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Original Article

Assessment of nutritional status and its association with anthropometric measurements, blood results and body composition in elderly cardiovascular patients

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Summary. *Background and Aim of the work:* This study is planned and applied to analyse nutritional status of elderly patients hospitalized with cardiovascular diseases, in order to identify the association of nutritional status with anthropometric measurements, body composition, blood results, and also to assess the alteration of nutritional status during hospital stay. *Methods:* Two hundred and eleven 65+ years old patients hospitalized in Dr. Burhan Nalbantoğlu State Hospital's cardiology and cardiovascular surgery wards more than 3 days were included in the study. Body weight, height, middle upper arm circumference and calf circumference were measured and body composition was assessed with Bioelectrical Impedance Analysis technique, while blood results were recorded from the patients' files both at admission to and discharge from hospital. Furthermore nutritional status was assessed with full Mini Nutritional Assessment. *Results:* According to full Mini Nutritional Assessment, on admission 8.5% of patients were malnourished and 43.10% had malnutrition risk while 9.5% of patients were malnourished, 47.4% had malnutrition risk at discharge. Having heart failure increases malnutrition risk 2.84 times when compared to patients having other cardiovascular diseases (p=0.005). Mean albumin, total protein, haemoglobin, body weight, body mass index, middle upper arm circumference and calf circumference values were significantly lower in malnourished and at risk patients than the ones with normal nutritional status both on admission and discharge ($p<0.05$). *Conclusion:* In order to prevent hospital malnutrition, it is important to assess nutritional status on hospital admission and keep monitoring patients' anthropometric measurements and blood tests during hospitalization.

Key words: malnutrition, elderly, anthropometry, albumin, BIA

Introduction

Most common morbidity seen in the elderly people is cardiovascular diseases (1). Many studies have shown that nutritional status is frequently impaired in elderly hospitalized cardiovascular patients (2-4). Even without catabolic illnesses, appetite is reduced with age, lean body mass may be decreased and physical activity is frequently diminished. Therefore malnutrition is a common finding in geriatric patients (5). Since there are many factors affecting malnutrition, nutritional assessment is a challenge. Thus, to classify nutritional status, a combination of indicators from several categories such as anthropometry, biochemical parameters, food intake and the presence of risk factors are recommended and have been used clinically (6). The Mini Nutritional Assessment (MNA®) is a simple non-invasive tool for assessing the nutritional risk of the elderly (7). The aim of this study was to analyse the prevalence of malnutrition and malnutrition risk in elderly patients hospitalized with cardiovascular diseases by using the MNA at both admission and discharge and to evaluate its association with albumin, total protein, lymphocyte count, haemoglobin, anthropometric measurements and body composition.

Material and Methods

Study design

This study was conducted on patients aged 65 years and above and having a hospital stay of 3 or more days at Cardiology and Cardiovascular Surgery wards between January-August 2011 in Dr. Burhan Nalbantoğlu State Hospital, Nicosia, North Cyprus. Written informed consent was obtained from all the patients. The patients aged below 65 years old, unable to communicate and not willing to give an informed consent, immobile and having a hospital stay less than 3 days in hospital during the survey were not included to the study. Two hundred and thirty nine patients were approached, during data collection period. Ten patients approached, refused to give informed consent, 3 patients died during the study period and approximately 15 patients who were discharged without informing the researcher were excluded from the study. Consequently 92 females, 119 males, totally 211 patients were included in the study.

Assessment of nutritional status and definition of nutritional risk

The nutritional status of patients was determined by full MNA®. The full MNA®, was developed by the joint effort of the Nestlé Research Centre in Lausanne, the Centre for Internal Medicine and Clinical Gerontology of Toulouse and the Clinical Nutrition Program at the University of New Mexico, to assess nutritional status as a part of the standard evaluation of elderly patients in nursing homes, clinics, hospitals, or among those who are otherwise frail. Then it was validated in three studies on more than 600 elderly subjects (8). According to full MNA® nutritional status is evaluated as; total score >24 indicates satisfactory nutritional status, scores between 17 and 24 indicate risk of malnutrition and score <17 indicates malnutrition (8, 9). Although 3 types of nutritional status were obtained as result of full MNA®, patients with malnutrition and at risk of malnutrition were evaluated together as one group and all statistical analyses performed according to two groups in this current study.

