Effect of Nutritional Status and Muscle Strength on Mortality of the Palliative Care Patients

Yasin Güçlü,[1] Hakan Demirci,[1] Gökhan Ocakoğlu,[2] Özge Aydın Güçlü[3]

[1]Department of Family Medicine, Bursa Yuksek Ihtisas Training and Research Hospital, Bursa, Turkey
[2]Department of Biostatistics, Uludag University Faculty of Medicine, Bursa, Turkey
[3]Department of Pulmonary Diseases, Uludag University Faculty of Medicine, Bursa, Turkey

ABSTRACT

Objectives: This study aimed to evaluate the association of nutritional status and muscle strength measurement results of the patients in the palliative care unit during their 6-month survival.

Methods: In this prospective observational study, the effects of nutritional status on mortality were evaluated during the 6-month follow-up of patients hospitalized in the palliative care units of Bursa State Hospitals between January 2018 and April 2018. Their handgrip strength was measured by a hand dynamometer, and their subcutaneous adipose tissue was measured by skin-fold calipers. Mini Nutritional Assessment was used to evaluate the sociodemographic characteristics and nutritional status of the patients.

Results: A total of 211 patients aged 73.3±14.6 years treated in the palliative clinic were included in the study, of which 112 (53.1%) were males. The frequency of malnutrition at the beginning of follow-up was 75 (78.1%) in the living group and 108 (93.9%) in the dead group (p=0.001). During the 6-month follow-up period, 115 (54.5%) cases died. The frequency of malnutrition after 6 months was observed in 175 (82.9%) of the entire patients. The average muscle strength of the right and left arms was found to be significantly higher in alive patients than in dead patients [5.0 (0.0–21.8) kg vs 0.0 (0.0–10.0), p=0.001].

Conclusion: Nutritional status and muscle strength may be important in palliative care patients' survival. It would be appropriate to promote a balanced diet and physical activity to patients before the need for palliative care develops.

Keywords: Malnutrition, mortality, muscle strength

INTRODUCTION

Palliative care is multidisciplinary care aimed at avoiding the symptoms that may occur in patients with a severe illness or providing relief for them and achieving the best quality of life for them.[1] The World Health Organization defines palliative care as "an approach that improves the quality of life of patients and their families facing the problem associated with a life-threatening illness, through the prevention and relief of suffering through early identification and impeccable assessment and treatment of pain and other problems, physical, psychosocial and spiritual."[2]

Care of palliative care patients is a little complicated because of multimorbidity.[3] However, the most common problems in palliative care are bedsores and malnutrition. Both are known to have a strong association with mortality. Also, it is known that the protection of

muscle strength is a factor supporting survival in these patients. One of the well-known consequences of malnutrition is muscle dysfunction, manifested by reduced grip strength. Decreased muscle strength is also associated with impaired functional status.[4] There is an important relationship between nutritional status and pressure ulcers and mortality.[5–7]

Deterioration of wound healing, immunosuppression, the decline in striated muscle mass, intestinal mucosal atrophy, diffuse edema development, recession in cognitive functions, and decline in functional capacities may occur due to malnutrition developing in case of inadequate food intake and insufficient calorie need during illness.[8] These negative factors develop due to malnutrition, increased complication rates, hospital costs, and mortality.[9]

"Hand dynamometer" can be preferred to identify the first state of the patient at the bedside for a functional evaluation, and it is also a method that can be applied in patients' follow-up.[10,11] This measurement method is essential in patients with malnutrition for skeletal muscle function evaluation as it is sensitive to changes in food intake and muscle mass.[11] Declined muscle strength detected with a hand dynamometer is associated with increased mortality in several studies.[12] However, it is still uncertain which mechanism increases mortality. Grip strength measurement is a preferable method in classifying the patients' mortality risk as it is cheap and easily applicable.

This study aimed to evaluate the association between nutritional status and muscle strength measurement results of the patients in the palliative care unit during their 6-month survival.

METHOD

This research was conducted on individuals hospitalized in palliative care units of Bursa State Hospitals between January 2018 and April 2018. The study protocol is described as a flow chart in Figure 1.

