Determinants of Malnutrition and Post-operative Complications in Hospitalized Surgical Patients

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ABSTRACT

The study aimed to determine the nutritional status (NS) of hospitalized surgical patients and investigate a possible association between NS and type of disease, type of surgery and post-operative complications. The gender, age, disease, surgery, complications, length of hospital stay, number of medications, laboratory test results, and energy intake of 388 hospitalized surgical patients were recorded. NS was determined by classical anthropometry. The inclusion criteria were: nutritional status assessment done within the first 24 hours of admission, age ≥20 years, and complete medical history. Univariate and multiple Cox's regression analyses were employed to determine which variables were possible risk factors of malnutrition and complications. Malnutrition was more common in males (p=0.017), individuals aged 70 to 79 years (p=0.000), and individuals with neoplasms and digestive tract diseases (p=0.000). Malnourished individuals had longer hospital stays (p=0.013) and required more medications (p=0.001). The risk of malnutrition was associated with age and disease. Individuals aged 70 years or more had a two-fold increased risk of malnutrition (p=0.014; RR=2.207; 95% CI 1.169-4.165); those with neoplasms (p=0.008; RR=14.950; 95% CI 2.011-111.151) and those having digestive tract diseases (p=0.009; RR=14.826; 95% CI 1.939-113.362) had a 14-fold increased risk of malnutrition. Complications prevailed in older individuals (p=0.016), individuals with longer hospital stays (p=0.007), and individuals who died (p=0.002). The risk of complications was associated with age and BMI. In the present study, the risk of malnutrition was associated with age and type of disease; old age and low BMI may increase complications.

Key words: Complications; Hospitalized surgical patients; Malnutrition; Nutritional status; Brazil

INTRODUCTION

The nutritional status of adult and elderly hospitalized patients has been discussed for years. The rates of malnutrition in this population usually depend on disease and assessment criteria and vary from 10% to 50% (1-3). However, the risk of malnutrition varied from 19% to 60% according to a British study (4), was 27.4% according to a German study (5), and 46% according to a Canadian study (6). Finally, a study in Spain found mild, moderate and severe malnutrition rates of 50.7%, 26.4%, and 5.7% respectively (7).

Recent studies in Brazil (8) found a malnutrition rate of 14.1% shortly after admission to hospital. These rates varied according to the assessment method.

Different parameters are being developed to assess the nutritional status of hospitalized patients and better map this reality (5-9). Nevertheless, malnutrition is still underreported (10), despite its association with increased morbidity, mortality, and hospital costs (10).

Malnutrition increases the risk of complications from abdominal surgery (11,12) but weight loss, low albumin, and low body mass index (BMI) are not always associated with mortality and morbidity in surgical patients (13). Although many studies have assessed the nutritional status of hospitalized patients, including some from this research group (8,14,15), the relationship between nutritional status and other variables, such as type of disease, type of surgery, and occurrence of complications, among others, should be further explored. Newfound Associations may help improve interventional actions and control strategies that aim to prevent malnutrition-related intercurrences.
The objective of this study was to determine the nutritional status of hospitalized surgical patients and investigate whether their nutritional status was associated with type of disease, type of surgery, and post-operative complications.

MATERIALS AND METHODS

This study was conducted at the university hospital (Hospital e Maternidade Celso Pierro) of the Pontifical Catholic University of Campinas, a large university in the state of São Paulo, Brazil, from 2010 to 2011, after approval from the local Research Ethics Committee. This university hospital is a tertiary-level hospital that routinely treats high-risk patients, such as those with polytrauma, and performs complex surgeries for cancer. Its catchment areas are the city of Campinas and the respective metropolitan regions.

The study is part of a research project called “Nutritional status of hospitalized patients and its relationship with disease, clinical and surgical variables, and length of hospital stay.” Since the study location was the surgical ward, the study patients were surgical patients. The inclusion criteria were: nutritional status assessed within the first 24 hours of admission, age ≥20 years, and availability of complete medical records. The exclusion criteria were: terminal patients, patients with oedema or ascites, patients undergoing haemodialysis, patients with psychiatric diseases, patients kept in isolation, patients of ocular surgery, and those admitted only for clinical investigation and/or tests. Bed-ridden patients or patients who could not talk were also excluded since their body-weight and habitual energy intake (HEI) could not be determined. At first, 512 adult and elderly patients (aged >60 years according to the Brazilian Elderly Statute) in the surgical ward were selected systematically but, after applying the selection criteria, 388 retained, constituting the final sample.