Data collection

All anthropometric measurements and body composition analyses were done in 48 hours after admission and repeated at discharge. Albumin, total protein, haemoglobin, and total lymphocyte count (TLC) of patients were recorded from patients' files at admission and discharge. Body weight was measured via Bioelectrical Impedance Analysis (BIA) device with light clothes and without shoes to the nearest 0.1kg, while body height was measured with a standard type height scale without shoes, standing still, in an upright position to the nearest 0.5 cm. BIA was performed using a tetra polar body composition analyser TANITA BF350 (Tokyo, Japan) by applying alternating electric currents of 500 μA at 50 kHz. Patients were measured in the morning after 3 hours fast. In order to measure middle upper arm circumference (MUAC), left arm was bent and the point between olecranon and acromion process was marked. While the arm hanging straight down the tape was wrapped around midpoint mark and MUAC was measured. Calf circumference (CC) was measured at the widest point of the calf.

Ethical considerations

Ethical approval was obtained from the Near East University Scientific Research Evaluation Ethical Committee (No:003-2011, Date:10.01.2011). The study was also approved by the chief medical officer of Dr. Burhan Nalbantoğlu State Hospital.

Statistical analyses

Independent Samples T test was used to compare mean results or the Mann Whitney U test was undertaken if data were not normally distributed. Differences in proportions were analysed using χ^2. Paired sample t test was used for comparison of admission and discharge values of the same variable. McNemar test was used to test the difference between paired proportions. Logistic regression was used to relate nutritional status to various factors. Data are presented as proportions, means and standard deviations or median unless otherwise indicated. Analysis was performed with SPSS statistical software package version 15.0. Statistical significance was defined as $p < 0.05$.

Results

During the study period, 119 male (mean age: 73.38 ± 7.29 years) and 92 female (mean age: 73.93 ± 6.37 years) patients were screened. Of these patients; 27.30% had heart failure, 15.60% had cardiovascular surgery and 62.10% had variety of other cardiovascular diseases. According to MNA® scores; 51.60% of patients (malnourished patients: 8.50%, risk of malnutrition: 43.10%) were malnourished and at risk of malnutrition at admission, while 56.90% of patients (malnourished patients: 9.50%, risk of malnutrition: 47.40%) were malnourished and at risk of malnutrition at discharge. There was an increase in the percentage of malnutrition and malnutrition risk (p=0.152). Many factors affect nutritional status. In Table 1, it was shown that gender was not associated with nutritional status at admission, while aging was found associated. It was found that, each year increase in age increased the risk of malnutrition 1.046 times (p=0.043). When effect of diagnosis was analysed, it was seen that being a heart failure patient increased malnutrition risk 2.839 times than the patients with other cardiovascular diseases at admission (p=0.005) (Table 1). Association of anthropometric measurements and blood test results with nutritional status at both admission and discharge was shown in Table 2 and Table 3 respectively. Patients with malnutrition and malnutrition risk had significantly lower weight, body mass index (BMI), MUAC, CC than patients with normal nutritional status at both admission and discharge (p<0.05) (Table 2). Furthermore patients with malnutrition and malnutrition risk had significantly lower albumin (p=0.000) and haemoglobin (admission p=0.005, discharge p=0.000) levels both admission and discharge, while total protein level was significantly lower only at discharge (p=0.004) (Table 3). The association of body composition and nutritional status was shown in table 4. Female patients with normal nutritional status had significantly higher body percentage of fat (BPF) than patients with malnutrition and malnutrition risk at admission but not discharge (p=0.015). Male patients with normal nutritional status had significantly higher BPF and fat mass than the patients with malnutrition and malnutrition risk both at admission (p=0.002) and discharge (p=0.000) (Table 4).

