NUTRITIONAL STATUS AND EVOLUTION OF ORTHOPEDIC URGENCY SURGERY IN THE ELDERLY

FERNANDA DE JESUS AGUIAR, DANIELLE SAAD NEMER, LUIZ EUGÊNIO GARCEZ LEME

ABSTRACT

Objective: We assessed patients of both sexes, aged over 60 years, admitted to the Institute of Orthopedics and Traumatology Godoy Moreira, Hospital das Clínicas, Faculty of Medicine, University of São Paulo, for emergency hip arthroplasty (hip fracture). Methods: The nutritional assessment included data on current weight and reported weight six months before the current condition, the index of nutritional risk, and complementary exams. For the categorical variables, contingency tables were compiled, which were analyzed by the chi square test. Where possible, the Student t test was used for unpaired samples, and in cases in which normality was not observed, the nonparametric (Mann Whiney) test was used. The following conditions were analyzed as co-variables: mortality, infections, re-admissions and complications (sum of the previous three). Thirty-eight patients aged over 60 years were analyzed: 15 men and 23 women, with a mean age of 79.21 (SD 9.12), and ages ranging from 60 to 94 (median 81 years). Results: No associations were found between age, weight, NRI, hemoglobin, albumin, IDL and handgrip and the co-variables. A strong relationship was observed between the number of previous diseases with mortality ($p = 0.0012$), infection ($p = 0.002$) and complications ($p = 0.0305$) but not with readmission ($p = 0.640$). A link was also found between hospitalization time and infection during hospitalization ($p = 0.0016$). Conclusions: It is observed that parameters related to number of diseases, hospitalization time and functionality, measured through the ability to carry out basic activities of daily living, were capable of predicting complications such as mortality, re-admissions and even re-infection, and may be useful in the preoperative evaluation of highly fragile elderly patients with hip fractures. Level of Evidence: Level II, prognostic studies.

Keywords: Elderly. Hip fracture. Nutrition.

Citation: *Aguiar FJ, Nemer DS, Leme LEG. Nutritional status and evolution of orthopedic urgency surgery in the elderly. Acta Ortop Bras. [online]. 2011;19(5):293-8. Available from URL: http://www.scielo.br/aob*

INTRODUCTION

It is known that malnutrition is a serious problem in elderly patients that need to undergo arthroplasties, particularly those secondary to hip fractures.[1] The poor nutritional picture in this patient profile can arise from countless factors, including: alterations in the gastrointestinal physiology, medications, chronic clinical conditions, decrease of appetite, of physical activities and of the thin mass of the body, chronic diseases in the liver and kidneys, cancer and surgery.[2]

There is even evidence that nutritional[3] or hydric and caloric replacement[4] interventions can improve the evolution of these patients in several indicators.

The nutritional state of elderly patients hospitalized with hip and femur fracture appears to affect their recovery, with the most well-nourished having better and faster clinical rehabilitation. Many elderly individuals are lacking a follow-up that encourages them to seek healthier eating habits. Duncan et al.[2] demonstrated that the employment of the so-called dietary assistants has a significant impact on the improvement of the nutritional condition of patients, and consequently, on their recovery without fracture-related complications.

Nutrition also has an influence in the preoperative period, since it directly affects the development of the bones and subsequent structure.

Protein deficiency causes an increase in the number of infections, sores, muscle weakness, respiratory complications and death. Low albumin levels are associated with high morbidity and mortality, increase of hospitalization time and readmissions.[5] On the other hand, evidence of oral replacement of proteins and high energy foods is not strong, requiring new studies for an adequate investigation of this matter.[6]

This relationship between nutrition and postoperative evolution

All the authors declare that there is no potential conflict of interest referring to this article.

Faculty of Medicine of Universidade de São Paulo – São Paulo, Brazil.

