Review article

Protein-energy malnutrition in the rehabilitation setting: Evidence to improve identification

Skye Marshall*

Faculty of Health Sciences and Medicine, Bond University, Robina, Queensland 4226, Australia

ARTICLE INFO

ABSTRACT

Methods of identifying malnutrition in the rehabilitation setting require further examination so that patient outcomes may be improved. The purpose of this narrative review was to: (1) examine the defining characteristics of malnutrition, starvation, sarcopenia and cachexia; (2) review the validity of nutrition screening tools and nutrition assessment tools in the rehabilitation setting; and (3) determine the prevalence of malnutrition in the rehabilitation setting by geographical region and method of diagnosis. A narrative review was conducted drawing upon international literature. Starvation represents one form of malnutrition. Inadequate energy and protein intake are the critical factor in the aetiology of malnutrition, which is distinct from sarcopenia and cachexia. Eight nutrition screening tools and two nutrition assessment tools have been evaluated for criterion validity in the rehabilitation setting, and consideration must be given to the resources of the facility and the patient group in order to select the appropriate tool. The prevalence of malnutrition in the rehabilitation setting ranges from 14-65% worldwide with the highest prevalence reported in rural, European and Australian settings. Malnutrition is highly prevalent in the rehabilitation setting, and consideration must be given to the patient group when determining the most appropriate method of identification so that resources may be used efficaciously and the chance of misdiagnosis minimised.

© 2016 Elsevier Ireland Ltd. All rights reserved.

Contents

* Fax: +61 7 5595 3524.
   E-mail address: skye_marshall@bond.edu.au

1. Introduction

Ever since Dr Charles Edwin Butterworth Jr's seminal 1974 article "The Skeleton in the Hospital Closet", there has been a positive movement in clinical health care to address "hospital malnutrition" [1]. However, in highly developed countries, such as Australia and the UK, malnutrition remains widespread in older adults, where prevalence is the highest in rehabilitation wards (30–50% of inpatients) [2]. In addition, there has been confusion in the literature and in clinical practice regarding malnutrition, starvation, sarcopenia and cachexia in older adults, which are conditions characterised by involuntary loss of lean tissues [3].

Nutrition screening and nutrition assessment are essential parts of the nutrition care process, as accurate identification and diagnosis of malnutrition is required in order for patients to be adequately treated, and for nutrition resources to be used efficaciously [4]. However, it is essential that the nutrition screening tools and nutrition assessment tools used to complete these steps have undergone adequate evaluation for validity so that the most appropriate tool can be selected for the patient group [2].

The prevalence of malnutrition in rehabilitation and the nutrition screening and assessment tools appropriate for use in rehabilitation have not been reviewed since 2006 [2]. Examining the validity of nutrition screening and assessment tools in rehabilitation will help practitioners select the most appropriate tool for their facility. Additionally, understanding the limitations of a particular tool in a particular setting is required so that appropriate steps can be taken to minimise the risk of misdiagnosis. For this reason, the method of diagnosis should be considered when reviewing the prevalence of malnutrition. The prevalence of malnutrition in rehabilitation has not been evaluated with consideration given to the method of diagnosis, nor the various settings in which it was measured, such as rural *versus* metropolitan prevalence or by country or region. Understanding the prevalence of malnutrition in these various settings will help health care workers to understand the risk of malnutrition for particular patient groups and assist in the allocation of nutrition resources.

Therefore, the purpose of this narrative review was to: (1) examine the defining characteristics of malnutrition, starvation, sarcopenia and cachexia; (2) review the validity of nutrition screening tools and nutrition assessment tools in the rehabilitation setting; and (3) determine the prevalence of malnutrition in the rehabilitation setting by geographical region and method of diagnosis.