Data collection

A protocol was developed specifically for this study to collect the following data systematically from the patients' medical records during their stay: gender, age, length of stay (LOS) at the hospital, type of disease, type of surgery, post-operative complications, anthropometric indicators of nutritional status, laboratory test results, HEI, and number of medications prescribed during the stay.

Nutritional status assessment

Body-weight, height, arm-circumference (AC), triceps skinfold thickness (TST), and calf-circumference (CC) were measured; and body mass index (BMI), arm muscle-circumference (AMC), arm muscle-area (AMA), and arm fat-area (AFA) were then calculated. The patients were also asked whether they had gained, maintained, or lost weight in the six months before admission, and their weight changes were classified accordingly.

The BMIs of adults aged <60 years were calculated and classified as recommended by the World Health Organization (16) and those of the elderly people (≥60 years of age) as recommended by Lipschitz (17).

The parameters AC, AMC, AMA, TST, and AFA of adults aged ≤65 and >65 years were classified according to the percentile distribution reference values given by Frisancho (18) and Burr and Phillips (19) respectively. Patients were considered to be wasting when their AC, AMC, and AMA were equal to or below the 5th percentile (≤P5); at risk of wasting when those parameters were between the 5th and 15th percentiles (P5-P15); and with preserved lean body mass (PLBM) when those parameters were above the 15th percentile (>P15). Fat mass was considered depleted (DFBM) when TST and AFA were equal to or below the 5th percentile (≤P5); at risk of depletion (RDFBM) when those parameters were between the 5th and 15th percentiles (P5-P15); and preserved lean body mass (PFBM) when those parameters were above the 15th percentile (>P15) (18,19). Only the elderly’s CCs were measured and classified as recommended by the WHO (20), using the cutoff point of 31 cm.

Habitual energy intake (HEI) assessment

The patients were interviewed individually to determine habitual food intake. The software NutWin® (2002) (21) was then used for calculating energy intake. The percentage of HEI adequacy (% HEI/ER) was calculated for each individual. Individual requirements were estimated by the Harris and Benedict equation (22) as described elsewhere (8,14). Energy intake was considered low when it was <75% of the individual’s requirement (HEI/ER <75%) (23,24).

Variable classification

The diseases were classified as follows: digestive tract diseases (peptic ulcers, bowel diseases, inflammatory bowel diseases, pancreatitis, gall bladder diseases, and others), gynaecological diseases (endometriosis, ovary cysts, and others), vascular...
diseases (peripheral artery diseases, aneurisms), neoplasms (malignant neoplasms), and trauma (polytrauma). Types of surgery were classified as head and neck surgery, digestive system surgery, gynaecological surgery, orthopaedic surgery, plastic surgery, thoracic surgery, urologic surgery, vascular surgery, neurosurgery, and exploratory laparotomy. Complications were defined as clinical intercurrents that occurred after surgery and classified as cardiovascular, infectious, pulmonary, other, and no complications. Laboratory tests included that for haemoglobin and lymphocyte counts, and both were considered risk factors when found below the reference range (25).

Definition of malnutrition

The diagnosis of malnutrition (on admission) was based on the assessments of anthropometric indicators. Individuals were considered malnourished when BMI was <18.5 kg/m² for adults and ≤22 kg/m² for the elderly; or BMI <20.0 kg/m² and AMC or TST equal to or below the 15th percentile (≤P15) (2,26).

Study of associated factors

All the anthropometric and laboratory variables, HEI, LOS, gender, age, type of the disease, type of surgery, and number of medications prescribed during hospital stay were tested for association with malnutrition and complications. The following were considered possible risk factors of malnutrition: gender, age, disease, HEI, and low haemoglobin count (lymphocyte count was not included in multiple analyses because of limited information). The following were considered possible risk factors of complications: gender, age, disease, malnutrition, anthropometric variables, HEI, low haemoglobin (again, lymphocyte count was not included for the same reason mentioned above), and number of medications prescribed during stay at the hospital.