Institute of Orthopedics and Traumatology of Hospital das Clínicas of the Faculty of Medicine of Universidade de São Paulo – São Paulo, SP. Brazil.
Study conducted at LIM 41 – Musculoskeletal Medical Investigation Laboratory of the Department of Orthopedics and Traumatology of the Faculty of Medicine of Universidade de São Paulo.
Mailing address: Rua Professor Ovidio Pires de Campos, 333, 3º. andar, São Paulo, SP, Brazil. CEP 05403-010. E-mail:lueglem@usp.br

Article received on 6/8/10 and approved on 8/10/10.

can be found in an even more evident manner in very elderly patients[7], including for purposes of early assessment.[8] Studies may also suggest that different nutritional profiles may also interfere at the fracture site (intracapsular or trochanteric).[9]
National literature is poor in the evaluation of this correlation, referring to age alterations in relation to vitamin ingestion and nutritional parameters, yet without focusing on postoperative evolution in arthroplasties.[10]

OBJECTIVES

Primary objective

To conduct a prospective study with a cohort of elderly individuals submitted to urgent hip arthroplasty, correlating their evolution with the nutritional parameters gauged upon surgical intervention having the ratio of clinical evolution of surgical intervention with regards to intrahospital mortality, late mortality (3, 6, 12 months), hospitalization time, infection rate, readmission rate, functional evolution (ADL, IDL), dementia and depression as a hypothesis to be tested.

Secondary objectives

To study the variables of functionality, hospitalization characteristics and conditions of muscle strength in the mortality, infection and readmission rates in the group of patients considered.

STUDY DESIGN

Prospective cohort study.

METHOD

We assessed patients of both sexes, aged over 60 years and admitted to the Instituto de Ortopedia e Traumatologia Godoy Moreira of Hospital das Clínicas da Faculdade de Medicina da Universidade de São Paulo for emergency hip arthroplasties (hip fracture).
This study was approved by CAPPesq (CEP HCFMUSP) under number 973/08.
After informed consent, the patients that agreed to take part in the study were submitted to the global geriatric assessment and nutritional evaluation, consisting of targeted anamnesis, application of the mini nutritional assessment scale, application of Folstein's mini mental state examination[11] validated for the Portuguese language by Bertolucci et al.[12], the Yesavage[13] geriatric depression scale, evaluation of basic and instrumental activities of daily[14] living.[15]
The nutritional evaluation incorporated data on current weight and weight referred at six months before the current condition. The nutritional risk index (NRI)[16] was also calculated when possible through the formula NRI = (1.519 x serum albumin, g/L) + (41.7 x current weight/usual weight)

The complementary tests included:
- Complete blood count with HSS
- Study of plasma proteins
- Iron
- Vitamin B12
- Folic Acid
- Calcium
- Phosphorus
- Glucose
- Creatinine
- Cholesterol and Fractions
- Triglycerides
- Uric Acid

In cases in which the patient was not able to decide or to inform (dementia), the consent form and the questionnaire were applied to the responsible caretaker.
The data on procedures performed were registered and tabulated. Data referring to the postoperative evolution of the patients were also recorded, and included:

- Intrahospital mortality
- Late mortality (3, 6, 12 months)
- Hospitalization time
- Infection rate
- Readmission rate
- Functional evolution (ADL, IDL)
- Dementia
- Depression

Correlation was performed between the nutritional parameters and the postoperative evolution of the patients including stratification for:

- Sex
- Type of fracture
- Type of surgery
- Age bracket

Inclusion factors

Patients over 60 years of age of both sexes that have been admitted to the Instituto de Ortopedia e Traumatologia Godoy Moreira (Orthopedics and Traumatology Institute) of Hospital das Clínicas da Faculdade de Medicina da Universidade de São Paulo to undergo hip arthroplasties, secondary to acute disorders (fractures), were considered for inclusion.

Exclusion factors

- Surgery due to pathological fractures caused by cancer, Paget's disease, or other metabolic disorders except for osteoporosis.
- Patients whose intervention or clinical situation did not allow the initial approach.
- Patients that did not agree to take part in the study.

Statistical analysis

The data were initially analyzed through descriptive statistics and analysis of central tendency measures (mean, median and standard deviation).
Contingency tables were drawn up for the categorical variables and analyzed through the chi-square test.
For the continuous variables we analyzed normality through the Kolmogorov Smirnov formula. Where possible, the Student's t-test was used for unpaired samples and for cases in which normality was not observed we used a non-parametric analysis (Mann Whitney).

RESULTS

We analyzed thirty-eight patients over 60 years of age, with 15 men and 23 women, and mean age of 79.21 years (SD 9.12), ranging from 60 to 94 (median of 81 years). (Table 1)

All the patients presented hip fracture due to falls, with 13 in RLL and 25 in LLL. As regards the fracture site, 24 occurred at the femoral neck and 14 in the intertrochanteric region.