Discussion

This study was the first study in North Cyprus focusing on malnutrition in Turkish Cypriot elderly patients. Based on the MNA, 8.50% of the patients were malnourished and 43.1% of the patients had malnutrition risk at admission and 9.50% were malnourished and 47.4% had malnutrition risk at discharge. Different studies with different nutritional assessment methods showed malnutrition rates varying from 10% to 57% (10-15). The malnutrition prevalence found in various studies had a wide range because of several

Table 1. Effect of various factors on nutritional status at admission to hospital[†]

Factor	B	P	OR	95% Confidence Interval
Sex (Female)	-0.355	0.223	1.426	0.806-2.523
Diagnosis				
Other Cardiovascular Disease[¶]		0.016	1.00	
Surgical Cardiovascular Diseases	-0.06	0.885	0.942	0.417-2.127
Heart Failure	1.043	0.005	2.839	1.361-5.923
Age	0.045	0.043	1.046	1.001-1.092
Constant	-3.220			

[†]Logistic Regression; [¶]Atrial Fibrillation, Angina Pectoris, Myocardial Infarction, Ischemic Heart Disease, Vein Thrombosis, Cardiac Pace Maker Insertion, Hypertension, Pulmonary Oedema, Cardiomegaly, Syncope, Peripheral Thromboembolism, Systolic Ejection, Cardiopulmonary Arrest, Artery Occlusion, Pericarditis, Angio, Atrial Extra-systole, Thrombophlebitis, Lymphangitis, Peripheral Arterial Disease and Aortic Aneurysm.

Table 2. Association of nutritional status with anthropometric measurements at admission to and discharge from hospital[†]

Anthropometric Measurements	Normal Nutritional Status ($\bar{x}$± S)	Malnutrition and Malnutrition Risk ($\bar{x}$± S)	P
Admission to Hospital			
Weight (kg)[‡¶]	80.64±15.48	71.99±15.89	p=0.000
BMI (kg/ m2)[‡¶]	31.37 ± 5.86	28.60±6.44	p=0.001
MUAC (cm)[‡¶]	31.69 ± 3.76	29.35±4.83	p=0.000
Calf Circumference (cm)[‡¶]	35.51 ± 4.36	34.13±4.62	p=0.027
Discharge from Hospital			
Weight (kg)[‡¶]	79.08±14.36	72.72±17.00	p=0.004
BMI(kg/ m2)[‡¶]	30.77±5.47	28.76±6.80	p=0.018
MUAC (cm)[‡¶]	31.12±3.65	29.38±4.77	p=0.003
Calf Circumference(cm)[‡¶]	35.13±4.17	33.82±4.79	p=0.039

[‡]normal nutritional status n=102, [¶]malnutrition/at risk of malnutrition n=109; [†] T Test

Table 3. Blood test results and nutritional categories according to the MNA at admission to and discharge from hospital[†]

Blood Results	Normal Nutritional Status ($\bar{x}$± S)	Malnutrition and Malnutrition Risk ($\bar{x}$± S)	P
Admission to Hospital			
Albumin (g/dl)[a]	4.03±0.38	3.74±0.46	p=0.000
Total Protein (g/dl)[b]	7.12 ±0.59	6.96±0.68	p=0.073
Lymphocyte Count[c]	2.08±0.84	1.93±1.03	p=0.263
Haemoglobin (g/dl)[d]	12.33±1.68	11.62±1.92	p=0.005
Discharge from Hospital			
Albumin (g/dl)[e]	3.83±0.32	3.56±0.42	P=0.000
Total Protein (g/dl)[f]	6.89±0.57	6.64±0.60	P=0.004
Lymphocyte Count[g]	2.29±0.86	2.04±0.91	P=0.073
Haemoglobin (g/dl)[h]	12.13±1.48	11.25±1.65	P=0.000

[†] T Test; [a]normal nutritional status n=98, malnutrition and malnutrition risk n=103; [b]normal nutritional status n=99, malnutrition and malnutrition risk n=106; [c]normal nutritional status n=99, malnutrition and malnutrition risk n=103; [d]normal nutritional status n=102, malnutrition and malnutrition risk n=105; [e]normal nutritional status n=81, malnutrition and malnutrition risk n=112; [f]normal nutritional status n=81, malnutrition and malnutrition risk n=111; [g]normal nutritional status n=69, malnutrition and malnutrition risk n=104; [h]normal nutritional status n=71, malnutrition and malnutrition risk n=103

factors influencing the prevalence of malnutrition risk. Among these, characteristics of the selected patients, different hospital settings (16), different medical or geographic settings and also a wide variety of nutritional assessment method may be mentioned (17).

