MINI REVIEW

Different risk scores consider different types of risks: the deficiencies of the 2015 ESPEN consensus on diagnostic criteria for malnutrition

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Abstract

In 2015, an European Society for the Parenteral and Enteral Nutrition malnutrition diagnosis consensus was published to unify the definition and simplify the diagnostic procedure of malnutrition, in which 'nutritional risk', 'malnutrition risk' and 'at risk of malnutrition' were referred to several times, and 'at risk of malnutrition' was encouraged to be coded and reimbursed in the International Classification of Diseases and diagnosis-related group system systems. However, there may be some mistakes when using the concepts of different 'risk' mentioned above. In this study, we aimed to explain different 'risks' using the original concept by different screening tools to clarify the definition and provide a recommendation for nutritional screening.

Introduction

In 2015, the European Society for the Parenteral and Enteral Nutrition (ESPEN) published a consensus statement ('2015 Consensus' for short hereinafter) on the diagnostic criteria for malnutrition (undernutrition) [1]. The '2015 Consensus' was designed to provide simple and effective diagnostic criteria for malnutrition, which was independent of disease or inflammation. The consensus aimed to unify the definition of 'malnutrition', which in principle, is a laudable effort to unify professional understanding.

The concepts of 'nutritional risk', 'malnutrition risk', and 'at risk of malnutrition' had been described several times in the '2015 Consensus' and are considered to have the same meaning. The term 'at risk of malnutrition' was recommended to be coded and supported by the International Classification of Diseases (ICD) and diagnosis-related group system (DRGs) systems. This is a crucial prerequisite for the implementation of nutritional and metabolic care in clinical practice and in the community.

However, the understanding and application of the concept of 'risk' in the 2015 consensus is still confusing. The notion is derived from three different screening or assessment tools with different meanings, which make it difficult to appreciate its meaning. In this article, we analysed and interpreted different risks from different tools to clarify the relevant concepts, correctly apply the definitions and guide the clinical practice reasonably and normatively. In addition, a screening tool is recommended based on the most recent evidence.

Nutritional screening tools and relative diagnoses

Screening should lead to nutrition care [2]. Nutritional screening is the first step of the nutritional support therapy route consisting of 'nutritional screening', 'nutritional assessment', and 'nutritional intervention', which have been recommended by the 2003 ESPEN Guidelines, the 2008 Chinese Society for Parenteral and Enteral Nutrition (CSPEN) Guidelines, and the 2011 American Society for Parenteral and Enteral Nutrition (ASPEN) guidelines [3].

Practical nutritional screening tools should be easy to use, with a wide range of application, evidence-based and

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Table 1 Main items of different screening tools recommended by ESPEN

Tool	Items	Conclusion
NRS 2002	1. Nutritional impairment score (containing food intake decline, involuntary weight loss and BMI)	≥ 3 score: at nutritional risk
	2. Disease severity score (~increased nutritional requirement caused by disease)	< 3 score: no nutritional risk
	3. Age (70 years old)	
MNA-SF	1. Food intake decline	12–14 points: normal nutritional status
	2. Involuntary weight loss	8–11 points: at risk of malnutrition
	3. Mobility	0–7 points: malnutrition
	4. Psychological or acute condition	
	5. Neuropsychological problems	
	6. BMI or calf circumference	
MUST	1. BMI	0 score: low risk of malnutrition
	2. Unplanned weight loss	1 score: medium risk of malnutrition
	3. Acute disease effect	≥ 2 score: high risk of malnutrition

validated by clinical studies. Implementation of the tool could be completed by health care workers and dieticians.

There were 32 nutritional screening tools for hospitalised patients published in 1982–2007 [4]. A survey in 2010 showed that 67% medical institutions in Europe applied nutritional screening tools, among which >50% used the locally made screening tools, which differed from each other and lacked clinical evidence and validation. Nutritional risk screening 2002 (NRS 2002) was the second most commonly used tool, but it was used in only 20% institutions [5]. Improper selection of screening tools is a common problem in clinical practice. Although there is currently no 'gold standard' screening tool, NRS 2002 is the preferred tool and is evidence-based.

Three screening tools were recommended by the ESPEN guidelines in 2009, NRS 2002 for inpatients, mini nutrition assessment–short form (MNA-SF) for the elderly, and malnutrition universal screening tool (MUST; malnutrition universal screening tool) for the community. According to different items of the three tools, we may obtain different diagnoses (Table 1).

NRS 2002

NRS 2002 was created by Professor Jens Kondrup and four other professors from the Danish Society of Parenteral and Enteral Nutrition, published in 1999 and was first implemented in Denmark [6]. The creation was based on 12 studies (10 randomised controlled studies and 2 non-randomised controlled studies). At that time, it only included two parts, including the nutritional status score and disease severity score with the highest score of 6. Next, an ESPEN working group led by Professor Kondrup used 10 research papers (nine randomised controlled studies, one observational study) as the 'benchmark' to validate the tool,

and added the age-adjusted score (1 score if age >70). The highest total score increased to 7. Next, a retrospective validation study of 128 randomised controlled trials was performed to analyse the correlation between the tool and clinical outcomes. It was confirmed that nutritional support could improve the clinical outcomes of the patients who were at nutritional risk. Next, the tool was officially published at the ESPEN Annual Conference in Munich, Germany, and published in Clinical Nutrition in 2003 [2].

