Fractions of Urinary 17-OHCS in Patients with Impaired Renal Function and Hypertension

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The urinary 17-OHCS fractions were estimated using thin layer chromatography upon 48 cases with urologic and renal disorders such as stenosis of the urethra, stones of the upper urinary tract, renal tuberculosis, glomerulonephritis and hypertension.

In most cases, the ratio of THE (tetrahydrocortisone) to compound E (cortisone) was high. But in this respect there were no obvious differences among the various diseases.

Excretion of each fraction was less in hypertension.

Compound F (cortisol) was marked on the upper ordinate, THE (tetrahydrocortisol) on the lower, compound E (cortisone) on the right abscissa, and THE (tetrahydrocortisone) on the left. When the four spots were connected, a figure of a rhombus stretched upwards was shown in the cases with renal failure in general.

Thin layer chromatography has been widely used for rapid separation of small amounts of lipids or steroids, but there seems to be a few reports where this method is used for analysis of corticoids. In the present paper, thin layer chromatographic studies were made of urinary 17-OHCS, principally cortisol, cortisone and their tetrahydrates, in patients with urologic disorders with or without hypertension.

METHODS

Extraction of corticoid was carried out by Kanbegawa’s method (Fig. 1). Urine specimens were extracted with dichlormethane and the extraction procedure was repeated three times. Thirty grams of Kieselguhr Ct (Merck) were used for preparation of thin layers. For the developing solvent a chloroform-ethanol mixture (9:1) was used, and then Kieselguhr plates were placed twice in the tank. Porter-silver reagent was used for color reaction. For calculation of each fraction, four spots were scraped off and separated in centrifuge glasses. Calculation of 24 hours’ total excretion was made using a Beckman spectrophotometer. Subjects examined included 48 patients without hepatic involvement, and their renal function was evaluated by blood NPN.

Received for publication. November 9, 1967.
Fig. 1. Schematic illustration of extraction method of 17-OHCS, cortisone and their tetrahydrates from urine specimens.

The results were presented in graphic forms. Compound F (cortisol) was marked on the upper ordinate, THF (tetrahydrocortisol) on the lower, compound E (cortisone) on the right abscissa, and THE (tetrahydrocortisone) on the left. When the four spots were connected, a rhombus was graphically defined.

RESULTS

In 6 male adults aged 30 to 49 with normal renal function, the values for THE are higher than those for compound E, and the rhombus becomes flat with a deviation to the left (Fig. 2).

Fig. 3 shows urinary 17-OHCS patterns of 3 patients with renal failure, their NPN being 50 mg/100 ml, 61.0 mg/100 ml and 91.0 mg/100 ml, respectively. Compounds F and E were higher than their metabolites, and the rhombus extended upwards and to the right.

Fig. 4 shows urinary 17-OHCS patterns of 6 patients with glomerulonephritis. Dotted lines show cases of impaired renal function (i.e., of NPN higher than 40
Fig. 3. Urinary 17-OHCS pattern of patients with renal failure.

- Cardiac failure and syphilis, NPN 50 mg/100 ml
- Cerebral hemorrhage, NPN 61 mg/100 ml
- Polycystic kidney, NPN 91 mg/100 ml

Fig. 4. Urinary 17-OHCS pattern of patients with glomerulonephritis.

- Cases with renal failure
- Cases with normal renal function

mg/100 ml. Cases of normal renal function are shown with solid lines. In cases of normal renal function, THE was higher than compound E, and the rhombus deviated to the left. On the other hand, in cases of impaired renal function, compound F was higher than THE in one case, and in the others compound E was higher than THE, the rhombus showing a marked deviation upwards and to the right.

Out of 6 cases of urethral stenosis, THE was higher than compound E when
the renal function was normal, and the rhombus deviated to the left except in one case. But in a case of impaired renal function, the rhombus deviated upwards (Fig. 5).

In 7 cases of stones of the upper urinary tract, one case was complicated with bilateral hydronephrosis and the renal function was found impaired. The analysis of the urinary 17-OHCS in this group revealed that there were many figures without a clear deviation to the left or downwards, but in a case of impaired renal
In 7 cases of renal tuberculosis, there were 2 of bilateral involvement with impaired renal function. Six patients with normal renal function showed the rhombus with deviation to the left or downwards. But in a case of impaired renal function, the rhombus deviated to the right or upwards (Fig. 7).

The urinary 17-OHCS fractions were further determined in 13 cases of hypertension. They were divided into 3 groups according to the degree of hypertension and impairment of renal functions. The first group consisted of 4 cases of hypertension with systolic pressure lower than 160 mm Hg at
admission, the second group of 6 cases with systolic pressure higher than 160 mm Hg, and the third group included 3 cases with distinctly impaired renal function. In the first group, 2 cases showed the same pattern as those of normal renal function. The others had higher compound E and as a result the rhombus was located in the center of the graph (Fig. 8). Moreover, in the second group, all fractions were lower, and consequently the figure was smaller than that of the normal adult (Fig. 9). However, the shape of figure in the majority of cases resembled that of normal subjects with relatively high THE, although there were some exceptions showing higher values in compound F or THE. Finally in the third group, compounds F and E were higher than the others, the rhombus assuming the form of a
Renal Function and Urinary 17-OHCS

This is the same type of the figure for 17-OHCS fractions as observed in cases of impaired renal function, and it was likely that urinary 17-OHCS fractions were influenced by impaired renal function rather than by hypertension itself.

DISCUSSION

Urinary 17-OHCS was separated into cortisol, cortisone and their tetrahydrates. For the purpose of easy understanding of their relationship, a square was drawn to show the pattern of urinary excretion of corticoids in graphic form. But no obvious differences could be seen among its patterns in various diseases. In patients with impaired renal function, the patterns differed markedly from those in patients with normal renal function. That is, all patients who showed a specific pattern of excretion as indicated by the changes of the square had impaired renal function, and the same results were obtained in cases of hypertensive patients. Now, a specific pattern (as shown in Fig. 3) in rhombus was brought about, because the ratios of cortisol/THF and cortisone/THE became higher than those of normal subjects. The reason was considered to be that the renal clearance of 17-OHCS, especially THF and THE, decreases in hypertensive patients. Kornel estimated the renal clearance of free and conjugated 17-OHCS in hypertensive patients, and obtained the following results: renal clearance of conjugated 17-OHCS was distinctly lower in hypertensive patients and the grade of its reduction was higher than that of creatinine clearance. On the other hand, Shiraiwa et al. observed a reduced excretion of total 17-OHCS in the urine of patients with impaired renal function. After all, if the excretion of urinary THF and THE was lowered and there were no greater changes in cortisol and cortisone excretion, then this can explain why our figure is transformed to a tall rhombus.

Kornel and Takeda estimated urinary 17-OHCS in the normotensives and hypertensives. They described that excretion of 17-OHCS glucuronides was lower in hypertensive patients but excretion of 17-OHCS sulfates was higher. Our measurements showed little excretion of total 17-OHCS in hypertensive patients with a blood pressure higher than 160 mm Hg and the square became smaller than in normotensive patients. Our results are considered to be almost the same as those of Kornel and Takeda's, because most of urinary corticoids are composed of glucuronides. We could not find any obvious difference in the ratio of THF and THE.

References
