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Original article

Impact of nutritional risk screening in hospitalized patients on management, outcome and costs: A retrospective study

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SUMMARY

Background & aims: Hospitalized patients should be screened for nutritional risk and adequately managed. Being nutritionally 'at-risk' increases in-hospital mortality, length of stay (LOS) and costs, but the impact on actual costs has seldom been assessed. We aimed to determine nutritional risk screening and management in a Swiss university hospital. The impact of being nutritionally 'at-risk' on in-hospital mortality, LOS and costs was also assessed.

Methods: Retrospective analysis of administrative data for years 2013 and 2014 from the department of internal medicine of the Lausanne university hospital (8541 hospitalizations, mean age 72.8 ± 16.5 years, 50.4% women). Being nutritionally 'at-risk' was defined as a Nutritional risk screening-2002 score ≥ 3 and nutritional managements were collected from medical records.

Results: Screening increased from 16.5% in 2013 to 41.9% in 2014 ($p < 0.001$), while prevalence of 'at-risk' patients remained stable (64.6% in 2013 and 62.7% in 2014, $p = 0.37$). Prevalence of 'at-risk' patients was highest in patients with cancer (85.3% in 2013 and 70.2% in 2014) and lowest in patients with disease of skin (42% in 2013 and 44.8% in 2014). Less than half of patients 'at-risk' received any nutritional management, and this value decreased between 2013 and 2014 (46.9% vs. 40.3%, $p < 0.05$). After multivariate adjustment, 'at-risk' patients had a 3.7-fold (95% confidence interval: 1.91; 7.03) higher in-hospital mortality and higher costs (excess 5642.25 ± 1479.80 CHF in 2013 and 5529.52 ± 847.02 CHF in 2014, $p < 0.001$) than 'not at-risk' patients, while no difference was found for LOS.

Conclusion: Despite an improvement in screening, management of nutritionally 'at-risk' patients is not totally covered yet. Being nutritionally 'at-risk' affects three in every five patients and is associated with increased mortality and hospitalization costs.

1. Introduction

Undernutrition is a critical condition among hospitalized patients, both as a cause and consequence of disease [1]. Notwithstanding over three decades of knowledge development, the worldwide prevalence of hospital undernutrition is still high (20–50%) mainly due to difficulties in the identification and adequate management of 'at-risk' patients [2,3]. Undernutrition status tends to deteriorate during hospital stay, worsening patient's outcome and increasing health costs [4,5]. Adequate screening and nutritional therapy have been shown to decrease the rate of nutrition-related complications, to decrease in-hospital mortality and to shorten length of stay (LOS) [6]. According to the European Society for Parenteral and Enteral Nutrition (ESPEN) recommendations, the Nutrition Risk Screening (NRS-2002) should be used for screening undernutrition in all hospitalized patients [1]. Still, even nowadays, proper nutritional risk screening is not performed in many European hospitals [7]; only in some countries like the United Kingdom, the Netherlands and part of Denmark nutritional risk screening is mandatory [8,9].

Switzerland is a small European country with one of the best health systems in the world [10]. Still, screening for nutritionally 'at-risk' patients has been unevenly implemented in hospitals and there is little information regarding prevalence, determinants, management and impact on health outcomes and cost of undernutrition [11]. Such information is important for the adequate

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management of hospital resources, both in Switzerland and similar countries.

In this study we used data from the department of internal medicine of a Swiss university hospital to assess the implementation of nutritional risk screening. We also assessed the prevalence, determinants and management of 'at-risk' patients, and impact of being nutritionally 'at-risk' on in-hospital mortality, LOS and costs.

2. Methods

2.1. Data collection

This is a retrospective study using electronic administrative data of the department of internal medicine of the Lausanne university hospital (CHUV) from January 1st, 2013 to December 31st, 2014. The CHUV is one of the five Swiss university hospitals, with a total staff of 10,000 and a bed capacity of 1642 (www.chuv.ch). In 2013, the department of internal medicine of the CHUV started implementing a nutritional risk screening procedure with the use of NRS-2002; this screening focused mainly, but not exclusively, on patients with heart and/or respiratory failure at admission.

This study included all adult (≥18 years old) patients who stayed for a minimum of one day (≥24 h) in the department of internal medicine of the CHUV.

2.2. Nutritional risk screening and data collection procedure

The patient's nutritional risk status was evaluated by the NRS-2002 [1]. Nutritional screening implementation was defined by the presence of NRS-2002 score in the electronic medical record which contain all the data related to nutritional risk status and managements since January 2013. In brief, according to the CHUV guideline, patients were interviewed by nursing staff at the first 48 h of admission about their nutritional risk status and disease severity according to the NRS-2002 criteria. NRS-2002 score is calculated by adding 'nutritional score' of 0–3 to the 'disease severity score' of 0–3 plus 1 extra score for patients older than 70 years.