Intrahospital mortality corresponded to eight patients (21.05%), while five patients (13.15%) died in the first six months after surgery, 3 (7.89%) in the first year after surgery and 2 (5.26%) one year after surgery, totaling mortality of 42.09% in the casuistry in the first postoperative year. There was the death of one patient whose date of death was not obtained. (Table 2)

The occurrence of infections during hospitalization was observed in 14 patients (36.84%). Readmissions occurred in six patients (15.78%).

The conditions of mortality, infections, readmissions and complications (sum of the previous three) were analyzed as co-variables.

Categorical variables

There was no association of sex with mortality (p=0.552), with infections (p=0.289), with readmissions (p=0.565), with dementia (p=0.597), with depression (p=0.142) or with fracture site (0.745). There was a relationship between sex and the fracture side, with women experiencing a higher incidence of RLL fractures (p=0.023).

There was a significant relationship between depression and dementia (p=0.000), between depression and mortality (p=0.003), dementia and mortality (0.000), dementia and infections (p=0.001), and no relationship between depression and infections (p=0.010), while there was a link between depression and readmission (p=0.04), but none between dementia and readmission (p=0.304).

There was no relationship between infection and readmission (p=0.473), but there was a relationship between infection and mortality (0.001). (Table 3)

Continuous variables

Other relations could be found in the analysis of the co-variables mortality, infection, readmission and complications (which is the sum of the first three). (Table 4)

A strong relationship was observed between the number of previous diseases with mortality (p=0.0012), infection (p=0.002) and complications (p=0.0305), but not with readmission (p=0.640). A relationship was also found between hospitalization time and infection during hospitalization (p=0.0016), while there was no association with mortality (p=0.3875), readmission (p=0.768) and complications (p=0.401). The number of lymphocytes was related to the existence of intrahospital infection (p=0.019), but not to mortality (p=0.225), readmission (p=0.105) and complications (p=0.136). Another finding was the existing relationship between the number of readmissions and the ADL (index used to evaluate the basic activities of daily living that the patient is able to develop). There were no relationships found between ADL and mortality (p=0.145), infections (p=0.1266) and complications (p=0.240)

Table 1. *Data on the 38 patients analyzed in the study.*

Variables	Mean	Standard deviation	Median
Age	79.21	9.12	81
Weight	60.49	23.35	56.30
Weight 6 months before	63.29	25.42	60.00
NRI	40.91	1.64	41.70
Red blood cells	3.95	0.67	4.08
Hemoglobin	11.98	1.98	12.20
No. of diseases	4.30	2.20	4.00
Hematocrit	36.49	5.83	36.75
Leukocyte	7909.21	3758.07	8055.00
Lymphocyte	1307.89	515.38	1300.00
INR	1.03	0.08	1.00
Albumin	3.04	0.47	3.00
Iron	60.88	39.58	45.50
Vitamin B12	3255.23	13123.65	467.00
Folic Acid	8.12	6.67	6.35
Calcium	8.40	0.85	8.10
Phosphorus	3.10	0.82	3.10
Glucose	113.32	53.84	109.00
Creatinine	1.27	1.08	1.00
HdlHDL	40.85	13.87	38.00
LDL	71.85	58.04	62.50
VHDL	24.96	17.58	20.00
Triglycerides	94.58	78.81	83.50
Uric Acid	3.90	1.56	3.55
Hospitalization Time	28.29	38.65	16.00
ADL	3.89	2.42	5.00
IDL	2.79	2.27	2.00
Handgrip	9.99	3.77	10.40

Age in years, Weight in Kg, Weight 6 months before in Kg, NRI in Kg, Red blood cells in 10x6/dl, Hemoglobin in g/dL, Hematocrit in %, Leukocyte in no./ml, Lymphocyte in no./ml, Albumin in g/dl, Iron in µg/dl, Vitamin B12 in picograms/ml, Folic Acid in ng/ml, Calcium in mg/dl, Phosphorus in mg/dl, Glucose in mg/dl, Creatinine in mg/dl, HDL in mg/dl, LDL in mg/dl, VHDL in mg/dl, Triglycerides in mg/dl, Uric Acid in mg/dl, Hospitalization Time in days, ADL and IDL in units of activities performed, Handgrip in kg.

