Nutritional support in chronic dialysis patients

D. Fouque (UK)
Nutritional support in renal disease
Topic 15, Module 15.2

Nutritional support in CKD 3-4

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Modif. from Daniel Teta and Enrico Fiaccdori MD, PhD
Topics

- Epidemiology and pathogenesis of protein-energy wasting (PEW) in CKD patients stage 3-4
- The role of Low-protein diet (LPD) and Very-low protein diet (VLPD)
- Metabolic advantages and additive effects of LPD and VLPD in CKD
- Nutritional safety and long-term outcome of LPD and VLPD
- Nutritional support in CKD with severe PEW
Low serum albumin in French dialysis Pts

Observatoire Phosphocalcique, January 2011

Serum Albumin (g/L)

36.1 ± 5.0 g/l

PEW < 38 g/l

6 000 pts

Normal values
A proposed nomenclature and diagnostic criteria for protein–energy wasting in acute and chronic kidney disease


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General aspects of PEW in CKD

- Nutritional status derangement is essentially characterized by loss of muscle mass and visceral proteins (wasting/cachexia), and eventually by a loss of fat mass (the concept of protein-energy wasting or PEW, as compared to simple malnutrition).

- PEW in patients with CKD predominantly affect patients in the more advanced stages (stages 4 and 5, GFR < 30 ml/min); at dialysis starting the prevalence of PEW is about 30-40%.

- The presence of PEW may negatively influence the natural course, quality of life, morbidity and mortality.
Pathogenesis of PEW in CKD

Kidney Int 2008;73:391
CKD stages and incidence of PEW

USRDS 2009 Annual Data Report
Fouque D et al., Kidney Int 2008; 73:391-398
Kovesdy C et al. Am J Clin Nutr 2009; 29;3-14
Relationship between nutritional status and the glomerular filtration rate: Results from the MDRD Study

MODIFICATION OF DIET IN RENAL DISEASE STUDY GROUP, prepared by JOEL D. KOPPLE, TOM GREENE, W. CAMERON CHUMLEA, DONNA HOLLINGER, BRADLEY J. MARONI, DONNA MERRILL, LAURA K. SCHERCH, GERALD SCHULMAN, SHIN-RU WANG, and GAIL S. ZIMMER

National Institutes of Diabetes, Digestive and Kidney Disease, National Institutes of Health, Bethesda, Maryland, USA

Close relationship between GFR reduction and PEW

Cross-sectional evaluation from the MDRD study at baseline (n=1785)
Anorexia in CKD: spontaneous decline in protein intake parallels GFR reduction

Prospective observation in 90 patients

Ikizler A et al. JASN 1995; 6: 1386-1391
Inflammation plays a key role in the unbalance between orexigenic and anorexigenic mechanisms controlling energy homeostasis in CKD.
Whole body protein metabolism

Acidosis
Inflammation
Steroids

Muscle

Food
70 g → 250 ↔ 250 g

C S

Aminoacids
Insulin
GH and IGF-1
EPO
Androgenes

70 g excretion
Diagnosis of PEW when at least one parameter is found below recommendation in three of the four nutritional variable groups.
Assessment of dietary intake and compliance

- Dietary interviews → energy intake
- Food diaries → energy intake
- Dietary recalls (3-7 days) → energy intake
- Urinary 24 hour N excretion → protein intake

no other simple way of determining nutrient intake and distribution of energy sources (lipids or CHO) available
24 hour urinary collection allows an estimation of dietary protein intake

\[
= [N \text{ urinary excretion g/day}) \times 6.25] + 30 \text{ mg/Kg/day}
\]

Maroni BJ et al., Kidney Int 1985
Urinary urea excretion (mmol/d)

Restriction protidique

from 1.1 to 0.7 g prot/kg/d

Low protein diet (LPD) in the nutritional care in patients with CKD

1. Progression of chronic renal disease
2. Urea production and excretion
3. Nutritional status
4. Inflammation
5. Dyslipidemia
6. Insulin resistance
7. Mineral and bone disease
8. Acidosis, anemia and blood pressure
9. Compliance
10. Evidence
11. Implementation

Aminoacid oxidation after reducing protein intake

From 1.1 to 0.7 g/kg/day during three months

Bernhard et al, J Am Soc Nephrol 2001
Conventional low-protein diet (LPD)

- 0.6-0.8 g protein/kg of ideal body (IBW) weight/day = minimum protein requirement for patients with CKD and proteinuria < 1.5 g/day

- 0.6-0.8 g/kg/iBW/day is the requirement in normal healthy individuals (to maintain a neutral nitrogen balance)

- Patients with CKD on LPD should be carefully monitored and the nutritional status should be regularly assessed.

