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Original article

Nutritional risk screening in hospitalized patients with heart failure☆

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SUMMARY

Background & aims: Malnutrition is an important issue in patient outcome. Screening tools to find risk patients need to be evaluated. This study looks at the validity and reliability of nutritional risk screening (named NRS-2002) in hospitalized patients with chronic heart failure.
Methods: In this cross-sectional study nutritional screening was performed using NRS-2002 in 131 patients with chronic heart failure. The predictive validity was evaluated in relation to whether NRS-2002 predicted the incidence of complications and length of hospital stay. NRS-2002's ability to locate nutritional risk in patients with edema was evaluated. The inter-rater reliability was measured between three investigators screening 45 patients each.
Results: The prevalence of nutritional risk was 57%. The incidence of complications and the median length of hospital stay were significantly higher in patients at nutritional risk compared to patients not at nutritional risk. Only the component of severity of disease in NRS-2002 and not the component of the nutritional status was associated with increased length of hospital stay in multivariate analysis. Patients with edema were classified correctly regarding nutritional risk status by NRS-2002 in all but one occasion. The inter-rater reliability was documented, kappa >0.60.
Conclusion: NRS-2002 was a reliable screening tool in an in-patient sample with chronic heart failure. The validity of NRS-2002 needs further investigation in a larger sample of hospitalized patients with chronic heart failure.

1. Introduction

Patients with chronic heart failure still have high morbidity and mortality despite the progress in medical and surgical treatment.[1,2] Malnutrition might play a role in this regard, but has not been sufficiently clarified.[1,3]

Prevalence of malnutrition in hospitalized patients has been found to be 34–70% in hospitalized patients with heart failure.[3–5] In the absence of a gold standard in evaluating nutritional status the prevalence of malnutrition will vary depending on diagnostic criteria and screening tools used in the study population.[6]

Since malnutrition indicates an unfavorable prognosis in patients with chronic heart failure,[3–5,7] nutritional intervention may prevent complications[8] and increase quality of life.[9] At hospital admission, it is important to evaluate the nutritional status of heart failure patients and to implement nutritional intervention in an early phase to malnourished patients. However, edema may complicate the nutritional assessment of heart failure patients.[6,7]

According to guidelines developed by the European Society of Clinical Nutrition and Metabolism,[10] not only heart failure patients, but all patients should be screened for nutritional risk at hospital admission, and the screening tool, nutritional risk screening (NRS-2002), is recommended in a hospital setting.[10] Nutritional

Abbreviations: AMC, arm muscle circumferences; BMI, body mass index; COPD, chronic obstructive pulmonary disease; CRP, C-reactive protein; EF, ejection fraction; LOS, length of stay; LRA, logistic regression analysis; MAC, mid arm circumference; MNA, Mini Nutritional Assessment; NRS-2002, nutritional risk screening; NSD, Norwegian Social Science Data Service; NYHA, New York Heart Association; REK, Regional Research Ethics Committee; SGA, Subjective Global Assessment; TSC, triceps skin fold.

☆ Conference presentation: Data from the study has not been presented at a congress.

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screening is seen as a rapid and simple process completed during admission procedures.[10] The purpose of this tool is to detect the presence of, or risk of developing, malnutrition.[10]

NRS-2002 has been evaluated in many hospital settings with different validating methods.[11–14] For adult hospital patients NRS-2002 has shown in a meta-analysis fair to good predictive validity to predict mortality, length of stay and complications.[15] Studies have shown inconsistent results according to how well NRS-2002 can screen patients' nutritional status (i.e. construct validity) ranging from poor to good validity.[15] The reliability of the inventory has been documented to be good.[11,14] However, NRS-2002 has not been evaluated in chronic heart failure patients.

The primary objective of this study has been to investigate the validity (predictive and construct validity) and reliability (inter-rater reliability) of NRS-2002 in a selected in-patient sample with chronic heart failure. Secondary objectives were to investigate the prevalence of nutritional risk found by NRS-2002 and whether nutritional care plans and nutritional support were carried out for patients screened at nutritional risk. We would also investigate whether relevant diagnosis classification (ICD-10) were carried out for these patients.