Table 2. *Data on the patients separated by mortality.*

	With Mortality			Without Mortality		
	Mean	Standard deviation	Median	Mean	Standard deviation	Median
Age	80.63	7.62	82.00	77.79	10.42	81.00
Weight	61.88	31.34	55.40	59.10	12.57	57.20
Weight 6 months	67.00	38.49	60.00	60.40	12.56	60.50
NRIS	40.68	2.31	41.70	41.06	1.06	41.70
Red blood cells	3.95	0.80	4.11	3.94	0.53	4.06
Hemoglobin	11.66	2.28	11.70	12.30	1.61	12.30
No. of diseases	5.26	2.54	5.00	3.28	1.13	4.00
Hematocrit	35.44	6.90	35.50	37.54	4.47	37.60
Leukocyte	8015.26	4096.12	7960.00	7803.16	3496.99	8100.00
Lymphocyte	1426.32	604.47	1400.00	1189.47	388.58	1200.00
INR	1.05	0.10	1.05	1.01	0.07	1.00
Albumin	3.06	0.53	3.00	3.07	0.42	3.00
Iron	72.00	46.42	53.00	54.79	32.79	43.00
Vitamin B12	487.13	155.58	496.50	5188.77	17072.93	491.00
Folic Acid	7.89	3.51	8.25	8.53	8.08	5.40
Calcium	7.95	2.03	8.40	8.35	0.91	8.05
Phosphorus	3.18	0.72	3.20	3.03	0.93	3.10
Glucose	116.47	60.42	104.00	110.00	47.44	109.50
Creatinine	1.37	1.33	1.00	1.18	0.77	1.00
HDL	40.91	16.83	37.00	40.80	11.88	38.00
LDL	94.45	78.51	76.00	55.27	30.29	53.00
VHDL	21.60	11.08	17.00	27.20	20.92	22.00
Triglycerides	131.55	101.05	86.00	67.47	43.99	79.00
Uric Acid	4.15	1.68	3.60	3.71	1.49	3.20
Hospitalization Time	41.16	51.81	19.00	15.42	6.07	15.00
ADL	2.80	2.95	1.00	4.20	2.14	5.00
IDL	2.40	2.51	2.00	2.80	2.24	2.00
Handgrip	8.79	3.74	8.34	12.40	2.79	11.90

Data on the patients separated by mortality. Age in years, Weight in Kg, Weight 6 months before in Kg, NRI in Kg, Red blood cells in 10x6/dl, Hemoglobin in g/dL, Hematocrit in %, Leukocyte in n°/ml, Lymphocyte in n°/ml, Albumin in g/dl, Iron in µg/dl, Vitamin B12 in picograms/ml, Folic Acid in ng/ml, Calcium in mg/dl, Phosphorus in mg/dl, Glucose in mg/dl, Creatinine in mg/dl, HDL in mg/dl, LDL in mg/dl, VHDL in mg/dl, Triglycerides in mg/dl, Uric Acid in mg/dl, Hospitalization Time in days, ADL and IDL in units of activities performed, Handgrip in kg.

Table 3. *Categorical variables*

	Mortality	infections	Readm	Dementia	Depression	Site	Sex
Fracture side	0.207	0.882	0.961	0.409	0.299	0.882	0.023
Mortality		0.001	0.449	0.000	0.003	0.670	0.565
Infections			0.473	0.001	0.010	0.912	0.289
Readmiss.				0.304	0.004	0.845	0.565
Dementia					0.000	0.064	0.597
Depression						0.473	0.142
Site							0.745

No associations were found between age, weight, NRI, hemoglobin, albumin, IDL and handgrip and the co-variables studied. Regarding the patients' evolution at six and 12 months, as well as subsequent evolution (18 months), we were able to observe mortality of 44% (intrahospital), 27% (six months), 16% (12 months) and 11% (18 months), the limit of our follow-up. (Table 5)

The patients' functionality was measured through basic activities of daily living (ADL) and instrumental activities of daily living (IDL). ADL was strongly related to the occurrence of readmissions, while no correlations were found for IDL. (Table 6)

In the patients without mortality, the ADL and IDL values did not have significant modifications one year after surgery. (Table 7)

DISCUSSION

The aim of this study was to correlate the evolution of elderly patients hospitalized and submitted to arthroplasty with the nutritional parameters gauged at the time of surgical intervention. Evolution was evaluated using the variables intrahospital mortality, late mortality (3, 6, 12 months), hospitalization time, infection rate, readmission rate, functional evolution (ADL, IDL), dementia and depression.

