Renin Dependent Hypertension by Dissecting Aortic Aneurysm

A Case Report

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SUMMARY

A 49-year-old female patient with dissecting aortic aneurysm and severe hypertension was reported. Aortogram revealed dissection of De Bakey type IIIb, which extended to the iliac artery and caused occlusion of the left renal artery. Peripheral plasma renin activity was extremely elevated and 1-Sar-8-Ile-angiotensin II produced a marked fall in blood pressure. The patient was treated conservatively with antihypertensive agents for about 4 years from July, 1974 to October, 1978 when she died suddenly in an early morning.

Additional Indexing Words:
Plasma renin activity 1-Sar-8-Ile-angiotensin II Aortic dissection
De Bakey type IIIb Divided renal vein renin

HYPERTENSION is found frequently in patients with dissecting aortic aneurysm and it may be preexisting or following by aortic dissection.\textsuperscript{1}) Severe or malignant hypertension developed when dissection involved the renal artery,\textsuperscript{2}--\textsuperscript{5}) suggesting that renin-angiotensin system might play an important role. However no previous report had exact evidence indicating an etiological role of renin-angiotensin system, such as proof using angiotensin II competitive inhibitor or even a determination of peripheral plasma renin activity (PRA). Our report presented here is on a case with severe hypertension developed after almost complete occlusion of the left renal artery caused by dissecting aortic aneurysm, in which PRA was markedly elevated and angiotensin II analogue induced a significant fall in blood pressure.

CASE REPORT

A 49-year-old housewife was admitted on July 22, 1974, because of chest, back...
and abdominal pain with severe hypertension. She had taken antihypertensive agents on and off since 1966 when a diagnosis of essential hypertension was made. Range of blood pressure was 140 to 160 mmHg systolic and 100 to 110 mmHg diastolic. On July 7, 1974, she had severe chest, back, and abdominal pain of sudden onset and was brought to an emergency hospital. Narcotica was given without noticeable effect. Three days later, she was transferred to another hospital, where high blood pressure of 220/114 mmHg and abnormal pyelogram were found. Arterial blood pressure rose to 230/136 mmHg next week while daily doses of 2250 mg of methyldopa and 4 mg of trichlormethiazide were given. Her body weight reduced by 8 Kg in 2 weeks.

The patient was 159.5 cm in height and 56 Kg in weight. Blood pressure was 192/122 mmHg in supine position with a pulse rate of 78 regular and symmetric beats. On funduscopy the disks appeared normal, but there were banking and tapering of the veins at the arteriovenous crossings with a few white hard spots and a flame-shaped hemorrhage. A grade 2 ejection murmur was heard at the Apex. Bruit was audible over the upper abdomen and the left back region. Urinalysis revealed pH of 5.5, a specific gravity of 1.026 and a ++ test for protein; the sediment contained 7 to 10 red cells with a few granular casts per high power field. Hemogram showed Hb of 12 Gm/dl, Ht of 35%, RBC of 394×10^4 and WBC of 12,100 with 57% neutrophils. Blood urea nitrogen was 19 mg, creatinine 1.4 mg and total protein 8.2 Gm per 100 ml. Serum sodium was 131 mEq, potassium 2.6 mEq and chloride 86 mEq. Arterial blood showed metabolic alkalosis, that Po2 was 67 mmHg, Pco2 41 mmHg, HCO3⁻ 27 mEq/L and pH 7.47. SGOT and SGPT were normal. LDH was 240 mU/ml and analysis for isoenzyme of LDH

![Effect of 1-Sar-8-Ile-angiotensin II on blood pressure. Blood pressure was 235/143 mmHg on average during infusion of saline for 20 min. Following the infusion of the peptide in saline at a rate of 600 ng/Kg/min for 60 min in a total volume of 30 ml, it fell to 175/120 mmHg at the end of the infusion. Her sodium intake on the previous day was estimated about 70 mEq/day.](attachment:image.png)
disclosed a slight increase of fast moving fraction. Endogenous creatinine clearance was 32 ml/min and a PSP test showed 16% excretion in 15 min.

An electrocardiogram demonstrated left ventricular hypertrophy associated with inverted T wave and prominent U wave. An X-ray of the chest showed cardiac enlargement with widening of the aortic shadow (cardiothoracic ratio = 54%). The intravenous pyelography which had been taken at another hospital 5 days before admission showed a faint nephrogram in the left kidney and a normal collecting system and renal outline in the right. PRA was 25.3 ng/ml/hr, determined by radioimmunoassay at 8:00 after overnight recumbency on third hospital day when antihypertensive agents had been withdrawn after admission (normal range of resting value of PRA in our laboratory: 1.0–5.4 ng/ml/hr on 175 mEq sodium diet, 2.5–21.5 ng/ml/hr after administration of 120 mg of furosemide followed by 35 mEq sodium diet for 4 days). Infusion of angiotensin II analogue (1-Sar-8-Ile-angiotensin II) performed on fifth hospital day caused a significant fall in both systolic and diastolic pressure (Fig. 1). PRA just before starting the infusion was 23.4 ng/ml/hr. Transfemoral aortography disclosed aortic dissection arising just distal to the left subclavian artery and extending down to the left iliac artery, that was Type IIIb of De Bakey. The left renal artery was obstructed but the right renal artery appeared to be intact (Fig. 2). Venous blood samples for PRA determination were taken from the right renal vein and inferior vena cava below the renal veins. The values of PRA were 13.8 ng/ml/hr and 13.7 ng/ml/hr, respectively. Unfortunately, the sampling from the left renal vein was unsuccessful.