Statistical analyses

The chi-square test or Fisher’s exact test were used for verifying associations or comparing proportions (for gender, age-group, type of disease, type of complications, type of surgery, anthropometric indicators, energy intake, length of stay at the hospital, and outcome, i.e. death or discharge).

Continuous or ordinal measures between two groups were compared by the Mann-Whitney test. The risk factors of malnutrition and complications were determined by Cox’s regression. The relative risk (RR) and respective confidence intervals (CIs) of 95% were also calculated (27,28). A univariate regression analysis of each factor of interest was done, followed by multiple regression analyses. Variables were selected by the stepwise method. The significance level was set at 5% (p<0.05). The data were treated by the software SAS (Statistical Analysis System) (29).

RESULTS

The sample consisted of 388 patients: 204 (52.58%) females and 184 (47.42%) males; 167 (43.04%) stayed at the hospital for up to 3 days; 122 (31.44%) stayed for 4 to 7 days; and 99 (25.52%) stayed for 8 days or more. Ten (2.58%) patients died. The rate of malnutrition was 15.98%. The rate of malnutrition dropped to 12.37% if only BMI was used. Almost half of the sample (42.97%) had an HEI/ER <75%; 20.77% had lost weight recently; and 43.04% had low haemoglobin level.

Comparison of nourished (N=326) and malnourished (N=62) patients showed that malnutrition was more prevalent in males, individuals aged 70 to 79 years, individuals with neoplasms or digestive tract diseases, and individuals subjected to digestive system or head and neck surgery (Table 1). As a matter of fact, individuals admitted for head and neck surgery were already more malnourished at admission. Table 1 also shows that complications were more common in older individuals, those staying at the hospital for ≥7 days, and individuals who died. Individuals subjected to digestive tract surgery or with neoplasms also tended to have complications but the difference was not significant. More information can be found in Table 1.

Malnourished individuals had significantly lower AC, TST, AMC, AMA, and CC. The CC was a good predictor of malnutrition in the elderly. Recent weight loss was also associated with malnutrition as well as stay at the hospital for ≥7 days. AFA, low haemoglobin count, HEI/ER <75%, and death were not associated with malnutrition. Not all the individuals who died were malnourished (Table 2).