The tool was recommended by ESPEN as a screening tool for non-emergency hospitalised adult patients. It consisted of three parts: impaired nutritional status score, disease severity score and age score. The nutritional status score can be determined using the body mass index (BMI), changes in body weight and food intake. These items are also contained in other screening tools in addition to the criteria of '2015 Consensus'. When the score of impaired nutritional status reaches three points, we can not only confirm the 'nutritional risk' but also reach the diagnosis of 'malnutrition', and thus, nutritional support is required.

For inpatients, the severity of disease is another important factor affecting the nutritional status. The score of disease severity is equivalent to the increased requirement and consists of three prototypes. For example, two scores indicate a patient who is confined to bed owing to illness, e.g., following major abdominal surgery. Protein requirement is substantially increased but can be covered, although artificial feeding is required in many cases. Three scores indicate a patient in intensive care with assisted ventilation. Protein requirement is increased and cannot be covered even by artificial feeding. Protein breakdown and nitrogen loss can be significantly attenuated.

The age factor is a unique component of this screening tool and takes into account the pathophysiological

characteristics of elderly patients. When the total score equals or surpasses 3, the patient has nutritional risk, and a nutritional support strategy should be developed, including nutritional assessment and intervention.

In December 2004, after the establishment of CSPEN, the 'Nutritional Risk–Undernutrition—Support–Outcomes —Cost/Effectiveness (NUSOC) Collaborative Group' was founded. The group has been working with Denmark and the United States to carry out clinical studies to validate NRS 2002 prospectively in Chinese people. Until recently, ~ 50,000 cases from > 30 centres and 20 cities all over China were included in the database, and several high evidence articles have been published [7–9] and some were cited by ASPEN guidelines [10]. These results suggested that nutritional support could improve the clinical outcomes of patients with nutritional risk. Its feasibility and effectiveness were also proven in cancer patients, elderly patients, community and nursing homes.

In 2012, Skipper et al. performed an analysis of 11 commonly used screening tools, and indicated that NRS 2002 was the best evidence-based tool with good validation and reliability. It is the only screening tool, which achieved the grade of level I based on the ADA's Evidence Analysis Library [11, 12]. In 2016, it was recommended by ASPEN and the American Society of Critical Care as the first choice of nutritional risk screening tools [10].

MNA-SF

Mini nutritional assessment (MNA) was created by Professor Yves Guigoz, Switzerland in 1994 and was applied to evaluate the elderly in the community and nursing homes [13]. The tool consists of several items, such as human body measurement and diet questionnaire. Because it has a dual role of screening and assessment, the ASPEN guidelines classified it as a nutrition assessment tool in 2011 [3]. The aim is to diagnose undernutrition or to identify people who are at risk of developing malnutrition.

MNA-SF is a short table based on MNA and it is a screening tool [14]. It consists of six questions as shown in Table 1 and different scores indicate different diagnoses: normal nutritional status (1–14 points), at risk of malnutrition (8–11 points) and malnutrition (0–7 points).

Judging from the level of evidence and current published validated papers, MNA and MNA-SF did not correlate well with outcomes, such as mortality [15, 16] and complication [17, 18]. Thus, it is not recommended to use MNA-SF as the preferred screening tool [4]. Moreover, studies have shown that the specificity of MNA-SF is poor, and by applying the tool, there will be more patients who are misdiagnosed as 'at risk of malnutrition', resulting in unnecessary intervention [19, 20].

MUST

MUST is a screening tool created by the BAPEN Malnutrition Consultation Group in 2003, which is currently widely used in the United Kingdom and other countries worldwide [21]. It can be used in adults in a hospital, community and other healthcare institutions.

The tool includes three components: BMI, unplanned weight loss and acute disease effect score (Table 1). Through its five steps, it proceeds to different levels of relevant diagnosis and makes recommendations for intervention. The diagnosis of 'overall risk of malnutrition' is graded as low, medium and high.

Compared to NRS 2002 and MNA-SF, both in the general population and the elderly, its association with the outcome is much lower [22, 23].

Precisely understanding the 'risk'

The result of NRS 2002 is 'nutritional risk', which refers to the risk of the occurrence of adverse effects on clinical outcomes owing to infaust nutrition related affairs (e.g., increased infectious complications and length of stay, decreased quality of life and survival, etc.). The 'risk of malnutrition' derived from the other two tools refers to 'the possibility of developing malnutrition', which has no direct connection with outcome. Therefore, from the definitions of these three screening tools, we can conclude that the emphasis of 'nutritional risk' is on the risk of having a bad outcome and of the 'risk of malnutrition' to be or become malnourished, which are completely different.