2. Methods

A narrative review was conducted which drew upon international literature published up until 15 August 2015. A review was conducted as part of the narrative review to identify the nutrition screening and assessment tools evaluated for validity in the inpatient rehabilitation facilities, as well as determine the prevalence of malnutrition. For this review, published English-language literature was searched on Google Scholar from 1980—15 August 2015. The search terms were ("MNA" OR "SGA" OR "PG-SGA" OR "ICD-10-AM" OR "Malnutrition Universal Screening Tool" OR "SNAQ" OR "NRS-2002" OR "nutrition screening tool") AND "Malnutrition" AND ("Rehabilitation" OR "Subacute"). The search strategy was complemented by a snowball search of literature cited by identified papers. Studies were included for the prevalence study only when malnutrition was diagnosed by a validated method.

3. Defining malnutrition

Protein-energy undernutrition, also known as protein-energy malnutrition, and frequently referred to simply as *malnutrition*, occurs when food and nutrient intake is unable to meet protein, energy and nutrient requirements over time leading to a disruption of homeostasis in lean tissues, body weight and physical function [5,6]. Lean tissues include fat-free, metabolically active tissues such as skeletal muscle, viscera, blood cells and the immune system. Lean tissues are the largest body component, comprising 35–50% of the total body weight of a healthy adult [6]. A decrease in lean tissue is the main cause of unintentional weight loss in most cases of malnutrition, although loss of fat mass may also be a contributing factor, and is caused by starvation or a combination of starvation and catabolic stress [6].

3.1. Malnutrition, starvation, sarcopenia or cachexia?

It has been widely recognised that muscle mass frequently decreases with age. Malnutrition, starvation, sarcopenia and cachexia are all conditions characterised by loss of lean tissue and typically occur in older adults, leading to confusion in the literature and in clinical practice [3].

Starvation is the loss of both fat-mass and fat-free mass as the result of a chronic inadequate intake of protein and energy [3]. Therefore, starvation may be a cause of malnutrition, as reflected by the Academy of Nutrition and Dietetics (AND) standardised set of diagnostic characteristics for malnutrition: (a) starvation-related malnutrition, (b) chronic-disease related malnutrition and (c) acute disease or injury-related malnutrition [7]. The AND have defined starvation-related malnutrition as protein-energy malnutrition due to pure chronic starvation or anorexia nervosa [7]. Overall, starvation may be an important component of malnutrition in some clinical situations, but should be used with caution when discussing malnutrition in general.

Since being coined in 1989, the definition of "sarcopenia" has continued to evolve as the condition is further explored [8]. However, in 2009 and 2010 three separate groups of experts met to gain consensus for the definitions of sarcopenia. As each of these consensus definitions were slightly different, no definition is yet universally accepted and there still remains confusion and inconsistency in the literature when describing and diagnosing this "geriatric syndrome" [9]. However, all three definitions agree that sarcopenia is characterised by the progressive age-related loss of lean muscle mass, muscle strength and physical function, and is associated with poor health outcomes [10–12]. One important development in the consensus of sarcopenia is the recognition that inadequate dietary intake and/or nutrient malabsorption is a possible factor in the aetiology of the syndrome (known as nutrition-related sarcopenia) by the European Working Group on Sarcopenia [10]. However, both the International Working Group on Sarcopenia and the Society for Sarcopenia, Cachexia and Wasting Disorders have not recognised inadequate nutrition as a potential cause in the multifactorial aetiology of the syndrome; though they did recognise that it has a role in the pathophysiology of sarcopenia [11,12]. This may reflect the lack of strong research in exploring the nutritional mechanisms in sarcopenia along with the fact that it may be uncommon to find an older adult with sarcopenia who meets estimated energy and protein requirements [8]. However, there have not been enough well designed studies to conclude whether the severity or progression of sarcopenia is affected by dietary intervention. In addition, it may be possible for both malnutrition and sarcopenia to present as comorbidities, known as the malnutrition–sarcopenia syndrome (MSS); though it must be acknowledged a method of diagnosis for MSS has not yet been evaluated for validity or reliability [13].

Similar to disease-related malnutrition, cachexia is a complex syndrome associated with underlying illness, characterised by the loss of body weight, predominately skeletal muscle, which increases the risk of misdiagnosis [14]. Conditions which predis-