Table 3 shows the comparison between other variables of the malnourished and nourished groups. Age, LOS, and lymphocyte count differed significantly between the groups. Malnourished individuals were older, had longer LOS, were prescribed more drugs during their stay at the hospital, and had lower lymphocyte counts. Significant differences were also found between some variables of the groups with and without complications, namely age, LOS, and haemoglobin level (Table 3).
| Variable                | Nourished n (%) | Malnourished n (%) | p value | No complication n (%) | With complication n (%) | p value |
|------------------------|-----------------|-------------------|---------|-----------------------|------------------------|---------|
| Females                | 180 (55.21)     | 24 (38.71)        | 0.0170* | 169 (52.3)            | 35 (53.8)              | 0.8223* |
| Males                  | 146 (44.79)     | 38 (61.29)        |         | 154 (47.7)            | 30 (46.1)              |         |
| Age (completed years)  |                 |                   |         |                       |                        |         |
| <60                    | 228 (69.94)     | 31 (50.0)         | 0.0007* | 226 (69.9)            | 33 (50.8)              | 0.0167* |
| 60 to 69               | 53 (16.26)      | 10 (16.13)        |         | 49 (15.1)             | 14 (21.5)              |         |
| 70 to 79               | 31 (9.51)       | 17 (27.42)        |         | 36 (11.1)             | 12 (18.5)              |         |
| ≥80                    | 14 (4.29)       | 4 (6.45)          |         | 12 (3.7)              | 6 (9.2)                |         |
| Type of disease        |                 |                   |         |                       |                        |         |
| Digestive tract        | 63 (19.33)      | 16 (25.81)        | 0.0001* | 66 (20.4)             | 13 (20.0)              | 0.1664* |
| Gynaecological         | 84 (25.77)      | 4 (6.45)          |         | 78 (24.1)             | 10 (15.4)              |         |
| Vascular               | 43 (13.19)      | 5 (8.06)          |         | 41 (12.7)             | 7 (10.8)               |         |
| Neoplasms              | 87 (26.69)      | 32 (51.61)        |         | 91 (28.2)             | 28 (43.1)              |         |
| Trauma                 | 49 (15.03)      | 5 (8.06)          |         | 47 (14.6)             | 7 (10.8)               |         |
| Type of surgery        |                 |                   |         |                       |                        |         |
| Head and neck          | 24 (7.36)       | 12 (19.35)        | 0.0018**| 29 (8.9)              | 7 (10.8)               | 0.7176**|
| Digestive system       | 82 (25.15)      | 23 (37.10)        |         | 82 (25.4)             | 23 (35.4)              |         |
| Gynaecological         | 67 (20.55)      | 6 (9.68)          |         | 62 (19.2)             | 11 (16.9)              |         |
| Orthopaedic            | 37 (11.35)      | -                 |         | 34 (10.5)             | 3 (4.6)                |         |
| Plastic                | 10 (3.07)       | -                 |         | 8 (2.5)               | 2 (3.1)                |         |
| Thoracic               | 5 (1.53)        | -                 |         | 5 (1.6)               | -                     |         |
| Urologic               | 26 (7.98)       | 5 (8.06)          |         | 27 (8.4)              | 4 (6.1)                |         |
| Vascular               | 29 (8.90)       | 6 (9.68)          |         | 29 (8.9)              | 6 (9.2)                |         |
| Neurosurgery           | 18 (5.52)       | 3 (4.84)          |         | 19 (5.9)              | 2 (3.1)                |         |
| Laparotomy             | 28 (8.59)       | 7 (11.29)         |         | 28 (8.7)              | 7 (10.8)               |         |
| Complications          |                 |                   |         |                       |                        |         |
| Yes                    | 52 (15.95)      | 13 (20.97)        | 0.3322* |                       |                        |         |
| No                     | 274 (84.05)     | 49 (79.03)        |         |                       |                        |         |
| Type                   |                 |                   |         |                       |                        |         |
| Cardiovascular         | 36 (11.04)      | 4 (6.45)          | 0.0964**|                       |                        |         |
| Infectious             | 12 (3.68)       | 5 (8.06)          |         |                       |                        |         |
| Pulmonary              | 1 (0.31)        | 3 (4.84)          |         |                       |                        |         |
| Other                  | 3 (0.92)        | 1 (1.61)          |         |                       |                        |         |
| No complication        | 274 (84.05)     | 49 (79.03)        |         |                       |                        |         |
| LOS                    |                 |                   |         |                       |                        |         |
| Up to 6 days           | 229 (70.9)      | 35 (53.8)         | 0.0071* |                       |                        |         |
| ≥7 days                | 94 (29.1)       | 30 (46.1)         |         |                       |                        |         |
| Death                  |                 |                   |         |                       |                        |         |
| Yes                    | 4 (1.2)         | 6 (9.2)           | 0.0022**|                       |                        |         |
| No                     | 319 (98.8)      | 59 (90.8)         |         |                       |                        |         |

Table 1. Comparison of the study variables of the nourished and malnourished groups and the groups with and without complications.

Laparotomy=Exploratory laparotomy; Type=Type of complication; LOS=Length of stay at hospital; *Chi-square test; **Fisher’s exact test.
Univariate Cox’s regression was used for identifying the risk factors of malnutrition, followed by multiple analysis with the variables, such as gender, age, disease, haemoglobin level, and HEI/ER <75%—all selected by the stepwise method. Table 4 shows the model that best predicted malnutrition. The rate of malnutrition in the category ‘gynaecological diseases’ was low (6.4%) (Table 1). So, this category was used as reference for comparison with other disease categories and possible risk factors of malnutrition. Risk of malnutrition was associated with age and type of the disease. Patients aged 70 years or more had a two-fold increased risk of malnutrition, and patients with neoplasms or digestive tract diseases had a 14-fold increased risk of malnutrition. Hence, age and type of disease were the main risk factors of malnutrition (Table 4).