A hand dynamometer measured their handgrip strength, and skin-fold calipers measured their subcutaneous adipose tissue. "Mini Nutritional Assessment" was used to interrogate the sociodemographic characteristics and nutritional status of the patients. Mini Nutritional Assessment was completed in 10–15 min. Patients with a score of 24 and more were accepted as normal, patients with a score between 17 and 23.5 were accepted under malnutrition risk, and those with a score less than 17 were accepted as having malnutrition.[13]
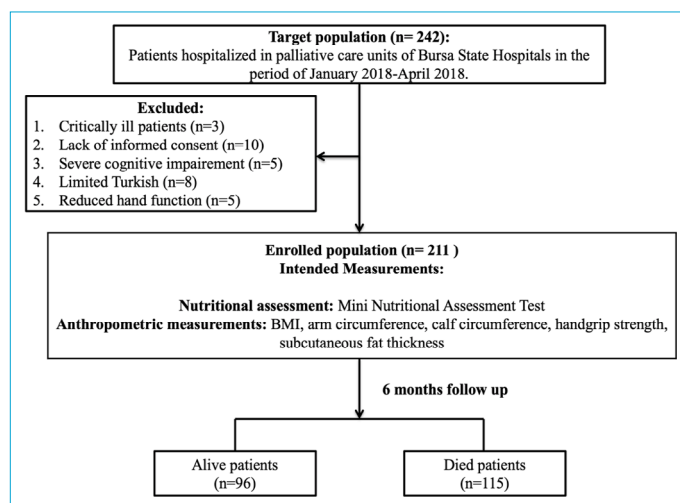
Among the anthropometric measurements, height and

Figure 1. Study flow chart.

weight were measured with standard measurement tools. The individuals were asked to take off their shoes during height measurement and advised to wear lightweight dresses during weight measurement. Body mass index was calculated by dividing the weight by the square of the height of the patients (kg/m^2).

For arm circumference measurement, the upper arm in the supine position was measured twice at the midpoint between the tip of the shoulder and the tip of the elbow (olecranon process and the acromion) using a measuring tape.[14] Its average was recorded in centimeters. For calf circumference measurement, the knee was bent 90° in a sitting position with the foot fully pressing the ground, and the circumference of the broadest part was measured twice using a measuring tape.[15] The average is recorded in centimeters. Individuals who could not sit bent their leg 90° from the knee in decubitus position with the sole facing across, and the measurement was made. Handgrip strength was measured using a Baseline (Fabrication Enterprises, Inc., White Plains, NY) hydraulic hand dynamometer. The measurement was made in a sitting position recommended by the American Society of Hand Therapists (ASHT), with the shoulder in adduction and neutral rotation, arm at the right angle, front arm in midrotation and supported, and wrist in the neutral position.[16] Three measurements were made in the test procedure with 1-min rest between for grip strength, and the average was recorded. Skinfold caliper (Holtain® calipers) was used to determine subcutaneous fat thickness. The previously marked area to be measured was gripped with the thumb and the index finger at 1-cm depth, the caliper was placed, and the measurement was read within 2–4 s. Three measurements were made on one side three times at 15-s intervals. The arithmetic mean of the three measurements was calculated.

The data were analyzed using SPSS (IBM Corp. Released 2012, IBM SPSS Statistics for Windows, Version 21.0. Armonk, NY) software. The compatibility of the variables to normal distribution was analyzed with the Shapiro–Wilk test. Continuous variables were expressed as mean, standard deviation, and median (minimum–maximum) values, whereas categorical variables were expressed as frequency and percentage. According to the normality test results, the Mann–Whitney U test was used in case of noncompatibility of the variables to normal distribution. Pearson's Chi-squared test and the Fisher–Freeman–Halton test were used to compare categorical variables among the groups. The program was used for statistical analysis, and p<0.05 was accepted as statistically significant.

RESULTS

A total of 211 patients aged 73.3±14.6 years treated in the palliative clinic were included in the study, of which 112 (53.1%) were males. The most common comorbid diseases were hypertension 109 (51.7%), cardiovascular disease 78 (36.9%), and diabetes mellitus 64 (30.3%). The demographic, anthropometric, and nutritional details of the patients are summarized in Table 1.

