

# The Effect of Malnutrition on Osteoporosis for Periton Dialysis Patients and Solutions

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## Abstract

**Introduction:** Malnutrition is seen much more in the peritoneal dialysis patients. Because, Periton Dialysis causes much more loss of body proteins than hemodialysis. Osteoporosis which is a kind of bone interaction seen in chronic renal failure is a long term complication and also it is the result of the deformation of bone structure.

**Objective:** Our aim in this survey is to view the osteoporosis conditions of dialysis patients who have malnutrition on the continuous peritoneal dialysis (CAPD) or not. At the same time, we aimed to find solutions for prevention of the complications that can occur in these patients.

**Material and method:** Our subjects are 27 patients who are being observed at Cumhuriyet University Faculty of Medicine Nephrology Department Periton Dialysis Unit. Malnutrition of patients was identified by NRS-2002 valuation questionnaire. Patients were divided into two groups: the ones who have malnutrition and the ones who don't. The scale of bone mineral density, malnutrition situations and biochemical parameters of patients were obtained. Malnutrition was identified in 14 of (51,8%) 27 patients. Bone mineral density measurements were low in the patients who had malnutrition. A significant relationship between malnutrition and femur dEXA values was observed. ( $p < 0,05$ ). Serum CRP levels were high in the group of malnutrition.

**Conclusion:** It is found out that the bone mineral density levels were low for malnutrition patients. So, they should be regularly under consideration for nutrition and osteoporosis.

**Keywords:** Malnutrition; Peritoneal dialysis; Osteoporosis

## Introduction

Osteoporosis is defined as the deformation of the microstructure of bone cambium. As a result of this, there occurs a probability of fragment. It can be diagnosed only by way of bone biopsy. However many patients do not accept this and bone mineral density levels are considered for diagnosis. Secondary hyperparathyroidism, osteomalacia and adynamic bone disease have important role in the etiology of bone disease seen in end stage renal failure. The bone mineral density is an important parameter for objective evaluation of the systematic diseases like osteoporosis. The dual energy x ray absorptiometry (DEXA) methods are used to measure the bone mineral density.

Lack of protein and energy in the body is called as malnutrition or protein energy malnutrition. Malnutrition is frequently seen among the dialysis patients. Malnutrition prevalence is seen in dialysis populations in different percentages (18-76%) [1-2]. The evaluation of nutrition of dialysis patients can be investigated by the way of biochemical parameters, the speed of protein catabolism, anthropometrical measurements and body composition. And also subjective global evaluation can be used to evaluate malnutrition of the end stage renal failure [3]. Nutritional screening and evaluation: it is important to evaluate the nutrition for acute and chronic malnutrition diagnosis in the peritoneal dialysis patients.

## Objective

The target of this study is to define the level of malnutrition of the patients that were under the treatment of CAPD. Besides, to determine the account of osteoporosis by way of measuring bone mineral density

with DEXA method and searching the relationship between the osteoporosis and malnutrition. We aimed to find solutions in preventing the complications of related with osteoporosis.

## Material and Method

Our subjects are 27 patients being observed at Cumhuriyet University, Faculty of Medicine Nephrology Department Periton Dialysis Unit (14 female and 13 male). Patients were divided into two groups who have malnutrition and who do not. They were applied personal information forms to identify their socio-demographic clinical features. Their calcium, phosphorus, blood urea nitrogen, creatinine, potassium, albumin, hemoglobin, hematocrit, parathyroid hormone, C-reactive protein (CRP), Kt/v, body mass index and vitamin D levels were determined. For measuring the bone mineral density, DEXA was applied to their forearm and femur neck. Patients malnutrition conditions were defined by way of NRS 2002 inquires. Patients who had cancer or who did not have periton dialysis less than 3 months were not included to the survey. According to the World Health Organization criteria: bone structure T score  $\leq 2,5$  osteoporosis, T score  $-2,5-1$  osteopeny, T score  $>1$  is considering as normal [4], we evaluated our patients according to these criteria.

There are many kinds of guides to identify the malnutrition. For example: subjective Global Evaluation, mini-nutritional evaluation, and NRS 2002 questionnaire. Nowadays NRS 2002 is the most wide spread one, for ESPEN (European Society of Parenteral and Enteral Nutrition) NRS 2002, and for old patients the Mini Nutritional Evaluation is advised. With NRS 2002 patients were evaluated in insufficient nutrition and

severity of disease and were scored like below: no (0) insignificant (1) average (2) and serious (3). Patients with total score  $\geq 3$  were evaluated as under the nutrition risk [5]. At first, NRS 2002 nutritional screening form was filled (Table 1). If the answers are no, forms have to be filled weekly again. If the answer of any question is yes, then the last screenings have to be done (Table 2).