Body composition indicators, BMI, recent weight change, HEI/ER <75%, haemoglobin level, and degree of malnutrition did not differ between the group of patients that had complications and the group that did not have complications.

Table 5 shows the model that best predicts complications (univariate analysis followed by multiple Cox’s regression with the variables selected by the stepwise method). Risk of complications was associated with age and BMI. Each year of life and each additional BMI integer increased the risk of complications by 1.03 and 1.07 respectively (Table 5).
DISCUSSION

This work was part of another research that studied the nutritional status of hospitalized surgical patients (8,14,15). Assessment of 388 patients found that 15.9% were malnourished, 20.7% had lost weight in the 6 months before admission, and 42.9% had HEI/ER <75%. Hence, a considerable proportion of this population could be considered at risk of malnutrition shortly after admission. These findings corroborated those from other studies (2,5,6). Additionally, more than 10% of

| Study variable          | N   | Mean±SD | Median | p value* |
|-------------------------|-----|---------|--------|----------|
| Age (years)             |     |         |        |          |
| Nourished               | 326 | 49.9±16.9| 50.0   | 0.0044   |
| Malnourished            | 62  | 56.4±18.5| 59.0   |          |
| No complications        | 323 | 49.5±17.1| 50.0   | 0.0002   |
| With complications      | 65  | 58.4±16.4| 59.0   |          |
| LOS (days)              |     |         |        |          |
| Nourished               | 326 | 5.9±6.0 | 4.0    | 0.0132   |
| Malnourished            | 62  | 8.1±8.6 | 6.0    |          |
| No complications        | 323 | 5.6±5.1 | 4.0    | <0.0001  |
| With complications      | 65  | 9.4±9.3 | 6.0    |          |
| HEI (kcal)              |     |         |        |          |
| Nourished               | 321 | 1,758±701.3| 1,600.3| 0.0933   |
| Malnourished            | 59  | 1,576±562.7| 1,438.1|          |
| No complications        | 318 | 1,756.1±707.8| 1,580.0| 0.2076   |
| With complications      | 62  | 1,593.9±531.1| 1,579.2|          |
| TER (kcal)              |     |         |        |          |
| Nourished               | 323 | 2,088±367.5| 2,027.8| 0.1878   |
| Malnourished            | 62  | 2,021±384.2| 1,977.3|          |
| No complications        | 320 | 2,079.9±373.9| 2,010.1| 0.8660   |
| With complications      | 65  | 2,066.2±355.7| 2,025.24|         |
| HEI/ER <75%             |     |         |        |          |
| Nourished               | 318 | 85.2±33.2| 78.8   | 0.2751   |
| Malnourished            | 59  | 80.9±31.7| 72.7   |          |
| No complications        | 315 | 85.5±33.7| 78.7   | 0.3345   |
| With complications      | 62  | 80.0±28.6| 75.6   |          |
| Number of prescriptions |     |         |        |          |
| Nourished               | 259 | 5.9±3.5 | 5.0    | 0.0017   |
| Malnourished            | 50  | 7.4±3.6 | 7.0    |          |
| No complications        | 260 | 6.1±3.6 | 5.0    | 0.7704   |
| With complications      | 49  | 6.2±3.2 | 5.0    |          |
| Haemoglobin level       |     |         |        |          |
| Nourished               | 258 | 12.8±2.9| 13.1   | 0.2418   |
| Malnourished            | 51  | 12.2±2.6| 12.6   |          |
| No complications        | 251 | 12.9±3.0| 13.1   | 0.0379   |
| With complications      | 58  | 12.1±2.5| 12.2   |          |
| Lymphocyte count        |     |         |        |          |
| Nourished               | 145 | 1,859±1171.8| 1,680.0| 0.0159   |
| Malnourished            | 34  | 1,427±723.0| 1,202.0|          |
| No complications        | 139 | 1,784.5±1127.1| 1,642.0| 0.7409   |
| With complications      | 40  | 1,754.2±1071.6| 1,580.5|          |