The frequency of malnutrition at the beginning of follow-up was 75 (78.1%) in the living group and 108 (93.9%) in the dead group (p=0.001). During the 6-month follow-up, 115 (54.5%) cases died. The frequency of malnutrition after 6 months was observed in 175 (82.9%) patients in the entire population. Demographic, anthropometric, and nutritional details of alive and dead patients are summarized in Table 2.

DISCUSSION

In this study on patients treated on palliative care unit service, malnutrition was detected in 82.9% of the participants. When the muscle strengths of the patients were assessed, mean muscle strengths were high in patients who lived more than 6 months.

Although malnutrition prevalence was estimated between 20% and 50% in hospitalized patients, it can be predicted that the real prevalence is much higher than mentioned as it is not usually identified sufficiently, especially in critical diseases.[17] In a study performed in Turkey, including 29 139 patients from 32 hospitals, the nutritional risk was detected in 15% of the patients at the time of admission to the hospital. Together with nutritional treatment, this risk regressed by 5.2% until the end of the second week.[18] In another study, although the hospitalized patients were at normal nutrition levels, slight malnutrition was detected in 50% of these patients within the elapsed time.[19] In a multicenter epidemiologic study performed in Latin America,

Table 1. Demographic, anthropometric, and nutritional details of the patients

	Mean±SD
Age (years)	73.3±14.6
Body mass index (kg/m²)	23.1±4.8
Calf circumference (cm)	28.2±8.2
Arm circumference (cm)	22.1±4.1
	n (%)
Gender	
Female	99 (46.9)
Male	112 (53.1)
Comorbid diseases*	
Hypertension	109 (51.7)
Cardiovascular disease	78 (36.9)
Diabetes Mellitus	64 (30.3)
Chronic renal failure	28 (13.3)
Malignancy	27 (12.8)
Chronic obstructive pulmonary disease	26 (12.3)
Nutritional status	
Oral	148 (70.1)
Percutaneous endoscopic gastrostomy	27 (12.9)
Parenteral	7 (3.3)
Nasogastrictube	29 (13.7)
	Median (minimum–maximum)
Muscle strength (kg)	
Right	5.0 (0.0–25.0)
Left	5.0 (0.0–20.0)
Average	5.0 (0.0–23.0)

*There is more than one comorbid disease in some cases.

9348 hospitalized patients over 18 years of age were evaluated. Critical undernutrition was detected in 11.2% of these patients with malnutrition in 50.2% of them.[20] In another study run by Correia et al. on 374 surgery patients, critical undernutrition was found in 19% of the patients with malnutrition in 55% of them.[21] In the current study, 82.9% of the patients were assessed to have malnutrition, which is high when the literature is considered. However, this frequency is not surprising as the study was run on patients in the palliative care unit.

Elderly adults with reduced muscle strength have a higher mortality risk.[22] Muscle strength is closely associated with decreased muscle mass due to age.[23] It is assumed that this decrease in muscle mass contributes to functional limitations and the development of disability in senility. Thus, it is included in muscle strength and mortality correlation.[24]

Table 2. Demographic, anthropometric, and nutritional details of alive and dead patients

	Alive (n=96)	Dead (n=115)	p
Age (years)	72.0 (62.0–82.0)	79.0 (65.0–85.0)	0.084*
Gender			
Female	43 (44.8)	56 (48.7)	0.571[†]
Male	53 (55.2)	59 (51.3)	
Body mass index (kg/m^2)	22.5 (20.1–25.4)	22.7 (19.9–25.4)	0.590*
Calf circumference (cm)	27.0 (23.5–32.0)	25.0 (22.0–32.0)	0.229*
Arm circumference (cm)	22.2 (19.0–25.7)	22.0 (18.4–24.0)	0.034*
Nutritional status			
Oral	70 (72.9)	78 (67.8)	0.065[‡]
Percutaneous endoscopic gastrostomy	15 (15.6)	12 (10.5)	
Parenteral	4 (4.2)	3 (2.6)	
Nasogastric tube	7 (7.3)	22 (19.1)	
Muscle strength (kg)			
Right	5.0 (0.0–23.7)	0.0 (0.0–10.0)	0.004
Left	5.0 (0.0–20.0)	0.0 (0.0–10.0)	0.002
Average	5.0 (0.0–21.8)	0.0 (0.0–10.0)	0.001
Subcutaneous fat tissue	13.0 (8.0–18.0)	10.0 (7.0–16.0)	0.053
Nutritional status			
Normal	6 (6.3)	2 (1.7)	0.001[‡]
Under risk of malnutrition	20 (20.8)	8 (7.0)	
Malnutrition	70 (72.9)	105 (91.3)	

