardial damage was emphasized.

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