Various medical conditions such as diseases may reduce appetite and have a negative influence on the nutritional intake. Older people are more prone to malnutrition than younger adults and have a higher risk of nutrient deficiencies (18), because of medical,

Table 4. Association of Nutritional Status with BIA at Admission to and Discharge from Hospital†

BIA	Normal Nutritional Status ($\bar{x}$± S)	Malnutrition and Malnutrition Risk ($\bar{x}$± S)	P
Admission to Hospital			
Female	n=39	n=49	
BPF (%)	41.83±4.98	37.75±10.03	p=0.015
Fat Mass (kg)	32.97±9.97	28.34±12.13	p=0.053
Fat Free Mass (kg)	44.98±9.43	43.54±7.19	p=0.418
Male	n=59	n=54	
BPF (%)	30.04±9.90	24.62±8.08	p=0.002
Fat Mass (kg)	25.16±10.43	18.98±10.00	p=0.002
Fat Free Mass (kg)	57.07±10.63	54.05±9.65	p=0.118
Discharge from Hospital			
Female	n=33	n=53	
BPF (%)	41.05±6.43	38.40±9.93	p=0.136
Fat Mass (kg)	31.50±10.33	29.15±12.74	p=0.373
Fat Free Mass (kg)	43.98±8.25	43.62±8.33	p=0.846
Male	n=53	n=59	
BPF (%)	30.24±9.02	23.49±7.97	p=0.000
Fat Mass (kg)	26.00±10.92	17.93±9.60	p=0.000
Fat Free Mass (kg)	55.82±9.14	54.78±9.27	p=0.551

† *T Test; BIA: Bioelectrical Impedance Analysis, BPF: Body Percentage of Fat*

social, psychological changes and reduced functions (19). In our study the variables that were independently associated with malnutrition were age and diagnosis.

Some studies examining age and malnutrition relationship, showed no significant relationship between age and malnutrition (20, 21). Despite these studies some other studies found that older elders have higher risk of malnutrition than younger elders (11, 13, 22). Marco and his colleagues showed in their study that each one year increase in age, increases malnutrition risk 1.007 times (23), while Vanderwee and his colleagues found that being 85 years and older increases malnutrition risk 1.42 times (11). In this current study a similar result was found that each one year increase in age, increases malnutrition risk 1.046 times (p<0.05).

Malnutrition is widespread in patients with cardiovascular diseases (24). Studies including patients having various cardiac operations with different assessment methods have shown that malnutrition varies between 7.0% - 55.0% (4, 25-27). While in other studies including hearth failure patients, malnutrition rate was found 6.4-60.4% (2, 3, 28, 29). In this study, it was seen that being a heart failure patient increased malnutrition risk 2.839 times than the patients with cardiac surgeries and other cardiovascular diseases (p=0.005). The influence of heart failure on nutritional status could be associated with poor appetite, dyspepsia, malabsorption (30) and catabolic states imposed by the disease either by neurohormonal or immune inflammatory activation (3).

Anthropometric measurements are components of the nutrition assessment which are useful for evaluating overnutrition or undernutrition (31). The full MNA contains anthropometric indices including BMI, MUAC, and CC. The MUAC and CC provides

predictions of skeletal muscle and the alteration of lean muscle mass together with decrease of activity (6). In this current study lower body weight, BMI, MUAC and CC were found associated with malnutrition and malnutrition risk, similar to other studies (32, 33).

One of the most obvious clinical signs of malnutrition is the weight loss caused by depletion of fat and muscle mass, including organ mass (34). BIA is an easy method which is quick, non-invasive, operator-independent (35), easily performed, (36) and inexpensive (37) that can be used to analyse body composition in both healthy and ill adults (35). Various results are found in the studies examining association of body composition and malnutrition with BIA. Venzin and colleagues found malnourished patients had significantly lower fat-free mass (FFM) and fat mass (FM), than those adequately nourished (12). While Persson and colleagues found malnourished female patients had significantly lower FM, than those adequately nourished, but no difference with FFM (5). In this current study no significant relationship was found with FFM and nutritional status. In addition to this malnourished/at risk female patients had significantly lower BPF than adequately nourished ones at admission, but not at discharge. Malnourished/at risk male patients had significantly lower FM and BPF than adequately nourished ones both admission and discharge. BIA is accepted as a valid technique, unless overhydration is present. Unfortunately all patients with severe malnutrition are overhydrated (38). BIA device used in this study was not capable of measuring overhydration and oedema, which may cause the result found about FFM and nutritional status.

