Nutritional Management in Elderly CKD Patients in Japan

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Summary The number of chronic kidney disease (CKD) patients is increasing globally because kidney function is affected by aging and lifestyle habits. Malnutrition, muscle weakness, and a decline in activities of daily living (ADL) are often observed in elderly CKD patients and dialysis patients, and are related to their CKD prognosis and life prognoses. Chronic inflammation and atherosclerotic disease are associated with malnutrition. Because malnutrition and its related factors affect patients’ prognoses, it is necessary to identify and treat patients with malnutrition at an early stage. The state in which the stored protein and energy sources are reduced in CKD is called protein energy wasting (PEW). PEW is diagnosed on the basis of biochemical test findings such as hypoalbuminemia, unhealthy physique, and decreased muscle mass and dietary intake. For evaluating PEW, a complex nutritional index taking into account the pathophysiology specific to CKD patients is useful. Not only nutritional therapy but also exercise therapy is necessary to stop the vicious cycle associated with PEW and the decline in ADL.

Key Words chronic kidney disease, protein energy wasting, inflammation, dialysis, elderly

Introduction Kidney function is affected by aging and lifestyle habits. Currently, Japan and Europe have aging populations, and it is expected that the number of chronic kidney disease (CKD) patients will increase in the future. CKD is a risk factor for not only end-stage kidney disease (ESKD) but also cardiovascular disease (CVD) and death (1).

The risk factors for CVD include aging, gender, hypertension, diabetes, dyslipidemia, and smoking. In addition to these risk factors in CKD patients, uremia, renal anemia, CKD-mineral and bone disorder (CKD-MBD), malnutrition, nitric oxide production disorder, and chronic heart failure are also identified as specific risk factors that increase the risks of CVD and death. Hemodialysis patients have arteriovenous fistulae, which increase cardiac output. They also have abrupt changes in body fluid volume before and after dialysis, hypotension, reduced coronary arterial blood flow, and a high risk of CVD.

For elderly CKD patients, it is important to prevent the progression of CKD. Problems such as complications, malnutrition, decline in activities of daily living (ADL), and nursing care are more frequently found in elderly CKD patients and dialysis patients than in healthy elderly persons (2). Moreover, in elderly CKD patients, ADL declines after starting dialysis and mortality rate increases (3). In dialysis patients, malnutrition, loss of appetite, and low ADL level are risk factors for death (4–6). To prevent the progression of CKD in elderly patients, it is necessary to consider nutrition and ADL simultaneously.

From the above, CKD, malnutrition, ADL, and life prognosis are closely related to each other. Moreover, inflammation is involved in malnutrition, which not only worsens the prognosis of life but also decreases the ADL level owing to a decrease in muscular strength.

Characteristics of nutritional status of CKD patients Malnutrition in CKD patients is characterized by the involvement of inflammation, unlike in ordinary malnutrition caused by, for example, starvation with low nutritional intake. Chronic inflammation and atherosclerotic disease often develop as complications and together characterize the so-called malnutrition inflammation atherosclerosis (MIA) syndrome, in which CVD and death are likely to occur. As CKD progresses, chronic inflammation continues and arteriosclerosis develops.

Malnutrition in CKD patients is a state in which the amounts of proteins, such as those in the muscle, and fat and energy storage decrease. The International Society of Renal Nutrition and Metabolism (ISRN) defined such type of malnutrition as protein energy wasting (PEW) (7). The categories for diagnosis include (1) biochemical test (serum chemistry), (2) body mass, (3) muscle mass, and (4) dietary intake. PEW is observed in 18 to 45% of patients with CKD stages G3 to G5 and in 75% of dialysis patients (7, 8).

Various factors affect PEW, not only malnutrition but also uremic toxin, inflammation, catabolism, metabolic acidosis, decreased physical activity, dialysis, and complications. Sarcopenia is muscle loss due to aging. The The European Working Group on Sarcopenia in Older People defines sarcopenia as a state in which muscle mass reduction and muscle weakness accompany physical dysfunction. Frailty is a state that is likely to be a health impairment caused by the deterioration of energy reserve capacity due to aging. The definition of
frailty includes not only muscle strength but also elements of psychophysiological aspects such as physical activity and depression, which reflect conditions requiring nursing care and support. PEW is determined from biochemical test results, not from muscle strength or physical activity. Sarcopenia and frailty are not determined from biochemical test results, but from a decrease in muscular strength and physical function. These concepts are complementary, and it is important to multilaterally evaluate the nutrition and activity of elderly CKD patients.

### Cause of PEW

Various causes of PEW are known: reduction in dietary intake, inflammatory cytokines, CKD, uremic toxins, complications (CVD, diabetes, depression), fluid overload, decrease in muscle mass, and dialysis-related factors. Decreased dietary energy intake (DEI) and dietary protein intake (DPI) are associated with loss of appetite, dietary restriction, depression, dysphagia, uremic substances, acidosis, inflammation, and dialysis.

As kidney function decreases, hormonal imbalance occurs, which results in decreases in appetite and muscle mass, and malnutrition. Insulin resistance occurs at the early stage of CKD, and glucose metabolism and insulin sensitivity are reduced. Insulin resistance accelerates protein catabolism and the decrease in muscle mass.

Owing to the effects of the above-mentioned factors, the balance between muscle synthesis and degradation breaks down because of malnutrition, resulting in a decrease in muscle mass. These result in the reduction in the levels of testosterone, estrogen, growth hormone, and other anabolic hormones, thereby worsening the nutritional condition.

### Strategy against PEW

The strategy to prevent and treat PEW is as follows (Fig. 1). ① Screening for malnutrition and ② nutrition assessment of patients with malnutrition are conducted periodically. ③ If PEW is found, nutritional intervention is considered. Since PEW includes not only malnutrition but also a decrease in muscle mass as a diagnostic criterion, physical rehabilitation is also required to increase muscle mass. ④ If the nutritional status improves, ③ is conducted again. However, ⑤ if nutritional status does not improve, ④ nutritional intervention should be conducted again.

### Conclusion

In CKD patients, not only problems associated with aging but also various complications are often present, which affect their nutritional status. Their malnutrition causes a decrease in muscle strength and ADL. Falls and fractures may occur owing to the decrease in muscle strength, which leads to a decrease in social activity, and an increase in the need for nursing care. These problems also lead to loss of appetite and PEW. Because PEW involves nutritional status, muscular strength, ADL, and social life, the combined effects of various problems exacerbate PEW and affect the life prognosis of CKD patients and dialysis patients. It is necessary to develop a social support system that enables patients to continue their treatments.

### Disclosure of state of COI

The author declares no conflicts of interest associated with this manuscript.

### REFERENCES


