Measurement of Proximal Tubular Diameter for Evaluation of Tubular Hypertrophy

K.	Kazuyoshi	Okada
S.	Susumu	Takahashi

Internal Medicine, Nishi-Kofu National Hospital, Yamanashi, Japan

Dr. K. Okada, Internal Medicine, Nishi-Kofu National Hospital, 3368 Yamamiya-cho, Kofu, Yamanashi 400 (Japan)

Dear Sir,

It is well known that both glomerular and tubular hypertrophy occur in rats with chronic renal failure (CRF) at an early stage [1, 2]. In order to statistically evaluate the degree of glomerular hypertrophy by light microscopy, either the maximum glomerular diameter or maximum glomerular planar area is measured [3, 4]. However, statistical evaluation of tubular hypertrophy is very difficult to determine by light microscopy. We recently reported that the mean value of the planar area of glomeruli can be employed for the statistical evaluation of glomerular hypertrophy in CRF at an early stage [5]. Since the tubules become atrophic in CRF at a late stage, we attempted to evaluate the degree of tubular hypertrophy in CRF at an early stage using the mean value of proximal tubular diameter in light microscopy. Twenty-four male Sprague-Dawley rats, weighing 275-325 g, were subjected to a sham operation (S; n = 6), 2/3 nephrectomy (Nx; n = 12) and 4/5 Nx (n = 6). After surgery, the rats were given free access to water and rat chow (CE-2, Clea Japan, Tokyo, Japan). Half of the 2/3 Nx rats were sacrificed at week 4 and the others were sacrificed at week 10. The kidneys were fixed in buffered 10% formalin, embedded in paraffin, sectioned and stained with periodic acid-Schiff for light microscopic examination. The shortest diameter of 100 proximal tubules (PTD), which are nearly circular in each rat, were measured using an image analysis system (LA-555, Pias, Tokyo, Japan) linked to a computer (fig. 1), and the mean value in each rat was used. The levels of PTD were $5.0 \pm 0.1 \times 10^{-2}$ mm in S at week 10, $5.9 \pm 0.1 \times 10^{-2}$ mm in 2/3 Nx at week 4, $6.1 \pm 0.1 \times 10^{-2}$ mm in 2/3 Nx at week 10, and $6.7 \pm 0.1 \times 10^{-2}$ mm in 4/5 Nx at week 10, respectively. The level of PTD in 2/3 Nx at week 10 was significantly increased from that at week 4 ($p < 0.02$). The

Fig. 1. Method for measurement of proximal tubular diameter.

Fig. 2. Comparison of mean values of the shortest diameter of proximal tubules (PTD) in the different groups (S, % Nx and 3/4 Nx at week 10).

levels of PTD at week 10 were significantly different between the groups (fig. 2). The present results indicated that proximal tubular hypertrophy becomes evident with the progression of CRF at an early stage and the measurement of mean PTD is useful for the early evaluation of tubular hypertrophy in CRF.

References

Fine L: The biology of renal hypertrophy. *Kidney Int* 1986;29:619-634. Nagata M, Schärer K, Kriz W: Glomerular damage after uninephrectomy in young rats. I. Hypertrophy and distortion of capillary architecture. *Kidney Int* 1992;42:136-147. El-Khatib MT, Becker GJ,

Kincaid-Smith PS: Morphometric aspects of reflux nephropathy. *Kidney Int* 1987;32:261-266.

/

«- 1/8rv
- ~1/8*

P < 0.001

2/3 Nx 4/5 Nx

Yoshida Y, Kawamura T, Ikoma M, Fogo A, Ichikawa I: Effects of antihypertensive drugs on glomerular morphology. *Kidney Int* 1989; 36:626-635.

Takahashi S, Okada K, Shimamura T: Influence of factors in the digestive tract on the progression of chronic renal failure. *Jpn J Nephrol* 1993;35:1-11.

© 1995 S.KargerAG, Basel

0028-2766/95/0701-0122

\$8.00/0