As expected, the mean plasma albumin level was greater in patients with normal nutritional status (admission: 4.03±0.38) g/dl, discharge: 3.83±0.32g/dl) than in malnourished and at risk patients (admission 3.74±0.46 g/dl, discharge: 3.56±0.42gdl) (p=0.000). Hence, patients with lower MNA scores also had a higher level of visceral protein depletion (39). This component of protein malnutrition may be related to the effect of the chronic disease that led to hospitalization (40). A significant association between malnutrition and serum albumin has also been described in other studies (12, 41-44).

Plasma protein levels of patients with normal nutritional status was also greater (admission: 7.12±0.59) g/dl, discharge: 6.89±0.57g/dl) than that of the malnourished and at risk patients (admission 6.96±0.68 g/dl, discharge: 6.64±0.60gdl) which is statistically significant only at discharge (p=0.004).

Little evidence exists whether TLC reflects the nutritional status of elderly, despite its use as a marker in the assessment of nutritional status (43). In this study it is concluded that TLC is not a suitable marker of malnutrition in the elderly. This conclusion was based on the observation that no significant association was detected between TLC and MNA score. In addition, MNA score was associated with all of the biochemical and anthropometric markers used in the present study except for TLC. This result is consistent with other studies about TLC and nutritional status in elderly (22, 33, 43, 45).

Anaemia is frequent in elderly which is also associated with weight loss often seen in hospitalized patients. On the contrary higher haemoglobin concentrations are associated with decreases in length of hospital stay (46). Low haemoglobin levels are found associated with malnutrition in many studies including elderly subjects (12, 22, 41, 44). In this study patients with malnutrition and at risk of malnutrition had significantly lower levels of haemoglobin than patients with normal nutritional status both at admission and discharge.

Conclusion

Mean albumin, total protein, haemoglobin, body weight, BMI, MUAC and CC values were significantly lower in malnourished and at risk patients than the ones with normal nutritional status both on admission and discharge ($p<0.05$). In this study it is concluded that TLC as a marker and BIA as a device are not suitable for assessment of malnutrition in the elderly.

In order to prevent hospital malnutrition, it is important to assess nutritional status on hospital admission and keep monitoring patients' anthropometric measurements and blood tests during hospitalization.

Limitations

Most of the patients with severe malnutrition are overhydrated which can cause fluctuations in the body composition. In this study, BIA device that was used for analysing body composition was not capable of measuring overhydration and oedema, which makes it difficult to compare the body compositions of the malnourished patients with the well-nourished ones.