- If proteinuria > 1.5 g/day, an equivalent amount of the protein loss should be supplemented with the diet
Very low-protein (VLPD) diet

In advanced CKD stages (4-5), VLPD supplemented with ketoanalogues of essential amino acids (KA) may be prescribed:
- 0.30 g protein/kg iBW/day + KA
- KA = 0.1-0.3 g/kg iBW/day

Proved advantages of VLPD + KA versus LPD
1) Protein+KA total intake not exceeding 0.7g/kg/day should be enough to maintain nitrogen balance in steady state patients
2) The nature of KA (keto-and hydroxy forms of essential amino acids) leads to a greater decrease of serum urea
3) Keeps nitrogen balance neutral and a good nutritional status, provided that an adequate energy intake is maintained
4) Benefits in proteinuria reduction and in GFR decline may be greater
Benefits of LPD in CKD

- Reduction in GFR decline
- Delay in renal replacement therapy start
- Improvement of uremic symptoms
- Reduced insulin resistance and oxidative stress
- Reduction of serum phosphorus levels
- Reduction of proteinuria

Chauveau P, Aparicio M. J Ren Nutr 2013 in press
Low protein diet and risk of ESRD requiring dialysis


N = 1514, risk reduction 31%
Ten studies were identified from over 40 studies. A total of 2000 patients were analysed, 1002 had received reduced protein intake and 998 a higher protein intake. There were 281 renal deaths recorded, 113 in the low protein diet and 168 in the higher protein diet group (RR 0.68, 95% CI 0.55 to 0.84, P = 0.0002). To avoid one renal death, 2 to 56 patients need to be treated with a low protein diet during one year.

Reducing protein intake in patients with chronic kidney disease reduces the occurrence of renal death by 32% as compared with higher or unrestricted protein intake. The optimal level of protein intake cannot be confirmed from these studies.
Very low protein diet (VLPD) of 0.3 g/kg/day: effect on proteinuria

Aparicio et al, Nephron 1988
Very low protein diet supplemented with ketoanalogls improves blood pressure control in chronic kidney disease

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MDRD study 1: Effect of LPD on nutrition status

Low protein diet (LPD) : is it worth?

Yes, in selected CKD patients

• If no PEW at baseline
• If no critical illness is present
• If no PEW occurs during follow-up (LPD must be monitored by skilled renal dieticians)
• If LPD is accompanied by adequate calorie intake
Energy requirements

- An appropriate energy intake is crucial when LPD and VLPD + KA are prescribed in patients with CKD 3-4.

- An energy intake of 30-35 kcal/kg iBW/day is sufficient to maintain nutritional status in patients with CKD.

- Higher energy intakes - in the range of 35-45 kcal/kg/day - are associated with better nitrogen balance in predialysis patients on LPD (0.6g/kg/day), with gain in body weight and improvement in body composition.
Guidelines for nutritional management in patients with CKD progression

CKD stage 3 (GFR 30-60 ml/min/1.73 m²)
- protein intake 0.6 iBW/d (LPD)
- energy intake: 35 kcal iBW/kg *
- animal:vegetable protein ratio 1:1

CKD stage 4-5 (GRF 15-30 ml/min/1.73m²)
- protein intake 0.6 g/kg iBW/d (LPD) or 0.3 g (VDLP) + KA
- energy intake: 35 kcal/kg iBW/d*
- animal:vegetable protein ratio 1:1

- in obese patients, energy restriction to 25-30 kcal/kg iBW/d (studies needed in this setting)

ESPEN guidelines Clin Nutr 2009;28:401-14
Mineral and fluid intake in patients with CKD progression (ESPEN)

- Phosphate: 800 mg/d
- Potassium: 2000 mg/d
- Sodium: 2 g/d
- Fluids: Unlimited*

*According to urinary output, type of kidney disease, cardiac function, hypertension etc.
Quality of proteins is important

Vegetarian Compared with Meat Dietary Protein Source and Phosphorus Homeostasis in Chronic Kidney Disease

Despite equivalent protein and phosphorus concentrations in the diets (meat-based vs vegetarian diet), subjects on the vegetarian diet had lower serum phosphorus levels, a trend toward decreased urine 24-hour phosphorus excretion and significantly decreased FGF23 levels

Correction of metabolic acidosis is important

Bicarbonate Supplementation Slows Progression of CKD and Improves Nutritional Status

Ione de Brito-Ashurst, Mira Varagunam, Martin J. Raftery, and Muhammad M. Yaqoob

Correction of metabolic acidosis is associated with nutritional status improvement.
Nutritional approach to CKD with severe PEW

If PEW is severe and spontaneous intake < 20 kcal/kg/day and/or if stress conditions (eg. severe infection, surgery), a daily nutritional support is necessary to meet nutritional needs. The following measures may be proposed:

- Oral nutritional supplements
- Tube feeding
- Parenteral nutrition

Choice of management depends on:
- Degree of malnutrition
- Spontaneous intakes
- Patient compliance
Conclusions

1. PEW is prevalent in patients with CKD especially in advanced stages of the syndrome

2. PEW is associated with adverse outcomes

3. LPD (0.6 prot/kg/day) and VLPD (0.3 g prot/kg/day + KA) are worth to prescribe if:
   
a) there is no established PEW

b) energy intake is appropriate (35 kcal/kg/day)

c) Regular monitoring of nutrition status is implemented
Thank you for your attention!