*Mann-Whitney test; HEI=Habitual energy intake; HEI/ER <75%=Habitual energy intake <75% of the energy requirement; LOS=Length of hospital stay; TER=Total energy requirement
Table 4. Risk factors associated with malnutrition according to univariate and multiple Cox's regression

Univariate analysis

| Variable            | Reference                        | p value  | Relative risk | CI (95%)          |
|---------------------|----------------------------------|----------|---------------|-------------------|
| Gender              | Male vs Female                   | 0.0309   | 1.755         | 1.053-2.926       |
| Age-group           | 60-69 vs <60 years               | 0.4376   | 1.326         | 0.650-2.705       |
| Age-group           | ≥70 vs <60 years                 | 0.0005   | 2.658         | 1.528-4.626       |
| Age                 |                                   | 0.0145   | 1.019         | 1.004-1.034       |
| Disease             | DTD vs Gynaecological            | 0.0075   | 4.456         | 1.490-13.328      |
| Disease             | Vascular vs Gynaecological       | 0.2164   | 2.292         | 0.615-8.534       |
| Disease             | Neoplasms vs Gynaecological      | 0.0008   | 5.916         | 2.092-16.728      |
| Disease             | Trauma vs Gynaecological         | 0.2889   | 2.037         | 0.547-7.586       |
| AC                  | ≤P5 vs >P15                      | <0.0001  | 9.529         | 5.274-17.217      |
| AC                  | P5-P15 vs >P15                   | 0.0003   | 3.852         | 1.871-7.930       |
| AMA                 | ≤P5 vs >P15                      | <0.0001  | 5.292         | 2.950-9.492       |
| AMA                 | P5-P15 vs >P15                   | 0.0015   | 3.375         | 1.594-7.146       |
| AFA                 | ≤P5 vs >P15                      | 0.0866   | 1.961         | 0.908-4.236       |
| AFA                 | P5-P15 vs >P15                   | 0.2423   | 2.022         | 0.621-6.854       |
| Haemoglobin         |                                  | 0.2204   | 0.937         | 0.845-1.040       |
| HEI/ER <75%         |                                  | 0.3993   | 0.996         | 0.988-1.005       |
| Lymphocytes         |                                  | 0.0521   | 1.000         | 0.999-1.000       |

Multiple analysis

| Variable            | Reference                        | p value  | Relative risk | CI (95%)          |
|---------------------|----------------------------------|----------|---------------|-------------------|
| Age-group           | 60-69 vs <60 years               | 0.5814   | 1.247         | 0.569-2.733       |
| Age-group           | ≥70 vs <60 years                 | 0.0146   | 2.207         | 1.169-4.165       |
| Disease             | DTD vs Gynaecological            | 0.0094   | 14.826        | 1.939-113.362     |
| Disease             | Vascular vs Gynaecological       | 0.0568   | 8.103         | 0.941-69.753      |
| Disease             | Neoplasms vs Gynaecological      | 0.0082   | 14.950        | 2.011-111.151     |
| Disease             | Trauma vs Gynaecological         | 0.3228   | 3.357         | 0.304-37.051      |

AC=Arm-circumference; AFA=Arm fat-area; AMA=Arm muscle-area; CI=Confidence interval; DTD=Digestive tract diseases; HEI/ER <75%=Habitual energy intake <75% of the energy requirement; P=Percentile

The high proportion of patients with recent weight loss (20.7%) corroborates the findings of Cacciabianza et al (6) who found a recent prevalence of 22.8% weight loss in hospitalized patients. These proportions are within those reported in the literature, which vary from 3.2% in orthopaedic and thoracic surgery patients (32) to approximately 39% in all types of patients (23).