### Statistical analysis

Data of the survey was evaluated with SPSS 15.0 programme. Percentage and average calculations and Mann-Withney U tests were used to evaluate the data.

### Results

The average ages of the patients were found as  $45,6 \pm 12$ . Patients were divided into two groups, the ones with malnutrition (1 male, 13 female) average ages of these were  $48,3 \pm 10,3$  years old; dialysis period  $55,6 \pm 29,2$  months; the other ones without malnutrition (6 male, 7 female) average ages  $42,6 \pm 13,5$  years, dialysis period  $39 \pm 29,7$  months.

The relationship between the two groups demographic and biochemical parameters of the patients (Table 3). Any difference between two groups were not identified according to age, gender, dialysis periods, calcium, phosphorus, blood urine nitrogen, creatine, hematocrite, parathyroid hormone, kt/v, body mass index, forearm dexavalues and 25 (OH) vitamin D levels ( $p < 0,05$ ). 14 of 27 patients in our survey (51,8%) had malnutrition. 10 of the 14 patients with malnutrition were identified having osteopenia, and 4 of them osteoporosis. 3 of 13 patients who do not have malnutrition were identified osteopenia, and 4 of them osteoporosis. A significant relationship was found between malnutrition and dxa measurements in the both groups ( $p < 0,05$ ). 29,6% of SAPD patients were detected osteoporosis and 48,1% osteopenia.

### Discussion

There are a lots of risk factors for the osteoporosis development of patients with chronic renal failure. These are female gender, over aging, decreased calcium intake, secondary hyperparathyroidism, low vitamin D, long term steroid usage, sedentary life and some genetic factors. And also low bone mineral density is known a risk factor for bone fracture [6]. The patients with long term renal failure bone mineral density is detected lower than normal healthy population measurements. Patients with the longer period on the peritoneal dialysis treatment has lower bone mineral density [7].

The Baszko-blaszyk and et al. were found the osteoporosis prevalence of 48,6% and 21,6% in lumbar vertebrae and femoral neck, respectively [8]. Doğukan and et al. showed that periton dialysis patients, osteoporosis prevalence in lumbar vertebra of 25,7%, femoral neck of 28,6% [9]. Ersoy et al. declared that the osteoporosis frequency is 19,2% and 26%. The percentage of 56% patients was osteopenic [10]. Our study detected that 29,6% of CAPD patients have the osteoporosis and 48,1% of them are the osteopenic.

Loss of protein and energy is important for chronic peritoneal dialysis patients and it has the negative prognostic factor for morbidity and mortality [11]. Thus, it is important to define the nutrition disorders in time and to treat rightly in the end stage renal disease patients. Especially, because of the protein loss during the periton dialysis, these patients should be checked regularly for malnutrition and osteoporosis. Serum albumin level is a strong evidence of the survival of these patients.

In a few survey, It has been detected a negative correlation between the serum albumin concentration and mortality in hemodialysis and peritoneal dialysis patients [12,13]. The low level of serum albumin is detected as 28% in chronic periton dialysis patients in Turkey [14]. In our study, the low level of serum albumin was found as 77,7% ( $< 3,5$  g/dl). It was higher than other researches [15].

In the five years survey which was carried on by Teenhan and his friends, the serum albumin level 3,5 g/dl and over in chronic peritoneal dialysis patients, the living expectation was found over 50 months. It was seen that the patients whose albumin level is lower, lost their lives within 40 months.

Although the serum albumin level differs in both inflammation and malnutrition situations, it was agreed that the albumin can be used as a strong evidence of nutrition even there was inflammation [15,16].

Inflammation plays an important role on malnutrition development of dialysis patients. While with the inflammation, the negative acute phase reactants are decreasing, positive phase reactants and cytokines increase. Inflammation results with protein catabolism, lipolysis and anorexia. Also, obesity contributes to the inflammation in the chronic renal failure [17,18].

Especially the glucose which is used as osmotic substance for periton dialysis solutions is a responsible for obesity. It is not certain but the surveys attract attention to the fact that increased inflammation indicators hasten the protein waste. In the animal experiments it is shown that IL-1, IL-2, IL-6 and TNF alpha, are the first cytokines that controls the metabolic answers. Increased IL-6 level is related to the protein break down of muscles and usage of IL-6 receptor antibody can prevent this effect. Anorexia is also one of well-known metabolic result of inflammation. IL-1 and TNF alpha's effect on the satiety point in brain is blamed of this. Many inflammatory diseases are related with the osteoporosis. Many of diseases of like Rheumatoid arthritis, systemic lupus, inflammatory intestine disease, chronic obstructive lung disease and other inflammatory diseases, were found increased risk for osteoporosis and bone fragility comparing with the healthy population [19-21]. Our study has some limitation such as low number ( $n=27$ ) of studied patients.