The data are given as median (minimum-maximum) and n (%).
*Mann Whitney U test; [†]Chi-square test; [‡]Fisher-Freeman Halton test.

Besides this, although only body weight, creatinine excretion, and some anthropometric measurements were used to estimate muscle mass in previous studies, the role of muscle mass mediating strength and mortality association could not be defined implicitly.[23] In a cohort study in which 3075 Afro-American men and women between 70 and 79 years of age were followed up for nearly 4.9 years, low muscle mass, muscle strength, and mortality correlation could not be explained.[25] It was shown that muscle strength, which was the indicator of muscle qualification, was more important than muscle mass in the expected mortality risk. The six-month survival of the patients was followed up in our study. The right–left hand grip and mean muscle strength measurements of the patients who survived at the end of 6 months were higher than the first measurements of the right–left hand and mean muscle strength of patients who died at the end of 6 months. The survival frequency of patients with high muscle force was also high.

Malnutrition is a significant health problem for the geriatric age group. This problem leads to various complications in old people living in the society and residential facilities and in hospitalized ones. Although malnutrition causes morbidity and mortality, its scanning cannot be made sufficiently, leading to delays in its diagnosis.[26] Malnutrition in hospitalized patients is associated with increased mortality, morbidity, length of hospitalization, and increased health expenses.[27] Functional and metabolic body disorders that emerged from previous health problems depend on the effect of malnutrition on almost all body organs and systems.[28] In malnutrition, after fat, the most loss occurs in muscle mass. While muscle mass is preserved in the first period of malnutrition, the muscle's function decreases. Then, the amount of stored glycogen, adenosine triphosphate, and creatinine decreases with the decreasing muscle mass. In addition to the loss of muscle mass due to malnutrition, the inflammatory process that causes malnutrition reduces muscle strength, endurance, and mobility.[29] Inflammation, hypoalbuminemia, and malnutrition have prognostic value in palliative patients. In a study, it is found that patients with poor nutritional status, hypoalbuminemia, or systemic inflammation had significantly lower survival.[30] A total of 709 patients over the age of 50 years were evaluated in the cohort study performed by Correia and Waitzberg showed that malnutrition at different levels was detected in 34.2% of the patients, and the mortality of the patients was clas-

sified according to their gender, age, nutrition status, infection, and the treatment they received.[31] The mortality rate of patients with malnutrition was significantly higher than that of patients without malnutrition. Similar to this study, a higher mortality rate was found in patients with malnutrition in our study. Most of the patients in our study had been previously hospitalized in intensive care units. Decreased independent eating skills of these patients, difficulties in oral communication, and knowledge level of the caretakers or relatives of the patients about nutrition may have caused this picture.

When the mortality rates and sociodemographic characteristics of the patients followed in the palliative clinic were evaluated, it was found that that age, gender distribution, body mass index, and calf circumference measurements did not affect mortality independently; however, arm circumference measurements were lower in dead patients with regard to the ones who survived at the end of 6 months. Nakamura et al. reported that arm circumference measurements are essential in predicting the mortality of cardiovascular patients, but nutritional scanning tools do not have an effect on prognostic assessments.[32]

One of the limitations of the study is that it reflects only the Bursa province. Furthermore, our study was not an interventional one. Prospective studies are necessary to evaluate the association of strengthening of nutrition in malnourished cases with survival.

CONCLUSION

There is a high malnutrition level (82.9%) among the volunteers participating in the study. Nutritional status and muscle strength may be important in palliative care patients' survival. It would be appropriate to promote a balanced diet and physical activity to patients by the family physicians before the need for palliative care develops.