References

1. Colloca G, Santoro M, Gambassi G. Age-related physiologic changes and perioperative management of elderly patients. Surg Oncol 2010; 19:124-130.
2. Colin-Ramirez E, Orea-Tejeda A, Castillo-Martinez L et al. Malnutrition syndrome, but not body mass index, is associated to worse prognosis in heart failure patients. Clin Nutr 2011; 30:753-58.
3. Bonilla-Palomas JL, Gamez-Lopez AL, Anguita-Sanchez MP et al. Impact of malnutrition on long-term mortality in hospitalized patients with heart failure. Rev Esp Cardiol 2011; 64 (9): 752–58.
4. Van Venrooij LMW, Van Leeuwen PAM, Hopmans W, Borgmeijer-Hoelen M, De Vos R, Mol B. Accuracy of quick and easy undernutrition screening tools—Short Nutritional Assessment Questionnaire, Malnutrition Universal Screening Tool, and Modified Malnutrition Universal Screening Tool—in patients undergoing cardiac surgery. J Am Diet Assoc 2011; 111: 1924-30.
5. Persson MD, Brismar KE, Katzarski KS, Nordenström J, Cederholm TE. Nutritional status using mini nutritional assessment and subjective global assessment predict mortality in geriatric patients. J Am Geriatr Soc 2002; 50: 1996–2002.
6. Küçükerdönmez Ö, Köksal E, Rakıcıoğlu N, Pekcan G, Assessment and evaluation of the nutritional status of the elderly using 2 different instruments. Suudi Med J 2005; 26 (10): 1611-16.
7. Tsai ACH, Ho CS, Chang MC. Population-specific anthropometric cut-points improve functionality of the Mini Nutritional Assessment (MNA) in elderly Taiwanese. Asia Pac J Clin Nutr 2007; 16 (4): 656-62.
8. Guigoz Y. The Mini Nutritional Assessment (MNA). Review of the literature – What does it tell us. J Nutr Health Aging 2006; 10 (6): 466 –87.
9. Bauer JM, Kaiser MJ, Anthony P, Guigoz Y, Sieber CC. The Mini Nutritional Assessment®—It's history, today's practice, and future perspectives. Nutr Clin Pract 2008; 23 (4): 388 – 96.
10. Suominen MH, Sandelin E, Soini H, Pitkala KH. How well do nurses recognize malnutrition in elderly patients? Eur J Clın Nutr 2009; 63: 292–96.
11. Vanderwee K, Clays E, Bocquaert I, Gobert M, Folens B, Defloor T Malnutrition and associated factors in elderly hospital patients: A Belgian cross-sectional, multi-centre study. Clin Nutr 2010; 29: 469 – 76.
12. Venzin RM, Kamber N, Keller WCF, Suter PM, Reinhart WH. How important is malnutrition? A prospective study in internal medicine. Eur J Clın Nutr. 2009; 63: 430–36.
13. Charlton KE, Nichols C, Bowden S, Lambert K, Barone L, Mason M and Milosavljevic M. Older rehabilitation patients are at high risk of malnutrition: Evidence from a large Australian database. J Nutr Health Aging 2010; 14 (8): 622 – 28.
14. Frew E, Sequeira J, Cant R. Nutrition screening process for patients in an acute public hospital servicing an elderly, culturally diverse population. Nutr Diet 2010; 67 (2): 71-76.
15. Amaral TF, Matos LC, Teixeira MA, Tavares MM, Alvares L, Antunes A. Undernutrition and associated factors among hospitalised patients. Clin Nutr 2010; 29 (5): 580-85.
16. Westergren A, Wann-Hansson C, Börgdal EB et al. Malnutrition prevalence and precision in nutritional care differed in relation to hospital volume – a cross-sectional survey. Nutr J 2009; 8 (20): [preceding p. 1]
17. Norman K, Pichard C, Lochs H, Pirlich M. Prognostic impact of disease related malnutrition. Clin Nutr 2008; 27 (1): 5-15.
18. Brownie S. Why are elderly ındividuals at risk of nutritional deficiency? Int J Nurs Pract 2006; 12 (2): 110-8.
19. Stechmiller J K. Early Nutritional Screening of Older Adults. J Infus Nurs. 2003; 26 (3):170-77.
20. Hengstermann S, Nieczaj R, Steinhagen – Thiessen E, Schulz RJ. Which are the most efficient items of Mini Nutritional Assessment in multimorbid patients? J Nutr Health and Aging. 2008; 12 (2):117-122.
21. Stratton RJ, King CL, Stroud MA, Jackson AA, Elia M. "Malnutrition Universal Screening Tool" predicts mortality and length of hospital stay in acutely ill elderly. Br J Nutr 2006; 95 (2): 325–330.
22. Kagansky N, Berner Y, Koren-Morag N, Perelman L, Knobler H, Levy S. Poor nutritional habits are predictors of poor outcome in very old hospitalized patients. Am J Clın Nutr. 2005; 82:784 –91.
23. Marco J, Barba R, Zapatero A, et al. Prevalence of the notification of malnutrition in the departments of internal medicine and its prognostic implications. Clin Nutr 2011; 30 (4):450 – 54.
24. Lomivorotov VV, Efremov SM, Boboshko VA et al. Evaluation of nutritional screening tools for patients scheduled for cardiac surgery. Nutrition 2013; 29: 436-42.
25. Rapp – Kesek D, Stahle E, Karlsson T. Body mass index and albumin in the preoperative evaluation of cardiac surgery patients. Clin Nutr 2004; 23: 1398-1404.
26. Engelman DT, Adams DH, Byrne JG et al. Impact of body mass index and albumin on morbidity after cardiac surgery. J Thorac Cardiovasc Surg 1999; 118: 866-73
27. Westvik HH, Maloney SP, Rutland R, Kudo FA, Muto A,