In our survey the malnutrition is found as 51,8%. The bone mineral density was detected lower in the patients with malnutrition. The CRP level which is the evidence of inflammation was significantly detected high for this group. As a conclusion, the malnutrition frequency is high for periton dialysis patients. There is a relationship between malnutrition

	Yes	No
1. BK- $< 20,5$		
2. Is there a loss of weight in last 3 months?		
3. Is there a decrease of nutrition intake?		
4. Is there a serious disease?		
Yes: if the answer of any question is Yes; you should pass to chard 2.		
No: if the answer of all questions are No; the patient is screened weekly. If there will be a major operation, a nutrition treatment plan should be done.		

Table 1: NRS -2002 (Nutritional Risk Screening)

Disorders of Nutrition state	Severity of Disease ( increase of needs)
No- score- normal nutrition state	No score- 0 simple nutrition requirements
Insignificant – 1 In 3 months >%15 loss of weight or the last week nutrition intake is less than %50-75 normal requirements.	Insignificant score: A broken hip bone Especially the chronicle patients with acute complications, cirrhosis, KOAH, chronical hemodialysis, diabet, oncology.
Avarage score: 2 In 2 months >% 15 loss of weight or BKi 18.5-20.5+ general state disorders or last week nutrition intake is %25-60 of normal requirements.	Avarage score2 Major Abdominal Surgery *, paralysis, severe phomoni, hematological malignity.
Severity score-3 In a month <%15 loss of weight (3 months>%15) or BKi <18,5+ general state disorder or last week nutrition intake is %0-25 lower than normal requirements. SCORE: AGE>= 70 YEARS PLUS 1.	Severity score 3 Head trauma, transplantation of bone marrow, intensive care patients (APACHE>10)
	Score=total score= total score adapted to the age.

**Table 2:** The Last Screening

PHARAMETERS	TOTAL(N:27)	GROUP WITH MULNUTRITION (N:14)	GROUP WITOUT MULNUTRITION (%13)	P
Age (year)	45,62 ± 12,1	48,35 ± 10,35	42,69 ± 13,54	0,234
Dialysis period ( month)	47,66 ± 30,12	55,64 ± 29,26	39,07 ± 29,73	0,114
Calcium (mg/dl)	8,76 ± 0,74	8,95 ± 0,71	8,56 ± 0,73	0,206
Phosphor(mg/dl)	4,71 ± 1,22	4,32 ± 1,25	5,13 ± 1,08	0,109
Photasium ( mg/dl)	4,18 ± 0,74	4,05 ± 0,67	4,32 ± 0,8	0,593
Blood ureea nitrogen(mg/dl)	49,7 ± 15,14	45,5 ± 12,76	54,23 ± 16,65	0,244
Creatin(mg/dl)	9,98 ± 2,61	9,17 ± 2,15	10,85 ± 2,86	0,089
Hemoglobin (mg/dl)	11,57 ± 1,93	10,86 ± 1,45	12,34 ± 2,14	0,036**
Hematocrit (%)	34,68 ± 6,14	32,67 ± 4,61	36,85 ± 6,99	0,120
C-reactive protein (mg/l)	6,87 ± 7,57	8,79 ± 9,99	4,8 ± 2,68	0,003**
Pharathormon (pg/ml)	461,04 ± 485,53	395,6 ± 392,82	531,51 ± 577,25	0,467
Femur dexta	-1,61 ± 1,24	-2,13 ± 1,06	-1,05 ± 1,22	0,035**
Forearm dexta	-1,76 ± 1,37	-2,05 ± 1,10	-1,45 ± 1,59	0,234
Kt /v	2,21 ± 0,56	2,23 ± 0,48	2,18 ± 0,65	0,734
BMI (kg/m2)	26,47 ± 9,06	26,42 ± 7,16	26,51 ± 11,06	0,576
25 (OH) D vitamin	11,8463 ± 4,95637	12,3 ± 4,49	11,35 ± 5,55	0,631

**Table 3:** The relationship between the two groups Demographic and biochemical parameters of the patients'

and bone mineral density. We think that this is a result of inflammation. Thus, for CAPD patients, it is important to educate them regularly for dieting and to check their malnutrition levels. At the same time we advice them to be trained about the risk of bone fragility.

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