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CASE REPORT

Acute cerebral hemorrhage normalized plasma renin activity in a patient with primary aldosteronism

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Dear Editor,

Plasma renin activity (PRA) is suppressed in almost all patients with primary aldosteronism. Therefore, the findings of a normal or high PRA level are believed to exclude the possibility of primary aldosteronism (PA). We report a contradictory case of a patient with cerebral hemorrhage, who presented with normal renin activity, which obscured the presence of PA.

Case report

A 33-year-old man was admitted to an emergency medical facility because of left putamen hemorrhage, hypertension (blood pressure, 290/160 mmHg at arrival), and hypokalemia (serum potassium level, 2.6 mg/dl). His medical history and family history were unremarkable. A CT scan revealed the presence of a right adrenal tumor; however, his PRA (3.5 ng/ml/h; reference range 0.3–2.9 ng/ml/h) and plasma aldosterone concentration (PAC; 142 pg/ml; reference range for subjects in the supine position 29.9–159 pg/ml) were within normal limits on day 3 after admission. An elevated plasma norepinephrine level of 1.36 ng/ml (reference range 0.07–0.31 ng/ml) on day 3 and a urine metanephrine level of 2.39 mg/day (reference range 0.13–0.52 mg/day) on day 4 suggested sympathetic activation.

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Once the patient's condition stabilized, he was transferred to our division. He had been prescribed oral antihypertensive drugs (amlodipine 10 mg and clonidine 0.45 mg) and sustained-release potassium (48 mEq/day). Physical examination revealed speech impairment, right hemiplegia, and an inability to stand. His blood pressure was 144/98 mmHg. The laboratory data were as follows: serum potassium, 4.4 mEq/l; serum creatinine, 1.07 mg/dl; PRA, 1.1 ng/ml/h; PAC, 201 pg/ml; plasma norepinephrine, 0.10 ng/ml; and urine metanephrine, 0.06 mg/day.

A brain CT scan showed a left putamen hemorrhage, and an abdominal T2-weighted MRI image showed a 16-mm right adrenal tumor with a low-intensity signal. On days 30 and 37 after the cerebral hemorrhage, PRA was undetectable, and PAC levels were elevated (Table 1). The captopril test was performed on day 37. Fifty milligrams of captopril was administered orally, and blood samples were obtained prior to and 60 and 120 min after administration. The PRA and PAC values measured at these times were <0.1, 0.3, and 0.5 ng/ml/h and 283, 217, and 243 pg/ml, respectively. ^{131}I-adosterol adrenal scintigraphy showed a hot spot at the right adrenal gland. On the basis of these findings, we diagnosed the patient as having PA caused by the right adrenal tumor.

Right adrenectomy was performed laparoscopically 1 year after the initial cerebral hemorrhage. Histological examination revealed a benign adrenal adenoma of the clear-cell type. His postoperative course was uneventful, and his PRA and PAC levels returned to normal.

Discussion

This patient suffered left putamen hemorrhage and presented with a normal PRA level; he was not diagnosed with

Table 1 Sequential changes in plasma renin activity, serum aldosterone and catecholamines after cerebral hemorrhage

	Post-hemorrhage				Reference range
	Day 3	Day 23	Day 30	Day 37	
Plasma renin activity (ng/ml/h)	3.5	1.1	<0.1	<0.1	0.3–2.9
Serum aldosterone (pg/ml)	142	201	320	283	29.9–159 (in the supine position)
Plasma norepinephrine (ng/ml)	1.36	0.10	UD	UD	0.07–0.31
Urine metanephrine (mg/day)	2.39	0.06	0.06	UD	0.13–0.52

UD undetermined

PA until 1 month later. This is probably because the cerebral hemorrhage directly activated the sympathetic nervous system through the hypothalamus. The resulting increase in the concentration of catecholamines induced renin secretion [1]. Plasma norepinephrine and urine metanephrine levels initially increased substantially but returned to normal on day 31 (data not shown). PRA was detected initially but was suppressed on day 30. Hence, we believe that the renin secretion induced by sympathetic activation overrode the suppressive effects of aldosterone overproduction due to PA. In a clinical study, Moran and Loewenson [2] found that the PRA level in patients with cerebral hemorrhage was considerably higher than that in patients with cerebral infarction. Moreover, animal experiments have proved that there is a marked increase in plasma norepinephrine after cerebral hemorrhage [3], and that stress and norepinephrine induce an elevation of plasma renin [4–7]. These reports provide evidence for our opinion.

Special attention is necessary when PA is suspected in patients with acute cerebral hemorrhage. In our case, the PRA level was within the normal range over 3 weeks following the hemorrhage. Therefore, if we had measured only hormone levels over the days immediately following the hemorrhage, it is likely that PA may not have been diagnosed easily because of the absence of PRA suppression. Patients with PA are more likely to develop cerebral hemorrhage than those with essential hypertension [8]. PA is also occasionally associated with normal shaped adrenal glands and therefore, mistakes in the assessment of hormonal data may result in the opportunity to cure the disorder being lost when unilateral lesions are surgically resected. Hence, if patients with cerebral hemorrhage are suspected of having PA, endocrinological tests should be carried out after the cessation of sympathetic nervous system activation.

The high levels of catecholamines that were measured during the initial phase of cerebral hemorrhage are indicative of the possible presence of a pheochromocytoma. However, the clinical course of this case showed the spontaneous normalization of catecholamines on day 23 after cerebral hemorrhage, and pathological examination of a resected specimen failed to reveal the presence of a pheochromocytoma. Hence, the concomitant occurrence of a pheochromocytoma was excluded.

Conclusion

The acute phase of cerebral hemorrhage probably masked PA in our case, and in order to make a definite diagnosis, it was necessary to restore the sympathetic nervous system to its normal state.

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