Disclosures

Peer-review: Externally peer-reviewed.

Conflict of Interest: The authors declare no conflict of interest.

Funding: No financial support was received for this research.

Ethics Committee Approval: The approval of research was obtained from Kartal Dr. Lutfi Kırdar Research and Training Hospital Ethics Committee (Approval date: Dec 10, 2017, and Approval number: 2011-KAEK-25 2016/14-11). The consent form was obtained from the patients.

Authorship Contributions: Concept – H.D.; Design – H.D.; Supervision – H.D.; Materials – O.A.G., Y.G.; Data collection and/or processing – O.A.G., Y.G.; Analysis and/or interpretation – G.O.; Literature search – O.A.G., Y.G.; Writing – O.A.G., Y.G.; Critical review – H.D.

REFERENCES

1. Rs M. Meier DE. Clinical practice. Palliative care. N Engl J Med 2004;350(25):2582–90. [CrossRef]
2. Sepúlveda C, Marlin A, Yoshida T, Ullrich A. Palliative care: the World Health Organization's global perspective. J Pain Symptom Manag 2002;24(2):91–6. [CrossRef]
3. Phillips P. Grip strength, mental performance and nutritional status as indicators of mortality risk among female geriatric patients. Age Ageing 1986;15(1):53–6. [CrossRef]
4. Norman K, Stobäus N, Smoliner C, Zocher D, Scheufele R, Valentini L, et al. Determinants of hand grip strength, knee extension strength and functional status in cancer patients. Clin Nutr 2010;29(5):586–91. [CrossRef]
5. Montalcini T, Moraca M, Ferro Y, Romeo S, Serra S, Raso MG, et al. Nutritional parameters predicting pressure ulcers and short-term mortality in patients with minimal conscious state as a result of traumatic and non-traumatic acquired brain injury. J Transl Med 2015;13:305. [CrossRef]
6. Malafarina V, Reginster J-Y, Cabrerizo S, Bruyère O, Kanis JA, Martinez JA, et al. Nutritional status and nutritional treatment are related to outcomes and mortality in older adults with hip fracture. Nutrients 2018;10(5):555. [CrossRef]
7. Iizaka S, Okuwa M, Sugama J, Sanada H. The impact of malnutrition and nutrition-related factors on the development and severity of pressure ulcers in older patients receiving home care. Clin Nutr 2010;29(1):47–53.
8. Schaible UE, Kaufmann SHE. Malnutrition and infection: complex mechanisms and global impacts. PLos Med 2007;4(5):e115.
9. Lim SL, Ong KC, Chan YH, Loke WC, Ferguson M, Daniels L. Malnutrition and its impact on cost of hospitalization, length of stay, readmission and 3-year mortality. Clin Nutr 2012;31(3):345–50. [CrossRef]
10. Flood A, Chung A, Parker H, Kearns V, O'Sullivan TA. The use of hand grip strength as a predictor of nutrition status in hospital patients. Clin Nutr 2014;33(1):106–14. [CrossRef]
11. Humphreys J, de la Maza P, Hirsch S, Barrera G, Gattas V, Bunout D. Muscle strength as a predictor of loss of functional status in hospitalized patients. Nutrition 2002;18(7-8):616–20.
12. Leong DP, Teo KK, Rangarajan S, Lopez-Jaramillo P, Avezum Jr A, Orlandini A, et al. Prognostic value of grip strength: findings from the Prospective Urban Rural Epidemiology (PURE) study. Lancet 2015;386(9990):266–73. [CrossRef]
13. Kaiser MJ, Bauer JM, Ramsch C, Uter W, Guigoz Y, Cederholm T, et al. Validation of the Mini Nutritional Assessment Short-Form (MNA®-SF): A practical tool for identification of nutritional status. J Nutr Health Aging 2009;13(9):782–8. [CrossRef]
14. Collins S. Using middle upper arm circumference to assess severe adult malnutrition during famine. JAMA 1996;276(5):391–5.
15. Bonnefoy M, Jauffret M, Kostka T, Jusot J. Usefulness of calf

circumference measurement in assessing the nutritional state of hospitalized elderly people. Gerontology 2002;48(3):162–9.