Fig. 2. Aortogram: the left panel shows aortic dissection arising just distal to the left subclavian artery. The left renal artery occluded at its entrance is shown in the right panel. The dissecting aneurysm is shown to extend to the left iliac artery.
CLINICAL COURSE

Antihypertensive treatment with propranolol, guanethidine, and hydralazine was started after estimation of renin-angiotensin system by angiotensin II analogue. Because of loss of appetite and hypovolemia indicated by elevated serum protein and hyponatremia, fluid replacement therapy was also prescribed. Blood pressure was reduced gradually; it was 148/90 mmHg in supine, 120/80 mmHg in standing position on the 28th hospital day when she complained no abdominal and back pain. Serum protein was changed from 8.2 to 6.8 Gm/dl, serum sodium from 131 to 142 mEq/L, Ht from 35 to 25% and Hb from 12 to 8 Gm/dl. PRA in supine position were also lowered, ranging from 0.2 to 0.3 ng/ml/hr.

Statistics on the correlations among mean blood pressure and other parameters such as the logarithm of PRA, serum protein and Ht determined coincidently during first 32 days from admission were tested. The changes in mean blood pressure correlated well with those of logarithm of PRA \( r=0.984, n=6, p<0.001 \), with serum protein \( r=0.976, n=5, p<0.005 \) and also with Ht \( r=0.947, n=5, p<0.02 \). Correlations between changes in the logarithm of PRA and those of serum protein or Ht were again significant \( r=0.929, n=5, p<0.05, r=0.959, n=5, p<0.01, \) respectively.

Blood pressure at discharge, 11 weeks after admission, was 149/94 mmHg in supine, 128/90 mmHg in standing position with maintenance daily doses of propranolol 180 mg, hydralazine 150 mg, guanethidine 10 mg and reserpine 0.3 mg. Endogenous creatinine clearance decreased a little to 26 ml/min, but serum creatinine remained constant; it was 1.4 mg/dl.

After discharge, she had been followed up and treated in our out-patient clinic for about 4 years. Blood pressure had been well controlled, but she died suddenly on October 29, 1978. Unfortunately, post-morten study could not be performed.

COMMENT

We demonstrated here a case of dissecting aortic aneurysm of Type IIIb of De Bakey with severe hypertension, to which exaggerated release of renin was considered to contribute. Bradbrook and associates\(^5\) suggested a possible involvement of renin-angiotensin system in severe hypertension developed after abdominal aortic dissection, whereas exact evidence indicating it was lacking. In our case, PRA was extremely high although a large dose of methyldopa, one of renin suppressive agents, had been given before the admission. A significant fall in blood pressure was obtained with an infusion of angiotensin II analogue. Since 1-Sar-8-Ile-angiotensin II is one of competitive angiotensin II antagonist,\(^6\) her hypertension was considered angiotensinogenic.

Pathophysiology of excessive release of renin was interesting. Occlusion of the left renal artery followed aortic dissection as revealed by aortography. However, a faint nephrogram of the kidney on intravenous pyelogram
suggests that the left kidney was perfused a little. Blood sampling from
the left renal vein was failed unfortunately, but the values of PRA in blood
derived from the right renal vein and inferior vena cava were equal, suggesting
that high PRA in peripheral blood might originate from the left kidney.
With the fact, it is easier to consider the acute phase of two kidney hyperten-
sion in experimental animal. Release of renin from the left kidney could be
augmented by reduction of perfusion pressure, and sodium output could be
increased from the right by high perfusion pressure (pressure diuresis), that
might make her hypovolemic as reflected by weight loss of 8 Kg, hyperpro-
teinemia and hyponatremia. Recent study7) showed in rats with two kidney
hypertension that volume depletion with subsequent activation of the renin-
angiotensin system played a key role in pathogenesis of malignant renal hyper-
tension. Severe hypertension in the present case is possibly caused by the
same mechanism. Significant relationship among blood pressure, PRA and
a set of parameters reflecting volume depletion was demonstrated.
Antihypertensive agents, which cause suppression of renin release, were
much effective on her high blood pressure. PRA demonstrated during first
32 hospital days under medication had close and significant correlation with
mean blood pressure and thereafter serial determination of PRA showed
suppression in renin-angiotensin system. No surgical procedure was pre-
ferable because of estimated high operative mortality on account of broad
extension of dissection8) and established conservative management with sus-
tained hypotension.9,10) Our patient survived further 4 years under success-
ful control of blood pressure with antihypertensive agents without considerable
progression of cardiovascular disease.

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