Mechanism of Kidney Stone Formation in Chronic Hemodialysis Patients

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Dear Sir,

Recently, we reported that amyloid-like kidney stones, commonly found in patients on maintenance hemodialysis, contained β 2-microglobulin (β 2-MG), lysozyme, serum amyloid P component (SAP) and PAS-positive substance other than calcium oxalate [1].

To compare the protein composition of calcium oxalate stones between nonrenal failure and chronic hemodialysis patients, we analyzed the matrix proteins of each stone. The main protein components of renal stones were β 2-MG > lysozyme > albumin, SAP, Tamm-Horsfall protein (THP) in chronic hemodialysis patients, whereas in nonrenal failure patients they were albumin > lysozyme > SAP, THP (fig. 1). These results suggested that kidney stone formation in chronic hemodialysis patients occurred by different mechanisms than in nonrenal failure patients.

Linke et al. demonstrated the presence of modified β 2-MG not only in kidney stone [2] but also in extrarenal amyloid deposition [3] in hemodialysis patients. Gejro et al. [4] pointed out that amyloid kidney stone also contained glycosaminoglycan, a common constituent of all amyloids.

In consideration of these facts, we proposed the possible mechanism of amyloid stone formation that calcium-mediated association of β 2-MG, lysozyme, SAP and glycosaminoglycans took place in kidney in chronic hemodialysis patients (fig. 2).

β 2-MG

(Intact) Proteolysis (Modified)

Glycosaminoglycans

Hyperoxaluria

Ca²⁺ SAP

\

I

Ca oxalate Glycoproteins

Lysozyme

Amyloid deposit -X→· Proteolysis

Amyloid stone formation in kidney

in extrarenal

tissue

Fig. 2. Mechanism of kidney stone formation in chronic hemodialysis patients.

Protein

14-«t
β²-MG

SAP 1 2

%::

Lys 1 2

THP 1 2

Fig. 1. Comparison of protein components of calcium oxalate kidney stone between nonrenal failure and chronic hemodialysis patients. 1 = Hemodialysis patient; 2 = nonrenal failure patient. Extraction of protein from stones, SDS-PAGE and Western blot analysis were performed as previously described [1].

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