Endocrinological Analysis of the Living-related Renal Transplantation in a Patient with Bartter's Syndrome

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Key words: Bartter's syndrome, renal transplantation, growth hormone therapy, renin-angiotensin-aldosterone, prostaglandin

Introduction

In order to clarify endocrinological changes before and after living-related renal transplantation (RTx) in a patient with Bartter's syndrome (BS) and chronic renal failure (CRF), serial quantitative determinations of the renin-angiotensin-aldosterone system and 24 hour excretion of 6-keto-prostaglandin $F_{1\alpha}$ (PGF $_{1\alpha}$) and kallikrein were performed. It has been suggested that in this syndrome CRF rarely develops. This is the first report of a patient with BS who has undergone RTx.

Case Report

A 13 year-old male was admitted to our hospital because of pallor and short stature. He was 126 cm in height (M-3.8 SD) and 30 kg in weight (M-1.9 SD) on initial admission. Bone age was 9 years. Secondary sexual characteristics were appropriate for Tanner Stage

I. Blood pressure was 110/60 mmHg, with no edema. Laboratory findings: hematocrit 22.1 %, serum potassium 2.9 mEq/L, sodium 137 mEq/L, chloride 103 mEq/L, creatinine clearance 30.7 mL/min/1.73 m² and elevation of β 2-microglobulin to 39.9 mg/L in the urinalysis. Arterial blood gas analysis revealed a metabolic acidosis of pH 7.333, bicarbonate 17.3 mEq/L and base excess -7.4. Plasma renin activity (PRA) and plasma aldosterone concentration (PAC) were markedly elevated to 24.23 ng/mL/hr and 738 pg/mL, respectively. 24hour urinary potassium measurement was 1.55 g/day. The insulin-like growth factor-I (IGF-I) level was 0.19 U/mL (normal: >0.2 U/mL). Peak plasma growth hormone (GH) levels after stimulation with insulin and propranolol-glucagon were 11.0 and 12.0 ng/mL, respectively. The kidney biopsy specimen showed diffuse glomerulosclerosis with severe interstitial fibrosis and edema; narrowing of the small arteries and hypertrophic change of juxtaglomerular apparatus were also demonstrated. He was diagnosed as having BS with short stature and CRF. Treatment with recombinant human GH at 0.5 IU/kg per week for 5 years was successful and his height SD scores

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Fig. 1 Clinical course

were significantly improved from -3.8 to -1.8 (Fig. 1). He was also treated with recombinant human erythropoietin (Epo) and the anemia improved. At the age of 18, he began hemodialysis and he underwent RTx donated from his mother in the next year. His clinical course from initial admission to RTx are summarized in Fig. 1. PRA, angiotensin I, II (AT-I, II) and PAC were markedly changed from 37.8 to 2.3 ng/mL/hr, 2,400 to 220 pg/mL, 256 to 17 pg/mL and 3,700 to 110 pg/mL, respectively. Urine PGF $_{1\alpha}$ and kallikrein were also improved (Table 1). An AT-II loading test revealed that an infusion rate of 100 μ g/kg/min was neces-

Growth chart

sary to increase the systolic and diastolic pressure by 20 mmHg before RTx. On the contrary, 20 μ g/kg/min was enough to increase both blood pressures by 20 mmHg after RTx (Fig. 2).

Discussion

Simopolos and Bartter(1) reported that growth retardation had often been seen in BS. The role of GH in the growth retardation of BS is not known. Our patient had relatively low peak levels of GH to insulin and propranolol-glucagon and a low IGF-I level sug-

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Table 1 Serial quantitative determinations of several hormones before and after RTx

	PRA (ng/ml/hr)	AT-I (pg/ml)	AT-II (pg/ml)	PAC (pg/ml)	Bradykinin (pg/ml)	u-Kallikrein (ug/day)	u-PGF _{1α} (ng/day)	IGF-I (U/ml)	Epo (mU/ml)	u-β ₂ MG (mg/l)
Initial Adm.	24.23	2020	139	739	25.0	410	860	0.19	19.9	39.9
Before RT _x	37.80	2400	256	3700		400	860	0.17	16.8	42.5
After RT _x	19.37	1540	148	1600						
After RT _x (1 day)	7.04	570	26	1100		11.2	338			
After RT _x (6 days)	2.75	340	15	530		12.6	438			
After RT _x (14 days)	2.31	220	17	110	17.0	25.2	321	0.19		
After RT _x (67 days)	1.50	240	18	26	11.2				15.4	2.1
Donor	0.60	250	15	72	18.0	12.0	455			
Normals	0.5-2.3	500<	9-47	35-240	9.6-21.0	28-220	125-620	0.20<	12.5-35.4	1.0>

Fig. 2 Effect of angiotensin II infusion test in doses from 5 to 100 ng/mL/min before and after RTx.

gested insufficient spontaneous GH secretion. Recently Boer and Zoppi(2) described a case of BS treated with GH in which catch-up growth occurred.

It had been suggested that BS cases rarely develop CRF. Rudin(3) described a review of 28 patients with BS followed for 10 years and only one case developed CRF. Sato(4) also

reported a case of this syndrome with gradual CRF. In this case renal biopsy was performed four times and gradual increase in glomerulosclerosis, interstitial fibrosis and narrowing of the small arteries were demonstrated and arterial blood gas analysis changed from metabolic alkalosis to acidosis in proportion to the progression of renal failure. In our case metabolic acidosis had already been shown on initial admission because the patient had developed renal failure.

As the grafted kidney fully performed hormonal regulation, abnormalities of several hormones characterized in BS could be normalized and a remarkable improvement of the AT- II loading test was also obtained.

From these results it can be deduced that the kidney plays an important role in the endocrinological pathogenesis of this syndrome.

References

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