2. Materials and methods

2.1. Design

This cross-sectional study was conducted in the department of cardiology at St. Olav's University Hospital in Trondheim, Norway between October 2008 and February 2010. The inclusion criteria used to identify hospitalized patients with heart failure eligible for the study were: 1) directly admitted to the department of cardiology, St. Olav's University Hospital, 2) age >18 years, 3) heart failure ≥3 months, 4) ejection fraction (EF) ≤50% and 5) New York Heart Failure Association classification II, III or IV.[16]

2.2. Study sample

Sample size was based on significance level of 0.05, power of 0.09, expected prevalence of malnutrition of 40% and the minimum clinical difference and standard deviation of the objective measurements (triceps skinfold, arm muscle circumference, albumin and pre-albumin).[17] In addition, sample size was estimated according to the statistical analyzes that would be used.[17,18] The required sample size for this study was estimated to be minimum 120 patients.

A total of 131 patients were included in the study. See Fig. 1 (flowcharts) for detailed descriptions of excluded patients ($N = 172$).

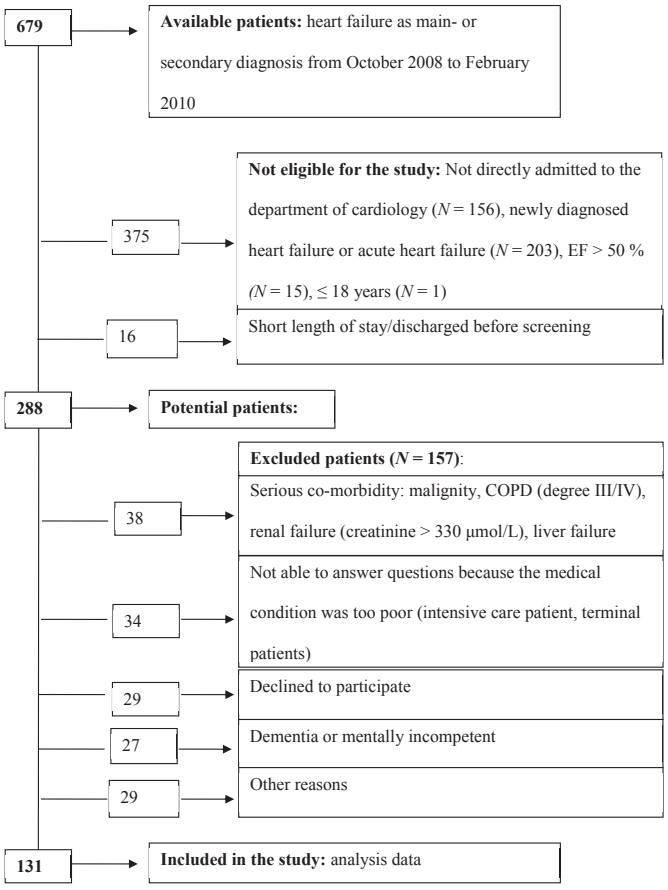

Fig. 1. Flowchart.

2.3. Variables

2.3.1. New York Heart Failure Association classification (NYHA-class)

The patient severity of heart failure symptoms was classified into a functional class system characterized as NYHA-class I–IV: NYHA-class I = no symptoms during ordinary physical activity; NYHA-class II = slight limitation during ordinary physical activity; NYHA-class III = marked limitation during ordinary physical activity; NYHA-class IV = inability to carry on any physical activity without discomfort and the patient has discomfort even at rest.[16]

2.3.2. Ejection fraction

Ejection fraction was measured with cardiac *ultrasound* (Echocardiography). Echocardiography was conducted by a cardiologist at the cardiac medical outpatient clinic at St. Olav's University Hospital. Information about ejection fraction was obtained from the patient journal.

2.3.3. Anthropometry

The patients were weighed before breakfast without shoes with light clothes on a portable Seca digital scale to the nearest 0.1 kg. Height was measured with Seca stadiometer to the nearest 0.1 cm. Body mass index (BMI) was calculated using the formula:

$$\mathrm{BMI} = \mathrm{weight(kg)} \Big/ \mathrm{height(m)}^2 \quad (6)$$

Triceps skinfold (TSF) and mid arm circumference (MAC) were measured according to established criteria.[19] Arm muscle circumference (AMC) was calculated using the formula:

AMC = MAC − (π × TSF × 0.1).[19] Reference values from a Swedish population were used.[20] Since TSF <10th percentile may indicate a depletion in the patients fat stores and AMC <10th percentile may indicate a depletion in the patients muscle stores[20] these cut off values were used in statistical analyses indicating risk of malnutrition.

2.3.4. Weight loss

Percent weight loss was estimated using the formula:

$$(\text{weight loss}/\text{earlier weight}) \times 100 = \text{weight loss in \%} \quad (6)$$

2.3.5. Edema

A subjective clinical assessment was used to measure peripheral edema on the patient's ankle, leg, thigh and back (sacral edema) at