As early as 2003, ESPEN's Nutritional Screening Guidelines has indicated that the purpose of nutritional screening was to discover potential nutritional factors, leading to adverse clinical outcomes and whether nutritional support can improve clinical outcomes [2]. This requires that the screening tool should be evidence-based and has been validated to verify a strong clinical significance. Therefore, the NRS 2002 meets these requirements, but the MNA-SF and MUST are not strongly validated and cannot be recommended.

Distinguishing the deficiencies of the '2015 Consensus'

Misunderstanding of different 'risk'

First, in the '2015 Consensus', nutrition screening is treated as the first step of the diagnosis of malnutrition. 'At risk' is a prerequisite for the diagnosis of malnutrition. However,

Table 2 Resemblance between 2015 consensus criteria and screening tools

Tool	BMI (kg/m^2)	Weight loss
NRS 2002	Score 2 = BMI 18.5–20.5 with impaired general condition	Score 0 = No weight loss
	Score 3 = BMI < 18.5 with impaired general condition	1 = >5% in 3 months
		2 = >5% in 2 months
		3 = >5% in 1 month or >15% in 3 months
MNA-SF	Score 0 = <19	Involuntary weight loss during the last 3 months
	1 = 19–21	Score 0 = >3 kg (6.6 pounds)
	2 = 21–23	1 = Does not know
	3 = >23	2 = 1–3 kg (2.2 and 6.6 pounds)
		3 = No weight loss
MUST	Score 0 = >20 (> 30 obese)	Unplanned weight loss in past 3–6 months
	1 = 18.5–20	Score 0 = <5%
	2 = <18.5	1 = 5–10%
		2 = >10%
2015 consensus criteria	BMI < 18.5	10% indefinite of time
		Or > 5% over the last 3 months combined with
		BMI < 20 kg/m^2 if < 70 years of age
		Or < 22 kg/m^2 if 70 years of age

determination of the 'risk' does not take into account the differences between screening tools and ignores the different types of risk.

Second, should nutritional risk (NRS 2002) or malnutrition be a prerequisite for nutritional support? According to current published evidence, people at 'nutritional risk' (NRS 2002) need nutritional intervention, which may improve their clinical outcome. At nutritional risk appears to be the proper indication of nutrition support and has been recommended by several guidelines. If we use the '2015 consensus' criteria, some of the patients at 'nutritional risk' may not meet the diagnosis criteria of 'malnutrition', potentially withholding further nutritional assessment and eventual treatment, some of who may suffer from adverse clinical outcome.

Therefore, the '2015 Consensus' criteria needs to further clarify the definitions of different types of risk, identify indications of nutritional support and requires further high-quality validation.

incomplete criteria of malnutrition

After nutritional screening to determine 'risk', the added items (BMI, weight loss and fat-free mass index) may be performed to complete the diagnosis as the second step. By comparing the criteria in '2015 consensus' and the recommended screening tools, the items contained in the '2015 consensus' (BMI, weight loss) are only a part of the screening tools (Table 2). A BMI and body weight loss score of two points in MUST, and an impaired nutritional status score of three points in NRS 2002 can directly lead to a diagnosis of malnutrition. With MNA-SF, we can also obtain a direct diagnosis of malnutrition (0–7 points). Thus, the recommendations of the '2015 Consensus' appear premature, such that the diagnostic process of 'malnutrition' using '2015 consensus' is only a part of the 'nutritional screening' and 'nutrition assessment', and should not be performed after confirming the 'risk'.

In addition, BMI and weight loss are only two of a number of independent factors influencing nutrition status. These screening tools also contain other nutritional-related factors, such as the severity of disease and mobility, which are lacking in the criteria of malnutrition in '2015 consensus'. As early as 2012, the Consensus statement of the Academy of Nutrition and Dietetics and ASPEN on adult malnutrition (undernutrition) emphasised the role of the inflammatory response in the incidence, progression and resolution of malnutrition, and an aetiologically based diagnostic nomenclature was recommended for routine clinical practice [24]. In 2016, a comment written by a group of senior ESPEN members suggested to rethink the pathophysiology of malnutrition and provided a comprehensive definition of malnutrition as follows: 'a disordered nutritional state resulting from a combination of

inflammation and a negative nutrient balance, leading to changes in 'body composition, function and outcome' [25]. Thus, we concluded that the criteria in the '2015 consensus' are incomplete for diagnosing malnutrition.

Conclusion

The diagnostic criteria of the '2015 Consensus' has the following problems: (1) the confusion of concepts of different types of risk; and (2) ignorance of other factors, specifically the severity of disease and relative inflammation in the diagnosis of malnutrition. Thus, more studies are needed to validate the criteria.

Nutritional risk determined by NRS 2002 has a good correlation with clinical outcome due to its retrospective and prospective clinical validation. It has been recommended by several guidelines and incorporated into the National Essential Medicare and Reimbursement Formulary of China as the only indication of nutrition support [26]. In addition, we also recommend using 'nutritional risk' as a standard term in the ICD System.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

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