The 'nutritional score' is defined by adequacy of dietary intake due to three different parameters 1) quartile decreased of estimated oral food intake requirements, 2) presence of ≥5% weight loss within the previous 1–3 months and 3) low body mass index (<18.5 kg/m^2). The 'disease severity score' was categorized as none, slight, moderate and severe with the score of 0–3, respectively. A total NRS-2002 score ≥ 3 was considered as nutritionally 'at-risk'.

The nutritional management database of the CHUV included dietary regimen, enteral nutrition (EN) and parenteral nutrition (PN). At the CHUV, all prescriptions given to patients are coded using the Anatomical Therapeutic Chemical (ATC) classification system and procedures are coded according to ICD-9CM. EN was defined as prescribed oral nutrition supplements (ONS) and/or tube feeding according to the ESPEN guideline [12]. PN was defined as any prescription containing the ATC code B05BA (PN solution or premixed multichamber bag containing PN) or as a procedure containing the ICD-9CM code 99.15 (Parenteral infusion of concentrated nutritional substances).

2.3. Other variables

Socio-demographic data included age, sex, marital status and coming from home or other healthcare facilities. Clinical variables included main diagnosis and vital status at discharge (alive or dead). Main diagnoses (the most relevant diagnosis for the hospitalization at discharge according to the responsible physician) were categorized in groups according to the 10th International Classification of Diseases and related health problems (ICD-10). Main diagnosis groups are indicated in Supplementary Table 1. Only main diagnosis were used regardless any subsidiary diagnosis except for disease of circulatory system (Ischemic heart disease and Heart Failure) and pulmonary diseases (Pneumonia and Chronic obstructive pulmonary disease).

LOS was calculated according to the official Swiss Diagnosis-related group (DRG) guidelines, available at swissdrg.org/assets/pdf/Tarifdokumente/SwissDRG_Falldefinitionen_Version_5_2013_f_def.pdf. According to the "midnight rule", a patient who is admitted at the hospital before midnight and who stays at the hospital at midnight is considered as having spent a night at the hospital. Briefly, LOS is computed using the following formula:

[date of discharge − date of admission]/24 − hours of administrative leave/24.

The dates of discharge and admission include hours and minutes, and the number of hours of administrative leave (i.e. periods during which the patient is allowed to leave the hospital; only periods of ≥8 h are taken into account) is rounded to the lowest value. Calculations are made using hours as the primary unit and the values were provided to us by the hospital administration. According to the guidelines, only LOS of at least 24 h can be considered as hospital treatment; thus, our inclusion criteria included a minimum stay of 24 h.

Contrary to other studies that used DRG costs [13–15], total cost was defined as the actual costs. The cost of each patient's expenditures was extracted from the hospital billing system; this system considers costs related to anesthesia, surgery (including occupation of surgical wards), imagiology (X-rays, MRI, echography), clinical chemistry, pathology, ICU-related costs, medical care, external consultations (i.e. a specialist outside the internal medicine ward who is asked to examine the patient), administrative tasks, food (no-therapeutical), blood products (i.e. transfusions), drugs (including enteral and parenteral nutrition), medical material (catheters,…), transport, etc. Summation of all the costs was done to estimate the actual cost of patient care.

Due to anonymization constraints, only month and year of admission and discharge were available; hence, it was not possible to calculate readmissions within 30 days after discharge as two admissions occurring in the same month could not be sorted.

2.4. Statistical analysis

Statistical analyses were performed using Stata version 14 for windows (Stata Corp, College Station, Texas, USA). Descriptive results were expressed as number of participants (percentage) or as mean ± standard deviation (SD). Bivariate analyses were performed using chi-square or Fisher's exact test for qualitative variables and Student's t-test, analysis of variance or Kruskal–Wallis test for quantitative variables. Multivariate analysis was performed using logistic regression including sex, age, year, coming from home and main diagnosis in the model; the results were expressed as odds ratio (OR) and 95% confidence interval (CI). Statistical significance was assessed for a two-sided test with $p < 0.05$.

2.5. Ethics

The study was approved by the Ethics Commission of Canton Vaud (www.cer-vd.ch, decision 428-14, of Dec 2, 2014) and by the CHUV board of directors (decision of Dec. 5, 2014). Only routinely collected data was used. Patients were not asked to provide informed written consent and no intervention was performed. All

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