The present sample represents most hospitalized surgical patients well. BMI, if sufficiently sensitive, could be a good indicator of patients that require special care. The BMIs of patients with digestive tract diseases and neoplasms were very good indicators of nutritional status. In general, patients with neoplasms have the highest prevalence of malnutrition, and the relative risk of death doubles in malnourished patients (30,31).
tive tract diseases, head and neck surgeries, longer stays at the hospitals, number of drugs prescribed during hospital stay, recent weight loss, and the body-composition parameters. The number of medications prescribed during stay at the hospital, old age, and malignancy have been reported as independent risk factors of malnutrition (5). In the present study, malnutrition was not associated with the presence and type of complications, haemoglobin level, energy intake, and death. One study found that higher risk of morbidity and mortality was not associated with recent weight loss, hypo-albuminaemia, and low BMI in surgical gastric cancer patients (13), and another study found a nutritional risk prevalence of 14.3% in surgical patients, and malnourished patients were three times more likely to experience complications and required significantly longer hospital stays than nourished patients (10 vs 4 days, p<0.001) (12). The patients treated in the study hospital probably had a low socioeconomic status, which might have affected their nutritional status.

According to multiple regression analysis, the most important determinants of malnutrition were age
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>70 years, digestive tract diseases, and neoplasms. The other study variables were not associated with malnutrition. Other studies using multiple regression analyses found that risk of malnutrition was positively correlated with old age, recent weight loss, and malignant diseases (33). Marco et al. (10) found that all variables in their study were independently associated with malnutrition, especially dementia, HIV infection, and pressure ulcers. The present findings indicate the importance of making a nutritional diagnosis, in addition to the clinical diagnosis, shortly after admission.

Like the present study, other studies also found that older patients (30) and those with longer stays at the hospital (24) were more vulnerable to complications. However, unlike the present study, other studies found an increased risk of complications in patients with recent weight loss (30). The small number of patients with complications in the present study may justify this fact. Nevertheless, other studies (13,32) analyzed nutritional status, post-operative complications, and predictors of surgery-related infections but also failed to find an association between recent weight loss and complications. Finally, a study found that complications were strongly associated with disease severity and nutritional status, but not with age >70 years (12).

No association was found between malnutrition and complications. On the other hand, Schiesser et al. (12) found that complication rates were significantly higher in patients at nutritional risk: 40% of those at nutritional risk versus 15% of those without nutritional risk experienced complications (p<0.001); they also found a high prevalence of nutritional risk in patients with gastrointestinal surgery. Multiple regression analyses showed that post-operative complications correlated positively with pancreatic surgery, old age, recent weight loss, low serum albumin, and infrequent nutritional support, which corroborated findings from other studies (30).

The other study variables did not affect the complication odds during hospital stay. However, multiple regression analysis showed that age and BMI were determinants of complications. Age and BMI differed significantly in the multiple regression analyses. Therefore, nutritional status based on BMI and old age was independently associated with complications. Old age may compromise metabolism and catabolism, resulting in lower BMI and (multi) organ failure. Vitamin and other micronutrient deficiencies were also common.

The findings of this study reinforce the importance of assessing the nutritional status right after admission. These also indicate the need for developing and implementing protocols for nutritional screening, care, diagnosis, and monitoring during stay at the hospital. These protocols would enable the proposition of intervention strategies to improving patients’ clinical courses.

Limitations

This study has some limitations. Nutritional status was classified according to BMI, AMC, and TST (2,26). Although anthropometric parameters are considered pertinent to the nutritional status classification of hospitalized surgical patients, BMI can be an insensitive indicator because it does not reflect acute malnutrition, such as involuntary weight loss. The present study looked into recent weight loss but did not include it in the classification of nutritional status. Other limitations include not investigating the patients’ blood sugar levels, socioeconomic and behavioural characteristics, duration of disease, and treatment.

Conclusions

The risk of malnutrition is associated with age and type of disease; old age and low BMI may promote complications.