Some difficulties were encountered during the development of the study. The patients' general state and the immobility caused by the hip fracture made the study complicated, since to weight them it was necessary to have a certain degree of movement and many patients withdrew from the study when informed of the procedures to be performed. The referred weight of six months before hospitalization was a measurement that was hard to acquire since the patients in general did not remember or did not know how much they weighed. Such condition, as evidenced later, is referred to in literature, with the profile of elderly patients comparable to our group. In this condition, the calculation of the traditional NRI can often present limitations, proposing for this purpose the calculation of the geriatric nutritional risk index (GRNI)[17] based on anthropometric measurement of femoral length, a measurement not used in this study as the data gathering limitations are unknown.

The sample of patients gathered for the study was smaller than expected, impairing the analysis of variables. The ab-

Table 4. *Correlation of variables with Mortality, Infection, Readmission and Complications.*

	Mortality			Infection			Complications			Readmissions		
Variable	Yes	No	p	Yes	No	p	Yes	No	p	Yes	No	p
Age	82.5	81	0.192	82	81	0.412	82.0	81.0	0.232	79.5	81.0	1.000
Weight	55.4	57.2	0.743	55.40	59.47	0.423	56.3	59.0	0.609	56.64	59.25	0.944
NRI	41.700	41.702	0.961	41.129	41.702	0.915	41.518	41.704	0.379	41.700	41.704	0.940
Hb	11.60	12.45	0.356	11.40	12.65	0.07	11.60	12.45	0.534	12.30	12.45	1.000
Lymphocytes	1350	1200	0.225	1600	1200	0.019	1350	1100	0.136	1400	1100	0.105
No. diseases	4.5	4.0	0.0012	5.5	4.0	0.002	4	3	0.0305	4	4	0.640
Albumin	3.00	3.00	1.000	3.00	3.00	0.538	3.0	3.1	0.710	2.85	3.00	0.571
Hospit Type	18.5	15.5	0.3875	20.5	11.0	0.0016	18.5	15.5	0.401	18.5	15.5	0.768
ADL	1.00	5.00	0.145	1.0	6.0	0.1266	3	6	0.24	1	6	0.043
IDL	1.00	2.00	0.281	1.0	2.0	0.205	2	2	0.34	0	2	0.10
Handgrip	8.33	11.90	0.202	10.4	11.0	1.000	10.4	11.0	0.914	5.83	11.9	0.105

Variables: Age in years, weight in kilos, weight difference in kilos, albumin in mg%, serum Fe in mcd%, hospitalization time in days, handgrip in kilos, ADL and IDL in units of activities performed.

Table 5. *Temporal evolution to mortality of patients.*

Period	Number of deaths	Mortality%	Cumulative%
Hospitalization	8	44	44
6 months	5	27	72
12 months	3	16	88
24 months	2	11	100

Table 6. *Comparison of ADL and IDL indexes.*

	With Mortality	Without Mortality
ADL	2,8	4,2
IDL	2,4	2,8

Table 7. *Comparison of the ADL and IDL indexes one year after surgery.*

	After surgery	One year after surgery
ADL	4.2	4.0
IDL	2.8	3

sence of a relationship between age, weight, NRI, hemoglobin, albumin, IDL and handgrip and the co-variables mortality, infections, readmission and complications, may be due to the small sample group.

The mortality rate of the studied group was high, 42.09% of the patients. One of the reasons may be the advanced mean age of the group, 79.21 years. Another reason would be the high number of previous diseases, since the study showed an association of the number of comorbidities with mortality and infection.

The mortality rate was lower the higher the time elapsed since surgery, whereas the majority of deaths occurred in the hospitalization period, 44%, and the minority one year after surgery, 27%, showing that fragility of the patients upon hospital admission is a limiting factor for treatment.

Hospitalization time was one of the determinant factors of infection. This relationship was expected as the longer the hospitalization time, the greater the exposure to hospital infections. In the same way as the occurrence of infection during the hospital stay increases the hospitalization time for recovery.

It should also be taken into account that the hospitalization time is affected by the number of diseases and by their severity, as patients with a higher number of diseases and greater severity are hospitalized for longer periods.

Depression played an important role as a determinant of mor-

tality, readmission and dementia. Other studies also correlate this comorbidity with complications during treatment.[18]

What became patently clear in our perception is that right from the start the data refers to patients with medium to high degree of fragility, either due to the high mean age, or the weight limitation observed in almost all the patients, or even to the number of comorbidities and high mortality. This seems to be the most prevalent pattern in hospitals of high complexity as already demonstrated in previous studies at the same institution.[19]

Under these conditions, the alteration of nutritional parameters might not have the impact that it could have under other conditions, such as elective surgeries on patients with a diminished or absent degree of fragility, for instance.