16. MacDermid J, Solomon G, Valdes K, American Society of Hand Therapists. Clinical assessment recommendations. 3rd ed. Mount Laurel NJ: American Society of Hand Therapists; 2015.

17. Ridley EJ, Davies AR, Hodgson C, Deane A, Bailey M, Cooper DJ. Full predicted energy from nutrition and the effect on mortality and infectious complications in critically ill adults: a protocol for a systematic review and meta-analysis of parallel randomised controlled trials. Syst Rev 2015;4:179. [CrossRef]

18. Korfalı G, Gündoğdu H, Aydıntuğ S, Bahar M, Besler T, Moral AR, et al. Nutritional risk of hospitalized patients in Turkey. Clin Nutr 2009;28(5):533–7. [CrossRef]

19. González Castela L, Coloma Peral R, Ascorbe Salcedo P, Indo Berges O, Rodríguez Carballo B, Martínez Tutor MJ. Current status of the degree of malnutrition in hospitalized patients of the Community of La Rioja. Nutr Hosp 2001;16(1):7–13.

20. Correia MIT, Campos ACL, Study EC. Prevalence of hospital malnutrition in Latin America: The multicenter ELAN study. Nutrition 2003;19(10):823–5.

21. Correia M, Caiaffa WT, da Silva AL, Waitzberg DL. Risk factors for malnutrition in patients undergoing gastroenterological and hernia surgery: an analysis of 374 patients. Nutr Hosp 2001;16(2):59–64.

22. Metter EJ, Talbot LA, Schrager M, Conwit R. Skeletal muscle strength as a predictor of all-cause mortality in healthy men. J Gerontol Series A Biol Sci Med Sci 2002;57(10):359–65.

23. Metter EJ, Lynch N, Conwit R, Lindle R, Tobin J, Hurley B. Muscle quality and age: cross-sectional and longitudinal comparisons. J Gerontol Series A Biol Sci Med Sci 1999;54(5):207–18.

24. Evans W. Functional and metabolic consequences of sarcope-nia. J Nutr 1997;127(5):998–1003.

25. Newman AB, Kupelian V, Visser M, Simonsick EM, Goodpaster BH, Kritchevsky SB, et al. Strength, but not muscle mass, is associated with mortality in the health, aging and body composition study cohort. J Gerontol Series A Biol Sci Med Sci 2006;61(1):72–7. [CrossRef]

26. Ozturk A, Ozenc S, Canmemis S, Bozoglu E. Preventive health measurements in geriatric period. TJFM&PC 2016;10(1):33–9.

27. Chima CS, Barco K, Dewitt ML, Maeda M, Teran JC, Mullen KD. Relationship of nutritional status to length of stay, hospital costs, and discharge status of patients hospitalized in the medicine service. J Am Diet Assoc 1997;97(9):975–8. [CrossRef]

28. Chandra RK. Nutrition and the immune system: an introduction. Am J Clin Nutr 1997;66(2):460–3. [CrossRef]

29. van Zutphen T, Ciapaite J, Bloks VW, Ackereley C, Gerding A, Jurdzinski A, et al. Malnutrition-associated liver steatosis and ATP depletion is caused by peroxisomal and mitochondrial dysfunction. J Hepatol 2016;65(6):1198–208. [CrossRef]

30. Cunha MS, Wiegert EVM, Calixto-Lima L, Oliveira LC. Relationship of nutritional status and inflammation with survival in patients with advanced cancer in palliative care. Nutrition 2018;51:98–103. [CrossRef]

31. Correia MIT, Waitzberg DL. The impact of malnutrition on morbidity, mortality, length of hospital stay and costs evaluated through a multivariate model analysis. Clin Nutr 2003;22(3):235–9.

32. Nakamura T, Kamiya K, Matsunaga A, Hamazaki N, Matsuzawa R, Nozaki K, et al. Prognostic usefulness of arm circumference and nutritional screening tools in older patients with cardiovascular disease. Nutr Metab Cardiovasc Dis 2018;28(7):743–8.