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REFERENCES

1. Edington J, Boorman J, Durrant ER, Perkins A, Giffin CV, James R et al. Prevalence of malnutrition on admission to four hospitals in England. Clin Nutr 2000;19:191-5.
2. Amaral TF, Matos LC, Teixeira MA, Tavares MM, Álvares L, Antunes A. Undernutrition and associated factors among hospitalized patients. Clin Nutr 2010;29:580-5.
3. Waitzberg DL, Caiaffa WT, Correia MITD. Hospital malnutrition: the Brazilian National Survey (IBRANUTRI): a study of 4000 patients. Nutr 2001;17:573-80.
4. Stratton RJ, Hackston A, Longmore D, Dixon R, Price S, Stroud M et al. Malnutrition in hospital outpatients and inpatients: prevalence, concurrent validity and ease of use of the ‘malnutrition universal screening tool’ (MUST) for adults. Br J Nutr 2004;92:799-808.
5. Pirlich M, Schütz T, Norman K, Gastell S, Lübke HJ, Bischoff SC et al. The German hospital malnutrition study. Clin Nutr 2006;25:563-72.
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6. Caccialanza R, Klersy C, Cereda E, Cameletti B, Bonoldi A, Bonardi C et al. Nutritional parameters associated with prolonged hospital stay among ambulatory adult patients. *CMAJ* 2010;182:1843-9.

7. Cabello AJ, Conde SB, Gamero MVM. Prevalencia y factores asociados a desnutrición entre pacientes ingresados en un hospital de media-larga estancia. *Nutr Hosp* 2011;26:369-75. [Spanish].

8. Leandro-Merhi VA, de Aquino JLBD, Sales Chagas JFS. Nutrition status and risk factors associated with length of hospital stay for surgical patients. *JPEN J Parenter Enteral Nutr* 2011;35:241-8.

9. Westergren A, Wann-Hansson C, Börgdal EB, Sjölander J, Strömblad R, Klevsgård R et al. Malnutrition prevalence and precision in nutritional care differed in relation to hospital volume—a cross-sectional survey. *Nutr J* 2009;8:20. doi: 10.1186/1475-2891-8-20.

10. Marco J, Barba R, Zapatero A, Matía P, Plaza S, Losa JE et al. Prevalence of the notification of malnutrition in the departments of internal medicine and its prognostic implications. *Clin Nutr* 2011;30:450-4.

11. Sungurtekin H, Sungurtekin U, Balcı C, Zencir M, Erdem E. The influence of nutritional status on complications after major intraabdominal surgery. *J Am Coll Nutr* 2004;23:227-32.

12. Schiesser M, Müller S, Kirchhoff P, Breitenstein S, Schäfer M, Clavien P-A. Assessment of a novel screening score for nutritional risk in predicting complications in gastro-intestinal surgery. *Clin Nutr* 2008;27:565-70.

13. Pacelli F, Bossola M, Rosa F, Tortorelli AP, Papa V, Doglietto GB. Is malnutrition still a risk factor of postoperative complications in gastric cancer surgery? *Clin Nutr* 2008;27:398-407.

14. Portero-McLellan KC, Staudt C, Silva FR, Bernardi JLD, Frenhani PB, Leandro-Merhi VA. The use of calf circumference measurement as an anthropometric tool to monitor nutritional status in elderly inpatients. *J Nutr Health Aging* 2010;14:2266-70.

15. Leandro-Merhi VA, de Aquino JLB, de Camargo JGT, Frenhani PB, Bernardi JLD, McLellan KCP. Clinical and nutritional status of surgical patients with and without malignant diseases: cross-sectional study. *Arq Gastroenterol* 2011;48:58-61.

16. World Health Organization. Obesity: preventing and managing the global epidemic. Report of a WHO consultation. Geneva: World Health Organization, 2000. 252 p. (Technical report series no. 894).

17. Lipschitz DA. Screening for nutritional status in the elderly. *Prim Care* 1994;21:55-67.
agement in hospitalized patients: implication for DRG-based reimbursement and health care quality. *Clin Nutr* 2005;24:913-9.

32. Gunningberg L, Persson C, Åkerfeldt T, Stridsberg M, Swenneb CL. Pre-and postoperative nutritional status and predictors for surgical-wound infections in elective orthopaedic and thoracic patients. *E Spen Eur J Clin Nutr Metab* 2008;3:e93-e101.

33. Saka B, Ozturk GB, Uzun S, Erten N, Genc S, Karan MA et al. Nutritional risk in hospitalized patients: impact of nutritional status on serum prealbumin. *Rev Nutr* 2011;24:89-98.