CONCLUSION

Although significance of nutritional state was not demonstrated in the mortality of highly fragile patients, parameters referring to number of diseases, hospitalization time and functionality measured through basic daily living activities had the power to predict complications such as mortality, readmissions and even infections, may be useful in the preoperative evaluation of extremely fragile elderly individuals with a picture of hip fractures.

REFERENCES

1. Day S, Munski J. Nutritional considerations in hip fracture.Tech Ortop. 2004;19:223.
2. Duncan DG, Beck SJ, Hood K, Johansen A. Using dietetic assistants to improve the outcome of hip fracture: a randomised controlled trial of nutritional support in an acute trauma ward. Age Ageing. 2006;35:148-53.
3. Sullivan DH, Nelson CL, Klimberg VS, Bopp MM. Nightly enteral nutrition support of elderly hip fracture patients: a pilot study. J Am Coll Nutr. 2004;23:683-91.
4. Eneroth M, Olsson UB, Thorngren KG. Insufficient fluid and energy intake in hospitalised patients with hip fracture. A prospective randomised study of 80 patients. Clin Nutr. 2005;24:297-303.
5. Eneroth M, Olsson UB, Thorngren KG. Nutritional supplementation decreases hip fracture-related complications. Clin Orthop Relat Res. 2006;451:212-7.
6. Avenell A, Handoll HHG. Nutritional supplementation for hip fracture aftercare in older people. Cochrane Database Syst Rev. 2010;(1):CD001880.
7. 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 Clin Nutr. 2005;82:784-91.
8. Laveria CJ, Sierra RJ, Baerga L. Nutritional parameters and short term outcome in arthroplasty. J Am Coll Nutr. 1999;18:274-8.
9. Maffulli N, Dougall TW, Brown MT, Golden MH. Nutritional differences in patients with proximal femoral fractures. Age Ageing. 1999;28:458-62.
10. Saraiva GL, Cendoroglo MS, Ramos LR, Araújo LM, Vieira JG, Maeda SS, Borba VZ, Kunii I, Hayashi LF, Lazaretti-Castro M. [Prevalence of vitamin D deficiency, insufficiency and secondary hyperparathyroidism in the elderly inpatients and living in the community of the city of São Paulo, Brazil]. Arq Bras Endocrinol Metabol. 2007;51:437-42.
11. Folstein MF, Folstein SE, McHugh PR. Mini-mental state". A practical method for grading the cognitive state of patients for the clinician. J Psychiatr Res. 1975;12:189-98.
12. Bertolucci PH, Brucki SM, Campacci SR, Juliano Y. O mini-exame do estado mental em uma população geral: impacto da escolaridade. Arq Neuropsiquiatr. 1994; 52:1-7.
13. Yesavage JA, Brink TL, Rose TL, Lum O, Huang V, Adey M, Leirer VO. Development and validation of a geriatric depression screening scale: a preliminary report. J Psychiatr Res. 1982-1983;17:37-49.
14. Katz S. Assessing self-maintenance: activities of daily living, mobility, and instrumental activities of daily living. J Am Geriatr Soc. 1983;31:721-7.
15. Lawton MP, Brody EM. Assessment of older people: self-maintaining and instrumental activities of daily living. Gerontologist. 1969;9:179-86.
16. Perioperative total parenteral nutrition in surgical patients. The Veterans Affairs Total Parenteral Nutrition Cooperative Study Group. N Engl J Med. 1991;325:525-32.
17. Kyle UG, Pirlich M, Schuetz T, Lochs H, Pichard C. Is nutritional depletion by Nutritional Risk Index associated with increased length of hospital stay? A population-based study. JPEN J Parenter Enteral Nutr. 2004;28:99-104.
18. Costa ACB, Demétrio FN, Guajardo VD, Gattaz WF, Amatuzzi MM, Cafalli F, et al . Prevalência de depressão em mulheres idosas com fratura de quadril. Rev Psiquiatr Clín. 2009;36(Supl.3):79-82.
19. Garcia R, Leme MD, Garcez-Leme LE. Evolution of Brazilian elderly with hip fracture secondary to a fall. Clinics (Sao Paulo). 2006;61:539-44.