Leite JOM, et al. Malnutrition after vascular surgery: are patients with chronic renal failure at increased risk? Am J Surg 2006; 192: e22-e27.
28. Veloso LG, Oliveira Junior MT, Munhoz RT, Morgado PC, Ramires JAF, Barretto ACP. Nutritional repercussion in advanced heart failure and its value in prognostic assessment. Arq Bras Cardiol 2005; 84 (6): [preceding p. 1]
29. Yamauti AK, Ochiai ME, Bifulco PS et al. Subjective Global Assessment of Nutritional Status in Cardiac Patients. Arq Bras Cardiol 2006; 87 (6): 707-12.
30. Gariballa S, Forster S. Associations between underlying disease and nutritional status following acute illness in older people. Clin Nutr, 2007; 26: 446-473.
31. Hammond KA, Litchford MD. Clinical: Inflammation, physical and functional assessments. In: Mahan LK, Escott-Stump S, Raymond J, editors. Krause's food and nutrition care process. St. Louis Missouri: Elsevier Saunders; 2012. pp. 163-177
32. Saletti A, Lindgren EY, Johansson L, Cederholm T. Nutritional Status According to Mini Nutritional Assessment in an Institutionalized Elderly Population in Sweden. Gerontology 2000; 46 (3): 139–145.
33. Kuzuya M, Kanda S, Koike T, Suzuki Y, Satake S, Iguchi A. Evaluation of Mini-Nutritional Assessment for Japanese frail elderly. Nutrition (2005); 21: 498–503.
34. Saunders J, Smith T. Malnutrition: Causes and consequences. Clin Med 2010; 10 (6): 624-7.
35. Genton L, Karsegard VL, Kyle UG., Hans DB, Michel J, Pichard C. Comparison of Four Bioelectrical Impedance Analysis Formulas in Healthy Elderly Subjects. Gerontology 2001; 47: 315 – 23.
36. Tengvall M, Ellegard L, Malmros V, Basaeus N, Lissner L and Bosaeus I. Body composition in the elderly: Reference values and bioelectrical impedance spectroscopy to predict total body skeletal muscle mass. Clin Nutr 2009; 28: 52 – 8.
37. Pirlich M, Lochs H. Nutrition in the elderly. Best Pract Res Clin Gastroenterol 2001; 15 (6): 869-84.
38. Soeters PB, Reijven PLM, Van Bokhorst-de van der Schueren MAE et al. A rational approach to nutritional assessment. Clin Nutr 2008; 27: 706-16.
39. Paris AS, Garcia JM, Candela CG et al. Malnutrition prevalence in hospitalized elderly diabetic patients. Nutr Hosp 2013; 28 (3): 592-99.
40. Omran ML, Morley JE. Assessment of protein energy malnutrition in older persons, part II: Laboratory evaluation. Nutrition 2000; 16: 131 – 40.
41. Brantervik AM, Jacobsson IE, Grimby A, Wallen TCE, Bosaeus IG. Older hospitalised patients at risk of malnutrition: Correlation with quality of life, aid from the social welfare system and length of stay? Age and Ageing 2005; 34 (5): 444-449.
42. Cereda E, Pedrolli C, Lucchin L et al. Fluid intake and nutritional risk in non-critically ill patients at hospital referral. Br J Nutr 2010; 104 (6): 878–885.
43. Kuzuya M, Kanda S, Koike T, Suzuki Y, Iguchi A. Lack of correlation between total lymphocyte count and nutritional status in the elderly. Clin Nutr (2005); 24: 427–32.
44. Saka B, Kaya O, Bahat Ozturk G, Erten N, Karan MA. Malnutrition in the elderly and its relationship with other geriatric syndromes. Clin Nutr 2010; 29 (6): 745-748.
45. Drescher T, Singler K, Ulrich A, et al. Comparison of two malnutrition risk screening methods (MNA and NRS 2002) and their association with markers of protein malnutrition in geriatric hospitalized patients. Eur J Clın Nutr 2010; 64: 887–93.
46. Ramel A, Jonsson PV, Bjornsson S, Thorsdottir I. Anemia, nutritional status, and inflammation in hospitalized elderly. Nutrition 2008; 24: 1116–22.

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